

PRELIMINARY ACCOUNT OF ONE NEW GENUS AND THREE  
NEW SPECIES OF MEDUSÆ FROM THE PHILIPPINES.

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By HENRY B. BIGELOW,

*Of the Museum of Comparative Zoölogy, Cambridge, Mass.*

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The Medusæ described below were collected by the Fisheries steamer *Albatross* among the Philippine Islands during 1907-1910. A complete account of the collection, with figures, is now in preparation.

Genus PROTIARA Hæckel, 1879.

PROTIARA TROPICA, new species.

Station 5500, 200 fathoms, August 4, 1909, one specimen 9 mm. high by 9 mm. in diameter; the tentacles 3 mm. long.

In general appearance the specimen is so *Sarsia*-like that until I examined the gonads I referred it to that genus. Perhaps other *Protiaras* have passed as *Sarsias*, and thus escaped notice. The gelatinous substance is thick, the subumbrella cavity comparatively small, and higher than broad.

*Tentacles.*—There are four simple, hollow radial tentacles, the lumen of each being so large that it is easily seen on dissection. The tentacles are cylindrical and have no distinct basal swellings. There are no ocelli, either axial or abaxial, nor are there any pigment granules at the tentacle-bases.

*Canals.*—The margins of the canals, both radial and circular, are smooth, and all are rather narrow. In a *Sarsia* such a conformation might be taken for granted, but among the Pandeidæ their edges often show diverticula of one shape or another.

*Manubrium and gonads.*—The manubrium extends to about the mid-level of the bell cavity, but it is evidently somewhat contracted. The mouth is surrounded by a simple lip which is not crenulated or folded but merely slightly quadrate. As seen aborally the manubrium is distinctly cruciform, there being four prominent radial longitudinal ridges extending from the base nearly to the mouth opening.

The structure of the gonads, whether ring-like or not, can not be determined from surface views. I therefore sectioned the middle part of the manubrium in the transverse plane. On such a section it is evident that there are eight distinct sexual masses, the development of the genital products, in this case spermatozoa, being entirely discontinuous both in the per- and in the interradii. Apparently the gonads become continuous in the *interradii* at the base of the manubrium. But I could not determine this absolutely, not wishing to section the whole of this unique specimen. Judging from other Pandeids, such a condition might be expected. Probably here, as in *Tiara*, the adradial masses are fundamentally the arms of four interradial "horseshoes." In the lower (distal) part of the manubrium the interradial gap becomes broader and broader. The sexual products are far developed, if not mature. The sections show no trace of interradial entodermal septa such as Linko<sup>1</sup> described.

*Color.*—In the preserved specimen the manubrium and gonads are a faint yellow, otherwise it is colorless.

The various descriptions of the Atlantic *Protiaras* are so meager that it is not easy to determine whether or not the present specimen is identical with any of them. It is easily separated from Linko's specimen (*P. beroe* ?), the only one of which we have adequate knowledge, by the structure of gonads and manubrium. According to Linko the gonads are interradial, interrupted in the perradii but not in the interradii, and there are four longitudinal interradial entodermal septa which partially subdivide the cavity of the manubrium in its upper portion. As noted above there are no septa in the Philippine form and its gonads are interrupted in the inter- as well as in the perradii. The other accounts of the gonads in forms with four tentacles are vague. According to Hæckel<sup>2</sup> these organs are perradial, and Hargitt's<sup>3</sup> figure shows four perradial swellings in his *Protiara hæckeli*. But, to illustrate the unreliability of surface views as evidence for the location of the gonads of this genus, I need only point out that I would undoubtedly have described them either as continuous, or as perradial in *tropica*, had I not studied them on sections.

A difference which may serve to separate *tropica* from *borealis* is the presence of exumbrel nematocyst clusters and of terminal tentacular knobs in the latter, and their absence in the former. In both these respects *hæckeli* agrees with *tropica*, but the account of it is meager and it is doubtful whether it belongs to the family at all. The previous records of the genus are all from north temperate or arctic regions. The discovery of a tropical representative is therefore especially interesting.

*Type.*—Cat. No. 29380, U.S.N.M., from the locality given.

<sup>1</sup> Zool. Anzeiger, vol. 25, 1902, p. 162.

<sup>2</sup> Das System der Medusen, 1879.

<sup>3</sup> Medusæ of the Woods Hole Region. Bull. U. S. Bureau of Fisheries, vol. 24, 1905.

## Genus ZYGOCANNA Hæckel, 1879.

*Zygocanna* HÆCKEL+*Zygocannota* HÆCKEL+*Zygocannula* HÆCKEL.

Mayer<sup>1</sup> has summarized our vague knowledge of this, up till now problematical, genus. Its distinguishing feature among *Æquorids* is the fact that its canals bifurcate. Hæckel's accounts, taken from alcoholic material, are incomplete and the condition of his specimens preclude accuracy. Probably his three "species" and the *pleuronota* of Péron and Lesueur are identical.

The Philippine specimens can be described as having branched canals, and it is for this reason that I refer them to *Zygocanna*. But the branching takes place proximal to the margin of the stomach instead of at the margin of the stomach, as Hæckel describes it, and, as in *Octocanna*, the canals can be traced inward over the roof of the gastric cavity to its center, a feature not previously known for any *Æquorid*. The branching, moreover, is much less regular than Hæckel deemed it, and the subumbrella surface is studded with gelatinous papillæ so prominent, even in an alcoholic specimen, that Hæckel could hardly have overlooked them had they been present in his material.

These facts combined are sufficient grounds for the institution of a new species. The only known medusa with which they may be identical is a young unnamed *Æquorid* figured and described from the collection of the *Siboga* by Maas.<sup>2</sup>

## ZYGOCANNA VAGANS, new species.

*Æquoride* juv. gen.? sp.? MAAS, Die Craspedoten Medusen der *Siboga*-Expedition, 1905, p. 44, pl. 4, figs. 22, 23.

Station 5124, 281-0 fathoms, 1 specimen, 36 mm. in diameter.

Station 5190, 295-0 fathoms, 1 specimen, 39 mm. in diameter (type), and 9 other fragmentary specimens from 28-30 mm. in diameter.

Station 5216, 215-0 fathoms, 2 specimens, 76 and 68 mm. in diameter; in fair condition.

The bell is flat; the gelatinous substance thin but stiff, especially in an alcoholic specimen.

The most interesting feature is the structure of the stomach and of the canals. From the edge of the stomach to the margin of the bell the canals run direct, without branching or anastomosis; the branching is to be seen within the outer margin of the manubrium. At the center there is a cruciform figure, exactly as in *Irenopsis* and *Octocanna*, which can be reduced to four primary arms, though often irregular, and especially so in the type. Passing outward from the center the canals (or rather the lines on the roof of the manubrium, which represent their location at early stages) branch dichotomously, each main trunk, with its descendent branches, bifurcating three or

<sup>1</sup> *Medusæ of the World*, vol. 2, 1910.

<sup>2</sup> *Die Craspedoten Medusen der Siboga-Expedition*, 1905.

four times. The outermost branching is close to the margin of the stomach and is obscured by the lips. In the type there are 38 canals resulting from the bifurcating of the four primary ones.

As a result of this method of branching, the canals are in groups. The number of groups varies according to the number of branchings which each main stem has undergone, and the number of canals varies from group to group. In the type the "cross" is so irregular that it is hard to determine which trunks are the four primary ones. But in another specimen, in which the features are more regular, there are 10, 5, 7, and 7 canals, originating from each of the four primary trunks, respectively. In another there are 9, 12, 5, and 8. In the two young *Æquorids* described by Maas, which probably belonged to this species, the central cross is quite regular, and in each specimen there are 32 definitive canals.

The canal-stripes within the limits of the stomach are the visible evidence of lines along which the upper (outer) wall of the manubrium is now attached to the subumbrella. Between these lines it hangs loose, leaving spaces into which a probe can be inserted, or an air bubble injected. Consequently it is easily stripped off, and all the specimens show more or less damage of this sort. Maas doubts whether the conditions in his specimen, which are essentially similar to those here outlined, are to be explained as the result of the branching of primary simple canals, or whether the numerous canals arise directly from the base of the stomach which grows laterally sinously ("sinos"). The complexly branched figure seems to indicate the former. The difference between these two concepts is more apparent than real, for the specimens show that the "branching," that is, the growth of new centrifugally formed canals, takes place from the margin of the manubrium at the points whence the preexisting canals emerge from it. The manubrium itself broadens as so many sinuses along the successively formed canals. A still further specialization would be branching of canals outside the margin of the manubrium, such as Hæckel has described.

*Marginal organs.*—The numerical relations of tentacles and canals and the proportional size of the stomach are given in the table for seven specimens:

Diameter.	Diameter of stomach.	Canals.	Tentacles.
<i>mm.</i>	<i>mm.</i>		
76	(?)	38	About 70
68	25	45	About 50
50	-----	31	About 45
43	18	46	46
40	20	35	42
39	18	38	54
36	13	29	28
29	12	33	42



In the type the tentacles are arranged rather irregularly, some opposite canals, some between canals, some canals without tentacles. But in the specimen 36 mm. in diameter they are all opposite canals. The table shows that tentacles range from about as numerous as canals to almost twice as many. The tentacular bulbs are not laterally flattened, but cylindrical and stout. They have no spurs clasping the exumbrella, though they are truncate basally.

In addition to tentacles the margin bears a large number of rudimentary knobs. In one specimen in which I could count them approximately there were 29 canals, 28 tentacles, and about 110 knobs: 6, 4, 4, 11 between four successive pairs of tentacles. The very large number of bulbs contrasted with the invariably rather small number of tentacles shows that at least most of the former remain permanently rudimentary. Both tentacles and knobs bear excretory papillæ. These are unusually long, so that at first sight I took them for a third class of tentacles. But examination reveals their true nature. In all the specimens they are of the same remarkable proportions; the character, then, is constant enough to be a helpful field mark to the species.

The otocysts, of the usual closed type, are extremely numerous, from 0-3, usually 1 or 3 between every two bulbs, or bulb and tentacle, as the case may be. This indicates a total number of upward of 200, but I have not been able to count them all in any specimen. Each contains 1-3 otoliths. They are all so small that photographs do not show them, but they are easily made out in the specimens themselves.

*Gonads.*—The sexual glands are of the usual *Æquorid* type.

*Subumbrella sculpture.*—This is one of the most characteristic features of the species, one shared by but few other *Æquorids* (as *Æquorea grænlandica*). The central two-thirds of the disk is lenticular; the outer third hangs down; the sculpture is restricted to the former. Between every two canals there is a longitudinal row of stout gelatinous papillæ, conical and very stiff. The largest number counted in any one row was 15; the usual number is from 5-10; I once saw as few as 4. In the region of the manubrium these papillæ are represented by rounded knobs occupying the spaces between the canal-stripes. The number of knobs is variable; in one example there were 16. The upper wall of the stomach is often torn away where it covers them. When, as in the type, this is not the case, it is not possible to count them.

The preserved specimens are colorless.

The *Siboga* specimens were taken in Malay Archipelago. The early records of the genus are from New Guinea and from the Straits of Sunda.

*Type.*—Cat. No. 29388, U.S.N.M., from *Albatross* station 5190.

## NAUARCHUS, new genus.

The three specimens on which this new genus is based are extremely interesting, for while their relationship to the Olindiinæ is patent, the gonads are of the Geryonid type, and the manubrium is suggestive of that organ among Halicreasidæ, a conformation without parallel among Petasidæ.

The genus may be defined as Petasidæ with 6 radial canals, but without centripetal canals; manubrium short and flat, without distinct gastral portion; mouth surrounded by a simple circular lip; gonads leaflike; tentacles of one kind only, corresponding to the primary tentacles of *Olindias*, their basal ends lying in furrows of the gelatinous substance so that they appear to emerge from the exumbrella; with terminal nematocyst swellings; otcysts free clubs, between the bases of the tentacles and the exumbrella.

*Type of the genus.*—*Nauarchus halius*, new species.

## NAUARCHUS HALIUS, new species.

Station 5456, 120–0 fathoms, 3 specimens, the largest 12 mm. in diameter, the other two smaller, but too contracted for measurement. All three are so badly crumpled that it is impossible to make a photograph of the general habitus. But all were well preserved anatomically. The largest specimen may be taken as the type.

The gelatinous substance is thick centrally, thinner near the margin, the bell cavity shallow (at least after preservation). The velum is unusually broad; its circular muscles well developed. In general appearance the specimen strongly suggests a Halicreid, as, for instance, *Homæonema alba*. And the likeness is heightened by the gastric system.

The manubrium is small, 3 mm. in diameter; hexagonal in outline, its lower wall hardly at all pendent; the mouth surrounded by a simple thickened circular lip.

There are six broad radial canals, subtending equal arcs of the bell margin. The six gonads occupy the greater length of the radial canals, though leaving their extremities, distal and proximal, free. They are flat and leaflike, exactly like the corresponding organs in *Liriope*, and oval in outline. The specimen is apparently a male.

*Marginal organs.*—There are 12 solid tentacles, 6 radial and 6 interradial. The radials are larger, and one of the interradials is so small, that it was obviously formed very recently. Only two large tentacles are intact throughout their length, and both of these are interradials. For over four-fifths of their length they are smooth-walled, but near their ends they bear a series of about 20 prominent annulations, composed of nematocysts, and at the tip there is a prominent sub-spherical knob of closely crowded ectodermic cells radially arranged. But this is not flattened to form a "sucker," as in *Gonionemus*. (The

tentacle tips thus agree with those of *Gossea*, and more closely with the secondary than with the primary tentacles of *Olindias*, though the tentacles themselves are homologues of the latter. All the other tentacles are broken short off, except two of the radials, which have apparently suffered the same fate, but regenerated at the tips. On the young tentacle no terminal annulations or knobs have developed yet. The tentacles arise from the margin, but curve upward against the bell, where they lie in furrows of the exumbrella. A slight distance above the margin they bend outward, away from the bell. This is a condition very much like what we find in *Heterotiarra*. In *Olindias*, and especially in *Olindioides*, the basal parts of the tentacles have become entirely inclosed by the gelatinous substance, so that these organs actually do emerge from the exumbrella, but in *Nauarchus* the furrows remain open permanently.

*Otocysts*.—There is a single otocyst close beside each tentacle, lying within the exumbrella furrow, which sheaths the tentacle, but standing free instead of being inclosed in the gelatinous substance. The sense organ itself is a naked club, much like the corresponding organ in *Amphogona*, or *Aglantha*, except that it is nearly spherical. The covering layer of ectoderm can easily be distinguished from the entodermic core. In the only otocyst which was in perfect condition, or which I could study, this entoderm core consists of four large spherical, somewhat flattened, cells, each containing a small central mass which, judging from its high index of refraction, is the calcareous concretion.

*Color*.—All three specimens are colorless, at least after preservation, and very transparent.

The above description, taken from the type, applies very well to one of the other specimens also. But the remaining one is abnormal, so far as gonads and radial canals is concerned. Three of the canals, with their gonads, are of the normal type, but the other three are represented by a single trunk leaving the margin of the manubrium. This soon divides into three, each of which bears a gonad, leaflike in form but of rather less than normal size. Two of the resultant canals run to the margin, but the third ends with the end of the sexual gland. The specimen has 13 tentacles, two interradials in one sextant, one of them very small. Such an aberrant specimen is less surprising in this genus than it would be in some other families, for even more remarkable examples have been recorded for *Gonionemus*. Canals, gonads, and manubrium all vary to an extraordinary degree in these genera.

The foregoing account shows that this new genus does not fit in very well either with Mayer's<sup>1</sup> definition of *Olindiidæ* as having, *Petasinæ* as lacking, sucking disks on the tentacles, for though the structure of the margin shows unquestionable affinity with such genera as *Gonionemus* and *Olindias* the terminal knobs on the tentacles

<sup>1</sup> *Medusæ of the World*, vol. 2, 1910.

are mere swellings; there is nothing in their structure to suggest that they exercise a suctional function. But even if they do not support Mayer's scheme, they do not fit any better in the system proposed by Browne<sup>1</sup> and adopted by me<sup>2</sup> in which the criterion separating the two subfamilies is the structure of the sense organs, whether vesicles, either external or internal, or clubs; because though allied to *Olindiinæ*, they have free sense clubs. In short, it is intermediate between the two subfamilies.

*Type*.—Cat. No. 29365, U.S.N.M., from the locality given.

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<sup>1</sup> Hydromedusæ, in Fauna and Flora of the Maldive and Laccadive Archipelagoes, vol. 2, 1904.

<sup>2</sup> Mem. Mus. Comp. Zoöl., vol. 37, 1909.