

No. IV.—MEDUSÆ FROM THE INDIAN OCEAN.

(Collected by PROF. STANLEY GARDINER, in H.M.S. "Sealark," in 1905.)

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Plate 39.

Read 17th June, 1915.

INTRODUCTION.

The collection of Medusæ, made by Prof. Stanley Gardiner during the voyage of H.M.S. "Sealark" in the Indian Ocean, between Chagos, Mauritius and Seychelles, in 1905, was sent to me for examination. I heartily thank Prof. Gardiner for allowing me the privilege of writing this report upon the specimens, and must also express to him my regret for the delay over the work.

The chief interest in the collection centres in the geographical distribution of species as this part of the Indian Ocean had scarcely been explored for medusæ. It should be borne in mind that the collecting of medusæ was only a subsidiary part of the expedition's work. Nevertheless Prof. Gardiner was able to collect not less than thirty-five different genera, but none proved to be new to Science. The species were slightly more numerous than the genera, three new ones have received names, and others could have been added if the specimens had been in better condition.

The Anthomedusæ show a much better list of genera and species than in the previous collections from the Maldives and Ceylon. The poor list of species belonging to the Leptomedusæ is partly due to my failure to identify the specimens. There are always a certain number of bad specimens in every collection, and it so happened that the Leptomedusæ got more than their fair share of these.

The Anthomedusæ and Leptomedusæ are associated with the littoral fauna and are rarely found far from land or shallow water. Many of their genera are known to be connected with hydroids, so that their geographical distribution depends upon their hydroids finding a suitable habitat. Some are widely distributed, others have a very limited range. It is certainly strange that some of the commonest species have so far evaded the search for their hydroids and leave us still without a clue, but it is difficult to presume that some have no alternation of generations.

It is unfortunate that systematists on medusæ still hold divergent views over the question of species, but nevertheless progress is slowly being made. There has been a good advance since the day that saw the appearance of Haeckel's monograph which was by no means a success, except from an artistic point of view.

The medusæ which are known to be, or expected to be, connected with hydroids may require a finer discrimination of specific characters than those which have direct development. The linking together of species which very closely resemble each other under a common name, but are found in localities very far apart, may lead later on to further confusion and erroneous ideas on geographical distribution of marine animals. We are not yet certain that hydroids which are universally recognised as distinct species of a genus may not have medusæ so much alike that there is the possibility of their medusæ being regarded as belonging to the same species. We know that hydroids belonging to families far removed have medusæ closely related according to our present system of classification, but we do not know what surprises are in store when all the hydroid species of *Syncoryne*, *Bougainvillia*, *Perigonimus*, *Obelia*, *Campanulina*, etc., have had their medusæ reared and traced to their adult stages.

A different treatment of specific characters appears to me to be required for those medusæ which have direct development (without any hydroid stage), especially those belonging to certain genera, such as *Liriope* and *Pelagia*, which are found throughout the warm regions of the oceans. There are many genera which have a vast geographical range, but how far their species are valid is still a debatable subject. At one time a formidable list of species was being piled up, but the tendency is now to reduce the species to about one per genus. I think this latter process is being carried too far, it makes work easy for the systematist, but is bad for Science. It appears to me that a species belonging to this class of medusæ shows a far greater range of variation than those belonging to the Anthomedusæ and Leptomedusæ. We have formerly been basing the specific characters upon a too limited number of specimens, and have described the characters of an individual rather than those of a race. There are certainly distinct races of *Liriope* and *Pelagia*, and some of them are good species.

The following is a classified list of genera and species found on the cruise of the "Sealark":

HYDROMEDUSÆ.

ANTHOMEDUSÆ.

Euphysora bigelowi, Maas.
Steenstrupia normani, n. sp.
Zanlea orientalis, n. sp.
Zanlea juv.
Cytaeis tetrastyla, Eschscholtz.
Bougainvillia fulva, Agassiz and Mayer.
Turritopsis nutricula, McCrady.

Amphinema sp.
Leuckartiara gardineri, n. sp.
Pandæa juv.
Heterotiara minor, Vanhöffen.
Proboscidactyla tropica, Browne.
Proboscidactyla sp.

LEPTOMEDUSÆ.

Tiaropsis rosea, Agassiz and Mayer.
Phialidium sp.
Irene sp.

Mesonema pensile (Modeer).
Equorea macroductyla (Brandt).

TRACHOMEDUSÆ.

Olindias singularis, Browne.
Rhopalonema velatum, Gegenbaur.
Sminthea eurygaster, Gegenbaur.
Pantachogon rubrum, Vanhöffen.
Halicreas papillosum, Vanhöffen.

Aglaura hemistoma, Péron et Lesueur.
Amphogona apsteini (Vanhöffen).
Liriope tetraphylla (Chamisso et Eysenhardt).
Liriope sp.
Geryonia proboscidalis (Forskål).

NARCOMEDUSÆ.

Solmaris sp.
Ægina citrea, Eschscholtz.

Solmundella mediterranea (Müller).
Cunina sp.

SCYPHOMEDUSÆ.

Charybdea sp.
Nausithoe punctata, Kolliker.
Atolla wyvillei, Hæckel.
Pelagia panopyra (Péron et Lesueur).

Pelagia flaveola, Eschscholtz.
Pelagia sp.
Rhizostoma andromeda var. *maldivensis*, Browne.

LISTS OF SPECIES FOUND WITHIN DEFINITE AREAS DURING THE CRUISE OF
THE "SEALARK."

I have not prepared lists of medusæ taken in every haul of the nets nor for every station, but have grouped together the stations under convenient geographical headings. The longest list belongs to the Chagos Archipelago, and that may be probably due to more collecting of plankton having been done within that area, than in other areas, such as at Mauritius. Professor Gardiner made serial hauls at different depths and also hauls at definite intervals of time at several of the stations. I made records of the medusæ found in every haul, but failed to obtain any reliable results owing to the scarcity of specimens.

CHAGOS ARCHIPELAGO.

Steenstrupia normani.
Zanclaea orientalis.
Cytæis tetrastyla.
Bougainvillia fulva.
Turritopsis nutricula.
Pandæa juv.
Heterotiara minor.
Phialidium sp.
Mesonema pensile.
Æquorea macrodactyla.
Olindias singularis.
Rhopalonema velatum.
Sminthea eurygaster.

Pantachogon rubrum.
Aglaura hemistoma.
Amphogona apsteini.
Liriope tetraphylla.
Geryonia proboscidalis.
Solmaris sp.
Ægina citrea.
Solmundella mediterranea.
Cunina sp.
Nausithoe punctata.
Atolla wyvillei.
Pelagia panopyra.
Pelagia sp.

SAYA DE MALHA BANKS.

Cytæis tetrastyla.
Irene sp.
Æquorea macrodactyla.

Aglaura hemistoma.
Liriope tetraphylla.
Pelagia flaveola.

NAZARETH BANK (Cargados Carajos).

Euphysora bigelowi.
Irene sp.

Amphogona apsteini.
Liriope tetraphylla.

MAURITIUS.

Tiaropsis rosea.
Rhopalonema velatum.
Aglaura hemistoma.

Liriope tetraphylla.
Geryonia proboscidalis.
Cunina sp.

FARQUHAR GROUP.

Proboscidactyla sp.
Rhopalonema velatum.
Halicreas papillosum.
Aglaura hemistoma.
Liriope tetraphylla.

Solmaris sp.
Solmundella mediterranea.
Cunina sp.
Charybdea sp.

BETWEEN PROVIDENCE AND ALPHONSE ISLES

(Lat. 8° 16' S., Long. 51° 26' 8 E.).

Pantachogon rubrum.
Halicreas papillosum.

Liriope tetraphylla.
Atolla wyvillei.

ALPHONSE ISLAND.

Euphysora bigelowi.
Zanclaea juv.
Aglaura hemistoma.

Liriope tetraphylla.
Cunina sp.

AMIRANTE GROUP.

Bougainvillia fulva.
Amphinema sp.
Leuckartiara gardineri.
Proboscidactyla tropica.
Laodice ?
Phialidium sp.
Rhopalonema velatum.

Sminthea eurygaster.
Halicreas papillosum.
Aglaura hemistoma.
Liriope tetraphylla.
Solmundella mediterranea.
Nausithoe punctata.

SEYCHELLES GROUP.

Cassiopea andromeda var. *maldivensis*.

Some of the results obtained by this expedition for the geographical distribution of medusæ are rather interesting.

Turritopsis nutricula had not before been found in the Indian Ocean. It is a well-known species on the North Atlantic coast of the United States, south of Cape Cod, and it also has quite recently been recorded from Japan.

Tiaropsis rosea and *Euphysora bigelowi* have had their range extended westwards from the Malay area.

Proboscidactyla tropica is the most interesting find in the collection; it has not been recorded since Huxley first found it in Louisiade Archipelago (Malay area).

Olindias singularis occurs at Chagos, which is not so far from the Maldives, where it was first discovered. Since its discovery it has been found far away in the middle of the Pacific among the Paumotu Isles.

Sminthea eurygaster is new to the Indian Ocean; its old records are for the Mediterranean, the Bay of Biscay, and in the Atlantic as far south as Brazil.

HYDROMEDUSÆ.

ANTHOMEDUSÆ.

Genus EUPHYSORA, Maas, 1905.

Hartlaub (1907) and Mayer (1910) agree in uniting the genera *Euphysa* and *Euphysora* with *Corymorpha*. (Mayer uses the name *Steenstrupia* in the place of *Corymorpha*; the former is a medusoid generic name and the latter a hydroid generic name.) I am in agreement with them so far as *Euphysa* is concerned, but am not, at present, inclined to follow them in the case of *Euphysora*.

Both *Steenstrupia rubra* and *Euphysa aurata* have one fully developed perradial tentacle and three perradial marginal bulbs. The latter are called rudimentary tentacles by the above authors, but it must be clearly understood that the tentacles have completely disappeared on the three bulbs. Far remote ancestors may possibly have had four fully developed tentacles, but now only one tentacle remains, the others having their former positions marked by the bulbs.

It is known that *Steenstrupia rubra* is the medusa belonging to the hydroid *Corymorpha nutans*. Hartlaub believes that *Euphysa aurata* is probably connected with *Corymorpha nana* Alder, but at present there is no definite proof, though Mayer records the connection as a definite fact. We have no clue to the hydroids connected with *Euphysora*.

The genus *Euphysora* was established by Maas for those Codonidæ having four fully developed tentacles, but one tentacle unlike the others being larger and different in external appearance.

There are three species belonging to this genus. The first was described by Bigelow (1904, p. 251, pl. 1) from the Maldives under the name of *Euphysa tetrabrachia*, and the second by Maas from the Malay Archipelago under the name of *Euphysora bigelowi*, and this is the type species of the genus. Bigelow was doubtful about the generic position of his new species, but Maas placed it in the new genus *Euphysora* and at the same time pointed out the characters by which the two species could be recognised.

Without going into every minute detail the two species can be easily distinguished by the structure of their tentacles. *Euphysora tetrabrachia* has annular rings of nematocysts on all the tentacles, but more on the longest tentacle. *Euphysora bigelowi* has large globular clusters of nematocysts on the longest tentacle only. Mayer is inclined to regard the two species as being identical, for in his monograph (p. 37) he has written: "Future studies will probably show that these distinctions are not of specific value, but merely changes due to growth and variation, and that the two medusæ are identical and should be called *Steenstrupia tetrabrachia*."

The third species, *Euphysora valdiviæ* Vanhöffen (1911), has lateral branches on its principal tentacle. This species I shall refer again to under *Steenstrupia normani*.

1. *EUPHYSORA BIGELOWI*, Maas, 1905.

Euphysora bigelowi, Mass, 1905, p. 7, Taf. 1, figs. 1—3.

Euphysora bigelowi, Maas, 1906, p. 84, pl. 2, figs. 1—2.

Euphysora bigelowi, Müller, 1908, p. 59.

Steenstrupia bigelowi, Mayer, 1910, vol. i, p. 36, fig. 9.

Euphysora bigelowi, Vanhöffen, 1911, p. 197.

Euphysora bigelowi, Vanhöffen, 1912, p. 7, Taf. 1, fig. 3.

Localities. Cargados Carajos, Surface. 30 Aug. 1905, i. 2 specimens. Alphonse Is., Surface (Temp. 80° F.). 7 Oct. 1905, dd.* 1 specimen.

The specimens in the "Sealark" collection belong to the species *Euphysora bigelowi*, and only a brief description of them is necessary as the species has been fully described and well figured by Maas. The smallest specimen is about 1.5 mm. in length, and has seven globular clusters of nematocysts upon the principal tentacle. The next in size is about 3 mm. in length, and the principal tentacle is also provided with seven batteries of nematocysts. Neither of these specimens shows gonads. The largest specimen is about 4 mm. in length and 2 mm. in width, and has a well-developed spermary which surrounds the stomach and extends along its whole length, just leaving the circular mouth free. Upon the principal tentacle there are eleven globular clusters of nematocysts forming a half loop round the tentacle. The three other marginal tentacles are quite different in shape and appearance. They taper to a point and have a smooth external surface, the nematocysts being scattered. In the largest specimen the tentacle opposite to the principal tentacle is much shorter than the others, but in the smaller specimens the three tentacles are about equal in size. None of the specimens show the apical prolongation of the stomach in the shape of a canal, which was present in many of the medusæ seen by Maas.

Distribution. Indian Ocean; Pacific Ocean, Malay Area.

2. *STEENSTRUPIA NORMANI* nova species.

(Plate 39, fig. 1.)

Locality. North of Chagos, Lat. 4° 16' S., Long. 71° 53' E. 100—0 fms. 17 May, 1905, B. 1 specimen.

Description of the Species:—Umbrella about twice as high as broad, with a conical apex, and thin walls. Ex-umbrella with twelve longitudinal streaks of nematocysts extending from the margin to the apex, having lateral branches and forming a kind of network on the lower part of the umbrella. Stomach large, cylindrical, with a tube-like mouth extending beyond the velum, and with an endodermal cellular prolongation into the apex of the umbrella. Four thick radial canals and a very thick circular canal. One perradial tentacle, with a long, hollow, sac-like basal bulb, and terminating with a large globular ball containing nematocysts, and also three other globular clusters of nematocysts probably unilaterally arranged. Three small perradial bulbs without tentacles on the margin of the umbrella.

Size. Umbrella 1.25 mm. in width and 2.5 mm. in height.

The specimen is in very good condition, but a few more showing later stages would

* For List of stations see *Trans. Linn. Soc. Ser. 2. Zool. xii. (1907)*, p. 170.

have been welcomed. The stomach is very much swollen out with food and it almost fills up the whole of the cavity of the umbrella. It is evidently a young stage as I cannot detect gonads upon the stomach, which has fairly transparent walls. The stomach occupies the whole of the top of the cavity of the umbrella and even extends above it, as the radial canals leave the stomach laterally. The radial canals and circular canal have a very cellular appearance and look as if composed of a solid chord of very large cells. The solitary tentacle has a large sac-like basal bulb with rather thin walls, covered with large flat ectoderm cells and practically free from nematocysts. The tentacle itself is contracted and coiled up. It has three lateral clusters of nematocysts projecting from the tentacle and a large globular terminal cluster. The lateral clusters are globular and vary in size; the smallest at the top and the largest at the bottom. Owing to the coiling of the tentacle their exact position on the tentacle is doubtful.

In the three perradii without tentacles there are only small bulbs projecting from the margin. They are solid in appearance, covered with nematocysts, and show no signs of developing tentacles. It is not easy to trace out completely the tracks of nematocysts upon the ex-umbrella. There are clear indications of twelve longitudinal tracks running right up to the apex of the umbrella and some of these tracks unite near the apex. The main tracks have also short lateral branches which join on to branches from adjacent tracks and form a kind of network on the lower part of the umbrella. There are no signs of any ocelli on the marginal bulbs or tentacle.

The characters selected for distinguishing the species are the shape and structure of the tentacle and the numerous tracks of nematocysts upon the ex-umbrella.

This new species is named after my friend and neighbour the Reverend Canon A. M. Norman, whose name is well known to all marine zoologists.

Euphysora valdiviæ, which Vanhöffen (1911) described as a new species from a single specimen taken near Siberut Island off the west coast of Sumatra (west of Padang), has certain characters in common with *Steenstrupia normani*. Both species have similar tracks of nematocysts upon the ex-umbrella; the same type of large stomach, and large radial and circular canals. The principal tentacle of *Euphysora valdiviæ* has lateral branches, and is evenly covered with nematocysts without any arrangement of rings or knobs. In addition to the principal tentacle there are three other smaller tentacles without branches.

As *Steenstrupia normani* is not half the size of *Euphysora valdiviæ* and is at an immature stage, one has to consider the question of *Steenstrupia normani* being an early stage of *Euphysora valdiviæ*. There is no evidence that three marginal bulbs of *Steenstrupia normani* will develop tentacles, though there is a possibility of their doing so. The principal tentacle of *Steenstrupia normani* has very conspicuous globular clusters of nematocysts. These clusters project from the tentacle, but they do not appear to be upon stalks or lateral branches. But if such stalks or lateral branches were strongly contracted, then possibly the clusters would come alongside the tentacle. Vanhöffen states that the principal tentacle of *Euphysora valdiviæ* is without knobs or rings of nematocysts and his figures do not show them. Their absence is in favour of *Steenstrupia normani* being a distinct species.

3. *ZANCLEA ORIENTALIS* nova species. (Pl. 39, figs. 2 and 3.)

Locality. North of Chagos, Lat. $4^{\circ} 16' S.$, Long. $71^{\circ} 53' E.$ 500 fms. (Wolfenden's closing net). 18 May, 1905, G. 1 specimen.

Description of the Species:—Umbrella a little higher than broad, with a rounded summit and rather thin walls. Velum very narrow. Stomach cylindrical, about half the length of the cavity of the umbrella. Mouth circular. Gonads extending nearly the whole length of the stomach and forming interrarial swellings. Two large opposite perrarial tentacles armed with globular batteries of nematocysts upon contractile stalks. No tentacles in the other two opposite perradii, but only two very rudimentary internal bulbs. Four perrarial patches of nematocysts upon the margin of the umbrella, without any groove or streak leading to them.

Size. Umbrella about 1.5 mm. in width and 2 mm. in height.

The character selected to distinguish this new species is the presence of rather broad perrarial patches of nematocysts upon the margin of the umbrella. These patches (fig. 3) are situated directly on the margin and have no tracks or grooves leading to them. There are no longitudinal bands of nematocysts upon the ex-umbrella, but its whole surface is sprinkled with small isolated nematocysts. The tentacles are in a contracted condition and so also are the stalked batteries of nematocysts. The exterior of the battery is covered with a thin layer of ectoderm, and the nematocysts are packed away inside, practically filling the whole of the interior of the ball. The stalked batteries of nematocysts are along only the outer side of the tentacles.

The depth at which this specimen was taken is not trustworthy, as the messengers working the net were not acting properly.

4. *ZANCLEA* juv.

Locality. Alphonse Is., Surface. 7 Oct. 1905, ee. 1 specimen.

The umbrella is nearly 2.5 mm. in height and 1.75 mm. in width, with thick walls and a rounded summit. The stomach is short, about 0.5 mm. in length, and with a circular mouth. Four perrarial canals. There are two opposite perrarial tentacles armed along their outer side with stalked batteries of nematocysts, which are oval in shape, about twice as long as wide, and about twice the size of those in the batteries of *Zanclea orientalis*. The stalks have the appearance of rather fine filaments, studded with small isolated nematocysts. In the other two opposite perradii there is the merest trace of a marginal bulb, which has not the appearance of ever developing a tentacle. Upon the ex-umbrella there are four perrarial tracks of nematocysts. They are very short, just curling over the margin and terminating with a small cluster of nematocysts.

This is evidently a young medusa, as there are no signs of gonads upon the stomach.

5. *ZANCLEA* ?.

Locality. Chagos, Peros Atoll. 75—0 fms. 30 June, 1905, M. 1 specimen.

The umbrella is thick but contracted and torn; about 2.5 mm. in width and 2 mm. in height. The stomach is badly damaged, but there are cells at its base, interradi-ally

situated, having the appearance of ova. Two large opposite perradial basal bulbs, globular in shape, from which tentacles have been broken off. In each of the other two opposite perradii there is a minute rudimentary bulb. There are four perradial tracks of nematocysts upon the ex-umbrella, about 0.5 mm. in length. The tracks lead to an oval patch of nematocysts, situated upon a slight prominence of the ex-umbrella.

This specimen probably belongs to the genus *Zanclea*, as it has tracks of nematocysts upon the ex-umbrella, and only two tentacles.

6. ZANCLEA ?.

Locality. Lat. 8° 16' S., Long. 51° 26' E. (between Providence and Alphonse). 900—0 fms. 6 Oct. 1905, aa. 1 specimen.

The umbrella is thick, with a rounded summit, about 2.5 mm. in height and slightly less in width. The stomach at its base is cross-shaped and tapers down to a slender tube terminating with a circular mouth, which is about on a level with the margin of the umbrella. Upon the upper half of the stomach are situated four gonads, which occupy the whole of the spaces between the four perradii. There are four perradial basal bulbs all about the same size, from which tentacles have apparently been broken off. Upon the margin of the ex-umbrella there are four perradial tracks of nematocysts, one above each of the basal bulbs. They have the appearance of straight, narrow canals, less than 0.5 mm. in length.

Owing to the absence of tentacles it is impossible to be sure of the correct determination of the genus. It is probably a *Zanclea* with four tentacles.

Genus CYTÆIS, Eschscholtz, 1829.

There have been several species of *Cytæis* described at intervals, and located in different regions of the world. Vanhöffen, who has examined a very large number of *Cytæis* collected by different expeditions in the Atlantic, Indian and Pacific Oceans, definitely comes to a conclusion that there is only one species in this genus, and to it he assigns the oldest specific name, *Cytæis tetrastyla*, Eschscholtz.

There is, however, a feeling of doubt in my mind as to there being only one species of *Cytæis*. I am inclined to regard *Cytæis vulgaris*, Agassiz and Mayer, from the Fiji Isles as a distinct species, and also *Cytæis pusilla*, Gegenbaur, from the Mediterranean. I think that as Vanhöffen has taken as a type the somewhat vaguely defined and badly drawn *Cytæis tetrastyla* of Eschscholtz, it will be best to follow him by grouping under its name at all events the following:—

Cytæis nigratina, Haeckel, 1879, p. 74, Taf. 6, figs. 2—5.

Cytæis macrogaster, Haeckel, 1879, p. 74, Taf. 6, fig. 1.

Cytæis nigratina, Maas, 1904, p. 8, pl. 1, fig. 3.

Cytæis herdmani, Browne, 1905, p. 135, pl. 1, fig. 1.

Cytæis vulgaris, Bigelow, 1909, p. 190, pl. 6, fig. 3, pl. 40, fig. 2 and fig. 5, pl. 43, figs. 4—5.

Cytæis tetrastyla, Vanhöffen, 1911, p. 204, Text-fig. 6.

Cytæis tetrastyla, Vanhöffen, 1912, p. 8, Taf. 1, fig. 5.

The above-mentioned figures show specimens with large triangular basal bulbs extending some way up the umbrella, and the tentacles should have a pigmented endoderm.

7. CYTÆIS TETRASTYLA, Eschscholtz, 1829.

Localities. North of Chagos Archipelago, Surface (Temp. 82° F.). 18 May, 1905, D. 1 specimen. South of Saya de Malha Banks. 50—0 fms. 4 Sept. 1905, m. 2 specimens. North of Saya de Malha Banks, Surface (Temp. 77°—80° F.). 8 Sept. 1905, n. 1 specimen.

The specimens collected by the "Sealark" are not in good condition. The largest is about 2 mm. in diameter. Its stomach is on a short peduncle and the mouth surrounded with at least twelve capitate tentacles. The four perradial marginal tentacles are internally pigmented with a very dark reddish colour along their whole length, and covered with a very thick ectoderm. The specimens have a few medusa-buds upon the stomach. The structure of the tentacles and the shape of the basal bulbs are similar to those of *Cytæis herdmani*.

Some of the specimens reported upon by Vanhöffen were collected by the "Valdivia" in the Indian Ocean, one station being north of Chagos.

8. BOUGAINVILLIA FULVA, Agassiz and Mayer, 1899.

Bougainvillia fulva, Agassiz and Mayer, 1899, p. 162, pl. 2, fig. 6; 1902, p. 145, pl. 2, fig. 8.
Bougainvillia fulva, Maas, 1905, p. 10, Taf. 1, fig. 8, Taf. 2, figs. 9—10; 1906, p. 87, pl. 2, figs. 4—5.
Bougainvillia fulva, Bigelow, 1909, p. 195, pl. 6, fig. 7, pl. 44, figs. 5—7.
Bougainvillia fulva, Hartlaub, 1909, p. 448, Taf. 19, figs. 1—4.
Bougainvillia fulva, Mayer, 1910, p. 160.

Localities. Chagos Archipelago, Salomon Atoll. 180—0 fms. 30 June, 1905, O. 11 specimens. Amirante Isles, Desroches Atoll. 400—0 fms. 16 Oct. 1905, mm. 1 specimen.

Except for the contraction of the margin of the umbrella the specimens are in very good condition. The smallest one measured 6 mm. in height and 4 mm. in width, and the largest 13 mm. in height and 10 mm. in width.

The umbrella is very thick, about as thick at the top as on the side. Its natural shape is altered owing to the great contraction of the margin. The contraction produces deep perradial furrows and interrarial ridges or lobes which meet in the centre of the umbrella opening and close it up completely. The specimen figured by Maas (1906, pl. 2, fig. 5) resembles this very closely in the shape of the contracted umbrella, but the jelly above the sub-umbrella cavity is thicker than in my specimens.

The stomach varies considerably in shape. When empty and uncontracted it hangs down as a thin cruciform sac, but when full of food it becomes nearly globular. The four oral tentacles are dichotomously branched, four times in the smallest specimen and seven times in the largest one. The gonads form swellings upon the wall of the stomach and have the appearance of eight distinct sacs, isolated perradially and interradi- ally.

The marginal tentacles are more or less contracted, and are very small and slender when compared with the size of the umbrella. In the smallest specimen there are twelve tentacles on each compound bulb; and fourteen on a bulb was the maximum number counted in the largest specimen. An ocellus is situated on the inner side of every

tentacle, very close to the bulb; it is a narrow band of dark pigment on the surface of the ectoderm.

One specimen is infested with *Cunina* buds in different stages of development. The buds are attached to the sub-umbrella close to the base of the stomach. The largest *Cunina* shows three rows of otoporpæ on each lappet, and is about ready for liberation.

Bougainvillia fulva is widely distributed over the Pacific and Indian Oceans, and lives within the tropical belt.

Genus *TURRITOPSIS*, McCrady, 1857.

There are differences of opinion amongst specialists on medusæ as to the number of species that should be recognised as belonging to the genus *Turritopsis*. Mayer (1910) and Bigelow (1913) clearly consider that the American *Turritopsis nutricula*, McCrady, is identical with the European *Turritopsis polycirra*, Keferstein. Maas (1909) is practically of the same opinion, but he suggests that the species should be kept apart, as local forms or varieties. Acting upon his own suggestion, Maas described a new *Turritopsis* from Japan as a new variety of *Turritopsis nutricula*.

Hartlaub (1911) on the other hand seems fairly convinced that the American and European *Turritopsis* belong to distinct species. I may here say that I agree with Hartlaub in placing *Turris neglecta*, Lesson, as a synonym of *Turritopsis polycirra*. Sometime before the appearance of Dr Hartlaub's publication I had already come to the same conclusion.

With regard to the medusa described by Maas (1909) under the name of *Turritopsis nutricula*, var. *pacifica* from Japan, I think it should be regarded as a distinct species, and under the name *Turritopsis pacifica*. Maas clearly states that the ocelli are abaxial, that is to say, on the outer side (ex-umbrella side) of the basal bulbs, whereas both *Turritopsis nutricula* and *Turritopsis polycirra* have their ocelli on the inner side of the basal bulbs. Even if Maas, as Bigelow (1913) has hinted, has accidentally recorded and figured the ocelli on the wrong side of the bulb, still, in my opinion, it remains a distinct species. Maas's figures show that the formation of endoderm above the stomach is similar to that of *Turritopsis polycirra*, but it can be distinguished from *Turritopsis polycirra* by having a much larger number of tentacles (120—150) arranged in several rows round the margin of the umbrella.

Since I have seen the specimens of *Turritopsis* in the "Sealark" collection and compared them with specimens of *Turritopsis polycirra* from the English Channel and the North Sea, I am strongly in favour of Hartlaub's views and believe the reasons given by him for separating the American and European species are sound.

In *Turritopsis nutricula* the radial canals, by a considerable thickening of their walls, and coalescence, form a kind of endodermal peduncle upon which the stomach hangs.

In *Turritopsis polycirra* a further development of endoderm takes place. It is no longer confined to the walls of the radial canals, but grows across the top of the umbrella cavity and forms a homogeneous mass of cells. This extension also grows downwards and takes in the radial canals in the uppermost part of the sub-umbrella. The extension

of the endoderm is recorded by the leaving of the outer half of the radial canal wall in situ alongside the umbrella. In adult specimens the radial canals run alongside this mass of endoderm nearly to the top of the sub-umbrella and there they curve sharply inwards to the stomach.

Turritopsis nutricula has been well described and figured by American naturalists, and there is no evidence to show that its endodermal peduncle is converted by further development into a mass of cells which block up the upper part of the cavity of the sub-umbrella. Maas (1909) has already said that the differences between the two species may be defined as stages in development, and that is the case, but up to the present I have failed to find any proof that *Turritopsis nutricula* develops into *Turritopsis polycirra*.

9. TURRITOPSIS NUTRICULA, McCrady, 1857.

Oceania (Turritopsis) nutricula, McCrady, 1857, p. 55, pl. 4.

Turritopsis nutricula, McCrady, 1858, p. 127, pl. 8, fig. 1.

Modeeria multitentacula, Fewkes, 1881, p. 149, pl. 3, figs. 7—9.

Turritopsis nutricula, Brooks, 1886, p. 388, pl. 37.

Turritopsis nutricula, Brooks and Rittenhouse, 1907, pp. 429—460, pls. 30—35.

Turritopsis nutricula, Mayer, 1910, p. 143, pl. 14, figs. 10—13, pl. 15, figs. 10—13.

Turritopsis nutricula, Bigelow, 1913, p. 8.

Locality. Chagos Archipelago, Salomon Atoll, Surface. 5 July, 1905, Q. 2 specimens.

The umbrella is about as high as broad (2.5 mm.), with a rounded summit; its sides are slightly curved inwards about the middle and the walls are rather thin. Velum moderately broad. The stomach is large and cross-shaped. The mouth has four very short perradial lips and its whole margin is lined with isolated, globular, clusters of nematocysts. Four fairly broad radial canals. The radial canals on leaving the stomach proper are very wide and have very thick walls, which coalesce, so that the stomach appears to hang from a thick cellular peduncle, about one-third its length. The gonads are interradial upon the walls of the stomach; one specimen has ova and the other spermatozoa. The tentacles are arranged in a single row on the margin of the umbrella (one specimen with 56, the other with 45 tentacles). They have a smooth, even surface, but are densely covered with minute nematocysts, and terminate with a bulbous enlargement. The basal bulbs of the tentacles vary in size, especially in length. They adhere on the outer side to the margin of the umbrella, and the basal half of the inner side is covered with a semicircular loop of nematocysts. There is a small reddish-looking ocellus on the inner side of every bulb, situated close to the tentacle.

The specimens in the "Sealark" collection are similar to the published figures of *Turritopsis nutricula*. The formation of the endodermal peduncle is identical with that of *Turritopsis nutricula*, and not at all like that of *Turritopsis polycirra*.

Bigelow (1913) in his description of *Turritopsis nutricula* from Japan calls attention to a distinct terminal dilatation of the tentacles, and he points out that similar dilatations also occur in specimens taken on the American coast at Newport. It is strange that these dilatations have not been previously noticed by the American naturalists. The specimens

in the "Sealark" collection also show a large hollow enlargement of the distal end of some of the tentacles. I am rather inclined to regard these dilatations in some way due to the action of the killing re-agents used. I can find no such dilatations in *Turritopsis polycirra*; their tentacles in a semi-contracted condition are rather club-shaped, as shown in the figure of *Turritopsis nutricula* by Mayer (1910, pl. 14, fig. 13).

The hydroid of *Turritopsis nutricula* is known under the name of *Dendroclava*, which is probably identical with *Tubiclava* of Allman.

The medusoid genus has been previously recorded from the Indian Ocean. Vanhöffen (1911) found a damaged specimen of *Turritopsis* between the Chagos Islands and the Seychelles. Bigelow (1904) found a young *Turritopsis* in Felidu Atoll, Maldives.

Distribution. North Atlantic along the coast of United States. Pacific Ocean, Japan.

10. AMPHINEMA sp. ?

Locality. Amirante Islands, Desroches Atoll. 200—0 fms. 16 Oct. 1905, kk. 1 specimen.

This little medusa was preserved in alcohol and is in rather a fragile condition.

The umbrella is thin, a little less than 2 mm. in length and width, with apparently a small apical projection. The stomach is not situated upon a peduncle. The mouth has four small lips. The whole manubrium projects about half its length beyond the margin of the umbrella. There are four inconspicuous radial canals, which apparently leave the stomach a little way down its sides, and slight traces of very small inconspicuous mesenteries, but as it is difficult to estimate the amount of contraction and shrinkage the presence of mesenteries remains doubtful. The gonads form eight adradial folded bands along the upper half of the manubrium, and each contains a few fairly large ova.

There are two large, opposite, perradial tentacles, with large tapering basal bulbs, slightly laterally compressed. The basal bulbs are very opaque and of a dark brownish colour; but probably of quite a different colour when alive. On each half of the margin of the umbrella, between the two tentacles, there are five very small bulbs, little longer than broad, and evidently do not develop large tentacles. No trace of an ocellus could be seen on any of the bulbs.

This is an adult medusa probably belonging to a *Perigonimus*-like hydroid. I cannot determine the species with any degree of certainty, as it does not show clearly any well-marked character. A few more specimens were wanted, and in better condition.

Genus LEUCKARTIARA, novum nomen Hartlaub, 1914. (TIARA, preoccupied name.)

11. LEUCKARTIARA GARDINERI, nova species (Pl. 39, fig. 4).

Locality. Amirante Islands, Surface. 10 Oct. 1905, gg. 1 specimen.

Description of the Species:—Umbrella conical, about twice as high as broad, with rather thin walls. Four very conspicuous perradial canal-like bands projecting from the surface of the ex-umbrella, and extending from the tentacles nearly to the summit of

the umbrella. Stomach large, occupying more than half the cavity of the umbrella. Mouth large, and its margin in folds. Four fairly broad perradial canals, without any lateral processes, and with a slit-like union with the stomach along its whole length; thus forming the so-called "mesenteries" which attach the stomach perradially to the wall of the sub-umbrella. Four gonads, isolated perradially, and arranged in eight adradial bands, which are composed of bifurcated transverse folds and united interradi- ally by a transverse fold. Four long perradial tentacles, with laterally compressed basal bulbs clasping the margin of the umbrella. Also very minute interradi- al and adradial tentacles, and a few marginal bulbs without tentacles. A blackish ocellus on the outer side of all basal bulbs of the minute tentacles and marginal bulbs.

Size. Umbrella about 3.5 mm. in width and 6 mm. in height.

The collection contains only one specimen, and it is in a splendid state of preservation, but with the margin contracted inwards.

This new species, which I have great pleasure in naming after the leader of the "Sealark" expedition, has a character well-marked by the presence of four perradial canal-like bands upon the ex-umbrella. These bands are probably brightly coloured in the sea. They extend beyond the margin on to the outer edge of the basal bulbs of the large tentacles and contain nematocysts. Although ocelli are clearly visible on the basal bulbs of the minute tentacles, still they cannot be seen upon the basal bulbs of the large perradial tentacles. I am inclined to take the view that this species has not more than four large tentacles and that the minute tentacles remain in a rudimentary condition. The gonads show ova fairly well advanced, so that the specimen is not an early stage.

12. *PANDÆA* juv.

Locality. Chagos Archipelago, Salomon Atoll. 10—0 fms. 1 July, 1905, P. 1 specimen. Surface. 5 July, 1905, Q. 2 specimens.

The specimens are young stages in a contracted and crumpled condition. The smallest is about 2.5 mm. in diameter, its umbrella has conspicuous longitudinal ridges carrying nematocysts. There is a nematocyst track corresponding to every tentacle and bulb. The perradial ridges extend to the summit of the umbrella and the other ridges or tracks are shorter, their length and size being correlated with the age of the tentacle. The development of the gonads is just commencing and their position is marked by small isolated pits in the wall of the stomach. There are seven tentacles and a few adradial bulbs, the latter are at different stages of growth. A conspicuous black ocellus is situated on the outer side of all the basal bulbs of the tentacles and on some of the larger adradial bulbs.

The second specimen is a little older and about twice the size of the smallest specimen. In this specimen the stomach has flattened out and the mouth expanded to its extreme limit. The four perradial canals leave the stomach close to the four corners of the mouth. There are nine tentacles and seven tentacular bulbs, each one having a black ocellus.

The third specimen closely resembles the last one. It shows very clearly that the adradial tentacles do not all begin to develop at the same time.

These early stages are either identical with or closely related to *Pandæa conica* (Quoy et Gaimard) which is a common species in the Mediterranean. Vanhöffen (1911) records the occurrence of *Tiara* (*Pandæa*) *conica*, Lesson, in the Agulhas Current, Indian Ocean.

Genus *HETEROTIARA*, Maas, 1905.

There are two species belonging to the genus *Heterotiara*, namely *Heterotiara anonyma*, Maas (1905) and *Heterotiara minor*, Vanhöffen (1911). A complete description of *Heterotiara anonyma* could not be given by Maas as the specimens had lost their tentacles. Vanhöffen on the cruise of the "Valdivia" obtained *Heterotiara anonyma* as well as *Heterotiara minor*, and again *Heterotiara anonyma* was taken without tentacles.

Bigelow (1909) found, in the material collected by the "Albatross" in the Humboldt Current off Peru, two specimens of a medusa which he has fully described and figured under the name of *Heterotiara anonyma*. These specimens have their tentacles tapering to a point, and therefore are not like those of *Heterotiara minor* terminating with a bulb.

Bigelow (1913) also records *Heterotiara anonyma* from the Bering Sea, where the "Albatross" obtained many specimens. Their tentacles, however, terminate in a spherical knob much the same as in *Heterotiara minor*. On the same cruise *Heterotiara minor* was plentifully found at the Philippines, but the specimens have not yet been fully described. Bigelow states that *Heterotiara minor* and *Heterotiara anonyma* are undoubtedly distinct, "They are separated by the number of tentacles correlated with size, *H. anonyma* having twelve tentacles (or less) when adult, and reaching a height of 20 mm., whereas *H. minor* has about twice as many tentacles, though much smaller (only about 10 mm. high)."

Bigelow has described and figured *Heterotiara anonyma* from off the coast of Peru with tentacles tapering to a point, and from the Bering Sea with tentacles terminating in a bulb, as in *Heterotiara minor*. It seems to me that either the Peruvian specimens have been inaccurately described or that they belong to another genus, and I am inclined to take the latter view.

13. *HETEROTIARA MINOR*, Vanhöffen, 1911.

Heterotiara minor, Vanhöffen, 1911, p. 212, Taf. 22, fig. 5, Text-fig. 8.

Heterotiara minor, Bigelow, 1913, p. 25.

Locality. Lat. 4° 16' S., Long. 71° 53' E. (North of Chagos). 1200—0 fms. 17 May, 1905, C. 1 specimen.

This single specimen is in fairly good condition. Its umbrella measures 13 mm. in height and 12 mm. in width. The stomach is contracted into folds and hangs free inside the cavity of the umbrella. There are four radial canals and no centripetal canals. The tentacles are transparent, hollow, and terminate with a large hollow bulb, thickly covered with nematocysts. There are nineteen tentacles, varying slightly in size, the differences being due to age. The tentacles have no definite basal bulbs, but their basal portion is partly embedded in the jelly and situated in grooves on the margin of the umbrella. The specimen resembles Vanhöffen's text-figure 8.

14. *PROBOSCIDACTYLA TROPICA*, Browne, 1904.

Willisia sp. Huxley, 1877, p. 120, fig. 17.

Proboscoidactyla tropica, Browne, 1904, p. 727.

Locality. Amirante Isles, Desroches Atoll. 100—0 fms. 16 Oct. 1905, kk. 1 specimen.

Huxley, when off the Louisiade Archipelago in 1849, found a medusa which he briefly described and figured under the name of *Willisia*. In my revision of the Williadæ (1904) I recognised this medusa as a distinct species and called it *Proboscoidactyla tropica*.

Bigelow (1909, p. 220) considers *Proboscoidactyla tropica* to be identical with *Proboscoidactyla ornata* McCrady, 1857, var. *stolonifera*, Maas, 1905.

One of the characters, which I made use of to distinguish *Proboscoidactyla tropica* from all the other species of the genus, was the form of a blastostyle bearing a cluster of nematocysts at its free end, and upon the sides of this blastostyle the medusa-buds develop. This blastostyle is similar in structure to the blastostyle of the hydroid *Lar sabellarum*, upon which medusa-buds develop, which when set free belong to the medusoid genus *Willia*.

Maas (1905) in his description of the variety *stolonifera* from the Malaysian region makes no mention of this peculiar blastostyle, and if it had been present in his specimens he could not have failed to have noticed it.

Bigelow (1909, p. 219) states that *Proboscoidactyla gemmifera* (Fewkes) is only the budding form of *Proboscoidactyla ornata*, McCrady, 1858. I cannot very well link *Proboscoidactyla tropica* to *Proboscoidactyla ornata* by means of *Proboscoidactyla gemmifera*, as Brooks (1880) states clearly that the stolons have branches and each branch terminates with a medusa-bud. There is here also no mention made of any blastostyle-like stolon with a terminal cluster of nematocysts. Mayer's figures (1910, Pl. 21) confirms Brooks's statement. Under these circumstances I prefer to retain *Proboscoidactyla tropica* as a distinct species until at least we know more about the life-histories of the other species of the genus.

The specimen in the "Sealark" collection is about 2 mm. in diameter, and has lost its natural shape owing to contraction. The velum is very narrow. The stomach has four perradial lobes, from which the four main radial canals leave to join the tentacles. As in other species of the genus there is no circular canal. Each main radial canal has the appearance of being twice dichotomously branched, each terminal branch going to a tentacle. At the juncture of the first branch of each canal is situated a blastostyle-like stolon. This blastostyle has rather the appearance of a tentacle, for at its free end there is a large cluster of nematocysts. The medusa-buds are at different stages of development. Two to four on each stolon, and the largest is nearly ready for liberation. They are arranged round the sides of the stolon. Huxley, however, states that the buds are unilateral. He saw them alive, whereas I have only a contracted specimen. In one of the perradii at the junction of the second branch there is a second blastostyle-like stolon with a small bud developing. So apparently the medusa has stolons on the junction of the second branch as well as on the first.

There are sixteen tentacles, rather thick, in a contracted condition, with a thick semi-circular band of nematocysts on the inner side of the basal bulbs, which project into

the substance of the umbrella. Between every two tentacles are isolated clusters of nematocysts, which extend over the ex-umbrella from the margin up to the summit, and these clusters are similar to those described in the other species of the genus. Though the specimen is in fairly good condition, it is not suitable, owing to contraction, for the making of a good drawing.

15. *PROBOSCIDACTYLA* sp.

Locality. Farquhar Group, Providence Is., Surface. 3 Oct. 1905, x. 1 specimen.

Umbrella about 1.25 mm. in diameter. Five main radial canals, each with a lateral branch. Ten tentacles. No medusa-beds.

The specimen is not in very good condition. The number of radial canals shows that it is abnormal, and as each canal has only one branch it is evidently a young stage.

16. *ANTHOMEDUSA*, Genus ?.

Locality. Mauritius. 300—0 fms. 22 Aug. 1905, C. 1 specimen.

The umbrella is in a contracted condition, about 5 mm. in width and probably when alive about the same in height, rather thick. It has on its exterior surface four conspicuous, prominently projecting, perradial ridges, which extend from the margin to, or nearly to, the top of the umbrella. These ridges have rather a blunt rounded edge, with what appears to be a narrow shallow groove running along the middle of the edge. From the shape and general appearance I do not think that these ridges were formed artificially either by preservation or by contraction, but existed in the living specimen. I am not so sure, however, about the groove along the middle of the ridge, it might be due to shrinkage. I cannot recall seeing a figure of any *Anthomedusa* with ridges, such as appear in this specimen. The velum is very narrow, and the sub-umbrella is well covered with a layer of fine muscles. The stomach is rather contracted, and has a plain circular mouth. In its contracted condition it is rather broad, and sac-shaped. It is not likely to extend beyond the margin of the umbrella even when fully stretched out. There are four conspicuous radial canals. The wall of the stomach has the appearance of being covered with male gonads, and if so, then the gonads are at an early stage as there is no definite swelling.

The medusa has only two opposite perradial tentacles, both of which are unfortunately broken off at the basal bulbs and leaving not the slightest clue as to their structure. The basal bulbs are rather large and globular, and are attached to the margin of the umbrella, but do not project into the substance of the umbrella. The other two opposite perradii are natu- without any tentacles and also without any rudimentary bulbs, and the whole margin is also without minute rudimentary bulbs. There is apparently a patch of nematocysts on the margin of the umbrella in each of the four perradii, and there is also evidence of a short extension of them along the ridges of the ex-umbrella. No ocelli could be found.

With the complete loss of the tentacles it is impossible to determine the genus. It has certainly only two opposite tentacles, so it may be a *Dicodonium*, a *Zanclea*, or even a new genus.

LEPTOMEDUSÆ.

17. LAODICE ?.

Locality. Amirante Isles, Surface. 9 Oct. 1905, gg. 1 specimen.

This specimen is probably a young *Laodice*, but the absence of gonads, which have not yet begun to develop, makes the determination of the genus uncertain. The umbrella is saucer-shaped, about 4 mm. in diameter, and moderately thick. The tentacles, not exceeding sixty in number, are very slender and short, with small basal bulbs partly extending over the margin of the umbrella and without a well-defined spur. There are a few marginal bulbs, from some of which tentacles have been broken off. Between every two tentacles or bulbs there is generally a single cordylus. Cirri are also present, but not many remain. A conspicuous black globular ocellus is situated on the inner side of most of the basal bulbs of the tentacles and marginal bulbs.

18. TIAROPSIS ROSEA, Agassiz and Mayer, 1899.

Tiaropsis rosea, Maas, 1905, p. 30, Taf. 7, figs. 45—47.

Tiaropsis rosea, Mayer, 1910, p. 260.

Locality. Mauritius. 125—0 fms. 22 Aug. 1905, a. 1 specimen.

Description of the specimen :—Umbrella, about 3 mm. in diameter, moderately thick, and hemispherical. Velum broad. Stomach cross-shaped. Four radial canals. Gonads upon the radial canals, forming globular sacs near the stomach. Four large perradial tentacles, with pigmented basal bulbs. Seven marginal bulbs between every two tentacles. Eight adradial sensory vesicles, with a large black roundish ocellus, situated at the base of the vesicle and on the inner side.

This specimen, though much smaller in size, agrees very closely with a *Tiaropsis* described by Maas from Damar, Malay Archipelago. Maas' description and figures are based upon a single adult specimen about 15 mm. in diameter, and he considers it to be the adult stage of *Tiaropsis rosea* of Agassiz and Mayer. It has yet to be definitely proved that *Tiaropsis rosea* of Agassiz and Mayer found in Suva Harbour, Fiji, is an early stage of *Tiaropsis rosea*, Maas. /

The arrangement of the marginal bulbs may help to determine this species. There are seven in each quadrant, situated as follows :—three in the interradial portion, and two on the perradial side of the two sense organs. The gonads do not extend along the radial canals as figured by Maas, but the specimen has the appearance of being immature and has probably not reached its maximum growth.

PHIALIDIUM sp. ?

There are apparently two species of *Phialidium* in the collection, but the specimens are not in a condition suitable for the determination of species.

19. PHIALIDIUM sp. A.

Locality. North of Chagos, Lat. 4° 16' S., Long. 71° 53' E., Surface (Temp. 86° F.). 17 May, 1905, B. 5 specimens.

Umbrella hemispherical, 3—5 mm. in diameter. Stomach quadrangular, on a slight

thickening of the sub-umbrella. Mouth with four lips. Gonads close to the margin of the umbrella and extending over about one-quarter the length of the radial canals. Tentacles, 14—16, with globular basal bulbs. One or two sensory vesicles between every two tentacles, very minute and probably have contained only one otolith.

20. PHIALIDIUM sp. B.

Locality. Amirante Isles, Surface (Temp. 79° F.). 9 Oct. 1905, gg. 6 specimens. Surface. 17 Oct. 1905, oo. 3 specimens.

Umbrella hemispherical, 5—6 mm. in diameter. Gonads close to the margin of the umbrella, linear or oval sacs extending over about one-quarter the length of the radial canals. Tentacles, 30—40, with globular basal bulbs. One to three sensory vesicles between every two tentacles.

21. IRENE sp. ? A.

Locality. Nazareth Bank, Cargados Carajos, Surface. 30 Aug. 1905, g. 1 specimen.

This is an early stage without gonads. The umbrella is about 6 mm. in diameter and very thin. The stomach is small and upon a short peduncle. There are eight tentacles, with globular basal bulbs, and three to four marginal bulbs between every two tentacles. All the bulbs have a pair of cirri adjacent to them, and excretory pores are visible. A few sense organs were found, and there is probably one between every two marginal bulbs and tentacles.

22. IRENE sp. ? B.

Locality. Saya de Malha Banks. 58—0 fms. 6 Sept. 1905, C, 14. 11 specimens.

These specimens are all in bad condition, so that only a general description can be given just to indicate that the Irene-like medusa occurs in that district. Their umbrellas measured 30 to 40 mm. in diameter and are moderately thick. From the centre of the umbrella hangs down a broad thick peduncle, about 20 mm. in length. Upon it a broad stomach is situated, and its mouth has four lips with the margin closely folded. It is a large mouth even in a contracted condition. There are four radial canals. The gonads, some containing well-developed ova, form laminar bands along the canals upon the sub-umbrella, but they do not extend down the peduncle. Some of the specimens have the above-mentioned organs in fairly good condition, but all have the margin of the umbrella, either completely denuded of its appendages or in such a fragmentary condition that not even one quadrant is complete. I consider there should have been fifty or more tentacles, about three marginal bulbs between every two tentacles, and at least one small sensory vesicle between every two bulbs. Excretory pores are visible in connection with the basal bulbs of the tentacles and the marginal bulbs. I can find no definite indication of marginal cirri. The margin is not only broken but has rather a macerated appearance, therefore it is not advisable to describe it in detail or base drawings upon it.

23. MESONEMA PENSILE (Modeer) 1791.

Mesonema pensile, Browne, 1904, p. 733, pl. 55, fig. 4, pl. 57, figs. 8—9.

Mesonema pensile, Browne, 1905, p. 147, pl. 2, figs. 11—15.

Mesonema pensile, Maas, 1905, p. 42, Taf. 8, fig. 52.

Mesonema pensile, Maas, 1909, p. 26.

Locality. Chagos Archipelago, Diego Garcia. 10—14 fms. 10 July, 1905.
1 specimen.

The genus *Mesonema* of Eschscholtz has undergone several changes in its definition. In 1904 I defined it as follows:—"Æquoridæ with numerous, simple, unbranched radial canals. Stomach circular, with lower wall quite rudimentary. Mouth nearly as large as the diameter of the stomach and cannot be closed." The type species of the genus is *Mesonema pensile* (Modeer) 1791, and specimens similar to the type were described and figured by me in 1904. Both Mayer (1910) and Bigelow (1909) have raised objections to my distinguishing marks of the genus, and by which I separated it from *Æquorea*. They rightly say that owing to the great contractibility of the lower wall of the stomach it is difficult to assign to the correct genus certain species of the Æquoridæ, and therefore they consider it is advisable to recognise *Æquorea* only, and place *Mesonema* in its list of synonyms. I clearly foresaw this difficulty, but had hopes that further researches on the Æquoridæ might lead to the permanent retention of *Mesonema* by adding other characters so as to definitely separate it from *Æquorea*.

Vanhöffen (1911) also rejects my definition of *Mesonema* and brings forward a new definition as follows:—

Mesonema. Leptomedusæ with numerous radial canals, and with large tentacles considerably less in number than the canals. Tentacles with triangular and especially heart-shaped bulbs.

Æquorea. Leptomedusæ with numerous radial canals, with fully developed tentacles about as many or more than radial canals. Tentacles with conical basal bulbs.

Vanhöffen's characters for separating the two genera may be an improvement on mine. It is quite easy to isolate the extremes as separating characters, whether one uses the size of the mouth, the number of canals in relation to the number of tentacles, or the shape of the basal bulbs, but the difficulty is to assign to the right genus those specimens which come near the border line. We have a very imperfect knowledge of the species belonging to the genus *Æquorea*, using the term in its widest sense. Some of the species exist on paper only, as their descriptions are too vague for any further use, a few have been fully described and figured, and many disputed as to their validity by systematists.

Vanhöffen (1911) considers that *Æquorea macrodactyla*, Brandt, *Æquorea maldivensis*, Browne, and *Æquorea parva*, Browne, are all identical with *Mesonema cælum pensile* of Modeer. It is still, however, my firm opinion that *Æquorea macrodactyla* and *Mesonema pensile* are quite distinct species. Although the original descriptions of these two old species are rather vague and their figures more like rough sketches, still their names are now associated with medusæ which have been described and figured according

to modern requirements. At present, I have no valid reasons for ranking *Æquorea parva* as a synonym.

It appears to me, in spite of the descriptions and figures given by Maas and myself of *Mesonema pensile* and *Æquorea macrodactyla*, that Vanhöffen has failed to see clearly the difference between the two species. In his sketch (1911, p. 223, text-fig. 21) of the margin of umbrella showing the basal portion of the tentacles of *Mesonema pensile*, they appear to be very much like the basal bulbs of *Æquorea macrodactyla*; they are not at all like the basal bulbs of a genuine *Mesonema pensile*.

In the "Sealark" collection there is only one specimen, which is in very bad condition. By the shape of the basal bulbs I think it is *Mesonema pensile*. The umbrella is about 15 mm. in diameter. There are eight tentacles. The radial canal system is practically destroyed, just a few canals left.

Distribution. Tropical Pacific and Indian Oceans. Maas (1909) records it from Sagami Bay (35° N., 139° 37' E.), Japan.

24. *ÆQUOREA MACRODACTYLA* (Brandt) 1834.

Æquorea maldivensis, Browne, 1904, p. 732, pl. 56, figs. 4—12.

Mesonema macrodactylum, Maas, 1905, p. 40, Taf. 8, figs. 51 and 54.

Æquorea macrodactyla, Bigelow, 1909, p. 37, pl. 36, figs. 5—10.

Localities. North of Chagos. 1200—0 fms. 17 May, 1905, C. 1 specimen.
Chagos Archipelago, Salomon Atoll. 180—0 fms. 30 June, 1905, O. 1 specimen.
Saga de Malha. 55—0 fms. 6 Sept. 1905, C. 14. 8 specimens.

Æquorea macrodactyla of Brandt received a description according to modern requirements by Maas in 1905, and more recently Bigelow has published an account of some specimens taken in the Eastern Tropical Pacific. As the two best specimens in the "Sealark" collection agree very well with the descriptions given by Maas and Bigelow, I have no doubt that we have all seen the same species.

In one of my earlier publications on Medusæ I pointed out that the shape of the basal bulbs of the tentacles was a useful aid in the determination of the species belonging to the *Æquoridae*. There are distinct types of basal bulbs, and for each type an allowance must be made for variation and also for contraction or distortion due to preservation. *Æquorea macrodactyla* has the basal bulbs curling over or clasping a thickening of the margin of the umbrella, and the character is clearly seen when a tentacle is cut out from the umbrella and viewed sideways.

Maas, when he re-described *Æquorea macrodactyla*, pointed out that its basal bulbs belonged to the same type as that found in *Æquorea maldivensis*, which had then not long been described by me as a new species. Bigelow, however, has gone a step further and considers *Æquorea maldivensis* to be the same species as *Æquorea macrodactyla*. It would now be very hard for me to keep the two species apart except by hair-splitting differences which, as far as possible, should be avoided.

The basal bulbs of the "Sealark" specimens are more like those figured by Maas and Bigelow for *Æquorea macrodactyla* than those figured by me for *Æquorea maldivensis*, but the type is the same and the differences would come within the range of variation.

The oral lips are similar in shape and structure as those figured for *Aequorea maldivensis*, but are more numerous. I am not sure that it would be advisable to take the number into consideration for one of the specific characters. Maas found the oral lips to be less than half as numerous as the radial canals. Bigelow does not mention them in his text, but a figure indicates fewer lips than canals. One of the "Sealark" specimens has about the same number of lips as radial canals.

All the specimens from the Saya de Malha Banks are in bad condition, and it is only just possible to determine the species in one specimen which has a few tentacles left. Their stomachs measured from 23—34 mm. in diameter, and radial canals numbered 72 to 100.

A few notes can be given on the specimens from the other stations.

A. The umbrella measures 42 mm. in diameter and is moderately thick. The stomach measured 27 mm. and the mouth 23 mm. in diameter. Even allowing for the lower wall of the stomach being considerably contracted, I doubt very much if it could expand sufficiently so as to allow the mouth to close up. There are 92 radial canals, a few have developed much later than the rest and bear no gonads. Seventeen large tentacles and seven much smaller in size at different stages of development. There are between every two tentacles 5—10 marginal bulbs with excretory pores. This specimen shows in a marked manner the radial muscle bands extending from the proximal end of the radial canals, across the lower wall of the stomach, to the oral lips. There is a muscle band in connection with every radial canal.

B. The umbrella is shaped like a biconvex lens and measures 45 mm. in diameter. The stomach is about 30 mm. and the mouth about 20 mm. in diameter. Around the margin of the mouth are numerous lips, about as many radial canals, and of the latter there are seventy-nine. The gonads show ova and extend as laminar bands along nearly the whole length of the canals. There are 16 large tentacles and four smaller in size. Between every two tentacles are situated 8 to 10 marginal bulbs, the central one is usually larger than the other and shows signs of developing a tentacle. The sense organs are very numerous, usually 2 to 5 between every two bulbs.

The excretory pores in both these specimens are very conspicuous on the inner side of the circular canal. They stand out like papillæ. There is one corresponding to and opposite every tentacle and large marginal bulb.

Distribution. Indian Ocean and Tropical Pacific.

25. LEPTOMEDUSA, No. 1.

Localities. North of Chagos. 75—0 fms. 16 May, 1905, A. 1 specimen. Farquhar Group, Providence Is., Surface. 5 Oct. 1905, y. 1 specimen.

The specimens are young stages, without gonads, and they probably have not yet developed their generic characters. At all events, I cannot assign them to a definite genus. Mayer (1910) gives figures (Pl. 25, fig. 8, and Pl. 27, fig. 1) of early stages of a *Dipleurosoma* which somewhat resembles these specimens.

Description.—The umbrella is thick, not quite so high as broad, about 4 mm. in diameter, without any apical projection. Velum narrow. The stomach is cross-shaped

when contracted, and quadrangular when expanded. It is fairly large and occupies the greater part of the top of the cavity of the umbrella. The mouth is fairly large, and has four lips. There are four radial canals, without any branching. Eight tentacles (4 per-radial and 4 interradial) with thick conical basal bulbs. Between every two tentacles there are three marginal bulbs, very small and short, a little longer than broad, and from their general appearance they evidently do not develop tentacles. A conspicuous roundish dark brownish ocellus is situated on the outer side of all the basal bulbs and on all the small marginal bulbs. No trace of any cordyli, cirri, or marginal sensory vesicles could be seen. One of the specimens is a little smaller and younger than the other. It has only two marginal bulbs between every two tentacles, and one of its interradial tentacles is missing. Both specimens are badly contracted, but in a fairly good state of preservation.

26. LEPTOMEDUSA, No. 2.

Localities. Farquhar Group, Surface. 2 Oct. 1905, w. 1 specimen. Amirante Isles, Desroches Atoll. 50—0 fms., 200—0 fms. 16 Oct. 1905, kk. 2 specimens.

Description:—Umbrella hemispherical, fairly thick, 5—8 mm. in diameter. Stomach small, quadrangular when expanded. Mouth with four large lips having a crenate margin. Four narrow radial canals. Gonads extending over the outer half of the radial canals. Tentacles 16 (perhaps more), small, with small globular basal bulbs. Three to seven (usually five) elongated marginal bulbs (?) between every two tentacles. Two sensory organs between every two tentacles.

I cannot determine the genus to which these specimens belong owing to the condition of the marginal bulbs. These bulbs are elongated, and vary in length. They may be cirri in a state of contraction, or minute tentacles unlike the large ones, or genuine bulbs. I am in favour of their being contracted cirri. The sense organs are small, about large enough to contain a couple of otoliths, and are probably open sensory pits; if so, the specimens would belong to the Mitrocomidæ. The tentacles are not always equidistant apart, hence the irregular number of bulbs between them. One specimen has a quadrant containing six tentacles.

27. LEPTOMEDUSA, No. 3.

Localities. Nazareth Bank, Cargados Carajos, Surface. 30 Aug. 1905, i. 1 specimen. Amirante Isles, Surface. 18 Oct. 1905, oo. 3 specimens.

Description:—Umbrella rather flat, about 3 mm. in diameter. Stomach small and flat, similar to that of a *Phialidium*. Four radial canals (one specimen with five canals) without branches. Gonads sausage-shaped, along nearly the whole length of the radial canals. One specimen has conspicuous ripe ova. Tentacles small and slender, about 40, and terminating with a small cluster of nematocysts. No signs of cirri, or rudimentary marginal bulbs between the tentacles. No sense organs of any kind could be found.

All the specimens have rather a macerated appearance, and consequently it is not safe to rely upon the absence of sense organs.

TRACHOMEDUSÆ.

28. OLINDIAS SINGULARIS, Browne, 1904.

Olindias singularis, Browne, 1904, p. 737, pl. 56, fig. 2, pl. 57, fig. 1.

Olindias singularis, Bigelow, 1909, p. 109, pl. 4, fig. 1, pl. 31, figs. 1—10, pl. 32, fig. 8.

Olindias singularis, Mayer, 1910, p. 357.

Locality. Chagos Archipelago, Diego Garcia. 10—14 fms. 10 July, 1905.
4 specimens.

This species was first described by me from a single specimen, which Professor Stanley Gardiner found on his expedition to the Maldive Archipelago.

The chief specific character was based upon the presence of a single sense organ at the base of the primary tentacles. All the other species of the genus having a pair of sense organs in that position.

Bigelow fortunately found no less than 23 specimens in Managreva Harbour, Paumotu Archipelago in the Tropical Pacific, and he has given a more adequate description of the species, accompanied by excellent figures. In that series of specimens Bigelow noticed that the presence of a single sense organ did not hold good, for in the largest specimens (30—60 mm. in diameter) single and paired sense organs were found in the proportion of about four to one.

On searching the margin of the umbrella of the specimens from Diego Garcia I could find only a single sense organ at the base of the primary tentacles in three specimens, but the fourth specimen showed the presence of pairs. In quadrant (A) thirteen singles occurred, in quadrant (B) twenty-three singles and two pairs, in quadrant (C) twelve singles and five pairs, in quadrant (D) thirteen singles. It will be noticed that one quadrant is more prolific in pairs than the others, and that two quadrants are without pairs.

In these specimens the umbrella is somewhat flattened out, and measures 17 to 22 mm. in diameter. There are about seven centripetal canals in each quadrant. All the specimens show a fair quantity of primary tentacles, but the secondary tentacles have all but disappeared. It was not until a special search was made for them that a few, at a very early stage of development, were found. The fully grown secondary tentacles were probably broken off in the net, and now only their stumps remain. All the four specimens have gonads well developed.

In my report on the Maldive medusæ I stated that the primary tentacles of *Olindias* did not possess adhesive pads or suckers, and included their absence amongst the generic characters. Mayer and Bigelow have, however, proved the presence of adhesive pads in *Olindias tenuis*, and no doubt they occur in all the species of the genus. The error on my part arose from using sections of material which had not been specially preserved for that purpose. I failed to distinguish the adhesive cells, and on finding plenty of nematocysts came to the conclusion that the primary tentacles terminated with a battery of nematocysts.

Distribution. Tropical Pacific and Indian Oceans.

29. RHOPALONEMA VELATUM, Gegenbaur, 1856.

Rhopalonema velatum, Maas, 1893, p. 14, Taf. 1, figs. 5, 9—11.

Rhopalonema velatum, Vanhöffen, 1902, p. 59, Taf. 10, fig. 16, Taf. 11, fig. 32.

Rhopalonema velatum, Lo Bianco, 1904, p. 55, Taf. 34, fig. 137.

Rhopalonema velatum, Maas, 1905, p. 50, Taf. 10, fig. 69.

Rhopalonema velatum, Bigelow, 1909, p. 129.

Rhopalonema velatum, Mayer, 1910, p. 378, text-figs. 214, 216, 218, 219.

Rhopalonema velatum, Vanhöffen, 1912, p. 29.

Rhopalonema velatum, Vanhöffen, 1912, p. 371.

Localities. Chagos Archipelago; Mauritius; Farquhar Group; Amirante Isles. (The collection contained about sixty specimens taken at about twenty different stations.)

The specimens collected by the "Sealark" are about 2 to 5 mm. in diameter, and in different stages of development; the larger specimens have quite ripe gonads. The gonads form elongated swellings, not exceeding one millimetre in length and are usually situated about the middle of the radial canals. In shape these gonads are very similar to those of *Rhopalonema velatum* from Naples.

Rhopalonema velatum and *Rhopalonema cœruleum* have one character in common, namely, a conical top-knot on the summit of the umbrella. Bigelow found the top-knot to be very constant in his Pacific specimens. Although, at first, the top-knot was not regarded as of any importance, later its absence became useful for distinguishing *Rhopalonema funerarium*, Vanhöffen, from the other species of the genus. Nearly all the specimens in the "Sealark" collection show clearly the top-knot on the summit of the umbrella, but a few do not. The top-knot when properly formed stands out as a kind of conical projection on the top of the umbrella, and is usually marked off from the rest of the umbrella by a transverse circular furrow or depression. In shape and size it varies considerably, and is scarcely recognisable in extreme cases, as only a slight depression in the contour of the upper part of the umbrella is present. In this collection there are a few specimens which show no signs of a depression. These specimens are about 5 mm. in diameter, with well-developed gonads, and have rather a conical-shaped umbrella. Although certain specimens have not the characteristic top-knot, still there is not sufficient evidence to connect them with *Rhopalonema funerarium*. This latter species has a differently shaped umbrella and apparently does not begin to develop its gonads until about 6 mm. in diameter, and the gonads extend over the outer two-thirds of the radial canals. It lives at a greater depth than *Rhopalonema velatum*, and belongs to the mesoplankton.

According to Vanhöffen *Rhopalonema velatum* has eight perradial tentacles, eight interradial cirri, sixteen adradial cirri, and eight sense organs adjacent to the interradial cirri. Certain authors, however, have described and figured *Rhopalonema velatum* with sixteen sense organs. Maas (1893) gives the number of sense organs as sixteen, and figures two octants with three sense organs in each, thus showing that the number may even exceed sixteen. Mayer (1910, p. 380) gives a figure of *Rhopalonema velatum* drawn by himself at Naples, and it shows clearly sixteen sense organs, eight adjacent

to the perradial tentacles, and eight adjacent to the interr radial cirri. Bigelow (1909) could only find eight sense organs in specimens collected in the Eastern Pacific.

There should be no difficulty in seeing sense organs in living specimens, but after specimens have been preserved for some time the sense organs frequently have a marvellous way of either disappearing or so changing their appearance that it is not an easy matter to recognise them. Among the specimens in the "Sealark" collection I have found three with sense organs adjacent to the perradial tentacle and in one of the specimens the root of the adradial cirrus was visible. The tentacles and cirri are broken off in most of the specimens. When any are present it is the interr radial cirrus. Only about three specimens have any perradial tentacles left and the adradial cirri have either not developed or else broken off at the base.

Rhopalonema velatum is widely distributed throughout the warm regions of all the oceans. It is generally found at or near the surface.

Bigelow (1909) after an examination of a large series of specimens collected by the "Albatross" in the Eastern Tropical Pacific, has come to the conclusion that *Rhopalonema velatum*, Gegenbaur, and *Rhopalonema cæruleum*, Haeckel, are identical. In 1906, when I reported upon specimens of *Rhopalonema cæruleum* collected in the Bay of Biscay, I certainly felt sure that *Rhopalonema velatum* and *Rhopalonema cæruleum* were distinct species. The distinguishing character was based upon the shape of the gonads, which in *Rhopalonema velatum* are either globular or oval, but in the Biscayan *Rhopalonema cæruleum* the gonads form narrow bands, which occupy the central third of the radial canals. Although I have re-examined the Biscayan specimens, still I am not yet convinced that they are identical with *Rhopalonema velatum*.

Mayer (1910, p. 380) regards *Rhopalonema cæruleum*, Haeckel, as a distinct and good species. Under its name he has placed the following:—*Rhopalonema cæruleum*, Maas (1905); Browne (1906). *Rhopalonema funerarium*, Vanhöffen (1902); Bigelow (1909). Bigelow considers the *Rhopalonema cæruleum*, Haeckel and Browne, to be identical with *Rhopalonema velatum*, Gegenbaur. Mayer, on the other hand, regards it as identical with *Rhopalonema funerarium*. I cannot agree with Mayer's synonymy, for, I believe, that he has mixed up two distinct species; *Rhopalonema cæruleum*, Haeckel and Browne, belongs to one species, and *Rhopalonema funerarium*, Vanhöffen (1902), Bigelow (1909); *Rhopalonema cæruleum*, Maas (1905) belong to another species.

30. SMINTHEA EURYGASTER, Gegenbaur, 1856.

Sminthea eurygaster, Gegenbaur, 1856, p. 245, Taf. 9, figs. 14—15.

Trachynema eurygaster, Haeckel, 1879, p. 260.

Trachynema manimæforme, Haeckel, 1879, p. 262, Taf. 17, figs. 13—15.

Sminthea eurygaster, Metschnikoff, 1886, p. 244, Taf. 1, figs. 18—20.

Trachynema eurygaster, Maas, 1893, p. 12.

Trachynema eurygaster, Browne, 1906, p. 171.

Sminthea eurygaster, Mayer, 1910, p. 383, text-figs. 226—227.

Localities. North of Chagos, Lat. 4° 16' S., Long. 71° 53' E. 125—0 fms. 17 May, 1905, B. 1 specimen. 50—0 fms. 18 May, 1905, F. 2 specimens. Chagos Archipelago,

Peros Atoll. 75—0 fms. 30 June, 1905, M. 1 specimen. Amirante Isles, Desroches. 100—0 fms. 16 Oct. 1905, kk. 1 specimen.

Mayer (1910) has revived the old generic name *Sminthea* of Gegenbaur and defines the genus as follows:—"Trachymedusæ with only eight tentacles, one at the foot of each of the eight radial canals. In other respects this genus is similar to *Rhopalonema*." The chief advantage in the use of the name *Sminthea* is that it has a good type species, known as *Sminthea eurygaster*. It is quite easy to recognise this species when the gonads are present as they form globular swellings on the radial canals adjacent to the margin of the umbrella. In the early stages with the gonads undeveloped, it is necessary to rely upon the absence of any intercanal tentacles or cirri, and take the risk of their being early stages belonging to another genus.

The specimens in the "Sealark" collection are between 2 to 3 mm. in diameter and some have gonads. The tentacles are all broken off at their base.

This is rather a rare medusa. It has been previously recorded from the Mediterranean and the Atlantic. Its southernmost record in the Atlantic being in the South Equatorial Current off the north coast of Brazil.

31. PANTACHOGON RUBRUM, Vanhöffen, 1902.

Pantachogon rubrum, Vanhöffen, 1902, p. 63, Taf. 9, fig. 9, Taf. 10, figs. 19—20.

Pantachogon rubrum, Maas, 1905, p. 55, Taf. 10, fig. 66.

Pantachogon rubrum, Mayer, 1910, p. 389, text-figs. 240—241.

Localities. Chagos Archipelago, off Peros Banhos, 600—0 fms. 30 June, 1905, N. 1 specimen. Between Providence Is. (Farquhar Group), and Alphonse Is., Lat. 8° 16' S., Long. 51° 26' E. 900—0 fms. 6 Oct. 1905, aa. 1 specimen.

Unfortunately both specimens are in bad condition, but it is just possible to determine the species. The umbrella is dome-shaped, with an evenly rounded summit, about 7 mm. in width and 5 mm. in height. The stomach is about 2 mm. long, without a peduncle, and its mouth has four short lips. The gonads are evidently just beginning to develop on the lower half of the eight radial canals. The tentacles are indicated by their stumps, and there are evidently eight in each octant.

The second specimen is of about the same size and shape as the first one. It is, however, in far worse condition, but useful as it shows a certain amount of bright reddish coloration on the sub-umbrella.

Distribution. Widely distributed in the warm regions of the Atlantic and Indian Oceans, and belonging to the mesoplanktonic zones.

32. HALICREAS PAPILLOSUM, Vanhöffen, 1902.

Halicreas papillosum, Vanhöffen, 1902, p. 68, Taf. 9, figs. 7—8, Taf. 11, fig. 30.

Halicreas papillosum, Maas, 1905, p. 57, Taf. 10, fig. 70, Taf. 11, fig. 71.

Halicreas papillosum, Bigelow, 1909, p. 138, pl. 3, fig. 3, pl. 33, figs. 8—9, pl. 34, figs. 1—3, 5, 8, 10, 11.

Halicreas papillosum, Mayer, 1910, p. 391, figs. 242—243.

Localities. South of Farquhar Group, Lat. 10° 27' S., Long. 51° 17' E. 1000—0 fms. 27 Sept. 1905, q. 3 specimens. North of Farquhar Group, Lat. 8° 16' S., Long. 51° 26' E.

900—0 fms. 6 Oct. 1905, aa. 2 specimens. Amirante Isles. 750—0 fms. 16 Oct. 1905, ll. 3 specimens. 16 Oct. 1905, mm. 400—0 fms. 2 specimens.

All the specimens are in very bad condition, and but little better than clear lumps of jelly.

This species has been very rarely taken near the surface, and it evidently belongs to the mesoplanktonic zone.

Distribution. Throughout the tropical and sub-tropical regions of all the oceans.

33. *AGLAURA HEMISTOMA*, Péron et Lesueur, 1809.

Aglaura hemistoma, Haeckel, 1879, p. 275, Taf. 16, figs. 3—4.

Aglaura hemistoma, Maas, 1893, p. 25, Taf. 1, figs. 12—13.

Aglaura hemistoma, Vanhöffen, 1902, p. 78.

Aglaura hemistoma, Lo Bianco, 1904, p. 55, Taf. 34, fig. 138.

Aglaura hemistoma, Browne, 1906, pp. 176, 184.

Aglaura hemistoma, Bigelow, 1909, p. 119, pl. 2, fig. 6.

Aglaura hemistoma, Mayer, 1910, p. 398, pl. 46, figs. 4—5, pl. 49, figs. 3—7, pl. 50, fig. 11, text-figs. 250—251.

Aglaura nausicaa, Haeckel, 1879, p. 274, Taf. 16, fig. 1.

Aglaura hemistoma var. *nausicaa*, Maas, 1893, p. 26.

Aglaura hemistoma var. *nausicaa*, Mayer, 1910, p. 400, fig. 252.

Aglaura laterna, Haeckel, 1879, p. 274, Taf. 16, fig. 2.

Aglaura hemistoma var. *laterna*, Maas, 1893, p. 25, Taf. 1, fig. 14.

Aglaura hemistoma var. *laterna*, Mayer, 1910, p. 400, fig. 253.

Aglaura prismatica, Maas, 1897, p. 24, Taf. 3, figs. 4—5.

Aglaura prismatica, Agassiz and Mayer, 1899, p. 165, pl. 4, fig. 13.

Aglaura hemistoma var. *prismatica*, Mayer, 1910, p. 400.

Aglaura octogona, Bigelow, 1904, p. 257, pl. 2, fig. 9.

Aglaura hemistoma var. *octogona*, Mayer, 1910, p. 401.

For further synonyms and references see Mayer, 1910, pp. 397—401.

Localities. North of Chagos; Off Mauritius; North of Saya de Malha Bank; Farquhar Group; Alphonse Is.; Amirante Isles. (The collection contained about 120 specimens taken at 21 different stations.)

After the cruise of the "Valdivia" Vanhöffen came to the conclusion that only one species of *Aglaura* existed. Bigelow on the "Albatross" cruise in the Eastern tropical Pacific paid special attention to *Aglaura* by examining specimens alive, and he also has decided in favour of a single species. Mayer is of the opinion that only one species exists, but he retains in his monograph the names of the varieties.

Aglaura hemistoma belongs to the epiplanktonic fauna, and is widely distributed throughout the warm regions of all oceans and seas. In the Biscayan Plankton (Browne, 1906) it was most plentiful at about 50—100 fms, scarcest at the surface. It did not occur in closing nets below 100 fms. On the "Sealark" expedition Professor Gardiner used the Wolfenden closing-net at only three stations and at each *Aglaura hemistoma* was taken. It occurred once at 250 fms, and twice at 500 fms. The serial hauls taken with open nets from different depths gave no reliable clue, owing to the paucity of specimens, as to the depth at which the species was most abundant. On each occasion the nets used within 50 fms of the surface contained specimens, and the numerous surface tow-nettings showed that it was not uncommon at the surface.

Most of the specimens are in good condition and resemble figures given by Maas (1893, Taf. 1, figs. 12—14). The umbrella having its length greater than its width, but in a few the length and width are about equal. None exceeded 3 mm. in length. The peduncle showed great variability in its length. In some specimens it is scarcely visible owing to contraction, whilst in others it reaches halfway down the cavity of the umbrella. The gonads at an early stage are globular, and become cylindrical or sausage-shaped when fully grown.

34. AMPHOGONA APSTEINI (Vanhöffen) 1902.

Pantachogon apsteini, Vanhöffen, 1902, p. 65, Taf. 10, fig. 18, Taf. 11, fig. 28.

Amphogona apsteini, Browne, 1904, p. 740, pl. 54, fig. 5, pl. 56, fig. 1, pl. 57, figs. 10—15.

Amphogona apsteini, Bigelow, 1909, p. 126, pl. 2, figs. 1—2, pl. 34, figs. 12—15, pl. 45, fig. 10.

Amphogona apsteini, Mayer, 1910, p. 405, text-fig. 257.

Localities. North of Chagos, Surface. 18 May, 1905, H. 1 specimen. Cargados Carajos, Surface. 30 Aug. 1905, i. 3 specimens. Farquhar Group, Surface. 2 Oct. 1905, x. 5 specimens.

Hermaphroditism occasionally occurs in this species and as such a feature is very rare amongst the Hydromedusæ it breaks the monotony of the usual descriptions. I first noticed (1904) in specimens collected by Professor Gardiner from the Maldives Islands; the male and female gonads alternating with one another in the radial canals.

Bigelow on the cruise of the "Albatross" in the Eastern Pacific found six specimens in Acapulco Harbour. These specimens turned out to be unisexual, all the gonads of any given individual being either male or female.

Hartlaub (1909, p. 462, Taf. 21, fig. 27) has described a new species under the name of *Amphigona pusilla* from Djibuti in the Gulf of Aden. One specimen showed hermaphroditism, and the other was unisexual and female.

In the "Sealark" collection one specimen shows three gonads, similar in shape and size on adjacent canals, and they have every appearance of being males, so it may be presumed that this specimen is unisexual. Another specimen shows large and small gonads alternating with one another, as figured by Vanhöffen, but they are too immature for the determination of the sex. The other specimens have either lost or nearly lost all their gonads and are useless for this purpose.

The specimens are about 2.5 mm. to 4.5 mm. in diameter, and have their stomach upon a peduncle, which varies in length according to the size of the specimen and the amount of contraction. The smallest specimen has about six tentacles, and the largest eight tentacles in each octant. The sense organs have all disappeared.

Distribution. Previously recorded from Indian Ocean, Maldive Is.; West coast of Sumatra. Pacific Ocean; Acapulco Harbour (Mexico).

Genus LIRIOPE, Lesson, 1843.

This is a difficult genus for finding reliable specific characters. The character which has usually been selected is the shape of the gonads. If the gonads be taken for the sole character, then it is possible to connect together specimens with linear gonads, through

a series of oval and ovoid forms, on to specimens with heart-shaped and triangular gonads, providing that the specimens are sufficiently numerous and taken over a large area. This method of determination leads to a considerable reduction in the number of described species, and practically it means that the genus should have only a single species.

Another character which has been used as an aid to the determination of species is the number of centripetal canals. These increase in number by age and by the growth of the umbrella, so that taken alone they are not very reliable. Other characters have also been used, such as the length of the peduncle and the shape of the umbrella. By taking each character separately one can connect together specimens which have every appearance of being quite distinct species.

Some of the species have no doubt been described from single specimens, every character has been used for the purpose, especially the shape of the gonads and no allowance made for variation or growth. Apparently a description and figure based upon a single or just a few individuals are not sufficient in the case of *Liriope*. It has, however, occurred to me that by taking a sufficient number of adults at the same place and time, and using all the possible characters, one would be able to obtain an impression of the type of that particular lot of specimens, and produce a sketch not of an individual but of the characters of the type. By adopting this method I think there is a chance of isolating species or at all events local races.

The number of specimens in the "Sealark" collection was not sufficient for finding out the exact number of local races or species living within the area covered by the voyage. After rejecting early stages and bad specimens the number left for the purpose was small. I am able, however, to isolate two races or species, and got on to the track of a third one.

35. *LIRIOPE TETRAPHYLLA* (Chamisso et Eysenhardt) 1821.

The specimens with triangular gonads I have placed under the old name of *Liriope tetraphylla*, and they are very similar to Vanhöffen's figure of *Liriope tetraphylla* (1902, Taf. 10, fig. 14).

The umbrella is thin, 5—8 mm. in diameter. The length of the peduncle is about twice the diameter of the umbrella. Velum very broad. In each quadrant there are three centripetal canals, the interradial the longest extending up to or nearly to the top of the gonads, the adradial canals about half the length of the interradial. The gonads are of the triangular type, about equilateral, either with angular or rounded corners and do not extend down to the margin of the umbrella.

36. *LIRIOPE*, sp. ?

The second species or race I leave without a name, as I have not been able to find a published figure showing the characters of the race, and the condition of the specimens is not suitable for drawing.

The umbrella is thin, about 5 mm. in diameter. The peduncle is a little longer than the diameter of the umbrella. Only one centripetal canal (interradial) in each quadrant. The gonads are longer than they are broad, either oval or elongated shield-shaped.

The great differences between the two species are in the shape of the gonads and

in the number of centripetal canals. The specimens with triangular gonads have always three centripetal canals in each quadrant, even in the intermediate stages when the gonads are beginning to develop. The specimens with elongated oval gonads have only one centripetal canal in each quadrant and the gonads begin as linear enlargements of the radial canals.

Liriope was found at 27 stations. A good haul was made north of Chagos (17 May, 1905, C.) when 78 specimens were taken. These were mostly early stages with a few adults of *Liriope* sp. Another large haul of the same species was made at the Farquhar Isles (1 Oct. 1905, v.). Except at these two stations *Liriope* was rather scarce.

37. GERYONIA PROBOSCIDALIS (Forskål) 1776.

Geryonia proboscidalis, Vanhöffen, 1902, p. 84, Taf. 10, fig. 15.

Geryonia proboscidalis, Bigelow, 1909, p. 116.

Geryonia proboscidalis, Mayer, 1910, p. 425, pl. 53, figs. 1—3, pl. 54, fig. 10, text-fig. 282.

Geryonia hexaphylla, Maas, 1897, p. 26, Taf. 3, fig. 6.

Carmarina hastata, Haeckel, 1865, p. 74, Tafs. 1, 4, 5.

Carmarina hastata, Lo Bianco, 1904, p. 56, Taf. 35, fig. 140.

Geryones mexicana, Agassiz and Mayer, 1902, p. 149, pl. 4, fig. 17.

Carmaris rosea, Agassiz and Mayer, 1902, p. 149, pl. 4, fig. 18.

For further synonyms and references see Mayer, 1910, p. 425.

Localities. North of Chagos, 1200—0 fms. 17 May, 1905, C. 1 specimen. Chagos Archipelago, Salomon Atoll, 10 fms. 1 July, 1905, P. 1 specimen. Mauritius, 300—0 fms. 22 Aug. 1905, c. 1 specimen.

The specimens are early stages and not in good condition. The smallest, about 3 mm. in diameter, has one centripetal canal in each interradius, and the perradial hollow tentacles are just beginning to develop. The largest specimen, about 8 mm. in diameter, has three centripetal canals in each interradianal sextant. The gonads are beginning to develop. Two of the sense organs have two otoliths instead of the usual single one.

Distribution. At the surface in the tropical and warm regions of all the Oceans, and in the Mediterranean.

NARCOMEDUSÆ.

38. SOLMARIS sp. ?

Localities. North of Chagos, Surface (Temp. 82° F.). 18 May, 1905, F. 1 specimen. Chagos Archipelago, Salomon Atoll, Surface. 4 July, 1905, Q. 3 specimens. Farquhar Is., Surface. 29 Sept. 1905, u. 1 specimen.

Out of the five specimens taken only one is in moderately good condition, and it is the largest.

Description:—The umbrella is about 5 mm. in diameter, slightly curved, and moderately thin. The marginal lappets are about as broad as long, and curved on the outer edge. Velum narrow. The stomach is circular, its lower wall rather loose, and the mouth closed in the form of projecting lips. There are broad marginal canals, but not

in the form of a solid chord of cells. The gonads are developing on the outer third of the lower wall of the stomach in a continuous ring, which is without any projecting pouches. There are eight tentacles, about as long as the diameter of the umbrella; they are not very stiff, and taper to a fine point. Below each tentacle is a well-marked peronial groove, lined with nematocysts. On each of the eight marginal lappets are five sense organs, rather ovate in shape, showing a clear circular vesicle, and without any external hairs. Otoporpæ are present as narrow bands just curling over the margin of the umbrella and situated on ridges.

The other specimens are smaller in size and very much contracted. Two of them have nine tentacles.

It is difficult to assign a specific name to these specimens, as some are certainly quite young stages and the largest has not reached maturity. They come nearest to Haeckel's *Solmaris lenticula* from the Indian Ocean. This species was only briefly described and never figured by Haeckel. Mayer thinks that it was probably only an immature form.

39. *ÆGINA CITREA*, Eschscholtz, 1829.

Ægina citrea, Maas, 1905, p. 71, Taf. 11, fig. 72, Taf. 13, figs. 79—82.

Ægina citrea, Bigelow, 1909, p. 73, pl. 1, fig. 5, pl. 14, fig. 5.

Locality. Chagos Archipelago, Peros Atoll. 600—0 fms. 30 June, 1905, N. 1 specimen.

I am not certain about the correct determination of this specimen, which is far from being perfect. The umbrella has a rather rounded summit, and measures 14 mm. in width and 7 mm. in height. There are eight stomach-pouches, one of which shows signs of a small notch in the middle of the lower edge; the other pouches are either without a notch or in an imperfect condition. Four tentacles about 30 mm. long. The margin of the umbrella is imperfect, but four sense organs were seen in one octant.

Genus *SOLMUNDELLA*, Haeckel, 1879, ex Maas, 1904.

This genus is found in all the oceans from the tropics to the icy waters of the poles. It is quite easy to determine the genus even from very bad specimens, but one has yet to settle the exact number of species, and this delicate point is not so easily disposed of.

Vanhöffen considers that the genus has only a single species, which he calls *Solmundella bitentaculata*, after the oldest specific name. The doubtful species is known as *Solmundella mediterranea*. Whether this is a good species, or a variety of *Solmundella bitentaculata* or identical with it, is a point which, in my opinion, requires further researches.

Maas and Bigelow evidently recognise two species; Mayer is very doubtful, and only ranks *Solmundella mediterranea* as a variety. As in the case of *Liriope*, I think that there are at least local races of *Solmundella*. The difficulty is to make sure of their status. Are they distinct species or varieties? If it should be finally decided that there is only one species, then I think that local races should be recognised by names for the sake of geographical distribution.

The Antarctic race has a character which has not been described in specimens from other places. Both Vanhöffen and myself note the occurrence of clusters of nematocysts upon the ex-umbrella, especially near the margin. If these clusters are not found in specimens from other localities they could be used to isolate the Antarctic race. The English and German expeditions to the Antarctic found *Solmundella* very plentifully at their respective winter quarters, and it apparently stays there and breeds there throughout the year. Though we both found the same race, still we called it by different names. Vanhöffen regarded it as *Solmundella bitentaculata* on account of his recognising only a single species, whereas I tried to separate it from that species and called it *Solmundella mediterranea* on account of its possessing only eight sense organs. The number of sense organs has generally been used to separate the two species. *Solmundella mediterranea* usually with eight sense organs and not more than sixteen, whereas *Solmundella bitentaculata* may have double that number. The sense organs alone are hardly sufficient to separate the two species because *Solmundella bitentaculata* passes through stages with eight and sixteen sense organs. The shape of the umbrella may be useful when one is examining living specimens or specimens preserved in perfect condition; the latter, however, are not often found in collections from abroad.

40. SOLMUNDELLA MEDITERRANEA (Müller) 1851.

Solmundella mediterranea, Maas, 1906, p. 12, Taf. 1, fig. 5, Taf. 3, figs. 23—24.

Solmundella mediterranea, Browne, 1910, p. 38.

Solmundella bitentaculata var. *mediterranea*, Mayer, 1910, p. 456, pl. 54, figs. 1—3, pl. 55, fig. 4.

Localities. North of Chagos, Surface (Temp. 84° F.). 16 May, 1905, A. 2 specimens. 50—0 fms. 18 May, 1905, F. 1 specimen. Chagos Archipelago, Salomon Atoll, Surface. 5 July, 1905, Q. 4 specimens. Farquhar Group, Surface. 3 Sept. 1905, x. 3 specimens. Amiraute Isles, Desroches Atoll. 50—0 fms. 16 Oct. 1905, kk. 2 specimens. Amirante Isles, Surface. 18 Oct. 1905, oo. 1 specimen.

I have decided to place the "Sealark" specimens under the name of *Solmundella mediterranea* as the best and largest specimen comes nearest to it. The umbrella is highly arched, about 3 mm. in diameter, with isolated nematocysts scattered over the ex-umbrella. The gonads are confined to the pouches and show ripe ova. The tentacles are 13 mm. in length. There are nine sense organs, with otoliths, and four interradial marginal bulbs. The other specimens are of little value for specific determination, being either early stages or damaged. One specimen has *Cunina*-buds inside the stomach.

41. CUNINA sp. ?

Localities. North of Chagos. Chagos Archipelago. Farquhar Alphonse Is. Amirante Is.

The collection contains about 50 specimens taken at nine different stations.

Nearly all the specimens of *Cunina* belonged to early stages, about 3 mm. in diameter. Most of them have 8 tentacles, and a few have 7, 9 or 10 tentacles. They are in rather bad condition and probably represent more than one species.

At a station, North of Chagos, a series larger in size was taken, and had the

specimens been in better condition I might have succeeded in determining the species. In general appearance they resemble Gegenbaur's figure of *Cunina lativentris* (Gegenbaur, 1856, Taf. 10, fig. 2). The largest specimen measures 8 mm. in diameter, and its umbrella is moderately thick. It has twelve tentacles, about 3 mm. long, tapering to a fine point; at their base is a semicircular band of nematocysts. The gastric pouches are about as broad as long, with gonads in the course of development, and in shape somewhat similar to Gegenbaur's figure. The otoporpæ take the form of short narrow lines, situated on ridges, four to five on each lappet.

SCYPHOMEDUSÆ.

CHARYBDÆIDÆ

42. CHARYBDEA sp. ?

Locality. Farquhar Group, Surface. 2 Oct. 1905, x. 1 specimen.

This single specimen is immature, and at a stage which makes identification so very uncertain that it is perhaps best not to give it a specific name.

The umbrella is 15 mm. wide and 23 mm. high, and tapers very slightly towards the summit, which is slightly rounded. The ex-umbrella is free from warts and clusters of nematocysts. The stomach is very short and rather flat; the mouth has four lips. The phacellæ or gastric filaments are neither arranged in groups nor branched, but each interradial set is composed of simple filaments. The velarium has six unbranched canals in each quadrant. There are four tentacles, with pedalia about 7 mm. in length, and having a flat spatula-like expansion on the inner side. The gonads are immature, about 11 mm. in length, and do not extend so far down as the plane of the sense organs. The four perradial sense organs are situated about 4 mm. above the margin of the umbrella, and the sensory clubs are suspended by a stalk in a deep pit, which projects out on the wall of the sub-umbrella. The sensory clubs have two ocelli, one of which is very large and nearly terminal, the other is above it, close to the stalk, and is very much smaller. These are the median ocelli, but no lateral ocelli could be detected.

CORONATÆ.

43. NAUSITHÖE PUNCTATA, Kolliker, 1853.

Nausithöe punctata, Bigelow, 1909, p. 35, pl. 12, fig. 5.

Nausithöe punctata, Mayer, 1910, p. 554, pl. 60, figs. 4—5.

Nausithöe punctata, Bigelow, 1913, p. 85.

Localities. North of Chagos. Chagos Archipelago. Amirante Isles.

The collection contains 16 specimens taken at eight different stations.

The specimens are rather small, not exceeding 5 mm. in diameter. Nearly all the specimens have globular gonads, about equidistant apart. Two specimens, however, have oval gonads, about twice as long as broad.

This medusa inhabits the tropical and warm regions of all the oceans, and belongs to the surface fauna.

Genus ATOLLA, Haeckel, 1880.

After reading the work of Bigelow (1909 and 1913), Mayer (1910) and Broch (1913) on *Atolla*, it seems to me that the genus has only two species, namely, *Atolla wyvillei* and *Atolla chuni*. The latter is easily distinguished by the presence of warts on the marginal lappets. All the other species which have been described by various authors apparently fall under the oldest name of *Atolla wyvillei*. The presence and shape, or the absence, of radial furrows on the central disc, formerly relied upon for distinguishing species, are apparently worthless as specific characters.

Broch, after examining over 200 specimens of *Atolla* collected by the "Michael Sars" in the North Atlantic, was able to separate the material into three groups.

"First, those furnished with distinct radial furrows all over the central disc; second, those with incomplete radial furrows, in many cases visible only at the margin of the central disc; and third, those with a perfectly smooth central disc, showing no trace whatever of radial furrows."... "The intermediate group contains every transition stage from *Atolla bairdii* (with a smooth central disc) to *Atolla verrillii* (with narrow radial furrows on the central disc), and we are therefore compelled to consider *Atolla verrillii* as a synonym of *Atolla bairdii*."

Out of this large number of *Atolla* Broch was able to isolate a single specimen, which he has placed under the name of *Atolla wyvillei*. "The broad and conspicuous radial furrows of the central disc and the strongly-marked longitudinal furrows of the pedalion distinguish this species from the other Atlantic species." Broch apparently found no connecting link between *Atolla wyvillei* and *Atolla verrillii*.

Bigelow, according to his reports on collections from the Eastern and North-Western Pacific regions, has experienced the difficulty of separating *Atolla wyvillei* (with broad radial furrows) from *Atolla verrillii* (with narrow radial furrows). He says: "In the Eastern Pacific specimens there was considerable variation in the breadth of the furrows, which were usually broad in large, narrow in small specimens." In the North-Western Pacific specimens "the furrows vary so much that no sharp line can be drawn between specimens in which they are broad and those in which they are narrow."

Bigelow records no specimens in these collections with a perfectly smooth disc (*Atolla bairdii*). It is clear from Broch's researches that the absence of or presence of radial furrows are not good characters for the determination of species, and from Bigelow's researches that the width of the radial furrows is also useless.

Broch also gives tables which show that there is no good evidence for assuming that the smooth-disc form of *Atolla* and the furrow-disc form are separate geographical races, or that they live at different depths, or that differences are due to growth. The two kinds are found together at the same stations, depth, and of the same size.

44. ATOLLA WYVILLEI, Haeckel, 1880.

Localities. N.E. of Chagos, Lat. 4° 30' S., Long. 71° 15' E. (Depth about 2000 fms.) 2 specimens caught in Fowler's self-closing net. 1000—500 fms. 18 May, 1905, J. Between Providence and Alphonse, Lat. 8° 16' S., Long. 51° 26' E. 1 specimen caught in a large square net. 900—0 fms. 6 Oct. 1905, aa.

The specimens are in bad condition. The smallest measured 7 mm. across the circular muscle band, and it is an early stage, with 20 tentacles. The largest is 30 mm. in diameter, across the circular muscle band and has 24 tentacles. The radial grooves on the margin of the central disc are well marked and belong rather to the type associated with *Atolla verrillii* than to *Atolla wyvillei*.

SEMÆOSTOMEÆ.

Genus PELAGIA, Péron et Lesueur, 1809.

Pelagia is one of the genera which has its species in a state of confusion. There has been a general reduction in the number of species, and some of those which have been left are still uncertain. The characters selected for the determination of the species have not produced satisfactory results.

The classification based upon the warts on the ex-umbrella failed owing to their being treated too minutely, but I believe that they will yet prove useful for distinguishing races, if not species. Warts vary considerably in shape and size in each individual, but there is a predominating type which becomes characteristic of the race or species, and belongs to that particular race only. The predominance of high conical warts is characteristic of *Pelagia flaveola*. This type of wart does not occur in *Pelagia panopyra*, which has low oval-shaped warts; but minute roundish warts are common to both.

The marginal lappets in all the specimens which I have seen are too much alike in shape and size to be of any definite use for distinguishing species. The position and density of the warts on the lappets may be useful for distinguishing races.

Attempts have been made to distinguish species by the length and size of the manubrium and oral arms, but one never knows when examining preserved specimens how much the oral arms have contracted.

In the "Sealark" collection there are three distinct kinds of *Pelagia*. *Pelagia flaveola* I am in favour of recognising as a distinct species on account of its peculiar warts.

45. PELAGIA PANOPYRA (Péron et Lesueur) 1807.

Pelagia panopyra, Bigelow, 1909, p. 43.

Pelagia panopyra, Mayer, 1910, p. 575.

Pelagia panopyra, Kishinouye, 1910, p. 9.

Pelagia panopyra, Bigelow, 1913, p. 88.

Locality. South West of Chagos, Surface. 31 July, 1905. 5 specimens.

The specimens from this station have warts on the ex-umbrella marked by ridges and furrows. The warts form low mounds varying in shape from round to oval. The oval-shaped warts predominate and are characteristic. The ridges and furrows are formed in the jelly, and are clearly revealed where the ectodermal covering has been rubbed off. An oval-shaped wart has a longitudinal ridge with lateral ridges and furrows running

down at right-angles to the main central ridge. A roundish wart has ridges and furrows radiating out from the centre.

The specimens are from 20 to 25 mm. in diameter; the largest measured 25 mm. in width and 15 mm. in height. The umbrella is hemispherical in shape with a slightly flattened top, and moderately thick.

The marginal lappets are about as long as broad, with rounded corners. They are thin and partly covered with small roundish or oval patches of nematocysts. The oral arms are rather contracted, and have a firm solid appearance, about 15 mm. in length. The manubrium, oral arms, and frills, are covered with warts, usually oval in shape, but more variable in shape and size on the frills. On the margin of the umbrella, opposite every sense organ, there is a small shallow conical pit. The largest specimen has ova in the genital sacs.

46. PELAGIA sp. ? A.

Locality. South of Saya de Malha, Surface. 4 Sept. 1905, m. 1 specimen.

One specimen found amongst those of *Pelagia flaveola* by the shape of its warts clearly belongs to another species. It has a number of long and oval-shaped warts upon the ex-umbrella, which is in an excellent state of preservation and completely covered with ectoderm. The warts are very variable in shape and size, some are roundish. On the top of the warts there is a patch of nematocysts corresponding to the general shape of the raised warts. There are no clear indications of ridges and furrows in these warts. I am rather inclined to think that the appearance of ridges and furrows on the surface of the warts, which have been denuded of ectoderm, has some connection with a shrinkage of the jelly, and that they probably would not be noticed if the warts were completely covered with ectoderm.

The specimen measures about 12 mm. in diameter. The marginal lappets are loosely covered with small roundish or oval warts, which are confined to the areas occupied by the canals on the lappets. A shallow, roundish pit exists on the margin of the ex-umbrella, opposite each sense organ. This single specimen comes nearest to *Pelagia panopyra* on account of the presence of the oval-shaped warts.

47. PELAGIA FLAVEOLA, Eschscholtz, 1829.

Pelagia flaveola, Eschscholtz, 1829, p. 76, Taf. 6, fig. 3.

Pelagia papillata, Haeckel, 1880, p. 509.

Pelagia tahitiana, Agassiz and Mayer, 1902, p. 158, pl. 8, figs. 34—35.

Pelagia flaveola, Mayer, 1910, p. 575, text-fig. 364.

Locality. South of Saya de Malha, Surface. 4 Sept. 1905, m. 24 specimens.

The specimens of *Pelagia* taken at this station can easily be distinguished from those taken at the other stations by the shape of the warts upon the ex-umbrella. The warts are formed of conical lumps of jelly capped with a small cluster of nematocysts, and they stand up conspicuously as figured by Agassiz and Mayer (1902, Pl. 8, fig. 34) for *Pelagia tahitiana*. The largest warts are upon the upper half of the umbrella and they decrease

in size towards the margin. There is a considerable variation, both in shape and size of the warts, due either to pressure or to a shrinkage of the jelly. The latter produces strange effects, such as a wart having the appearance of being surmounted by a small capitate tentacle, or the ex-umbrella being covered with tentacular-like papillæ clearly visible to the naked eye. It is quite easy to distinguish this species by the shape of the warts provided that the specimens are in good condition, but there is a good chance of a failure if the warts are squeezed out of shape by pressure.

The description of *Pelagia tahitiana* by Agassiz and Mayer agrees so well with my specimens that I cannot find anything of importance to add to it, and as Mayer considers that *Pelagia tahitiana* is identical with *Pelagia flaveola* of Eschscholtz I have followed his synonymy.

The size of the specimens in the "Sealark" collection is from 10 to 25 mm. in diameter with the umbrella flattened out. A few large specimens have immature gonads hanging down from the sub-umbrella. All the specimens are colourless in formaline, but they should have been yellowish when alive. The oral arms of all the specimens are in bad condition. They are apparently only very thinly covered with small patches of nematocysts upon slight elevations of jelly. There is a small pit on the margin of the umbrella opposite each sense organ.

Some of the specimens have small barnacles attached to the ex-umbrella.

Distribution. Tropical Pacific and Indian Oceans.

48. PELAGIA sp. ? B.

Locality. North of Chagos, Lat. $4^{\circ} 16' S.$, Long. $71^{\circ} 53' E.$ 75—0 fms. 17 May, 1905, B. 1 specimen. Surface. 18 May, 1905, B. 6 specimens. 75—0 fms. 18 May, 1905, B. 2 specimens.

The warts on the ex-umbrella of these specimens are low and roundish, with a broad patch of nematocysts in the centre. These warts show no traces of ridges and furrows, and none are oval-shaped as seen in *Pelagia panopyra*. In one specimen in a depression at the top of the umbrella some of the warts are rather taller than the others, suggesting a resemblance to the warts of *Pelagia flaveola*.

The specimens measured from 7 to 13 mm. in diameter. The umbrella has a flattish top, nearly twice as broad as high and moderately thick. The marginal lappets are about as long as broad, with rounded corners, and well covered with rounded patches of nematocysts. The manubrium and oral arms are rather longer than in *Pelagia panopyra* and thickly covered with roundish patches of warts. There is a shallow pit on the ex-umbrella, opposite every sense organ. The gonads are only just beginning to develop in the larger specimens.

RHIZOSTOMÆ.

49. CASSIOPEA ANDROMEDA var. MALDIVENSIS, Browne, 1905.

Cassiopea andromeda var. *maldivensis*, Browne, 1905, p. 962.

Cassiopea andromeda var. *maldivensis*, Mayer, 1910, p. 963.

Locality. Seychelles Group. Praslin Reef. 2 specimens.

These specimens agree fairly well with the description of the variety which I described from the Maldives.

The umbrella of the largest specimen measured 110 mm. when flattened out, and the smaller one measured 80 mm. in diameter. The ex-umbrella is quite smooth, without any trace of a circular band, and without any colouration markings. The margin of the umbrella is too imperfect for counting the number of lobes. The largest specimen has at least 18 sense organs, which are very irregular in position. The oral arms are provided with appendages very similar to those described in Maldivian specimens. The small appendages adjacent to the oscula are either leaf-shaped or cylindrical. In addition to these appendages there are a few others very much larger. One in the very centre of the oral disc measured 22 mm. in length and 7 mm. in width; others near it are shorter and more cylindrical. Both specimens are thickly covered with Green Cells or Zooxanthellæ.

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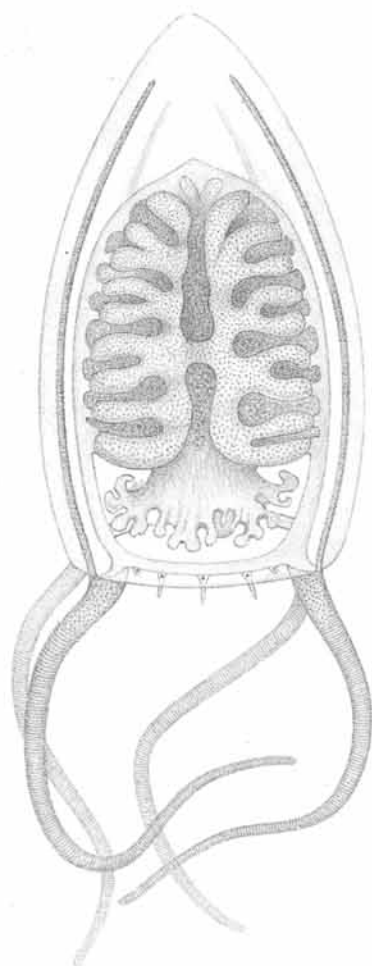
DESCRIPTION OF PLATE 39.

Fig. 1. *Steenstrupia normani*, n. sp. $\times 25$.

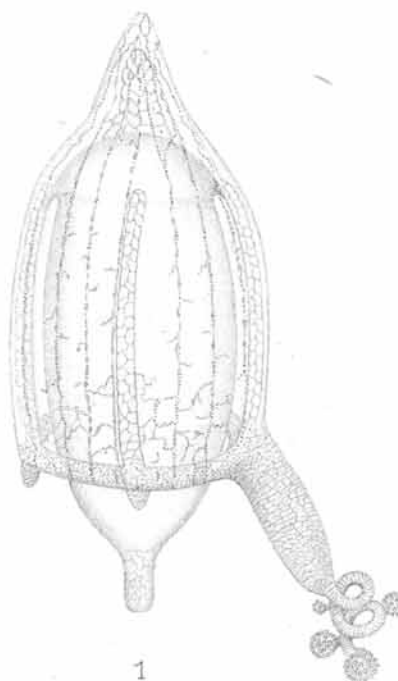
Fig. 2. *Zanclea orientalis*, n. sp. $\times 25$.

Fig. 3. *Zanclea orientalis*. A perradial rudimentary bulb (B) with a patch of nematocysts (N) on the margin of the ex-umbrella (Ex.). Circular Canal (CC). Velum (V).

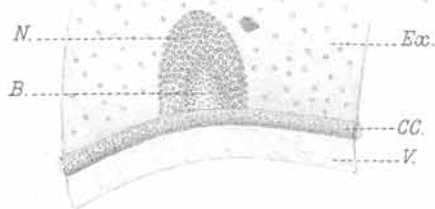
Fig. 4. *Leuckartiara gardineri*, n. sp. $\times 12$.



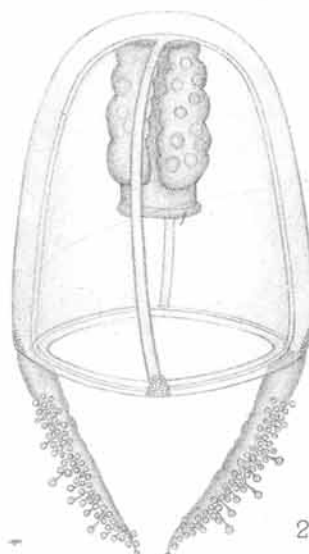
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