CŒLENTERA.

V.—MEDUSÆ.

By Edward T. Browne,

Zoological Research Laboratory, University College, London.

(7 Plates.)

CONTENTS.

Introduction.

The collections of Medusæ brought home by the 'Discovery' and 'Southern Cross' are combined in this report. There was nothing whatever to be gained by keeping the collections separate, as they were made in localities not far apart, within two years of each other, and both belong to the British Museum. Many of the species are common to both collections, and as the collections contained a high percentage of specimens in very bad condition, it was a distinct advantage to be able to use the best specimens and to pass over the bad ones. Some of the specimens were in such bad condition that without a good clue it would have been impossible to determine the genus.

With such soft-bodied animals as jelly-fishes so much depends, for a good description and figure, upon the condition of the specimens. There is a difference between a description or drawing of a living Medusa in perfect condition and one based upon a contracted and damaged specimen. When dealing with the latter kind one has to use a certain amount of imagination, and to make allowances for defects. Although some of the figures may not be absolutely accurate in outline, still I have striven to make clear the characters of the species.

The collection made by the 'Southern Cross' in 1899–1900 came from the neighbourhood of Cape Adare (lat. 70° 18′ S., long. 170° 9′ E.). Some of the specimens were collected during May, 1899, and others during November and December, 1899, and January, 1900. The surface temperature of the sea on the 10th May, 1899, was 27° F., on the 13th Sept., 28·6° F., and during the summer months—December, January and February—it rarely rose above 32° F. During the winter months the temperature of the sea under the ice remained constant at 27·8° F.

Most of the specimens were taken in tow-nets or dredges in shallow, open water not far from shore, and a few were picked up after having been washed ashore. Unfortunately, the specimens were not sufficiently preserved, and were badly stored in bottles or tins; consequently they nearly all arrived home macerated and damaged. It was, undoubtedly, a stroke of good luck that two out of three of the species peculiar to the 'Southern Cross' collection happened to be in good condition.

A preliminary account of the Hydrozoa of the 'Southern Cross' Expedition was published by me in 1902. It was based upon a rapid survey of the collection, and abstracted from a manuscript written for the benefit of Mr. Hodgson, who was then about to sail in the 'Discovery.' The preliminary account carries no priority, as none of the species were named.

The 'Discovery' collection was made under conditions totally different from those of the 'Southern Cross' collection. Nearly all the specimens were captured in nets which were let down through holes in the ice. Owing to the low air temperatures the plankton on being placed in the collecting bottles froze in winter at once, and had to be thawed out on board ship. In summer the water in the bottles was generally full of ice crystals which, with the jolting of the sledge as it travelled shipwards, cut the more delicate animals to pieces (Hodgson, 1907). When Medusæ are collected under such severe conditions one must not be surprised at seeing damaged specimens.

The 'Discovery' was held fast in the ice for two years (March, 1902, to February, 1904) in McMurdo Sound (lat. 78° 49′ S., long. 166° 20′ E.). This sound is between the mainland of South Victoria Land and Ross Island, upon which the volcanoes Erebus and Terror are situated. The sound is converted into a bay at the southern end by Ross's Great Ice Barrier. At the barrier end the sound is over 400 fms. deep, but over the area covered by Mr. Hodgson's collecting the water is from 5 fms. to 180 fms. deep. Beneath the ice a current flowed through the sound in a south-easterly direction. The temperature of the sea beneath the ice ranged from 28·4° F. in winter to 30° F. in summer.

LIST OF MEDUSÆ COLLECTED BY THE 'DISCOVERY' AND 'SOUTHERN CROSS' EXPEDITIONS.

HYDROMEDUSÆ.

	Discovery.	*Southern Cross.*
Anthomedusæ—		
Margelopsis australis. n.sp.	×	..
Catablema weldoni. n.sp.	×	×
Perigonimus. sp.	×	..
Sibogita borchgrevinki. n.sp.	..	×
Koellikeria maasi. n.sp.	×	..
Eleutheria hodgsoni. n.sp.	×	..
Leptomedusæ—		
Ptychogena antarctica, Browne	×	×
Cosmetirella simplex. n.g. n.sp.	×	×
Cosmetira frigida. n.sp.	×	..
Trachomedusæ—		
Pantachogon scotti. n.sp.	×	..
Narcomedusæ—		
Solmundella mediterranea (Müller)	×	×

SCYPHOMEDUSÆ.

Incoronata—		
Lucernaria vanhoeffeni. n.sp.	..	×
Coronata—		
Periphylla dodecabostrycha (Brandt)	×	×
Atolla wyvillii, Haeckel	×	..
Semæostomata—		
Desmonema gaudichandi (Maas)	×	×
Diplulmaris antarctica, Maas	×	×
„ gigantea. n.sp.	..	×

There are altogether seventeen species belonging to at least sixteen genera, and with the exception of three species, all are either new species or have been recently described as new species from the Antarctic. The 'Discovery' brought back fourteen species and the 'Southern Cross' ten, but seven species are common to both collections. The 'Discovery' obtained seven species of the ten collected by the 'Southern Cross.' Eleven species belong to the Hydromedusæ and six to the Scyphomedusæ.

The Hydromedusæ have nine species belonging to the Anthomedusæ and Leptomedusæ, which are usually littoral Medusæ, but the Trachomedusæ and Narcomedusæ, which are generally oceanic Medusæ, are each represented by a single species. The preponderance of littoral over oceanic species is no doubt due to most of the collecting having been done not far from shore.

The nine species belonging to the Anthomedusæ and Leptomedusæ are probably all liberated from hydroids, which have still to be found. In the report on the Hydroids collected by the 'Discovery' Messrs. Hickson and Gravely (1907) draw attention to the fact that out of twenty-three species of Hydroids found in McMurdo Sound not one exhibits free-swimming medusiform gonophores. When we take into consideration the difficulties under which Mr. Hodgson worked, and the very small area of ground scraped by the trawl and dredge, there seem to be good reasons for presuming that more species have still to be recorded.

The Scyphomedusæ are represented by six species, of which two, belonging to *Periphylla* and *Atolla*, have a wide geographical range, and four are at present confined to the Antarctic region.

The reports on the Medusæ collected by the recent expeditions to the Antarctic have now been published, and I give a list of the species found south of latitude 60° S.

'Belgica' Collection. (Maas, 1906.)

Phialidium iridescens, n.sp.

Lat. 70° 21′ S., to 71° 15′ S. Long. 82° 48′ W., to 93° 17′ W. (Four specimens.)

Isonema amplum (Vanhöffen).

Lat. 69° 48′ S., to 70° 49′ S. Long. 81° 19′ W., to 93° 17′ W. (Forty-two specimens.)

Homoenema racovitzæ, n.sp.

Lat. 70° 09′ S. Long. 82° 35′ W. (One specimen.)

Solmundella mediterranea (Müller).

Lat. 69° 48′ S., to 70° 50′ S. Long. 81° 19′ W., to 92° 22′ W. (Twelve specimens.)

Couthouyia, ? sp. [= *Desmonema*].

Lat. 69° 59′ S. Long. 82° 39′ W. (One specimen.)

'Scotia' Collection. (Browne, 1908).

Halicreas papillosum, Vanhöffen var. *antarctica* nov.

Lat. 70° 02′ S. Long. 23° 40′ W. 0–1000 fms. (Two specimens.)

Botrynema brucii, n.g. et n.sp.

Lat. 64° 48′ S. Long. 44° 26′ W. 0–2485 fms. (One specimen.)

Atolla wyvillii, Haeckel.

Lat. 72° 02′ S. Long. 23° 40′ W. 0–1000 fms. (One specimen.)

'Français' Collection. (Maas, 1908.)

Couthouyia gaudichaudi, Lesson. [= *Desmonema gaudichaudi*, Maas.]

About Lat. 65° S. Long. 66° W. (Paris). Off Wandel Island.

Diplulmaris antarctica, n.g. et n.sp.

About Lat. 65° S. Long. 66° W. (Paris). Off Anvers Island.

'Français' Collection. (Bedot, 1908.)

Wandelia charcoti, n.g. et n.sp. [= *Eleutheria charcoti*, Bedot.]
About Lat. 65° S. Long. 66° W. (Paris). Off Wandel Island.

'Gauss' Collection. (Vanhöffen, 1908.)

Lucernaria australis, n.sp.
About Lat. 66° S. Long. 75° E. 385 metres. (One specimen.)

Desmonema chierchiana, Vanhöffen. [= *Desmonema gaudichaudi*, Maas.]
About Lat. 66° S. Long. 89° E. North of Kaiser Wilhelm II. Land.

Diplulmaris drygalski, n.g. et n.sp. [= *Diplulmaris antarctica*, Maas.]
About Lat. 66° S. Long. 89° E. (Several specimens.)

On glancing at the Table given on page 7 to show the distribution of the Medusæ in McMurdo Sound, it will at once be noticed that *Solmundella* was by far the commonest and most abundant Medusa. The number of specimens taken on certain dates shows that it must have been in shoals under the ice. If a Medusa like *Solmundella* was so frequently found in the tow-net, there is no reason for supposing that the net would fail to catch some of the other small Medusæ, if they were present. The regularity of the occurrence of *Solmundella* tends to show that the nets were being properly handled. The only conclusion which I can draw from the Table is that, with the exception of *Solmundella*, Medusæ were very scarce in McMurdo Sound. It is unfortunate that there were not more records for 1902, but it was during that year that Mr. Hodgson was battling with the difficulty of erecting suitable shelters to the holes in the ice, and then he had not found out how to avoid ice crystals in the nets. The crystals played such havoc with the plankton as to practically stop tow-netting.

The failure by Mr. Hodgson to catch *Desmonema*, though its tentacles were occasionally found entangled on the lines, was due to his not being able to use the right kind of net. For large Scyphomedusæ an ordinary plankton tow-net is perfectly useless. A large mosquito net with a mouth at least six feet square or a small otter trawl is required. With a net of that description one stands a chance of securing a specimen, or a bag full if a shoal is met with.

Geographical Distribution.—As Dr. Maas (1906) has given lists of Medusæ recorded for the Arctic and Antarctic regions, there is scarcely need for me to compile another. The conclusion which he arrived at, after fully discussing the distribution problem, is that, so far as Medusæ are concerned, there is no proof that a single species is common to both the Polar regions. With that conclusion I quite agree. It is probable, however, that when we know more about the species of *Solmundella*, *Periphylla* and *Atolla*, one species belonging to each of those genera may be found to extend through the oceans from Pole to Pole.

I now compare the Medusæ collected by the 'Discovery' and 'Southern Cross' with those collected in Stanley Harbour, Falkland Islands, by Mr. Rupert Vallentin.

TABLE SHOWING THE DISTRIBUTION OF MEDUSÆ IN McMURDO SOUND.

Sun below the horizon. (March 23 to August 21, 1903)

	1902.						1903.																																						1904.
	Feb.		Aug.		Dec.		March.				March & April.	April.					May.									May & June.	June.			July.		August.				Sept.			Oct.		Nov.		Dec.		Jan.
——	19	20	1	8	1	25	12	16	23	27		11	16	23	25	29	5	6	9	10	13	15	18	26	29		1	16	28	13	24	1	13	21	27	7	9	18	2	21	2	5	7	—	4
Margelopsis australis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Catablema weldoni	1	..	..	..	..	..	..	..	..	..	1	1	..	..	1	..	..	..	1	..	..	..	2	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Perigonimus sp.	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..
Koellikeria maasi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	3	2	4	..	2	6	2	..	..	..	1	1	..	..	..	1	..	..	..	..	..	1	..
Eleutheria hodgsoni	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ptychogena antarctica	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cosmetirella simplex	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cosmetira frigida	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	2	..	..	..	..	..	2	..	1	..	..	..	..	..	..	..	1	..
Pantachogon scotti	..	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	4	..	..	4	..	..	7	..	1	2	..	..	2	..	..	..	..
Solmundella mediterranea	..	..	1	6	..	..	..	2	4	5	..	2	..	2	1	1	3	1	1	1	3	4	16	38	2	24	24	35	1	12	2	11	7	24	9	2	1	17	29	7	11	22	..	..	1
Periphylla dodecabostrycha	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Diplulmaris antarctica	..	..	..	..	..	..	1	..	2	7	2	..	2	6	..	..	..	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

1st Feb. 1902 : 'Discovery' arrived at Winter Quarters in McMurdo Sound.
24th March : Ship frozen in.
28th March : McMurdo Sound frozen over.
2nd March, 1903 : Six miles of ice between the 'Discovery' and the open sea.
16th Feb. 1904 : 'Discovery' escaped from the ice and left McMurdo Sound.

In the collection from the Falklands there are seventeen species of Hydromedusæ (for names, see Browne, 1902) belonging to sixteen genera. Not one of these species has yet been found in the Antarctic, and only two of the genera, namely, *Eleutheria* and *Phialidium*, are represented there. Among the Scyphomedusæ the genus *Desmonema* is common to the Magellanic and Antarctic regions, but the species are distinct. *Eleutheria charcoti*, found off the Antarctic continent near Wandel Island (south of the Falklands), is more like *E. hodgsoni* from McMurdo Sound than like *E. vallentini* from the Falklands. If we compare the Antarctic Medusæ with the records (which are still very meagre) from Australia and New Zealand, we find that only one genus (*Margelopsis*) and no species are common to both regions.

The recent Antarctic explorations have produced a fair number of new Medusæ, many of which have well-marked and interesting specific characters, but there are only about three new genera. I expect that ultimately not one of them will remain peculiar to the Antarctic fauna. All the genera, except those recently described, have representatives in other parts of the world, frequently living under totally different conditions and in localities far apart. As the littoral Hydromedusæ of the Antarctic have not yet been found in the Magellanic, South Australian, and New Zealand areas, it looks as if they belonged to an ancient stock which has long been isolated by the Great Southern Ocean from the rest of the world.

Sir John Murray, K.C.B. (1896), says: "In water of a low temperature the metabolism in cold-blooded animals would be much less rapid than in water of a high temperature, and all those changes which result in the evolution of new species would proceed at a much slower rate at the poles than in the tropical belt." If the Medusæ of the Antarctic region have long been isolated, and their evolution has proceeded at a slow rate on account of the coldness of the water, then, when an Antarctic species is compared with another species of the same genus inhabiting warmer water we ought to be able to see a difference and mark the course of evolution. As evolution is proceeding at a much slower rate in cold than in warm regions, the characters of an Antarctic Medusa should be more primitive than those of one from warmer seas.

The following are instances of this primitive condition :—

The genus *Solmundella* has a very wide geographical range, extending from the tropics to the Antarctic. It has only two opposite perradial tentacles, and the genus is descended, without doubt, from a genus which had four perradial tentacles. Beneath the two tentacles there is always a deep groove in the wall of the umbrella. In the Antarctic form there is still a conspicuous groove present in the two perradii without tentacles. The grooves have disappeared from the two perradii without tentacles in the species found off Ceylon. The species from Ceylon has not only lost all traces of the grooves, but in addition has developed about four times the number of sense organs found in the Antarctic species.

A new species of *Sibogita* found in the Antarctic has only four centripetal canals, whereas the other species have eight or more centripetal canals.

The Antarctic species of *Koellikeria* has fewer tentacles, with smaller compound basal bulbs, than are present in the species found in warm water and there are no ocelli. The absence of ocelli is not a characteristic feature of the Antarctic Medusæ, as *Eleutheria* possesses them.

The species of *Desmonema* found within the Antarctic region has about seven very thick tentacles in each group, but the species found in the Magellanic region has as many as sixty slender tentacles in each group.

The new genus, *Cosmetirella*, of the Mitrocomidæ is characterised by possessing no ocelli and no cirri. Their absence shows characters more primitive than are found in the other genera of the family.

Bathymetrical Distribution.—The occurrence of *Periphylla* at the surface on the Antarctic coast shakes my faith in the term "deep-sea" Medusæ, as it is commonly understood. The origin of the name is due to Prof. Haeckel, and is based upon certain Medusæ collected by the 'Challenger.'* It is necessary to remember that the nets used by the 'Challenger' were all open nets. The self-closing net is a later invention, and has not been very extensively used even by recent expeditions. The deep-sea Medusæ have been regarded as permanent inhabitants of the lowest zones of the oceans, living in very cold water and in darkness, and carefully avoiding sunlight and warm water.

Mr. Bigelow (1909) discusses very fully the bathymetrical range of Medusæ, and his conclusions are partly based upon the results obtained by the 'Albatross' in her cruise (1904–5) over the Eastern Tropical Pacific. Both *Periphylla* and *Atolla* were taken by the 'Albatross' within 300 fms. of the surface (one specimen of *Periphylla* was captured within 200 fms. of the surface). Within the area worked over by the 'Albatross' the temperature of the sea at the surface was between 65° F. and 85° F.; at 200 fms. between 48·5° F. and 56·7° F.; at 300 fms. between 42·7° F. and 48·2° F.; and at 400 fms. 41·9° F. and 42·5° F. Bigelow states that "not a single species was taken in hauls below 300 fms. which was not taken in other hauls between 300 fms. and the surface; although the majority of the genera of Medusæ as yet known to belong to the intermediate fauna were taken during the expedition, and several of them in considerable abundance." With regard to the term "intermediate" fauna, Bigelow prefers to adopt "intermediate" in preference to "deep-sea" ("Tiefsee"), as he term is ambiguous from its common application to abyssal bottom animals.

There is good evidence that some of the deep-sea Medusæ extend down to about 1,000 fms., but we do not yet know the depth which they usually frequent. Many more hauls with self-closing nets will have to be taken before we can find that out.

* *Cf.* The *Athenæum* for July 16th, 1881, where the writer (who may safely be supposed, from internal evidence, to have been Professor Moseley) said: "In reality there is no proof that any of the corals came from a greater depth than thirty fathoms. The dredge ranged whilst down from thirty fathoms, or one fathom, or ten fathoms to greater depths; but there is no proof that it did not pick up the corals at the least depth encountered."—Ed.

The occurrence of *Periphylla* at the surface in the Antarctic tends to show that the "deep-sea" Medusæ are lovers of cold water, or, at all events, flourish best at a cool temperature. If the temperature of the water fixes their bathymetrical distribution, then we can account for their keeping below the warm water zones in the tropical and temperate regions. I agree with Bigelow that the term "deep-sea" had better be abandoned, as it is only misleading, especially as the 'Albatross' obtained the majority of the deep-sea genera within 300 fms. of the surface where the temperature was above 42·7° F.

Anatomical Results.—In the Hydromedusan genus *Koellikeria* I have found the interior of the stomach covered with minute endodermal papillæ. Whether these papillæ have the same function as the gastric filaments of the Scyphomedusæ remains to be found out. In the Antarctic species of this genus there are radial grooves in the wall of the sub-umbrella, adjacent to the radial canals. The grooves are lined with columnar ectoderm cells, and evidently from their appearance have a definite function. The Mediterranean species (*K. fascicularis*) has not got these grooves.

The new species of *Sibogita* has its stomach completely converted into a reproductive organ when the gonads attain their full development. The stomach then ceases to function as stomach, and its cavity is filled with endoderm. The gonads are apparently in ectodermal pouches which are embedded in the endoderm, and the pouches have openings to the exterior for the discharge of their contents.

Classification.—The revisions of the old genera and sub-families and the addition of new genera which have come to light during recent years are gradually changing the system of classification as laid down by Prof. Haeckel. Although improvements have been made in some sub-families or groups, others still remain practically in their old condition, mainly through the want of fresh material to work upon.

By means of a new species of *Catablema* in the Antarctic collections I have endeavoured to show that the family Cladonemidæ is no longer required. The chief character which linked together the genera of this family is based upon the tentacles having branches, or filaments, or stalked nematocysts. It has resulted in the bringing together of a number of genera which have no true relationship with one another. The character selected for the family is more suitable for a generic or even a specific character. It is easy to abolish a family and to scatter the genera, but it is very difficult at the present time to assign new places for them, as this involves revision of other families or sub-families.

A new genus (*Cosmetirella*) of Leptomedusæ with open sensory pits led me to examine other genera with similar organs, and I have collected them together under the name of Mitrocomidæ, and have defined the genera.

A new species of the Margelidæ raised difficulties over the old genus *Rathkea*. As a revision of the species could not be satisfactorily accomplished without the use of another generic name, I considered it is best to revive the generic name *Koellikeria* of Agassiz, and thus to obtain a good type species.

In 1908 Prof. Bedot published a description of a new Coelenterate from the Antarctic under the name of *Wandelia charcoti*; with his assistance I have been able to show that it belongs to the genus *Eleutheria*.

I have been able to confirm Dr. Vanhöffen's statement that the tentacles described by Dr. Rennie as belonging to large Antarctic Siphonophores are the tentacles of a *Desmonema*.

HYDROMEDUSÆ.

ANTHOMEDUSÆ.

Family CODONIDÆ.

Margelopsis, Hartlaub, 1897. 1907.

Generic Character.—Codonidæ with four perradial groups of tentacles, each with two or more tentacles; with four radial canals; with gonad encircling the stomach.

Margelopsis australis.

(Plate IV., figs. 6 and 7.)

Description of the Species.—Umbrella bell-shaped, about as broad as high. Ex-umbrella covered with nematocysts which are not arranged in groups. Stomach cylindrical, nearly as long as the umbrellar cavity. Mouth circular. Four radial canals. Gonad completely encircles the stomach and forms a conspicuous globular swelling. Four perradial groups of tentacles, each group containing two small tentacles, placed one behind the other.

Size.—Umbrella about 0·75 mm. in width.

There is only one specimen of this little Medusa in the 'Discovery' collection. It was taken on the 29th May, 1903, in McMurdo Sound. The specimen very closely resembles *Margelopsis hartlaubi*, Browne (1903), which inhabits the fjords of Norway in the neighbourhood of Bergen. I have not succeeded in finding a good reliable character for distinguishing the Antarctic species from *M. hartlaubi*; this is partly due to the minuteness of the specimen, and to its somewhat contracted and crumbled condition.

When the specimens from Norway and the Antarctic are placed side by side they look like two distinct species, but the different appearance is mainly due to the shape of the umbrella, and to the much larger size of the Norwegian specimen.

The ex-umbrella of *Margelopsis hartlaubi* is covered with nematocysts which are grouped together into clusters, each cluster containing about a dozen nematocysts. The ex-umbrella of *Margelopsis australis* is covered with isolated nematocysts which are not arranged in groups. The stomach of *M. hartlaubi* has a very thick quadrangular base, which is situated in the jelly above the top of the umbrellar cavity.

This thick base is apparently absent in *M. australis*, but as the top of the umbrella is crushed in, it is impossible to see every detail clearly.

The arrangement of the tentacles is similar in both species. There are two tentacles, one placed behind the other (Pl. IV., fig. 7), on each of the four perradial bulbs. My figures of *M. hartlaubi* show the tentacles in this position, but I omitted to direct attention to the arrangement of the tentacles in the description of the species. Both species have practically the same kind of basal bulb. The tentacles of *M. australis* are closely contracted, and it is impossible to make out the arrangement of the nematocysts upon the tentacles. This is unfortunate, because if the structure of the tentacles should differ from *M. hartlaubi*, we should have a useful aid towards the determination of the species. I have decided to give the Antarctic *Margelopsis* a specific name because I cannot prove that it is identical with *M. hartlaubi*. One really wants another specimen in far better condition than this to definitely elucidate the specific characters.

The Medusæ which Prof. Dendy (1902) found attached to the Hydroid *Pelagohydra mirabilis*, which was washed up on the coast of New Zealand, probably belong to the medusoid genus *Margelopsis*. As these Medusæ had not detached themselves from the Hydroid and were without gonads, they must be regarded as quite early stages. They have five tentacles on each of the four perradial basal bulbs. These tentacles are arranged in two pairs, one behind the other, with the fifth tentacle by itself on the innermost side of the basal bulb.

Family TIARIDÆ.

Catablema, Haeckel, 1879.

Generic Character.—Tiaridæ with radial canals having lateral branches or diverticula.

The above definition of the genus may be regarded as rather vague, but it can be added to when all the genera and species of the Tiaridæ have undergone a thorough revision. The conformation of the sexual organs has hitherto been used as the chief means of distinguishing the different genera, but I am rather inclined to use the shape of the gonads for one of the specific characters. A new Antarctic species compels me either to omit the gonads from the generic character or to establish a new genus. I prefer, at any rate for the present, to place the new species in the genus *Catablema*. The new species is named after the late W. F. R. Weldon, who was for some years Professor of Zoology in University College, and who gave me my first lessons in this fascinating subject.

One of the characters which has always been associated with the genus *Catablema* is the presence of diverticula on the radial canals; but other species with similar diverticula have been placed in the genus *Turris*, because the conformation of their gonads is not like that in the typical *Catablema*. The type species of the genus *Turris*

is *Turris neglecta*, Lesson (1837), and this Medusa is quite unlike any *Catablema* or *Tiara*. It is generically distinct from *Turris digitalis* of Forbes and from the other species which have been recently added to the genus *Turris*.

In the genus *Catablema* Haeckel placed three species—namely, *C. vesicarium* (A. Agassiz, 1865), *C. campanula*, Haeckel, 1879 (the earlier references to *Medusa campanula* of Fabricius, 1780, are perfectly useless), and *C. eurystoma*, Haeckel, 1877. I think that the above three species may with safety be united under the name of *Catablema vesicarium*. Dr. Maas (1904) has already linked *C. campanula*, Haeckel, to *C. vesicarium*. It is clearly an Arctic Medusa, which occasionally drifts into the North Atlantic. *Catablema weldoni* has radial canals with long blind diverticula, which are simply long lateral canals. It is probable that the very short diverticula present in *C. vesicarium* are rudiments of long lateral canals.

In the genus *Turris* the following species have radial canals with diverticula or a jagged edge: *T. digitalis*, Forbes (1848); *T. coeca*, Hartlaub (1902); *T. pelagica*, Agassiz and Mayer (1902); *T. breviconis*, Murbach and Shearer (1903); and *T. fontata*, Bigelow (1909). I do not intend to attempt a revision of the Tiaridæ now, as it would be no light undertaking, so must leave it for another occasion or for some other student to accomplish.

Catablema weldoni.

(Plate I., figs. 1–5.)

Description of the Species.—Umbrella somewhat bell-shaped, with a rounded summit and thick walls, a little higher than broad. Velum narrow. Stomach large and globular, occupying the upper half of the umbrellar cavity. Mouth large, with four short lips and a closely folded margin. Four broad radial canals; each with about 20 pairs of long diverticula or branches, at right angles to the radial canals, variable in length and shape, and usually branched. Circular canal broad, with a few rudimentary diverticula. Gonads in eight longitudinal rows, extending along the whole length of the stomach, each row consisting of a series of transverse folds. About 24 long tentacles, evenly distributed round the umbrellar margin, each having on the inner side a series of filaments with nematocysts. One small marginal bulb between every two tentacles.

Size.—Umbrella up to 30 mm. in height.

Description of an Early Stage (Plate I., fig. 1).—Umbrella somewhat bell-shaped, with a rounded summit, and fairly thin walls, about as high as broad. Velum narrow. Stomach small and somewhat quadrangular. Mouth with four rather long lips and a slightly folded margin. Four fairly broad radial canals, each with about 16 pairs of short, simple diverticula, variable in length, but not branched. Circular canal rather narrow, without diverticula. Gonads just appearing in small folds along the stomach. Two long, opposite perradial tentacles with filaments, and two very

small opposite perradial tentacles at an early stage of development, with filaments just appearing. Four interradial marginal bulbs and eight adradial bulbs, smaller than the interradial.

Size.—Umbrella about 4 mm. in width and height.

The presence of two long opposite perradial tentacles in the early stage indicates that this Medusa begins its free-swimming career with only two tentacles. The genus *Catablema* is very closely related to the genus *Tiara*. It is known that *Tiara pileata* is liberated from a hydroid belonging to the genus *Perigonimus*, and that on liberation the Medusa has only two opposite perradial tentacles. It is very likely that *Catablema* is also liberated from a *Perigonimus*-like hydroid. The early stages of *Catablema weldoni* were taken in January and June, and the adults during April and May.

The 'Discovery' collection contains nine specimens of this new species, which can be easily distinguished from the others of the genus by the tentacles possessing filaments with nematocysts, and by the length of the lateral diverticula of the radial canals. The specimens all came from under the ice in McMurdo Sound. There are two early stages with four tentacles, and two intermediate stages with 9 and 12 tentacles. The others are adults with 16 tentacles. Only two specimens are in good condition.

The 'Southern Cross' collection possesses ten specimens, all of which are in a very bad and rotten condition. They are solely recognisable by the structure of the tentacles and by the lateral diverticula of the radial canals. These specimens, however, were useful, for some are larger in size and possess more tentacles than those in the other collection. They were all taken at Cape Adare, at the surface and near the beach, on 10th May, 1899. Temperature of the sea, 27° F.

As the stomach is large, its attachment to the roof of the umbrellar cavity is strengthened by "mesenteries." These so-called mesenteries are formed by outgrowths of the stomach along a portion of the radial canals, and consequently the canals leave the stomach not at the top, but laterally. In *Catablema weldoni*, the outgrowths are very short, extending just over the top of the umbrellar cavity, and unless specially searched for are likely to be overlooked. Prof. Haeckel attached importance to the presence or absence of mesenteries in his classification of the Tiaridæ, and included them in the character of the genera. They are not true mesenteries, such as *Ptychogastria polaris* possesses, but simply outgrowths of the stomach, and their extension along the canals depends greatly upon the size and weight of the stomach.

The gonads (Plate I., fig. 5) are arranged in eight straight, adradial, longitudinal rows, which extend along the whole length of the stomach. Each row is composed of many small transverse folds, which bear the generative cells. The arrangement of the gonads in straight rows is only seen in those specimens which have the stomach properly expanded. Two specimens have their stomachs contracted back, and the gonads are curved and thrown back against the top of the umbrellar cavity.

In *Catablema campanula*, Haeckel, the diverticula of the radial canals are short

and dendritic in shape, forming a kind of ornamental border to the radial and circular canals. Haeckel calls these diverticula "leberartigen Canal-Drusen," but there is no evidence that they function as glands. The diverticula of the radial canals in the early stage of *Catablema weldoni* are simply short lateral outgrowths without any branching. In the adult, though some of the diverticula are short and simple, most of them are more or less branched. The mode of branching is, however, very variable, and scarcely two diverticula are alike. It is important to notice that the diverticula are long and that some nearly meet those from the adjacent radial canals; there is no definite arrangement of the diverticula upon the sides of the canals. They are sometimes in opposite pairs, sometimes alternate, and apparently develop wherever there is a sufficient space. In some of the other species of *Catablema* the circular canal has diverticula upon its upper margin, similar to those upon the radial canals. In *Catablema weldoni* the diverticula of the circular canal have disappeared, and their former presence is just indicated by a few minute vestigial outgrowths.

The most interesting feature of this Medusa is the presence of filaments (Plate I., fig. 4) along the inner side of all the tentacles. The filaments are closely packed together, forming a kind of frill which extends along nearly the whole length of the tentacle, being absent from the basal portion only. The crowding together of the filaments, so as to form thick dense masses, depends entirely upon the contraction of the tentacle. In a semi-contracted tentacle the filaments are about four deep, transversely, and when the tentacle is closely contracted they are denser still. In a fully-expanded tentacle the filaments are probably arranged in a single or double row, and then they should somewhat resemble the appearance of the filaments on the tentacle of *Ctenaria ctenophora*. In some of the specimens, owing to great shrinkage, the tentacles have the appearance of long narrow ribbons, with one edge lined with filaments.

The state of preservation of the specimens is not good for minute histological details, but is sufficiently so to show that the filaments are composed of ectoderm cells. The filaments are solid, and have a central strand of mesoglaea. They are capable of a certain amount of expansion and contraction. There is no visible evidence that the endoderm of the tentacle enters the filament. Sections through the tip of a filament show that it contains numerous very minute nematocysts.

The tentacles are frequently very long; some measure 60 to 80 mm. in length, and are by no means fully expanded. They are hollow and well supplied with ectodermal muscle fibres.

The basal bulbs of the tentacles are laterally compressed and curve over the thick margin of the umbrella. There is not the slightest indication of a pigment spot on the basal bulbs, nor of any other kind of sense organ. Between every two tentacles there is a small marginal bulb, which is probably capable of developing a tentacle when another is needed.

One specimen has nine long tentacles, with a small bulb in between every two

tentacles on the one half of the umbrellar margin, and on the other half only twelve small bulbs. Another specimen has one short tentacle and five bulbs close together in one quadrant, and the other three quadrants are without tentacles, bulbs, or a circular canal. These specimens are either congenitally abnormal, or else in the process of repairing serious injuries. The latter specimen has every appearance of having lost the greater portion of its original umbrellar margin, and the wound seems to have healed up. The former probably lost one half of its tentacles and has begun to develop a fresh set.

There is an interesting abnormality in one specimen. From one of the radial canals, not far from the top of the umbrellar cavity, hangs down an extra stomach with a mouth. The stomach has the shape of a slender tube, and bears a few genital folds. The mouth is fairly large for the size of the stomach, and its margin is folded.

A large Amphipod belonging to the genus *Hyperia* was found inside the umbrellar cavity of two specimens.

Perigonimus. sp. ?

In the 'Discovery' collection there are four specimens of a little Medusa which looks like a very early stage of a *Perigonimus*. They are all about the same age and have not been long liberated from their hydroid. The shape and structure of the tentacles are not in favour of this Medusa being a very early stage of *Catablema*.

Description.—The umbrella is about 1 mm. or less in length and width, with a small conical process on the summit. The stomach is short, and the mouth has four little lips. Four radial canals. The gonads have not begun to develop. There are two long, opposite perradial tentacles, with large tapering basal bulbs. Two very small, opposite perradial and four very small interradial tentacles.

Family BYTHOTIARIDÆ (Maas, 1905), Bigelow, 1909.

Genus Sibogita, Maas, 1905.

sens. em.

Generic character.—Bythotiaridæ with four perradial canals; with four or more centripetal canals, which may either remain blind canals, or join the radial canals (when the latter have the appearance of being branched), or join the base of the stomach.

Mr. Bigelow (1909) has recently emended Maas' original definition of the genus, so as to be able to include within the genus a new species called *Sibogita simulans*, found in the Tropical Pacific between Panama and Chatham Island, and also in the Behring Sea; and another new species called *S. nauarchus*, found in the Gulf Stream off the North American coast. I now find it necessary to slightly alter Bigelow's definition of the genus for the admittance of a new Antarctic species, named *Sibogita borchgrevinki*, in honour of the leader of the 'Southern Cross' Expedition to the South Pole. I think it is advisable to leave the structure of the gonads out of the generic

definition, and instead of saying "numerous" centripetal canals, to fix the number at four or more.

The type species of the genus *Sibogita* is *S. geometrica*, Maas. This Medusa, according to Maas' figure, certainly has the appearance of possessing radial canals with lateral branches, as stated by Maas, and there is no indication of the lateral branches being really centripetal canals, which originate from the circular canal and afterwards join the radial canals.

It was my intention to place the Antarctic species in a new genus, but Mr. Bigelow's account of the development of the canal system of *Sibogita simulans* has led me to place the new species in the genus *Sibogita*. I believe that Mr. Bigelow is right in associating his two new species with the genus *Sibogita*, especially as the tentacles and the umbrella are similar to those of the type species.

The two specimens of *Sibogita simulans* collected in the tropical Pacific have eight adradial blind centripetal canals, but the single specimen from the Behring Sea is older than those two and has twelve centripetal canals, which all unite with the base of the stomach. In *S. nauarchus* the centripetal canals are more numerous and are all blind. *Sibogita borchgrevinki* has only four centripetal canals, which may or may not unite by lateral branches with the base of the stomach.

In the species described by Dr. Maas and by Mr. Bigelow the gonads are transversely folded, and occupy the whole space between the perradii. The gonads of the new Antarctic species are distinctly peculiar, as they are in pockets, and the whole stomach is converted into a reproductive organ.

Sibogita borchgrevinki.

(Plate II., figs. 1–5.)

Description of the Species.—Umbrella ovoid, a little higher than broad, and very thick. Velum narrow. Stomach about one-third the length of the umbrellar cavity, somewhat conical, tapering slightly towards the mouth, and with four perradial ridges. Mouth with four small lips and the margin slightly folded. Four perradial canals, and four interradial centripetal canals. The latter may or may not unite with the cruciform base of the stomach. Gonads (male) in pockets and embedded in the wall of the stomach, with definite openings to the exterior. About sixteen fairly long, hollow, smooth tentacles, each with a large terminal bulb containing nematocysts.

Size.—Umbrella 15–18 mm. in width and 20 mm. in height.

Three specimens of this interesting Medusa were taken at the surface during November 1899 at Cape Adare by the 'Southern Cross' Expedition. The specimens are in very good condition, but all have the margin of the umbrella so very much contracted that it was necessary for examination to cut it into pieces. Two of the specimens are fully ripe males, and the third specimen has shed its gonads.

The jelly of the umbrella is not only very thick, but very firm. There is no apical depression in the wall of the umbrella, as found in *S. nauarchus*. The margin of the umbrella is divided by grooves, which are opposite the tentacles, into small lobes.

The mouth has four short perradial lips, and the margin is arranged in slight folds. Just inside the mouth there are four interradial, endodermal processes somewhat triangular in shape. On the closing of the mouth these processes meet and close the entrance to the stomach. One specimen is, however, abnormal, and its mouth has seven pointed lips. It has five longitudinal ridges on the stomach.

The most interesting features in this Medusa are the gonads and their position with regard to the stomach. The stomachs of two specimens were cut into transverse sections. One series (Plate II., fig. 4) shows ripe spermaries, and the spermatozoa in the process of being discharged; the other series (Plate II., fig. 5) shows the condition of the stomach after the gonads have been discharged.

On the outside of the stomach there are four perradial longitudinal bands (fig. 2) which slightly project as ridges. Inside each ridge runs a canal-like cavity lined with endoderm (fig. 4). These canals branch out from the interior of the "mesenteries," and are in direct communication with the top of the stomach and also with the radial canals. They run down the wall of the stomach nearly to the mouth, and there terminate blindly, without any communication with the exterior.

Between the perradial bands on the outside of the stomach there are numerous small holes (fig. 2). The shape of the holes varies in the different specimens, and they may be either circular, oval, or somewhat quadrangular. The holes are arranged in a single row on both sides of the perradial bands, and a few occupy the interradial spaces in the upper part of the stomach. Within these holes, or protruding from them, is a whitish flocculent substance, which is composed of spermatozoa.

The sections show very clearly that the growth of the gonads has converted the stomach into a reproductive organ, and that its function as a stomach has ceased. There is practically no cavity for the reception and digestion of food, for although a very small cavity does exist in the centre of the stomach (fig. 4), it is not in communication with the mouth. In the lower part of the stomach the endoderm forms a solid mass in the centre.

The spermaries form globular or spherical masses encased in a very thin membrane which lies next to the endoderm of the stomach. The endoderm, stained with hæmatoxylin, in the sections, has the appearance of a mosaic pavement in different tints of blue. The cells have not a well-defined wall and are filled with a rather dense homogeneous cytoplasm. The preservation is not good for cytological details, and it must be borne in mind that the specimens were merely preserved for the determination of the species.

It is unfortunate that there are no intermediate stages of this Medusa in the collection for the elucidation of the development of the gonads. The four perradial

longitudinal canal-like tubes, which run along the stomach, are probably the four corners of an ordinary quadrilateral stomach which has become nearly blocked up owing to the growth of the gonads. I do not think that they are permanent canals, like the radial canals, but rather spaces in the stomach which have not become filled up with endoderm. At the same time it is possible that they might be used as channels for the conveyance of nutriment to the developing gonads.

Although the gonads have every appearance of being next to the endoderm, without the intervention of a layer of mesoglæa, and without a trace of ectoderm, still there is no evidence that they are of endodermal origin. The gonads are shut off from the endoderm by a very thin delicate membrane which may be a layer of mesoglæa. As the gonads are fully ripe they have probably in the course of development absorbed all the adjacent ectoderm cells. The position of the ripe gonads is certainly peculiar, and a few young and intermediate stages were much wanted for tracing the development.

The sections of the stomach belonging to the specimen which has shed all its gonads are also of interest. The positions of the shed gonads are marked out by spaces, which are either straight simple cavities or tubular cavities more or less curved (fig. 5). These cavities are lined with a well-marked ectoderm which has apparently developed after the shedding of the gonads. The new ectoderm is continuous with the old ectoderm on the outside of the stomach.

The specimen which has quadrangular holes alongside the perradial ridges has somewhat the appearance of having its gonads arranged in short, transverse folds, as described in the other species of the genus. But it is after all only an external resemblance.

The four perradial canals are in direct communication with the stomach through the interior of the "mesenteries" upon which the stomach is suspended, and which form its cruciform base. The four interradial canals have no direct communication with the stomach. They run nearly the whole length of the sub-umbrellar cavity. Some terminate at their proximal end, i.e., nearest to the top of the umbrellar cavity, either in a straight point, or in slight diverticula (fig. 2), without any communication with the stomach or the perradial canals. In this condition they have every resemblance to long centripetal canals which develop direct from the circular canal.

A few of the interradial canals at their proximal ends do communicate with the perradial canals by means of irregular branches. There is either a single branch running to one of the adjacent perradial canals, or two opposite branches running to both the adjacent canals. The union with the perradial canals is at the point where the "mesenteries" are about to becomes radial canals. In one specimen none of the interradial canals show any connection with the perradial canals. But in another specimen three of the interradial canals have a connection by means of an irregular branch or branches.

In the distal half of the umbrella the perradial and interradial canals are alike in size and appearance, but in the proximal half the interradial canals are thinner and more slender than the perradial. It is evident that the connection between the interradial and perradial canals is very slight, and probably takes place late in life. The main current from the stomach to the circular canal runs through the perradial canals. From the general appearance of the interradial canals I am inclined to the view that they originate as centripetal canals and that some of them make a union with the perradial canals or the base of the stomach. One specimen shows a slight variation by the presence of two centripetal canals in one quadrant.

There are about sixteen tentacles; eight of which are opposite the radial canals, and one is usually present between every two canals. Two specimens have in addition a few very minute tentacular processes, which are evidently tentacles in an arrested state of development. The tentacles (Plate II., fig. 3) are about 10 mm. in length and, although hollow, have rather a stiff appearance. At the distal end there is a large hollow bulb, the ectoderm of which is thickly packed with nematocysts. The basal portion of the tentacles lies in a little groove formed in the margin of the umbrella, and the basal bulb is inconspicuous, just a slight enlargement. One abnormal tentacle with two terminal bulbs was seen; the extra bulb being on a short lateral branch not far from the distal end.

There are no indications of any sense organs upon the margin of the umbrella.

Sibogita borchgrevinki may be distinguished from the other species of the genus by the structure of its gonads, and by the presence of only four (interradial) centripetal canals.

Family MARGELIDÆ.*

Genus Koellikeria, L. Agassiz, 1862.

Rathkea (partim), Haeckel, 1879.

Rathkea, Maas, 1905.

Generic Character.—Margelidæ with four perradial and four interradial groups of tentacles; and with four branched oral tentacles.

The genus *Rathkea* was instituted by Brandt (1838) for *Oceania blumenbachi*, Rathke, 1835. This is the type species of the genus, and unfortunately it has been inadequately described and badly figured. According to Rathke's figure the Medusa has eight radial canals, eight groups of tentacles, each group having three tentacles. The mouth is shown in a crude drawing which is difficult to interpret. Haeckel, however, defines the genus *Rathkea* with only four radial canals, and suggests that the other four (interradial) canals in Rathke's figure are probably radial muscle bands. *Rathkea blumenbachi* was found near Sevastopol, in the Black Sea, and since Rathke described it, no one else has again recorded it.

* This form of the family name has the sanction of custom only, to which it has been agreed to defer.—Ed.

Another species placed by Professor Haeckel in the genus *Rathkea* is *Cytæis octopunctata* of Sars (1835). This species is fairly well known and has been found in the Arctic regions and in the North Atlantic, along the coast of North America, and also along the coast of Europe, from Norway to about as far south as the English Channel. There is no evidence that the species occurs in the Mediterranean. *Cytæis octopunctata* belongs to the genus *Margellium* Haeckel. It has four radial canals, eight groups of tentacles, and a peculiar mouth. The mouth has the appearance of possessing four perradial tentacles, each of which is distally bifurcated and terminates with a small globular cluster of nematocysts. These are not true tentacles, but simply the four corners of the mouth stretched out so as to resemble stalks. The clusters of nematocysts are really on the margin of the mouth and there is no mistaking their position when the mouth is seen wide open.

Rathkea fasciculata (Péron, 1809) is the third and last species mentioned by Prof. Haeckel. This species is well known and has been described and figured by Gegenbaur (1856), by Keferstein and Ehlers (1862) under the name of *Lizzia koellikeri*, and by Leuckart (1856) under the name of *Bougainvillia koellikeri*. It was originally named by Péron *Melicerta fasciculata*, and was transferred by L. Agassiz (1862) to a new genus called *Koellikeria*, because *Melicerta* was a pre-occupied name. This Medusa has four radial canals, eight groups of tentacles on the margin of the umbrella, and four perradial oral tentacles which are very much branched. The oral tentacles arise a little way from the margin of the mouth, which has four lips without any clusters of nematocysts upon them. The species is confined to the Mediterranean, and is well known at Naples by the name of *Lizzia koellikeri*.

I do not think that *R. blumenbachi* belongs to the same genus as *R. fascicularis*, as Rathke's drawing of the mouth does not represent branched oral tentacles, such as *R. fascicularis* possesses. It is also necessary to bear in mind that Rathke figured eight radial canals.

For the classification of the Margelidæ it is necessary to know not only the number of groups of marginal tentacles, but also whether the species has definite oral tentacles (which may be branched or unbranched) or only clusters of nematocysts on the margin of the mouth. Under the circumstances I think it is best to give *Rathkea fascicularis* another generic name, and to place *Rathkea blumenbachi* on the dormant list until we really know something more about it. There is not much to be gained by retaining a badly described type species, as it only leads to confusion.

I think it will be an advantage to use in future the name *Koellikeria* for the genus, and then *fascicularis* will become the type species. To this genus should be transferred *Rathkea octonemalis*, Maas (1905), found at Ternate, and *Lizzia elegans*, Mayer (1900), found off Tortugas, Florida. I am also rather inclined to include *Chiarella centripetalis*, Maas (1897). *Chiarella* is distinguished from the other genera of the Margelidæ by possessing a double bundle of tentacles in each of the eight groups, and by having interradial extensions of the circular canal, but these are almost too slight to be called

centripetal canals. The characters selected for the genus would make very good specific characters. *Chiarella centripetalis* was found by Agassiz in the Gulf of California.

Koellikeria maasi.

(Plate IV., fig. 1–5.)

Description of the Species.—Umbrella very thick, a little higher than broad, with a rounded summit. Stomach fairly large, cross-shaped, and internally covered with papillæ. Four oral tentacles, each of which is many times dichotomously branched. Four broad radial canals. Gonads separated perradially into four masses, which cover very nearly the whole wall of the stomach. Eight groups (four perradial and four interradial) of marginal tentacles, each group containing seven tentacles, of which the central tentacle is the largest. Compound basal bulbs of the tentacles very inconspicuous. Ocelli absent.

Size.—Umbrella up to 9 mm. in width and 10 mm. in height.

Description of an Early Stage (Plate IV., fig. 1). Umbrella moderately thin, without a mass of jelly above the stomach and slightly higher than broad. Stomach small and cross-shaped, about one-third the length of the umbrellar cavity. Four oral tentacles, each of which is 2–3 times dichotomously branched. Four fairly broad radial canals. Eight groups of marginal tentacles, each group containing three tentacles, of which the central one is the largest. Umbrella about 1·5 mm. in width.

It is a pleasure to me to associate this new species with the name of Professor Otto Maas.

There are twenty-four specimens of this Medusa in the 'Discovery' collection. The specimens, especially the larger, were difficult to examine, owing to the contraction of the umbrellar margin and to its curling far up into the interior of the umbrellar cavity. For the drawing (fig. 2) of the adult several specimens were used. Its outline may not be quite correct when compared with a living specimen. It shows, however, the characters of the species.

The specimens were taken from May to December, 1903. As the early, intermediate, and adult stages occurred during May, and different stages of development during the other months, it is probable that the Hydroid has no definite breeding period.

The stomach in transverse section has the shape of a cross, and is attached at its base to the radial canals. Its interior is covered with minute endodermal papillæ (0·1 to 0·3 mm. in length), which are formed by outgrowths of the wall of the stomach. A series of sections, from a specimen which happened to be in a fair state of preservation, shows that the cells of the papillæ are similar to those which form the endodermal wall of the stomach (fig. 5). Along the centre of the papilla runs a slender strand of mesoglæa, which is in continuation with the mesoglæa between the ectoderm and endoderm in the wall of the stomach.

One of the intermediate stages has its mouth widely expanded, so that a good view is obtained of the interior of the stomach. The papillæ are arranged in longitudinal rows, which are interradial and adradial in position. The interradial papillæ are a little longer than the adradial ones, and evidently were the first to develop. In the adult the papillæ have the appearance of being rather irregularly scattered over the stomach, but they are not present in the perradial portions. The papillæ extend only over the areas occupied by the gonads. As these papillæ are simply outgrowths of the wall of the stomach, their function is probably digestive. After finding papillæ in this species I examined specimens of *Koellikeria* (*Rathkea*) *fascicularis* (Péron) and found the stomach well covered with them. I do not think that papillæ have hitherto been recorded inside the stomach of any Hydromedusæ, but on account of their minuteness they may easily have been overlooked.

The oral tentacles in the youngest stage of the series are three to four times dichotomously branched, and the number of branches increases with age. The adult has its oral tentacles at least seven times dichotomously branched. The branching is sometimes irregular, and a semi-contracted oral tentacle has a tree-like appearance. The distal branches all terminate with a small cap containing nematocysts.

The radial canals are broad and are adjacent to the ectodermal lining of the sub-umbrella. The ectoderm cells opposite the radial canals are quite different in shape and appearance from the flat epithelial cells which form the sub-umbrellar lining. They are distinctly columnar (fig. 4) and project out so as to give a jagged outline, and are, moreover, within a well-marked groove, which runs along the whole length of the umbrellar cavity. I have not seen these grooves with specialised columnar cells in any other Medusa, but owing to their minuteness they are not easily detected, except in transverse sections. There are also indications of columnar cells forming a narrow interradial line, about three cells wide, but here the groove is absent.

The gonads practically cover in an even layer (fig. 5) the whole outer wall of the stomach, but they are divided into four separate masses by very narrow perradial bands of ectoderm which are completely free from genital cells.

The number of tentacles in each of the eight groups depends upon the growth and age of the individual. The youngest specimens of the series have three tentacles in each group, and the large adults have seven (fig. 3), which is probably the maximum. The number of tentacles in the perradial and interradial groups are frequently the same, but not always. One large adult has seven tentacles in the perradial groups and five in the interradial (fig. 2). Among the intermediate stages specimens occur with five tentacles (perradial groups) and three (interradial groups). In each group of tentacles the central tentacle is always the largest, and the central perradial tentacle is larger than the central interradial tentacle. The difference in the size of the tentacles is due to a difference in age. The central tentacle in each group is the first to appear, and as the central perradial tentacles are the largest, the Medusa,

on liberation from its Hydroid, either has only four perradial tentacles or eight (four perradial and four interradial) tentacles. The tentacles which appear later develop in pairs and in the order shown by these figures—4, 3, 2, 1, 2, 3, 4. Some of the specimens have the groups of tentacles quite close together, which gives the appearance of the tentacles being uniformly distributed round the margin of the umbrella; but their position is entirely due to the contraction and shrinkage of the jelly, and this is especially noticeable in the specimens preserved in alcohol. The tentacles are solid, and the endodermal core is in direct contact with the endoderm of the circular canal. The lower side of the basal portion of the tentacles in each group is covered with a layer of ectoderm containing nematocysts. There is no well-marked, conspicuous compound basal bulb common to each group of tentacles, such as occurs in *Margelis* or *Chiarella*. The tentacles in a semi-contracted condition show at their distal ends conspicuous circular bands of nematocysts (fig. 3), but these bands seem to disappear when the tentacles are fairly well expanded, and the nematocysts become evenly distributed. There is not the slightest trace of ocelli at the base of the tentacles.

Family CLADONEMIDÆ.

Prof. Haeckel, in 1879, collected together various genera of Anthomedusæ having either tentacles with branches, or tentacles bearing appendages armed with nematocysts, or tentacles provided with stalked cnidophors, and placed them in the family Cladonemidæ. The character of the family has remained practically unaltered to the present day, but the genera have slightly increased in number and have been revised and re-classified by Mr. R. T. Günther (1903) and by Dr. Hartlaub (1907), who adopts Mr. Günther's classification of the genera.

The Cladonemidæ are divided into two sub-families:—

1. Pteronemidæ with unbranched tentacles having filaments with nematocysts, or tentacles armed with cnidophors.

   Genera—*Pteronema, Zanclea, Halocharis, Mnestra, Ctenaria.*

2. Dendronemidæ, with branched tentacles; one branch terminating in a sucker or adhesive disc, the other branch or branches provided with batteries of nematocysts.

   Genera—*Eleutheria* (*Clavatella*) *Zancleopsis, Cladonema, Dendronema.*

In accordance with the classification at present in vogue for the Anthomedusæ, the new Antarctic Medusa which I have described under the name of *Catablema weldoni* on page 13 should have been described as a new genus of the Cladonemidæ and not placed in the genus *Catablema* of the Tiaridæ. Although this Medusa has tentacles which bear appendages or filaments armed with a terminal battery of nematocysts, I do not consider that it has any connection with the Cladonemidæ. The structure of the gonads, the basal bulbs of the tentacles, and the mouth are

distinctly of the type belonging to the Tiaridæ. To place *Catablema weldoni* among the Cladonemidæ because of the presence of filaments upon the tentacles when all its other characters are distinctly those of the Tiaridæ would, in my opinion, be wrong.

Placed among the Cladonemidæ is the remarkable *Ctenaria ctenophora* of Haeckel. It has filaments upon the tentacles somewhat similar to those of *Catablema weldoni*; but it has an important character, namely, the presence of oral tentacles round the mouth, a character which alone should be sufficient to place it in the family Margelidæ.

The genus *Zanclea*, sometimes called *Gemmaria*, which is the generic name of its Hydroid, has tentacles provided with cnidophors situated on very fine thread-like, contractile stalks. These are not at all like the filaments on the tentacles of *Ctenaria* or *Catablema weldoni*. The Hydroid *Gemmaria* belongs to the Syncorynidæ, and there is no reason, so far as I can see, why *Zanclea* should not be placed among the Codonidæ, not far away from the genus *Sarsia*, which is connected with the Hydroid *Syncoryne*.

Pteronema is one of Prof. Haeckel's genera and its two species have not been recorded since they were first described. *Pteronema darwini* has radial canals with short diverticula, like those of a *Catablema*, so it may turn out to be one of the Tiaridæ.

Mnestra is a curious parasitic Medusa. As the cnidophors on the tentacles are much like those of *Zanclea*, it may belong to the same family.

Halocharis is a Hydroid genus belonging to the Syncorynidæ, but its Medusa is not known.

In the second sub-family, the Dendronemidæ, there are three important genera :— *Eleutheria*, *Cladonema* and *Dendronema*. Both *Cladonema* and *Dendronema* have oral tentacles round the mouth, a character also belonging to the Margelidæ.

Eleutheria, better known under the name of *Clavatella*, is usually associated with *Cladonema* on account of both having suckers on the tentacles. The suckers are specialized organs which have arisen and been perfected by a change in the habits of the Medusæ belonging to these two genera. Suckers also occur in certain genera belonging to the Trachomedusæ. *Eleutheria* is distinctly a crawling Medusa, and its habits are not like those of *Cladonema*, which is an active swimmer, and only uses its suckers for attachment. Except for the presence of suckers, there is nothing in common between *Eleutheria* and *Cladonema* to justify their being placed in the same family.

Zancleopsis is a new generic name for *Gemmaria dichotoma* of Dr. Mayer (1900), and it is evidently an early stage without gonads.

It seems to me that the characters selected to distinguish the Cladonemidæ from the other great families (Codonidæ, Tiaridæ, and Margelidæ) of the Anthomedusæ are more suitable for generic or specific characters, as they are based upon the structure of the tentacles. Moreover, the structure of the tentacles does not belong to one

definite type, but to three distinct independent types, as found in *Zanclea*, *Ctenaria*, and *Cladonema* respectively.

Genus Eleutheria, de Quatrefages, 1842.

This genus is better known to English zoologists by the name of *Clavatella*, through Hincks's description of *Clavatella prolifera*, which had, however, been previously described by de Quatrefages under the name of *Eleutheria dichotoma*. The Medusa has normally six tentacles, each of which is bifurcated. The upper or outer branch of the bifurcation terminates with a large cluster of nematocysts, and the lower branch ends with an adhesive disc or sucker, by means of which the Medusa is able to crawl about sea-weeds at the bottom of rock-pools.

A second European species is recorded under the name of *Eleutheria claparedii*. It differs from *E. dichotoma* in having both branches of the tentacles terminating with clusters of nematocysts. It is quite probable that it is only an abnormal form of *E. dichotoma*, with some nematocysts in the adhesive discs.

Another species of this genus inhabits Stanley Harbour, Falkland Islands. A single specimen was found there by Mr. Rupert Vallentin in 1898, and I described it under the name of *Eleutheria vallentini*. In 1900 Mr. Vallentin obtained some more specimens which have not yet been described. This species has twenty-four tentacles, each of which is bifurcated. The upper branch bears a terminal cluster of nematocysts, and, in addition, two to three clusters along the upper side, and occasionally a cluster on the lower side. The other branch of the bifurcation has an adhesive disc. The finding of an *Eleutheria* in the Falklands was of considerable interest, because the genus had been previously known only to Europe.

In 1908 Prof. Bedot published a Paper bearing the title "Sur un Animal Pélagique de la Région antarctique," and the animal was named *Wandelia charcoti*. It was taken off Wandel Island, lat. 65° S., long. 66° W. (Paris), by the 'Français' Expedition. The specimens, as the figures show, were in a very fragmentary condition. Although Prof. Bedot felt sure that the animal was not the remains of a Siphonophore, he was uncertain about its position amongst the Coelentera.

At first I did not recognise the animal, but on a second reading a picture of an *Eleutheria* came into my mind. As there was nothing in the description or figures to render the idea an impossible one, I wrote to Prof. Bedot. I suggested that his remarkable animal might possibly be an *Eleutheria*, and sent him the original drawings of *Eleutheria vallentini* for comparison. Prof. Bedot most kindly sent me specimens of *Wandelia* for examination, and I, in return, sent specimens of *Eleutheria hodgsoni*. We both came definitely to the conclusion that *Wandelia* was undoubtedly an *Eleutheria*.

The condition of the specimens of *Wandelia* was so bad that without a good clue it was practically impossible to associate the animal with an *Eleutheria*. I was

able to provide this clue by means of my figures of *Eleutheria vallentini*, but they have not yet been published, and only a preliminary description of the Medusa has been printed. To any one who has seen either specimens or drawings of *Eleutheria vallentini* or *E. hodgsoni* it would be fairly easy to identify the genus.

Eleutheria charcoti, now called by its rightful name, is, I consider, a new species, and is distinguished from *E. vallentini* and *E. hodgsoni* by the radial canals having slender lateral branches with a tendency towards anastomosis. As I have compared Prof. Bedot's figures with the original specimens, I must say that his drawings are of the greatest accuracy, even to the minutest details.

The largest specimens of *Eleutheria* in the 'Discovery' collection have 20 to 32 tentacles, and in general appearance closely resemble the species from Falkland Island. Each tentacle is bifurcated, the upper branch has clusters of nematocysts and the lower is provided with a terminal adhesive disc. There are more clusters of nematocysts, and their position upon the branch is different from that of *E. vallentini*, but similar to that in *E. charcoti*. They are arranged laterally along the branch, *i.e.* at right angles to the clusters of *E. vallentini*.

There are also other characters, which will be mentioned later on, showing that the *Eleutheria* in the 'Discovery' collection is specifically distinct from the one found in the Falklands. The two Antarctic species are more closely related to one another than to *E. vallentini*.

I have much pleasure in associating the new Antarctic *Eleutheria*, brought home by the 'Discovery,' with the name of Mr. T. V. Hodgson, whose perseverance and energy under the most trying conditions have led to a very considerable advance in our knowledge of the marine fauna of the Antarctic region.

Our knowledge of the habits of *Eleutheria* is almost entirely based upon *Eleutheria dichotoma*, which only moves about by crawling, and is apparently incapable of propelling itself through the water. There is no evidence that it uses its tentacles for swimming, and its umbrella is far too much reduced for that purpose. Mr. Vallentin saw the Falkland *Eleutheria* alive, and states in his notes that it is able to swim at a fairly respectable pace by means of its tentacles, which rapidly open and close, and so in a manner the Medusa rows itself along. But it evidently prefers to crawl amongst seaweed, for Mr. Vallentin writes in his notes, "These ambulatory gonozooids appear to live on a fine weed which is uniformly spread over the bottom of the harbour. The gonozooids are always on the move, crawling in and out of the fine filaments and twisting themselves into the most peculiar shapes as they slowly progress through the miniature tangled forest."

Mr. Hodgson informed me that he caught his specimens in a tow-net, which was left all night over the stern of the 'Discovery.' The ship was at anchor and swung with the tide.

Eleutheria hodgsoni.

(Plate III., figs. 1–4.)

Description of the Species.—Umbrella rudimentary, and reduced to a nearly flat circular disc, 1·5 to 2 mm. in diameter. Velum very broad, covering the whole of the under side of the umbrella. Stomach conical, partly projecting through the aperture of the velum. Mouth small and circular. Radial canals eight in number and very short. Gonads surrounding the stomach. Tentacles twenty to thirty-two, each of which is bifurcated close to the basal end; the upper arm bears five to six pairs of lateral clusters of nematocysts and a terminal cluster; the lower arm, without clusters of nematocysts, terminates in an adhesive disc, or sucker. On the under side of the basal portion of the tentacles is situated a thick pad of nematocysts, and on the upper side, close to the ex-umbrella, a conspicuous reddish-brown ocellus is present.

The 'Discovery' collection contains six well-preserved specimens of this interesting Medusa. They were taken on 20th February, 1902, ten days after the ship had taken up her position for the winter, and a month before she was frozen in.

The youngest specimen of the series is about 1 mm. in diameter, with the gonads just visible. It has eleven radial canals, and nineteen tentacles in various stages of development, seven of which are tiny buds. The other specimens are much older and approach nearer to the adult stage.

Notes on the Specimens.—The umbrella is rudimentary in the sense that it has completely lost its function as a swimming organ owing to the almost complete disappearance of the umbrellar cavity. A reduction in the length of the umbrella has taken place, and this gives it the appearance of its being flattened out. The velum is very broad and covers the whole of the lower side of the umbrella, and its aperture fits tight round the conical stomach. In nearly all the specimens the velum is close against the sub-umbrella, and in this position it is not at once recognised. The largest specimen has its velum more expanded and curved outwards, so that a space is clearly visible between the velum and the wall of the sub-umbrella. This space represents the umbrellar cavity, and is, I believe, used as a brood pouch for the development of the ova up to the planula stage.

The stomach has the shape of an inverted cone, and when expanded projects through the aperture of the velum. At the apex of the cone is a small circular mouth. The radial canals (fig. 2) are variable in number. Three specimens have eight canals, and three specimens have six, ten, and eleven canals respectively. The canals are very short, extending from the base of the stomach, across the top of the sub-umbrella, to the circular canal. According to Mr. Vallentin, the Falkland species has four radial canals.

The gonads form a continuous ring round the stomach and are extended into seven or eight swellings. Sections of one specimen show that each swelling contains a large ovum, which is absorbing the small surrounding germinal cells. There are no

visible signs of Medusa-buds in any of the specimens, and, if this species does reproduce asexually, then some buds should be present in the young stages. It is quite probable that only *Eleutheria dichotoma* in this genus has Medusa-buds.

The number of the tentacles increases with age, and they are closely packed together round the margin of the umbrella. It is very likely that the number of tentacles present when the Medusa is liberated from its Hydroid corresponds to the number of radial canals, one tentacle being opposite each canal. The tentacles opposite the radial canals in the later stages have their ocelli further in from the margin (Plate III., fig. 2), indicating that they are the oldest of the series. Each tentacle is bifurcated or branched, and the bifurcation is visible soon after the first appearance of the tentacle. The upper branch comes off close to the umbrella, and, when fully developed, is provided with ten to twelve clusters of nematocysts arranged laterally in pairs, and a terminal cluster of nematocysts is also present. When the branch is expanded (Plate III., fig. 1) the clusters are far apart and form an alternating series, but in a contracted branch (fig. 4) their arrangement is pinnate. It is by the position of these clusters of nematocysts that this species can be easily distinguished from *Eleutheria vallentini*, which has two or three clusters on the upper (aboral) side, and occasionally one on the under side. The lower branch of the bifurcation is without clusters of nematocysts, and it terminates in a slight enlargement, the adhesive disc or sucker, which is composed of specialised ectoderm cells. The tentacles are hollow and the endodermally lined lumen extends along both the branches. The basal portion of each tentacle is covered on its under side with an extra thick layer of ectoderm containing nematocysts (Plate III., fig. 3), but there is no enlargement of the nature of a basal bulb. Both *Eleutheria dichotoma* and *E. vallentini* have a continuous band of nematocysts round the margin of the umbrella. This band is absent from *E. hodgsoni*, but it is represented by isolated patches of nematocysts on the basal portion of the tentacles.

LEPTOMEDUSÆ.

Family LAODICIDÆ.

Ptychogena, A. Agassiz, 1865.

Generic Character.—Laodicidæ with four radial canals; with a central stomach and mouth; with the basal bulbs of the tentacles without ocelli (Browne, 1907).

Ptychogena antarctica.

(Plate II., figs. 6–9).

Ptychogena antarctica, Browne, 1907, p. 474.

In my preliminary notes on the 'Southern Cross' Hydrozoa I alluded to this Medusa under the name of *Laodice*. Later on, when I revised the Laodicidæ, it was placed in the genus *Ptychogena*, and a brief description of the species was given.

The 'Southern Cross' collection contains three specimens, taken at Cape Adare. The largest is in a mutilated condition, having a clean-cut hole through the centre of the umbrella. The stomach and mouth have completely disappeared, and so also have the proximal ends of the gonads, but the margin of the umbrella is in good condition. The two other specimens are intermediate stages in bad condition.

The 'Discovery' collection also contains a mutilated specimen, which was taken in McMurdo Sound on 27th March, 1903, through one of the holes in the ice.

Description of the Adult.—Umbrella slightly convex, and thick, about four times as broad as high. Velum broad. Four radial canals with sinuous margins in the gonadal regions, but without conspicuous lateral diverticula. Gonads large and broad, arranged in lateral and transverse folds, and extending over nearly the whole length of the radial canals. Tentacles long and slender, about 300, with a reddish pigment in the endoderm, and with laterally compressed basal bulbs. One long club-shaped cordylus between every two tentacles.

Size.—Umbrella up to 60 mm. in diameter.

Notes on the Specimens.—The 'Discovery' specimen shows that the gonads extend from the base of the stomach nearly to the circular canal. They are arranged in a series of lateral folds, along both sides of the radial canals, and form a closed tube. There is no evidence of a mouth extending over and along the gonads, a character which distinguishes *Staurophora* from *Ptychogena*. The radial canals of *Ptychogena antarctica* have not the conspicuous lateral diverticula of *P. lactea*. In the proximal part of the canals there about two very short irregular diverticula, but the margins of the canals are of a rather irregular wavy nature, so that the pinnate arrangement of the gonads, conspicuous in *P. lactea*, is absent in this species.

The tentacles are closely packed together round the margin of the umbrella, and are like long, slender threads, some of which measure 40–50 mm. in length. The endoderm of the tentacle, including the basal bulb, contains a dark reddish pigment (in formalin). Sections show that the pigment is in minute globules, either isolated or grouped in clusters. The ectoderm of the tentacle is thick, and composed of many layers of very small cells, amongst which are numerous long slender nematocysts, about 15 μ in length. The nematocysts frequently congregate in clusters or layers adjacent to the mesoglæa, and look in that position just like spicules. The basal bulbs of the tentacles are laterally compressed (Pl. II., fig. 8) and the upper (aboral) side of the bulb is arched, but when viewed from the aboral side, the basal bulbs look long and tapering (Pl. II., fig. 7).

The cordyli are long and club-shaped (fig. 9), and are situated on the margin of the umbrella close to the velum. There is usually only one cordylus between every two tentacles. The cordyli are without pigment. Some of the cordyli possess just a few nematocysts similar to those in the tentacles. I have not noticed nematocysts in a cordylus before, but here at any rate is an exception to the rule. Haeckel (1882) in his description of *Ptychogena pinnulata* states that the cordyli appear chalk-white in

reflected, black in transmitted light. I noticed that a few of the cordyli of *Ptychogena antarctica* were chalk-white, and this conspicuous whiteness was also present in patches on the surface of some of the gonads. I am unable to explain the cause of the whiteness, but it is evidently due to minute particles, which are perhaps products of the decomposition of the endoderm. The white cordyli mounted in balsam show no cellular structure, but seem to be simply masses of granules.

The two intermediate stages in the 'Southern Cross' collection taken on 19th May, 1899, are in a bad condition. Their connection with the large specimen, mentioned above, was traced by the shape of the basal bulbs of the tentacles and by the presence of the long club-shaped cordyli. The umbrella has the appearance of being hemispherical in shape, and measures about 25 mm. in width. The margin of the umbrella is crowded with tentacles, the number of which is estimated at about one hundred. Long cordyli were found between some of the tentacles, but not between every two tentacles. Their scarceness is no doubt due to the condition of the specimens. The better of the two specimens shows the gonads with the characteristic folds and a stomach. Unfortunately the stomach and gonads are compressed into a flat mass and matted together. Dissection could only be incompletely carried out owing to the rotten condition of the tissues. There is every appearance of a large central stomach, which hangs down in the umbrellar cavity, and a large mouth with a folded margin. The gonads extend along the radial canals from the base of the stomach nearly to the circular canal. The radial canals can be traced up to the centre of the umbrella, where they meet, and probably the stomach hangs down from them.

Mr. Borchgrevink may have alluded to this species in his book "First on the Antarctic Continent," p. 125: "10th May, 1899. In the forenoon I had discovered a small white clear jellyfish with a distinct blue cross in it." The gonads of the two intermediate stages showed a deep bluish-black colour when, some years ago, I first examined them; but now the colour has changed to a dark brown (in alcohol).

The single specimen in the 'Discovery' collection is in a fairly good state of preservation, but is mutilated and out of shape. It was useful for the description of the gonads, which are fairly perfect in this specimen and contain large ripe ova. The umbrella is rather thin, and is about 35 mm. in diameter.

Ptychogena antarctica is distinguished from *Ptychogena lactea* by the absence of the conspicuous diverticula on the radial canals, and by the colour of the tentacles, which are red.

Mr. Bigelow (1909) described a new species—*P. erythrogonon*, from the eastern tropical Pacific (between Galapagos Islands and Callao). It has well-marked specific characters, possessing a very thick globular umbrella and about 80 tentacles. Its coloration is a very brilliant brick-red.

Family MITROCOMIDÆ (Haeckel, 1879), Torrey, 1909.

Character of the Family.—Leptomedusæ with open sensory pits on the velum, containing otocysts.

In the summer of 1908, I began a revision of the Leptomedusæ with open sensory pits, but circumstances arose which compelled me to lay aside the work before the critical examination of the species was finished, and even now it must be deferred for another communication. Prof. Maas, in 1893, practically laid the foundation of the family, which he called the Lafoeidæ; but I agree with Mr. Torrey (1909) that Mitrocomidæ is a better name to use, and it was that which I was going to adopt. The hydroid genus *Lafoea* has no connection with the Medusæ belonging to the Mitrocomidæ. Messrs. Maas and Torrey include the genus *Halopsis* in the family with open sensory pits, but in the descriptions given by Prof. Agassiz (1865) and Mr. Fewkes (1888) of *Halopsis ocellata*, which is the type species of the genus, no mention is made of the sense organs being open pits. Before *Halopsis* can be included among the Mitrocomidæ the structure of the sense organs must be re-investigated.

The family consists of the following genera:—*Cosmetirella*, *Cosmetira*, *Tiaropsis*, *Mitrocomella* and *Mitrocoma*. I give the characters of the genera and just mention the species, but some of the latter have not been critically examined.

Cosmetirella.

Generic Character.—Mitrocomidæ with four radial canals; with eight sensory pits; without marginal cirri; and without ocelli adjacent to the sense organs.

This new genus is established to receive a new Antarctic species, described on p. 34, under the name of *Cosmetirella simplex*. This genus corresponds to *Phialella* among the Eucopidæ. The only real difference between *Cosmetirella* and *Phialella* is that the former has open sensory pits, and the latter closed sensory vesicles.

Cosmetira (Forbes, 1848), Hartlaub, 1909.

Generic Character.—Mitrocomidæ with four radial canals; with eight sensory pits; with marginal cirri.

The type species of the genus is *Cosmetira pilosella* (Forbes). It was originally described by Forbes under the name of *Thaumantias pilosella*, and he proposed *Cosmetira* as a sub-generic name. He never mentioned the existence of sense organs, which I found some years ago, when (1896) I temporarily placed the species in the genus *Euchilota*, which has closed sensory vesicles and belongs to the Eucopidæ. Subsequently I noticed that the sense organs were open pits, and realised that the species would have to be removed to another genus, for which I selected Forbes' name of *Cosmetira*.

Not long ago Professor Hartlaub informed me in a letter that he had obtained a new Medusa from Norway with open sensory pits, but thought, after all, that it must be *Thaumantias pilosella* of Forbes. An exchange of letters and specimens proved that the specimens were *Thaumantias pilosella*, and Prof. Hartlaub adopted the name *Cosmetira* for the genus.

Cosmetira pilosella is a very common Medusa during the summer months on the British coasts, and occasionally it occurs in vast shoals.

The Medusa described by Prof. Maas (1893) under the name of *Halopsis megalotis* belongs to this genus.

I have also placed provisionally in this genus a new Antarctic species called *Cosmetira frigida*, a description of which is given on p. 35.

Tiaropsis, Agassiz, 1849.

Generic Character.—Mitrocomidæ with four radial canals; with eight sensory pits; with an ocellus adjacent to each sense organ; without marginal cirri.

This is the oldest genus of the family, and contains about six species. Mr. Torrey (1909) has recently split the genus into two. For the species with tentacles which are all alike the old name *Tiaropsis* is retained, but for those species with two kinds of tentacles, large and small (some of which are no doubt young stages), he proposes a new genus called *Tiaropsidium*. The one character common to all the species, and it is a conspicuous character, is the presence of a definite ocellus adjacent to the sensory pit. I consider that it is best to keep all the species with this character together, and that another genus is not really wanted. I must leave for another occasion the critical examination of the species, which are at present as follows: *Tiaropsis multicirrata* (M. Sars), 1835, *T. diademata*, Agassiz, 1849, *T. mediterranea*, Metschnikoff, 1886, *T. rosea*, A. Agassiz and Mayer, 1889, *T. punctata*, Mayer, 1900, *T. davisi*, Browne, 1902, and *T. kelseyi* (Torrey), 1909.

Mitrocomella, Haeckel, 1879.

Generic Character.—Mitrocomidæ with four radial canals; with sixteen sensory pits; with marginal cirri.

This genus probably contains only a single species, namely, *M. polydiadema* (Romanes), 1876, which has been found on the coasts of the British Isles and Norway. On a casual examination it is easy to mistake this Medusa for *Cosmetira pilosella*, unless the number of sense organs be counted. I think the species described by me in 1903 under the name of *Mitrocomella fulva* had better be placed as a synonym of *M. polydiadema*.

Mitrocoma, Haeckel, 1864.

Generic Character.—Mitrocomidæ with four radial canals, with numerous open sensory pits, with marginal cirri.

This is the type genus of the family and contains four species, namely, *M. annæ*, Haeckel, 1864, *M. minervæ*, Haeckel, 1879, *M. mbengha* [sic], Agassiz and Mayer, 1899, and *M. discoidea*, Torrey, 1909.

Cosmetirella simplex.

(Plate I., fig. 6-8.)

For the generic characters, see p. 32.

Description of the Species.—Umbrella hemispherical, a little broader than high, and fairly thick. Velum narrow. Stomach quadrilateral and short. Mouth with four small lips having a slightly folded margin. Four radial canals. Gonads linear or cylindrical, extending over the central third of the radial canals. Thirty-two or more tentacles, having rather large conical basal bulbs, and usually a tentacular bulb between every two tentacles. Eight adradial sensory pits on the velum, containing several otocysts.

Size.—Umbrella up to 7 mm. in width and 6 mm. in height.

Three specimens were taken by the 'Discovery' amongst pack ice in lat. 66° 52′ S., long. 178° 15′ E. on 3rd January, 1902. One of them is at an intermediate stage of development, and has nineteen fully formed tentacles and about as many tentacular bulbs or tentacles in the process of development.

In the 'Southern Cross' collection there are two specimens which were taken at Cape Adare on 27th November, 1899. In my preliminary report upon the collection I mentioned these specimens under the name of *Phialidium*, and also stated that the marginal sense organs were not visible. They were visible, but I did not recognise them owing to the invisibility of the otocysts, which had lost their refrangibility in formalin.* After finding the sense organs in the 'Discovery' specimens, and thus knowing exactly what to look for, I again examined the 'Southern Cross' specimens and found the sensory pits.

The 'Southern Cross' specimens are similar to those in the 'Discovery' collection, except that the tentacles are very much longer and have larger basal bulbs, and the velum is a little broader.

There is a specimen in the 'Discovery' collection taken under the ice in McMurdo Sound on 16th March, 1903. It has evidently undergone a considerable amount of contraction and shrinkage, as the umbrella has become a flat disc about 7 mm. in diameter. There are forty-nine tentacles and thirteen sensory pits. The sensory pits are irregular in position, and their number in each quadrant is 4, 4, 3, 2 respectively. The gonads are large, cylindrical in shape, and look about ripe. It may be the fully grown adult of this species with an abnormal number of sense organs.

Another specimen in the 'Discovery' collection was taken during May, 1903. The umbrella is about 8 mm. in height and 5 mm. in width. The specimen is in

* This is a fact about the use of formalin which is new to me, and should, I think, be noted.—Ed.

formalin and shows no sign of shrinkage, but the length and narrowness of the umbrella are no doubt due to contraction at the moment of death. The stomach is very short and quadrilateral. The gonads contain fairly large ova and are evidently about ripe. They occupy the central third of the radial canal and are cylindrical in shape. The curious feature of this specimen is that it has only three little degenerate-looking tentacles. The margin of the umbrella looks quite perfect and shows no signs of damage. There are eight sensory pits, two in each quadrant. Although the margin looks perfect, yet it has an unnatural appearance. The presence of one interradial and two perradial tentacles, without any marginal bulbs, rather indicates that the normal course of development has not taken place.

Localities.—'Discovery' Coll.; 3. ix. 02; Lat. 66° 52′ S., long. 178° 15′ E. 'Discovery' Coll.; 16. iii. 03 and May, 1903; Winter Quarters, McMurdo Sound. 'Southern Cross' Coll.; 27. xi. 99; Cape Adare; Surface temp. 28° 9′ F.

Cosmetira frigida.

For the generic characters, see p. 32.

In the 'Discovery' collection there are several specimens of a Leptomedusa with tentacles, cirri, and traces of open sensory pits. All the specimens are in bad condition and it is impossible to give a satisfactory account of them, or a trustworthy drawing. As the exact number of sense organs remains unknown, this species is placed provisionally in the genus *Cosmetira*.

Description of the Species.—The umbrella is probably hemispherical in shape, with fairly thin walls. The largest specimen measures about 7 mm. in height and 10 mm. in width. The stomach is fairly large, with a cross-shaped base attached to the radial canals. The mouth is large and its margin is slightly folded. Four broad radial canals and a broad circular canal. The gonads extend along nearly the whole length of the radial canals, but not over the proximal and distal ends of the canals. They are band-shaped and hang down in folds. There are about thirty-two tentacles, fairly long and covered with transverse rows of nematocysts. Their basal bulbs are long, hollow and tapering, and slightly compressed laterally. Between every two tentacles there are numerous long cirri, some of which are situated on the side of the ex-umbrella, just a little way above the margin. The cirri have a minute, oval, terminal cluster of nematocysts.

The above description is based upon the best specimen, in which sense organs could not be detected. But three smaller specimens, which evidently belong to the same species, do show sense organs. They are open sensory pits with the aperture situated upon the inner side of the velum. The species has probably eight sense organs, which from their size should contain several otocysts.

There are four other specimens which may belong to the same species. They have smaller tentacles and basal bulbs, and their gonads are over the outer half of the radial canals. They also have cirri and open sensory pits.

TRACHOMEDUSÆ.

Family TRACHYNEMIDÆ.

Genus Pantachogon, Maas, 1893.

Generic Characters.—Trachynemidæ with numerous similar tentacles; with gonads extending along the radial canals, and separated from the stomach by a short interval.

Pantachogon scotti.

(Plate III., figs. 5 and 6.)

Description of the Species.—Umbrella hemispherical, a little broader than high, and fairly thin. Velum very broad. Stomach very small, roundish, and not on a peduncle. Mouth with four short lips. Eight very narrow radial canals. Gonads long, extending over the proximal two-thirds of all the radial canals, and separated by a short interval from the stomach. Tentacles all alike, very short and numerous, about fifteen in each octant.

Size.—Umbrella up to about 4 mm. in diameter.

The 'Discovery' collection contains twenty-five specimens of this little Medusa. They were all taken from under the ice in McMurdo Sound from May to December.

It was not until after much consideration that I decided to place this new species, which is named in honour of the leader of the 'Discovery' Expedition, in the genus *Pantachogon*. The type species of the genus is *Pantachogon haeckeli*, Maas (1893), which has gonads distributed at intervals along the whole length of the radial canals. Another species is *P. rubrum*, Vanhöffen (1902), which has gonads upon the outer half of the radial canals. The new species has its gonads upon the proximal part of the canals, where they form a continuous band. There is a difference in the structure of the gonads compared with the type species, but I am rather inclined to regard this difference as a specific character. I think it is best to leave the new species in the genus *Pantachogon* until better specimens have been examined and the sense organs found.

The shape of the umbrella in most of the specimens is somewhat plano-convex, and, I believe, the shape is due partly to the shrinkage of the jelly and partly to the curling inwards of the margin of the umbrella. The drawing of fig. 5 is based upon a single specimen which is in fairly good condition.

Some of the specimens show a saucer-shaped depression at the apex of the umbrella, just over the top of the stomach. I am not sure whether the depression is a natural one or the result of shrinkage. There appears, however, to be a decrease in the thickness of the jelly above the stomach. Several specimens have a ring-shaped stomach, and the shape is due to the contracting back of the wall of the stomach. The

position of the gonads upon the radial canals is slightly variable. Some specimens have the gonads extending over the proximal half of the canals, and others over the central third portion of the canals. There is always a space between the stomach and the gonads, so that the species cannot be placed in the genus *Isonema* of Maas, which has the gonads adjacent to the stomach.

One specimen still retains most of its tentacles, but the other specimens have, as usual, lost their tentacles, and only the stumps remain. The tentacles are long and thread-like, and have more the appearance of long cirri. They are too macerated for a detailed description of their structure. Sense organs were searched for, but not found.

NARCOMEDUSÆ.

Family ÆGINIDÆ (Gegenbaur, 1856), Maas, 1904.

Solmundella (Haeckel, 1879), Maas, 1904.

Generic Character.—Æginidæ with two tentacles, and with a stomach having eight pouches.

Prof. Vanhöffen (1908), in his revision of the Narcomedusæ, recognises only one species for the genus, namely, *Solmundella bitentaculata* (Quoy et Gaimard), 1833. Under that name all the *Solmundellæ* taken by the 'Valdivia' on her long cruise (1898–1899) in the North Atlantic, South Atlantic, Antarctic, and Indian Oceans have been placed.

Prof. Maas, on the other hand, recognises two species, *S. bitentaculata* and *S. mediterranea* (Joh. Müller), 1851. The latter species Maas (1906) has also recorded from the Antarctic, where it was taken by the 'Belgica.'

The differences between the two species, according to Maas, are the shape of the umbrella, colour, and the number of sense organs. *S. bitentaculata* has a rather high conical umbrella, with its apex above the exit of the tentacles, and the fully grown adult has sixteen to thirty-two sense organs. *S. mediterranea* has a rather flat-topped umbrella, not usually extending above the level of the exit of the tentacles, and the sense organs do not exceed eight in number.

Dr. Bigelow (1909) points out that the number of sense organs would be the best character to select for the distinction of the two species. *S. bitentaculata*, however, passes through a stage with eight sense organs, and the number increases with age, so that at an early stage it resembles *S. mediterranea*.

I became familiar with *S. bitentaculata* in Prof. Herdman's collection of Medusæ from Ceylon, and after a prolonged second examination of the *Solmundellæ* in the 'Discovery' collection, I came to the conclusion that *S. mediterranea* is a distinct species. About twenty of the largest adult specimens in the 'Discovery' collection were specially examined for the number of sense organs. I could not find more than eight, and they are distinctly adradial. *S. bitentaculata* of a similar size would have

at least double the number of sense organs. I could not find a single specimen in the collection with the characteristic conical umbrella of *S. bitentaculata*. *S. mediterranea* is a colourless Medusa, and Mr. Hodgson informed me that the 'Discovery' specimens were colourless when alive. *S. bitentaculata*, on the other hand, has reddish gonads and tentacles, but the colour disappears after preservation.

Solmundella mediterranea.

Æginopsis mediterranea, J. Müller, 1851, p. 272, Taf. XI.; Leuckart, 1856, p. 33, Taf. II.; Metschnikoff, 1874, Bd. xxiv., p. 26, Taf. IV.; Haeckel, 1879, p. 352; Lo Bianco, 1904, p. 56, Taf. XXXV., fig. 142.
Solmundella mediterranea, Maas, 1906, p. 12, Taf. I. (fig. 5), Taf. III. (figs. 23, 24).
Solmundella muelleri, Haeckel, 1879, p. 352.
Solmundella henseni, Maas, 1893, p. 55, Taf. V., fig. 11.

The 'Discovery' collection contains about 300 specimens of this species, but only a few are in a satisfactory condition, and all are more or less contracted. It was by far the commonest Medusa in McMurdo Sound. In 1903 specimens were taken from the middle of March throughout the Antarctic winter up to the beginning of November. Young and adult stages frequently occurred together, and apparently the Medusa has no definite breeding season.

In the 'Southern Cross' collection there are three specimens of *Solmundella*, which no doubt belong to this species. They were taken at Cape Adare on 10th May, 1899.

The umbrella is a little broader than high, with a rather flat top, about on a level with the exit of the tentacles. The umbrella of the largest specimens measured 7 mm. in diameter. Over the ex-umbrella there are scattered many small clusters of cells, which are especially noticeable near the margin of the umbrella. These are ectodermal cells containing many well-defined granules, and amongst these cells are generally a number of nematocysts.

There are four peronial grooves in the wall of the umbrella. The groove below each tentacle is of the normal type, but the groove in each of the perradii without tentacles is in a rudimentary condition. Prof. Maas (1905), p. 72, figs. 74 and 75, mentions and figures slight peronial grooves in the perradii without tentacles in *S. bitentaculata*, taken by the 'Siboga' expedition in the East Indies, and he includes the presence of four radial grooves in the generic character. The specimens which I examined of the same species taken off Ceylon (Browne, 1905, p. 153) did not show a groove in the perradii without tentacles.

The Antarctic specimens have very conspicuous grooves in the perradii without tentacles. The grooves cut deep into the jelly at the margin of the umbrella, but the length and depth of the groove show a considerable amount of variation. The peronial band in each of the perradii without tentacles, after running alongside the sub-umbrella turns off at the level of the stomach to the ex-umbrella, where there is

a small funnel-shaped pit, which, like the groove, shows a fair amount of variation. This pit is probably a vestige of the upper part of the peronial groove. The existence of a peronial band and of the vestiges of a peronial groove in the perradii without tentacles marks the former existence of tentacles in those perradii, and shows that *Solmundella* is descended from a Medusa which had four perradial tentacles.

The gonads are usually confined to the pouches of the stomach. In one specimen, however, the gonads extend over the lower part of the stomach, nearly up to the circular mouth. Many of the specimens of *S. bitentaculata* from Ceylon had gonads on the lower wall of the stomach, as well as on the walls of the pouches.

The two tentacles are of the normal type, and are long, four to seven times as long as the diameter of the umbrella. None of the specimens possessed tentacles exceeding 40 mm. in length.

The margin of the umbrella was invariably curled up, and had to be unfolded or cut off for the examination of the sense organs. Not a single specimen examined possessed more than eight sense organs. There are four very minute interradial bulbs on the margin.

Distribution.—S. mediterranea, as its name implies, occurs in the Mediterranean, and it is also widely distributed over the Atlantic (Maas, 1893). It is recorded by Maas (1906) for the Antarctic. About a dozen specimens were taken by the 'Belgica' about lat. 70° S., long. 81° to 90° W. They were mostly larval stages, but one adult, 3 mm. in diameter, was also found. Dr. Fewkes (1886) recognised from a sketch a *Solmundella* which was taken in Discovery Harbour, lat. 81° 44′ N., long. 64° 45′ W. As one is not likely to be led astray over even a rough drawing of a *Solmundella*, the record shows that *Solmundella* extends from Pole to Pole.

SCYPHOMEDUSÆ.

INCORONATA.

Family LUCERNARIIDÆ.

Genus Lucernaria, O. F. Müller, 1776.

In the 'Southern Cross' collection there are two fine specimens of a *Lucernaria*, which were dredged off Cape Adare at the depth of 28 fathoms on 9th January, 1900. Both specimens are in a contracted condition, and it was necessary for the determination of the specific characters and for the investigation of the internal anatomy to cut them longitudinally in half.

When Prof. Haeckel (1881) described *Lucernaria bathyphila*, he pointed out that the reproductive organs had lobed sacs and branched hollow spaces, and that in this respect the species differed from the other *Lucernariæ*. He was rather inclined to make it a type of a new genus, for which he proposed the name *Lucernosa*.

In 1892 Dr. Antipa described three new species from the Arctic Ocean, and on account of their having gonads in tubular follicles he adopted Haeckel's name *Lucernosa* for the genus. The species with gonads of a simple structure are left in the old genus *Lucernaria*, and those with a compound structure placed in the genus *Lucernosa*. The new species from the Antarctic belongs to the latter group, owing to the structure of its gonads.

I am not in favour of the splitting up of the species into two genera solely on account of the structure of the gonads, especially as the structure of the gonads of *L. bathyphila* forms a connecting link between *Lucernaria campanula* and *Lucernaria vanhoeffeni* and also Antipa's species. The Arctic species of *Lucernaria* and *Lucernaria bathyphila* found in deep water, 540 fms., between Faroe Islands and Shetland Islands, are all of great size, and in this respect the new Antarctic species can take its place along with them.

Prof. Vanhöffen (1908) has described a new species of *Lucernaria* under the name of *L. australis*, which was found at the 'Gauss' winter station off the Antarctic continent at the depth of 385 metres (about 210 fms.). Unfortunately, only a single specimen was obtained, and this turned out to be an early stage without gonads. It is not likely to be an early stage of *L. vanhoeffeni*, because it has minute rudimentary tentacles, called "conuli" by Vanhöffen, one about midway between every pair of arms, and in addition there is no indication of a definite peduncle.

Lucernaria vanhoeffeni.

(Plates V., figs. 3–6, and VII., figs. 3 and 4.)

Description of the Species.—Umbrella campanulate, about as high as broad. Peduncle very short, expanding into a very large, broad, flat, adhesive disc; one chambered, with four interradial tæniolæ terminating in bulbous enlargements without muscles. Eight arms, about equal distances apart, with the four perradial bays about as wide and deep as the interradial. Each arm with about 300 tentacles, the exterior row of which has lateral adhesive pads. Stomach short, and containing branched filaments. Mouth with large leaf-like lips. Eight longitudinal bands of genitalia, extending from the stomach to the base of the arms; each genitalium composed of numerous elongated sacs which have tubular follicles containing gonads.

Size.—About 60 mm. in height (including peduncle) and 60 mm. in width.

It is a pleasure to me to associate this new species with the name of Prof. Ernst Vanhöffen.

Owing to the contraction of the arms the umbrella has lost to a slight extent its natural shape. The sub-umbrellar cavity is large and spacious. The walls of the umbrella are rather thin and have the appearance of being very pliable. The ex-umbrella is covered with a thick layer of ectoderm which is opaque and white in formalin.

The peduncle (Plate V., fig. 3) is remarkable for its shape. It is flattened out

into a very broad adhesive disc, by which the animal fixes itself to the bottom of the sea. There is no true stalk, and only a narrow constriction separates the umbrella from the adhesive disc. The peduncle is hollow and consists of one single chamber, which is partly filled up with the bulbous enlargements of the four tæniolæ. The internal longitudinal muscle bands of the tæniola terminate at the constriction, and do not proceed into the peduncle itself. In the peduncle the tæniolæ are wholly gelatinous, as in *Lucernaria campanulata*. The jelly or mesoglæa on the bottom of the peduncle and of the tæniola is permeated by small branched canals which come from the hollow chamber. The ectodermal surface of the peduncle is divided up into numerous small lobes and irregular folds, which are flattened out on the side used for attachment.

The mouth has a large, thin, leaf-like margin which is beautifully arranged in folds. It opens through a small constricted œsophagus into the stomach, which is rather small for the size of the umbrella, and is well packed with gastric filaments. The funnel cavities are large and penetrate about half the length of the stomach. The gastric filaments are very much crowded together on the tæniolæ. As a rule they are branched close to their base, and occasionally near their distal ends. They have the appearance of flat slender ribbons, about 5 to 10 mm. in length.

The arms are short and thick, and are about equal distances apart. Upon each arm is situated a large oval cluster of short capitate tentacles, the number of which is estimated up to about three hundred. The capitate apex of the tentacle is crowded with long nematocysts. The tentacles forming the outer row, on the ex-umbrellar side, are provided with a lateral adhesive pad (Plate V., fig. 4), and some of the tentacles in the second row have also similar pads. *Lucernaria campanulata* has adhesive pads of similar structure on the tentacles occupying the same position as those of *Lucernaria vanhoeffeni*.

The gonads extend from the stomach to the base of the arms, forming fairly broad bands. Each band consists of a large number of elongated sacs (Plate V., fig. 5). Transverse and longitudinal sections were cut of the sacs, but only a diagram (Plate V., fig. 6) of their structure is given, as the preservation was too bad for the drawing of an actual section. Each sac consists of a large number of little branched or unbranched tubes, lined with endoderm and separated from one another by mesoglæa. All the tubes are connected with a main duct, which runs the whole length of the sac and opens at one end to the exterior. The blind end of the tubes is blocked with cells, amongst which small ova are clearly visible. It is amongst these cells at the end of the tubes that the gonads develop, and when the ova reach a certain size they pass down the tubes into the main duct which opens into the gastric pouch. In the male the small tubes are not so well defined. There are masses of sperm mother-cells, which are connected with tubes leading into a large broad duct filled with spermatozoa. The structure of the gonads of *Lucernaria vanhoeffeni* is similar to that described by Antipa for *L. walteri*.

The eight narrow longitudinal muscle bands lie close to the interradial septa; each pair forming nearly parallel bands along the greater length of the umbrella, but diverging near the umbrellar margin to enter the arms. A circular marginal muscle band, divided into eight segments by the arms, is also present. The interradial septa do not extend quite to the umbrellar margin, and the space left forms an opening which places the gastric pouches in communication with one another.

The smaller specimen of the two, about 40 mm. in diameter, is abnormal. It has only seven arms, six longitudinal bands of gonads, and three septa. This individual probably received an injury, early in life, near one of the interradial septa, and the new growth has not taken the normal course. One arm is smaller than the others, with smaller and fewer tentacles, and this arm is next to where the missing arm should be. Here a septum is missing, and it is replaced by a tæniola, which runs along the whole length of the umbrella and is covered along its whole length with gastric filaments. The two bands of gonads are also missing on the injured side.

Lucernaria vanhoeffeni has certain characters in common with *L. campanulata*, the well-known British species, which occurs widely in Europe. The lateral adhesive discs on the outer row of tentacles, the absence of muscles in the tæniolæ within the peduncle, and the arrangement of the arms on the umbrellar margin, are common to both species. The shape of the peduncle distinguishes *L. vanhoeffeni* from the other species of the genus.

CORONATA.

Family PERIPHYLLIDÆ (Haeckel, 1880), Vanhöffen, 1902.

Genus Periphylla, Steenstrup, 1837.
(sens. emen. Vanhöffen, 1892; Maas, 1904.)

Generic Characters.—Periphyllidæ with four interradial sense organs; with 12 tentacles (three between every two sense organs); and with 16 marginal lobes.

Periphylla dodecabostrycha.

Chrysaora dodecabostrycha ?, Brandt, 1838, p. 387, Taf. XXIX., fig. 30.
Periphylla dodecabostrycha,* Haeckel, 1880, p. 421.
Periphylla mirabilis, Haeckel, 1880, p. 422; *id.*, 1881, p. 54, Taf. XVIII.–XXIII.; *id.*, 1882, p. 64, Pls. XVIII.–XXIII.
Periphylla dodecabostrycha, Vanhöffen, 1892, p. 10, Taf. II., fig. 1; Maas, 1897, Taf. XI., fig. 1; Mayer, 1906, p. 1136, Pl. III., figs. 5, 6.

In the 'Southern Cross' collection there are five specimens of *Periphylla*, which were found either at the surface or in less than 6 fathoms of water off Cape Adare in

* Prof. Haeckel had no authority to write Brandt's name as he did; *Dodecabostrycha* is (see Brandt, p. 387) one of the three sub-genera of *Chrysaora*, and the following is an exact transcript: "3. Art.? *Chrysaora* (*Dodecabostrycha*?) *Dubia*."—Ed.

December, 1899, and January, 1900. The ice was then breaking up and departing from the coast. The temperature of the sea at the surface was 29° to 30° F. These specimens were evidently ruined by bad storage. It is sad to see large specimens in such an unsatisfactory condition, especially when the correct determination of the species is of importance.

The 'Discovery' obtained a single specimen on 1st August, 1902. It was captured by hand in McMurdo Sound. This specimen also got broken into pieces.

The occurrence of *Periphylla* at or near the surface in the icy Antarctic region is very interesting, because it is not a surface-seeking Medusa in the Atlantic or Pacific, but prefers to inhabit the intermediate and deeper zones of those oceans. I have but little doubt, from the appearance and condition of the internal organs, that these specimens were alive and in healthy condition when taken out of the sea; and that they were not dying specimens, as Vanhöffen has suggested, or ones washed up from the depths of the Antarctic Ocean.

Haeckel, from the material collected by the 'Challenger,' described and figured in great detail two new species of *Periphylla*, namely, *P. mirabilis*, of which a single specimen was taken in lat. 40° 28′ S., long. 177° 43′ E. (off the east coast of New Zealand); and *P. regina*, a single specimen of which was found south-west of the Kerguelen Islands (lat. 62° 26′ S., long. 95° 44′ E.).

Messrs. Maas and Vanhöffen recognise three species of *Periphylla*, namely, *P. hyacinthina*, Steenstrup, *P. dodecabostrycha* (Brandt), and *P. regina* (Haeckel).

Periphylla mirabilis is considered by Maas (1897) and by Vanhöffen (1902) to be identical with *P. dodecabostrycha*.

According to Prof. Haeckel's description and figures, the rhopaliar pedalia of *P. mirabilis* are shorter than the tentacular ones. It seems to me that he has divided the rhopaliar pedalia into two parts by a transverse groove. In the 'Challenger' type specimen of *P. mirabilis* the groove is more like a crease on the surface of the jelly than a natural groove. If one disregards this crease, then the rhopaliar pedalia are longer than the tentacular pedalia, and are similar in shape to those on the specimens in the two Antarctic collections, and also similar to the pedalia of *P. hyacinthina* (Haeckel, 1880, Taf. xxiv.).

The 'Challenger' type specimen of *P. regina* in the British Museum consists of a few fragments. From a scientific point of view these fragments are of little value, and can now be looked at only as objects of historical interest.

The description and figures of *P. dodecabostrycha*, as first given by Brandt (1838), are based upon a large specimen about 200 mm. in length and width. The specimens taken by the recent exploring expeditions have usually been small ones, not larger than 27 mm. in height and 18 mm. in width. Mr. Bigelow (1909) has put forward good reasons for regarding the small specimens of *P. dodecabostrycha*, described by Messrs. Mass and Vanhöffen, as young and less pigmented forms of *P. hyacinthina*.

Dr. Mayer (1906) has described and figured some specimens of *P. dodecabostrycha* taken by the 'Albatross' off the Hawaiian Islands in June, 1902, at the depth of 577–480 fms. and 478–453 fms. The smallest specimen was 55 mm. high and 50 mm. wide at the tentacular zone, and the largest 70 mm. high and 100 mm. wide. From the description and figures these specimens agree very well with those in the Antarctic collections. Mayer draws attention to the shape of the umbrella changing with age, becoming flatter and relatively wider as the Medusa grows larger. All the specimens taken by the 'Albatross' were deeply pigmented with brownish purple, especially in the zones of the radial and circular muscles. Mayer is of the opinion that it is possible that all of the so-called species of *Periphylla* may in the end prove to be local races of one and the same form.

After the first examination of the specimens in the Antarctic collections I felt fairly sure that they were large specimens of *Periphylla hyacinthina.* My determination was based not so much upon the shape of the umbrella, or upon the amount of pigmentation, as upon the shape of the pedalia. All the specimens have the rhopaliar pedalia longer and narrower than the tentacular ones. In this respect they resemble Haeckel's figures of *P. hyacinthina.*

The rounded shape of the top of the umbrella is in favour of the specimens being *Periphylla regina.* But after comparing Dr. Wilson's sketch (Plate VII., fig. 1) with Agassiz's sketch of *P. regina,* drawn and coloured from life (see Maas, 1897, Taf. X.), I came to the conclusion that the specimens did not belong to that species. According to Prof. Agassiz's figure the pedalia of *P. regina* are semi-globular in shape, and all of the same size.

At present the three species of *Periphylla* are mainly distinguished by the shape of the umbrella and by the colour and amount of pigmentation. I think that we require a better and more definite character for the determination of the species, especially as the identification has usually to be based upon preserved specimens.

If *Periphylla hyacinthina* and *P. dodecabostrycha* be really distinct species, then I think a character could be found upon the margin of the umbrella, such as the shape of the pedalia, by which they could be readily distinguished.

I have placed the specimens collected by the 'Southern Cross' and 'Discovery' under the name of *Periphylla dodecabostrycha* because they agree very well with Haeckel's *P. mirabilis,* which is considered to be identical with *P. dodecabostrycha.* I am rather in favour of Mr. Bigelow's suggestion that the small *P. dodecabostrycha,* described by Messrs. Maas and Vanhöffen, are young stages of *P. hyacinthina.* I am also inclined to think that the large specimens called *P. mirabilis* and *P. dodecabostrycha* will eventually be proved to be only very large specimens of *P. hyacinthina.*

NOTES ON THE SPECIMENS. 'SOUTHERN CROSS' COLLECTION.

Specimen A.—This is the smallest specimen in the collection. The diameter of the central disc is about 50 mm. and its height nearly 40 mm. The umbrella is covered with a thick layer (about 7 mm.) of transparent jelly, and through it one can see the dark brown conical-shaped stomach. At its apex there is a short (nearly 2 mm.) spike-shaped projection. That portion of the Medusa which lies below the coronal furrow is not in good condition. The pedalia are present, but the lobes, tentacles, sense organs and pigment have either completely or nearly disappeared. The tentacular pedalia are about 10 mm. in width and 13–15 mm. in length (measured from the coronal furrow to the base of the tentacle). The distance from the coronal furrow to the distal edge of the marginal lobes is estimated at about 28 mm. The specimen is too much macerated to show any gonads.

Specimen B.—The external appearance of this specimen shows that it was originally placed mouth downwards in a tin can with straight sides and a flat bottom. The specimen is in a fairly good state of preservation, but spoilt through having been squeezed into a small can and stained with iron rust.

The central disc is about 75 mm. in diameter, but it has lost its natural shape, as the sides are straight and the top flattened. There is a thick layer (about 8 mm.) of jelly, which suddenly thins out to about 1 mm. in thickness, marking the apex of the umbrella. The tentacular and rhopaliar pedalia in general appearance resemble closely those in Prof. Haeckel's figures of *Periphylla hyacinthina* (1880, Taf. 24, fig. 11) and of *P. mirabilis* (1882, Plate 18, fig. 1). The tentacular pedalia are about 25 mm. in length and 15 mm. in width. The rhopaliar pedalia are about 33 mm. in length (measured from the coronal groove to the rhopalium) and about 13 mm. in width at the proximal end (next furrow), and about 8 mm. wide near the distal end. They have a somewhat wedge-shaped appearance, and are longer and narrower than the tentacular pedalia. The tentacles are broken off close to the pedalia, and the rhopalia are entirely gone. Some of the marginal lobes appear to be in fairly good condition, but have completely lost their pigment. The only conspicuous pigment left below the coronal furrow is a triangular patch within the tentacular pedalia, at the base of the tentacles. The distance from the coronal furrow to the distal edge of the marginal lobes is about 50 mm. The gonads are in a very immature condition. They are just narrow bands about 2 mm. in width.

Specimen C.—This is a large adult in alcohol, with the jelly very much shrunken and of a rather opaque whitish colour. The disappearance of the dark brown pigment and the thinness of the jelly, which resembles a thick tough skin, are no doubt due to the method of preservation.

The specimen has lost its natural shape, so that measurements are of little scientific value, but are given to indicate the size of the specimen. The central disc has a broad conical appearance, and its height is not less than 90 mm. The total

length of the whole umbrella is not less than 200 mm. The pedalia have lost their external form and have become flattened. The tentacular pedalia are a little over 40 mm. in length and 25 to 30 mm. in width. The rhopaliar pedalia are at least 60 mm. in length and 20 to 25 mm. in width. Nearly all the tentacles are present, and one measures 300 mm. in length. The tentacular lobes are a little over 55 mm. in length and 30 mm. in width. The gonads are large, about 80 mm. in length and 20 mm. in width, and show ova in different stages of development.

The other two specimens in the 'Southern Cross' collection are densely stained with iron rust, broken and much flattened out. They are of about the same size as specimen C, and have well-developed ovaries.

'Discovery' Collection.

The 'Discovery' specimen was preserved in chromic-formol solution, and is of a greenish colour, which is due to the chromic acid. It is very much broken and damaged.

From the appearance of the above specimens it seems to me that a large *Periphylla* requires not only careful preservation, but very careful packing. A specimen should be well soaked in several changes of formalin or alcohol, and then placed in a jar or can larger than the specimen, but not along with starfish, glass tubes, or the like.

The sketch of *Periphylla* made by Dr. Wilson, who is an accurate and skilled artist, is of considerable value. It is a life-size sketch of a living specimen. As such accurate sketches are very rare, I have given a photographic reproduction of it (Plate VII., fig. 1), and only regret that it was necessary to reduce the size.

The sketch shows that the specimen was nearly 200 mm. in height and about 300 mm. wide across the lobes. The central disc measures in height from the coronal furrow to the top of the umbrella about 100 mm., and its width is about 160 mm. The tentacular pedalia are about 40 mm. in length and 30 mm. in width, and the rhopaliar pedalia about 50 mm. in length and 20 mm. in width. (These measurements agree with those made upon the specimen, except that the rhopaliar pedalia are a little longer, nearly 60 mm.) Mr. Hodgson informs me that the Medusa when alive was of a reddish (?) brown colour, by no means intense, except round the lower portion of the umbrella, where the colour was very dark.

I have in my collection a well-preserved specimen of *Periphylla hyacinthina* from the North Atlantic. In this specimen two of the rhopaliar pedalia show a transverse groove, and the other rhopaliar pedalia do not. The groove is in about the same position as that figured by Prof. Haeckel for *P. mirabilis*. The absence of a groove on two of the rhopaliar pedalia points strongly to the groove being a crease formed by the bending back of the margin of the umbrella either whilst the Medusa was in the net, or on deck, or in the handling of the specimen.

Distribution.—Pacific Ocean : off the coast of Chile (Vanhöffen, 1892), off the coast of Central America (Maas, 1897), off the Hawaiian Islands (Mayer, 1906), off New Zealand (Haeckel, 1880).

Family ATOLLIDÆ.

Genus Atolla, Haeckel, 1880.

(sens. em. Vanhöffen, 1902, Maas, 1897–1904.)

Atolla wyvillii.

(Plate VII., fig. 2.)

Atolla Wyvillei, Haeckel, 1880, p. 488 ; *id.*, 1882, p. 113, Pl. XXIX., figs. 1–9 ; Vanhöffen, 1902, p. 13, Taf. V., fig. 22 ; Browne, 1908, p. 241 ; Bigelow, 1909, p. 39.

There is one specimen of this Medusa in the 'Discovery' collection. It was taken in lat. 70° 30′ S., long. 169° E., off Admiralty Range (near Cape Adare), in a trawl (bottom at 610 fms.), on 26th February, 1904, when the ship was among pack ice.

The aboral side of the umbrella is in good condition, but the oral side is damaged. The stomach is torn, and only two of the gonads remain. The jelly is of a dark green colour, which is due to fixing with chromic acid, but the dark reddish brown pigment, which should coat the greater part of the umbrella, has been rubbed off, and only traces of it now remain in grooves, depressions, and other more or less protected places.

This species has been very well described and figured by Prof. Haeckel. It is distinguished from the other species of the genus by the presence of conspicuous lobes, separated by broad furrows around the margin of the central disc of the umbrella. The specimen shows this character very clearly. It has 21 lobes separated from each other by a broad, deep U-shaped furrow.

The width of the umbrella is about 77 mm. and the height about 20 mm. The top of the central disc is probably not perfectly flat, but slightly convex ; its diameter measured 46 mm. There are 22 tentacles and an equal number of sense organs. The pedalia of the tentacles measured 6 mm. in length and 7 mm. in width. The length of œsophagus is about 20 mm. The diameter of circular muscle band is about 65 mm.

Until Prof. Agassiz carried out in the 'Albatross' (1904–05) his explorations in the Eastern Pacific, *Atolla wyvillii* was known from the Antarctic and sub-Antarctic regions only. Mr. Bigelow (1909), in his report on the Medusæ collected by Agassiz's expedition, records specimens from the neighbourhood of the Galapagos Islands, and from other stations. In the region explored *Atolla* occurs within 300 fms. of the surface.

SEMÆOSTOMATA.

Family CYANEIDÆ.

Desmonema, L. Agassiz, 1862.

(sens. em. Maas, 1908.)

Generic Character.—Cyaneidæ with eight rhopalia; with eight straight or nearly straight groups of tentacles, each group containing only a single row of tentacles; with eight tentacular and sixteen rhopaliar lobes; without radial muscles on the lobes.

In 1862 L. Agassiz placed *Chrysaora gaudichaudi*, Lesson (1830), in a new genus called *Desmonema*, and at the same time he described *Couthouyia pendula* as a new genus and species. Prof. Haeckel (1880) emended the definition of the genus *Desmonema* and reduced *Couthouyia* to a synonym of it. Dr. Vanhöffen (1888) has also emended the generic definition of *Desmonema* and added a new species called *Desmonema chierchiana*[*um*], on the ground that the earlier species were not recognisable owing to their imperfect descriptions.

Until quite recently the above-mentioned species had only been recorded from the Magellanic area, and it was generally considered that they belonged to one genus, and that probably only one species really existed. The occurrence of a second species of *Desmonema* in the Magellanic area has still to be proved, as *Desmonema chierchianum* is the only one which has been adequately described and figured from that area.

Dr. Vanhöffen (1908) in his report on the 'Gauss' Medusæ has recorded *Desmonema chierchianum* from Kerguelen and Heard Islands, and also large tentacles of a *Desmonema*, and early stages from the 'Gauss' Winter Quarters of Kaiser Wilhelm II. Land on the Antarctic continent.

Dr. Maas (1908) in his report on the Medusæ collected by the 'Français' Antarctic expedition records a *Desmonema* under the name of *Couthouyia gaudichaudi*, from Booth-Wandel Island, off Danco's Land on the West Antarctic continent. From Maas' description and figures there can be no doubt that his *Couthouyia* and the *Desmonema* in the 'Southern Cross' collection belong to the same species. It must be clearly understood that there is no proof whatever, at present, that *Desmonema* (*Couthouyia*) *gaudichaudi* of Maas is identical with *Desmonema* (*Chrysaora*) *gaudichaudi* of Lesson.

Dr. Maas (1906) has also given a brief description, without figures, of an early stage of a Medusa which he considers to be probably a young *Couthouyia*. This specimen was taken in October, 1898, by the 'Belgica,' in lat. 69° 59′ S., long. 82° 39′ W., at a station which is south-west of the 'Français' station off Danco's Land. According to Maas the specimen measured 15 mm. in diameter. It has sixteen marginal lobes which show the beginnings of branched canals, and eight tentacles and eight sense organs alternating with one another. This young *Couthouyia* is probably an early stage of *Desmonema gaudichaudi*, because *Desmonema chierchianum* of a similar

size has eight groups of tentacles, each group with one long tentacle and four to six minute tentacles or tentacular buds. (Browne, 'Scotia' Report, p. 244.) I regret that I cannot follow Maas in using the name *Couthouyia* instead of *Desmonema*. The latter seems to me to be the correct name to use, and Vanhöffen is also of this opinion.

I believe that *Desmonema chierchianum* (Vanhöffen) and *Desmonema gaudichaudi* (Maas) are two distinct species belonging to the same genus, and I shall also endeavour to show that the *Desmonema* taken at the 'Gauss' Winter Station is not *Desmonema chierchianum*, but *Desmonema gaudichaudi* (Maas). Before the name *Desmonema gaudichaudi* can be definitely established for the Antarctic species, the Medusa must be found in the Magellanic area, but I have decided to use the name in this report in preference to introducing a new specific name. Up to the present the records show that *Desmonema gaudichaudi* (Maas) is an Antarctic species occurring south of latitude 60°; whereas *Desmonema chierchianum* is a sub-Antarctic species occurring north of latitude 60°.

Desmonema gaudichaudi can easily be distinguished from *Desmonema chierchianum* by the thickness and number of the tentacles. The former has up to about seven tentacles in each group, and these tentacles become very thick, 5 mm. or more in diameter. The latter species, *Desmonema chierchianum*, has a very large number of tentacles, up to sixty in each group, and they are thin and slender, about 2 mm. in diameter. The difference in the number and size of the tentacles is not due to age (Plate V., figs. 1 and 2).

Desmonema gaudichaudi.

(Plate V., fig. 1.)

Couthouyia gaudichaudi, Maas, 1908, p. 3, Pl. I. ('Français' Exped.).
Desmonema chierchiana, Vanhöffen, 1908 (partim), p. 44, fig. 9, Taf. X., fig. 3, and text relating to specimens taken off the Antarctic continent, 'Gauss' Winter Station.

The 'Southern Cross' collection contains three specimens which were taken near the surface of the sea at Cape Adare on 27th December, 1899, and 15th and 17th January, 1900. It is not possible to give a complete description, as the specimens arrived in bad condition.

Specimen A.—The diameter of the umbrella, measured to the periphery of the circular muscles, is about 150 mm. There are eight groups of tentacles, each containing two large tentacles, and four of the groups have an additional small tentacle. The gonads are very much flattened out, and in this condition measured 25 mm. in length and 50 mm. in width. The genital openings are about 35 mm. in length and the spaces between, forming the pillars of the oral arms, are 6 to 10 mm. in width.

Specimen B.—The diameter of the umbrella measured to the periphery of the circular muscles is about 160 mm. The number of tentacles in each of the eight

groups is as follows :—3 large + 1 small, 2 l. + 2 s., 2 l. + 2 s., 2 l. + 2 s., 2 l. + 2 s., 2 l. + 1 s., 3 l., 1 l. + 1 s. The large tentacles are 4 to 5 mm. thick near the base, and one measured 260 mm. in length. The small tentacles are in the course of development; they vary very much in size and length, and are situated on the outer sides of the group. Some of these little tentacles are only just visible, and measure about 2 mm. in length. The gonads protrude about 30 mm., and the genital openings in the wall of the stomach are 20 to 25 mm. in width and 35 to 40 mm. in length, and the spaces between the openings about 8 mm.

Specimen C.—This specimen is in better condition than the other two, but it is by no means perfect. The diameter of the umbrella, measured to the periphery of the circular muscles, is about 220 mm. The umbrella is of moderate thickness and its external surface is smooth and free from warts or clusters of nematocysts.

The stomach is circular in outline, about 80 mm. in diameter, with sixteen radial pouches. The tentacular pouches are 45 to 55 mm. in width at their distal margin, and the rhopaliar pouches about 35 mm. The oral arms are incomplete, only the basal parts remain, and these have large frills. The width of the pillars of the arms is about 10 mm. The gonads in general appearance are similar to those of *Desmonema chierchianum*, and are about 70 mm. in length. The genital openings are large and somewhat rectangular in shape and measure about 40 mm. in length and 30 mm. in width.

There are eight groups of tentacles arranged in a single row, adjacent to the outer edge of the circular muscles. The largest tentacles are in the middle of the group and the smallest on either side. The large tentacles are broken off close to the umbrella, and stumps show that they were about 5 mm. in thickness. In each group there are two or three large tentacles and two that are smaller. The sense organs are eight in number and are very much like those in *Desmonema chierchianum.*

The tentacular lobes (Pl. V., fig. 1) measure about 45 mm. in length and 55 mm. in width, and their distal margin is without any clefts or indentations. The rhopaliar lobes are about 35 mm. in length and 25 mm. in width. The canal system in the marginal lobes is of the same type as that in *Desmonema chierchianum* (Pl. V., fig. 2). In the tentacular lobes there is a canal between every two tentacles. Owing to the fewness of the tentacles in *Desmonema gaudichaudi* the canals are also few in number, but they are much broader than in *Desmonema chierchianum*, and occasionally nearly coalesce in the proximal part of the lobes.

The young *Medora* stage of *Desmonema chierchianum* described by Dr. Vanhöffen (1908, p. 46, Taf. II., fig. 3) and taken at the 'Gauss' Winter Station, I consider to be a young *Desmonema gaudichaudi* Maas. It measures 38 mm. in diameter, with eight groups of tentacles, each group containing one large stout tentacle and one minute tentacle or tentacular bud. In the Report on the 'Scotia' Medusæ I described young stages of *Desmonema chierchianum* from the Falkland Islands. One specimen,

16 mm. in diameter, has one long slender tentacle and four to six minute tentacles or tentacular buds in each group. A specimen 25 mm. in diameter has in each group three to six tentacles, one of which is very long and slender, and about six tentacular buds ('Scotia' Report, Pl. II., fig. 2). It is clear that the young stages of *Desmonema chierchianum* have far more tentacles in each group than Vanhöffen's *Medora* stage, though the latter is larger in size. There is also a difference in the shape of the tentacular lobes.

Detached Tentacles taken in Nets.—The 'Scotia' when in lat. 72° 31′ S., and long. 19° W., on 5th March, 1904, found in a drift net at 1 to 100 fms. some long, thick tentacles. The longest was over four feet in length and the maximum thickness measured was 7 mm. These tentacles have been described and figured by Dr. Rennie (1905) and considered by him to be the tentacles of a Siphonophore.

The 'Discovery' obtained isolated tentacles in McMurdo Sound, and these were also examined by Dr. Rennie (1907), who considered them to be the tentacles of another Siphonophore. "These tentacles differ from those of the Scottish Expedition, both in colour and consistency, the latter being brownish and of a markedly gelatinous nature even in their badly preserved parts. They appear to belong to a distinct and otherwise unknown form."

Dr. Vanhöffen (1908) has proved, beyond all doubt, the tentacles of Rennie's Siphonophore to be the tentacles of a *Desmonema*. The 'Gauss' obtained similar large tentacles at her winter quarters off the Antarctic Continent.

I obtained from the British Museum a piece of one of the tentacles found by Mr. Hodgson in McMurdo Sound and cut some sections of it. The sections clearly show that Dr. Vanhöffen was right when he said that the tentacles belonged to a *Desmonema* and not to a Siphonophore. The structure of the tentacles of Dr. Rennie's Siphonophore is similar to that of *Desmonema gaudichaudi* in the 'Southern Cross' collection.

The tentacles of *Desmonema chierchianum* and *D. gaudichaudi* are similar in structure, but the muscle bands of *D. chierchianum* are smaller in size and more slender than those of *D. gaudichaudi*. As the tentacles of *D. gaudichaudi* are much thicker than those of *D. chierchianum*, so also are the muscle bands larger and thicker.

Distribution.—Antarctic Ocean. Booth-Wandel Island, lat. 65° S., long. 66° W. (Paris) (Maas, 1908, 'Français' Expedition); lat. 69° 59′ S., long. 82° 39′ W. (Maas, 1906, 'Belgica' Expedition); lat. 66° S., long. 89° E. (Vanhöffen, 1908, 'Gauss' Expedition); Cape Adare, lat. 70° 18′ S., long. 170° 9′ E. ('Southern Cross' Expedition); lat. 72° 31′ S., long. 19° 00′ W. (Rennie, 1905, 'Scotia' Expedition); McMurdo Sound. Lat. 78° 48′ S., long. 166° 20′ S. (Rennie, 1907, 'Discovery' Expedition).

Family ULMARIDÆ.*

Diplulmaris, Maas, 1908.

Generic Character.—Ulmaridæ with 16 rhopalia, 16 tentacles, and 32 marginal lobes, regularly alternating (with numerous radial canals, some branching and all anastomosing in a network at the periphery and communicating with a circular canal).

Diplulmaris antarctica.

(Plate VI.)

Diplulmaris antarctica, Maas, 1908, p. 9, Pl. II., figs. 2, 3.
Ulmaropsis drygalskii, Vanhöffen, 1908, p. 45, figs. 10–12.
Ulmaropsis antarctica, Vanhöffen, 1909, Deutsche Südpolar Exped. Vorwort, Bd. x. (Zool., Bd. ii.), p. v.

This interesting Medusa was first described by Maas as a new genus and species, and his description is based upon two specimens collected by the French Antarctic expedition. A few months after the appearance of Maas' report on the Medusæ of the French expedition, Vanhöffen's report on the Medusæ of the German Antarctic expedition was published, and in it he described a new Medusa under the name of *Ulmaropsis drygalskii*, n.g. et n.sp. Messrs. Maas and Vanhöffen soon recognised that both expeditions had collected specimens of this new Antarctic Medusa, and that they had described it under different names. This was, however, unavoidable, owing to the short interval of time between the publications of the two reports. Dr. Vanhöffen (1909) recognises Maas' priority and proposes that the name *Ulmaropsis antarctica* should be used instead of *Diplulmaris antarctica*. I am sorry that I cannot agree to Vanhoeffen's proposed generic name, because it is directly opposed to the rules of nomenclature, which are very clear and definite on this point. The generic name *Diplulmaris* has priority over *Ulmaropsis*, just as the specific name *antarctica* has priority over *drygalskii*. The name *Diplulmaris* is quite valid and must be used.

The 'Discovery' brought home twenty-six specimens of this species, and they nearly all belong to the ephyra and meta-ephyra stages; but three are certainly adults.

There is also a single specimen in the 'Southern Cross' collection. It belongs to the meta-ephyra stage, and was taken at Cape Adare on 10th May, 1899.

The Ephyra stage (Plate VI., figs. 1 and 2).—The smallest and youngest specimens of the series are between 4 and 5 mm. in diameter, and have the typical ephyra appearance. At this stage the ephyra has sixteen fairly long arms, each divided into two flat lobes, which in the adult become the marginal lobes of the umbrella, and each arm carries a rhopalium. There are thirty-two straight, unbranched, radial canals, sixteen of which run direct from the stomach to the rhopalia, and sixteen belong to

* As *Ulmaris* is a name coined by Prof. Haeckel, and not of Greek origin, *Ulmaridæ* may be allowed to pass, but *Diplulmaris* is so shocking a hybrid that a protest must be entered. *Ulmaropsis* is, of course, as bad.—Ed.

the tentacular series, regularly alternating with the former. The tentacular canals are evidently not of the same age as the rhopaliar canals, but of a slightly later growth.

The tentacles are just beginning to make their appearance, and are indicated either by bulb-like buds, by tapering elongated buds, or by minute tentacles. Four tentacular buds varying in size and age are found in the smallest specimens, and as the Medusa grows twelve more buds develop, making the total up to sixteen. It is clear that the tentacles do not all develop at the same time, but at irregular intervals and apparently in no definite order. Ultimately the full number is reached, and corresponds to the number of sense organs.

It is quite probable that there is a still younger ephyra stage, which is not represented in the collection—a stage with only sixteen rhopaliar canals, and without the tentacular canals.

The stomach is very small, circular in outline, and four gastric filaments are visible inside. The filaments increase in number as the Medusa grows. In the early stages one filament in each group is much longer than the others, and this is probably the primary one. The mouth is simply a large opening, without any definite lips or arms, which appear later.

The ex-umbrella is covered with small clusters of nematocysts. In the later stages the nematocysts are confined to the aboral side of the marginal lobes.

The circular canal is formed by outgrowths from the radial canals (Plate VI., fig. 2), and is evidently formed just before the branches of the rhopaliar canals begin to develop.

The Meta-ephyra stage.—The normal appearance of this stage has been very well figured by Maas (1908, Plate II., fig. 2). It may be distinguished by all the rhopaliar canals possessing two opposite lateral branches, which lead into the circular canal. The tentacular canals remain unbranched, as in the earlier stages. The branching of the rhopaliar canals in the 'Discovery' specimens is rather irregular, and there is a want of uniformity in the pattern. The number of tentacles or tentacular buds present is very variable and is not correlated with the size of the umbrella, which at this stage is 15 to 25 mm. in diameter.

Variation.—Among the ephyra and meta-ephyra stages fourteen specimens are sufficiently perfect for counting the number of rhopalia or rhopaliar canals. One specimen has eleven rhopalia, four have fourteen rhopalia, two have fifteen rhopalia, and seven have the normal number of sixteen.

The early stages were mostly taken by the 'Discovery' during April and May. As meta-ephyra stages were taken at the end of March and ephyra stages in May and June, there is no clue given as to the breeding season of this Medusa. The ephyra and meta-ephyra stages were found by the 'Gauss' in January and March. Vanhöffen's account of these stages is based upon nine specimens, 4 to 22 mm. in diameter.

The Adult.—The adult specimens were all placed in one jar and labelled "Winter Quarters, various dates, 1903. Chromic-formalin." They were afterwards transferred

to alcohol, as the storage room on the ship was below freezing point. These specimens have now been preserved about six years, and the tissues are still in good condition, and the mesoglæa remains transparent and pliable. The jar contained at least three specimens.

Specimen A.—The umbrella is about 60 mm. in diameter, and it is unbroken, though the margin is torn away and the whole of the mouth. This is, however, a valuable specimen, as it is the only one showing the gonads *in situ*, and they are in good condition.

Specimen B.—This specimen is represented by one-half of the umbrella, with about eight rhopalia and eight tentacles. The diameter of the umbrella is estimated at about 70 mm.

Specimen C.—This one consists of only one-half of the umbrella, with seven rhopalia. The diameter of the umbrella is estimated at about 75 mm. From the appearance of the radial canals, Specimens B and C belong to different Medusæ, and not to one Medusa torn in half. In addition to the above there are four fragments belonging to the margin of the umbrella, with tentacles and rhopalia. These fragments may be parts of the above specimens, or of other specimens.

Description of the Adult.—The umbrella is thin and probably slightly convex in shape. The margin of the mouth is studded with warts and short protuberances containing nematocysts. The fragments belonging to the mouth are from the margin of a large mouth with either four lips, or four short arms, about 35 mm. in length, something like the oral arms of *Aurelia aurita*, but thinner and more membrane-like. The stomach is a flat circular cavity, about two-thirds the diameter of the umbrella, and its lower side is covered with a moderately thick layer of mesoglæa.

In a normal specimen 32 radial canals should leave the stomach. Sixteen of these belong to the rhopaliar series and are branched, and sixteen to the tentacular series and are unbranched. All the radial canals communicate with a circular canal and also with one another by means of an irregular anastomosing network of canals near the periphery of the umbrella (Plate VI., fig. 3). The rhopaliar canals have opposite lateral branches, which are irregular in their position on the main canal. In the adult the primary lateral branches have not unfrequently lost their connection with the main canal, and are in direct communication with the stomach. This is evidently due to the outward growth of the periphery of the stomach cutting off the proximal portion of the radial canals, including the junctions of the branches. (In *Aurelia aurita* it is not unusual to find the interradial branched canals isolated from their main canal, which then runs as a straight isolated canal from the stomach to the sense organ.) The main rhopaliar canals have frequently secondary lateral branches, which originate nearer the margin of the umbrella. The secondary branches were not present in the ephyra stages, and were only seen in the adults.

The gonads begin to make their appearance in the meta-ephyra stage, and are then indicated by a very narrow band on the outer side of the gastric filaments. As

the gonads develop the band becomes sinuously folded and broadens. In the young adult the band is about 4 mm. in width and somewhat semicircular in shape. There is no sub-genital cavity as in *Aurelia aurita*. The gonads protrude from the stomach and hang down from the sub-umbrella like the gonads of a *Chrysaora*. In the meta-ephyra stage the genital sacs have the appearance of simple sac-like enlargements, with very thin walls ; on the wall of the stomach inside are situated two rows of gastric filaments and the embryonic genital band. By the time the gonads have reached maturity the genital sacs have become lobated (Plate VI., fig. 5). Internally the proximal end of the sac is covered with numerous gastric filaments, and its distal end or bottom holds the gonads, which are now arranged in more complicated and somewhat irregular folds.

The tentacles are very much laterally compressed, especially in the basal portion, but the distal portion is more round and tapers off to a slender point. Along the whole length of the tentacle, on the inner side, runs a band or ridge, which is closely studded with clusters of nematocysts. The outer side of the tentacle is smooth and free from clusters of nematocysts (Plate VI., fig. 6). The tentacles are hollow throughout their whole length, a flat tube-like cavity running close to the inner edge. They are apparently in a semi-contracted condition, and the tube-like cavity is contracted into a series of transverse folds, which, when viewed from the outer edge of the tentacle, have the appearance of a series of rings. The folding or wrinkling is present in all fully-grown tentacles, and is sufficiently conspicuous to be noticed by the naked eye.

In the adult there are normally sixteen sense organs, alternating with sixteen tentacles. The rhopalium, or tentaculocyst, is not well protected in this Medusa—neither by lying back in a groove nor by a covering formed by the marginal lobes. It is situated on the wall of the niche formed by the marginal lobes, and points upwards towards the aboral side of the umbrella. The rhopaliar canal, which leads from the circular canal to the sense organ, is broad and flat in the adult. Over the rhopaliar canal and on the surface of the umbrella is situated a small patch of darkly coloured cells, in the midst of which there is generally a slight depression forming the dorsal sensory pit. The pit has the appearance of being in a rather rudimentary condition and is occasionally absent.

Although the marginal lobes are more or less torn, there are no indications of any further increase in number, beyond the original thirty-two of the ephyra stage, by subsequent division. The ex-umbrellar side of the lobes is covered with numerous warts containing nematocysts. The lobes show a slight variation in shape, and fill up the space between the sense organs and the tentacles. As these are not always at equal distances apart, some of the lobes are broader than others.

Vanhöffen's description of the adult is based upon a large fragment of the marginal part of the umbrella, and Maas had only one quadrant of an umbrella to work upon. Vanhöffen describes and clearly figures tentacular lobes on the margin of the

umbrella in addition to the rhopaliar lobes. Each rhopaliar lobe is divided by a deep cleft. Maas, on the other hand, figures the rhopaliar lobes with an undivided margin. I have carefully examined the tattered marginal lobes of my specimens, and can occasionally see a small isolated lobe in the position of Vanhöffen's tentacular lobes. From their general appearance I have come to the conclusion that they are only detached portions of the torn rhopaliar lobes. Although none of my specimens have one absolutely perfect lobe, still, in building up a picture from the many imperfect lobes I cannot trace or find any definite cleft in these rhopaliar lobes.

Distribution.—Antarctic. 'Gauss' Winter Station, about lat. 66° S., long. 89° E.; north of Kaiser Wilhelm II. Land (Vanhöffen). Wandel Island; lat. 65° S., long. 66° W. (Paris) ('Français' Expedition). (Maas, 1908.) McMurdo Sound; lat. 78° 49′ S., long. 166° 30′ E. ('Discovery' Expedition). Cape Adare; lat. 70° 18′ S., long. 170° 9′ E. ('Southern Cross' Expedition).

Diplulmaris (?) gigantea.

In Mr. Borchgrevink's "First on the Antarctic Continent" there is an allusion to the capture of a very large Scyphomedusa. "One large jellyfish was caught near the peninsula, with arms, or extremities, about 12 yards long; its weight was 90 lbs." There are also two illustrations from photographs of this Medusa; one showing it at the surface of the sea, and the other after it was landed from the boat. This specimen was apparently caught on 10th October, 1899, and there is a record of another specimen for December 27th. "Mr. Fouger secured a magnificent specimen of a jellyfish." In the 'Southern Cross' collection there is one specimen of a large Scyphomedusa labelled "Cape Adare, January, 1900; 7 fathoms." It was originally in formalin, but was transferred to alcohol at the British Museum.

I saw this specimen soon after its arrival at the Museum. It was then in a broken condition and thickly coated with a deposit of iron rust, which had uniformly stained the surface of the Medusa a dark reddish-brown colour. It seems to me that this specimen must have passed through some other chemical besides formalin, because the jelly of the umbrella has become very much consolidated and rather hard and brittle.

When the specimen was laid out flat in a dish, the umbrella measured about 18 inches (500 mm.) in diameter. (The size of the "90-lb. Medusa" is not stated, but from the photographs I roughly estimate the umbrella to have been about $2\frac{1}{2}$ feet in width and about 1 foot in height.) There is a central mouth and four oral arms, which are not perfect. The longest arm measures 7 feet (over 2 metres), and another arm 5 feet. They must have been very much longer when the animal was alive. They have every appearance of great strength and length, so that I do not think that the length of 12 yards for the oral arms of the "90-lb. Medusa" was a very great exaggeration. The arms are evidently of the *Desmonema* type, V-shaped transversely, broad at the base, and tapering towards the distal end. The delicate membranous folds, which form the sides of the arm, have disappeared, and only the keel and thick

gelatinous parts remain. The basal portion of the arm, close to the mouth, is very much compressed laterally, resembling a thick fleshy leaf, about 130 mm. broad and about 20 mm. thick.

The lower wall of the stomach is thick and strong for carrying the weight of the oral arms. In it there are four interradial genital openings, which are semi-oval in shape, measuring about 20 mm. in length. These openings are very small for the size of the stomach, but larger openings would tend to weaken its lower wall. From one of the openings a gonad is protruding about 50 mm. The stomach is circular in shape, forming a large cavity without internal septa and without distal pouches. From the periphery of the stomach go forth many radial canals. The courses of several of the canals were traced by dissection. They pass through the layer of jelly and come to the surface of the sub-umbrella. It has already been stated that the Medusa is of a dark reddish-brown colour, which is an opaque surface layer confined to a very thin skin, which can be peeled off from the underlying jelly This skin, at first, was mistaken for the ectoderm, but after further investigation and consideration, it seems more likely to be an artificial product, formed after preservation On tracing the radial canals from the stomach it was found that they came to the surface of the sub-umbrella near the periphery of the stomach, and that their open ends were covered by the reddish skin. There is not the slightest trace of a canal system over the surface of the sub-umbrella, nor of any muscles. One would naturally expect to see powerful circular muscles on the sub-umbrella, considering the size of and thickness of the umbrella, and the great length of the oral arms. I believe that all the circular muscles, and the whole of the canal system on the sub-umbrella, have peeled off. Their absence would account for the abrupt termination of the radial canals after passing through the wall of the stomach.

The margin of the umbrella is very much damaged and broken, but there are indications, here and there, of lobes, which are, perhaps, the basal portions of larger lobes. There is not the slightest trace of a tentacle, nor of a sense organ. Except for the gonads the specimen is but little more than a gelatinous skeleton.

The presence of a central mouth, and oral arms without internal canals excludes this Medusa from the Rhizostomata. It, no doubt, belongs to the Semæostomata. The absence of marginal gastric pouches, and the presence of radial canals, indicate that it belongs to the Ulmaridæ. It is best to place this large Medusa provisionally in the genus *Diplulmaris*, as it is too imperfect to justify the possession of a new generic name.

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DESCRIPTION OF THE PLATES.

KEY TO THE LETTERING OF THE PLATES.

ad., adhesive pad (*Lucernaria*).
ad. f., adhesive disc of the foot (*Lucernaria*).
b., basal bulb.
c., cordylus.
ca., cavity of the peduncle (*Lucernaria*).
cc., circular canal.
cm., circular muscles.
dc., diverticulum of the circular canal.
ec., ectoderm.
ec. c., ectodermal cavities.
en., endoderm.
ex., exumbrella.
f., filament of the stomach.
g., gonad.
gd., genital duct.
inter. c., interradial canal.
k., canal in foot of *Lucernaria*.
m., mouth.
mb., marginal bulb.
mes., mesoglæa.
mesen., mesentery.
n., nematocysts.
oc., ocellus.
oc. l., ocular lobe (= rhopaliar lobe).
or., oral lip.
ot., otocyst.
ov., ovum ; ovary.
p., papilla.
per., perradial.
per. c., perradial canal.
r., radial canal.
rh., rhopalium.
rh. c., rhopaliar canal.
rh. l., rhopaliar lobes.
s. p., sensory pit.
spt., septum.
st., stomach.
st. r., perradial ridge of stomach.
sub., sub-umbrella.
t., tentacle.
ta., tæniola.
tc., tentacular canal.
tl., tentacular lobe.
uw., umbrella wall.
v., velum.

PLATE I.

FIG. 1.—*Catablema weldoni*. Early stage. × 10.

FIG. 2.—*Catablema weldoni*. Adult. × $3\frac{1}{2}$.

FIG. 3.—*Catablema weldoni*. The basal portion of a tentacle. Lateral view. × 12. *b.*, basal bulb ; *cc.*, circular canal ; *dc.*, diverticulum ; *ex.*, exumbrella ; *mb.*, marginal bulb ; *r.*, radial canal.

FIG. 4.—*Catablema weldoni*. The filaments upon a tentacle. Lateral view. × 25.

FIG. 5.—*Catablema weldoni*. Lower portion of the stomach, showing the gonads (*g.*), and the mouth (*m.*) with perradial lip (*per.*). × 20.

FIG. 6.—*Cosmetirella simplex*. Adult. Lateral view. × 7.

FIG. 7.—*Cosmetirella simplex*. A portion of the margin of the umbrella, showing a sensory pit (*s.p.*) and two tentacles. × 60.

FIG. 8.—*Cosmetirella simplex*. Transverse section of a sensory pit. × 480. *cc.*, circular canal ; *ot.*, otocyst ; *v.*, velum.

PLATE II.

FIG. 1.—*Sibogita borchgrevinki.* Adult. Lateral view. × 2½.

FIG. 2.—*Sibogita borchgrevinki.* Lateral view of the stomach. × 7. (Wall of the umbrella partly cut away.) *g.*, genital opening in the wall of the stomach; *st. r.*, perradial ridge or band along the stomach; *mesen.*, "mesentery" connecting the perradial canal (*per. c.*) with the stomach; *inter. c.*, interradial canal with diverticula.

FIG. 3.—*Sibogita borchgrevinki.* Lateral view of a tentacle. × 15.

FIG. 4.—*Sibogita borchgrevinki.* Transverse section through the middle of the stomach, showing the position of the gonads. × 20.

FIG. 5.—*Sibogita borchgrevinki.* Transverse section of the stomach of a specimen which has shed the gonads. *ec. c.*, cavities lined with ectoderm. × 20.

FIG. 6.—*Ptychogena antarctica.* Margin of the umbrella curled over, showing the distal portion of a gonad (*g.*), the width of the velum (*v.*) and the arrangement of the tentacles. Oral view. × 2.

FIG. 7.—*Ptychogena antarctica.* Basal bulbs of the tentacles and the cordyli (*c.*). Aboral view. × 15.

FIG. 8.—*Ptychogena antarctica.* The basal bulb of a tentacle. Lateral view. × 15.

FIG. 9.—*Ptychogena antarctica.* A cordylus. × 80.

PLATE III.

FIG. 1.—*Eleutheria hodgsoni.* Lateral view of the medusa. × 20.

FIG. 2.—*Eleutheria hodgsoni.* Aboral view of the umbrella, showing the base of the stomach (*st.*), radial canals (*r.*), the bases of the tentacles (*t.*), and ocelli (*oc.*). × 20.

FIG. 3.—*Eleutheria hodgsoni.* Oral view of the umbrella showing the mouth (*m.*), the gonads (*g.*), covered over by the velum (*v.*), and the bases of the tentacles covered with nematocysts (*n.*). × 20.

FIG. 4.—*Eleutheria hodgsoni.* A tentacle showing the arrangement of the clusters of nematocysts when the upper branch is contracted.

FIG. 5.—*Pantachogon scotti.* Lateral view of the medusa. × 13.

FIG. 6.—*Pantachogon scotti.* Diagram showing the position of the gonads upon the radial canals. Oral view.

PLATE IV.

FIG. 1.—*Koellikeria maasi.* An early stage. Lateral view. × 30.

FIG. 2.—*Koellikeria maasi.* Lateral view of the adult. × 6.

FIG. 3.—*Koellikeria maasi.* Portion of the margin of the umbrella, showing the perradial and interradial groups of tentacles of an adult. Oral view. × 20. *per.*, perradial; *v.*, velum; *cc.*, circular canal; *b.*, compound basal bulb.

FIG. 4.—*Koellikeria maasi.* Transverse section of a radial canal, showing the ectoderm cells and groove in the wall of the sub-umbrella. × 230.

FIG. 5.—*Koellikeria maasi.* Transverse section through the wall of the stomach, and showing a longitudinal section of a gastric papilla (*p.*), and the ovary. × 230.

FIG. 6.—*Margelopsis australis.* Lateral view of the Medusa. × 55.

FIG. 7.—*Margelopsis australis.* Oral view of a basal bulb, showing the position of the two tentacles. × 200.

PLATE V.

FIG. 1.—*Desmonema gaudichaudi.* A tentacular and two rhopaliar lobes on the margin of the umbrella, showing the canal system in the lobes and the bases of the tentacles. Nat. size.

FIG. 2.—*Desmonema chierchianum.* A tentacular and two rhopaliar lobes on the margin of the umbrella, showing the canal system in the lobes and the bases of the tentacles. Nat. size.

FIG. 3.—*Lucernaria vanhoeffeni.* The interior of the peduncle. × 2. *ta.*, tæniola with gastric filaments (*f.*) in the lower part of the stomach (*st.*), and terminating in bulbous enlargements; *ca.*, cavity of the peduncle in communication with the stomach; *k.*, blind branched canals from the cavity of the peduncle in the wall of the adhesive foot (*ad. f.*); *uw.*, wall of the umbrella.

FIG. 4.—*Lucernaria vanhoeffeni.* Tentacles with adhesive pads (*ad.*). × 16.

FIG. 5.—*Lucernaria vanhoeffeni.* Portion of the genital bands, showing the elongated sacs containing gonads. × 4.

FIG. 6.—*Lucernaria vanhoeffeni.* Diagram of a longitudinal section through a genital sac. *ov.*, ova or ovary; *gd.*, genital duct.

PLATE VI.

Diplulmaris antarctica.

FIG. 1.—Ephyra stage; showing an early stage of the development of the canal system and the tentacles. Oral side. × 15.

FIG. 2.—Ephyra stage later than fig. 1, showing the circular canal and the commencement of the branching of the rhopaliar canals. Oral side. × 5.

FIG. 3.—Portion of the margin of the umbrella of an adult, showing the anastomosing of the canal system. Oral side. × 2.

FIG. 4.—Sense organ. Aboral view. × 11.

FIG. 5.—Sketch of a gonad lying on the sub-umbrella. Oral view. × 2.

FIG. 6.—Tentacle of an adult. Lateral view. × 3.

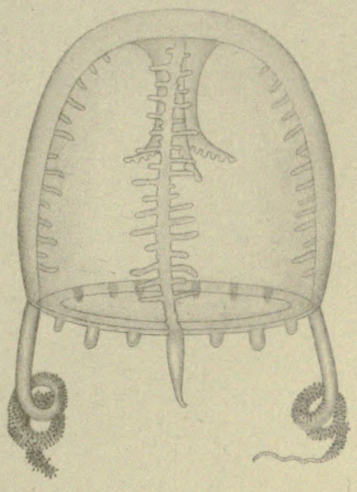
PLATE VII.

FIG. 1.—*Periphylla dodecabostrycha.* Photograph of Dr. Wilson's sepia drawing. Reduced nearly $2\frac{1}{2}$ times.

FIG. 2.—*Atolla wyvillii.* Photograph to show the wide furrows round the margin of the central disc. About natural size.

FIG. 3.—*Lucernaria vanhoeffeni.* Photograph showing a lateral view of the medusa. About natural size.

FIG. 4.—*Lucernaria vanhoeffeni.* Photograph of a specimen cut longitudinally to show the interior of the umbrella and the stomach. Slightly larger than natural size.



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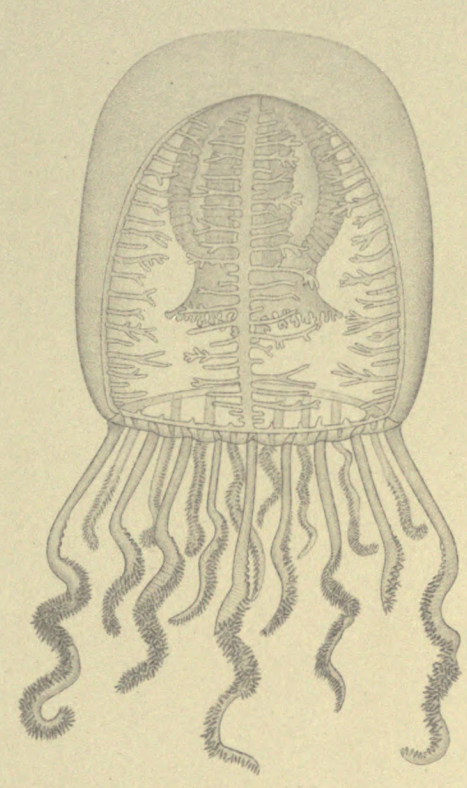

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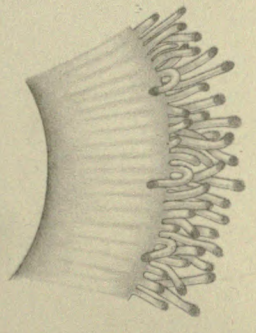

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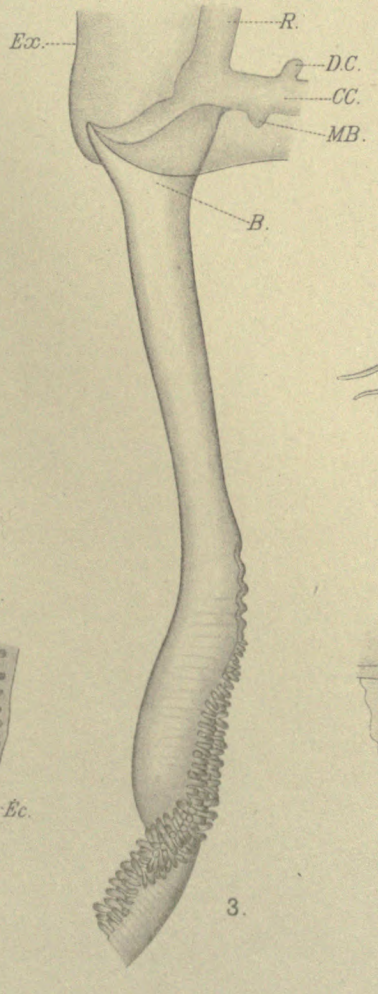

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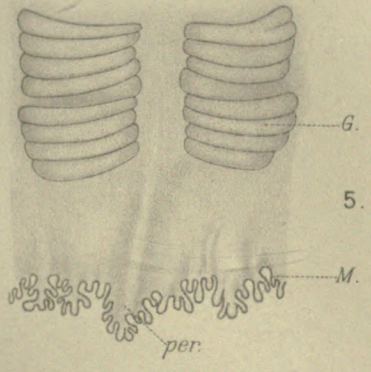

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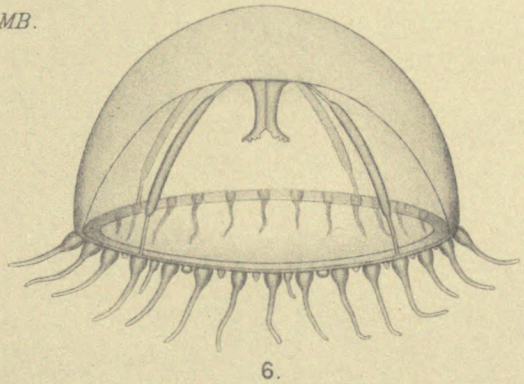

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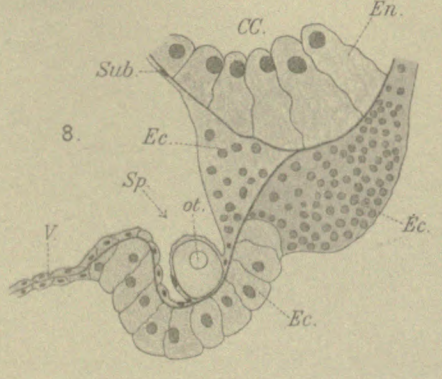

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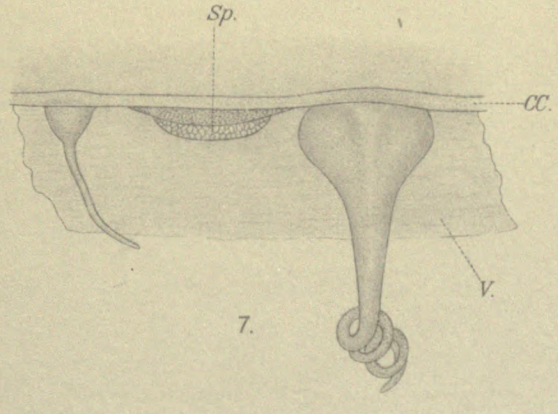

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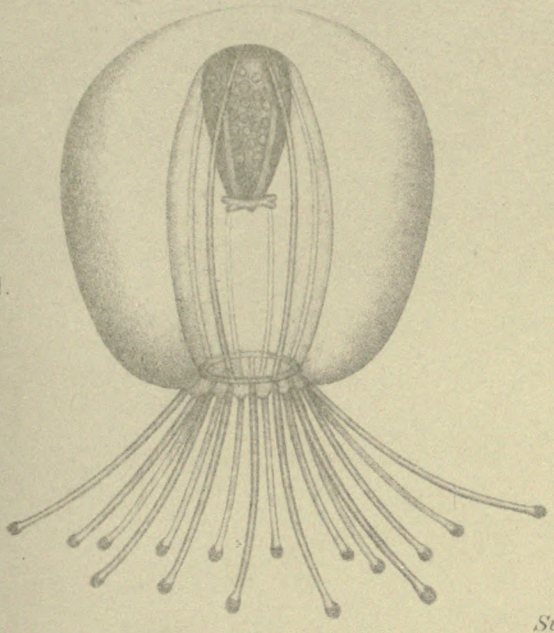

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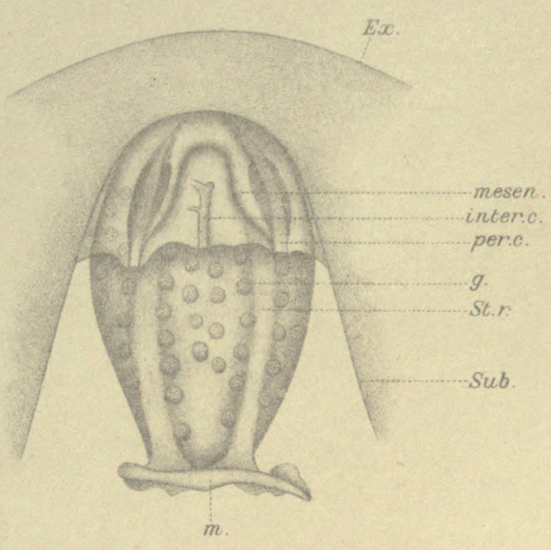

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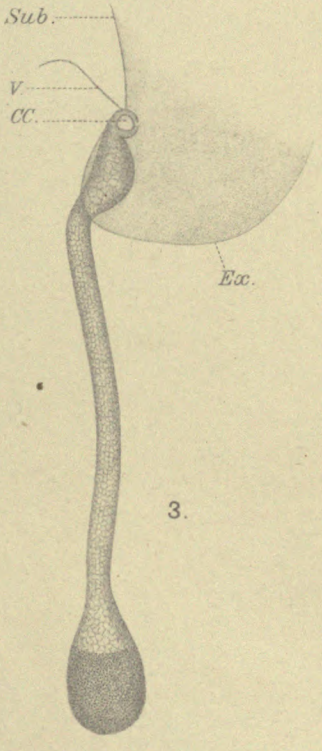

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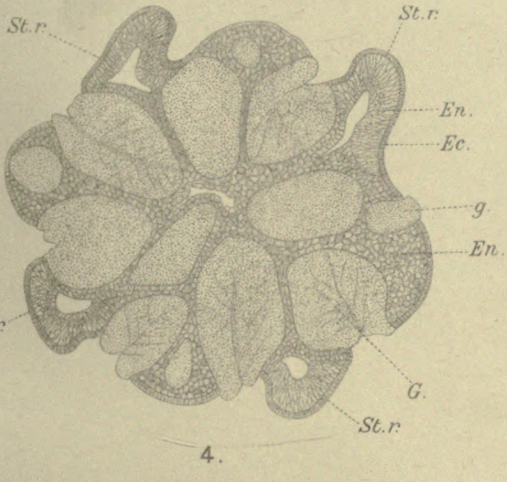

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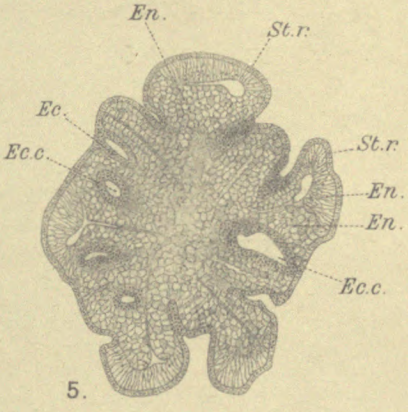

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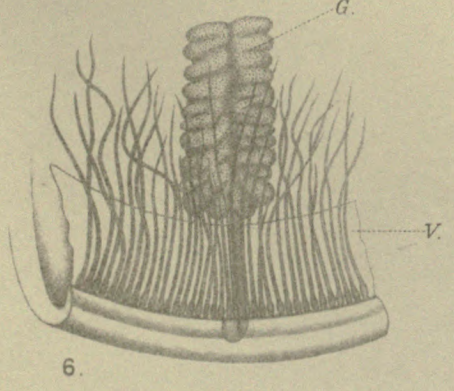

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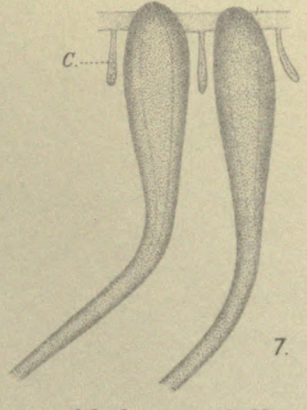

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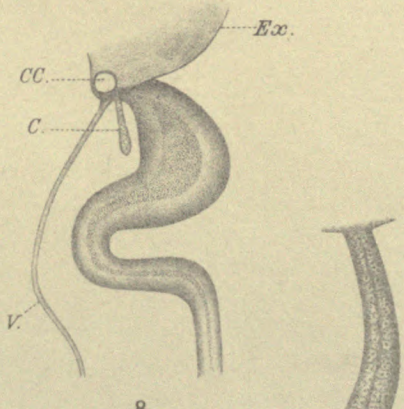

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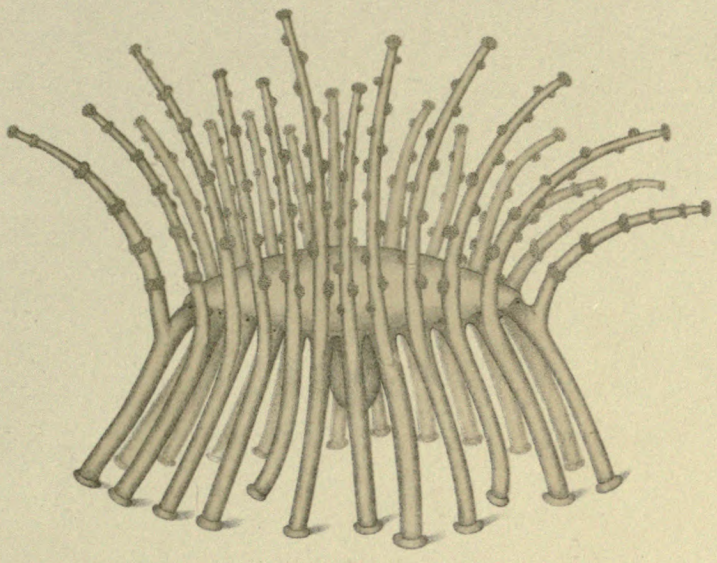
9.

Antarctic (Discovery) Exp. Medusae pl. II. Aut. del., Wilson lith.



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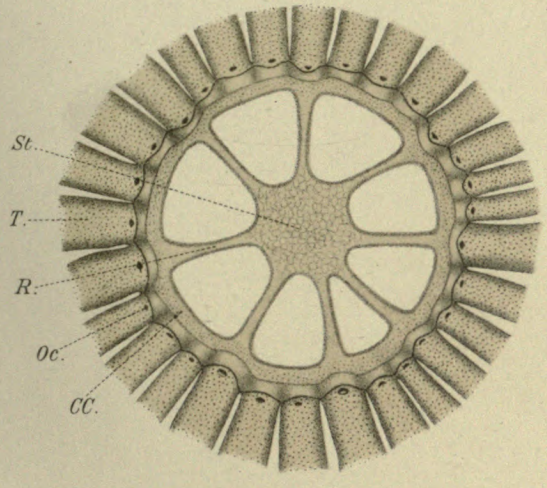

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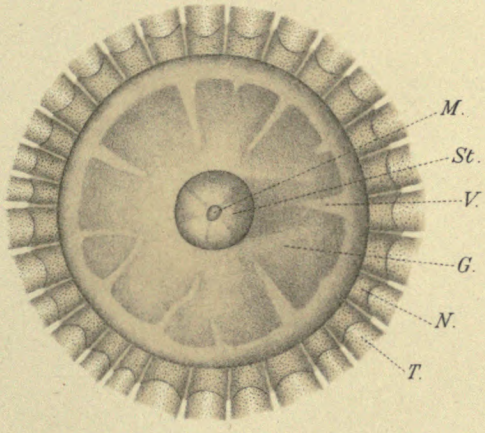

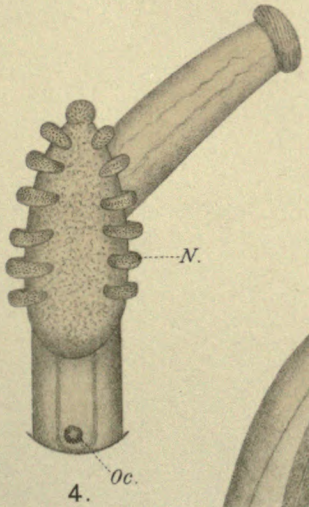

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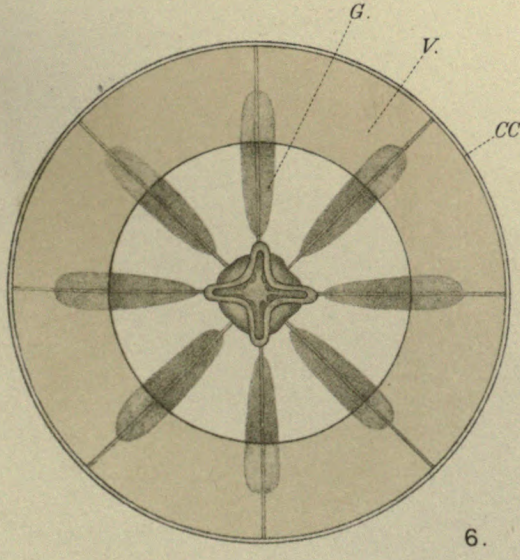

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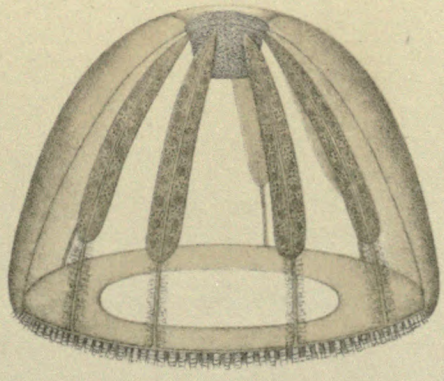

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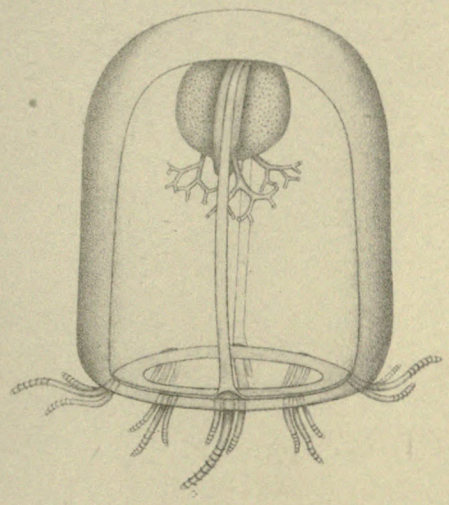
Antarctic (Discovery) Exp. Medusae pl. III. Aut. del., Wilson lith.



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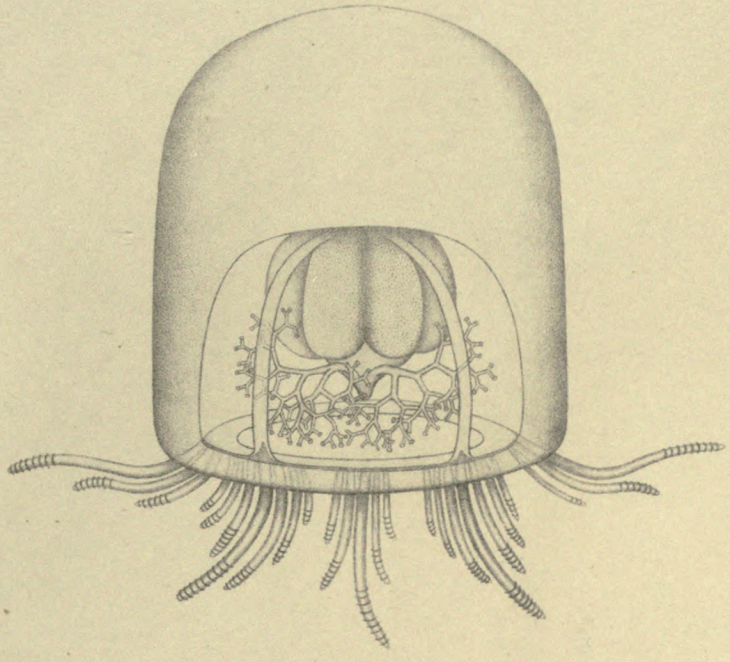

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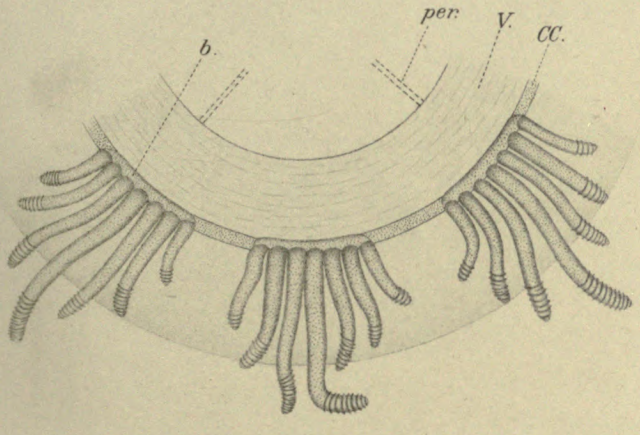

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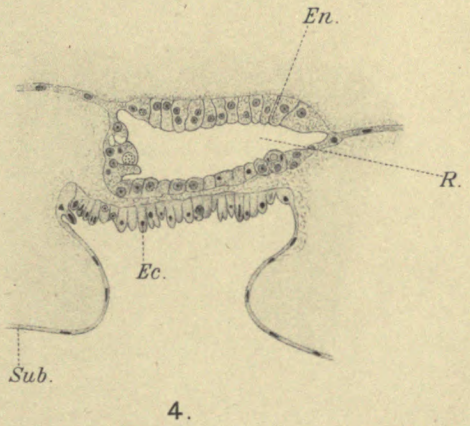

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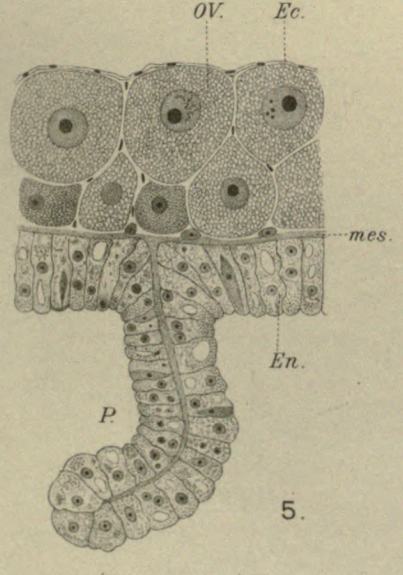

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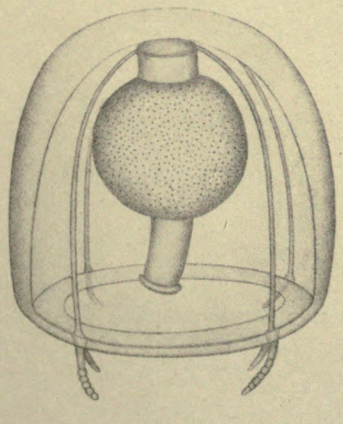

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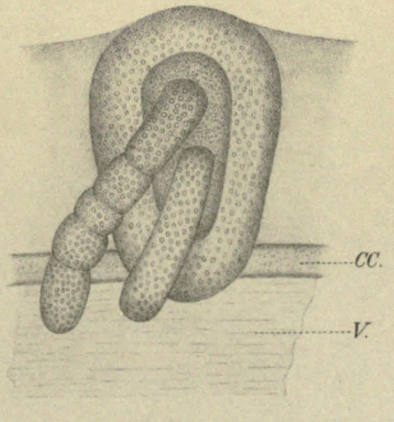
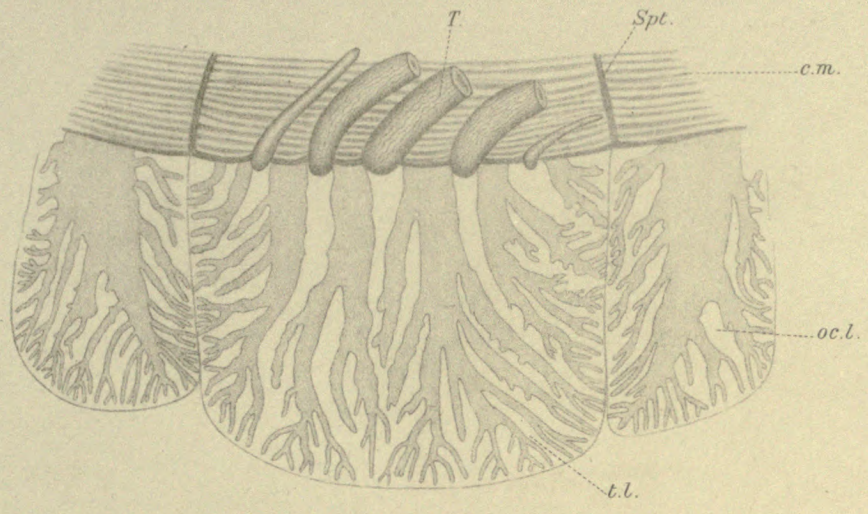


7.

Antarctic (Discovery) Exp. Medusae pl. IV. Aut. del., Wilson lith.

1.



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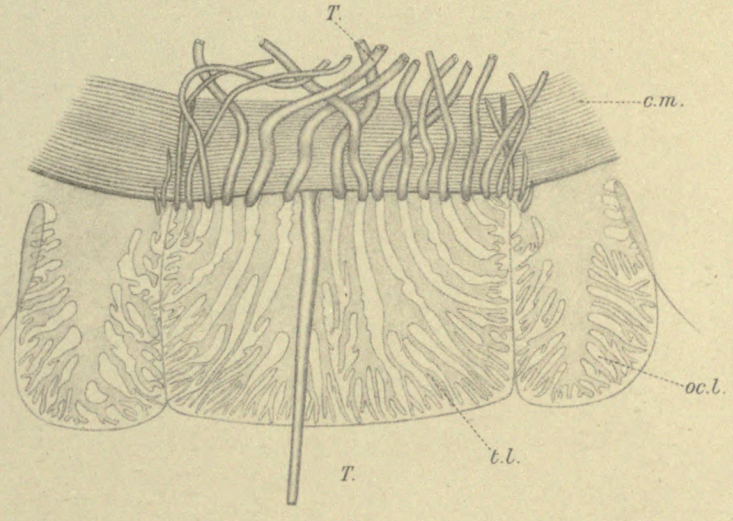

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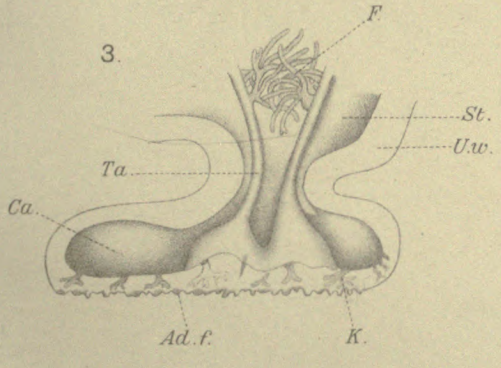

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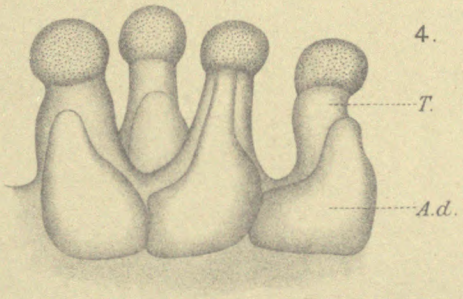

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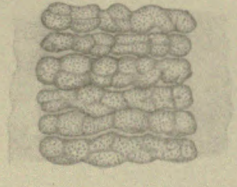

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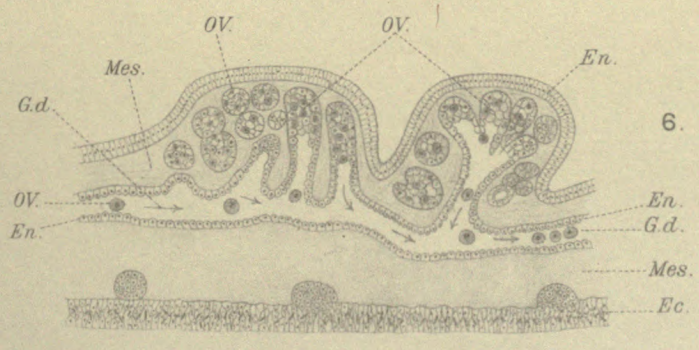
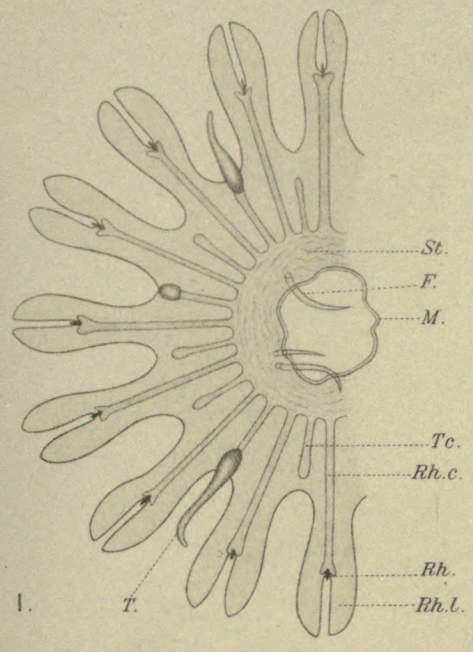


Antarctic (Discovery) Exp. Medusae pl. V. Aut. del., Wilson lith.



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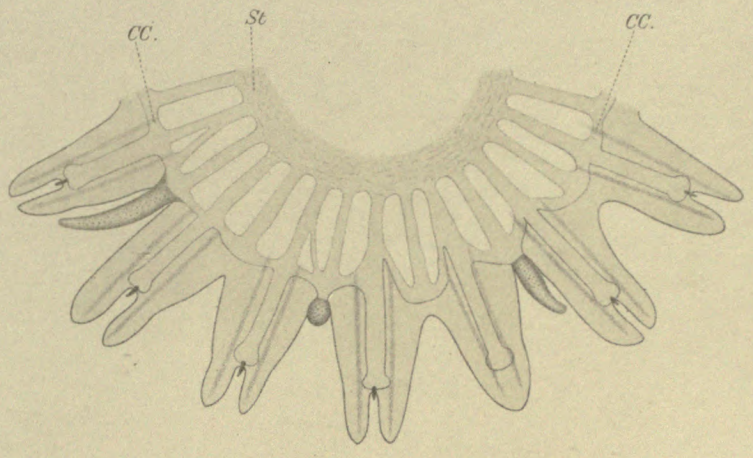

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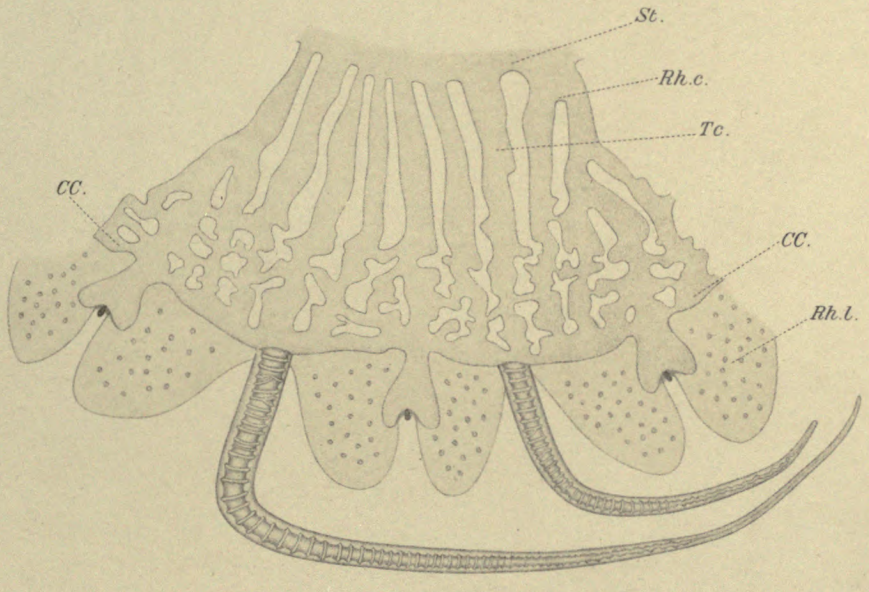

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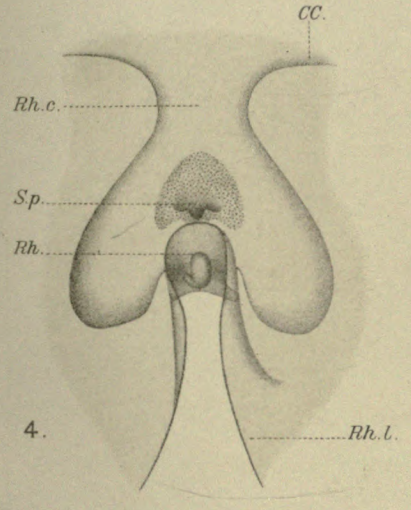

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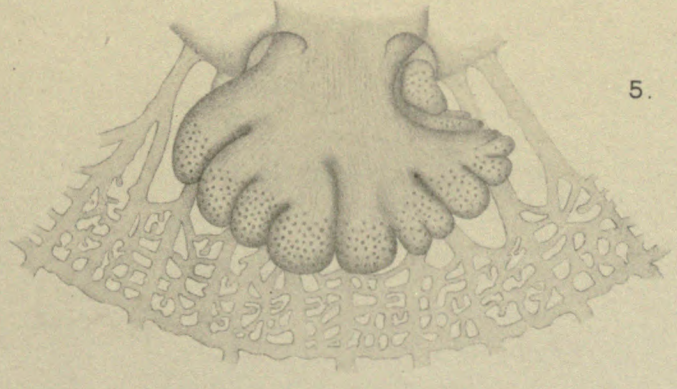

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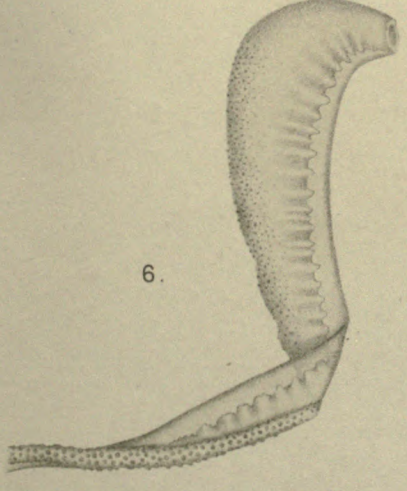
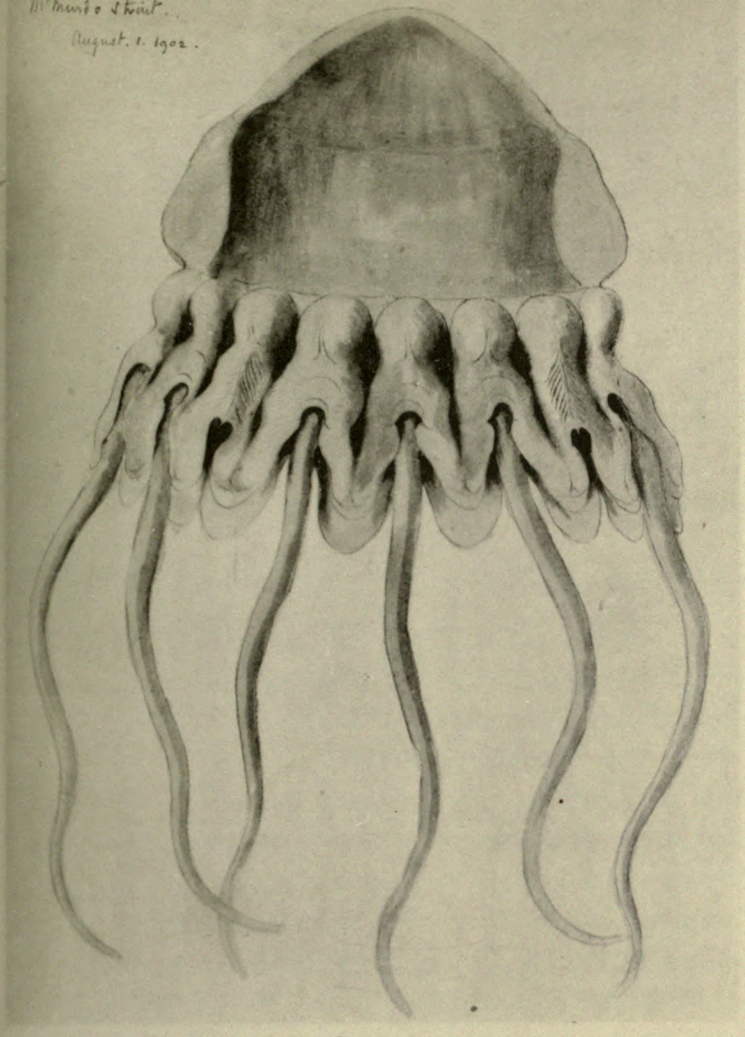
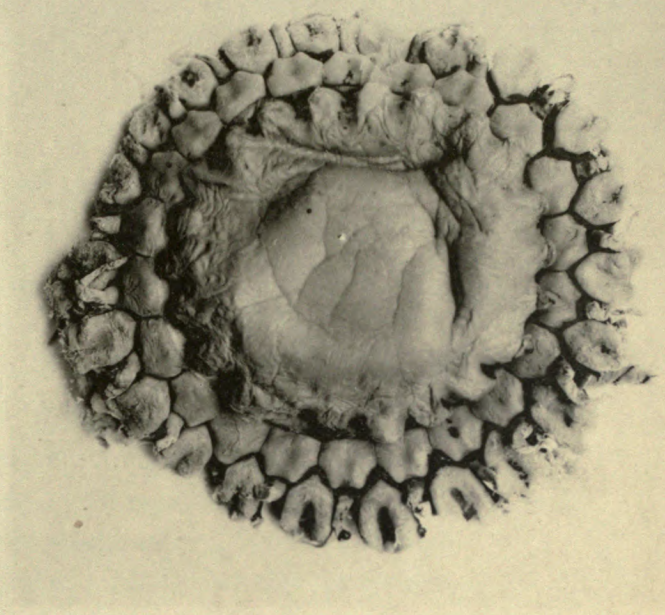


6.

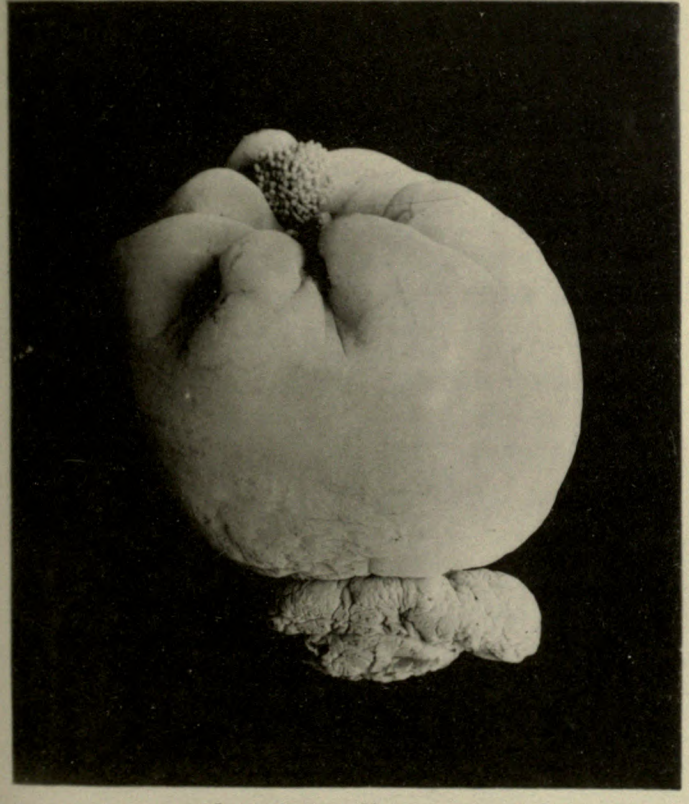
Antarctic (Discovery) Exp. Medusae pl. VI. Aut. del., Wilson lith.



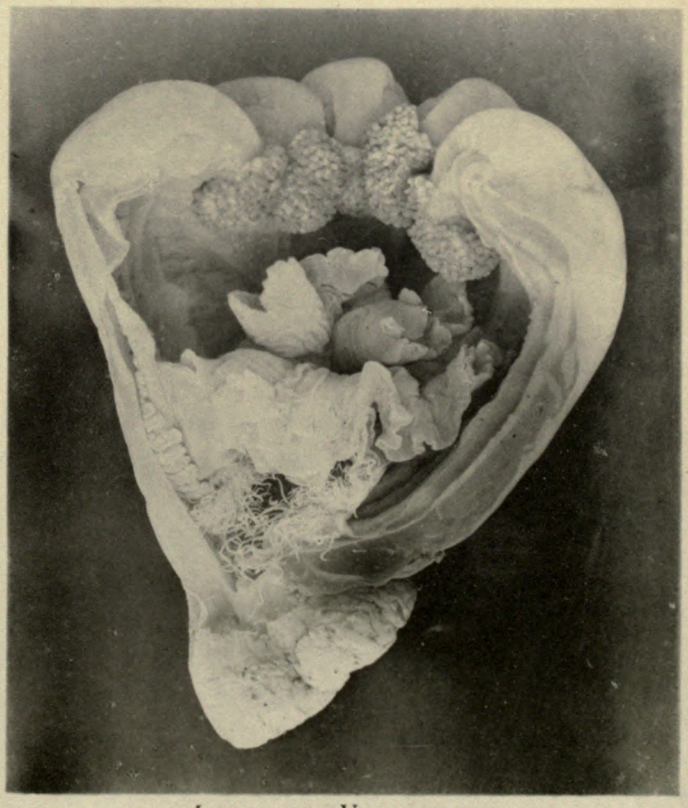
PERIPHYLLA DODECABOSTRYCHA.
Fig. 1.



ATOLLA WYVILLII.
Fig. 2.



LUCERNARIA VANHOEFFENI.
Fig. 3.
(*exterior*).



LUCERNARIA VANHOEFFENI.
Fig. 4.
(*interior*).

MEDUSAE PL. VII.

Morgan & Kidd—Photo.