No. 1. — *Descriptions of New and Little-known Medusæ from the Western Atlantic.* By Alfred Goldsborough Mayer.

LIST OF SPECIES.

SCYPHOMEDUSÆ.

Bathyluca solaris, nov. gen. et sp.

HYDROMEDUSÆ.

Bougainvillia Gibbsi, nov. sp.
Lymnorea borealis, nov. sp.
Oceania carolinæ, nov. sp.
Oceania singularis, nov. sp.
Octonema gelatinosa, nov. sp.
Orchistoma tentaculata, nov. sp.
Stomotoca apicata, L. Agassiz.
Stomotoca rugosa, nov. sp. = **Stomotoca apicata**, Fewkes.
Syndictyon angulatum, nov. sp.

CTENOPHORÆ.

Mnemiopsis McCradyi, nov. sp.

The Medusæ described in the following paper were obtained by the author as assistant to Mr. Alexander Agassiz in collecting new material for a work upon the Medusa-fauna of the Atlantic Coast of North America. The descriptions of Western-Atlantic Medusæ herein given will eventually be published also in the new edition of The North American Acalephæ now in preparation by A. Agassiz and A. G. Mayer.

Eight species are new; of these one is a Scyphomedusa, one a Ctenophore, and six are Hydromedusæ. In addition to these there is one Hydromedusa (Stomotoca rugosa) that we have redescribed under a new name.

The Scyphomedusa (Bathyluca solaris) is, judging from its structural affinities, a deep-sea type, although the single specimen from which our figures were obtained was found upon the surface of Narragansett Bay, Rhode Island.

The Medusæ described in this paper were collected at different times at Eastport, Maine; Newport, Rhode Island; Charleston, South Carolina; and in the Bahama Islands during visits made to the above localities at the suggestion of Mr. Agassiz.

SCYPHOMEDUSÆ.

BATHYLUCA, nov. gen.

Bathyluca solaris, nov. gen. et sp.

Figs. 1, 2, Plate 1.

A single specimen of a new genus of Discomedusa belonging to the family Ephyridæ was found in Narragansett Bay, Rhode Island, on July 27, 1896, by R. W. Hall, Esq. The medusa was found floating upon the surface, but as it was very much torn and battered, and as it differs widely from any of the hitherto known pelagic medusæ of our coasts, we are inclined to suspect that it may prove to be a deep-sea form, a specimen of which has wandered to the surface.

Generic Characters. — Bathyluca, nov. gen. Discomedusæ with a simple cruciform, central mouth opening, without mouth-arms or palps. There are 16 wide, radial, gastro-vascular pouches (8 ocular and 8 tentacular). There is no ring canal. There are 8 marginal sense-organs and 16 marginal tentacles. There are 4 gonads in the oral floor of the disk, and there are 4 sub-genital pits.

Specific Characters. — The umbrella is flat, and the gelatinous substance is quite thick. It is 45 mm. in diameter, and about 10 mm. in height. The aboral surface of the umbrella is sprinkled over with small clusters of nematocysts. There are 8 marginal sense-organs that are deeply sunken within small niches between the lappets. The entoderm of these sense-organs contains no pigment, but instead there are small white granules (Figure 2). There are 24 marginal lappets and 16 long hollow tentacles. The mouth opening is cruciform in shape, and there appear to be no mouth-arms or palps. We may, however, be mistaken in regard to this, for our specimen was much torn and battered, and it is possible that the palps may have disappeared. There are 4 wide sub-genital pits. The gonads are found in the entoderm of the lower floor of the gastro-vascular cavity, and their position is marked by 4 horseshoe-shaped ridges upon the lower floor of the sub-umbrella. There are a number of long gastric cirri that arise from the regions of the gonads

and project slightly beyond the mouth opening. The stomach is large, its diameter being about ½ that of the umbrella itself. Sixteen wide, simple radial pouches extend outward from the stomach cavity into the peripheral regions of the umbrella. Eight of these pouches go to the marginal sense-organs, and 8 to the tentacles which are hollow throughout almost their entire length. There are 8 radial bands of muscle fibres in the ex-umbrella. These go to the marginal sense-organs. The gelatinous substance of the disk is translucent but slightly bluish in color. The clusters of nematocysts over the aboral surface are dull yellowish brown, and the tentacles are slightly green in color.

Single specimen, Narragansett Bay, Rhode Island.

HYDROMEDUSÆ.

STOMOTOCA, L. Agassiz, 1862.

Stomotoca apicata, L. Agassiz.

Fig. 3 ♂, Fig. 4 ♀, Plate 2.

Male
- Saphenia apicata, McCrady, J., 1857, Gymn. Charleston Harbor, p. 27, Pl. VIII. Figs. 2, 3.
- Stomotoca apicata, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. p. 347.
- Stomotoca apicata, Agassiz, A., 1865, North Amer. Acal., p. 168.

Female
- Dinematella cavosa, Fewkes, J. W., 1881, Bull. Mus. Comp. Zoöl. Harvard Coll., Vol. VIII. p. 151, Pl. II. Figs. 2, 3; Pl. IV. Fig. 3.
- Dinematella cavosa, Fewkes, J. W., 1884, Amer. Nat., Vol. XIX. p. 195, Fig.

Stomotoca apicata, L. Agassiz, is distinguished by the fact that the entoderm of the proboscis in the male is emerald green, or straw-colored; and in the female dull ochre. Also the tentacle bulbs in the male are purple, and in the female dull ochre. This species has been confounded by Brooks, 1883, and Fewkes, 1881, with another form in which the entoderm of the proboscis and tentacle bulbs is brick-red in both sexes. For this brick-red form we propose the name Stomotoca rugosa.

Specific Characters. — Stomotoca apicata. In the adult medusa the bell is about 4 mm. high and 2 mm. broad. It is provided with a prominent apical projection that is solid in the males, but usually hollow in the females, the gastro-vascular space leading upward into it. There are two long tentacles with large, hollow basal bulbs. In addition to the two long tentacles there are usually 6 small rudimentary tentacle bulbs upon the bell margin. The proboscis is flask-shaped, there is no peduncle, and the 4 lips are curved slightly upward. The ectoderm of the upper portion of the proboscis, under the 4 radial tubes, is thrown into folds or convolutions, and it is in this region that

one finds the gonads. There are 4 broad radial tubes and a broad circular vessel with somewhat jagged outlines. The velum is well developed. The color of the proboscis in the male varies from intense green to dull ochre-yellow, or cream-color; and the basal bulbs of the tentacles vary from faint to deep purple. In the females, the proboscis and tentacle bulbs are usually dull ochre-yellow, or cream-color, but in some few individuals the proboscis is faintly straw-colored, and the tentacle bulbs faint purple. In the female the apical projection of the bell is hollow, while in the male it is usually solid.

Common at Newport, Rhode Island, from July 15–September. Rare at Charleston, South Carolina.

The young medusa resembles the adult excepting that the apical projection to the bell is wanting, or is but little developed. There are 2 tentacles and 2 rudimentary tentacle bulbs. The sexual color difference is seen in the youngest medusæ we have observed. The hydroid stock is unknown.

Stomotoca rugosa, nov. sp.

Fig. 5, Plate 2.

Stomotoca apicata, Fewkes, J. W., 1881, Bull. Mus. Comp. Zoöl., Vol. VIII. p. 152, Pl. II. Figs. 1, 4, 9.

Amphinema apicatum, Brooks, W. K., 1883, Studies Biol. Lab. Johns Hopkins Univ., Vol. II. p. 473.

The bell is 5 mm. high and 3 mm. broad; it bears an apical projection which in some specimens is long and slender, and in others is short and blunt. The substance of this projection is solid throughout. There are 2 long, well-developed tentacles and 14 small rudimentary ones. The basal bulbs of the long tentacles are large and hollow. When fully stretched, the long tentacles attain a length of 4–6 times the bell height. The velum is well developed. There are four broad radial tubes, and a broad circular vessel with jagged outlines. The proboscis is flask-shaped, the lips being flanged and quite prominent. The sexual products are found in the ectoderm of the upper portion of the proboscis where the outer surface is folded into a complex series of ridges. The bell is transparent, and the entoderm of the tentacle bulbs and of the proboscis is brick-red. In some individuals the 4 radial tubes and the circular vessel are faint red.

There is a well-marked southern variety of this species, found at the Tortugas, Florida, in which the proboscis and the tentacle bulbs are brick-red streaked with black. In some individuals, indeed, the proboscis and tentacle bulbs are coal-black.

Brooks, 1883, has described the hydroid and young medusa of this species from Beaufort, North Carolina. According to him, the hydroid stock is a Perigonimus very much like P. minutus, Allman, 1871, p. 324, Plate XI. Figures 4–6.

This medusa is common at Newport, Rhode Island, and is also found at Charleston, South Carolina. It is rare at the Tortugas, Florida.

SYNDICTYON, A. Agassiz, 1862.

Syndictyon angulatum, nov. sp.

Figs. 6-8, Plate 3.

Specific Characters. — The bell is almost square in cross-section and is not quite as broad as it is high. The bell height in the specimens found by us was about 2.5 mm. There are 4 stiff tentacles that are about three-fourths as long as the bell height. The distal halves of these tentacles are conical in shape, and are covered thickly with clusters of nettle cells. The basal bulbs of the tentacles are large and swollen, and contain each a single well-developed ectodermal ocellus. This ocellus is formed by a cup-shaped invagination of ectodermal cells that are deeply stained with dark-brown pigment granules. It is probable that this structure constitutes a very primitive udoscopic eye. The velum is small. There are 4 narrow, straight, radial tubes and a slender circular vessel. The proboscis is spindle-shaped, and the mouth is a simple circular orifice. The gonads are situated within the ectoderm of the proboscis. The entoderm of the proboscis and of the tentacle bulbs varies from turquoise to blue-green in different specimens.

Several specimens of this medusa were found off Turks Islands, Bahamas, January 20, 1893.

BOUGAINVILLIA, Lesson, 1836.

Bougainvillia Gibbsi,[1] nov. sp.

Figs. 14, 15, Plate 4.

Specific Characters. — Adult medusa ; Figure 14. The bell is about 4 mm. in height and 3.8 mm. in diameter. The gelatinous substance is very thick, so that the bell cavity is only about one half as deep as the height of the animal. There are 4 clusters of marginal tentacles which arise from 4 large bulbous swellings, situated at the bases of the 4 radial canals. Each bulbous swelling gives rise to 4 or 5 long slender tentacles. There is a single dark-brown ocellus at the base of each tentacle upon the centripetal (lower) side. The velum is small. There are 4 straight, narrow, radial canals. The proboscis is wide and cruciform in cross-section, and the radial canals arise from the 4 corners of the cross. The proboscis is short and does not extend quite one half the distance from the inner apex of the bell cavity to the velar opening. The mouth is situated at the extremity of a short tubular neck, and there are no prominent lips. Four radially situated oral tentacles arise from the sides of the neck of the proboscis. Each one of these branches dichotomously about twice. The gonads are developed upon the sides of the stomach, and

[1] Named for Mrs. Theodore K. Gibbs.

in the female the ova are large and prominent. The proboscis is pearl-colored, or of a delicate green. The entodermal cores of the tentacle bulbs are red surrounded by a delicate yellow-green. The supporting lamella of the bell often displays a faint greenish tinge.

Young Medusa. — In the young medusa there are but 8 tentacles, 2 from each tentacle bulb. The bell is a little higher than a hemisphere and the gelatinous substance is not very thick, being of about uniform thickness everywhere instead of being very thick at the aboral pole, as in the adult. The proboscis is short and quadratic, and there are 4 short, unbranched, knob-shaped oral tentacles. When the medusa is about 3 mm. in height, the bell is still hemispherical. The proboscis is wide, shallow, and quadratic, and the oral tentacles branch once dichotomously. About 4–5 marginal tentacles arise from each tentacle bulb.

This medusa is found in Newport Harbor, Rhode Island, from July until October.

This species is distinguished from Margelic carolinensis, L. Agassiz, by the greater height and less width of its bell. Also in M. carolinensis the proboscis is long and slender, while in B. Gibbsi it is short, wide, and cruciform in cross-section. The proboscis of M. carolinensis is widest at about the middle point of its length, while that of B. Gibbsi is widest at its proximal base.

LYMNOREA, Péron and Lesueur, 1809.

Lymnorea borealis, nov. sp.

Figs. 16–18, Plate 5.

Specific characters. — The bell is 3 mm. in height. The bell walls are thin, and there is a slight apical projection. There are 32 well-developed marginal tentacles with large basal bulbs. These tentacles are about $\frac{1}{2}$ as long as the bell height, and are curled slightly upward. They are not very flexible. The velum is well developed. There are 4 straight, narrow radial tubes. The proboscis is pyriform and the mouth is surrounded by 4 short, dichotomously branching, oral tentacles. Each of these oral tentacles branches 2 times, thus giving rise to 4 tentacle tips (see Figure 18). These tips are short and knob-like and are covered with long slender nematocyst capsules borne upon thread-like filaments (see Figure 17). The gonads occupy 4 radially situated, longitudinal swellings upon the proboscis. The entoderm of the proboscis, and of the bulbs of the marginal tentacles, is red.

Three specimens, all of them being males, were found in Eastport Harbor, Maine, on September 19, 1898.

OCEANIA, Péron and Lesueur, 1809.

Oceania carolinæ, nov. sp.

Figs. 9-11, Plates 3, 4.

Specific Characters. — The bell is not quite a hemisphere, and is 14 mm. in diameter. The cavity of the bell is shallow, so that the gelatinous substance is quite thick. There are 16 well-developed marginal tentacles with large, hollow basal bulbs. These are only about half as long as the bell diameter, but as they are usually carried coiled in a close helix they appear much shorter. In addition to these well-developed tentacles there are 48 small rudimentary tentacle bulbs that probably never develop into tentacles. There are 64 otocysts, 4 between each adjacent pair of large tentacles (see Figure 11). Each otocyst contains 2 spherical otoliths. The velum is well developed. There are 4 narrow, straight, radial canals. The mature proboscis (Figure 10) is flask-shaped, and there are 4 simple curved lips. The gonads are developed upon the radial tubes at about one quarter the distance from the circular vessel to the proboscis. In the female the ova are very conspicuous. The entoderm of the tentacle bulbs and proboscis and of the radial tubes in the region of the gonads is bright yellow-green.

This species was extremely abundant in Charleston Harbor in the early part of September, 1897, and in June, 1898.

Oceania singularis, nov. sp.

Figs. 12, 13, Plate 4.

Specific Characters. — The bell is 2 mm. in diameter and the sides are quite straight and sloping. Near the apex of the bell there is a sharp constriction, above which there is a lens-shaped apical projection. There are 16 well-developed marginal tentacles with large, hollow, conical-shaped basal bulbs. The lashes of the tentacles are short and are covered with nematocystic cells. In addition to the 16 functional tentacles there are 16 intermediate rudimentary ones. There are 32 otocysts, each containing a single highly refractive spherical otolith. There are 4 straight radial tubes. The proboscis is quadrangular in cross-section, and there are 4 simple lips. The 4 gonads are developed upon the 4 radial canals near the base of the proboscis. The entoderm of the proximal part of each tentacle bulb is turquoise-green, and the distal part is brownish-red. The entoderm of the proboscis and of the radial tubes in the neighborhood of the gonads is of a delicate turquoise tinge.

A single specimen of this medusa was found in Newport Harbor, Rhode Island, on August 22, 1896.

OCTONEMA, Haeckel, 1879.

Octonema gelatinosa, nov. sp.

Figs. 20, 21, Plate 6.

Specific Characters. — Young medusa? The bell is 3.5 mm. in diameter and somewhat flatter than a hemisphere. The gelatinous substance is quite thick. In the single specimen examined there were 4 tentacles with long hollow basal bulbs. These tentacles were about 2 times as long as the bell diameter. Within the entoderm of the inner side of each tentacle bulb there was a single dark-colored pigment spot. In addition to these long tentacles there were 12 rudimentary tentacle bulbs upon the bell margin. It is possible that these might have in time developed tentacles; in the specimen observed by us, however, they were very small and apparently rudimentary. A dark-colored pigment spot was found in the entoderm of each of these tentacle bulbs. There were 8 marginal clubs, 2 in each quadrant. A dark-brown entodermal pigment spot was situated at the base of each (see Figure 21). The velum was well developed. There were 4 straight radial canals upon the upper regions of which the gonads were situated. The proboscis was a simple tube with 4 simple lips. The color of the entoderm of the 4 large tentacle bulbs, and of the radial tubes in the region of the gonads was green.

A single specimen was found in Charleston Harbor, South Carolina, September 14, 1897.

ORCHISTOMA, Haeckel, 1879.

Orchistoma tentaculata, nov. sp.

Fig. 19, Plate 5.

Specific Characters. — Young medusa: The bell was 6 mm. in height. The sides near the margin were slightly flanged outward. The gelatinous substance of the upper portion of the bell was very thick, so that the concavity was shallow. There were thirty-two marginal tentacles in various stages of development, the longest being about 1.5 times as long as the bell height. The tentacles possessed long, hollow basal bulbs. There were no marginal sense-organs. There were sixteen functional radial tubes, and sixteen others in process of development. The radial tubes were straight, and there were no traces of gonads upon them. The velum was well developed. The proboscis was flat and shallow, and there were 8 lips. The entoderm of the basal bulbs of the tentacles was of a delicate green. Only one immature specimen of this medusa has ever been seen; it was found at Newport, Rhode Island, August 18, 1896. The genus is closely related to Melicertum.

CTENOPHORÆ.

MNEMIOPSIS, L. Agassiz, 1860.

Mnemiopsis McCradyi,[1] nov. sp.

Figs. 22, 23, Plate 6.

Specific Characters. — Mnemiopsis McCradyi: This species is closely allied to Mnemiopsis Leidyi, A. Agassiz, but differs from it chiefly in the much greater complexity of the ramifications of the chymiferous tubes within the lappets; and also in the very decided amber color of the gelatinous substance of the animal. It is also remarkable that in this species the gelatinous substance of the body is of so tough a nature that the creature may be removed from the water by hand without suffering injury. Indeed, we know of no Ctenophore that is as resistant as this species. The animal is 100 mm. in length, our figures being natural size. There are eight longitudinal rows of ciliated plates. Four of these rows, that extend down the lateral lappets, are about twice as long as are the four others that lead from the apex to the auricles. The body is markedly compressed, the broad lateral axis, extending through the lappets, being about twice as great as the auricular axis. (Compare Figures 22 and 23.) The lateral lappets are about as long as the remaining portion of the body, and are similar in shape and size to those of M. Leidyi, and much longer than in M. Gardeni. (See A. Agassiz, 1865; North American Acalephæ, Figures 20, 21 and 22, 23.) The apical sense-organ is found at the bottom of a deep cleft at the aboral pole of the body, and is similar in structure to that of M. Leidyi. The chymiferous tubes that wind through the lateral lappets are of a decided purple color and their ramifications are very complex. The mature ova are similar in appearance to those of M. Leidyi.

A single perfect specimen of this species was found in Charleston Harbor, South Carolina, September 15, 1897.

[1] This species is named in honor of Professor John McCrady in recognition of his important researches upon the medusæ of Charleston Harbor.

PLATE 1.

Fig. 1. Bathyluca solaris, nov. gen. et sp. Oral view of the medusa.
Fig. 2. Bathyluca solaris. Oral view of one of the marginal sense-organs.

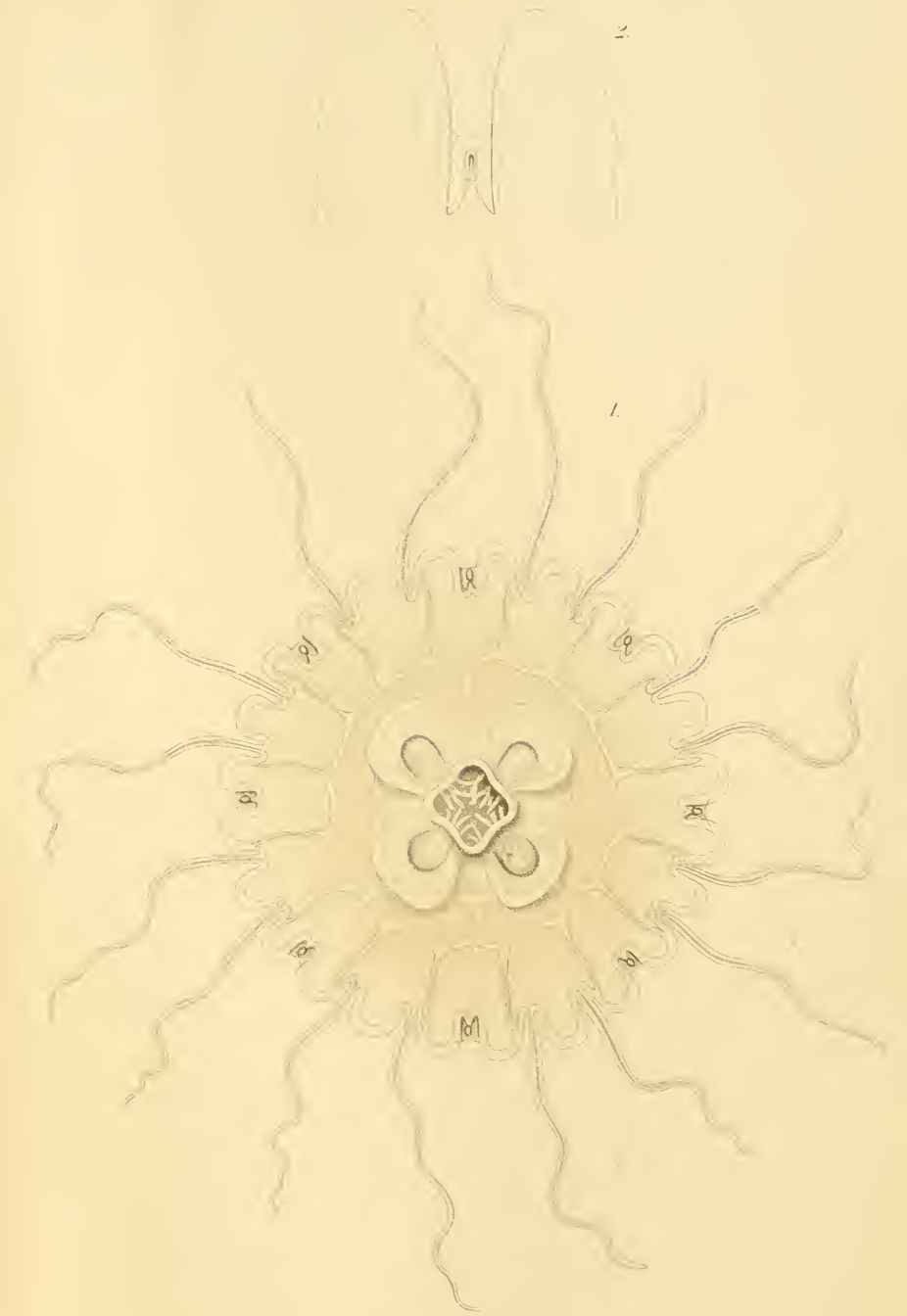

PLATE 2.

Fig. 3. Stomotoca apicata, L. Agassiz. Male medusa.
Fig. 4. Stomotoca apicata. Female medusa.
Fig. 5. Stomotoca rugosa, Mayer = Stomotoca apicata, Fewkes, 1881.

A.G.M. del. B. Meisel lith. Boston

PLATE 3.

Fig. 6. Syndictyon angulatum, nov. sp. Side view of medusa.
Fig. 7. Syndictyon angulatum. Side view of one of the tentacle bulbs, showing the ocellus.
Fig. 8. Syndictyon angulatum. Surface view of tentacle bulb.
Fig. 9. Oceania carolinæ, nov. sp.


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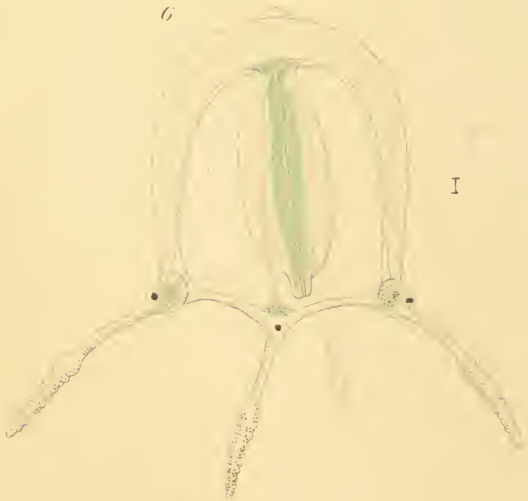
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PLATE 4.

Fig. 10. Oceania carolinæ, nov. sp. Side view of proboscis and radial canal.
Fig. 11. Oceania carolinæ, nov. sp. View of bell margin.
Fig. 12. Oceania singularis, nov. sp.
Fig. 13. Oceania singularis. View of bell margin.
Fig. 14. Bougainvillia Gibbsi, nov. sp. Mature medusa.
Fig. 15. Bougainvillia Gibbsi, nov. sp. Young medusa.


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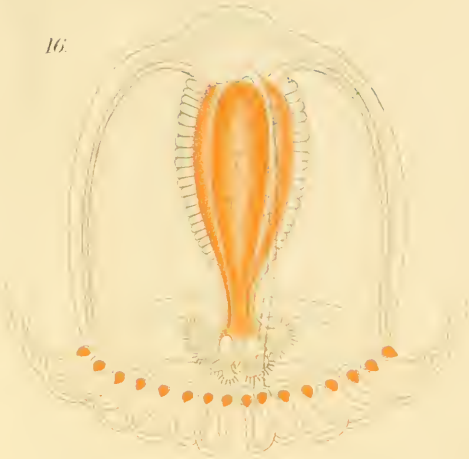
14.
15.

PLATE 5.

Fig. 16. Lymnorea borealis, nov. sp.
Fig. 17. Lymnorea borealis, nov. sp. View of nematocyst capsules upon the oral tentacles.
Fig. 18. Lymnorea borealis. Side view of proboscis, showing the oral tentacles.
Fig. 19. Orchistoma tentaculata, nov. sp.

16.



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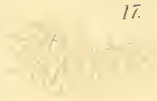

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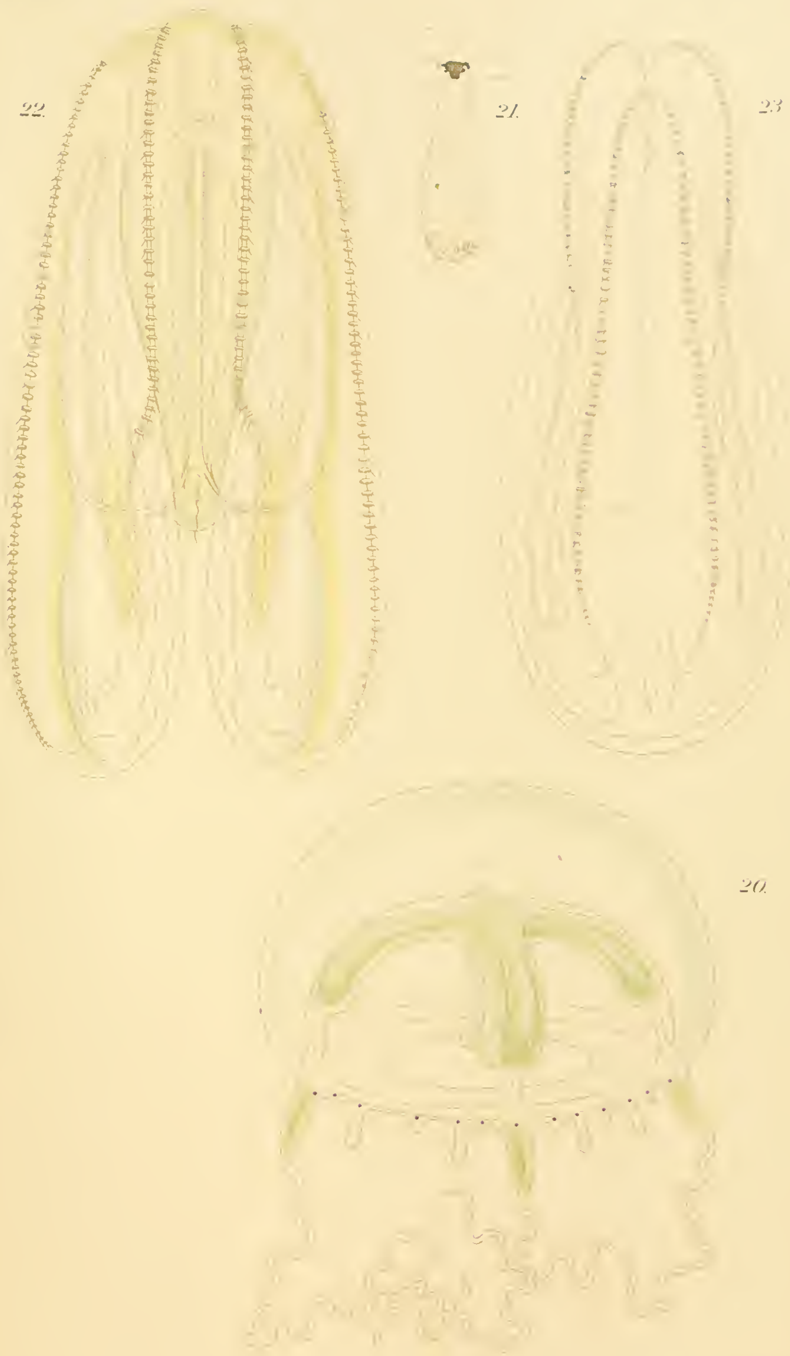
19.

PLATE 6.

Fig. 20. Octonema gelatinosa, nov. sp.
Fig. 21. Octonema gelatinosa, nov. sp. Marginal sense club.
Fig. 22. Mnemiopsis McCradyi, nov. sp. View of broad side. Natural size.
Fig. 23. Mnemiopsis McCradyi, nov. sp. View of narrow side. Uncolored figure, natural size.



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The following Publications of the Museum of Comparative Zoölogy are in preparation: —

Reports on the Results of Dredging Operations in 1877, 1878, 1879, and 1880, in charge of ALEXANDER AGASSIZ, by the U. S. Coast Survey Steamer "Blake," as follows: —

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C. HARTLAUB. The Comatulæ of the "Blake," with 15 Plates.
H. LUDWIG. The Genus Pentacrinus.
A. E. VERRILL. The Alcyonaria of the "Blake."

Illustrations of North American MARINE INVERTEBRATES, from Drawings by BURKHARDT, SONREL, and A. AGASSIZ, prepared under the direction of L. AGASSIZ.

A. AGASSIZ. The Islands and Coral Reefs of the South Seas. "Albatross" Expedition of 1899-1900.
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A. AGASSIZ and A. G. MAYER. The Acalephs of the East Coast of the United States.
A. G. MAYER. Some Acalephs from the South Pacific.
A. G. MAYER. Acalephs from the Tortugas, Florida.
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A. AGASSIZ. The Pelagic Fauna.
" The Echini.
" The Panamic Deep-Sea Fauna.
J. E. BENEDICT. The Annelids.
K. BRANDT. The Sagittæ.
" The Thalassicolæ.
C. CHUN. The Siphonophores.
" The Eyes of Deep-Sea Crustacea.
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E. P. VAN DUZEE. The Halobatidæ.
H. B. WARD. The Sipunculids.
H. V. WILSON. The Sponges.
W. McM. WOODWORTH. The Nemerteans.

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Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.
Vol. XXXVII. No. 2.

SOME MEDUSÆ FROM THE TORTUGAS, FLORIDA.

By Alfred Goldsborough Mayer.

With Forty-four Plates.

CAMBRIDGE, MASS., U.S.A.:
PRINTED FOR THE MUSEUM.
July, 1900.

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SOME MEDUSÆ FROM THE TORTUGAS, FLORIDA.

By Alfred Goldsborough Mayer.

With Forty-four Plates.

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INTRODUCTION.

The medusæ described in the following paper were obtained by the author while assistant to Mr. Alexander Agassiz in collecting for a work upon the Medusa fauna of the Atlantic Coast of North America. Three expeditions were made, for Mr. Agassiz, to the Tortugas, Florida, extending from June 10–22, 1897; June 25–August 19, 1898; and May 14–July 4, 1899. The manuscript has been submitted to him, and the descriptions herein given will ultimately be published also in the new edition of "North American Acalephæ" now in preparation by A. Agassiz and A. G. Mayer.

We wish to avail ourselves of this opportunity to express our appreciation of the cordiality and kindness of George R. Billbury, Esq., head

keeper of the lighthouse at Loggerhead Key, Tortugas, to whose intelligent and painstaking co-operation we owe much that may be of value in the following paper. We also wish to thank Major J. E. Sawyer, U. S. A., to whose permission we were indebted for the use of the government steamer, "George W. Childs," for transportation to and from between Key West and the Tortugas. We are also indebted for a like service to the officers of the Union Bridge Company in allowing the use of their steamer "Ambrosio Bolivar."

The Tortugas occupy what is probably the most favorable situation from which to study the pelagic life of the Tropical Atlantic. They lie upon the northern edge of the deep channel of the Gulf Stream as it issues from the Gulf of Mexico. Pure, deep ocean water surrounds them, and there are none of the shallow mud-flats that render the shore waters of Florida so turbulent, at times, that many of the more delicate pelagic animals are killed. As is well known, the Gulf Stream pours outward from the Gulf of Mexico through the Straits of Florida. The Gulf Stream does not occupy the whole cross-section of the strait, however, but according to the researches of Lieutenant, now Commander, J. E. Pillsbury (Report U. S. Coast and Geodetic Survey, 1885–87), it flows nearer to the Cuban coast than to the line of the Florida Keys. The northern limit of this great stream lies at least 28 miles south of Rebecca Shoal, the average edge being about 6 miles farther south, or 34 miles south of Rebecca Shoal (see U. S. Coast Survey Report, 1887, pp. 174, 175, Illustration 42).

The currents in the immediate vicinity of the Tortugas are extremely variable and are greatly under the influence of the tides and winds, while the tides themselves are small and easily influenced by extraneous circumstances. In the passage between Rebecca Shoal and the Tortugas the current sets practically north with the flood tide and south with the ebb. About five miles west of Loggerhead Key the southerly set of the ebb tide is stronger than the northerly current induced by the flood. There can be no doubt that the prevailing winds play an important part in setting up local currents in the immediate vicinity of the Tortugas. The prevailing E.–S.E. winds of the summer months cause a decided westerly surface drift, and this is evidenced by the fact that during this period sand is washed away from the eastern shore of Loggerhead Key and spread out into long cuspate forelands[1] which extend from

[1] "Cuspate foreland" is a term used by F. P. Gulliver (1896; Bull. Geol. Soc. America, Vol. VII.) to denote a sandy, projecting point of land which has cuspate outlines, and is formed by the agency of currents.

both the north and south ends of the island in a westerly direction. The island thus assumes, roughly, the form of a crescent with its horns pointing westward. The north winds that occur during the winter months annually destroy these crescentic horns, but they are annually replaced by the summer breezes.

Although the northern edge of the *current* of the Gulf Stream probably never impinges against the Tortugas, a fresh south breeze is sufficient to drive its surface waters, unaccompanied by the current,[1] upon the islands, and under these conditions vast quantities of gulf-weed, and large numbers of Physalia, Velella, and other pelagic animals are cast up upon their shores. It is well known that the Gulf Stream bears along upon its surface vast numbers of floating animals that are drawn into it by winds and currents from the adjacent tropical regions of the Atlantic, and thus it comes about that pelagic animals from all over the Gulf of Mexico and West Indies are drifted past the Tortugas.

The temperature of the surface waters in the immediate vicinity of the Tortugas is remarkably high, being about 74°–77° F. in winter, and 80°–86° F. in summer, the average for the whole year being about 78° F. It is probably owing to this high temperature, and also to the great purity of the ocean water, that marine animals may be maintained alive in aquaria with remarkable success at the Tortugas; for the temperature of the laboratory is almost sure to be lower than that of the sea, and thus the animals in the aquaria are refreshed and thrive well.

Comparison of the Tortugas Fauna with that of the Southern Coast of New England.

Ninety species of Acalephs have been found at the Tortugas. Of these, 62 are Hydromedusæ, 16 Siphonophoræ, 7 Scyphomedusæ, and 5 Ctenophoræ. Of these, 39 species are new to science, 33 being Hydromedusæ, 3 Siphonophoræ, 1 Hydroid, and 2 Scyphomedusæ.

The Acalephian fauna of the Tortugas is strictly tropical, and is totally different from that of the eastern coast of New England north of Cape Cod. A number of characteristic Tortugas forms are, however, blown northward every summer, and are thus found in considerable numbers upon the southern coast of New England, where they have been found in Newport Harbor and in Buzzard's Bay. Only three Tortugas species have, however, succeeded in establishing themselves

[1] See Lieutenant (now Commander) J. E. Pillsbury, 1886, Report of U. S. Coast and Geodetic Survey, Appendix No. 11, p. 287.

in Buzzard's Bay and Newport Harbor; these are: Turritopsis nutricula, Margelis carolinensis, and Stomotoca rugosa. But these northern specimens of the two latter forms display distinct and constant color differences which distinguish them from their near relatives in the Tortugas, and probably entitle them to rank as varieties one of the other. In addition to these three Hydromedusæ, there is one Scyphomedusa, Dactylometra quinquecirra, that is established in Tampa Bay, Florida, and also in the bays and estuaries of the southern coast of New England. It has not yet been found at the Tortugas, but, judging from its range of distribution, it probably will be discovered there.

There are a number of other characteristic Tortugas Acalephs that may be classed as occasional visitors to the southern coast of New England, upon which they are drifted by the agency of the prevailing S.–S.W. winds of the summer months. None of these appear to succeed in establishing themselves permanently upon the New England coast. Among these Hydromedusæ may be mentioned, Eutima mira, Æquorea floridana, Glossocodon tenuirostris, and Liriope scutigera; and among the Siphonophoræ, Physalia pelagica, Velella mutica, Porpita Linnæana, Diphyes bipartita, Eudoxia campanula, Ersæa Lessonii, Diphyopsis campanulifera, and Diplophysa inermis. No doubt further researches will increase this list of tropical Acalephs that are drifted far from their southern habitat and slowly perish in the colder waters of the north.

It is interesting to notice that the Acalephian fauna of Charleston Harbor, South Carolina, in latitude 32°, 20′, is very different from that of the Tortugas, and may be said to be subtropical; for it is intermediate in character between the fauna of the Tortugas and that of the southern coast of New England. For example, the following 13 Acalephs are established both at Charleston, South Carolina, and on the southern coast of New England: Dactylometra quinquecirra, Cyanea versicolor, Eucheilota duodecimalis, Epenthesis bicophora, Oceania languida, Willia ornata, Gemmaria gemmosa, Pennaria tiarella, Stomotoca rugosa, Stomotoca apicata, Turritopsis nutricula, Margelis carolinensis, and Nemopsis Bachei; and the following 17 Acalephs are found both at Charleston and the Tortugas: Dactylometra quinquecirra? Beroë Clarkii, Bolina vitrea, Margelis carolinensis, Stomotoca rugosa, Gemmaria gemmosa, Turritopsis nutricula, Halitiara formosa, Æquorea floridana, Eutima mira, Eutimalphes cœrulea, Epenthesis folleata, Eucheilota ventricularis, Steenstrupia gracilis, Liriope scutigera,

Glossocodon tenuirostris, and Dyscannota gemmifera. In addition to these there are a few Acalephs such as Stomolophus meleagris that are strictly subtropical, having been found neither at the Tortugas nor upon the southern coast of New England, but which are abundant at Charleston.

It is important to observe, also, that the Acalephian fauna of the Bermudas, like that of Charleston, is distinctly intermediate between the fauna of the Tortugas and that of the southern coast of New England. Of the 30 species described from the Bermuda Islands by Fewkes (1883; Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XI.), 9 are established at Newport, Rhode Island; and 16 at the Tortugas.

Not a single species of acaleph known from the Tortugas has been found established upon the eastern coast of New England north of Cape Cod. The fauna of the eastern coast of New England is, however, closely related to that of the northern coast of Europe (see Browne, 1895, Trans. Liverpool Biol. Soc., 96; Proc. Zoöl. Soc., London; Hartlaub, 1897; Helgolands Medusen, etc.).

To summarize, then, we have at the Tortugas a tropical fauna that gradually disappears, and is replaced by other forms, as we go northward along the coast of the United States. Only three species of the Tortugas fauna are established upon the southern coast of New England, and not one extends north of Cape Cod, Massachusetts. It appears that the great majority of the forms established at the Tortugas are incapable of surviving in the colder waters of the north, although individuals are annually driven far to the northward of their natural habitat by the agency of the Gulf Stream, and the prevailing S.–S.W. winds of the summer season.

Comparison of the Tortugas Fauna with that of the Tropical Atlantic.

Very instructive facts are brought to light when we compare the Acalephian fauna of the Tortugas with that of the warm zone of the Atlantic Ocean. By the term "warm zone" we include all that region of the Atlantic lying between 30° N. Lat. and 10° S. Lat., and extending from the coast of Africa to the American shores. This "warm zone" includes the Canary and Cape Verde Islands, the Bahamas and West Indies, the Guinea Stream, the North and South Equatorial Currents, and the warmer parts of the Gulf Stream. At the present time about 130 species of Hydromedusæ are known to inhabit this "warm zone."

Haeckel, 1879, describes 30 species from the Canary Islands, 10 from the coast of Africa and Cape Verde Islands, and 10 from the "Tropical Atlantic." Maas, 1893, in his account of the Hydromedusæ of the Plankton Expedition, enumerates about 21 additional species; and 57 others have been made known by L. Agassiz, Brooks, Fewkes, and Mayer from the Bahamas, Florida Reefs, and Tortugas.

The Hydromedusan fauna of the Tortugas is so closely related to that of the Florida Reefs and the Bahama Islands, that they may be said to be practically identical; and we will therefore speak of it hereafter as the "Bahama-Tortugas" fauna.

When we come to compare the Hydromedusan fauna of the Bahama-Tortugas with that of the remaining portion of the "warm zone," exclusive of the West Indies, we are met with the remarkable fact that only 7 species are known to be common to both the Bahama-Tortugas region and the great remaining region of the "warm zone." Thus only 5 Hydromedusæ have been found in both the Canary Islands and Bahama-Tortugas region. These are Æginella dissonema, Aglaura hemistoma, Aglaura hemistoma var. Nausicaa, Staurodiscus tetrastaurus, and Laodicea ulothrix. Two other Hydromedusæ, Glossocodon tenuirostris and Liriope scutigera, are found in the midst of the ocean between the Canary Islands and the West Indies. It will be noticed that 5 out of these 7 forms that are common to both the eastern and western halves of the "warm zone" are Trachylina, or forms that develop through a free-swimming planula and pelagic actinula stage. The two others, Laodicea ulothrix and Staurodiscus tetrastaurus, belong to the Leptolinidæ and probably develop through a sessile hydroid stage with alternation of generations. In 1893 it was shown by Maas in "Die Craspedoten Medusen der Plankton-Expedition," and in Natural Science, Vol. II. pp. 92–99, that the great majority of the Hydromedusæ found in the midst of the Atlantic, far from land, belong to the Trachylina, and the few Leptolina discovered always show a relation to some neighboring coast. As is well known, it was the avowed object of Hensen's Plankton Expedition of 1889 to study the organic life of the high seas as free from the influence of coasts as possible. This expedition entered the region that we have designated the "warm zone" on August 20, and left it on October 20, 1889. During these two months the expedition remained for by far the greater part of the time upon the high seas, approaching land only at the Cape Verde Islands, Ascension, Fernando Noronha, and the mouth of the Amazon. As has been shown by Maas, 1893, the Hydromedusæ

found in this region consisted almost entirely of forms of Trachylina, composed of Trachynemidæ, Aglauridæ, and especially Geryonidæ. (See Craspedoten Medusen der Plankton Expedition, 1893, Taf. VII., VIII.)

The facts then appear to be that we have at the eastern extremity of our "warm zone," or in that region adjacent to the coast of Africa and in the neighborhood of the Canary Islands, a Hydromedusan fauna composed of both Trachylina and Leptolina, and the species which compose this fauna show a distinct relationship with Mediterranean forms. In the midst of the "warm zone," midway between the Canary Islands and the West Indies, the fauna is composed *almost entirely* of forms of Trachylina that are pelagic species *par excellence*, and are distributed widely over the high seas, and also reach the coasts of Africa and America. In the Bahama-Tortugas region we find a Hydromedusan fauna composed of both Trachylina and Leptolina, the Leptolina forms of which are *almost wholly distinct* from those of the Canary Islands.

We wish to call attention to the fact that a comparison of the Hydromedusan fauna of the Bahama-Tortugas with that of the Canary Islands is open to serious objections, and that the conclusions arrived at through such a comparison may be of but little value. The Canary Islands occupy a small area, and are surrounded by water of 1000–2000 fathoms in depth, while the temperature of the surface water in their neighborhood is about 10° F. colder than that of the Bahama-Tortugas region. We might then expect that a marked difference would be observed in the Hydromedusan faunæ of the two regions, for in the neighborhood of the Bahamas and Tortugas we find great areas of very shallow water having a very high temperature, while even the deepest parts of the Gulf of Mexico and Caribbean Sea have a temperature of 39½° F. It would be much fairer and far more conclusive, were we able to do so, to institute a comparison between the fauna of the Bahama-Tortugas and that of the Gulf of Guinea in the neighborhood of the Islands of Anno Bom, St. Thomas, and Fernando Po; for here the continental slope of the African coast is more gradual than at any other place, and the islands are surrounded by a depth of water not greater than 500 fathoms, having a bottom temperature of 39½° F.; which is exactly the same as that of the deep parts of the Gulf of Mexico. The temperature of the surface water is also nearly the same as that of the Bahama-Tortugas region. The conditions at the Tortugas in August and September are very similar to those in the Gulf of Guinea

in February and March, as will become clear through an inspection of Krümmel's Temperature Charts (Kettler's Zeitschrift, Bd. VI., Taf. II., III. Also, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XIV., pp. 240, 242, Figs. 168, 169). Unfortunately the Hydromedusan fauna of the Gulf of Guinea is unknown, but when we come to know it, we would not be surprised were it found that many Tortugas forms are established in this region.

The Scyphomedusæ of the Bahama-Tortugas region are, for the most part, distinctly West Indian types, and are quite different from the species found on the Atlantic Coast of Africa. It is well known that these forms are much more abundant along coasts than they are in the open sea. The Discomedusæ, especially, are given to congregating in swarms in bays and estuaries. We are therefore not surprised to find that most of the Bahama-Tortugas species are peculiar to the West Indies and the adjacent warm coasts of North and South America. Vanhöffen (1888; Bibliotheca Zoologica, and 1892; Acalephen der Plankton Expedition) has given maps showing the geographical distribution of Scyphomedusæ, and from an inspection of his charts it becomes quite apparent how these forms are distributed along coasts, and that few of them have yet been found in the open sea. Indeed, according to Vanhöffen ('92) only six Scyphomedusæ were found by the Plankton Expedition of 1889, which confined its investigations, as far as possible, to the open sea far from coasts.

The following Scyphomedusæ appear to be restricted to the Bahama-Tortugas region and the West Indies: Cassiopea frondosa, Lamarck; Cassiopea xamacana, Bigelow; Linerges mercurius, Haeckel; Linerges pegasus, Haeckel; Linuche ungiculata, Eschscholtz; Linuche vesiculata, Haeckel; Aurelia habanensis, Mayer; Aurelia marginalis, L. Agassiz; Charybdea xamacana, Conant; Tripedalia cystophora, Conant; Charybdea punctata. In addition to these the following forms are established in the Bahama-Tortugas region, but extend also for a considerable distance northward along the coast of the United States: Pelagia cyanella, Péron and Lesueur; Dactylometra quinquecirra, L. Agassiz; Tamoya haplonema, F. Müller. The following species extend from the West Indies southward along the Brazilian coast; Dactylometra lactea, L. Agassiz; Tamoya haplonema, F. Müller.

There are also a few Scyphomedusæ of very wide distribution that are found in the region of the West Indies and Bahamas. Among these are: Nausithoë punctata, Kölliker, found in the Mediterranean, the Tropical Atlantic, and the Bahamas. A very close variety, N.

punctata var. pacifica, occurs in the Tropical Pacific. Periphylla hyacinthina, Steenstrup; found widely distributed throughout the whole Atlantic Ocean (see Vanhöffen, 1892; Akalephen der Plankton Expedition, Taf. V.). Pelagia phosphora, Haeckel; appears to be widely distributed over the Tropical Zone of the Atlantic Ocean (see Haeckel, 1879, p. 507, Vanhöffen, 1892, pp. 19, 20); Atolla Bairdii, Fewkes, is a deep sea form that has been found by the "Albatross" in the Gulf Stream, off the coast of the United States, and by Vanhöffen south of the Cape Verde Islands, off the African coast.

The Siphonophoræ of the Bahama-Tortugas region are almost all widely distributed Tropical Atlantic forms, and most of them have already been found by Haeckel, and by Chun, in the Canary Islands. The Siphonophoræ are pelagic animals *par excellence*, and as they undergo their development while floating within the ocean, and are quite, if not wholly, independent of the bottom, one finds them widely distributed by ocean currents. As was pointed out by Chun (1897, Siphonophoren der Plankton Expedition, p. 101, etc.), the Siphonophoræ of the warm regions of the Atlantic Ocean are widely distributed, distinctive species not being confined to particular regions. It is quite true, however, as Chun also shows (pp. 107–109), that, while many of the Atlantic Siphonophoræ are found in the Mediterranean, there are others which are peculiar to the Mediterranean and have not been seen in the Atlantic; while there are also a number of Atlantic species that do not appear in the Mediterranean. It is possible, as future researches may demonstrate, that there are a few Siphonophoræ that are restricted to the Gulf of Mexico, or the Bahama Banks, but as yet we are certainly not justified in making any such statement.

The Ctenophoræ of the Bahama-Tortugas region are not sufficiently well known, and too little has been discovered concerning their distribution to warrant us in drawing general conclusions in regard to their geographical range. Beroë Clarkii and Bolina vitrea appear to be confined to the West Indies and the southern Atlantic Coast of the United States, while Ocyroë crystallina probably has a wider distribution over the Tropical Atlantic. The so-called "Eucharis multicornis," "Hormiphora plumosa," and "Beroë ovata" of the Tortugas have not been studied with sufficient care to warrant our stating that they are actually identical with the Mediterranean species bearing the same names.

Comparison of the Bahama-Tortugas Fauna with that of the Fiji Islands and Tropical Pacific.

In 1897, A. Agassiz and the author made a study of the Acalephian fauna of the Fiji Islands, South Pacific, in 18° S. Lat., 178° E. Long. from Greenwich. The results of our investigations have been published in the Bulletin of the Museum of Comparative Zoölogy at Harvard College, 1899, and we there show that the Hydromedusæ and Siphonophoræ of the Fiji Islands are very closely related to those of the Tortugas, Florida. All of the Hydromedusæ and Siphonophoræ found by us in the Fiji Islands belong to well-known Atlantic genera. In the case of the Hydromedusæ 4 Fijian species are so closely related to forms found at the Tortugas that we are unable to distinguish any specific difference between them, and therefore we venture to assert that they may be identical species. These forms are Æginella dissonema, Halitiara formosa, Pandea violacea, and Æquorea floridana. It will be observed that only one of these identical species belong to the Trachylina (*i. e.* A. dissonema), the other three being Leptolina forms. In addition to the species already mentioned, the following genera of Hydromedusæ are represented both in the Fiji Islands and in the Tortugas by very closely allied, although distinct species, — Aglaura, Eutima, Laodicea, Oceania, Epenthesis, and Tiaropsis.

Among the Siphonophoræ (Abyla quincunx, Aglaisma quincunx) and Agalma Pourtalesii are found both at the Tortugas and Fiji Islands. Sphæronectes Köllikeri of the Fiji Islands and Tropical Pacific is certainly very closely allied to Sphæronectes gracilis of the Tortugas and Tropical Atlantic; and the two species may eventually prove to be identical, and the same may be said of Nectophysa Wyvellei.

The Scyphomedusæ of the Fiji Islands are with two exceptions quite distinct from those of the Tortugas, for there are a number of characteristic Rhizostomata in the South Pacific that have no near allies in the Atlantic Ocean. We find, however, in the Fiji Islands a variety of Nausithoë punctata that may prove to be specifically identical with the form found at the Tortugas and in the Mediterranean. Another form, Linerges aquila, of Fiji is closely allied to, although distinct from, L. mercurius of the West Indies.

Among the Ctenophoræ of Fiji, Eucharis grandiformis is a species that bears quite a close resemblance to E. multicornis of the Atlantic and Mediterranean, although it is certainly specifically distinct.

We must conclude, then, that the Acalephian fauna of the Fiji Islands is almost as closely related to that of the Tortugas as the latter is to

that of the Canaries. It should be borne in mind, however, that the physical conditions in the Fiji Islands are in many respects quite similar to those of the Tortugas, and are very different from those of the Canary Islands. In both the Fiji and Tortugas Islands we find luxuriant coral reefs and wide areas both of deep and shallow water, and in addition the temperature of the water in the two groups of islands is very nearly the same. In the Canaries, however, we find few corals, and no extensive shallow areas, the islands being surrounded by water of great depth. The temperature of the water there is also much lower than at the Fiji and Tortugas Islands.

We have shown that the Tortugas medusæ cannot survive in cold water, for not a single species is to be found upon the coast of New England north of Cape Cod. The Tortugas forms that are now established at the Fiji Islands must therefore have passed from the Atlantic into the Pacific Ocean somewhere within the tropical, or warm, regions of the Earth, and there can be but little doubt that the Tropical Atlantic was at one time in direct connection with the Pacific. Under these circumstances the Great Equatorial Current would pour from the Atlantic into the Pacific, and the pelagic life of the tropical regions of both oceans would become closely related. A fuller discussion of this subject, and of the researches of Hill, 1898 (Bull. Mus. Comp. Zoöl., Vol. 28) upon the geological history of the Isthmus of Panama will be found in our paper upon Fiji Acalephs in 1899.

In view of the close relationship that exists between the Acalephian faunæ of the Fiji and Tortugas Islands, one would be led to expect that the medusæ of the Gulf of Panama and the west coast of Mexico would also display a resemblance to those of the West Indies and Tropical Atlantic; and this is, indeed, the case. Maas, 1897, in his report upon the medusæ of the "Albatross" expedition of 1891, records 18 species of Hydro- and Scypho- medusæ belonging to 15 genera. All but one of the genera (Chiarella) are represented in the Atlantic by well-known species. Five of the Hydromedusæ from the Gulf of Panama and Galapagos Islands are represented in the Atlantic by species so closely related to them that, were they found existing side by side in the same region, they would probably be considered to be varieties one of the other. Thus: —

Stomotoca divisa, Maas	is very closely related to	S. pterophylla, of the Bahamas.
Homœonema typicum, Maas		H. militare, of the Atlantic.
Aglaura prismatica, Maas		A. hemistoma, of the Atlantic.
Liriope rosacea, Eschscholtz		L. cerasiformis, of the Atlantic.
Geryonia hexaphylla, Brandt		G. (Carmerina) hastata, Mediterranean.

The following table will serve to show the wide geographical range of some species of Medusæ found at the Tortugas, Florida. (0) indicates absence; (1) indicates that the species is identical with that found at the Tortugas. For example, (1) found in the column headed "Canary Islands" shows that the Canary species is identical with that found at the Tortugas. (1±) indicates the presence of a form that *may* prove to be identical with the Tortugas species. (A) indicates the presence of a closely allied but nevertheless distinct species from that found at the Tortugas.

Name of Species.	Tortugas, Florida, 24° 40′ N. Lat. 82° 53′ W. Long.	Canary Islands, Atlantic Ocean, 28° 30′ N. Lat. 15′ W. Long.	Fiji Islands, South Pacific, 18° S. Lat. 178° E. Long.	Mediterranean Sea.
Hydromedusæ.				
Æginella dissonema . . .	1	1	1	0
Aglaura hemistoma . . .	1	1	1±	1
Halitiara formosa	1	0	1	0
Laodicea ulothrix . . .	1	1	A	0
Pandea violacea	1	0	1	0
Æquorea floridana . . .	1	0	1±	0
Staurodiscus tetrastaurus .	1	1	0	0
Tiaropsis heliosa	1	0	A	A
Scyphomedusæ.				
Nausithoë punctata	1	?	1±	1
Siphonophoræ.				
Abyla pentagona	1	1	0	1
Abyla quincunx	1	1	1	0
Agalma Pourtalesii . . .	1	0	1	0
Diphyes bipartita	1	1	0	1
Diphyopsis picta	1	1	0	0
Physalia pelagica . . .	1	1	0	1?
Rhizophysa Eysenhardtii .	1	1	0	0
Rhizophysa Murrayana .	1	1	0	0
Sphæronectes gracilis . .	1	1	1±	1
Ctenophoræ.				
Eucharis multicornis . .	1?	1	A	1

Morphology of Tortugas Medusæ.

Among the new species described in this paper the following are worthy of special notice: *Pseudoclytia pentata*, a hydromedusa, is normally pentamerous, having 5 radial canals 72° apart, 5 gonads, and 5 lips to the proboscis. This curious species has probably been derived, philogenetically, from a pentamerous sport of some form of Epenthesis, and represents the survival of a discontinuous, meristic variation.

Multioralis ovalis is a new genus of Hydromedusæ in which 4 separate manubria are situated upon a single straight chymiferous canal, which traverses the long diameter of the bell.

Eucheilota paradoxa is the only Leptomedusa known which gives rise to young medusæ by a direct process of budding.

Niobia dendrotentacula is a remarkable form of Hydromedusa in which the tentacles develop into new medusæ and are set free to propagate the species. This is accomplished through a process of growth, budding, and fusion of parts. After all of the tentacles have been cast off, the adult medusa reproduces by a sexual process.

In *Bougainvillia niobe*, Mayer, the medusa buds found upon the proboscis are formed entirely from the ectoderm, the entoderm taking absolutely no share in their construction.

Oceania McCradyi of Brooks, 1888, a hydromedusa that produces hydroid-blastostyles upon its gonads, has been found at the Tortugas.

In *Dysmorphosa dubia*, there appear to be 4 rudimentary gonads? upon the 4 radial canals. If future observations confirm this conjecture, the case will be almost unique among Tubularian medusæ.

Summary of Results.

There is at the Tortugas, Florida, a tropical Medusan fauna, only three species of which are established upon the southern coast of New England; and not one species of which is found upon the New England coast north of Cape Cod.

The Hydromedusæ of the Tortugas are more closely related to those of the Fiji Islands, South Pacific, than they are to those of the Canary Islands, off the Atlantic Coast of Africa.

In comparing the Hydromedusan fauna of the Tortugas with that of the Canaries, we see that the Leptolina forms of the Tortugas are *almost wholly* distinct from those of the Canary Islands. A number of Trachylina forms are, however, common to the two groups of islands.

As was shown by Maas, 1893, these Trachylina forms range widely over the open ocean; and this observation has been confirmed by us during the cruise of the U. S. F. C. S. "Albatross" in the Tropical Pacific, 1899–1900.

The Siphonophoræ of the Tortugas are *very* closely related to those of the Canary Islands. They also display a relationship to those of the Fiji Islands, South Pacific.

The Scyphomedusæ of the Tortugas are, for the most part, distinctly West Indian types, and are not closely related to forms known from the African coast.

33 Hydromedusæ, 3 Siphonophoræ, 1 Hydroid, and 2 Scyphomedusæ are new to science, and 44 forms are new to American waters.

DESCRIPTIONS OF SPECIES.

I. HYDROMEDUSÆ.

DIPURENA, McCrady, 1857.

Dipurena fragilis, nov. sp.

Fig. 41, Plate 17.

Specific Characters. — The bell is 4 mm. in height, and is half egg-shaped. The bell walls are of only moderate thickness. There are 4 long slender tentacles each bearing upon its distal end a single knob-shaped mass of nematocyst cells. A single black ocellus is situated in the ectoderm of the outer surface of each tentacle bulb. The velum is prominent. There are 4 slender straight radial canals, and a narrow ring-canal. The proboscis is about 8 mm. in length, and exhibits two distinct annular swollen regions where the gonads are situated. The entoderm of the proboscis, and of the basal bulbs of the tentacles, is ochre-yellow. The entoderm of the distal nematocyst knobs of the tentacles is slightly orange. Several specimens were found at the Tortugas in June, 1897.

This species differs from Dipurena strangulata of Charleston (see McCrady, Proc. Elliott Soc., 1857, p. 33, Plate 9, Figures 1, 2) in that the tentacles are longer and much more slender; and the color of the entoderm of the proboscis and tentacles is light ochre-yellow instead of rich green and red as in the Charleston species.

Dipurena picta, nov. sp.

Figs. 45, 46, Plate 18.

Specific Characters. — The bell is cylindrical in shape and 3 mm. in height. The bell walls are very thick and of a tough gelatinous consistency. There are 4 slender tentacles that are not quite as long as the bell height. These tentacles bear from 3–5 bulb-shaped nematocystic swellings near their distal ends (see Figure 46). The basal bulbs of the tentacles are large, and each one bears a dark purple ocellus. There are 4 straight radial tubes and a narrow circular tube. The velum is not very well developed. The proboscis is about 5 mm. in length and exhibits two distinct annular swellings that mark the places where the gonads are situated. The entoderm of the proboscis and basal bulbs of the tentacles is of a beautiful custard-yellow. The entoderm of the nettle knobs of the tentacles is port-wine-colored.

Two specimens were found at the Tortugas, Florida, during the first week in August, 1898.

This species is closely allied to Dipurena dolichogaster, of the Mediterranean (see Haeckel, Syst. der Medusen, 1879, p. 25, Taf. II., Figures 1–7). It differs, however, from the Mediterranean form in that the bell is much thicker and more nearly cylindrical in shape, and there are fewer nematocyst-bearing bulbs upon the tentacles.

STEENSTRUPIA, Forbes, 1848.

Steenstrupia gracilis, Brooks.

Figs. 36, 37, Plate 16.

Steenstrupia gracilis, Brooks, W. K., 1882, Studies Biol. Lab. Johns Hopkins Univ., Vol. II. p. 144.

Specific Characters. — The bell is 4.5 mm. in height, and is surmounted by a slender apical projection fully 2 mm. in length. There are 2 rudimentary tentacle bulbs, one short, stiff tentacle, and one long tentacle which is ringed with a number of annular swellings. The velum is well developed. There are 4 slender radial canals and a narrow ring-canal. A long slender canal runs up from the proboscis into the apical projection of the bell. In mature specimens (Figure 36) the proboscis extends a short distance beyond the velar opening. The proboscis is cone-shaped, and the mouth is a simple round opening without oral lappets. The entoderm of the proboscis is intense yellow-green and rose-color. The entoderm of the tentacles is either yellow-green or rose-colored. Found at the Tortugas, Florida, and on the North Carolina coast, in July and August.

DINEMA, Van Beneden, P. J., 1867.

Dinema jeffersoni,[1] nov. sp.

Fig. 126, Plate 37.

Specific Characters. — The bell is dome-shaped and higher than it is broad; the height being about 1 mm. and the breadth 0.75 mm. The outer surface is sparsely sprinkled with nematocyst cells. There are 2 short marginal tentacles and 2 well-developed tentacle bulbs. The tentacles are covered with numerous small, wart-like, nematocyst-bearing swellings. The basal bulbs are well developed. There are 4 ocelli, one in each tentacle bulb. These ocelli are ectodermal and are situated on the centripetal sides of the bulbs. The velum is well developed. There are 4 straight narrow radial canals and a simple slender circular vessel. The proboscis is about as long as the height of the bell cavity. It is simple, round, and tubular, and the mouth-opening is situated at the extremity of a short cylindrical neck. A simple, short-style canal extends upward from the gastric cavity into the gelatinous substance of the bell. The entoderm of the tentacles and tentacle bulbs is of a delicate green. The ocelli are bright red-brown, and the entoderm of the proboscis is flesh-colored. This form is occasionally met with at the Tortugas late in May and early in June.

Dinema floridana, nov. sp.

Specific Characters. — The bell is about 4 mm. in height and 3 mm. in diameter. The gelatinous substance is thin and uniform, and the side walls of the bell are vertical. There are 2 well-developed, radially situated tentacles. Near the distal end of each of these tentacles there is a large knob-shaped swelling which terminates in a thin, nematocyst-bearing lash. The knob-shaped swelling is hollow and is connected with the general gastro-vascular system of the medusa by means of a narrow tube which extends throughout the length of the entodermal core of the tentacle. The basal bulbs are not large and there are no ocelli. In addition to the 2 long tentacles there are 2 simple rudimentary tentacle bulbs 90° from the well-developed tentacles. The velum is well developed. There are 4 straight narrow radial canals. The proboscis is flask-shaped, being narrower at its base than at the middle of its length. It extends a short distance beyond the velar opening, and the mouth is a simple round opening, at the extremity of a long narrow neck. The entoderm of the proboscis and tentacle bulbs is bright yellow. The entoderm of the swollen distal ends of the tentacles is yellow flecked with orange.

A single specimen of this medusa was found at the Tortugas, Florida, June 17, 1897.

[1] Named after Fort Jefferson, at the Tortugas, Florida.

HALITIARA, Fewkes, 1882.

Halitiara formosa, Fewkes.

Halitiara formosa, Fewkes, J. W., 1882, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. IX. p. 276, Pl. IV. Fig. 2.

Specific Characters. — The bell is 3 mm. in height, and is provided with a solid apical projection. There are four long, radially situated tentacles, the distal ends of which are usually carried coiled in a tight helix. These tentacles are hollow, and have well-developed basal bulbs. In addition to these there are 24–35 short, solid tentacles that are usually carried tightly coiled. The velum is well developed. There are 4 straight, narrow radial tubes and a narrow, simple, circular vessel. The proboscis is pyriform, and extends for about half the distance from the apex of the bell cavity to the velar opening. The mouth is a simple round opening, and there are no prominent lips. The gonads are situated within the proboscis. In the case of the female the ova are very large and conspicuous. The entoderm of the proboscis and tentacle bulbs in the females is green; in the males, light brown. This medusa is certainly the commonest of all at the Tortugas, Florida, during the summer months. We have found this species in the Fiji Islands.

ECTOPLEURA, Agassiz, L., 1862.

Ectopleura minerva, nov. sp.

Fig. 38, Plate 16; and Fig. 125, Plate 37.

Ectopleura, sp., Fewkes, J. W., 1883, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XI. p. 85, Pl. I. Fig. 11.

This form possesses but two marginal tentacles instead of four, as in all other species of Ectopleura.

Specific Characters. — The bell is 2.5 mm. in height and is pear-shaped, having a well-developed apical projection. The gelatinous substance is of only moderate thickness. 8 rows of nematocyst cells extend from the tentacle bulbs to the bell apex. There are 2 well-developed tentacles, and 2 small tentacle bulbs. There are 6–9 separate, wart-like swellings upon the upper (aboral) side of each tentacle. These swellings are crowded with nettling cells. The velum is well developed. There are 4 straight, narrow, radial canals and a slender circular vessel. The proboscis is pear-shaped and is about $\frac{2}{3}$ as long as the height of the bell cavity. A simple, short style-canal extends upward into the apical projection of the bell. The entoderm of the proboscis and tentacles is of a delicate purple, while the supporting lamella of the bell is of a

decided green. There are a large number of brilliant yellow spots in the radial canals and tentacle bulbs. This form is rare at the Tortugas, Florida. It was found by Fewkes, 1883, at the Bermudas.

STOMOTOCA, Agassiz, L., 1862.

Stomotoca australis, nov. sp.

Fig. 2, Plate 1.

Specific Characters. — The bell is about 2.5 mm. in height, and there is a well-developed, solid, conical projection upon the aboral surface of the umbrella. The bell walls are thin. There are 2 large diametrically opposed tentacles, which are situated at the foot of two of the radial canals. The basal bulbs of these tentacles are hollow, and are long and conical. In addition to the two long tentacles there are two rudimentary tentacle bulbs situated at the bases of the radial canals 90° away from the long tentacles. There are 8 ectodermal ocelli. 4 of these are situated upon the centrifugal surfaces of the 4 tentacle bulbs, and the 4 others occupy intermediate positions upon the bell margin. The velum is wide. The radial canals and circular tube are broad, and their edges are smooth and simple. The proboscis is short and urn-shaped, and extends about halfway from the inner apex of the bell cavity to the velar opening. The gonads occupy complexly folded and corrugated regions upon the sides of the stomach. The proboscis and tentacle bulbs are yellow, or greenish yellow. The ocelli are orange. The entodermal core of the proboscis often displays a faint orange tinge. This species is common throughout the summer at the Tortugas, Florida.

Stomotoca rugosa.

Stomotoca apicata, Fewkes, J. W., 1881, Bull. Mus. Comp. Zoöl., Vol. VIII. p. 152, Pl. II. Figs. 1, 4, 9.

Amphinema apicatum, Brooks, W. K., 1883, Stud. Johns Hopkins Biol. Lab., Vol. II. p. 473.

This species has usually been confounded with Stomotoca apicata, L. Agassiz. Stomotoca apicata, L. Agassiz, is, however, distinguished from S. rugosa by the circumstance that the entoderm of the proboscis in the male is green, or straw-colored, and in the female, dull ochre ; and the tentacle bulbs in the male are purple, and in the female, dull ochre. In the form described by Fewkes and Brooks, for which we propose the name S. rugosa, the entoderm of the proboscis and of the tentacle bulbs is always brick-red in both sexes.

Specific Characters. — The bell is 5 mm. high and 3 mm. broad. It bears an apical projection which in some individuals is long and slender and in others short and blunt. The substance of this projection is solid throughout. There are 2 long, well-developed tentacles and 14 small rudimentary ones.

The basal bulbs of the long tentacles are large and hollow. When fully stretched, the long tentacles attain a length of 4–10 times the bell height. The velum is well developed. There are 4 broad radial tubes, and also a broad circular vessel with jagged outlines. The proboscis is flask-shaped, the lips being flanged and quite prominent. The mature sexual products are found in the ectoderm of the proximal portion of the proboscis where the outer surface is folded into a complex series of ridges. The bell is transparent. The entoderm of the tentacle bulbs and of the proboscis is brick-red. In some individuals the entoderm of the 4 radial tubes and of the circular vessel exhibits a faint tinge of red. The specimens of this species from the Tortugas, Florida, are peculiar in that the red color of the proboscis and tentacle bulbs is streaked with black. In some cases, after the medusæ had been confined in aquaria for a number of days, the proboscis and tentacle bulbs became wholly black.

This medusa is very common at Newport, Rhode Island, but does not extend north of Cape Cod. It is found all along the southern coast of the United States, but is rare at the Tortugas, Florida.

Hydroid, and young medusa. — Brooks, 1883, describes the hydroid of this species. It is a Perigonimus, very much like P. minutus, Allman (1871; Tubularian Hydroids, p. 324, Plate XI. Figures 4–6). It was found growing upon the lower surface of the shell of Limulus, fastened to the sand tubes of Sabellaria. The stems are simple and unbranched and are about 0.2 mm. in height. The stems are covered for about two thirds of their length by a delicate, closely adherent film of perisarc to which foreign particles become attached. The stomach occupies about one fourth or one fifth of the stem, from which it is separated by a slight constriction. Each polypite possesses ten tentacles, which point alternately backwards and forwards, those pointing forwards being a little longer than the others. The medusæ are attached by very short peduncles to the sides of the stems. When the medusa is set free it is about 0.5 mm. in height, and there is no trace of the apical projection, which develops in the course of about 8 days.

In an abnormal individual of this species found at Newport, Rhode Island, in July, 1892, there were 4 long tentacles, one at the base of each radial canal. This medusa was maintained alive in an aquarium for more than a month. When first found it had but two diametrically opposed tentacles, each at the foot of a radial canal. The other pair of large tentacles developed later, after the first pair had attained their full length. The medusa then possessed 4 long tentacles and 12 small rudimentary tentacle bulbs. This variation is interesting, as it illustrates the close relationship between Stomotoca and Modeeria.

PANDEA, Lesson, 1837.

Pandea violacea, Agassiz and Mayer.

Fig. 1, Plate 1.

Pandea violacea, Agassiz, A., and Mayer, A. G., 1899, Bull. Mus. Comp. Zoöl. Harvard Coll., Vol. XXXII. p. 160.

Specific Characters. — The bell is pear-shaped and 4 mm. in height. The bell walls are only of moderate thickness. There are 32 tentacles, 8 of these are each about 3 times as long as the bell height, and 24 are small and rudimentary. The basal bulbs of the long tentacles are hollow. There are 32 ocelli, one on each tentacle bulb. The velum is well developed. The proboscis is flask-shaped, its proximal portion being distended by the 4 gonads. The lips are simple and cruciform. There are 4 straight radial tubes, and a broad circular vessel. The entoderm of the proboscis and tentacle bulbs is of a delicate pink. A green streak runs along the outer surface of the entodermal lining of the radial canals. The ocelli are purple in color. The medusa is common at the Tortugas, Florida, throughout the summer. We have found a species at the Fiji Islands that appears to be identical with the Tortugas form. Our figure is drawn from a specimen found at the Tortugas.

TIARA, Lesson, 1843.

Tiara superba, nov. sp.

Fig. 39, Plate 16.

Specific Characters. — The bell is 5 mm. in height and possesses a small apical projection. There are 4 long hollow tentacles and 12 small rudimentary tentacles. A brilliant red eye-spot is found in the ectoderm of the outer surface of each tentacle bulb. The velum is well developed. There are 4 broad straight-edged radial tubes and a broad circular vessel. The proboscis is very broad and the lips are surrounded by complexly fimbricated lappets. The gonads are found in 4 sharply folded, radially arranged regions in the upper portion of the proboscis. The proboscis is bound to the radial tubes by means of 4 mesenteries. The entire gelatinous substance of the medusa is of a delicate rose-pink. The entoderm of the proboscis and tentacles is of a rich rose-color, and the entodermal core of the proboscis is emerald-green. This medusa makes its appearance in June and continues to be common throughout the summer at the Tortugas, Florida.

GEMMARIA, McCrady, 1857.

Gemmaria dichotoma, nov. sp.

Fig. 40, Plate 17.

Specific Characters. — The bell is 3 mm. in height and there is a solid mitre-shaped apical projection. The bell walls are thin. There are two rudimentary tentacle bulbs and two well-developed tentacles. The entodermal core of these large tentacles is hollow. They terminate in a bulb-shaped nematocyst swelling, which in some individuals is provided with delicate bristles. A number of tentaculæ arise from the upper or "dorsal" side of the tentacle, and each one of these terminates in a bulb-shaped swelling similar to that at the distal end of the main tentacle. The youngest and least-developed of these side branches is always found nearest the bell. The basal bulbs of the tentacles are large, and there is a single deep red ocellus in the outer surface of the ectoderm of each. The velum is quite well developed. There are 4 straight radial canals and a narrow circular canal. The proboscis is pyriform and extends about half the distance from the apex of the bell cavity to the velar opening. The entoderm of the proboscis and tentacles is ochre-yellow. Several specimens were found at the Tortugas early in July.

Gemmaria gemmosa, McCrady.

Figs. 137, 138, Plate 41.

Gemmaria gemmosa, McCrady, J., 1857, Gymn. Charleston Harbor, p. 49.
Zanclea gemmosa, McCrady, J., 1857, Gymn. Charleston Harbor, p. 48, Pl. 8, Figs. 4, 5.

Specific Characters. — Hydroid stock; Gemmaria gemmosa. The hydroid was found at the Tortugas, Florida, growing upon a piece of floating gulf-weed (Sargassum). The hydrorhiza is creeping and net-like, and gives rise at irregular intervals to short, more or less twisted hydrocauli. Both the hydrorhiza and hydrocauli are covered with a horny, chitinous perisarc, which in the hydrocaulus displays a number of annulations. The hydrocaulus is corrugated, and opaque in color, throughout its length; and in this respect differs from the European G. implexa described by Allman (1871, Tubularian Hydroids, p. 290, Plate VII.). The fully developed hydranths are only 1.5 mm. in height. They are elongate, and the diameter near the proximal end is a little greater than at the free oral extremity. The tentacles arise in 5–8 whorls from the side of the hydranth. Each whorl contains 4–6 short tentacles. Each tentacle terminates in a distal knob which is armed with a dense cluster of nematocysts. The cells of the shafts of the tentacles are vacuolated, and the tentacles themselves quite stiff and inflexible. 4–8 medusa-buds arise from the side of the hydranth immediately below the proximal whorl of tentacles.

When set free the young medusa possesses 2 well-developed diametrically opposed tentacles and 2 rudimentary tentacle bulbs (Figure 137). The 4 radial, nematocyst-bearing swellings upon the ex-umbrella extend halfway up the sides of the bell from the margin toward the apex. The bell walls are uniform, and very thin and flexible. There are 4 slender radial canals, and the proboscis is a short simple tube with no trace of gonads. Before being set free, the tentacles are carried coiled inward so that they lie protected within the bell cavity. Soon after liberation, however, the tentacles are turned outward. (Compare Figures 137 and 138.) The deep-lying entoderm of the hydranth is of a delicate creamy pink, while the more superficial entoderm is of a translucent milky color. The entodermal cells of the superficial entoderm are large and vacuolated. The hydrorhiza is of a horny yellow color. This species is quite different from Gemmaria implexa of Allman. It is probably the hydroid of Zanclea gemmosa, McCrady, of Charleston Harbor, but not having been able to raise the medusæ we must remain in some doubt concerning its identity.

NIOBIA, nov. gen.

Niobia dendrotentacula, nov. sp.

Figs. 141-143, Plate 42; Fig. 144, Plate 43.

Generic Characters. — Niobia. Cladonemidæ with 2 simple and 2 bifurcated radial canals. There are 4 simple lips to the proboscis, but no oral tentacles. The marginal tentacles develop into free-swimming medusæ.

There is no place in the system of Haeckel (1879; p. 101) for this genus. It cannot be placed among the Dendronemidæ, for it has no oral tentacles, and as it has branched radial canals it cannot be classed among the Pteronemidæ. It combines the essential characters of both of these subfamilies, however, and forms a good connecting link between them.

Specific Characters. — Adult medusa. The bell is slightly flatter than a hemisphere, and is about 4 mm. in diameter. The gelatinous substance is quite thin and uniform, but not very flexible. The tentacles are arranged in bilateral symmetry, the axis being in the diameter of the two simple radial canals (see Figure 144, Plate 43). The oldest tentacle is situated at one end, and the youngest at the other end of this axis. (Figures 142, 144.) Each half of the medusa is a reflection of the other, and the order in age of the tentacles is given by the following diagram, the oldest tentacle being numbered (1) and the youngest (7): —

Tentacles (1) and (7) are situated at the bases of the simple radial canals, while tentacles (2, 2) and (3, 3) are found at the bases of the two bifurcate canals. In addition to these there are the intermediate sets of tentacles (4, 4), (5, 5), and (6, 6); and thus the medusa possesses 12 tentacles, each successive pair being 30° apart. It is very remarkable that through a peculiar process of growth each tentacle bulb is developed into a young medusa which resembles the adult, and is finally set free into the water. Various stages of this process will be seen by an inspection of Figures 141, 142, and 144. The oldest tentacle is the first to be transformed into a new medusa, and the others follow in the order of their age until all of the tentacles have been cast off. The first stage in this process is the development of a hernia-like outgrowth, involving both entoderm and ectoderm, adjacent to and on the centripetal side of each tentacle bulb upon the floor of the sub-umbrella. Soon after this two pointed outgrowths appear on both sides of each tentacle bulb, and finally develop into new tentacles. These outgrowing tentacles become larger, and soon a still younger pair make their appearance centrifugal to the first, and these are soon followed by two others which lie centripetally from the oldest pair. Before this, however, 4 short canals (the radial canals of the future medusa) develop, and place the gastric cavity of the future proboscis into communication with the circular vessel. An opening then appears in the velum of the adult medusa immediately below the proboscis of the future medusa, and this constitutes the velar opening of the new animal. The proboscis becomes cruciform in cross-section, and finally the new medusa is constricted off and becomes free in the condition represented in Figure 142. Here we see that the simple radial canals, the circular canal, the velum, and the oldest tentacle are stolen directly, so to speak, from the parent medusa. The forked canals, proboscis, and younger tentacles are new growths. Even before the outgrowing medusa is detached from the old one, hernia-like outgrowths appear upon the

sub-umbrella wall near the bases of *its* tentacles, and thus the process of forming new medusæ is repeated in the next generation. The medusæ are very hardy when detached and grow rapidly, and proceed at once to develop new medusæ from their own tentacle bulbs. When detached, the bell of the new medusa is about 1.5 mm. in diameter. It is difficult to comprehend the phylogenetic history of this curious and fortuitous combination of local growth, fusion, and budding which results finally in the formation of a medusa exactly resembling the adult. It is probable, however, that it has been derived from the usual budding process so common in hydromedusæ, but that in this case a greater and greater number of parts have been taken directly from the adult medusa, until the present state has been arrived at. After the original tentacles have been cast off, new ones grow out in their places, and thus the old medusa always has 12 tentacles. After every one of the original 12 tentacles has been cast off, however, the process of forming new medusæ becomes less active and finally ceases altogether. Then the gonads develop in 4 separate interradial regions on the wall of the gastric part of the proboscis. In the female the ova become very prominent, and are finally dehisced into the water. I was unable to raise them, however, and know nothing of the development of the sexual generation. The proboscis is flask-shaped, and there are 4 simple cruciform lips. The entoderm of the proboscis tentacle bulbs and circular canal is ochre-yellow, all other parts of the medusa being transparent. The medusa is very active and thrives well in confinement. Large numbers of them appeared at the Tortugas, Florida, on May 21, and continued more or less common until June 4, 1899.

TURRITOPSIS, McCrady, 1857.

Turritopsis nutricula, McCrady.

Turritopsis nutricula, McCrady, J., 1857, Gymn. Charleston Harbor, p. 25, Pls. IV., V., VIII. Fig. 1.

Modeeria multitentacula, Fewkes, J. W., 1881, Bull. Mus. Comp. Zoöl. Harvard Coll., Vol. VIII. p. 149, Pl. III. Figs. 7–9.

This medusa was well described by McCrady in 1856 and 1857. Fewkes, 1881, however, redescribed it as a new species under the name "Modeeria multitentacula." To add to the confusion respecting this species, a medusa that has since been identified by Martha Bunting, 1894, as Podocoryne carnea, was described by A. Agassiz, 1862, 1865, under the name of "Turritopsis nutricula." The latter author was deceived by the close resemblance of the young of Podocoryne carnea to the young medusa of T. nutricula, McCrady, 1857, into the belief that the two were identical. The mature medusæ, however, are easily distinguished one from the other, and the hydroid stocks differ widely from each other.

Specific Characters. — Mature medusa. The bell is pear-shaped with thin walls, and is 4 mm. in height. There are 40–50 marginal tentacles that are capable of much contraction and extension. There is a single brown, ectodermal, pigment spot upon the centripetal side of each tentacle near the point of its junction with the tentacle bulb. The velum is well developed. There are 4 straight, narrow, radial canals. The proboscis is wide and fills about half of the cavity of the bell. The upper portion of the proboscis consists of highly vacuolated cells, or chambers, through the midst of which run the 4 radial canals. The mouth opening of the proboscis is found at the end of a short, narrow, cylindrical neck, and is surrounded by 4 radially arranged nematocyst-bearing knobs. The gonads are situated within the proboscis. The entoderm of the proboscis is dull yellow, streaked with brownish orange. The ocelli of the tentacle bulbs are orange, or brown in color.

This medusa is extremely abundant from the coast of Cuba to Newport, Rhode Island. It is not found north of Cape Cod, Massachusetts. It is very common in Charleston Harbor, South Carolina, where it is infested by the young of Cunoctantha octonaria. This medusa is one of the few that appears to develop from the hydroid stock both at the Tortugas and at Newport, Rhode Island. For while medusæ indigenous to the Tortugas are often driven into Newport Harbor by southerly winds, very few of these southern visitors establish themselves permanently in the northern waters.

The hydroid stock of this species was found by Brooks, 1886, at Morehead City, North Carolina. It is a Tubularian belonging to the genus Dendroclava. Brooks gives a number of good figures of it in his paper in the Memoirs of the Boston Society of Natural History, Vol. III., 1886.

CYTAEIS, Eschscholtz, 1829.

Cytaeis gracilis, nov. sp.

Figs. 122-124, Plate 36.

Specific Characters. — Mature medusa; Figure 122. The bell is dome-shaped and a little broader than it is high, and the aboral apex terminates in a slight projection. The animal is 3 mm. in diameter. The gelatinous substance of the bell is of only moderate thickness. There are 8 quite stiff curled tentacles; 4 radial and 4 interradial. The radial tentacles are about two thirds as long as the bell height, while the interradial ones attain only about one half this length. The basal bulbs of all of the tentacles are large and deeply pigmented. The velum is broad. There are 4 straight, narrow, radial canals, and a simple slender circular vessel. The proboscis is mounted upon a short, wide peduncle. The gastric portion of the proboscis is only about one half as long as the height of the bell cavity. The mouth is a simple, round opening, surrounded by 8 unbranched oral tentacles. 4 of these tentacles are radial and 4 interradial in position, and each one terminates in a knob-like end formed of spindle-shaped

nematocyst cells. Medusa buds arise from the sides of the gastric portion of the proboscis. When set free each medusa possesses 4 short equally developed tentacles. The entoderm of the proboscis is usually red in color, although sometimes the inner core is red or pink and the outer annulus is green. Each tentacle bulb is provided with a dense mass of red entodermal pigment, which in the case of the radial tentacles extends for a considerable distance up the course of the radial canals.

Young Medusæ. — The youngest medusa found free in the water was 1.5 mm. in height (Figure 124), and the bell was about twice as high as it was broad. The gelatinous substance was quite thin. There were only 4 marginal tentacles and these were radial in position. The distal tips of these tentacles were slightly knobbed and their entoderm was tinged with green. There were 8 simple oral tentacles, and the proboscis lacked a peduncle. In an older individual, which was 2.5 mm. in height, the bell was pyriform. The proboscis possessed a peduncle, and there were 8 marginal tentacles, 4 radial and 4 interradial. There were no traces of medusa buds upon the proboscis.

This medusa was quite common at the Tortugas, Florida, about the middle of June, 1899.

DYSMORPHOSA, Philippi, 1842.

Dysmorphosa dubia, nov. sp.

Figs. 64-66, Plate 22.

Specific Characters. — The bell is egg-shaped and 1.5 mm. in height. The bell walls are thin and flexible. There are 8 quite stiff tentacles (Figure 66) that are carried curled slightly upward. The distal ends of these tentacles are thickly covered with nettling cells. A very large black ocellus is situated in the ectoderm of the under side of each tentacle bulb. The velum is well developed. There are 4 straight, narrow, radial tubes ; and a slender circular canal. The proboscis is pear-shaped, and there is a slightly developed peduncle. 4 radially situated oral tentaculæ surround the mouth. Each one of these terminates in a knob-like cluster of nematocysts (Figure 65). 4 small, rudimentary gonads? appear to be developed at points midway along the lengths of the 4 radial canals. The entoderm of the proboscis, tentacle bulbs, and gonads ? is of a delicate yellow. One specimen was found at the Tortugas, Florida, on July 20, 1898.

The presence of what appear to be gonads ? upon the radial tubes is certainly remarkable ; it should be remembered, however, that such appearances are not unknown among genera of Tubularian medusæ that normally bear their gonads upon the proboscis. In the case of Dipurena halterata bodies that are very similar in general appearance to rudimentary gonads are found upon the radial canals. (See Forbes, E., 1848, British Naked-Eyed Medusæ, p. 53, Plate VI., Figures 1, b, c, d. Also Browne, E. T., 1898, Proc. Zoöl. Soc. London, p. 816, Plate 49, Figure 2.)

Dysmorphosa minuta, nov. sp.

Fig. 42, Plate 18.

Specific Characters. — The medusa is extremely minute, the bell being only 0.3 mm. in height. It is pear-shaped and the walls are quite thick. The gelatinous substance is remarkably delicate, and the medusa soon contracts into a shapeless mass in captivity. There are 8 marginal tentacles, with well-developed basal bulbs. The velum is small. There are 4 straight, slender radial canals and a narrow circular vessel. The proboscis possesses a distinct peduncle. The gastric portion as well as the peduncle is 4-sided in cross-section. 4 well-developed oral tentacles surround the mouth, one being situated at each radial corner. Each of these tentacles terminates in a knob-shaped distal end, which is thickly covered with nematocysts. The entodermal cells of the oral tentacles are disk-shaped and highly vacuolated. Several medusa buds in various stages of development are found upon the upper interradial regions of the gastric portion of the proboscis. In some specimens the entoderm of the proboscis and tentacle bulbs is turquoise blue, and in others lilac. The medusa was common at the Tortugas, Florida, in the middle of July, 1898. It is the smallest hydromedusa known. Its color is also very different from D. fulgurans, A. Agassiz, of Newport Harbor.

BOUGAINVILLIA, Lesson, 1836.

Bougainvillia frondosa, nov. sp.

Fig. 5, Plate 3.

Specific Characters. — The bell is dome-shaped and about 2 mm. in height. There are 4 bunches of marginal tentacles, which are situated at the bases of the 4 radial canals. Each tentacle bulb gives rise to but 2 tentacles, thus making 8 in all. There are no ocelli at the bases of the tentacles. The velum is small. There are 4 straight, simple, radial tubes. The proboscis is short, thick, and flask-shaped, and extends only about one half of the distance from the inner apex of the bell cavity to the velar opening. There are 4 radially situated oral tentacles, each of which branches dichotomously two or three times. The mature gonads are found in 4 radially situated swollen regions upon the ectoderm of the proboscis, above the origins of the oral tentacles. There are a number of flask-shaped bodies with narrow necks protruding from the surface of the proboscis in the region of the gonads. Each of these flask-shaped capsules is filled with yellow-colored cells. Although it is possible that these may be developing planulæ, we incline to the opinion that they are parasitic zoöxanthellæ. We are led to this opinion on account of the decided yellow-green color of these cells, and also because we have found similar capsules scattered irregularly over the surface of the sub-umbrella of Laodicea

ulothrix at the Tortugas. The entoderm of the proboscis and tentacle bulbs is cream-colored, and the tips of the tentacles are turquoise. A single specimen of this medusa was found at the Tortugas, Florida, on June 11, 1897, and another in June, 1899.

Bougainvillia niobe, Mayer.

Bougainvillia niobe, Mayer, A. G., 1894, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXV. p. 236, Pl. I. Fig. 2.

Specific Characters. — The bell is 6.75 mm. in height and 4.8 mm. broad. The bell walls are thick and gelatinous. The marginal tentacles arise from 4 radially situated bulbous swellings, each one of which gives rise to 6–8 tentacles. At the base of each tentacle, upon the inner or centripetal side, there is a dark-colored pigment spot, or ocellus. This is an ectodermal structure, and it projects slightly from the surface of the tentacle. The tentacles are not very flexible and are about as long as the bell height. The velum is well developed. There are 4 straight, narrow, radial tubes. The proboscis is wide, but not very long, extending only about half the distance from the apex of the bell cavity to the velar opening. There is a small peduncle. There are 4 large, radially arranged bunches of oral tentacles. These arise as 4 main stems, each of which branches dichotomously 4 times, thus giving rise to 16 tentacle tips from each quadrant of the proboscis. These terminal tentacle tips are slightly knobbed, and are composed chiefly of nematocyst cells. The tentacles of the proboscis are very flexible and may be observed waving gracefully to and fro within the cavity of the bell.

The most remarkable characteristic of this species is the presence of numerous medusa buds that arise from the gastric region of the proboscis. These budding medusæ are found in 8 radially arranged clusters situated near to and on both sides of the places where the 4 radial tubes enter the gastric portion of the proboscis. A study of sections of the proboscis of medusæ killed in Flemming's Chrome-Osmic-Acetic, and stained in Kleinenberg's 70% Alcoholic Hæmatoxylin, has shown that *the proliferating medusæ are formed entirely from the ectoderm*, the entoderm taking no part whatsoever in their formation. There is a very well-defined lamella between the ectoderm and the entoderm of the proboscis of the parent medusa, and the membrane of this lamella is never broken during the time of the formation of the medusa bud from the ectoderm of the proboscis. Indeed, the gastro-vascular cavity of the budding medusa is never connected with that of the parent. The medusa buds develop very much as has been demonstrated by Chun (1895 ; Bibliotheca Zoologica, Heft 19, Lfg. 1, p. 1–51, Taf. I., II.) in Rathkea octopunctata, and Lizzia Claperèdei ; excepting that while in the forms studied by Chun the gastro-vascular cavity of the bud finally acquires a connection with that of the parent, in Bougainvillia niobe no such connection is ever formed. Chun concluded that medusa buds which are derived entirely from ectoderm cannot be homologous with those that are

formed from both ectoderm and entoderm in the manner commonly observed in Hydroids, and in the medusa of Sarsia; for it is necessary, if organs be homologous, that they have a similar origin. It has occurred to us, however, that Chun may be mistaken in this conclusion, and that his statement may be more a matter of definition than of fact; for it may well be that, in the course of phylogeny, the entoderm has come to take less and less part in the formation of medusa buds, until finally, as in the case of Bougainvillia niobe, it has abandoned all share in their formation. Considered from the physiological standpoint it may be that in B. niobe the ectoderm of the parent proboscis being very thick, there is an abundance of cells from which to form the bud without having resource to those of the deep-lying and somewhat inaccessible entoderm. When set free the young medusa possesses 4 radial tentacles. The bell of the medusa is transparent, and the entoderm of the proboscis and tentacle bulbs is rosin-yellow.

Found in Nassau Harbor, New Providence Island, Bahamas, in March, 1893.

It is interesting to notice that Hartlaub (1897; Hydromedusen Helgolands) has shown that the sex cells of Bougainvillia superciliaris are first found in the entoderm of the young medusa, and that as development proceeds they pass into the ectoderm, where they become mature. It is possible that the cells which give rise to the medusa buds of Bougainvillia niobe are similarly derived from the entoderm of the young medusa. We have not seen the young and immature medusa of B. niobe, and in the mature animal the supporting lamella between the ectoderm and entoderm of the proboscis is very distinct and unbroken, and we have never succeeded in discovering any cells which were passing through it.

Margelis carolinensis, Agassiz, L.

Hippocrene carolinensis, McCrady, J., 1857, Gymn. Charleston Harbor, p. 62, Pl. 10, Figs. 8–10.

Margelis carolinensis, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. p. 344.

In the Tortugas and Charleston Harbor examples of this species, the entoderm of the tentacle bulbs and of the proboscis is of a delicate sage-green color; while the gonads are cream-colored, and the tentacular ocelli dark-brown or black. In northern examples of this medusa, found at Newport, Rhode Island, and Naushon, Massachusetts, A. Agassiz describes the color of the tentacle bulbs as brilliant red surrounded by a green edge bordered with light yellow; and the digestive cavity as brick-red, or green. No such brilliant coloration has been seen in the southern specimens. The medusa is not very common at the Tortugas, being met with only occasionally during the summer months. In Charleston Harbor, South Carolina, however, it is extremely abundant.

LIZZIA, Forbes, 1846.

Lizzia elegans, nov. sp.

Fig. 127, Plate 38.

Specific Characters. — The bell is 3–7 mm. in height, and the gelatinous substance is of moderate and nearly uniform thickness. The sides of the bell are almost straight and vertical, and the top is dome-shaped. There are eight groups of marginal tentacles, 4 radial and 4 interradial. Each radial group is composed of 4, and each interradial of 3 tentacles. The tentacles are quite stiff and curve upward, and are only about one-half as long as the bell height. There is a small dark-brown ectodermal ocellus upon the under (oral) side of each tentacle near the basal bulb. The velum is wide and provided with strong muscles. There are 4 straight, narrow, radial canals, and a simple circular vessel. There is a well-developed conical peduncle to the proboscis, down which the radial canals lead in their course to the gastric sac. The gastric part of the proboscis is cruciform in cross-section and pear-shaped in general longitudinal contour. The mouth is a simple round opening without prominent lips. The oral tentacles arise from the four radial sides of the proboscis at a short distance above the mouth. Each tentacle branches dichotomously 3 times and then each tip terminates in three small branches which are covered with nematocysts. The entodermal cells of the oral tentacles are chordate. The genital products are situated upon the 4 radial sides of the gastric portion of the proboscis. The entoderm of the tentacle bulbs and radial canals is of an intense opaque pearly-white color, often displaying a tinge of pink. The entoderm of the gastric portion of the proboscis is of an intense green, and the oral tentacles are pearly-pink. The intense opaque color of the radial canals contrasting with the hyaline transparency of the bell renders this medusa one of the most beautiful to be found at the Tortugas, Florida.

Several specimens were captured early in July, 1899.

DISSONEMA, Haeckel, 1879.

Dissonema turrida, nov. sp.

Figs. 3, 4, Plate 2.

Specific Characters. — Adult medusa; Figure 3. The bell is about 4 mm. in height. It is blunt and cone-shaped, and there is a prominent apical projection, which is hollow. There are 2 large hollow tentacles, which when expanded are 3–4 times as long as the bell height. In addition to these, there are 14 small solid tentacles, or marginal cirri. There are 16 ocelli, one at the base of each tentacle. These ocelli are situated within the ectoderm of the outer

(centrifugal) side of the tentacles. The proboscis is pyriform, and the lips project beyond the velar opening. The walls of the proboscis are very thin, and the lips are crenulated. The 4 radial canals are broad, and the 4 gonads occupy their proximal halves. In the female each gonad contains about six large ova, which stand out prominently over the surface of the organ. The entoderm of the proboscis and tentacles is of a delicate shade of green. The genital organs and circular canal are tinged with pink.

Young Medusa. — Figure 4, Plate 2, represents a young medusa of this species in which the genital organs have not yet made their appearance. There are but 4 tentacles, and 8 ocelli; and it is remarkable that the long tentacles are as yet solid, although they become hollow throughout their length in the adult medusa. This species is common throughout the summer at the Tortugas, Florida.

NETOCERTOIDES, nov. gen.

Netocertoides brachiatum, nov. sp.

Figs. 43, 44, Plate 18.

Generic Characters. — Cannotidæ with 8 bifurcating, radial canals. 16 canals reach the circular vessel. There are neither marginal sense-organs nor cirri.

Specific Characters. — The bell is mitre-shaped and 3 mm. in height. There are 32 marginal tentacles. 16 of these are well developed, and are situated at the bases of the 16 radial canals; and the others are smaller, and alternate with the large tentacles in position. The large tentacles are only about one quarter as long as the bell height, and the others are much smaller. There are no marginal sense-organs. The velum is well developed. The proboscis has the shape of an 8-rayed star, each ray of which bifurcates, thus giving rise to 16 radial canals which reach the circular vessel. The gastric portion of the proboscis is wide, but flat, and the mouth extends but a short distance down into the bell cavity. The gonads appear to be situated upon the 8 rays of the stomach. Two specimens were found at the Tortugas, Florida, on July 10, 1898.

As it floats in the water this medusa bears a wonderfully close resemblance to the little pelagic Alga (Trichodesmium), which is very abundant at the Tortugas.

STAURODISCUS, Haeckel, 1879.

Staurodiscus tetrastaurus, Haeckel.

Figs. 47-49, Plates 18, 19.

Staurodiscus tetrastaurus, Haeckel, E., 1879, Syst. der Medusen, p. 145, Taf. IX. Figs. 1–3.

Specific Characters. — The bell is 4.5 mm. in diameter, and about twice as wide as it is high. In adult medusæ there are 8 long flexible tentacles with hollow basal bulbs. In some specimens there are 24, and in others 16 sensory clubs upon the bell margin. There are always 32 black entodermal ocelli, one at the base of each tentacle bulb and sensory club. The velum is well developed. Only 4 radial canals reach the circular vessel. Each of these canals gives rise to a pair of side branches that end blindly. The gonads are situated upon these side branches and upon the distal portion of each radial canal. The proboscis bears 4 prominent lips. The color of the entoderm of this medusa is green or yellow.

In the youngest specimen observed, the bell was 1 mm. in diameter and about as high as it was broad. There were 4 well-developed tentacles, 4 rudimentary tentacle bulbs, and 8 marginal clubs (see Figure 47, Plate **18**). The medusa was very common at the Tortugas, Florida, in July and August, 1898. Haeckel, 1879, found this species in the Canary Islands, at Lanzerote.

TETRACANNOTA, nov. gen.

Tetracannota collapsa, nov. sp.

Figs. 14-16, Plates 7, 8.

Generic Characters. — Tetracannota is closely allied to Cannota and Berenice. It may be defined as having 16 radial canals, which in the adult become arranged in 4 groups, each group consisting of 4 canals. Gonads 16 in number, and situated upon the distal regions of the radial canals. An entodermal pigment spot at the base of each tentacle. No otocysts. Tentacles numerous.

Specific Characters. — Adult medusa; Figure 14. The bell is 7 mm. in diameter, and about as high as it is broad. The top is dome-shaped, and the side walls are vertical. There are 16 well-developed tentacles that are carried tightly coiled in close helices. In addition to these there are 112 very small, rudimentary tentacles. Dark-brown entodermal pigment is found at the base of each tentacle. There are 16 radial canals, arranged in 4 groups of 4 each. The gonads are found in the proximal portions of the 16 radial canals very near to the point where they branch off from the proboscis. The peduncle of the proboscis is wide and prominent. The proboscis possesses 8 slightly crenu-

lated lips. The entoderm of the proboscis in some specimens is green, in others pearly-white or yellowish. The entodermal pigment spots at the bases of the tentacles are dark brown.

Stages in Development. — The youngest medusa observed possessed a bell 1.5 mm. in diameter (see Figure 15). It had 4 simple radial canals, and 32 tentacles, 4 well developed and 28 rudimentary. The velum was prominent. There were 4 lips to the proboscis, and as yet no peduncle. There was no trace of the genital organs. In the next older stage (Figure 16), we find 16 radial canals, and 8 lips to the proboscis. As yet there is no peduncle and no trace of the gonads, nor have the radial tubes grouped themselves into four bundles as in the adult.

This medusa was very common at the Tortugas in June, and ample opportunity for observing its transformation was afforded. It possesses the curious habit of collapsing into an almost shapeless mass, in which condition it may remain for several hours and then "straighten out" and swim about in excellent condition.

Fewkes, 1883 ("On a Few Medusæ from the Bermudas," Bull. Mus. Comp. Zoöl., Vol. XI., No. 3, Figures 7, 7ª) has evidently figured the young of this species under the name of "Larva of an unknown Tubularian."

DYSCANNOTA, Haeckel, 1879.

Dyscannota gemmifera.

Fig. 17, Plate 8.

Willia ornata? Brooks, W. K., 1880, American Naturalist, Vol. XIV. p. 670.

Willia ornata, Brooks, W. K., 1881, Studies Johns Hopkins Univ. Marine Lab., Vol. II. p. 144.

Willia gemmifera, Fewkes, J. W., 1882, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. IX. p. 300, Fig. 24, Pl. I.

Specific Characters. — The bell is hemispherical, with a slight apical projection, and is 4 mm. in diameter. There are 12 long tentacles with well-developed basal bulbs. Each tentacle arises from the point of juncture of a radial tube with the circular vessel. The velum is well developed. 4 radial vessels arise from the proboscis, and each of these gives rise to two side branches, so that 12 radial tubes reach the circular vessel. In addition to these 12, very slender tubes branch off at right angles to the circular vessel and end blindly in the gelatinous substance of the bell. These tubes alternate with the 12 radial tubes and tentacles. Each one terminates under a cluster of nematocysts upon the outer surface of the bell. The proboscis is long and slender, and reaches about three quarters of the distance from the apex of the bell cavity to the velar opening. It is provided with 4 slightly recurved and fimbricated lips. This species is remarkable in that a stolon arises from each

of the 4 main radial canals near to their point of juncture with the proboscis. Each of these stolons gives rise to a number of medusa buds. The medusæ become free and thus the species is perpetuated. The proboscis is of a decided sage-green, and the entoderm of the basal bulbs of the tentacles is brown. A number of specimens of this medusa were found at the Tortugas, Florida, in June. A single specimen was found by Brooks at Beaufort, North Carolina. Brooks considered it to be an asexual form of Willetta ornata, and this explanation may prove to be correct; we have not found the sexual form of W. ornata, however, at the Tortugas, and incline to regard it as a distinct species.

The species differs from the common Willia ornata, A. Agassiz, of Buzzard's Bay and Newport Harbor, in that the proboscis is far more slender, the narrow tubes branching off from the circular vessel end each in a single cluster of nematocysts, instead of several clusters as in Willetta ornata; and above all, the possession of stolons bearing medusa buds separates this form from all other known Atlantic species of Willetta. It is interesting to notice that Huxley (1891, Anatomy Invert. Anim., p. 120, Figure 17) took a species of Willsia (Willetta) in the north Pacific, in which medusa-bearing stolons were developed at the point of bifurcation of each of the four main radial canals.

LAODICEA, Lesson, 1843.

Laodicea neptuna, nov. sp.

Figs. 50–52, Plate 20.

Specific Characters.— The bell is a little more than a hemisphere, and is 2.5 mm. in diameter. There are 8 short tentacles with large basal bulbs, and 8 small rudimentary tentacle bulbs. The tentacles are thickly covered with nematocysts and are usually carried coiled in a contracted bunch. A single, large, black ocellus is found at the base of each tentacle. There are numerous small nematocyst-bearing cirri upon the bell margin between the tentacles. The velum is well developed. There are four straight radial tubes, the upper regions of which, adjacent to the proboscis, are occupied by the gonads. The proboscis reaches slightly beyond the velar opening, and the lips are surrounded by 4 prominent clusters of nematocyst cells. The color of the entoderm of the proboscis, tentacle bulbs, and circular and radial tubes is pearly-white. The entodermal lamella of the bell is of a delicate shade of green. This medusa was occasionally found at the Tortugas, Florida, during July and August, 1898.

Laodicea ulothrix, Haeckel.

Laodicea ulothrix, Haeckel, E., 1879, Syst. der Medusen, p. 133, Taf. VIII., Figs. 5–7.

Specific Characters. — The bell is about 20 mm. in diameter and is about twice as broad as it is high. (Haeckel, 1879, p. 133, says "etwa doppelt so hoch als breit.") This is doubtless a misprint. There are 70–100 long, slender, stiff tentacles, the distal ends of which are coiled in a close helix. The basal bulbs of these tentacles are large and hollow, and there is a well-developed ectodermal ocellus upon the inner (centripetal) side of each bulb. In addition to these ocelli one often sees small spur-like projections upon the outer (centrifugal) sides of the tentacle bulbs. Not all of the tentacles possess these spurs. Sensory clubs and cirri are scattered somewhat irregularly between the tentacles. The sensory clubs are almost as numerous as the tentacles. They are flask-shaped, and their entodermal cores are in direct connection with the entoderm of the circular tube. There are no otoliths. The cirri are usually less numerous than the tentacles. They are coiled in a helix, and their distal ends are covered with large spindle-shaped nematocyst-capsules. The velum is well developed. There are 4 straight, narrow, radial tubes, the proximal halves of which, adjacent to the proboscis, are occupied by the gonads. The proboscis is short, and there are 4 recurved lips. The entoderm of the proboscis, gonads, and tentacle bulbs is brownish-white, or greenish-white in color. This medusa is one of the commonest at the Tortugas, Florida. Haeckel found it at the Canaries, and Brooks describes it from the Bahama Islands. The distribution of the sensory clubs is usually more irregular than is described by Brooks.

TIAROPSIS, Agassiz, L., 1849.

Tiaropsis punctata, nov. sp.

Figs. 60-63, Plate 22.

Tiaropsis diademata, Fewkes, J. W., 1882, Bull. Mus. Comp. Zoöl., Vol. IX. p. 277, Pl. VII. Figs. 13–14.

Specific Characters. — The bell is bluntly cone-shaped and is 4 mm. in diameter. There are 4 well-developed, radially placed tentacles, the distal ends of which are usually coiled in a close helix. In addition to these there are 4 rudimentary tentacle bulbs. The 8 marginal sense-organs are situated midway between the 8 tentacles. Each of these organs consists of a pocket-like fold of the velum containing 8–13 otoliths. Immediately above the otocyst there is a well-developed, deeply pigmented eye (see Linko, A., 1899; Travaux Soc. Imp.

des Nat. de St. Pétersbourg, T. XXIX. p. 155, Plate I. Figure 5). The velum is very well developed. There are 4 straight, narrow, radial tubes, upon the upper regions of which the gonads are situated. The proboscis is wide and flask-shaped, and the mouth is provided with four prominent, crenulated lips. The color of the entoderm of the proboscis and tentacle bulbs is ochre-yellow, or reddish-brown. Several specimens were found at the Tortugas, Florida, late in June and early in July, 1898, and in June, 1899.

It is evident that this species has been noticed by Fewkes, 1882, under the name of "Tiaropsis diademata." The species is quite distinct from T. diademata, however, for it is smaller, possesses fewer tentacles, and is of a different color; moreover the bell of the young medusa is very much flatter than is that of T. diademata in a corresponding stage of development. The Tortugas form is closely allied to T. roseæ of the Fiji Islands; and it also bears some resemblance to T. mediterranea, Metschnikoff (1886; Arbeit Zool. Inst. Wien. Bd. VI. p. 239, Taf. I. Figs. 6–8).

OCEANIA, Peron and Lesueur, 1809.

Oceania McCradyi.

Figs. 56–59, Plate 21.

Epenthesis McCradyi, Brooks, W. K., 1888, Studies Johns Hopkins Univ. Biol. Lab., Vol. IV. pp. 147–162, Pls. 13–15.

We present some colored figures of this remarkable medusa which develops hydroid-blastostyles upon its gonads. It has been found by Brooks among the Bahama Islands, and by Bigelow off the Florida Coast. We found it at the Tortugas, Florida, in July, 1898. Brooks, 1888, claims to have found the hydroid of this species.

Oceania magnifica, nov. sp.

Figs. 18, 18a, Plate 9.

Specific Characters. — The bell is thin and flat and 14 mm. in diameter. There are 32 slender tentacles of short length. There are 64 otocysts, 2 between each successive pair of tentacles. Each otocyst contains a single, spherical otolith. The velum is small. There are 4 straight, narrow, radial tubes. The gonads are developed upon the distal portion of these tubes near to the circular canal. The proboscis is short, and there are 4 sharply curled lips. The color of the entoderm of the proboscis and tentacle bulbs is intense green, while the ectoderm of the proboscis and of the genital organs is usually rich purple.

Several specimens were found at the Tortugas, Florida, in June, 1897, and a large number during the summers of 1898 and 1899.

Oceania globosa, nov. sp.

Figs. 19, 19[a], Plate 9.

Specific Characters. — The bell is globular in form, 14 mm. in diameter, The cavity of the bell is shallow so that the gelatinous substance is very thick. There are 32 large tentacles and 32 rudimentary ones. There are 64 otocysts alternating with the tentacles. Each otocyst contains 3–5 spherical otoliths (Figure 19[a]). There are 4 straight, narrow, radial canals. The 4 gonads are situated upon the distal portions of the canals. The proboscis is very short and there are 4 prominent lips. The color of the entoderm of the proboscis and tentacle bulbs is light drab.

Single specimen found at Tortugas, June 16, 1897.

Oceania gelatinosa, nov. sp.

Figs. 20, 20[a], Plate 10.

Specific Characters. — The bell is 7 mm. high and 3.3 mm. in diameter. The gelatinous substance of the upper portion of the bell is very thick. There are 16 well-developed tentacles and 16 rudimentary ones that may develop later. There are 32 otocysts alternating with the tentacles. Each of these otocysts contains 3–5 spherical otoliths (Figure 20[a]). The velum is prominent. There are 4 radial canals, in the upper or proximal portion of which the gonads are developed. The proboscis is long and slender and there are 4 prominent lips. The color of the entoderm of the proboscis and tentacle bulbs is light drab, or opaque white.

A specimen was found at the Tortugas, Florida, on June 14, 1897, and several others during the summer of 1899.

Oceania discoida, nov. sp.

Figs. 53-55, Plate 20.

Specific Characters. — The bell is quite flat, with conically sloping sides, and is 4 mm. in diameter. There are 16 short marginal tentacles with large basal bulbs. There are usually 3 otocysts between each successive pair of tentacles (see Figure 55). The velum is well developed. There are 4 straight radial tubes, upon the greater portion of the length of which the gonads are situated. In the case of the female the eggs are very large and prominent. The proboscis is urn-shaped and there are 4 recurved lips. The proboscis, gonads, and tentacle bulbs are yellow, or yellow-green. The entodermal supporting lamella of the bell is often of a delicate shade of green. The medusa is easily distinguished from the other species of Oceania at the Tortugas by the circumstance that it is very small in size, the bell is conical in shape, and the gonads are large and prominent. It is quite common throughout the summer.

Obelia, sp.

Eucope, sp. Agassiz, A., 1881, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. IX. p. 149.

A very few specimens of the medusa of an Obelia were found at the Tortugas, Florida, late in June, 1898. The bell was disk-shaped and about 3 mm. in diameter. There were 96 tentacles and 8 otocysts. The gonads were large and spherical, and much distended with ova. The bell was colorless. Not having seen the hydroid stock we are unable to determine whether or not this Obelia is identical with any of the forms found at Newport, R. I.

EPENTHESIS, McCrady, 1857.

Epenthesis folleata, McCrady.

Fig. 139, Plate 41.

Epenthesis folleata, McCrady, J., 1857, Gymn. Charleston Harbor, p. 89.
Oceania folleata, Agassiz, A., 1865, North Amer. Acal., p. 70.

Specific Characters. — Adult medusa. The bell is usually flatter than a hemisphere, and is about 5 mm. in diameter. Its cavity is shallow, and the bell walls diminish in thickness very gradually from the summit towards the margin. There are 16 slender tentacles with well-developed basal bulbs. 16 otocysts alternate in position with the tentacles. Each otocyst contains a single spherical otolith. The velum is well developed. There are 4 slender, straight, radial canals and a narrow ring-canal. The proboscis is short and simple and there are 4 slightly recurved lips. The 4 gonads are short and linear and are developed upon the 4 radial canals near the circular canal. In the young medusa they are found higher up upon the radial canals, but they migrate centrifugally as development proceeds. The entoderm of the proboscis, tentacle bulbs, and gonads is of a decided green color. This medusa is very common at the Tortugas, Florida, during the spring months, but becomes rare after the first of June. We have found it abundant in the Bahamas during the winter months. It is rare at Charleston, South Carolina, but Brooks found both hydroid and medusa at Beaufort, North Carolina.

EUCOPIUM, Haeckel, 1879.

Eucopium parvigastrum, nov. sp.

Fig. 140, Plate 42.

Specific Characters. — The bell is half egg-shaped and is 1 mm. in height. There is a very small apical projection. There are 4 very small radially

situated tentacles, which are hardly more than mere tentacle bulbs. There are 8 otocysts, 2 in each quadrant. Each otocyst contains a single spherical otolith. The velum is well developed. There are 4 straight, narrow, radial canals, and a slender circular vessel. The proboscis is very small, and is a mere tube, cruciform in cross-section and provided with 4 simple lips. The gonads occupy 4 linear swollen regions near the mid-regions of the 4 radial canals. The entoderm of the tentacle bulbs, gonads, and proboscis is of a decided brown color. This medusa was quite common at the Tortugas, Florida, late in June, 1899.

The very small proboscis and marginal tentacles as well as the remarkable swollen condition of the gonads in this medusa foreshadow the condition of Agastra mira (Hartlaub, 1897; Wissen. Meeresuntersuch. Biol. Anstalt Helgoland, Neue Folge, Bd. II. p. 504, Taf. XII. Fig. 10), where there is no trace either of proboscis or tentacles.

PSEUDOCLYTIA, nov. gen.

Pseudoclytia pentata, nov. sp.

Figs. 24-26, Plate 12; Figs. 35, 35a, Plate 15; Figs. 131, 132, Plate 39.

Generic Characters. — Pseudoclytia. Eucopidæ with numerous simple tentacles (20 in this species). Otocysts alternating with the equally numerous tentacles. 5 simple radial canals, 72° apart. 5 gonads situated upon the 5 radial canals. The proboscis lacks a peduncle and is provided with 5 simple lips.

Specific Characters. — Adult medusa. The bell is flatter than a hemisphere and is 8–13 mm. in diameter. There are 20 simple tentacles with well-developed basal bulbs. Each of these tentacles is a little less than half as long as the bell height. There are no lateral or marginal cirri. There are 20 otocysts which alternate in position with the 20 tentacles. Each otocyst contains a single spherical otolith (Figure 26). The velum is well developed. There are 5 straight, narrow, radial canals 72° apart. The 5 gonads are situated upon the radial canals at points midway between the proboscis and the bell margin (Figures 35, 131). In the female the ova are large and prominent, and when immature are seen to have a well-defined nucleus and nucleolus (Figures 35a, 131). The proboscis is flask-shaped and there are 5 simple recurved lips. The entoderm of the proboscis, gonads, and tentacle bulbs is usually slightly milky in color, with a few scattered cinnamon-colored granules. Occasionally an individual is met with in which these cinnamon-colored granules are developed to such an extent that the medusa displays a brick-red color (Figure 35). In most individuals, however, the colored granules are so faint as to be almost imperceptible. In some individuals there is a more or less decided green spot in the entoderm of each tentacle bulb (Figures 131, 132).

This medusa is very common throughout the summer months at the Tortugas, Florida. On July 22, 1898, a great swarm of them appeared, and were so abundant that one could not dip up a bucketful of sea-water without capturing several specimens; and two such swarms came in the summer of 1899.

This is the only Hydromedusa known which is normally formed upon the plan of five (pentamerous). It seems very probable that it has arisen, phylogenetically, as a sport from some species of Epenthesis or Oceania, some individuals of which made their appearance with 5 radial canals instead of 4; and these abnormal individuals succeeded in perpetuating a new species. Bateson (1894; Materials for the Study of Variation, p. 425) calls attention to an abnormal specimen of Sarsia mirabilis having five complete segments, and says that "there is perhaps in the whole range of natural history no more striking case of the Discontinuity and perfection of Meristic Variation. In the case of Eucope (Obelia) it has been shown by Agassiz and Woodworth (1896; Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXX. p. 121–150, 9 Plates) that among 3,917 medusæ 9 had three radial canals, 20 had five, and 3 had six radial canals. It thus appears that in Obelia the tendency to produce sports having 5 radial canals is about twice as great as that to produce individuals with any other number of canals. Yet sports of Obelia with 5 radial canals have not succeeded in perpetuating a new species.

I have made careful observations of 1000 individuals of Pseudoclytia pentata, and find that 70.3% are normal (*i. e.* have 5 canals 72° apart, 5 gonads, and 5 lips to the proboscis). The remaining 29.7% are abnormal in some respects, and a large number of the abnormalities tend toward the ancestral condition of 4 canals and 4 lips. The medusa is very much more variable than the 4-rayed Epenthesis folleata at the Tortugas, and its greater variability *may* be due to the fact that being a new form it displays a greater tendency toward variability in various directions. This question will, however, be made the subject of a special paper.

MULTIORALIS, nov. gen.

Multioralis ovalis, nov. sp.

Figs. 129, 130, Plate 39.

Generic Characters. — Multioralis. Leptomedusæ having a circular canal, and a single, simple chymiferous canal which extends across the sub-umbrella. A number of separate manubria are situated upon the chymiferous canal.

Specific Characters. — Adult medusa. The bell is quite flat, and is elliptical in outline, the major axis being 4 mm. and the minor 2.4 mm. The gelatinous substance is not very thick and is quite flexible. There are 20–25 short, simple, coiled tentacles with well-developed basal bulbs. These tentacles are only about one half as long as the minor axis of the bell. There are no lateral or marginal cirri. The otocysts are slightly more numerous than the tenta-

cles; usually one, but occasionally two, being found between each successive pair of tentacles. Each otocyst contains a single spherical otolith. The velum is simple and quite broad. There is a slender circular vessel, and a single straight chymiferous canal extends along the major axis of the bell. In the oldest medusæ observed there were 4 manubria. Two equally developed large manubria were situated on either side of the centre of the sub-umbrella, upon the chymiferous canal; while two small manubria were found upon the same canal centrifugally away from the larger manubria. There was thus no manubrium at the centre of the sub-umbrella. There were two small gonads upon the chymiferous canal immediately centrifugal from the small manubria. The entoderm of the manubria and of the basal bulbs of the tentacles is of an opaque glistening white. The supporting lamella of the bell is of a delicate green.

Young Medusa. — In the youngest medusa observed, there were but 2 manubria situated upon the chymiferous canal on either side of the centre of the disk. The major axis of the bell was 2.5 mm. and there was no trace of gonads. About a dozen specimens of this medusa were captured at the Tortugas, Florida, from June 30–July 2, 1899.

It seems possible that the bell of the large medusæ may divide by transverse fission, for one individual was found in which there was a decided notch in the bell-margin extending inward in the plane passing through the centre of the sub-umbrella perpendicular to the main chymiferous tube. This notch appeared, however, upon only one side of the bell and may have been due to an accident. The main chymiferous canal is of course equivalent, morphologically, to two diametrically opposed radial canals.

EUCHEILOTA, McCrady, 1857.

Eucheilota ventricularis, McCrady.

Fig. 128, Plate 38.

Eucheilota ventricularis, McCrady, J., 1857, Gymn. Charleston Harbor, p. 85, Pl. 11, Figs. 1, 2; Pl. 12, Figs. 1–3.

This medusa is quite rare at the Tortugas, Florida, and not more than a dozen specimens were obtained. They were remarkable in that the entoderm of the tentacle bulbs and proboscis was of a decided green color. Each otocyst contained 2–4 spherical otoliths. In specimens 2 mm. in diameter there were as yet no gonads upon the radial canals.

Eucheilota bermudensis.

Oceanopsis bermudensis, Fewkes, J. W., 1883, Bull. Mus. Comp. Zoöl., Vol. XI. p. 86, Pl. I. Figs. 8–10.

Specific Characters. — Adult medusa. The bell is not quite hemispherical, the sides being relatively straight and sloping and the top quite flat. It is about 6 mm. in diameter. There are 8 tentacles, 4 radial and 4 interradial. These tentacles are only about one third as long as the bell diameter, and are thickly covered with nematocysts. Their basal bulbs are large, and are each flanked by a pair of short, coiled, nematocyst-bearing cirri. In addition to these there are normally about 8 other cirri in each quadrant, and scattered between them are 8 otocysts. Thus the medusa has 32 otocysts and 48 cirri. Each otocyst is of small size and contains a single spherical otolith. The velum is well developed. There are 4 straight, narrow, radial canals, and a simple circular vessel. The proboscis is short, but wide, and there are 4 cruciform, slightly recurved lips. There is no peduncle. The 4 gonads are found upon the 4 radial canals near the proboscis. These are visible in young medusæ about 1.5 mm. in diameter; and in the adult they become quite large and swollen, the ova being distinctly seen lying along the side of the canal. The entoderm of the proboscis gonads and tentacle bulbs is grass green, and the supporting lamella of the bell is tinged with the same color. This medusa was quite common at the Tortugas, Florida, from June 17–25, 1899.

Young Medusa. — The youngest medusa was about 2 mm. in height and 1.5 mm. in diameter. It was very much in the condition described by Fewkes, 1883. There were 4 simple radially situated tentacles and 4 interradial tentacle bulbs. The interradial tentacle bulbs were flanked by lateral cirri, while the radial tentacle bulbs lacked these appendages. There were 4 otocysts, one upon the side of each of the interradial tentacle bulbs. Each otocyst contained a single spherical otolith. The gonads were already quite large, and lay along the 4 radial canals near the sides of the proboscis. The proboscis was short, and there were 4 simple lips.

Eucheilota paradoxica, nov. sp.

Figs. 134-136, Plate 40.

Specific Characters. — Adult medusa: the bell is somewhat fuller than a hemisphere and is 4 mm. in diameter. The gelatinous substance is of moderate thickness, and there is a very slight, blunt, aboral projection. There are 4 equally developed, radially situated tentacles. These tentacles are about as long as the bell height, but are usually carried coiled in a close helix. Their basal bulbs are elongate, and are hollow. The shafts of these tentacles are thickly covered with nematocysts. A pair of tightly coiled lateral cirri arise from the sides of each tentacle bulb. In addition to these well-developed tentacles there

are 4 interradial, rudimentary tentacle bulbs which are flanked by lateral cirri. There are 8 otocysts, 2 in each quadrant. Each otocyst contains a single spherical otolith. The velum is well developed. There is a narrow circular vessel, and 4 straight simple radial canals. The proboscis is flask-shaped, and there is no peduncle. There are 4 simple cruciform lips. Medusa buds in various stages of development are found upon the 4 gonads, which are situated at the middle points of the 4 radial canals. These medusa buds first develop 2 diametrically opposed tentacles (Figure 135), but when about to be set free they have 4 equally developed tentacles as in the adult. They have, however, no trace of gonads, and the interradial tentacle bulbs are not provided with lateral cirri. Usually from 2–5 medusa buds in several stages are found upon each gonad. The entoderm of the proboscis gonads and tentacle bulbs is of a milky-green color.

This medusa was common at the Tortugas, Florida, in June, 1899.

This is the first and only Leptomedusa which has been observed to give rise to free medusa buds.

EUTIMA, McCrady, 1857.

Eutima mira, McCrady.

Eutima mira, McCrady, J., 1857, Gymn. Charleston Harbor, p. 88, Pl. XI. Figs. 8, 9.

This medusa is common throughout the summer at the Tortugas, Florida. It is also abundant at Charleston, South Carolina, and at Beaufort, North Carolina. Damaged specimens are occasionally drifted into Newport Harbor, Rhode Island, by the southerly winds, late in the summer.

EUTIMALPHES, Haeckel, 1879.

Eutimalphes cœrulea.

Figs. 22, 22[a], Plate 11.

Eirene cœrulea, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV., p. 362.
Irene cœrulea, Haeckel, E., 1879, Syst. der Medusen, p. 203.

Specific Characters. — The bell is 10 mm. in diameter and a little broader than it is high. The gelatinous substance at the apex of the bell is quite thick, but becomes progressively thinner as one approaches the margin. There are about 32 short, slender, marginal tentacles, each one of which is furnished with small lateral cirri. In addition to the well-developed tentacles there are about 96 rudimentary tentacular swellings upon the bell margin. There are usually about three of these swellings between each successive pair of tentacles. (Figure 22[a].) There are 8 otocysts, 2 in each quadrant, and each one of them contains 3–5 spherical otoliths. There are 4 radial tubes. The

velum is well developed. There are 4 linear, slightly convoluted gonads. They begin about halfway between the circular vessel and the peduncle, and extend to a point close to the proboscis. The peduncle is well developed and reaches slightly beyond the velar opening. The gastric portion of the proboscis is short and is furnished with 4 slightly fimbricated lips. The proboscis, gonads, and tentacle bulbs are opaque white. Common at the Bahamas and Tortugas in the spring and winter months.

EUTIMIUM, Haeckel, 1879.

Eutimium serpentinum, nov. sp.

Figs. 69–72, Plate 23.

Specific Characters. — The bell is 10 mm. in diameter, and about 2½ times as broad as it is high. There are 4 radially situated tentacles; each being about as long as the bell diameter. There are no lateral or marginal cirri. The 8 otocysts are situated near to and on both sides of the radial tentacles. (Figure 70.) Each otocyst contains 4–8 spherical otoliths. The velum is well developed. There are 4 straight narrow radial tubes and a narrow circular vessel. The proboscis possesses a very long peduncle, which is about 3 times as long as the bell diameter. The upper region of the peduncle is conical in shape; then follows a long slender cylindrical region leading to the gastric part of the proboscis, which is urn-shaped with 4 slightly recurved lips. (Figure 71.) The 4 gonads are situated upon the long cylindrical portion of the peduncle, where they lie upon the radial canals. (Figure 72.) The proboscis, gonads, and tentacles are opaque bluish-white. Half a dozen specimens of this medusa were found at the Tortugas, Florida, late in July, 1898. It is closely allied to Eutimium elephas, Haeckel (1879; Syst. der Medusen, p. 190, Taf. XII. Figures 10–12), of the German Ocean.

PHORTIS, McCrady, 1857.

Phortis lactea, nov. sp.

Fig. 133, Plate 40.

Specific Characters. — The bell is 5 mm. in diameter and the sides flange slightly outward at the margin. The gelatinous substance is of moderate thickness at the aboral pole, but becomes thin at the margin of the bell. There are about 18–22 short simple tentacles, the basal bulbs of which are large and swollen. These tentacles are only about one fifth as long as the bell diameter. There are no lateral or marginal cirri. The otocysts are slightly more numerous than the tentacles, there being at least one, and occasionally two, of these structures between each successive pair of tentacles. Each otocyst contains a

single spherical otolith. The velum is well developed. There are 4 straight slender radial canals, which extend down the peduncle to the gastric portion of the proboscis. The peduncle is wide at its base, but not so wide as in Phortis pyramidalis. It extends for a short distance beyond the velar opening of the bell. The gastric portion of the proboscis is cruciform in cross-section and there are 4 simple recurved lips. The 4 gonads are situated upon the 4 radial canals a short distance above their junction with the circular vessel. Each gonad is linear, and in the female the ova are quite conspicuous. The gonads and the gastric portion of the proboscis are milky in color, while the tentacle bulbs are cream-colored with greenish entodermal granules. Found at the Tortugas, Florida, in June.

Phortis pyramidalis.

Figs. 21, 21ª, Plate 10.

Eutima pyramidalis, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV., p. 363.

Specific Characters. — Adult medusa. The bell is slightly flatter than a hemisphere, and attains a diameter of about 35 mm. There are about 100 small slender tentacles, which lack lateral cirri. About 100 otocysts alternate with the equally numerous tentacles. Each otocyst contains a single spherical otolith. (Figure 21ª.) There are 4 narrow radial canals. The proboscis is provided with a wide cone-shaped proboscis which fills most of the cavity of the bell, and projects outward for a considerable distance beyond the velar opening. The gastric portion of the proboscis is very small, and is provided with 4 delicately crenulated lips. The gonads are linear and are developed upon the centrifugal portions of the 4 radial canals near to the circular canal. The proboscis, tentacle bulbs, and gonads are of a delicate blue-green color. This medusa is very abundant among the Bahama and Tortugas Islands. At night, when disturbed, it glows with an intense blue-green phosphorescence which is far more brilliant than that of any other medusa that we have observed.

Young Medusa. — Phortis pyramidalis. In the youngest medusa observed the bell was higher than a hemisphere and 3 mm. in diameter. There was no peduncle to the proboscis, and the gelatinous substance of the bell was not very thick. There were 4 slender radial tubes and 16 tentacles, only 8 of which had attained to any length, the others being mere basal bulbs. There were about 8 otocysts, each containing a single spherical otolith. When the medusa is about 7 mm. in diameter, the bell is flatter than a hemisphere. The peduncle is well developed and extends beyond the velar opening. The gastric portion of the proboscis has grown very little and is relatively to size of the medusa much smaller than in the younger animal. There are 4 recurved lips. There are now about 32 tentacles and 16 otocysts.

ZYGODACTYLA, Brandt, 1835.

Zygodactyla cubana, nov. sp.

Figs. 84, 85, Plate 25.

Specific Characters. — Young medusa. The bell was quite flat and disk-shaped and 4.5 mm. in diameter. There were 8 long tentacles, 8 rudimentary, undeveloped tentacles, and 16 very small undeveloped tentacle bulbs, that probably develop later into tentacles. The tentacle bulbs possessed excretion papillæ and were further distinguished by the fact that there were two entodermal green pigment spots one on either side of the bulb (see Figure 85). These spots had the appearance of ocelli, but we do not venture to state that they are such. There were 32 otocysts, each containing one or two spherical otoliths. The velum was well developed. There were 16 radial canals, only 8 of which reached the circular vessel. The 8 others projected about halfway from the proboscis to the circular canal. The proboscis was wide and flask-shaped, and projected for a considerable distance beyond the velar opening. The 16 lips were recurved. The gonads were beginning to appear upon the radial canals. The entoderm of the proboscis and radial canals is sage-green. The entoderm of the tentacle bulbs was flesh-colored and the "ocelli" were green. Tortugas, Florida, July 25–29, 1898, and June, 1899.

Zygodactyla cyanea, Agassiz, L.

Figs. 23, 23ª, Pl. 11; Figs. 33, 34, Pl. 15.

Zygodactyla cyanea, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. p. 361.
Mesonema cyaneum, Haeckel, E., 1879, Syst. der Medusen, p. 227.

Specific Characters. — Adult medusa. None of our figures were drawn from full-grown medusæ. The bell is flatter than a hemisphere and is about 45 mm. in diameter (22 mm. in Figure 33). The gelatinous substance of the central part of the bell is very thick and there is a well-developed peduncle which projects downward into the cavity of the stomach. The peripheral zone of the bell is quite thin and flexible. There are 90–100 well-developed tentacles with large conical basal bulbs. Each tentacle bulb is hollow and is provided with a conical excretion papilla which projects outward (centrifugally). See Figure 34, Plate **15**. There are one or two (usually one) otocysts between each successive pair of tentacles. Each otocyst contains one or two spherical otoliths. The velum is well developed. There are 90–100 simple, straight radial tubes. The radial tubes do not extend down the peduncle of the proboscis, but empty into the stomach cavity at their highest point. The proboscis is wide and shallow, and does not protrude beyond the velar opening. The mouth is surrounded by numerous crenulated lips which are equal in number to the radial

canals. The stomach is about two thirds as wide as the bell diameter. The gonads are linear, and occupy almost the whole length of the radial canals. The entoderm of the gonads, tentacle bulbs, and proboscis is blue-green. The medusa is very common off the Florida Coast both in summer and winter.

ÆQUOREA, Péron and Lesueur, 1809.

Æquorea floridana.

Rhegmatodes floridanus, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. p. 361.

Specific Characters. — The bell is hemispherical and 25 mm. in diameter. The gelatinous substance of the bell is thick and of a tough consistency. There are 16 radial tubes and 64 well-developed marginal tentacles. The tentacle bulbs are large and hollow, and are provided each with one or two excretion papillæ, which project outward from the side of the bell. There are about 192 otocysts, three between each successive pair of tentacles. Each otocyst contains 2 spherical otoliths. The velum is well developed. The 16 gonads are developed upon the distal halves of the 16 radial canals. The surface of the mature gonads is slightly convoluted. The proboscis is wide and very shallow, and there are 16 slightly fimbricated lips. The gonads and the edge of the bell are milky-white. Common at the Tortugas and Bahamas in the spring months.

RHACOSTOMA, Agassiz, L., 1862.

Rhacostoma dispar, nov. sp.

Figs. 27-29, Pl. 13.

Specific Characters. — The bell is lens-shaped, and about 40 mm. broad and 20 mm. high. The cavity of the bell is remarkably small and shallow, so that the gelatinous substance is very thick. The velar opening of the bell is only about 5 mm. in diameter. There are about 8 very small rudimentary tentacles. There are 30–40 otocysts scattered between the tentacles. Each otocyst contains 3–5 oval-shaped otoliths (see Figure 29). There are no excretion papillæ. The velum is well developed. There are about 80 radial tubes, fully half of which end blindly without reaching the circular tube. The gonads are situated upon all of the radial tubes. They are linear, and their surfaces are slightly convoluted. They do not extend quite to the peripheri of the stomach, nor do they reach the circular canal. The proboscis is very wide, and may at times be protruded beyond the velar opening. There are about 80 small crenulated lips, which are apparently as numerous as the radial canals. The bell has a faint steel-blue tinge, and the genital organs are pink. A single specimen

was found at the Tortugas, Florida, in June, 1897. This remarkable species is extremely inactive. Owing to the small size of the velum, it is of but little service in swimming, and the medusa makes use of the contractions of its widely open mouth in order to propel itself through the water.

GONIONEMUS, Agassiz, A., 1865.

Gonionemus aphrodite.

Cubaia aphrodite, Mayer, A. G., 1894, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXV. p. 237, Pl. II. Figs. 1–3.

This medusa is occasionally met with at the Tortugas, Florida, and an examination of mature individuals has convinced me that it belongs to the genus Gonionemus. The gonads consist of a series of finger-shaped, or papilliform, processes that are crowded alternately to one side and the other of the radial canal very much as in the species of Gonionemus found at Woods Holl, Massachusetts.

GONIONEMOIDES, nov. gen.

Gonionemoides geophila, nov. sp.

Figs. 6-11, Plates 3-5.

Generic Characters. — This genus is closely related to Gonionemus, but differs from it in that the marginal tentacles are of two distinct kinds, and arise at slightly different levels from the bell margin. One of these sets of tentacles is provided with nettling cells, and the other is furnished with adhesive suckers, as in Gonionemus. There are 4 radial canals, and the circular vessel is simple without centripetal canals. The gonads are papilliform and are situated upon the radial canals. There are numerous otocysts upon the bell margin.

Specific Characters. — Adult medusa, Figures 6–9. The bell is quite flat and disk-shaped, and is about 9.5 mm. in diameter. There are 64 marginal tentacles. 16 of these bear, each one, a suctorial disk upon the aboral sides near their distal extremities. The extreme distal ends of the tentacles are cone-shaped, and are bent sharply at a right angle to the main shaft of the tentacle, very much as is the case in Gonionemus vertens, A. Agassiz. These sucker-bearing tentacles arise at a level, a little above the bell margin. The remaining 48 tentacles all arise from the bell margin, at a lower level than do the sucker-bearing ones. They possess no suctorial disks, but instead are armed with rings of nematocyst capsules (Figure 6). These nematocyst-bearing tentacles are far more flexible than are the sucker-bearing ones.

There are 12 otocysts upon the bell margin, each one of which contains a single otolith situated within an elongate, oval cavity (see Figure 7). The

velum is well developed. There are 4 straight radial tubes. The gonads occupy the distal halves of the radial tubes, but do not quite extend to the circular vessel. They present the appearance of a series of papilliform, or finger-shaped, processes that are crowded alternately to one side and the other of the radial tube, very much as is the case in Gonionemus vertens. The proboscis is a simple tube with 4 prominent lips. There are 4 radially situated green-colored spots upon the proboscis close to its junction with the 4 radial canals.

Young Medusa. — Figures 10, 11, Plate 5. The youngest medusa observed was 1.7 mm. in diameter. The bell was high and quite thick, and its aboral surface was covered with nematocyst capsules. The 16 sucker-bearing tentacles were already present, although the suctorial disk was visible upon only 8 of them. Figure 11 is a side view of the end of one of these young tentacles showing the beginning of the formation of the suctorial disk. There were 7 otocysts present. The velum was very prominent. There were no traces of genital organs present. The proboscis possessed a distinct peduncle. The color of the genital organs, bell margin, and proboscis of this medusa is pearly white. The entoderm of the tentacle bulbs and of the radial tubes in the region of the gonads is green. The ocelli ? of the proboscis are green.

The adult medusa would frequently lie flat upon the bottom of the aquarium with its oral surface upward (Figure 9, Plate 4). In this position the sucker-bearing tentacles would be stretched far out and the suckers would anchor the medusa to the bottom. The nematocystic tentacles, on the other hand, would wave freely upward apparently in position for the capture of prey. When disturbed the medusa would swim actively about for a few moments, and then reassume its characteristic position of rest.

This medusa was common at Key West from May 27–June 10, 1897.

HALICALYX, Fewkes, 1882.

Halicalyx tenuis, Fewkes.

Figs. 12, 13, Plates 5, 6.

Halicalyx tenuis, Fewkes, J. W., 1882, Bull. Mus. Comp. Zoöl. Harvard Coll., Vol. IX. p. 277, Pl. VII. Fig. 15.

Generic Characters. — This genus is closely allied to Gonionemoides, but differs from it in that none of the tentacles bear suctorial disks. The tentacles are of two distinct kinds and arise at different levels from the bell margin. The circular vessel gives off blind centripetal branches. There are otocysts at the bases of the tentacles. Tentacles numerous.

Specific Characters. — The bell is 25 mm. in diameter and is hemispherical. It is quite thick at the aboral pole, but becomes constantly thinner as one approaches the margin. The gelatinous substance is of very rigid consistency.

There are about 50 tentacles, and 64 short, blunt papillæ upon the bell margin. 32 of the tentacles arise from the side of the bell at a little distance above the margin. They are short and stiff and stand out sharply at right angles to the bell (see Figure 3). These tentacles are sprinkled over with wart-like protuberances of a deep purple color. A pair of otocysts, each containing a single otolith, are situated at the base of each of these stiff tentacles. Thus the medusa possesses 64 otocysts. In addition to the stiff tentacles there are about 20 others that are long and flexible, and arise from the bell margin. They are covered with rings of nematocyst cells closely coiled in a helical manner (see Figure 12). These tentacles are very flexible and are constantly being expanded to a length of 4–5 times the diameter of the bell and then contracted with a sudden jerk. The velum is small. There are 4 straight, narrow, radial tubes. The circular vessel is peculiar in that it gives off blindly ending, centripetal branches or diverticulæ, that penetrate inward into the substance of the bell. There are in all 28 side branches. 4 of these are each about half as long as the radial tube. 8 others are only one quarter as long as this, and the 16 remaining ones are still shorter. These diverticulæ are situated immediately above the short, stiff tentacles (see Figure 13). The gonads are found occupying the distal half of the radial canals, but do not reach quite to the bell margin. They hang downward into the bell cavity as a complex system of finger-shaped papillæ. The proboscis is very slender and the lips prominent. It extends for about three quarters of the distance of the height of the bell cavity. The gelatinous substance of the bell is slightly greenish in color. The entoderm of the proboscis, genital organs, circular tube, and tentacles is opaque yellow-green and reddish purple. There are 4 reddish-purple spots upon the proboscis just between the radial canals.

This medusa was common at Key West from May 27–June 10, 1897. It was extremely active in all of its movements and wonderfully hardy in captivity. One specimen lived for more than a week in a small glass bowl, the water of which was not changed. It seems probable that both this species and Gonionemoides geophila prefer the muddy and impure waters of the Florida Coast, for while they were both common at Key West, they were not seen at the Tortugas either in 1897, 1898, or 1899.

LIRIOPE, Lesson, 1843.

Liriope scutigera, McCrady.

Liriope scutigera, McCrady, J., 1857, Gymn. Charleston Harbor, p. 106.
Xanthea scutigera, Haeckel, E., 1864, Geryoniden, p. 24.
Liriantha scutigera, Haeckel, E., 1879, Syst. der Medusen, p. 287.

This medusa is not very common at the Tortugas, Florida. It is quite abundant at Charleston, South Carolina, and we have taken it at various places among the Bahama Islands, and off the Cuban Coast, during the winter months.

GLOSSOCODON, Haeckel, 1864.

Glossocodon tenuirostris, Fewkes.

Figs. 75-78, Plate 24.

Liriope tenuirostris, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. p. 365.
Glossocodon tenuirostris, Fewkes, J. W., 1882, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. IX. p. 278, Pl. VII. Figs. 1-9.
Liriope cerasiformis? Maas, O., 1893, Ergeb. der Plankton Exped., Bd. II. K. C., p. 35, Taf. II. Fig, 5. 6.

This medusa is common at the Tortugas, Florida; as indeed it is also among the Bahama Islands and along the Cuban Coast. It is met with in considerable numbers in Charleston Harbor, South Carolina; and occasionally a damaged individual is drifted into Newport Harbor, Rhode Island, by the southerly winds late in the summer months.

AGLAURA, Péron and Lesueur, 1809.

Aglaura hemistoma, Péron and Lesueur.

Figs. 79, 80, Plate 25.

Aglaura hemistoma, Péron, F., et Lesueur, C. A., 1809, Tableau des Méduses, p. 351, No. 73.
Aglaura Péronii, Leuckart, R., 1856, Archiv für Naturges. Jahrg. 22, p. 10, Taf. I. Figs 5–7.

This medusa is occasionally met with in June at the Tortugas, Florida. It is found also in the Mediterranean and is widely distributed throughout the tropical regions of the Atlantic (see Maas, O., 1893, Die Craspedoten Medusen der Plankton Expedition, Taf. VII.). A very closely allied species is found in the Tropical Pacific (see Agassiz and Mayer, 1898; Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXII. p. 166). One figure is drawn from a specimen obtained at the Tortugas, Florida.

Aglaura hemistoma, var. Nausicaa, Haeckel.

Aglaura Nausicaa, Haeckel, E., 1879, Syst. der Medusen, p. 274, Taf. XVI. Fig. 1.
Aglaura vitrea, Fewkes, J. W., 1882, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. IX. p. 277, Pl. VII. Fig. 10.
Aglaura hemistoma, var. Nausicaa, Maas, O., 1892, Die Craspedoten Medusen der Plankton Expedition, Bd. II. K. C., p. 26.

This variety is occasionally met with at the Tortugas, Florida.

CUNOCTANTHA, Haeckel, 1879.

Cunoctantha incisa, nov. sp.

Figs. 145, 146, Plate 44.

Specific Characters. — The bell is slightly flatter than a hemisphere and is about 5 mm. in diameter. There is a slight apical projection, which is solid. 8 stiff tentacles arise from the sides of the bell, about halfway between the margin and the apex. These tentacles are provided with well-developed conical insertions, and their entodermal cells are disk-shaped and highly vacuolated. There is a well-developed peronium beneath each tentacle. The tentacles are all of equal length, and are about three quarters as long as the bell diameter. The ex-umbrella extends outwards in 8 lobes, which are held together in a web formed of the ascending velum. These are 24 pear-shaped marginal sense-organs, each containing a crystalline otolith and surrounded by a sensory pad bearing delicate bristles. The lower velum is well developed. The proboscis is flat and the stomach cavity is small. The mouth is a simple opening without prominent lips. The stomach gives rise to 8 pouches which extend outward in the radii of the 8 tentacles. The incisions between these pouches are deeper than in Cunoctantha octonaria of Charleston Harbor. The entoderm of the tentacles, and sometimes of the stomach, is green. Two specimens of this medusa were found at the Tortugas, Florida, late in May, 1899.

ÆGINELLA, Haeckel, 1879.

Æginella dissonema, Haeckel.

Figs. 30-32, Plate 14.

Æginella dissonema, Haeckel, E., 1879, Syst. der Medusen, p. 340, Taf. XX. Fig. 16
Æginella dissonema, Agassiz, A., and Mayer, A. G., 1899, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXII. p. 166.

Specific Characters. — The bell is 3 mm. in diameter, and has the form of a frustum of a cone with rounded apex. It is a little wider than it is high. There are two long tentacles that arise from the sides of the bell at about $\frac{3}{4}$ of the distance from the margin to the apex. These tentacles are quite stiff and incapable of contraction. They are carried trailing behind the medusa in two straight parallel lines, and are about 3 times as long as the bell height. The entodermal core of each tentacle consists in a row of disk-shaped, highly vacuolated cells. (See Figure 31.) In addition to the long tentacles there are two very small protuberances (t. Figure 30) that arise from the bell margin, at the foot of the pair of peronial tubes that are situated 90° from the large tentacles. Haeckel, 1879, does not mention or figure these protuberances, and it

seems probable that they may be absent in some individuals, for we did not observe them in specimens of Æginella dissonema from the Fiji Islands. In addition to the above-mentioned protuberances there are 4 small interradial swellings situated upon the bell margin. There are 8 sensory clubs, 2 in each quadrant (see Figure 32), each one of which contains a single spherical otolith. The velum is large and powerful and is constantly contracting and expanding with great rapidity. There are 4 peronial double canals, each canal being divided into two by means of a longitudinal septum. The proboscis is small and flat, and the mouth is a simple circular opening. There are 8 interradial pouches that extend outward from the stomach into the substance of the bell. The gonads are developed upon these pouches and in the specimen here figured they contained immature ova. The color of the entoderm of the proboscis and of portions of the entodermal core of the tentacles is intense golden-green. The gonads in the specimens described by Haeckel were rose-red; in ours they were colorless.

A single specimen was found at the Tortugas, Florida, June 19, 1897. This medusa appears to be very widely distributed. Haeckel found it at the Canary Islands, and we found it in Suva Harbor, Fiji Islands, in January, 1898.

II. SCYPHOMEDUSÆ.

NAUSITHOË, Kölliker, 1853.

Nausithoë punctata, Kölliker.

Figs. 67, 68, Plate 23; Figs. 87, 88, Plate 26.

Nausithoë punctata, Kölliker, A., 1853, Zeit für Wissen. Zoöl., Bd. IV. p. 323.
Nausithoë punctata (Marginata albida), Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. pp. 122, 167.
Nausithoë albida, Carus, V., 1857, Icones Zoötom., Taf. II., Figs. 17, 22, 23.

Specific Characters. — Adult medusa. The umbrella is quite flat and is about 9 mm. in diameter. There are 8 stiff tentacles, each one of which is about $\frac{3}{4}$ as long as the bell diameter. The main portion of the entodermal core of each tentacle is solid, but as Vanhöffen, 1892, has shown, the basal bulbs of the tentacles are hollow and connected with the adjacent lappet-pouches. There are 8 marginal sense-organs that alternate with the 8 tentacles. As the Hertwigs (1878, Sinnesorgan der Medusen, Figure 2, Plate 9) and Claus (1883, Organ. Entwick. Medusen, Figure 47, Plate 7) have shown, each sense-organ consists of an ectodermal eye, provided with a lens and with nerve fibres; and also of an entodermal otocyst containing a number of otoliths. (See Figure 68, Plate 23.) The 16 marginal lappets are long and flexible, and it is by means of their movements that the medusa is enabled

to swim through the water with great rapidity. 16 diverticulæ or pouches from the stomach enter the 16 lappets. Each of these pouches is simple, and does not give rise to any system of canals ramifying through the lappets. The mouth is a simple cruciform opening and there are no oral appendages, or palps. The gastro-vascular cavity is a wide space occupying the whole centre of the umbrella and extending outward into the lappets to form the 16 lappet-pouches. There are 4 groups of gastric cirri, situated in such manner that the 2 diameters passing through them are 45° apart from the 2 diameters passing through the cross formed by the lips of the mouth. All 4 of these diameters pass through the marginal sense-organs. There are about 6 tentaculæ in each group of gastric cirri, thus making in all about 24 gastric tentaculæ. The 8 gonads are of entodermal formation, and are found in the 8 tentacular radii. As Claus, 1883, has shown, each one is formed from a pocket-like fold of the entoderm. A band of circular muscles is found in the ectoderm of the sub-umbrella, and radial muscle fibres run out from this band into the 16 marginal lappets. The color of this medusa is quite variable. The gelatinous substance of the bell is usually bluish white or brownish. The gonads are brownish red or, in the case of the males, bright yellow rosin-colored pigment spots are found in the ectoderm of the ex-umbrella, especially upon the lappets. These rosin-colored spots are due to small crystals (see Claus, 1883; Figure 44, Taf. VI.).

A young ephyra of this species (see Figures 67, 68; Plate **23**) was found by us near Flamingo Key, Bahama Islands, Feb. 9, 1893. It was 2 mm. in diameter. There were as yet no marginal tentacles. The otocysts each contained 5–6 oval otoliths. There were only 4 gastric cirri. A slightly older ephyra has been figured by Claus, 1883; Figure 48, Taf. VII.

This medusa is common in the Mediterranean, and is also found among the Bahama and Tortugas Islands. It was described by Vanhöffen, 1893, from near the mouth of the Amazon River. A *very* closely allied species was found by us in the Fiji Islands, Pacific Ocean.

LINERGES, Haeckel, 1880.

Linerges mercurius, Haeckel.

Linerges mercurius, Haeckel, E., 1880, Syst. der Medusen, p. 495, Taf. XXIX. Figs. 4–6.

Linerges pegasus ? Haeckel, E., 1880, Syst. der Medusen, p. 495.

Vast numbers of ephyræ of this medusa are found among the Bahama Islands and along the Florida Coast in March; and the mature medusæ are very abundant in June. At times these creatures appear in such numbers that hundreds are captured in every haul of the tow net. They congregate in great windrows, remain abundant for a few days, and then disappear for an indefinite period.

DACTYLOMETRA, Agassiz, L., 1862.

Dactylometra lactea, L. Agassiz.

Chrysaora lactea, Eschscholtz, F., 1829, Syst. der Acalephen, p. 81, Taf. VII. Fig. 3.
Dactylometra lactea, Agassiz, L., 1862, Cont. Nat. Hist. U. S., Vol. IV. pp. 125, 126, 166.
Dactylometra lactea, Agassiz, A., and Mayer, A. G., 1898, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXII. p. 7, Pls. XII., XIII., and Fig. 10, Pl. VII.

This medusa is extremely common in Havana Harbor, Cuba, in February, where it swims upon the surface during the afternoon hours. It has been described by Eschscholtz from the Bay of Rio Janeiro, Brazil. It is occasionally found at the Tortugas, Florida.

AURELIA, Péron and Lesueur, 1809.

Aurelia habanensis, nov. sp.

Figs. 73, 74, Plate 24; Fig. 86, Plate 26.

Specific Characters. — Adult medusa. The bell is 240 mm. in diameter. It is disk-shaped, and the gelatinous substance is quite thick. There are 8 simple marginal lappets, which bear upon their dorsal surfaces, at a slight distance above the bell margin, a row of numerous short tentacles. There are 8 marginal sense-organs that are deeply set within niches situated between the marginal lappets. The radiating chymiferous tubes are very similar to those of Aurelia flavidula, Péron and Lesueur. The mouth-arms, or palps, are long and narrow and extend almost to the bell margin. Their free edges are not lined with a fringe of tentacles as in Aurelia flavidula, but instead are covered with wart-like clusters of nematocyst cells (see Figures 73, 74, Plate **24**). This, indeed, constitutes the principal difference between this species and Aurelia flavidula. The 4 gonads are horseshoe-shaped and there are 4 subgenital pits. Both the gonads and subgenital pits are smaller than in Aurelia flavidula. The gelatinous substance of the bell is bluish white in color. The genital organs of the males are pink, and of the females white in color. The basal bulbs of the marginal tentacles are often pink.

This medusa is extremely abundant in Havana Harbor, Cuba, in February. It makes its appearance at the Tortugas in August, but we do not know whether it is found also at Havana at that time or not.

While in Havana Harbor in February, 1893, we had the opportunity of observing the curious habits of this medusa. During the morning hours not one was to be seen, but at about four o'clock in the afternoon they began to appear in great numbers, and continued to be seen until long after nightfall.

This species is quite distinct from Aurelia marginalis, L. Agassiz (1862;

p. 86). In Aurelia marginalis the gonads are very large and occupy at least one half of the whole diameter of the disk, so that the distance from the peripheral outline of these organs to the margin of the disk is as great, if not greater, than that to the centre of the disk. The mouth-arms, on the contrary, are comparatively small. In Aurelia habanensis the gonads never occupy more than one third of the diameter of the disk, and the mouth-arms are long and slender.

CHARYBDEA, Péron and Lesueur, 1809.

Charybdea aurifera, nov. sp.

Figs. 81-83, Plate 25.

Specific Characters. — Young medusa. Only one specimen of this medusa was found at the Tortugas, Florida, August 6, 1898. The bell was 2 mm. in height and a little higher than it was broad. The external surface of the bell was covered irregularly with numerous wart-like clusters of nematocyst cells. The 4 interradial tentacles were evidently very immature, and consisted of small knob-like protuberances from the bell margin. They were hollow and were in communication with the general gastro-vascular cavities of the bell. The 4 sense-organs, or rhopalia, arose from 4 radially situated niches, found upon the sides of the bell at a little distance above the margin. It should be noted, however, that although the rhopalia appear to arise at some distance above the bell margin, they are morphologically homologous with appendages of the bell margin. Each rhopalium arises from a niche in the side of the bell, and consists in a stalk-shaped body, bearing upon its distal end a knob-shaped portion which, in turn, contains the otolith and eye-spots. There are 5 eyes in each rhopalium; one of these is large and median, and the other 4 are smaller and paired (see Figures 82, 83). They are so situated that they may look inward towards the bell cavity. These eyes are ectodermal structures, and possess a lens and a layer of pigment cells. The otolith, on the other hand, is entodermal in origin and consists in a mass of glistening white granules. The velarium is well developed, and is supported by means of 4 partitions, or frenulæ (*f*, Figure 81), that suspend it from the sub-umbrella. The proboscis is wide and flask-shaped, and there are 4 quadratic lips. 4 long gastric cirri, one in each interradius, extend downwards into the stomach cavity. A highly refractive band of muscle fibres ? (*m s*, Figure 81) extend down the middle line of each radius of the bell to the rhopalia. The gelatinous substance of the bell possesses a bluish tinge. The nematocyst cells of the exumbrella, and also the proboscis, rhopalia, and tentacles are of a decided amber color.

Although careful search was made for them, no velar canals were observed. It is probable that these may develop at a later stage.

Charybdea punctata.

Tamoya punctata, Fewkes, J. W., 1883, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XI. p. 84, Figs. 4–6, Pl. I.

A single young medusa of this species was found at the Tortugas, Florida, on May 24, 1899. It was very nearly in the same state of development as the medusæ described by Fewkes, 1883, from the Bermuda Islands. The adult medusa has not been found.

CASSIOPEA, Péron and Lesueur, 1809.

Cassiopea frondosa, Lamarck.

Medusa frondosa, Pallas, P. S., 1774, Spicilegia Zoölog., Fasc. X. pp. 29, 30, Pl. 2, Figs. 1–3.

Cassiopea frondosa, Lamarck, J. de, 1817, Hist. Nat. Anim. sans Vert., Tom. II. p. 512.

Cassiopea pallasii, Péron, F., et Lesueur, C. A., 1809, Tableau des Meduses, p. 357, Nr. 85.

Polyclonia frondosa, Agassiz, L., 1860, Cont. Nat. Hist. U. S., Vol. III. Pls. 13, 13ª.

This medusa is very abundant at the Tortugas and along the Florida Reefs early in the spring, but is not seen during the summer months.

III. SIPHONOPHORÆ.

VELELLA, Bosc, 1802.

Velella mutica, Bosc.

Medusa velella, Linné, 1767, Systema Naturæ, Ed. XII. p. 1098.

Velella mutica, Bosc, L. A. G., 1802, Hist. Nat. d. Vers., Tom. II. p. 158.

Velella mutica, Agassiz, A., 1883, Mem. Mus. Comp. Zoöl. at Harvard Coll., Vol. VIII. No. 2, p. 2, Pls. I.-VI. 91 Figures.

Armenista mutica, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl. Vol. XXVIII. p. 84.

This Siphonophore appears occasionally in great numbers at the Tortugas, Florida, especially when southerly breezes drive the surface waters of the Gulf Stream upon the Florida Reefs. It is common among the Bahama Islands and along the Cuban coast, and isolated individuals are often carried far to the northward by the Gulf Stream, specimens having been taken in Newport Harbor, Rhode Island.

PORPITA, Lamarck, 1816.

Porpita Linnæana, Lesson.

Porpita Linnæana, Lesson, R. P., 1843, Hist. Nat. des Zoöph. Acal., p. 588.

This Siphonophore is met with occasionally at the Tortugas, Florida. It often occurs in vast swarms, which appear at irregular intervals, all along the coast of the United States from the Tortugas to North Carolina. A single specimen was found by A. Agassiz, in Newport Harbor, Rhode Island, in 1875.

RHIZOPHYSA, Péron and Lesueur, 1809.

Rhizophysa Murrayana, Chun.

Rhizophysa filiformis? Gegenbaur, C., 1854, Zeit. für Wissen. Zoöl., Bd. V. p. 324, Taf. XVIII. Figs. 5–11.

Cannophysa Murrayana, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl., Vol. XXVIII. p. 324, Pl. XXIV. Figs. 1–9.

Cannophysa Eysenhardtii, Mayer, A. G., 1894, Bull. Mus. Comp. Zoöl. Harvard Coll., Vol. XXV. p. 239, Pl. III. Figs. 1, 2, 4.

Rhizophysa Murrayana, Chun, C., 1897, Siphonophoren der Plankton Expedition, p. 84.

This Siphonophore has been found by us among the Bahama Islands and off the Cuban coast, and a single damaged specimen was obtained at the Tortugas, Florida. It has been obtained by Haeckel, 1888, at the Canaries, and by Chun, 1897, in the Tropical Atlantic. The Mediterranean species R. filiformis of Gegenbaur, 1854, is certainly very closely allied, if not identical with the Atlantic form.

Rhizophysa Eysenhardtii, Gegenbaur.

Rhizophysa filiformis, Huxley, T. H., 1859, Oceanic Hydrozoa, p. 90, Pl. VIII. Figs. 13–20.

Rhizophysa Eysenhardtii, Gegenbaur, C., 1859, Nova Acta Acad. Nat. Curios., Tom. 27, p. 408, Taf. 31, Fig. 46–49.

Nectophysa Wyvillei, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl., Vol. XXVIII. p. 327, Pl. XXIII. Figs. 1–8.

This Siphonophore is found occasionally at the Tortugas, Florida. It has been obtained by Haeckel in the Canary Islands, by the Plankton Expedition in the Sargasso Sea, and by Fewkes in the Bermudas.

Rhizophysa clavigera, Chun.

Cannophysa filiformis, Mayer, A. G., 1894, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXV. p. 241, Pl. III. Fig. 3.

Rhizophysa clavigera, Chun, C., 1897, Siphonophoren der Plankton Expedition, p. 104.

A single specimen of this Siphonophore was found floating within ten metres of the surface in the Gulf Stream between Havana and Key West.

PHYSALIA, Bosc, 1802.

Physalia pelagica, Bosc.

Salacia phisalus, Linné, 1756, Systema Naturæ, p. 158.
Holothuria physalis, Linné, 1767, Syst. Naturæ, Ed. XII. p. 1090.
Medusa caravella, Müller, O. F., 1776, Besch. Berlin Gesell. Natur. Freunde, Bd. II. p. 290, Taf. IX. Fig. 1.
Arethusa crista subrubella venosa, Browne, P., 1789, Nat. Hist. Jamaica, p. 386.
Physalia pelagica, Bosc, L. A. G., 1802, Hist. Nat. d. Vers., Tom. II. p. 168.
Physalis arethusa, Tilesius, W. G., 1812, Krusenst. Reise, p. 91, Pl. XXIII. Figs. 1–6.
Physalia caravella, Eschscholtz, F., 1829, Syst. der Acalephen, p. 160, Taf. XIV.
Physalia aurigera, McCrady, J., 1857, Gymn. Charleston Harbor, p. 74.
Physalia Olfersii, Quatrefages, A. de, 1854; Ann. des Sci. Nat., Ser. 4, Zoöl., Tom. II. p. 112, Pl. III. Figs. 1–9; Pl. IV. Figs. 1, 2.
Caravella maxima, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl., Vol. XXVIII. pp. 313, 338, 352, Pl. XXVI. Fig. 8.
Physalia maxima, Goto, S., 1897, Journ. Coll. Sci. Imperial Univ., Tōkyō, Japan, Vol. X. Part II. p. 175, Taf. XV. Figs. 1–12.

This large Siphonophore is frequently seen throughout the year floating past the Islands of the Tortugas, Florida, and a southerly breeze is almost sure to strand large numbers of them upon the beaches. The animal is found all over the Tropical and Subtropical Atlantic. It is carried by the Gulf Stream to the shore of Europe, and is often found in the Mediterranean near the Straits of Gibraltar. It appears, however, not to be permanently established in the Mediterranean. During the latter part of the summer this Siphonophore is quite common along the southern coast of New England, and individuals have been found as far north as the Bay of Fundy.

SPHÆRONECTES, Huxley, 1859.

Sphæronectes gracilis, Haeckel.

Fig. 89, Plate 27.

Monophyes gracilis, Claus, C., 1874, Schrift. Zoöl. Inst. Wien, II. Die Gattung Monophyes, p. 29, Taf. IV. Figs. 8–14.
Sphæronectes inermis, Fewkes, J. W., 1880, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. VI. p. 143, Pl. II. Fig. 6.

This Siphonophore is abundant in the Mediterranean and Tropical Atlantic. It was found throughout the winter by Chun in the Canary Islands, and several specimens were found by us at the Tortugas, Florida, in July, 1898. A

single specimen of its sexual generation (Diplophysa inermis) was found by Fewkes (1881; Bull. Mus. Comp. Zoöl., Vol. VIII. p. 166, Plate VI. Figure 12), in Newport Harbor, Rhode Island.

The Atlantic species of Sphæronectes is closely allied to, if not identical with, S. Köllikeri of the Tropical Pacific. Chun (1892, Abhandl. Senck. Gesell., Bd. 18, p. 86) says that in S. Köllikeri the distal portion of the phyllocyst curves downward toward the edge of the swimming-bell, while in S. gracilis it bends upwards. Our observations on S. Köllikeri from the Fiji Islands do not support this view (see Agassiz and Mayer, 1899 Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXII. p. 177, Plate 16, Figure 51), for there appears to be much individual variability in respect to the curvature of the phyllocyst in the Pacific species. All of the specimens of S. gracilis observed in the Tortugas, Florida, were colorless, whereas S. Köllikeri is often quite highly colored; the entoderm of the feeding-polypites being bright yellow, and the nematocyst batteries of the tentacles orange.

{ DIPHYES, Cuvier, 1817.
{ EUDOXIA, Eschscholtz, 1825.

{ Diphyes bipartita, Costa.
{ Eudoxia campanula, Leuckart.

Figs. 114, 114[a], Plate 34.

Polygastric Generation

- Diphyes bipartita, Costa, O. G., 1840, Genere Diphya, p. 4, Taf. IV.
- Diphyes acuminata, Leuckart, R., 1853; Die Siphonophoren, p. 61, Taf. III. Figs. 11–19.
- Diphyes gracilis, Gegenbaur, C., 1854, Zeit. für Wissen. Zoöl., Bd. V. p. 309, Taf. XVI. Figs. 5–7.
- Diphyes Sieboldii, Kölliker, A., 1853, Die Schwimmpolypen der Messina, p. 36, Taf. XI. Figs. 1–8.

This species is very abundant all over the Tropical Atlantic and in the Mediterranean; and specimens are often found at Newport, Rhode Island, late in the summer.

{ DIPHYOPSIS, Haeckel, 1888.
{ ERSÆA, Eschscholtz, 1829.

Diphyopsis campanulifera, Chun.

Figs. 93-95, Plate 28.

Polygastric Generation

- Diphyes ——, Quoy, J. R. C., and Gaimard, P., 1827, Ann. des Sci. Nat., Tom. 10, Pl. I. Fig. 7.
- Diphyes campanulifera, Eschscholtz, F., 1829, Syst. der Acalephen, p. 137.
- Diphyes Bory, Quoy, J. R. C., and Gaimard, P., 1833, Voyage de l'Astrolabe, Tom. IV. Zoöphytes, p. 83, Pl. IV. Figs. 1–6.
- Diphyopsis campanulifera, Chun, C., 1888, Sitzungsber. Akad. Wissen. Zoöl., Bd. XLIV. p. 1159.
- Diphyopsis compressa, Haeckel, E., 1888, Siphonophoræ., Challenger Report, Zoöl., Vol. XXVIII. p. 153, Plates 33, 34, 18 Figs.

Ersæa Lessonii, Chun.

Figs. 96, 97, Plate 28.

Free Sexual Generation

- Ersæa Gaimardi, Eschscholtz, F., 1829, Syst. der Acalephen, p. 128, Taf. XII. Fig. 4.
- Eudoxia Lessonii, Huxley, T. H., 1859, Oceanic Hydrozoa, p. 57, Pl. III. Fig. 6.
- Ersæa compressa, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl., Vol. XXVIII. p. 123, Pl. XXXIV. Figs. 9–18.

This Siphonophore is common all over the Tropical and Subtropical Atlantic. A few individuals are drifted into Newport Harbor every summer by the southerly winds, and are probably blown northward from the waters of the Gulf Stream.

Diphyopsis picta.

Polygastric Generation

- Doramasia picta, Chun, C., 1888, Sitzungsber. Akad. Wissen. Berlin, Bd. XLIV. p. 1154.
- Doramasia picta, Chun, C., 1892, Abhandl. Senckenberg Gesell., Bd. XVIII. p. 91, Taf. VIII. Fig. 3; Taf. IX. Figs. 5–9.

Ersæa picta, Chun.

Fig. 118, Plate 34.

Free Sexual Generation

- Ersæa picta, Chun, C., 1888, Sitzungsber. Akad. Wissen. Berlin, Bd. XLIV. p. 1154.

This form has been found by Chun in the Canary Islands, and it is also common at the Tortugas, Florida. We present a figure of the free sexual generation.

{ Diphyopsis hispaniana,[1] nov. sp.
{ Ersæa hispaniana, nov. sp.

Figs. 98-99, Plate 29.

Polygastric generation = Diphyopsis hispaniana.
Monogastric, sexual generation = Ersæa hispaniana.

Specific Characters. — Diphyopsis hispaniana. Figures 98, 99. The animal is 12 mm. in length. The cavity of the anterior swimming-bell is very voluminous, so that the bell walls are remarkably thin. They are, however, quite rigid, so that swimming is accomplished almost entirely by the movements of the powerful velum. There is a well-developed hydrœcium upon the ventral side of the anterior swimming-bell, and a long spindle-shaped phyllocyst arises from its inner apex, and extends upwards along the side of the bell cavity. The siphosome arises from the inner apex of the hydrœcium, immediately under the point of origin of the phyllocyst. The first appendage of the siphosome is the large posterior swimming-bell that is almost as large as the anterior. It is provided with 4 radial canals, and a circular vessel, and these are placed in connection with the gastro-vascular space of the siphosome by means of a long slender duct. The posterior swimming-bell possesses a well-developed velum, the contractions of which acting simultaneously with those of the velum of the anterior swimming-bell, cause the animal to dart through the water at a very rapid rate. The posterior swimming-bell is provided with two large lateral wings having serrated edges. The siphosome extends downward through the groove between these wings. The order of development of the various organs upon the siphosome is as follows: — First the feeding-polypites, then the tentacles, then the gonads and swimming-bells, and lastly the covering scales. The feeding-polypites are spindle-shaped, and quite contractile. The outer surface of their proximal portions displays a number of wart-like swellings. The entodermal cells of these swellings are of a decided ochre-yellow color, and it seems not improbable that their function may be similar to that of the "liver cells" of the feeding-polypites of Agalma. The tentacles arise from the sides of the feeding-polypites very near their point of origin from the siphosome. They give rise to a number of lateral branches that are studded with sharply projecting nematocyst cells. (See Figure 99.) These lateral branches terminate in swollen nematocyst batteries. The covering scales are spathiform and possess a deep ventral groove. A single gonad and a swimming-bell bud out side by side, very close together, from the base of each feeding-polypite.

When sufficiently developed, each unit, consisting in a feeding-polypite, tentacle, gonophore, swimming-bell and covering scale, is set free from the siphosome of Diphyopsis hispaniana, and becomes the free-swimming, monogastric, sexual generation known as Ersæa hispaniana.

[1] Called "hispaniana" on account of its red and yellow coloration. The entoderm of the feeding-polypites being ochre-yellow, and the tentacular nematocyst-batteries port-wine-red.

Ersæa hispaniana, nov. sp.

Fig. 100, Plate 29.

Specific Characters. — Ersæa hispaniana. The mature animal is 7 mm. in length. The covering scale is hood-shaped without a sharp apex. Its lower portion is sharp-edged, and overlaps the large swimming-bell. The phyllocyst is short and blunt, and contains a highly refractive "oil" globule. The large swimming-bell is provided with 4 longitudinal, serrated ridges that give it a rectangular appearance in cross-section. There are 4 radial tubes, a circular vessel, and a well-developed velum. Two or more gonophores are seen budding out from the side of the feeding-polypite near its base. These gonophores (*g*, Figure 100) are medusiform and are provided with 4 radial tubes, a circular vessel, and a velum. The genital products are found within the manubrium. In Figure 100 a single large, oval egg is seen occupying this position.

Both Diphyopsis hispaniana and Ersæa hispaniana were common at the Tortugas, Florida, in July, 1898, but were not seen during the summer of 1899.

{ ABYLA, Quoy and Gaimard, 1827.
{ AGLAISMA, Eschscholtz, 1829.

Abyla pentagona, Eschscholtz.

Figs. 101, 101a–103, Plate 30.

Polygastric Generation

- Abyla pentagona, Eschscholtz, F., 1829, Syst. der Acalephen, p. 132.
- Calpe pentagona, Quoy, J. R. C., and Gaimard, P., 1827, Ann. der Sci. Nat., Tom. X. p. 11, Pl. 2 A. Figs. 1–7.
- Abyla trigona, Vogt, C., 1854, Mém. de l'Institut Nat. Génevois, Tom. I. p. 121, Pl. XX. Figs. 4–7; Pl. XXI. Figs. 3–6, 10–13.
- Calpe Gegenbauri, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl., Vol. XXVIII. p. 164, Pl. XXXIX. Figs. 1–12.
- Abylopsis pentagona, Chun, C., 1897, Siphonophoren der Plankton Expedition, Bd. II. K. b. p. 30.

Aglaisma cuboides, Chun.

Fig. 104, Plate 30.

Free Sexual Generation

- Eudoxia cuboides, Leuckart, R., 1853, Siphonophoren, p. 59, Taf. III. Figs. 7, 8, 10.
- Einzelthiere der Abyla pentagona, Gegenbaur, C., 1854, Zeit. für Wissen. Zool., Bd. V. p. 295, Taf. XVI. Figs. 1, 2.
- Aglaisma Gegenbauri, Haeckel, E., 1888, Siphonophoræ, Challenger Report, Zoöl., Vol. XXVIII. p. 119, Plate XL. Figs. 13–20.
- Aglaisma cuboides, Chun, C., 1897, Siphonophoren der Plankton Expedition, p. 30.

This form is quite common at the Tortugas, Florida, as indeed it is all over the Tropical and Subtropical Atlantic. It is found in Charleston Harbor, South Carolina, but has not yet been taken north of the Carolina coast.

Abyla quincunx, Chun.

Figs. 115-117, Plate 34.

Polygastric Generation

- Abyla pentagona, Huxley, T. H., 1859, Oceanic Hydrozoa, p. 40, Pl. II. Figs. 2-2e.
- Abylopsis quincunx, Chun, C., 1888, Sitzungsber. Akad. Wissen. Berlin, Bd. XLIV. p. 1160.

Aglaisma quincunx.

Free Sexual Generation

- Aglaismoides Eschscholtzii, Chun, C., 1888, Sitzungsber. Akad. Wissen. Berlin, Bd. XLIV. p. 1160.
- Aglaismoides quincunx, Chun, C., 1897, Siphonophoren der Plankton Expedition, p. 29.

Chun found this Siphonophore in the Canary Islands, and it was taken by the Plankton Expedition in the Gulf Stream and Sargasso Sea. Huxley, 1859, found it in the tropical regions of the Atlantic, Pacific, and Indian Oceans. It has been taken by Agassiz and Mayer (1899; Bull. Mus. Com. Zoöl., Vol. XXXII. p. 180) in the Fiji Islands. These South Pacific specimens are, however, slightly different from those of the Atlantic in that their tentacular nematocyst-batteries are usually colorless instead of more or less orange, as in the Atlantic form.

Chunia capillaria, nov. gen. et sp.

Figure 90, Plate 27.

Generic Characters. — Chunia, novum genus. This genus belongs to the family Diphyidæ, Eschscholtz, and to the subfamily Abylinæ, L. Agassiz. It possesses a pentagonal, prismatic, anterior swimming-bell and a larger five-sided, posterior swimming-bell. The siphosome bears a long, slightly curved, sharp-pointed, hair-like bristle. The covering scales, or bracts, are leaf-shaped. The monogastric sexual generation is unknown.

Specific Characters. — The animal is about 10 mm. in length. The anterior swimming-bell is prismatic, and possesses one oblique, five-sided face and 5 lateral faces. Four of these are plane, but the fifth is sharply concave. The cavity of the swimming-bell opens upon this concave face. The bell cavity is long and spindle-shaped, and is provided with 4 radial tubes and a velum. There is a large spherical phyllocyst that gives rise to an apical cæcum containing a highly refractive "oil" globule. The hydrœcium of the anterior

swimming-bell is long and tube-like, and its axis is parallel to that of the bell cavity. Indeed, it is quite similar in form to the hydrœcium of Abyla quincunx (see Figure 115, Plate **34**). The first appendage of the siphosome is the posterior swimming-bell. This is somewhat larger than the anterior and is five-sided, the sides being bounded by prominent, angular, serrated ridges. There is a single median dorsal ridge and two pairs of lateral ridges. The ventral-most pair of lateral ridges are wing-like, and enclose a trough-like groove through which the siphosome extends. The bell cavity of the posterior swimming-bell is spindle-shaped and is provided with 4 radial tubes and a circular vessel. These are placed in communication with the general gastro-vascular cavity of the siphosome by means of a long slender duct. The posterior swimming-bell is furnished with a powerful velum, by the contractions of which the animal is enabled to shoot through the water. The siphosome is not very long and rarely extends beyond the posterior extremity of the trough-like groove in which it lies. The first organs to be developed upon it are the feeding-polypites; the tentacles soon arise as buds from the sides of the polypites, each feeding-polypite being provided with a single tentacle. The tentacles give rise to lateral branches each one of which terminates in a swollen cylinder-shaped nematocyst battery.

A long, slightly curved, bristle-like spine arises from the siphosome at a short distance below its origin, and extends outward to a considerable distance beyond the distal end of the posterior swimming-bell. It seems probable that this structure may be morphologically equivalent to a bract, that has become thus modified for defensive purposes. Other covering scales or bracts were observed upon the siphosome, but these were leaf-shaped (see *c s*, Figure 90, Plate **27**). No gonophores or sexual organs were observed, and the sexual generation is unknown.

This rare form is found among the Bahama Islands during the winter months. The specimen from which we have obtained our figure was captured in Nassau Harbor, New Providence Island. We also obtained a specimen at Watlings Island (San Salvador) on January 15, 1893.

AGALMA, Eschscholtz, 1825.

Agalma Pourtalesii, Agassiz and Mayer.

Figures 106-113, Plates 31-33.

Agalma Pourtalesii, Agassiz, A., and Mayer, A. G., 1899; Acalephs from the Fiji Islands, Bull. Mus. Comp. Zoöl. at Harvard Coll., Vol. XXXII. p. 180.

Specific Characters. — The entire animal (Plate **32**) is about 25 mm. in length. The feeding-polypites, dactylozoids, tentacles, and gonostyles, all arise from the ventral side of the siphosome. The float, or pneumatophore, is of small size, and its apical pore is surrounded by radially arranged streaks of dark

red pigment. The swimming-bells (Figures 109, 110, Plate **33**) are dovetailed alternately, one above another, so that their velar openings are situated on two diametrically opposite sides of the nectosome (see Figure 108).

The siphosome is densely covered upon all sides with thick prismatic bracts, or covering scales. One of these bracts detached from the animal is shown in Figure 112. The angular edges of the older bracts are usually smooth, but in the younger ones they frequently display a row of regularly arranged nematocyst-bearing papillæ (see Figure 113). A single, long, slender canal runs through the substance of each bract.

The feeding-polypites are somewhat stouter in shape than the dactylozoids, but in other respects are quite similar to them in appearance. They are quite contractile, and their mouths may be expanded, at will, so as to assume a funnel shape.

The tentacles arise from the bases of the dactylozoids and feeding-polypites. Each tentacle gives off a number of lateral branches, each one of which terminates in a coiled nematocyst-battery, an ampulla, and two paired finger-like processes (see Figure 111, Plate **33**).

Both male and female gonostyles spring from the siphosome of the same individual. They arise from the ventral side of the siphosome between the dactylozoids and feeding-polypites (see Figure 108). The gonophores arise from the sides of the gonostyles. The male gonophores are long and slender, while the female are short and stout. Both resemble medusa buds and are provided with 4 radial tubes, a circular vessel, and a velum. The genital products occupy the manubrium. The gonophores are borne upon long slender filaments attached to the sides of the gonostyle. These filaments are highly contractile.

The color of the entoderm of the stem, swimming-bells, feeding-polypites, and dactylozoids is rose-pink. The nematocyst batteries upon the terminal portions of the tentacles are port-wine-red. The gonads and bracts are colorless.

This species was found by us at the Tortugas Islands in June, 1897. We also met with it in Suva Harbor, Fiji Islands, in December, 1898.

Agalma virida, nov. sp.

Figs. 119-121, Plate 35.

A single immature individual of this beautiful species was obtained on June 6, 1899, at the Tortugas.

Specific Characters.— The animal is 3 mm. in length. The float is spherical and almost egg-shaped, and is covered by one of the larval bracts. The pore is a simple round opening at the aboral pole of the float, and is surrounded by large, polygonal pigment cells. There is a single large axial feeding-polypite which is capable of much expansion and contraction. The gastric cells of this polypite are large and oval. Six to eight mouthless

cystons arise from the side of the feeding-polypite. These are stiff and slender, and their distal extremities are armed each with several oval nematocyst cells of large size. The entoderm of the cystons display large, highly refractive oval cells quite similar to the digestive cells of the feeding-polypite. About half a dozen branched tentacles arise from between the cystons. Each branch terminates in a complexly formed coiled nematocyst battery which is enclosed within the substance of the terminal knob. The knob ends distally in a bladder-shaped ampulla and a pair of long curved finger-shaped processes, the latter being lined on their convex sides with a row of hair-cells (see Figure 120). Several small hernia-like protuberances, which probably consist of young swimming-bells, arise from the side of the main axis immediately below the level of the float. The bracts are three-cornered, and their sharp distal ends are armed with large nematocyst cells. The free edges of the primitive larval bract are lined with a row of small nematocyst cells. Each bract is provided with a long slender, unbranched canal. The pigment cells of the float are rich brown in color. The entoderm of the feeding-polypite and cystons is of a decided pink, and the coiled nematocyst batteries in the tentacle knobs are of a more decided reddish color. The entoderm of the float and the ectoderm of the terminal knobs of the tentacles are yellow, and the canals of the bracts are grass-green in color.

IV. CTENOPHORÆ.

OCYRÖE, Rang, 1826.

Ocyroë crystallina, Rang.

Fig. 105, Plate 31.

Ocyroë crystallina, Rang, S., 1828, Mem. Soc. Nat. Paris, Tom. IV. p. 172, Pl. XX. Fig. 4.

This Ctenophore is quite often met with at the Tortugas, Florida, from April until July. It makes its appearance at the surface when the ocean is perfectly flat and calm, and even a slight ripple is sufficient to induce it to sink into the depths. The species appears to be widely distributed over the Tropical Atlantic.

BOLINA, Mertens, 1833.

Bolina vitrea, L. Agassiz.

Figs. 91, 92, Plate 27.

Bolina vitrea, Agassiz, L., 1860, Cont. Nat. Hist. U. S., Vol. III. pp. 269, 289, Fig. 93.

Bolina littoralis? McCrady, J., 1858, Proc. Elliott Soc., Charleston, p. 1, Pl. 14.

Large numbers of this Ctenophore may be seen floating in the water on almost any calm day throughout the summer at the Tortugas, Florida. It is also common among the Florida Reefs, and probably extends as far up the coast as Charleston, South Carolina.

HORMIPHORA, Agassiz, L., 1860.

Hormiphora plumosa? Chun.

Cydippe hormiphora, Gegenbaur, C., 1856; Archiv für Naturges., p. 200, Taf. VIII. Fig. 10.
Hormiphora plumosa, Chun, C., 1880, Die Ctenophoren des Golfes von Neapel, p. 281, Taf. I. Figs. 5, 6; Taf. II. Figs. 2, 3; Taf. III. Figs. 8, 9.

Numerous fragments of a Hormiphora, that may be specifically identical with the common H. plumosa of the Mediterranean, were found during the summer of 1898 at the Tortugas, Florida.

Unfortunately no perfect specimens were captured, and we must remain in doubt concerning the specific identity of this animal with H. plumosa.

EUCHARIS, Eschscholtz, 1825.

Eucharis multicornis? Eschscholtz.

Eucharis multicornis, Eschscholtz, F., 1829, Syst. der Acalephen, p. 31.

A species of Eucharis believed to be specifically identical with E. multicornis of the Mediterranean is found at Key West and the Tortugas, Florida.

BERÖE, Browne, 1789.

Beroë Clarkii.

Beroë, Browne, P., 1789, The Civil and Nat. Hist. of Jamaica, p. 384, Table 43, Fig. 2.
Idyiopsis Clarkii, Agassiz, L., 1860, Cont. Nat. Hist. U. S., Vol. III. pp. 288, 296; Figs. 101, 102.

This Ctenophore is very abundant among the Bahama, Tortugas, and Florida Reefs; and it extends as far northward as Charleston Harbor, South Carolina.

PLATE 1.

Fig. 1. Pandea violacea, Agassiz and Mayer.
Fig. 2. Stomotoca australis, nov. sp.

PLATE 2.

Fig. 3. Dissonema turrida, nov. sp. Adult medusa.
Fig. 4. " " " Young medusa.


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PLATE 3.

Fig. 5. Bougainvillia frondosa, nov. sp.

Fig. 6. Gonionemoides geophila, nov. gen. et sp. Portion of bell margin showing sucker-bearing and nematocyst-bearing tentacles.

Fig. 7. Gonionemoides geophila, otocyst.


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PLATE 4.

Fig. 8 Gonionemoides geophila, nov. gen. et sp. Side view of adult medusa.

Fig. 9. " " Medusa with oral surface upward, and holding fast to the bottom of the aquarium by means of the adhesive suckers upon its tentacles.

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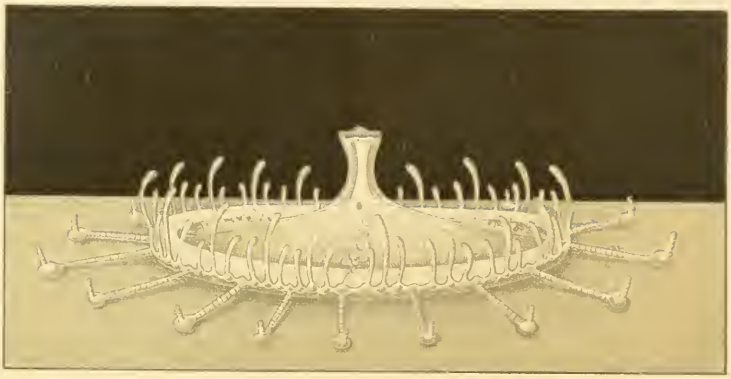

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PLATE 5.

Fig. 10. Gonionemoides geophila, nov. sp. Young medusa.

Fig. 11. Gonionemoides geophila, nov. sp. Distal end of tentacle showing the beginning of the formation of the suctorial disk.

Fig. 12. Halicalyx tenuis, Fewkes. Portion of bell margin.

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PLATE 6.

Fig. 13. Halicalyx tenuis, Fewkes. Side view of mature medusa.

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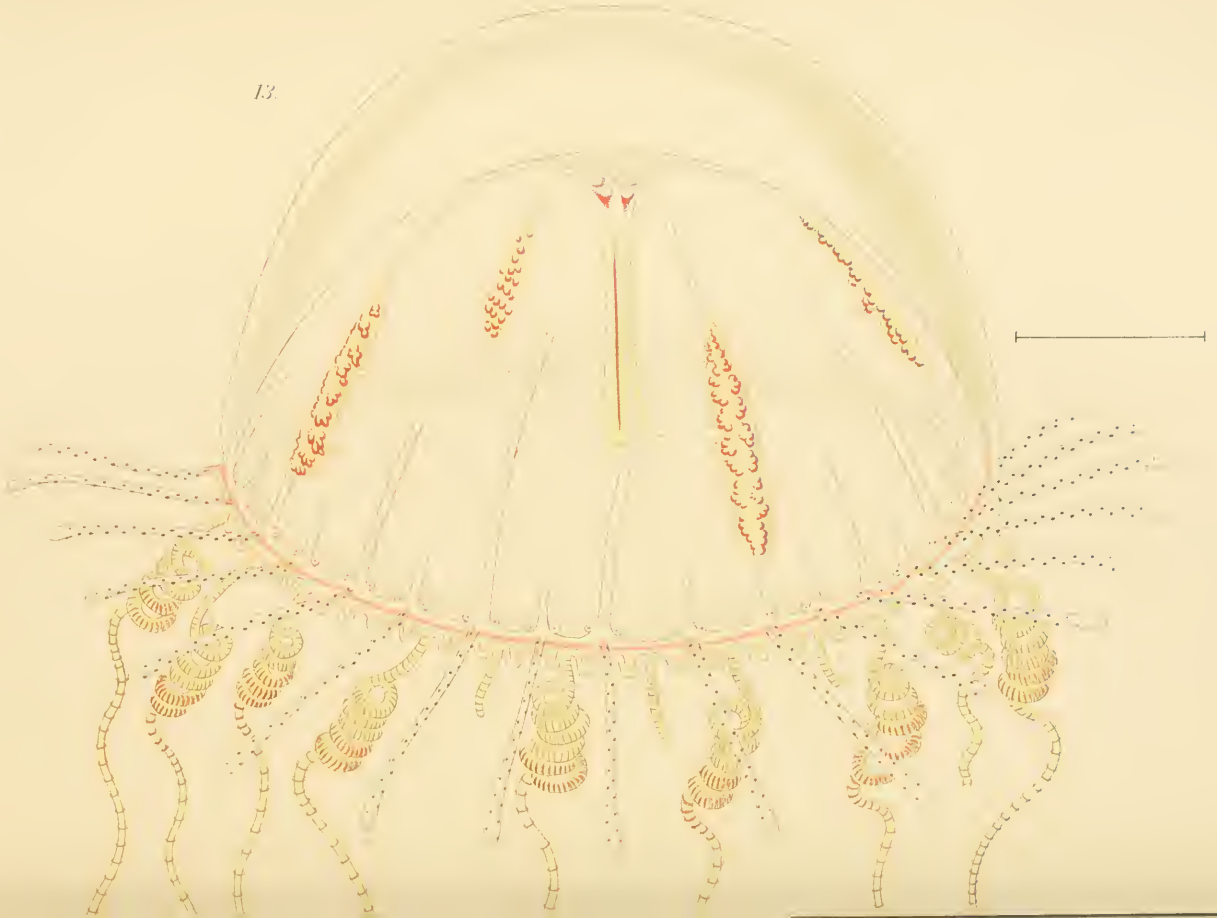

PLATE 7.

Fig. 14. Tetracannota collapsa, nov. gen. et sp. Adult medusa.
Fig. 15. " " " " Very young medusa

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PLATE 8.

Fig. 16. Tetracannota collapsa, nov. gen. et sp. Half-grown medusa.
Fig. 17. Dyscannota gemmifera = Willia gemmifera, Fewkes.

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PLATE 9.

Fig. 18. Oceania magnifica, nov. sp.
Fig. 18ª. " " Portion of bell margin, showing otocysts.
Fig. 19. Oceania globosa, nov. sp.
Fig. 19ª. " " Portion of bell margin.

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PLATE 10

Fig. 20. Oceania gelatinosa, nov. sp.
Fig. 20ª. " " Otocyst.
Fig. 21. Phortis pyramidalis = Eutima pyramidalis, L. Agassiz.
Fig. 21ª. " " Portion of bell margin.

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PLATE 11.

Fig. 22. Eutimalphes cœrulea = Eirene cœrulea, L. Agassiz.
Fig. 22a. " " Portion of bell margin.
Fig. 23. Zygodactyla cyanea, L. Agassiz. Young medusa.
Fig. 23a " " Otocysts.

A.G.M.

PLATE 12.

Fig. 24. Pseudoclytia pentata, nov. gen. et sp. Side view.
Fig. 25. " " Oral view of medusa.
Fig. 26. " " Side view of otocyst.

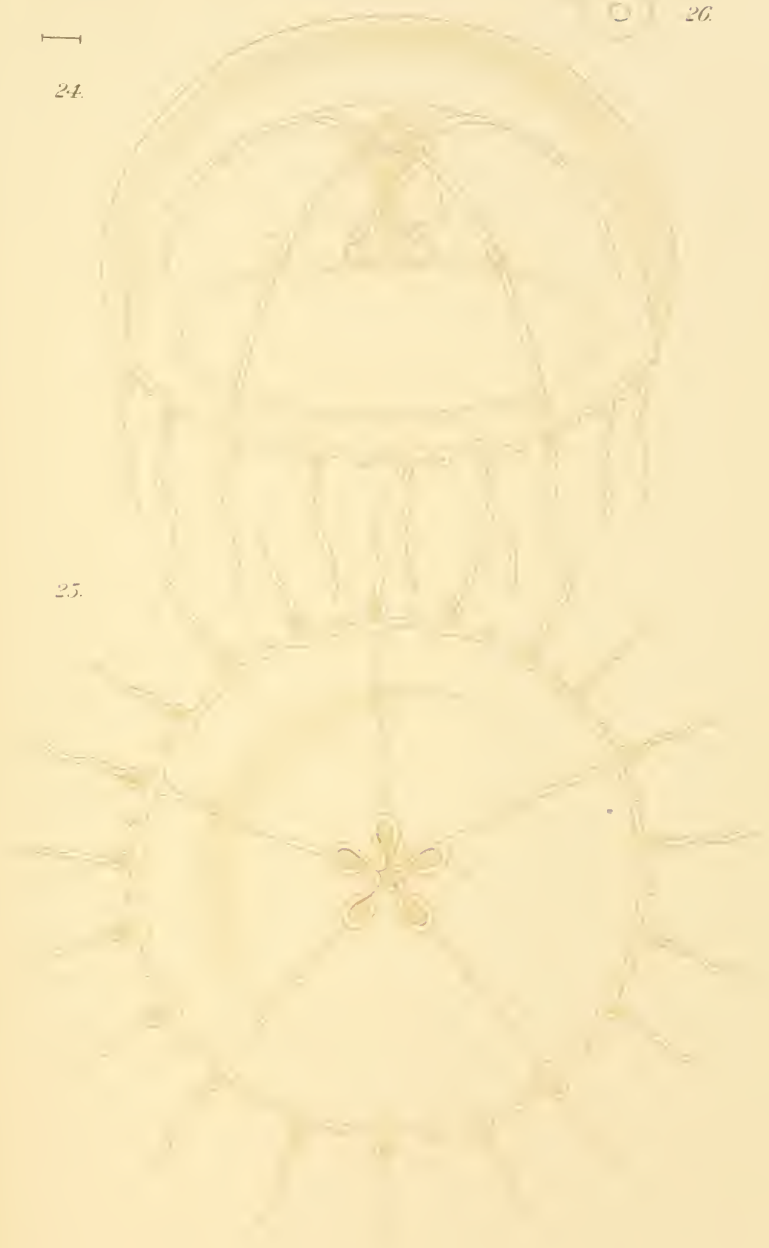
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PLATE 13.

Fig. 27. Rhacostoma dispar, nov. sp. Side view of medusa.
Fig. 28. " " Oral view of medusa.
Fig. 29. " " Otocyst.

A.G.M. del. B. M[illegible] lith. [illegible]

PLATE 14.

Fig. 30. Æginella dissonema, Haeckel. Side view of medusa.
Fig. 31. " " Longitudinal section of tentacle.
Fig. 32. " " Marginal sense-organ.

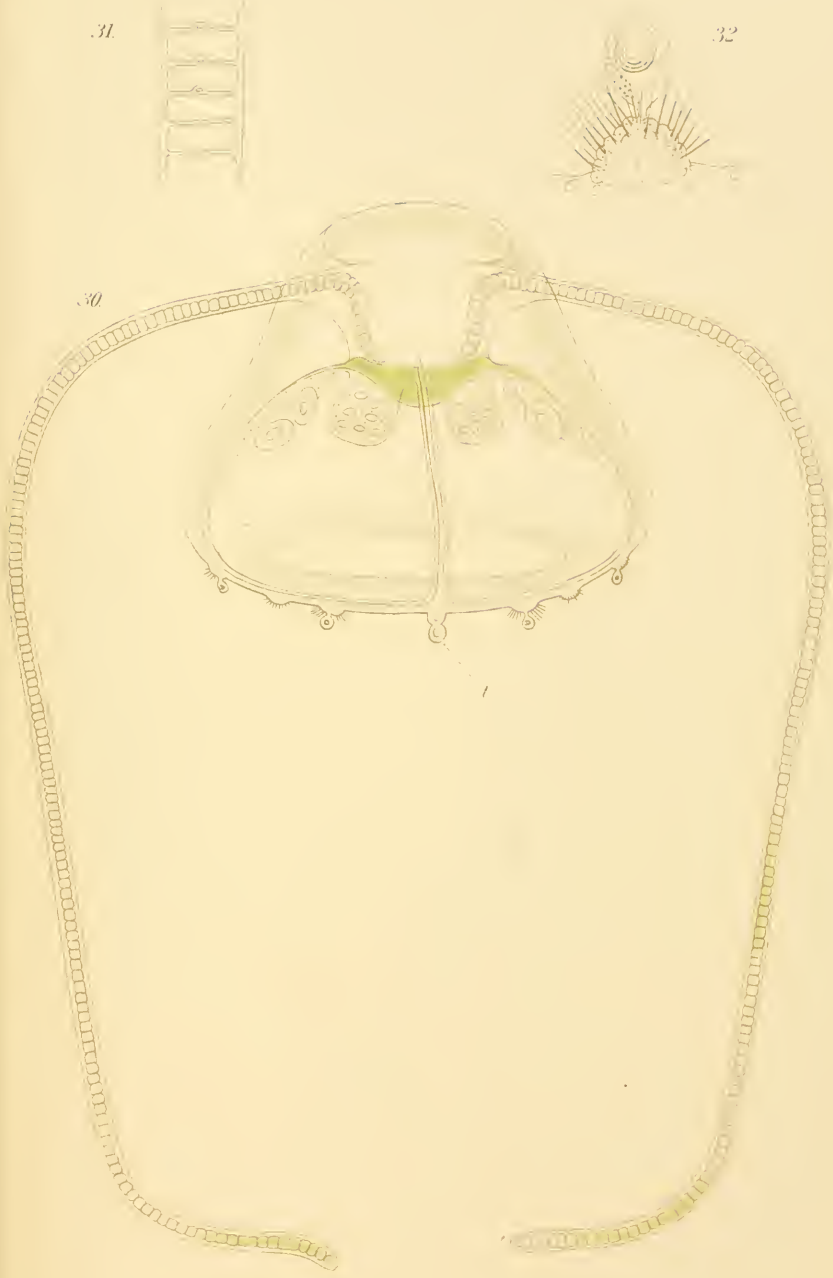
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PLATE 15.

Fig. 33. Zygodactyla cyanea, L. Agassiz. Medusa with 16 radial tubes.
Fig. 34. " " Portion of bell margin.
Fig. 35. Pseudoclytia pentata, nov. gen. et sp., red variety.
Fig. 35ª. " " View of ovary.

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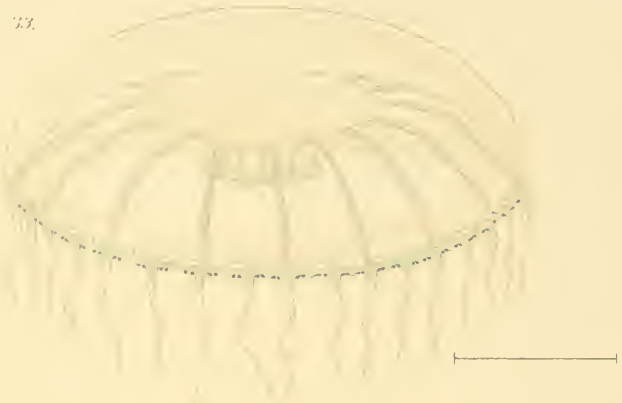

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PLATE 16.

Fig. 36. Steenstrupia gracilis, Brooks. Mature medusa ♂.
Fig. 37. " " Young medusa.
Fig. 38. Ectopleura minerva, nov. sp.
Fig. 39. Tiara superba, nov. sp.

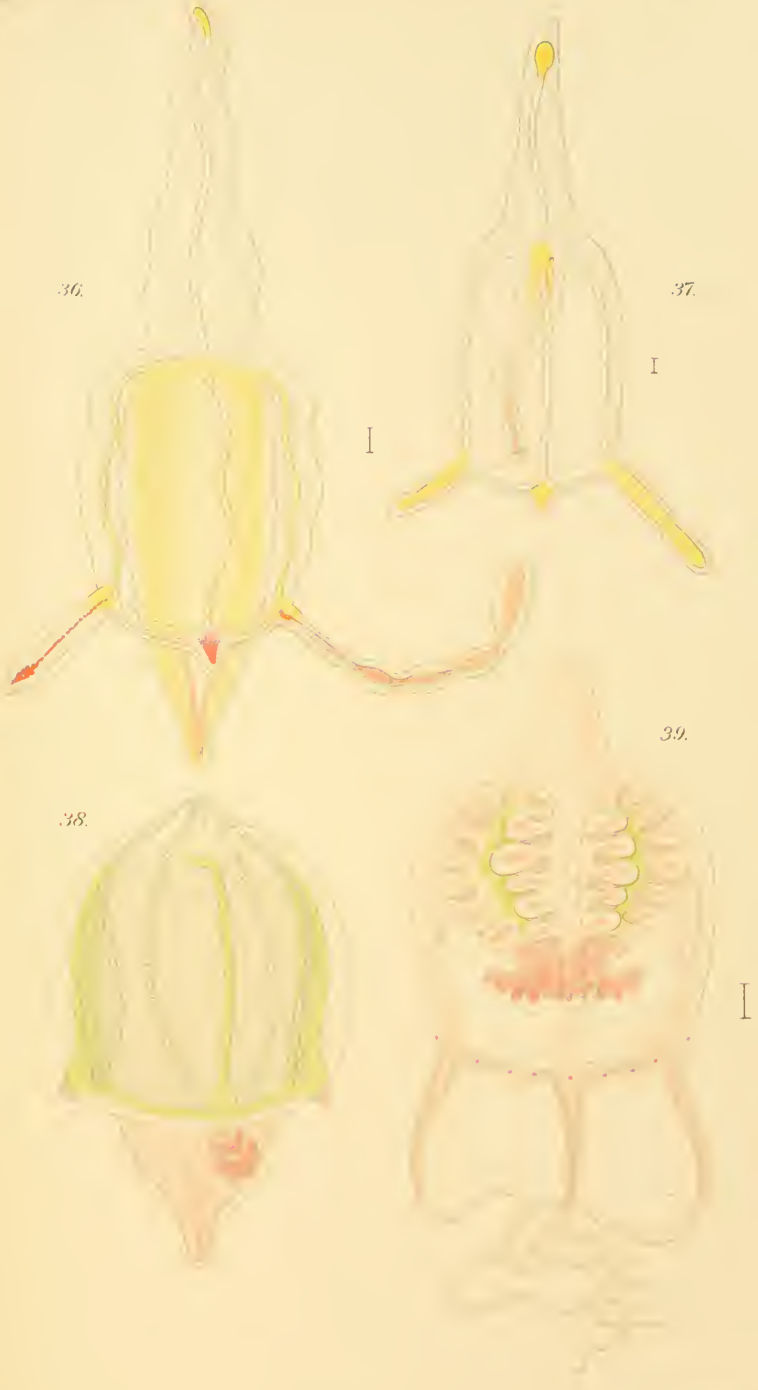
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PLATE 17.

Fig. 40. Gemmaria dichotoma, nov. sp.
Fig. 41. Dipurena fragilis, nov. sp.

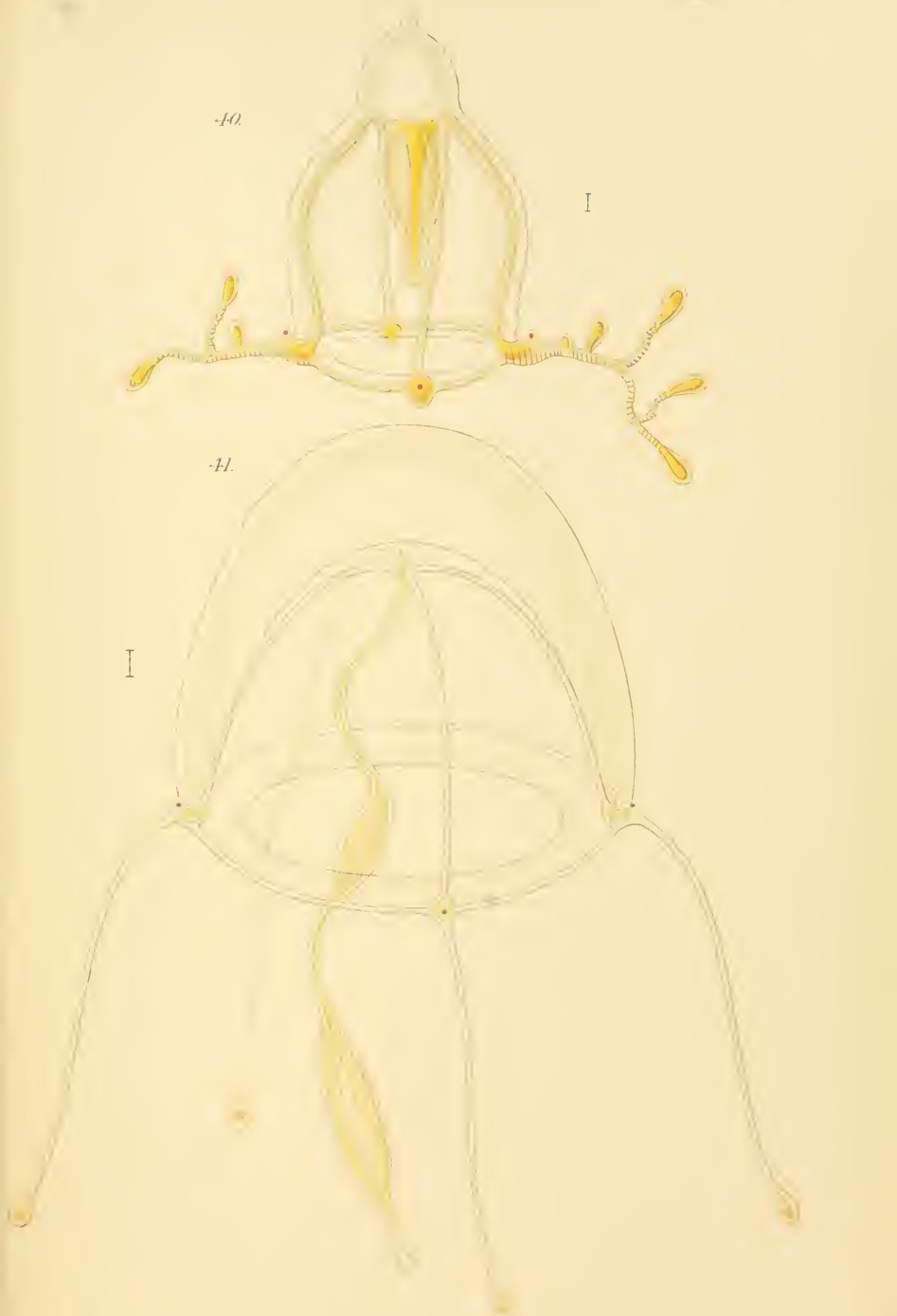
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PLATE 18.

Fig. 42. Dysmorphosa minuta, nov. sp.
Fig. 43. Netocertoides brachiatum, nov. gen. et sp. Side view.
Fig. 44. " " Aboral view.
Fig. 45. Dipurena picta, nov. sp.
Fig. 46. " " Terminal portion of tentacle.
Fig. 47. Staurodiscus tetrastaurus, Haeckel. Young medusa.

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PLATE 19.

Fig. 48. Staurodiscus tetrastaurus, Haeckel. Oral view of mature medusa.
Fig. 49. " " Side view of mature medusa.

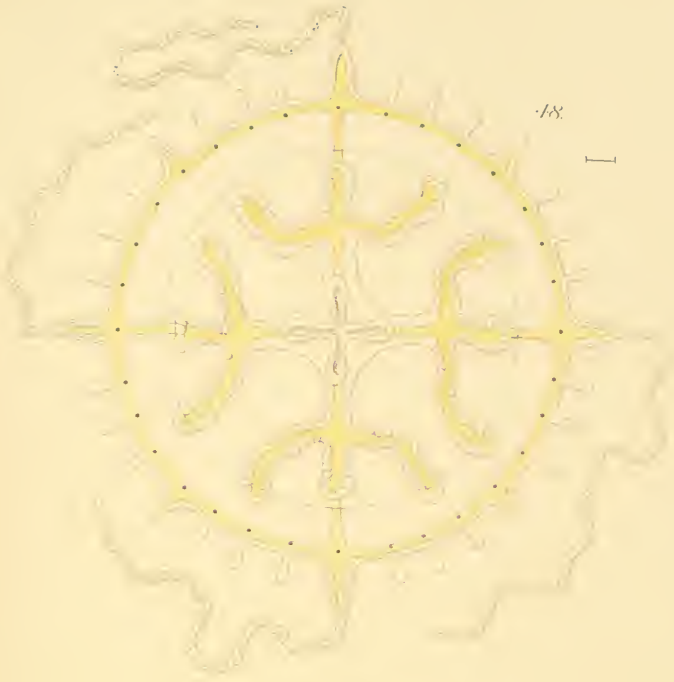

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PLATE 20.

Fig. 50. Laodicea neptuna, nov. sp. View of tentacle and ocellus.
Fig. 51. " " Side view of mature medusa.
Fig. 52. " " Oral view of mature medusa.
Fig. 53. Oceania discoida, nov. sp. Side view of mature medusa.
Fig. 54. " " Side view of young medusa.
Fig. 55. " " Oral view of bell margin of a young medusa.


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PLATE 21.

Fig. 56. Oceania McCradyi, Brooks. Side view of mature medusa.
Fig. 57. Oceania McCradyi, Brooks. View of one of the hydroid blastostyles that are produced upon the gonads.
Fig. 58. Oceania McCradyi, Brooks. Young blastostyle.
Fig. 59. " " " Oral view of mature medusa.

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PLATE 22.

Fig. 60. Tiaropsis punctata, nov. sp. Young medusa.
Fig. 61. " " Medusa older than Fig. 60.
Fig. 62. " " Otocyst of young medusa.
Fig. 63. " " Otocyst of medusa drawn in Fig. 61.
Fig. 64. Dysmorphosa dubia, nov. sp. Side view.
Fig. 65. " " Oral region of the proboscis.
Fig. 66. " " Tentacle and ocellus.


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PLATE 23.

Fig. 67. Nausithoë punctata, Kölliker. Oral view of young ephyra.
Fig. 68. " " Oral view of sense-organ of young ephyra.
Fig. 69. Eutimium serpentinum, nov. sp. Mature medusa.
Fig. 70. " " View of bell margin, and tentacle.
Fig. 71. " " Gastric portion of the proboscis.
Fig. 72. " " Proximal portion of the peduncle.


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PLATE 24.

Fig. 73. Aurelia habanensis, nov. sp. View of the edge of the mouth-arms, or palps, showing the wart-like clusters of nematocyst cells.

Fig. 74. Aurelia habanensis, nov. sp. One of the wart-like clusters of nematocyst cells from the edge of the palps.

Fig. 75. Glossocodon tenuirostris, Fewkes. Mature medusa.

Fig. 76. " " View of mouth.

Fig. 77. " " View of ovary.

Fig. 78. " " View of tentacle and otocyst.

73. 74. 75. 76. 77. 78.

G.M. del. B. Meisel lith.

PLATE 25.

Fig. 79. Aglaura hemistoma, Péron and Lesueur. Mature medusa.
Fig. 80. " " Otocyst.
Fig. 81. Charybdea aurifera, nov. sp. (*f*), frenula; (*ms*) muscle strands?
Fig. 82. " " Side view of rhopalium.
Fig. 83. " " View of rhopalium from without the bell.
Fig. 84. Zygodactyla cubana, nov. sp.
Fig. 85. " " View of bell margin.

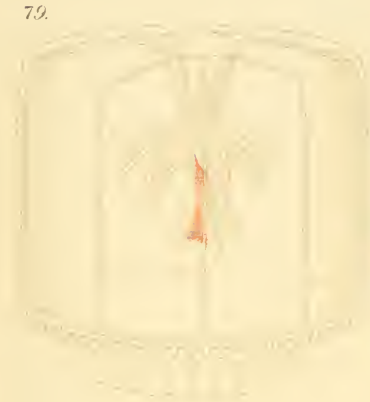
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PLATE 26.

Fig. 86. Aurelia habanensis, nov. sp. Oral view of mature medusa.
Fig. 87. Nausithoë punctata, Kölliker. Oral view of mature medusa.
Fig. 88. " " " Otocyst and ocellus.

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87. 88.

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PLATE 27.

Fig. 89. Sphæronectes gracilis, Haeckel. (*c*) connecting canal, (*f*) phyllocyst, (*p*) feeding-polypite, (*t*) tentacle.

Fig. 90. Chunia capillaria, nov. gen. et sp.

Fig. 91. Bolina vitrea, L. Agassiz. Mature animal.

Fig. 92. Bolina vitrea, L. Agassiz. View of apical sense-organ. (*c*) gastric cilia; (*f*) funnel; (*mu*) "muscle" fibres.

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PLATE 28.

Fig. 93. Diphyopsis campanulifera, Chun. Side view of mature animal. The posterior swimming-bell has been lost through accident.

Fig. 94. Diphyopsis campanulifera. Enlarged view of the proximal portion of the siphosome. (*ps*) place of origin of the large posterior swimming-bell that has been lost through accident; (*as*) small "reserve" swimming-bell; (*p*) feeding-polypite; (*t*) tentacle; (*cs*) covering scale, or bract; (*b*) immature swimming-bell (shown mature in Fig. 96, *b*).

Fig. 95. Diphyopsis campanulifera. Tentacular nematocyst battery.

Fig. 96. Ersæa Lessonii, Chun. The monogastric, sexual generation of **D.** campanulifera. (*b*) swimming-bell; (*cs*) apical bract, or covering scale; (*g*) gonophore.

Fig. 97. Ersæa Lessonii. Young ♀ gonophore containing two ova.


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93.
c.
96.
cs.
g.
b.
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94.
ps.
as.
p.
t.
cs.
b.
b.
cs.

PLATE 29.

Fig. 98. Diphyopsis hispaniana, nov. sp.
Fig. 99. " " Portion of the siphosome.
Fig. 100. Ersæa hispaniana, nov. sp. The monogastric, sexual generation of Diphyopsis hispaniana. (*g*) gonophore.

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PLATE 30.

Fig. 101. Abyla pentagona, Eschscholtz.

Fig. 101a. " " Usual form of the phyllocyst.

Fig. 102. " " Enlarged view of the siphosome. (*as*) small "reserve" swimming-bell; (*es*) bract, or covering scale; (*d*) duct of the large posterior swimming-bell; (*gs*) medusiform gonophore.

Fig. 103. Abyla pentagona. Tentacular nematocyst battery.

Fig. 104. Aglaisma cuboides, Chun. The monogastric, sexual generation of Abyla pentagona. (*cs*) bract, or covering scale; (*gs*) medusiform gonophore that functions also as a swimming-bell.


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c.s.
g.s.
101.
d.
101a.
103.
102
a.s.
p.
d.
t.
g.s.
c.s.
g.s.
c.s.
c.s.
g.s.

PLATE 31.

Fig. 105. Ocyroë crystallina, Rang. Figure $1\frac{1}{4}$ times the natural size. (*w*) wart-like protuberances upon the surface of the Ctenophore; (*au*) auricle.
Fig. 106. Agalma Pourtalesii, Agassiz and Mayer. Female gonads.
Fig. 107. " " Male gonad.

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PLATE 32.

Fig. 108. Agalma Pourtalesii, Agassiz and Mayer. Side view of the entire animal. From a specimen obtained at the Tortugas, Florida.

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PLATE 33.

Fig. 109. Agalma Pourtalesii, Agassiz and Mayer. Swimming-bell seen from above.

Fig. 110. Agalma Pourtalesii. Swimming-bell seen from the side.

Fig. 111. " " Terminal portion of tentacle.

Fig. 112. " " View of a detached bract.

Fig. 113. " " Nematocyst-bearing papillæ sometimes seen on young and immature bracts.

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PLATE 34.

Fig. 114. Diphyes bipartita, Costa.

Fig. 114ª. " " One of the units of the siphosome. (*g*) medusiform gonad, (*h*) siphosome, (*p*) feeding-polypite, (*t*) tentacle, (*cs*) covering scale or bract.

Fig. 115. Abyla quincunx = Abylopsis quincunx, Chun.

Fig. 116. " " Tentacular nematocyst battery.

Fig. 117. " " Small " reserve " swimming-bell.

Fig. 118. Ersæa picta, Chun.

PLATE 35.

Fig. 119. Agalma virida, nov. sp. Immature individual.
Fig. 120. " " Terminal knob of the tentacles.
Fig. 121. " " Polygonal pigment cells of the float.

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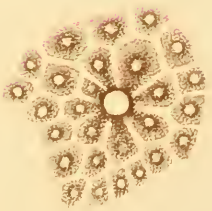

PLATE 36.

Fig. 122. Cytaeis gracilis, nov. sp. Mature medusa.
Fig. 123. " " Young medusa.
Fig. 124. " " Very young medusa.

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PLATE 37.

Fig. 125. Ectopleura minerva, nov. sp.
Fig. 126. Dinema jeffersoni, nov. sp.

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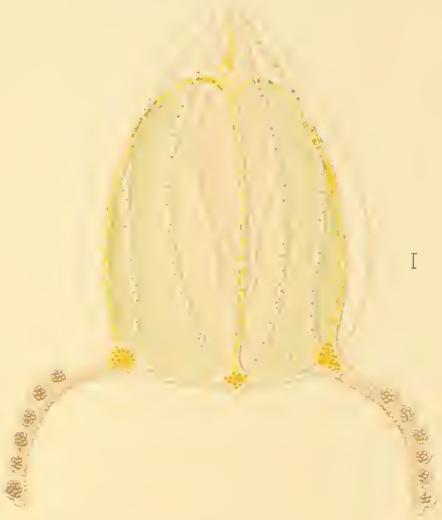

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PLATE 38.

Fig. 127. Lizzia elegans, nov. sp.
Fig. 128. Eucheilota ventricularis, McCrady.

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PLATE 39.

Figs. 129, 130. Multioralis ovalis, nov. gen. et sp.
Fig. 131. Pseudoclytia pentata, nov. gen. et sp. Side view of mature medusa ♀.
Fig. 132. " " Tentacle-bulb showing green entodermal pigment.

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B. Meisel lith Boston

PLATE 40.

Fig. 133. Phortis lactea, nov. sp.
Fig. 134. Eucheilota paradoxica, nov. sp.
Fig. 135. " " A young medusa bud.
Fig. 136. " " A medusa bud about to be set free from the parent.

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PLATE 41.

Fig. 137. Zanclea gemmosa, McCrady. Young medusa of Gemmaria gemmosa.
Fig. 138. Gemmaria gemmosa, the hydroid stock of Zanclea gemmosa, McCrady.
Fig. 139. Epenthesis folleata, McCrady. Adult medusa.

138. 137.

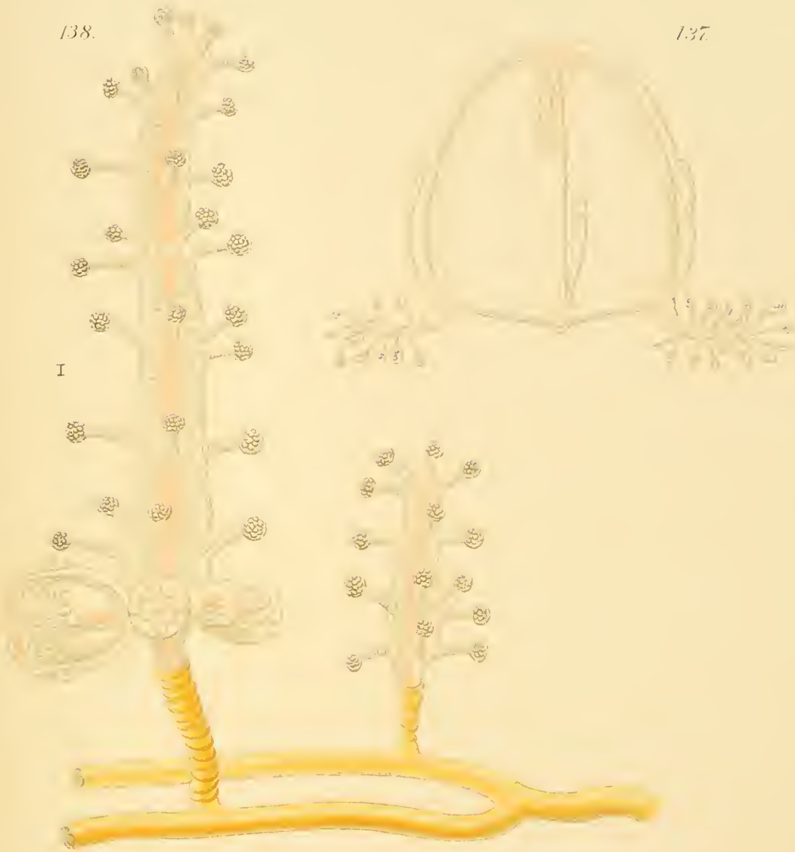

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PLATE 42.

Fig. 140. Eucopium parvigastrum, nov. sp. Adult medusa.
Fig. 141. Niobia dendrotentacula, nov. gen. et sp. Side view of an adult medusa.
Fig. 142. Niobia dendrotentacula. A young medusa recently separated from the adult individual.
Fig. 143. Niobia dendrotentacula. The proboscis and ova of a mature medusa after the cessation of the medusa-forming process.

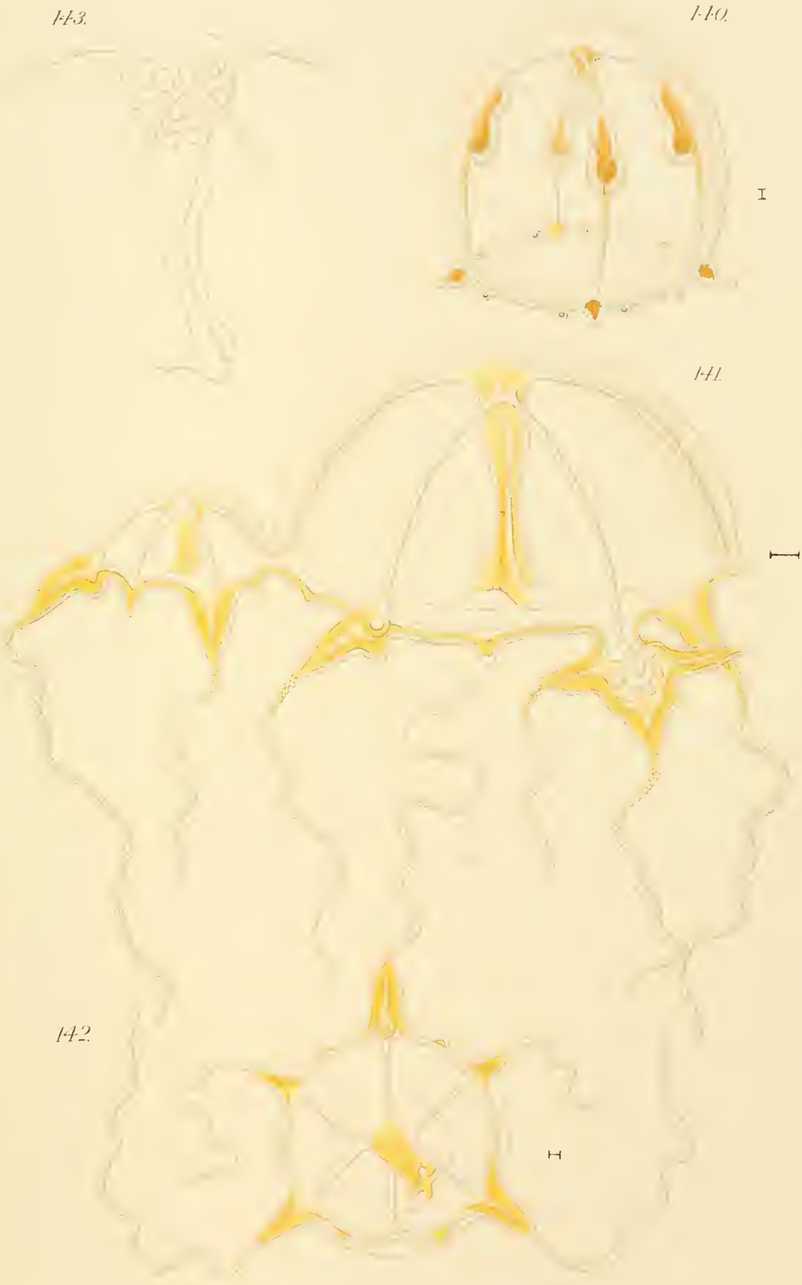

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PLATE 43.

Fig. 144. Niobia dendrotentacula, nov. gen. et sp. Oral view of an adult medusa, showing stages in the formation of new medusæ from the tentacle bulbs of the parent form.

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PLATE 44.

Fig. 145. Cunoctantha incisa, nov. sp. Oral view.
Fig. 146. " " " Side view.

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B. Mensel lith. Boston.