Calyconectid Siphonophorae (I)
by Tamiji Kawamura
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The bracketed **[..]** and emboldened comments are Totton's marginalia.

The author has reported in this publication several species of "Misaki" siphonophores during the past year. At the same time it was planned to consider other genera as well. However, for unforeseen circumstances the writing had to be discontinued. Therefore, the following report is to fulfil his past hope by simply reassembling the old manuscript on the subject. Now, among siphonophores, the Calycophorae (Calyconectae) are a group which is comparatively minute and often found in plankton nets. They are readily distinguishable from other siphonophores because they lack the pneumatophore and palpons. It, therefore, seems appropriate to give a general explanation of the pertinent developmental and morphological aspects of the various groups of this family before proceeding with the discussions of the individual species.

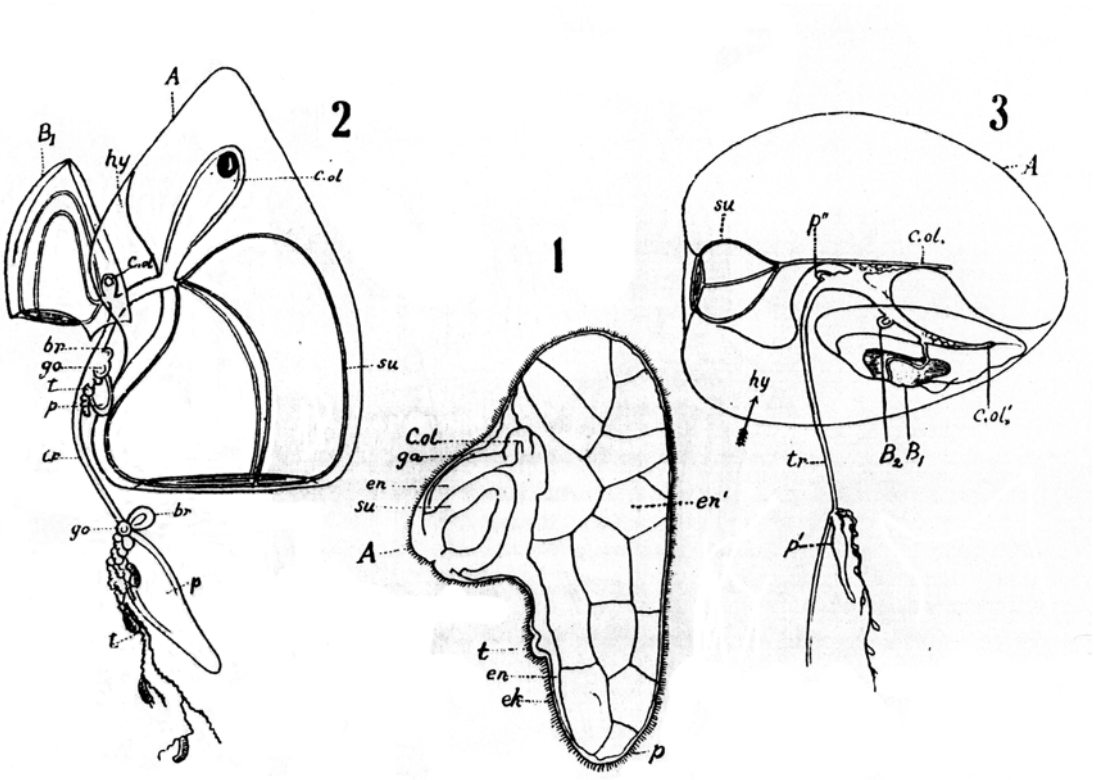


Figure 1. Larva of *Muggiaea*. [**after Chun, 1882, Taf. XVII, fig. 6**]
Figure 2. Already developed secondary nectophore of above. [***M. kochi***]
[**Rearranged from Chun 1882 Taf XVII, fig. 4**]
Figure 3. *Hippopodius*, young larval stage [**poor copy of Chun 1888**]

Legends

a. primary nectophore; b1. secondary nectophore; br. bract; c.ol. somatocyst; en. endoderm; ek. ectoderm; ga. gelatinous part; go. gonophore; hy. hydroecium; p. siphon; su. subumbrella layer (nectosac); t. tentacle; tr. stem.

1. Development.

The larva develops from the egg-shaped form as illustrated in figure 1 - the ectoderm consists of cilia, the external "covering layer" while the endoderm is composed of large polygonal cells. On one side of the upper half of the young organism, the bud nucleus which eventually becomes the subumbral cavity of the nectophore is developed. And its lower end stretches downward, finally making an opening at its pointed end. As this ruptured cavity comes in contact with the outside, a siphon is developed. The tentacle that accompanies this growth is also recognisable in the early stages as a process on the lateral side of the larva. About the time the upper half of the larva becomes a nectophore, the connecting section between it and the siphon grows into a stem by becoming long and narrow. At the top of the stem second and third nectophores, etc. bud off upward from a point of growth at the centre and many cormidia downward.

However, the initial nectophore developed from the upper half of the larva, is not, in many cases, a permanent growth but rather a temporary one. Thus, this is called the primary nectophore and all those appearing subsequently are called secondary nectophores. Inasmuch as they are quite similar structurally, the difference in their shape is very pronounced. The identification, on the other hand is not at all difficult. For example in *Muggiaea kochi*, the primary nectophore is hood-shaped and the secondary growth is pentagonal as illustrated in figure 2. But in this case, as soon as the secondary nectophore completes its growth, the primary one drops off. Therefore, for many years, this species having only one nectophore has been considered as belonging to the Monophyidae. On the other hand, in the genus *Sphaeronectes*, the nectophore that remains permanently is not the secondary nectophore but rather the primary one. Consequently, in this case, the organism has only the first primary nectophore that began its growth in the larval stage of the organism. We thus know that the secondary growth does not take place at all I n this case.

It is common that the very first growth of the secondary nectophores (that is, the one that develops immediately after the primary nectophore) differs in its internal structure from the others which develop later. For this reason in a case such as *Diphyes* with both upper and lower nectophores, the superior and inferior nectophores are not structurally similar. On the other hand, genera with two nectophores having an identical structure are not at all uncommon. In such cases, this results from regeneration as the older ones drop off and are replaced by newer growths. Often more than three nectophores are seen simultaneously, because the new ones grow before the older ones are completely detached.

Even in a genus such as *Hippopodius* with many nectophores, the primary and secondary nectophores are different in shape as illustrated in figure 3. However, in this group, the secondary nectophores are identical, whether an earlier or a later growth. Hence no regeneration takes place between nectophores.

Thus, the animal swims about in the plankton with one to several nectophores which develop as previously described and as it grows older (matures), its stem on which are many cormidia, becomes long. When a cormidium is sufficiently mature consisting of either female or male gonophores respectively - each cormidium is the sexual generation of calyconectid siphonophores. The parent animal that buds out this generation is the asexual generation. On the base of each cormidium there is also one siphon and on the parent animal there are many cormidia. These are thus sometimes called monogastric and polygastric generations, respectively. Such a distinction is

more obvious among the general in which a cormidium freely enters into the planktonic life for a time after it is separated from the stem of the parent animal. This planktonic cormidium is generally called the eudoxid. Among many investigators of the past generations, there were many who thought several eudoxids to be altogether different siphonophores and wrongly classified them in different genera. During Haeckel's (1888) time, even though this morphological relationship was known, the eudoxids were classified in different taxonomic groups as eudoxids paralleling their parent animal, similar to the situation in the hydromedusae, because there were many genera which had not been clearly defined as to the genetic relations of the parents and the offspring. Even today, this relation, as a whole, has not been clearly established and the analytic theory varies with different scientists. Some believe that an eudoxid, for example, is of a certain "A" parent, while others claim it to be different "B" parent. Thus it is not possible to remove this doubt.

The sex cells that are ejected from a eudoxid or the gonophore of a cormidium, first begin their growth by settling, in all case, to a deep layer and become egg-shaped larvae as has been described previously.

II. Shape and structure (Anatomical).

First, let as begin with those having a single nectophore. For example, of the family Sphaeronectidae (Sphaeronectidae was heretofore classified as Monophyidae but as the results of combining the genera *Monophyes* and *Sphaeronectes*, the classification was changed according to taxonomic rules) the shape of the genus *Sphaeronectes* generally resembles the larval stage of *Muggiaea* as shown in figure 2, without its secondary nectophore. The reason is that the nectophore of *Sphaeronectes* is the primary one that remains attached. At its upper end is a bell or hood-shaped nectophore with a smooth surface in the dorsal half, of which a subumbral cavity or nectosac is situated. Along its walls, four radial and one circular canal are found. The velum is located near the circular canal around the nectosac opening. The radial canals converge around the apex of the hydroecium which is situated in the middle of the ventral side and at this point the canals become connected to the inner cavity of the stem. Consequently, the stem extends outside thereof. A sac called the somatocyst is buried in the gelatinous substance on the upper side extending from the hydroecium inwards and filled with oil granules. This, of course, acts as a buoy. However, it is an organ within the nectophore and should never be compared to the pneumatophore seen in *Hippopodius* or *Agalma*, etc. A cormidium consists of such parts as bracts, tentacles, siphons, and gonophores and becomes an eudoxid by breaking loose.

Within the genus *Muggiaea* which should be included in the family group, the primary nectophore, previously discussed, drops off and is replaced by a secondary nectophore. This can be seen in figure 2 by assuming its upper part "A" completely taken out and the part "B" inflated. In the drawings above, figure 1 was made from the scale model of this genus. Next, the genus *Nectopyramis* has a nectophore whose external shape is smooth and its canal system, comparable to the somatocyst, is complicated, having branched out. Whether this nectophore is the primary one or the secondary growth is extremely difficult to determine without actually studying its growth. However, Bigelow claimed it to be the secondary nectophore despite the smoothness of the exterior and considered it to be the most advanced form in this family.

The structure of the eudoxid in all genera varies very slightly and consists of several gonophores which successively grow one bract, tentacle, and siphon respectively. The gonophores are medusiform resembling the shape of the nectophore. In certain genera, a gonophore remains permanently without the stalk in which the sex

cells are developed. This is called a special nectophore. As far as the external shape of the bract and special nectophore of the eudoxid is concerned, they are like those of the parent. When the latter is smooth and bell-like, the former takes a similar form. Likewise if the latter is many-ridges (polygonal, drill-like shape) the former takes the identical external appearance. In the centre of the bract, the eudoxid has a somatocyst like the one seen in the parental nectophore, in which oil granules are stored. The lower end of the somatocyst is connected to the apex (too) of a shallow groove (or a special nectophore) and at this point it becomes extremely short stem which ends in a siphon. However, the gonophore (or a special nectophore) is extremely large in size occupying the entire lower half of the eudoxid. Consequently the right siphon with the tentacle and successively growing young buds appear hemmed in the space between the right gonophore (or the special nectophore) and the bract. Actually, this space forms a convenient hydroecium between the depression (groove) of the superior bract and that of the gonophore situated below and facing the former. The siphon and the tentacle are drawn within when the necessity arises. With the genus *Nectopyramis*, the somatocyst of the bract changes into a branched canal system, and is quite similar to the parent nectophore of this genus.

Next, let us move on to the family Diphyidae. As has been previously described in the discussion, some embryological differences exist between the first and second growth of the secondary nectophore. This is due to the presence or absence of a somatocyst. Therefore, if "A" has nectophores remaining permanently attached there the superior and the inferior nectophores are dissimilar. But with "B" if regeneration takes place between these parts, there is, for example, obviously some structural variation but soon they become alike. Actually the former type of structure can be seen in such genera as *Diphyes*, *Diphyopsis*, *Abyla*, *Galeolaria*, etc., and the latter structural variation is obvious with *Amphicaryon*, *Praya*, *Stephanophyes*, et. There is another interpretation of the variations in the case of "B". That is, with this group the fact that the first and second nectophores, etc., of the secondary nectophore all have identical structure can be described in the case of the family Hippopodiidae. On the other hand, with *Praya*, etc., there is the canal system that may possibly be interpreted as a metamorphosis of the somatocyst of the nectophore although it is already known that the nectophore still undergoes regeneration even after the animal reaches maturity. In the final analysis, the question of whether the first growth of the secondary nectophore is identical to the second and successive growths or not, as the case may be, is quite difficult to answer without having a young specimen and no conclusive judgement can be given. In the past, it was rather preferred to classify "B" and "A" groups as sub-families according to the first interpretation but recently Bigelow recognised the dissimilarity between these two groups to be quite fundamental in thoroughly scrutinising the latter consideration. He subsequently named the "A" group as Diphyidae and the "B" group as Prayidae. This author therefore shall follow his classification.

The superior nectophore of Diphyidae does not differ at all structurally from the nectophore of the Sphaeronectidae. For this reason, for example, a young siphonophore of the genus *Diphyes* or one that lost the inferior nectophore is almost indistinguishable from some species of the genus *Muggiaea*. Only when there is a trace of the bud or point of severance of the inferior nectophore evident on the upper part of the stem can the difference be identified. This holds equally true in the genera *Diphyopsis* and *Dramasia*. Consequently, as a result of this confusion in the structure of some organisms, there were until recently many animals belonging to genera of the Diphyidae which had wrongly been classified in the family Sphaeronectidae.

However, even the superior nectophore of the family changes its shape from a drill-shape to a form slightly polygonal and likewise the somatocyst, the hydroecium and the nectophore too change their shape to a certain degree. It is therefore not uncommon at all to fail in the identification at a glance of a specimen of this family. The genus *Abyla* is a good example of this type.

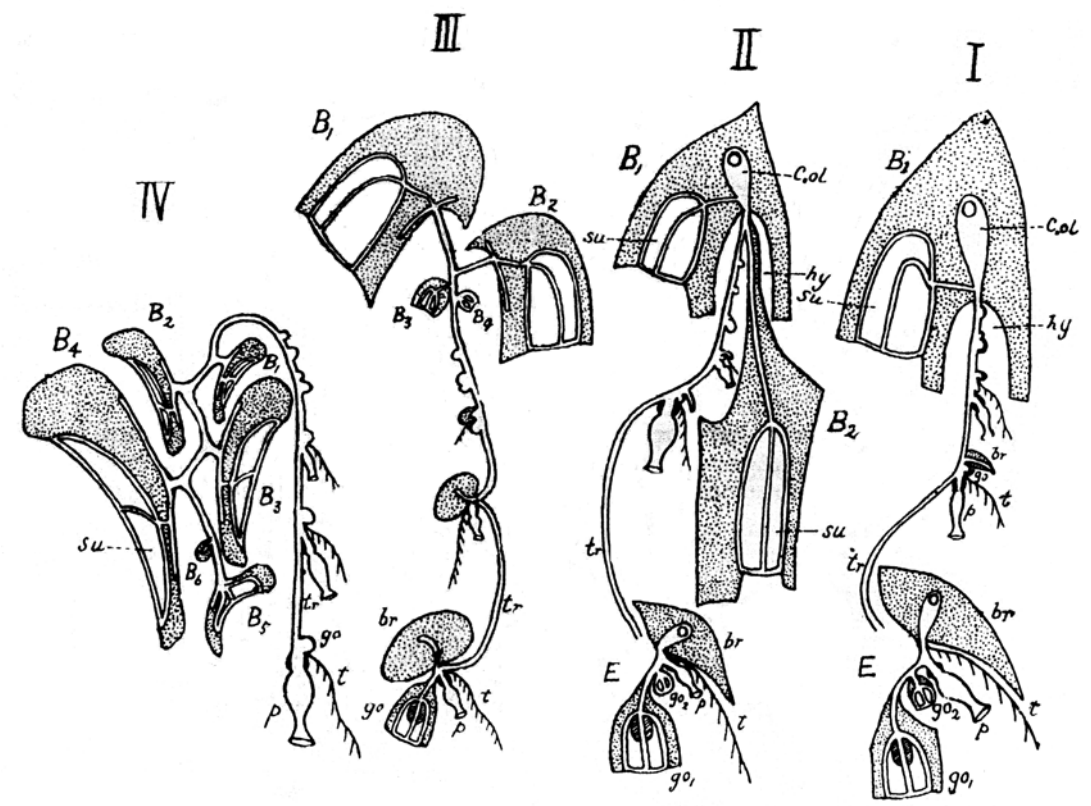
The inferior nectophore is a large one which has developed at the base of the stem. Ordinarily its size is approximately the same as the superior one, but it may attain a far greater size. Unlike the superior nectophore, this structure lacks a somatocyst or a canal system in contrast to the superior nectophore. This may be compared with the relation between the gonophore and the bract of the eudoxid. The external form of the inferior nectophore is smooth bell shape, drill-like or polygonal, thus resembles the superior nectophore in shape. Its dorsal surface, the side where the cormidium passes, is almost like a canal, having a deep groove that extends upwards and downwards. The stem is drawn within it when necessary. This is comparable to the hydroecium of the superior nectophore.

As far as these two nectophores are concerned, the dorsal and the ventral sides often face each other as in the case of the genus *Galeolaria*. On the other hand, they sometimes place themselves back to back.

The structure of the eudoxid is similar to that of the family previously discussed.

Several genera of this family are divided into three sub-families by the shapes and the sizes of the superior and inferior nectophore and also the characters of the cormidia. In the Galeolariinae, both nectophores are smooth and almost identical in size; in the Abylinae, they are polygonal and the superior nectophore is extremely small; in the Diphyopsinae, both are also polygonal and are of the same size. However, in the first sub-family, the cormidia do not become free, while in the second and the third group, they become eudoxids, the second having an angular columnar bract and the third with a round bract. The scale model drawing 2 was mostly made from the Diphyopsinae and describes the structure of this family.

Next, we shall move on to the family Prayidae which has two or more nectophores of identical structure. Although between the two nectophores in members of this family, there is some difference in age and in vertical position of the basal point from which the stem starts. As far as their positions are concerned they are situated side by side instead of being one over the other. Chun, therefore, named this group, sub-family Oppositae and the family discussed previously as the sub-family Superpositae (the reason for his sub-classification of these groups is clearly understandable from the developmental aspect). In such generic groups as *Praya* and others, the two large functional nectophores are situated actually back to back at the upper end of the animal, even when many nectophores have developed all at once through some irregularities in their regeneration. But in the genus *Stephanophyes* many nectophores grow side by side like a wreath and in the genus *Amphicaryon* without undergoing regeneration, the older one of the two nectophores through metamorphosis takes the shape of a bract. In this family (Prayidae), the nectophores are all smooth and round. None of them are polygonal like those of the other families. The structure of the nectophore, as described already, is comparable to the superior nectophore of the previous family group (considered as the inferior nectophore according to the older theory). It has canals as well as a nectosac, a hydroecium and a somatocyst. The cormidia either break loose or remain attached.



This family is again divided into three sub-families. In the sub-family Amphicaryoninae, the older one of the two nectophores metamorphose to a bract-like shape and the cormidia become eudoxids. With the sub-family Prayinae both nectophores always undergo regeneration and the cormidia do not become eudoxids. However, in the sub-family Stephanophyinae, many nectophores develop side by side in a wreath-like fashion and the cormidia remain attached without breaking loose. The scale **[? diagrammatic**] drawing III mainly based on the Prayinae describe the structure of this family.

The last family to be discussed is the Hippopodiidae. Although this group is identical with the previous family described in the structural characteristics of having many nectophores of the same structure, it is definitely a family by itself, although lacking bracts. These nectophores form two rows facing back to back in an orderly manner and the cormidia remain permanently attached. However, the position at which both nectophores bud are in reverse to those of the other three families and the farther away it is from the cormidia, the later it buds out. This is, as I have described in an issue during the past year. The scale drawing was made from *Hippopodius* sp. showing the structure of this family.

III. Taxonomic relations.

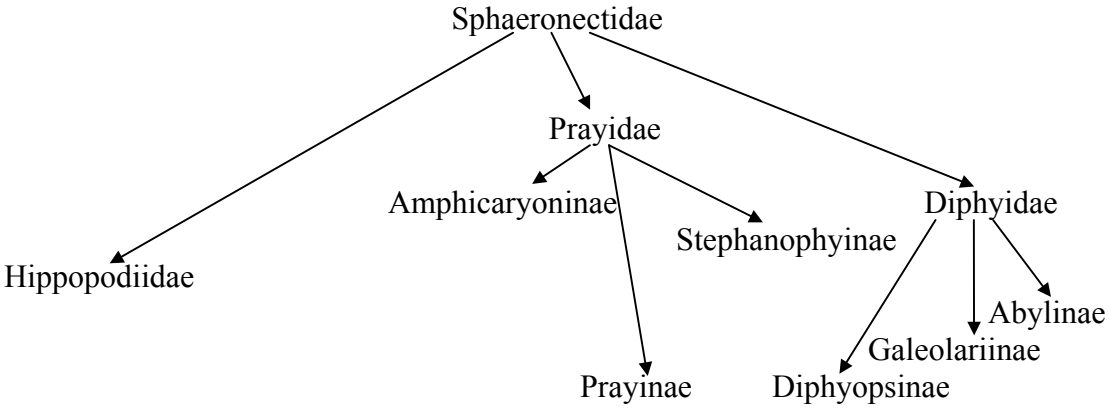
Hitherto, siphonophores have been classified into three major families of Monophyidae, Diphyidae and Polyphyidae. However, recently, Bigelow divided the second group into two other families. Therefore, we have four families at present as:

I. Sphaeronectidae - Monophyidae.
II. Diphyidae - Suprpositae.
III. Prayidae - Oppositae.
IV. Hippopodiidae - Polyphyidae.

The reason for reclassifying hitherto known Diphyidae and treating Prayidae (= Oppositae) and Diphyidae (= Superpositae) independently have already been discussed in the previous pages. Therefore, the author shall not repeat the same thing again. It is without doubt true that the family Sphaeronectidae Monophyidae is a most primitive form but it is significant that there is obvious evidence of the character of the nectophores and the cormidia of this and other families being parallel. That is among the nectophores of the family Sphaeronectidae Monophyidae there are smooth, polygonal shapes and smooth but with branched somatocyst. These are equally common among the other families. Further, the similarity is so great that with some species even the untrained eye can detect the difference. For example, the following resemblance is most common:

Sphaeronectes to several genera of Prayidae
Cuboides to several genera of Abylinae
Muggiaea, *Dramasia* to several genera of Diphyopsinae
Nectopyramis to Stephanophyinae.

This fact is to obvious to be a coincidence. Therefore, it should immediately taken into serious consideration as undoubtedly having a bearing on the systematic embryology. That is, it is clear that from several types of Sphaeronectidae Monophyidae, three other families have each developed in different directions. When Haeckel and Chun presented the theory that several genera of Sphaeronectidae 9= Monophyidae) were the most primitive forms from which other families developed, Schneider (1898) concurred in that *Sphaeronectes* was a primitive form but not in others, for example, in the case of *Muggiaea*. He further insisted that this is nothing more than the result of metamorphosis of such a "two-bell" type of *Diphyes* losing the inferior nectophore. However, Bigelow stated, on the other hand, that since *Muggiaea* showed no trace of having had an inferior nectophore, *Diphyes* should have originated from *Muggiaea* rather than vice versa. With a consideration on the few aspects pointed out above Bigelow gave the following relationships:



Schneider's interpretation of the anatomical structures are very different from those of others and his taxonomy too is extraordinary. An introductory note of his general discussion was made in an article in this publication under the title of "On Siphonophores" during the past years but a short remark on Calycophorae shall be included here at this time. He generally classified Calycophorae in two groups realising the extreme importance of differentiating varied nectophores - one with the somatocyst and the other without, stating that the one without the somatocyst is a true

nectophore and the other with it is a combined growth of the bract and the nectophore. For instance:

(I) Prayinae - the two nectophores are true to form.

(II) Diphyidae - one of the nectophores is a combination of a bract and a nectophore.

In the former group he has classified *Sphaeronectes*, prayids, *Hippopodius*, etc., and in the latter species of diphyids, abylids (*Muggiaea* is a product of metamorphosis of abylids). However, in this theory it is a question whether the presence of a so-called somatocyst comes from a bract and Schneider's explanation too is insufficient. Thus, Chun has presented a paper strongly refuting this theory. This author shall continue with a discussion of each generic species from this point.

る如く、前科の上泳鐘に(舊說によれば下泳鐘)比す可きものにして、泳嚢幹室及體嚢に相當する管を有し、幹群或は脫離し或は停まる。

本科も亦分ちて三亞科となす。Amphicaryoninae にては、二個の中、古き泳鐘退化して保護葉の如くなり。幹群遊離して「ユードキシッド」となる。Prayinae にては、二個の泳鐘常に代謝し、幹群遊離せず(?)。而して Stephanophyinae にては、多數の泳鐘花環狀に並び、幹群附着して遊離せず。模式圖 III は主として Prayinae の型に基ける本科の構造なり。

最後にバテイクラゲ科 (Hippopodiidae) にては、構造を同じうする多數の泳鐘を有することに於て前科と一致するも、全然保護葉を缺くことによりて明確なる一科をなせるなり。多數の泳鐘は正しく背中合せの二列に配列せられ、幹群は永久に附着して停まる。而して此科の鐘鐘の芽出する位置は他の三科の場合と逆にして、幹群に遠き方が却て後に出でたるものなること、余が先年本誌上に述べたるが如し。模式圖はバテイクラゲに據れる本科の構造なり。

(三)　類　緣

鐘泳類管水母は、從來單鐘科 (Monophyidae) 二鐘科 (Diphyidae) 及多鐘科 (Polyphyidae) の三科とせられたりしが、近頃ビゲロー第二を分つて二科となしたる爲、

(一)　タマクラゲ科 (Sphaeronectidae = Monophyidae)
(二)　フタツクラゲ科 (Diphyidae = Superpositae)
(三)　アヒオヒクラゲ科 (Prayidae = Oppositae)
(四)　バテイクラゲ科 (Hippopodiidae = Polyphyidae)

の四科となれり。從來の二鐘科を兩分し、アヒオヒクラゲ科とフタツクラゲ科とを共に獨立の科たらしめたる理由は、前條に詳なれば再び云はず。タマクラゲ科が最原始的なる型なること疑なし。而して此科と他科との間に、泳鐘及幹群の性質に著るしき平行の見らるゝことを注意す可し。即ちタマクラゲ科の泳鐘には、圓滑多稜、及圓滑にして體嚢分岐せるの三樣ありて、他の科にも亦同樣の三樣を見、而も其類似たる、或屬種にては最熟練したる眼にても區別し難き位なり。即ち

Sphaeronectes は Prayi'ae の諸屬に、
Cuboides は Abylinae の諸屬に、
Muggiaea, Dramasia は Diphyiopsinae の諸屬に、
Nectopyramis は Stephanophyinae の一屬に

酷似せり。此事實は、偶然の一致としては餘りに精確なるが故に、必ず系統發生上の價値を有するならんとは、直ちに考へ及ぶところなり。即ちタマクラゲ科の諸型より他の三科が別々の方向を取りて降り來れること明なり。曾てヘッケル・クーン等によりて、タマクラゲ科の諸

なせり。余は是に從ふべし。

フタツクラゲ科の上泳鐘は、構造少しもタマクラゲ科の泳鐘に異らず。是が爲に、例へば *Diphyes* 屬の管水母の幼きもの、若くは下泳鐘を失ひ居たるのに遭遇したる時は、殆ど *Muggiaea* 屬の或種と見分け難きものにして、唯僅に幹の上部に、下泳鐘の芽又は切斷したる痕跡の認めらるゝ場合に、之を判斷し得るのみ。*Diphyopsis* 屬か *Dramasia* 屬に於るも亦然り。此爲にフタツクラゲ科の管水母にして、近頃迄、誤りてタマクラゲ科に編入せられたりし例少からず。然れども此科の上泳鐘には又角錐形より變じて、略多角形といふ可き形となり、體嚢・幹室・泳鐘の位置も多少轉移して、一見してそれと知らるゝものなきに非ず。*Abyla* 屬の如き然り。

下泳鐘は幹の基部に生じた大なる泳鐘なり。大さは略上泳鐘と同大なるか、然らざれば遙に是より大なり。上泳鐘と異り、體嚢若しくは之に匹敵すべき管系統を缺くを以て、上泳鐘との關係は、恰も「ユードキシッド」の生殖體が、保護葉に於るが如し。下泳鐘の外形は、概して上泳鐘のそれに一致し、圓滑球形、角錐形若しくは多角形なり。其背側面常に幹群の往來する側は殆んど管の如き、長く深き溝ありて上下に貫通し、幹は必要に際して此中に引き納めらる。即ち上泳鐘の幹室に比較せらる可き所なりとす。上下兩泳鐘は、*Galeolaria* 屬の如く、背腹同じ側に面して並ぶこともあれば、*Diphyopsis* 屬の如く、背中合せとなりて上下に並ぶこともあり。

「ユードキッド」の構造は前科のものと同じ。

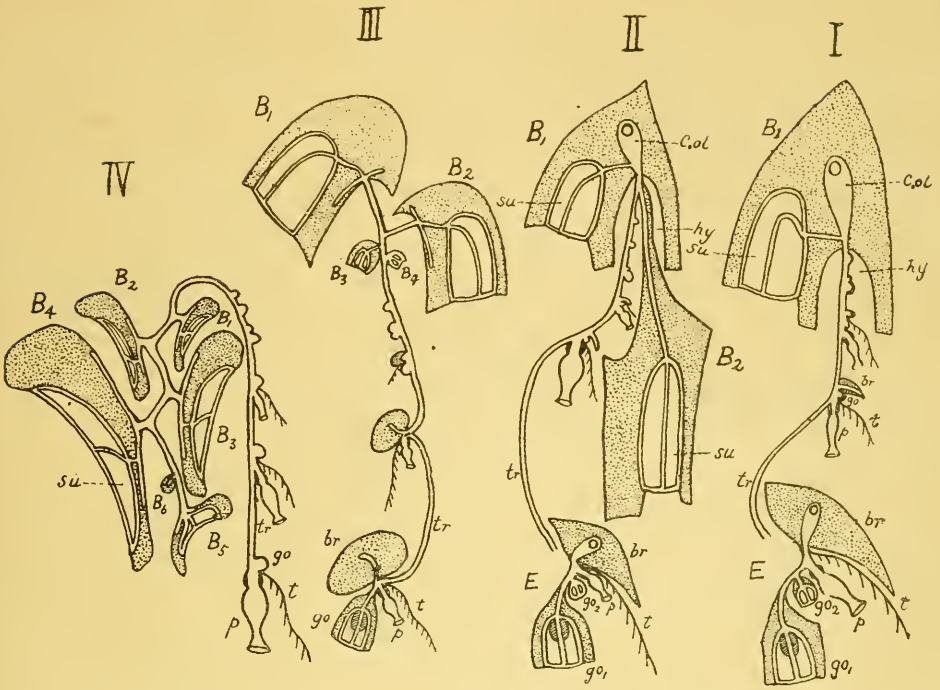
本科の諸屬は、上下泳鐘の形及大さの比、及幹群の性質によりて分つて三亞科となす。Galeolariinae にては、圓滑にして上下殆同大、Abylinae にては多稜形にして上泳鐘甚だ小さく、Diphyopsiinae にては多稜形にして上下同大なり。而して第一にては幹群遊離せず、第二と第三にては離れて「ユードキシッド」となれども、第二は角柱形の保護葉を、第三は圓形の保護葉を有す。模式圖II は主として Diphyopsiinae に據れる本科の構造なり。

次には二個若しくは二個以上の同構造の泳鐘を有するアヒオヒクラゲ科 (Prayidae) に移る可し。此科に於る二個の泳鐘は、老幼の差と幹より發する基點に上下の差とあれども、位置として上下に並ばずして、左右相對立す。クーンは故に此類を亞科 Oppositae として、前科を亞科 Superpositae (同氏が兩方を亞科とせし理由は發生の條下に詳なり。)となせり。*Praya* 等の屬に於ては、泳鐘新陳代謝の變調によりて、一時に多數の泳鐘が見らるる場合にも、實際官能的なる二個の大泳鐘は、背中合せとなりて上端に位すれども、*Stephanophyes* 屬にては多數の泳鐘花環狀に並立し、*Amphicaryon* 屬にては泳鐘の代謝なく、且つ二個中の古き方退化變形して、恰も保護葉の如き形を取れり。此科に於て、泳鐘はすべて圓滑形にして、多稜形なるもの無し。泳鐘の構造は既に述べた

複雜となれり。此泳鐘が、果して一次泳鐘なるか、二次泳鐘なるかは、發生を檢するに非れば決定し難きも、ビゲロウは、外形圓滑なるにも拘らず、之を二次泳鐘として、此型を本科中最進みたるものと稱せり。

「ユードキシッド」の構造は、孰れの屬のものにても大差なく、一個の保護葉・觸手・營養體と續出する數個の生殖體とより成る。生殖體は形泳鐘に似たる水母形なるが、或屬にては、最初に顯はれたる一つのみが、終りまで、生殖素を發達せしむる柄部無く、單に泳鐘として役立つことあり。之を特別泳鐘 (special nectocalyx) と呼ぶ。「ユードキシッド」の保護葉及生殖體特別泳鐘は、外形に於て常に母體の泳鐘に似るものにして、後者が圓滑球形なるときは、圓滑球形、後者が多稜角錐形なるときは多稜角錐なり。保護葉の中心には、母體の泳鐘に見ると同樣なる體囊ありて、油滴を藏す。體囊の下端は淺き凹入の頂に接し、此處にて極短き幹に移り、末端一個の營養體に終る。而して生殖體(又は特別泳鐘)は、形最も大にして、「ユードキシッド」の下半部を占有するが故に、右の營養體は、觸手並にて續出する生殖體の幼芽と共に、右の生殖體(又は特別泳鐘)と保葉葉との間隙内に挾まれたる如き感あり。且實際此間隙は上方保護葉の淺き凹入と、下方之に對する生殖體面の同樣なる凹入とによりて、都合よき一個の幹室を形成し、營養體觸手は、必要に應じ、全部此中に引き納めらるゝものなり。*Neoptopyramis* 屬に於ては、保護葉の體囊が、分岐せる管系統に代れること、同じ屬の母體泳鐘に於る如し。

次に二個の泳鐘を備ふるフタツクラゲ科 (Diphyidae) に移らん。先に發生に關して說ける如く、二次泳鐘の第一と第二以下との間には構造の差あり。そは體囊の有無是なり。故に(甲)若し此等二泳鐘が永久に殘存する場合には、上下兩泳鐘の間に右の差異を見る可く、(乙)泳鐘の間に新陳代謝存するときは。假令初めは上下泳鐘の間に此差異あるも、やがて上下共に同一樣のものとなる可し。實際に於て、甲は、*Diphyes*, *Diphyopsis*, *Abyla*, *Galeolaria* 等の屬に見られ、乙は *Amphicaryon*, *Praya*, *Stephanophyes* 等の屬に見らる。然るに乙の場合の成因には、今一つの考方あり。卽ち此類に於ては二次泳鐘中第一も第二以下も、全く同一の構造を有すること、恰もバテイクラゲ科に於るが如しと解釋するなり。一方 *Praya* 等にては、生長後にも泳鐘の新陳代謝あること既に知られ居るも、他方に於てこの泳鐘に體囊の變形と解釋して可なりと思はるゝ管系統あり。果して第一の二次泳鐘が第二以下に同じきか、異れるかは、幼き標品を獲たる上ならでは確定し難く、如何とも斷定し難し。從來は寧ろ初めの考方によりて、乙類と甲類とを、亞科を別にして分類し居たりしが、近頃ビゲローは、後の考方を採りて、二類の差を深く根本的なるものと認め、甲をフタツクラゲ科 (Diphyidae)、乙をアヒオヒクラゲ科 (Prayidae) と

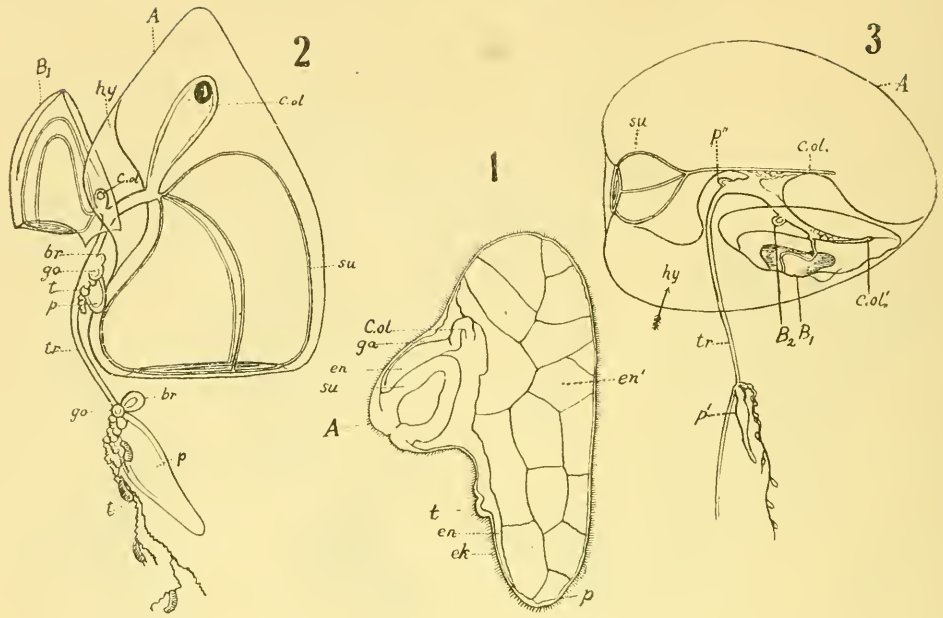


鐘泳類四科模式

I.　タマクラゲ科　(Sphaeronectidae)
II.　フタツクラゲ科　(Diphyidae)
III.　アヒオセクラゲ科　(Prayidae)
IV.　バティクラゲ科　(Hippopodiidae)
B_1, B_2 二次的泳鐘。　hy. 幹室。
br. 保護葉。　p. 營養體。
col. 體囊。　su. 泳囊。
E. 「ユードキシッド」　t. 觸手。
go. 生殖體。　tr. 幹。

の頂上に近く、管は此所に於て幹の內腔に通じ、從つて幹は此所より出づるなり。又此所より上方寒天質中に向ひ埋沒する一個の囊ありて、中に油滴を湛ふ。之を體囊(somatocyst)といふ。浮標として役立つものなること勿論なるも、泳鐘內の一器官にして、決してバレンクラゲ・ヤウラククラゲ等に見らるゝ氣胞體に對比すべきものに非ず。幹群は保護葉(bract)・觸手・營養體・生殖體より成り、後分離して「ユードキシッド」となる。

右と同じ科に入る可き *Muggiaea* にては、先に述べたる如く一次泳鐘脫離して、二次泳鐘之に代るを以て、第二圖中右上部Aを抹殺して、Bが肥大したるものと考ふれば可なり。上に示す模式圖中Iは此屬を型として作れるものなり。次に *Nectopyramis* 屬にては、泳鐘の外形は圓滑なるも、體囊に當る可き管系統、枝狀に分岐して



第一圖。　ヒトツクラゲ（*Muggiaea*）幼蟲。
第二圖。　同右。二次的泳鐘を生ぜるもの。
第三圖。　バティクラゲ（*Hippopodius*）幼期。

A.	一次的泳鐘。
B B_2	二次的泳鐘。
br.	保護葉。
col.	體囊。
en.	內層。
ek.	外層。
ga.	生殖體。
hy.	幹室。
p.	營養體。
su.	傘下層（泳囊）。
t.	觸手。
tr.	幹。
en.	寒天質。

（二）外形及構造

先づ單一なる泳鐘を有するものより始めんに、タマクラゲ科（Sphaeronectidae, 從來 Monophyidae といひ來りしも、*Monophyes* 屬が *Sphaeronectes* 屬に併合せられたる結果、命名規約により變更）の中、*Sphaeronectes* 屬の形態は、大凡第二圖に示せる *Muggiaea* の幼期より、左方の二次泳鐘Bを抹殺して考ふれば可なり。何となれば *Sphaeronectes* 屬の泳鐘は、一次泳鐘の永存せるものなればなり。上端には圓滑なる表面を有する球形又は頭巾形の泳鐘ありて、その背側半部には一個の傘下腔、卽ち泳囊（nectosac）あり、その壁に沿ひて四條の放射管と、一條の環狀管あり。後者に近く泳囊の口に緣膜あり。放射管の集合する所は腹側中央に位する幹室（hydroecium）

來りし、唯一個の泳鐘を有する型と成るなり。但しタマクラゲ（*Sphaeronectes*）屬にては、永存する一個の泳鐘は二次泳鐘に非ずして、寧ろ一次泳鐘なるが如く、從つて此場合には、幼蟲より起りし最初の一次泳鐘のみにして、以後少しも二次泳鐘の現はるゝことなきものと認めらる。

二次泳鐘中最初の一（即ち一次泳鐘に續きて出づるもの）は、爾餘の二次泳鐘と少しく內部の構造を異にするを常とす。是が爲に、フタツクラゲ（*Diphyes*）の如き、上下二個の泳鐘を備ふる時には、上泳鐘と下泳鐘との構造相同じからず。然れども二個の泳鐘を有しつゝ、兩者同一の構造を有する屬亦少からず。かゝる場合は泳鐘の間に新陳代謝ありて、順次に舊きが脫落して、新しきが補はれたる結果にて、往々舊きが未だ離れざるに、新しきが肥大したる爲に、同時に三個以上の泳鐘を見ることさへあり。

バテイクラゲ（*Hippopodius*）の如き多數の泳鐘を有するものにても、一次泳鐘と二次泳鐘とは形を異にすること第三圖を見て知らるべし、但し此類に於ては、二次泳鐘は前後全く同一の構造を有し、且泳鐘の間に新陳代謝を見ることなし。

動物は、右の如くにして生じたる、一個乃至數個の泳鐘によりて海中に浮游しつゝ、次第に老いて幹長くなり、その上に多くの幹群を運ぶ。幹群充分成長したる時は、その雌又は雄生殖體（gonophore）中に、雌又は雄生殖素を發育せしむ。即ち各幹群は鐘泳類管水母の有性世代にして、母體は之を芽出する無性世代に外ならず。又各幹群は一個の營養體を有し、母體は多くの幹群を有する點よりして、幹群を單營養體世代（monogastric generation）、母體を多營養體世代（polygastric generation）と呼ぶことあり。此區別は、幹群が母體の幹より分離して、若干時の間、自由に水中を浮游する多くの屬に於て一層明確なり。かゝる自由浮游性の幹群を「ユードキシッド」（eudoxid）と總稱す。昔の研究者は、諸種の「ユードキシッド」を以て全く別種の管水母と考へ、誤りて屬種名を設定したること多し。又ヘッケル（一八八八年）の時代には、既に此關係了解せられ居たりしも、未だ母子の名乘を爲さしめ得ざる屬種多かりしを以て、恰も「ヒドロ」水母類に於けるが如く、「ユードキシッド」は「ユードキシッド」のみにて、母動物と平行して、別個の分類系の內に配列せられたり。今日と雖、決して右の關係が、總てに就きて判明したる譯に非れば、學者によりて說を異にし、一人は甲の「ユードキシッド」と信じ、他の一人は乙の「ユードキシッド」と認むる如き混雜は、未だ全く一掃せられざるなり。

「ユードキシッド」又は幹群の生殖體より放出せられたる生殖素は、合して海の深層に沈み、茲に發育を始め、前に述べたる如き卵圓形の幼蟲となる。

鐘泳管水母類（一）

理學士　川村多實二

余は先年本誌上に、數種の三崎産管水母類を報告したりしが、當時引續き他の屬種にも及ぶ可き豫定なりしに、事情の爲暫く中絶し來れり。以下記す處は單に舊稿を繰擴げて、古き希望を充たすに過ぎざるなり。さて管水母類中、比較的細小にして、屢プランクトン網に入り來るものは、鐘泳類（Calycophoraе=Colyconectae）にして、氣胞體（Pneumatophore）と感觸體（Palpon）を缺けることによりて、其他の管水母より容易に明確に區別せらるゝものなり。今一々の種を記述する前に、此類の分類に必要なる發生と形態とに就て概括的說明を爲し置くの要あるべし。

（一）發　生

鐘泳類管水母の卵より發生したる幼蟲は、大體第一圖に示す如く卵圓形をなし、外層は纖毛を有する上覆層、內層は多角形の大なる細胞よりなる。その上半部の一側には、やがて泳鐘（nectocalyx）の垂下膜たるべき鐘核の作られたるあり、又その下端は下方に延びて、後には尖端に口を開きて、分裂腔は外界と引續きとなるを以て、茲に一個の營養體（siphon）を生ず。而して是に隨伴す可き觸手（tentacle）も亦早くより幼蟲の側面に於る小隆起として認めらる。幼蟲の上半が一個の泳鐘となり了る頃には、此部分と營養體との連接部は、細長く伸びて一本の幹（stem）を成す。幹の上にはその中央なる生長點より、上方に向ひては第二第三以下の泳鐘を、下方に向つては順次に多くの幹群（cormidia=Stammgruppen）を芽出す。

然るに右の如くにして幼蟲の上半部より起れる最初の泳鐘は、多くの場合、永久に存在することなくして、僅に一時的のものなり。之を一次泳鐘（primary nectocalyx）と云ひ、以後に現はるゝ總てを二次泳鐘（secondary nectocalyx）と云ふ。兩者は其構造略ぼ同一なるも、外形には著しき差あるを常とし、之を區別すること敢て難からず。例へば *Muggiaea kochi* にては、第二圖に示す如く、一次泳鐘は頭巾形にして、二次泳鐘は五稜形なり。而して此場合には二次泳鐘の完成するを待ちて、一次泳鐘は脫落し去るを以て、昔より Monophyidae と呼ばれ