"Bozunira" and "Katsuwo no Eboshi"
Rhizophysa and *Physalia*

by
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Dobutz Z. Tokyo, 22, 445-454, 1910

The bracketed **[..]** and emboldened comments are Totton's marginalia.

"Bozunira" is the Japanese name selected by the author for the Japanese species of *Rhizophysa* while "Katsuwo no Eboshi" is the Japanese name for the species of the genus *Physalia*. The purpose of describing these two genera together at the same time is because, despite the conspicuous differences in external appearance, they are closely related. Thus, their structural characteristics are more conveniently studies together. The name of the different parts of individuals will follow the nomenclature used in the chapter "On Siphonophores", Volume 20, of this journal.

"Bozunira"
Genus *Rhizophysa*

Although the genus *Rhizophysa* was established by Péron and Lesueur in 1807, a species which was classified as belonging to the genus *Physophora* by Forskål in 1775 is undoubtedly a member of this genus. Among them were some deep sea forms. Haeckel, then, reclassified them into six genera *Aurophysa, Cannophysa, Linophysa, Nectophysa, Pneumophysa*, *Rhizophysa* with eleven species. Schneider, without following this classification, divided the group into two genera, *Rhizophysa* and *Pterophysa*, with four species. Chun, on the other hand, rearranged them into three genera *Rhizophysa*, *Bathyphysa* and *Pterophysa*. However the two species of *Rhizophysa*, which will be discussed below, have in every case been classifies in that genus by the investigators mentioned above.

The taxonomic position of this genus is as follows:

Suborder: Cystonectae Haeckel, 1888

(Reference: "Taxonomy of Siphonophore" No. 259, Zoo. Mag.)

Family: Rhizophysidae Brandt, 1835

The stem is a long thin tube which elongates vertically. Numerous **[? nodal]** cormidia occur side by side on the stem between the internodal parts.

Genus: *Rhizophysa* Péron and Lesueur 1807

Each cormidium has a siphon and a tentacle.

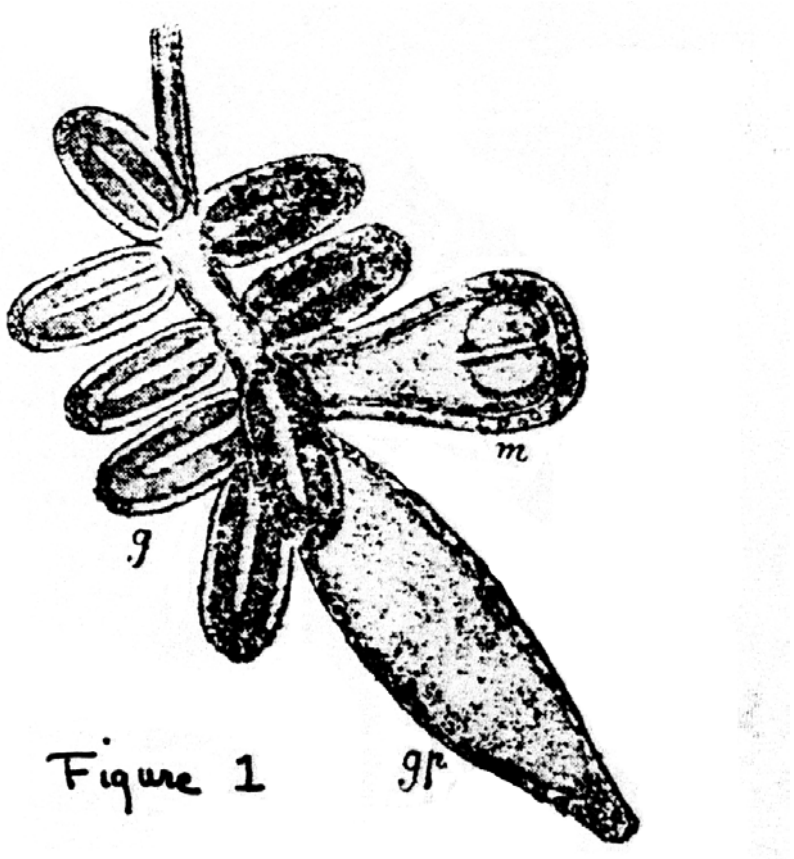
A. *Rhizophysa eysenhardti* Gegenbaur [**Pl. XIV, figs. 1,2**]

The body consists of an exceedingly large pneumatophore and a very long tubular stem with cormidia arranged in rows. Although the pneumatophore, stem, and siphon are ordinarily light red in colour, they are sometimes tinged with a light purple or yellow. The stem contracts and expands very easily, reaching a length of several metres when expanded while it barely measures one shaku (Japanese measurement, approximately 1 ft.) when contracted.

Since nectophores are not present [**except on gonodendra**] in this genus, the pneumatophore is the only locomotory organ [**Haeckel records their snake-like swimming motion**] regulating the ascent and descent of the members of this genus. The large egg-shaped pneumatophore has well developed longitudinal and lateral muscles on its outer wall. The upper one third to on quarter of this wall contains

purplish red pigment cells. The pigment becomes denser toward the upper surface reaching a maximum around the central pore on the upper surface. The pneumatosac, connected to the outside through this pore, is suspended in the inner cavity of the pneumatophore. The septa that in some species longitudinally divide the space between the walls of these layers, that is in the pericystic cavity, are lacking. Hence, the lines of the septa often seen in many siphonophores among the Physophorae, on the pneumatophore are not to be seen on the outside in this genus. The lower part of the pericystic cavity directly below the pneumatosac is filled with a mass of finger-like appendages which can be seen with the naked eye. These are tissues that develop from the pneumatosac are called either the *hypocystic villi* or Würelüsten. The pneumatophore may greatly change in size by expansion and contraction of the well developed muscle on its outer wall.

On the underside of the pneumatophore where it connects with the stem, is a budding zone where numerous young siphons are attached. The siphons gradually become larger as they grow downward. At first they bud out from the stem like nipples but later they develop a tubular opening at their tips. From the upper basal part of the siphons the tentacular buds develop in a similar manner.
Each cormidium has a siphon and a tentacle. The siphon is spindle-shaped when contracted and cylindrical when expanded with an opening like a morning glory. The muscle of the wall is well developed and has numerous processes called “hepatic villi”. However, such common parts as the stalk, basigaster, stomach and proboscis seen on the siphons of most siphonophores cannot be differentiated.



The tentacle is a long tubular string with develops from the upper surface at the base of the siphon. Along its entire dorsal surface, that is the upper side, a row of

lateral branches branch out which are superior to the nematocyst cluster. These lateral branches are reality merely a cylindrical tubular structure with numerous nematocysts occurring dorsally.

The golden gonophores although usually present at only one place on a node, may occasionally occur in two places. (Haeckel has used this characteristic in his identification of the genus, but later this was found to be an error.) The tree-like gonophore which is attached to the stem by a stalk, rebranches two or three times [**???**]. On examining a branch of the gonodendron (figure 1), this part is seen to have a gonopalpon (gp), five to ten egg-like gonophores (g), and a medusoid appendage.

Of the five specimens studied by the author, one was caught by R. Uchiyama, three by S. Ishida, two by M. Tahara and the remaining two by the author himself. In all cases, they were caught off the Misaki Marine Laboratory. Of these specimens, the one caught by Uchiyama was the largest and the most ingeniously preserved. However, as has been stated before, since there is a great variability in size depending on the degree of contraction, it is quite difficult to ascertain the size of the specimen accurately. By measuring the specimens preserved in formalin by the author, the pneumatophores were found to be 10 to 17 mm in height and 5 to 9 mm in width with the stem from 0.5 to 1.5 mm in diameter. The other parts had so greatly contracted that they were absolutely no use in measuring them. The measurement of extremely small parts is omitted.

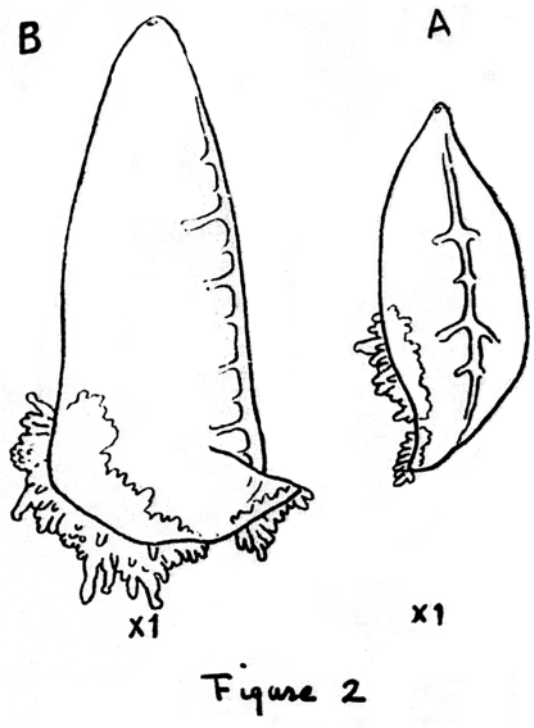


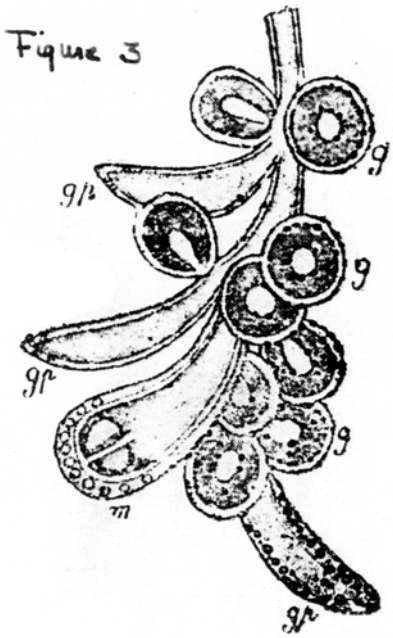
Figure 2

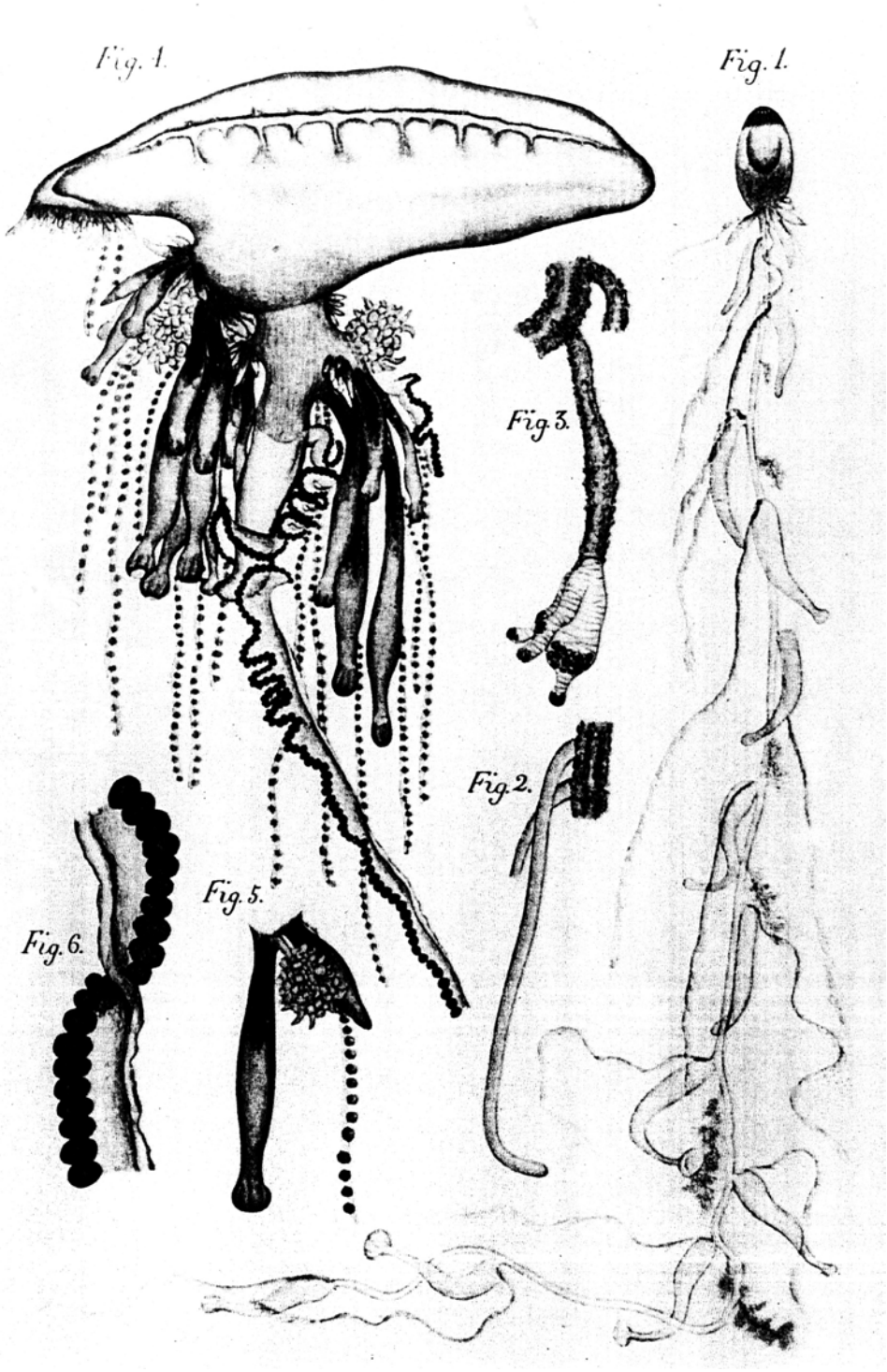
B. *Rhizophysa filiformis* Forskål
(Pl. XIV, fig. 3) [**a tentillum**]

The only two characteristics differentiating this species from the previous one is that the gonodendron is not present at the node (internodal part) but is attached directly to the underside of the siphon [**?**], and that the lateral branches of the tentacles separate into three secondary branches. There are absolutely no other differences to distinguish it from the other species. The tentacle will only be discussed here.

Although numerous lateral branches are present on the tentacle, there is no doubt that the closer these branches are to the base of the tentacle the younger they are. Upon examining a gully grown lateral branch, it was found to be a small cylindrical tube covered by woolly hairs. It ends in three branches. One of these is a large sac-like branch with a small terminal process containing large nematocysts. Its pointed end has smaller nematocysts. The remaining two branches which develop at either side of the first are shorter and have small nematocysts.

Three individuals have been studied by the author so far. One was caught by the author at Misaki. Although this is preserved in a greatly contracted state, its pneumatophore measured approximately 5 mm in height and slightly less than 4 mm in width. The other two were caught off Joga Shima in 1889 and kept in the classroom at the laboratory. They were about the same size as the first specimen.





Explanation of Plate XIV

NOTE - it is bound in wrong place in Totton's copy, bewteen pages 203 and 203.

Figure 1. A species of *Rhizophysa* (*Rhizophysa eysenhardti* Gegenbaur) x 1

Figure 2. Lateral branch of tentacle. x 15

Figure 3. A species of *Rhizophysa* (*Rhizophysa filiformis* Forskål) x 30

Figure 4. *Physalia* x 2

Figure 5. Cormidium, *Physalia* x 3

Figure 6. A part of major (or primary) tentacle x15

"Katsuwo no Eboshi"

Genus *Physalia*

Physalia is the generic name selected by Lamarck in 1816 for a taxonomic group that had formerly been recorded under the name of either Medusa or Holothuria. Subsequently, countless numbers of species were placed in the genus and they were further segregated into four genera, *Alophota, Arethusa, Physalia* and *Caravella* by Haeckel. However, because the first genus appears to be the young form of the third, and the second to be that of the fourth, while the third and the fourth genera seem to be identical, they are at present all reclassified in the one genus *Physalia*. Even the number of species has been considerably reduced in recent years. Schneider, for example, named all species *Physalia physalis* L., calling the Pacific species, *P. utriculus*, a variety. Chun, on the other hand, reclassified this variety into an Atlantic form, *P. arethusa*, and a Pacific form, *P. utriculus*. The present taxonomic position of this genus is shown below.

Suborder Cystonectae Haeckel, 1888

Family Physalidae Brandt, 1835

There is a short inflated stem [**no stem**] lying horizontally along the ventral surface of the large pneumatophore. Cormidia present in clusters.

Genus *Physalia* Lamarck, 1816

Physalia physalis var. *utriculus* La Martiniere

The body consists of an extremely large pneumatophore with a stem [**no stem**] attached to its ventral surface. The position of the latter, however, is only discernible by the clusters of cormidia.

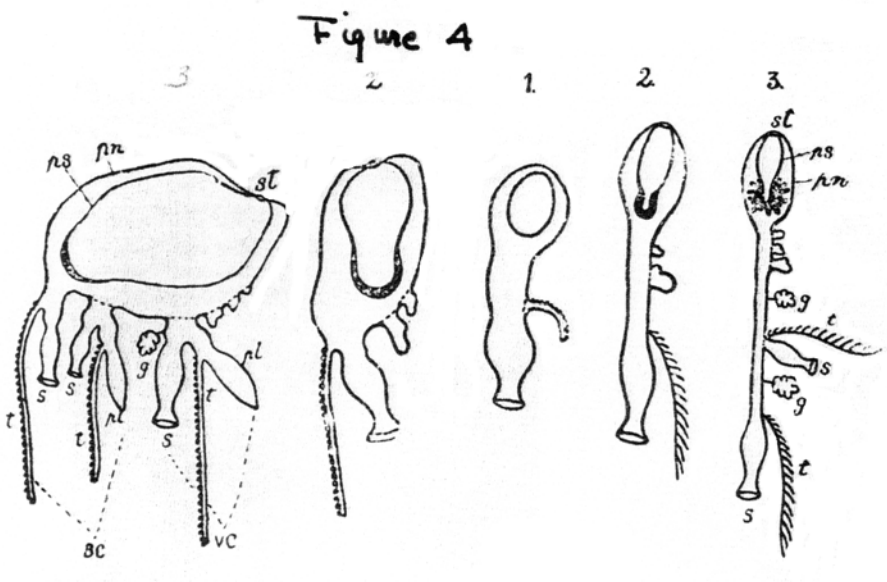
The pneumatosac of the pneumatophore is quite large horizontally. Its cavity is connected to the outside through a pore in its frontal surface [**at the after or down wind end**]. The position of this pore would ordinarily be at the upper end of the pneumatophore but because the growth of the stem is extremely asymmetrical, the vertically situated pneumatophore becomes horizontal and hence, the lateral position of the pore, The pneumatosac is suspended freely inside the pneumatophore and between it and the outer wall of the pneumatophore there are no partitions. The space between the inner and outer sacs is almost indistinguishable because of the size of the pneumatosac. Consequently, the pneumatophore, at a glance, appears to be a single layered sac rather than a two-layered sac. The lower posterior [**anterior**] surface of the pneumatosac is somewhat opaque. This is actually the gas gland.

The indigo [**sky**] blue outer wall of the pneumatophore contains longitudinal muscle fibres while the inner part contains transverse muscle fibres. The part forming the dorsal side forms a horizontal crest. In young specimens, this is simply a fold of the pneumatophore wall but gradually it becomes separated into a comb-like structure by several septa forming a number of compartments. Between these primary septa secondary septa develop within each compartment which therefore becomes further divided into two smaller compartments. With well developed specimens, a third growth of septa is occasionally seen. The position of the crest, too, in many cases, changes as the growth proceeds. When the animal is in a young stage, the crest is situated directly on the upper median line, but it gradually moves towards the right side as the left side (rarely the right side) of the pneumatophore grows more vigorously than the other. [**Use of r. and L. same as by Woodcock, 1944**] Thus, the median plane of the pneumatophore becomes crooked. Therefore,, it finally completely changes its position from the right to the left side. The crest and septa are a somewhat different green from other parts of the pneumatophore.

The general shape of the pneumatophore is spindle-like when young, but, because of the crest on the upper surface, it resembles a lamp shade made of net (figure 2A). However, as it develops, its posterior part, that is the side which had originally been the lower part of the pneumatophore, becomes more inflated that the anterior part [**Bad in conception - description**]. Therefore, it becomes egg-like in shape. Furthermore, because the pointed end of the posterior part moves to the right [**port side**] (rarely to the left) side, it finally becomes triangular (figure 2B). The shape of the pneumatophore, however, varies and hence it is not at all uniform. This description, therefore, is quite general.

Numerous individuals are attached in clusters on the underside of the pneumatophore and appear to be irregularly arranged. However, according to earlier investigators on young specimens, the cormidia are rather regularly arranged and each cormidium consists of a siphon, a palpon [**ampulla**] and a tentacle. In the larval stage the individual has a cormidium consisting of one siphon, a palpon [**NO ampulla**), and a tentacle at the posterior end of the pneumatophore. This never develops a gonodendron even in the adult. Then several cormidia develop in front of this cormidium but all are weak in growth. Haeckel differentiated them by calling them "basal cormidium" [**anterior sensu AKT**] and "ventral cormidium" respectively.

The ventral cormidia are strongly developed and permanently active, usually growing in clusters, slightly anterior [**posterior**] to the basal cormidia but never further forward [**back**] from the centre of the pneumatophore. Either when the crest on the dorsal side of the pneumatophore is divided by the primary septa or when the secondary septa start to develop, they are found on the ventral median line but as the colony develops, the median plane of the pneumatophore grows off centre, When the posterior [**anterior**] end bends to the right [**port**], their position is approximately at the left [**starboard**] posterior corner of the pneumatophore. However, among these cormidia, numerous large siphons, palpons [**ampullae**] and tentacles clustered without any obvious pattern.



Although a siphon in this case is a simple spindle-like canal when young, the adult form has three separate parts. (This is only true in the ventral cormidia). The part near the basal end that corresponds to the stalk and the basigaster [**the ampulla is**

the basigaster] of other siphonophores is extremely short. The large stomach in the centre is very capable of extending and contracting. Its inner wall has a rich growth of clack processes and the lips at its pointed end have a very muscular wall which extends and contracts very freely. It also has nematocyst around the fringe.

The gonodendron which develops near the basal part of the siphon becomes branched. The terminal branch (figure 3) has a large medusoid appendage (m), numerous gonophores, and three to five gonopalpons [**actually 2**]. The gonophores of this species will be discussed in detail with those of the species of *Rhizophysa*.

The parts that develop in a cluster from a common basal part rather than close to the base of the siphon are the individual palpons [**ampullae = basigaster**] with their accompanying tentacle. Studying one of these palpons, it is obvious that its shape is simply cylindrical, ending blindly at the tip, that, like the siphon, many blackish processes are present on its inner wall. The tentacle is an extremely long, thin, tape-like growth with well developed muscles. Its flat sides correspond to the lateral surfaces of the tentacle. Therefore, on its so-called dorsal side, the kidney shaped nematocysts [**pads**] are attached in a row while the ventral side, with well developed muscle, is inflated like a fringe.

On a cormidium attached to the bottom surface [**of the float**], the tentacle as well as the palpon [**ampulla**] from which it is suspended, attain an exceedingly large size at an early stage. The part of the pneumatophore adjacent to these also elongates to become a suspended canal. Consequently, a cormidium becomes divided into anterior and posterior parts. In order to differentiate this large tentacle from others, it is called the major (principle) or large tentacle. In addition there are sometimes one to several other smaller tentacles present.

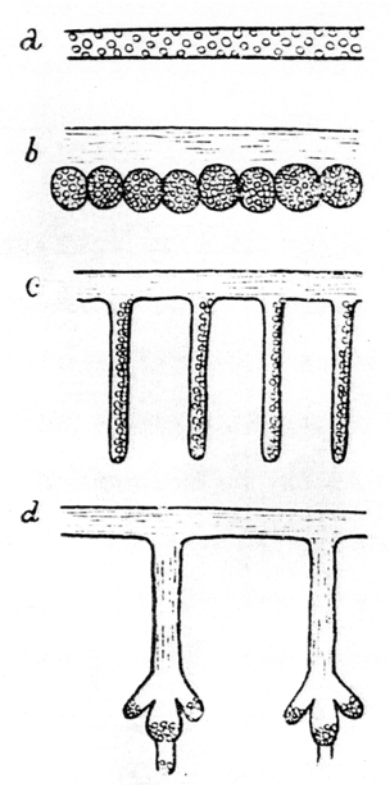


Figure 5

For a long time the number of these so-called principle tentacles has been used as a means of differentiating the Pacific from the Atlantic species - that is, while the Atlantic form was said have many numbers of these tentacles, the Pacific form had only one. However, of the specimens caught by the author near Izu Oshima (34°44'N, 139°24'E), two of them had two major tentacles while one of them had four such tentacles. Therefore, inasmuch as the shape and size of these tentacles could not have been said to be identical, it was possible to identify the minor or secondary tentacles even on the smaller specimen. And, furthermore, even among the specimens caught off Misaki and preserved in our classroom, there was one individual with two primary tentacles. Since these specimens were comparatively mature forms, the number of their primary tentacles might have perhaps increased with growth. In any case, it is erroneous to assume that the Pacific form has only one of this type of tentacle and that by this alone the distinction can be made. This hasty conclusion ,may have arisen from the fact, as Schneider assumed, that most of the specimens caught in the Pacific had been young. Now by reading the records of the Atlantic form, here and there, it appears that they do have a greater number of primary tentacles, and that not all the Pacific forms caught were young specimens. Therefore, it might perhaps be best to assume that with this [**Pacific**] form, the number of tentacles begins to increase at a much later stage of growth than the other form. At any rate, the author believes that the number of tentacles cannot be taken as a characteristic to distinguish these forms definitely. Therefore, they are considered to be the same species. However, there is some definite difference in the number of tentacles. Therefore, the author will tentatively classify the Pacific form as a variety of the other.

The author has been able to study a considerable number of *Physalia*. Of these, seven were collected by the author near Oshima and the others were caught by Prof. Kishikami and the late Mr. Hirota, etc. near Shima Aho (near Mie Prefecture 34°30'N, 139°30'E approximately), Miyake I. (34°05'N 139°32'E) and the Ogasawara (Bonin) Islands. The latter group was subsequently kept in the specimen room of one of our classrooms. The pneumatophores of the author's seven specimens measured 40-65 mm in horizontal length, 12-20 mm in maximum horizontal width. The width of the primary (major) tentacle was, even in the largest specimen, only 2 mm, but its length could not be ascertained since it had been artificially cut off. Among the other group of specimens, the largest one was found in the catch that had been made near Miyake Island, and its pneumatophore measured 80 mm in length and 38 mm in width.

Comparison of *Rhizophysa* and *Physalia*

Before discussing the structural similarity of *Rhizophysa* and *Physalia*, their individual developmental stages should be first studied. For example, figure 4 (1) is a larval form peculiar to the siphonophores of the Order Physophorae [**Rhizophysidae**]. In *Rhizophysa*, this form gradually elongates vertically as shown in figures 4 (2) and 4 (3) to become cormidia consisting of siphons (s), tentacles (t), and gonodendrons (g). While the pneumatophore remains in a vertical position as before, the larva develops a gad gland on the under side of the pneumatosac. However, in *Physalia*, the stages shown in figures 4 (2) and 4 (3) gradually take horizontal positions and the form basal cormidia [**BC**] consisting of siphons (s), tentacles (t), and palpons (p), [**gonos too**] at the posterior end. Next, in additional to these three structural parts, it develops a ventral cormidium [**VC**] which forms gonodendrons. The pneumatophore becomes inflated at the same time and the pneumatosac continues extending horizontally until

it fills the inner cavity of the pneumatophore. However, in both cases, the pneumatosac connects with the outside through a pore.

The tentacles of *Rhizophysa* grow from the base of the siphon. This is characteristic of siphonophores generally. However, since similar structures in *Physalia* develop from the base of the palpon [**basal ampulla = basigaster**], it is somewhat difficult to interpret it morphologically. In fact, many investigators in the past have tried to provide some sort of explanation for this. Eschscholtz, for instance, compared this to the sac at the base of the ambulacral feet of Echinoderms while Leuckart and Huxley called it "tentakelbläschen" (tentacular sac) and "basal sac". Yet it was Haeckel who called it a palpon. With due respect to these investigators, the physiological function of this structure, though variously named, is in reality identical to that of a palpon [**NO - basigaster**]. Haeckel further stated that this could either be considered as a sac which had, secondarily, developed from the base of a tentacle or a pair of siphons which had budded out from a common basal part, one of which had lost its tentacle in the course of development while the other had lost the opening at its pointed end and the hepatic villi on the inner wall.

Comparing the tentacles of *Rhizophysa* and *Physalia*, one finds an obvious difference between them. The branch-like portion of the former has a slender canal while the corresponding portion of the latter has a kidney-shaped globular structure [**nematocyst pad**]. In both cases, however, they are the most primitive form of tentacles found in siphonophores [**except *Apolemia***]. Ordinarily, the primary shape that a thread-like protective organ with nematocysts could take, is simply a long thin canal on whose wall numerous nematocyst are spotted (figure 5a). This is a common structure of tentacles in the hydromedusae. Although this type of tentacle is not generally present on [**gastrozooids of**] the siphonophores, the palpacle developed from the base of the palpon of some members of this group has the identical structure of this tentacle. The next type is a simple, slender, muscular canal without spotty presence of nematocysts which, in this case, are massed on the one side of the canal wall as illustrated in figure 5b. Such a type occurs on the tentacle of *Physalia*. Still a different tentacle is the one shown in figure 5c, where the nematocyst groups become collected on lateral branches extending sideways like sticks. In the genus *Rhizophysa*, this is true n the case of *Rhizophysa eysenhardti*. More advanced than this type of structure is that resulting from a second branching or a so-called lateral branch on which are masses of particularly large numbers of nematocysts as illustrated in figure 5d. This is exactly the type of structure seen on the tentacle of *R. filiformis*.

With a still further development complete nematocyst clusters grow on the tips of the lateral branches, and the structure itself becomes extremely complex. Such a growth, for example, may be an elastic filament which does not break easily when the nematocyst cluster attaches itself to an intruder's body, a small thread-like growth on the tip of the lateral branch that causes the nematocyst cluster to discharge when approached by an enemy, a swimming bell [**involucre**] to face the nematocyst cluster upward [**above**], a bell-like covering mantle, or a complex sac, which sometimes becomes doubly or even triply overlapped to store the cell clusters when not in use. Thus, this diversely developed structure is variable in each species but the detailed discussion of these will be postponed to a later date when species with such complex tentacular structures are recorded. The discussion at this time shall be limited simply to a comparison of the tentacles of *Rhizophysa* and *Physalia*.

The obvious analogous part of these animals is the structure of their gonophores. That is, in both cases, these are attached on a much branched stalk, with a gonopalpon and a medusoid appendage. The growth of the male sex cells on the

gonophore of either *Rhizophysa* or *Physalia* has been recognised for a long time and [**some of**] the gonophore [**s have been**] is shown to be a male. Therefore, there should not be a female gonophore. Yet Haeckel has assumed that the previously mentioned medusoid appendage is the female gonophore which, upon leaving the parent body, incubates the eggs. On the other hand, Brooks and Conklin have presented the theory that this medusoid appendage is not a female gonophore [**It is an asexual medusoid**]. As a result of this theory all previously known species [**specimens**] of *Rhizophysa* and *Physalia* are males and the female form is not yet known. In all probability they occur in markedly different structures [**NO**]. For this reason, Prof. Goto has also studied *Physalia*. Yet, according to the result of the investigations carried on independently by Stecke and Richter, three or four years ago, gonophores previously considered as male are not always of that sex and a [**so-called male**] gonophore of the gonodendron could be either male or female. [**Confirmed]**

There is still another much debated question from the standpoint of the histology in connection with these siphonophores - namely, the tissue on the underside of the pneumatosac of *Rhizophysa*. [**i.e. giant gas gland cells**] For instance, the result of studies by Chun and Schneider differ considerably. Consequently, their method of comparing the pneumatophores of this genus with those of other siphonophores also differs from other investigators.

Both *Rhizophysa* and *Physalia* are so well known as stingers that they are greatly dreaded by the fisher folk. *Physalia* particularly, has such an incomparably intense sting that such a sting causes the skin to form blisters like that of a burn.

Rhizophysa too is known to cause much trouble and consternation to the fishermen when they are hauling in fishing lines at night.

These genera both occur at the surface in tropical waters. An Atlantic specimen of *Physalia* recorded by Haeckel [**mentioned largest specimen with tentacle 20-30 metres or more**] had a pneumatophore measuring over 30 cm in length and a palpon of 20 cm in length which is the largest ever reported so far. The composition of the gas in the pneumatophore of *Physalia*, according to the analysis made by Schloessing and Richard is 1.7% carbon gas, 15.1 oxygen and 83.2 nitrogen and argon.

Although the siphonophores generally feed on [**fish and**] crustacea and minute organisms, Bigelow [**not H.B.**] records his experience of seeing a siphonophore feeding on a herring. From this one can readily understand how powerful a weapon the tentacle of *Physalia* is.

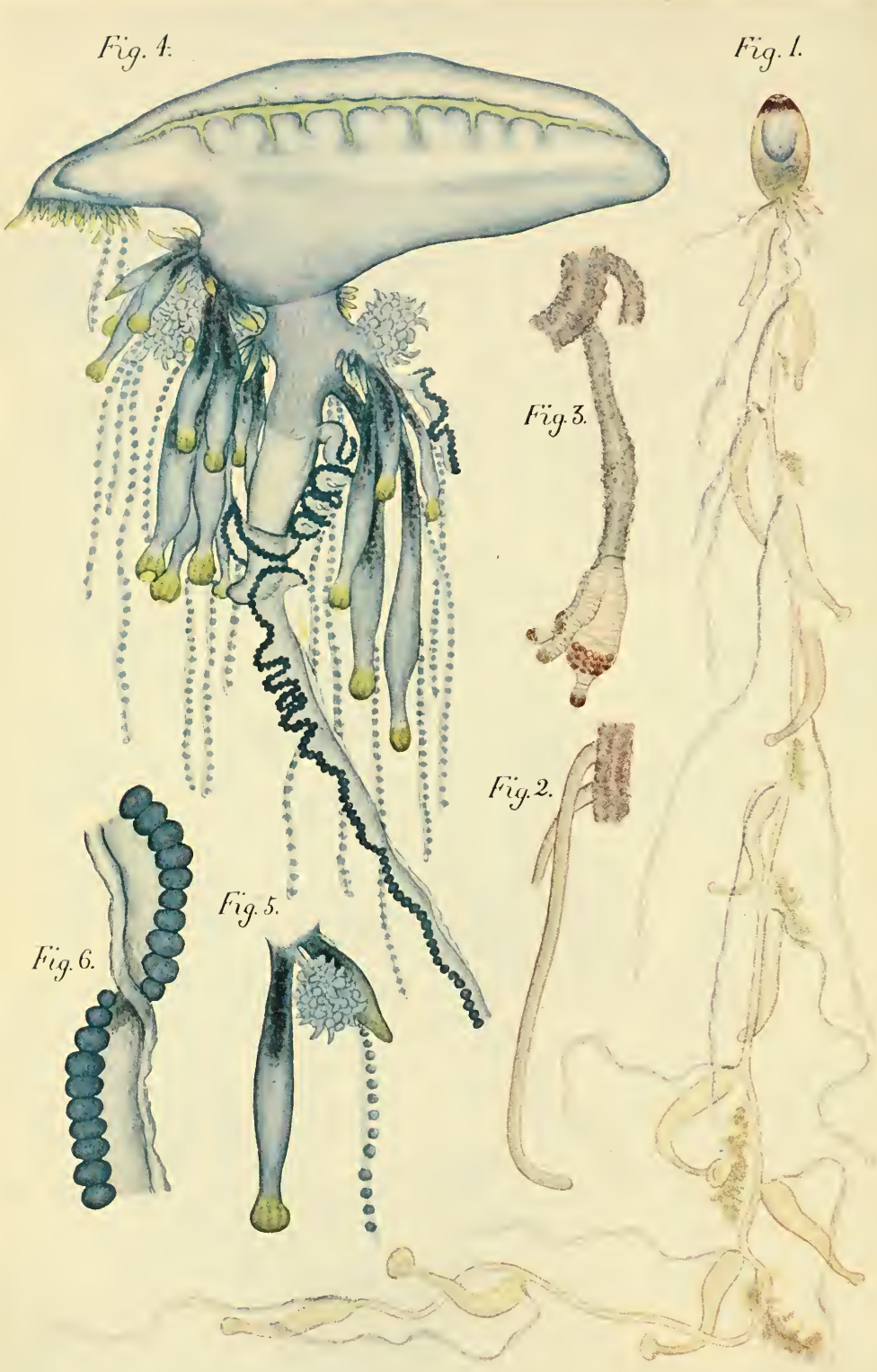


Fig. 4.
Fig. 1.
Fig. 3.
Fig. 2.
Fig. 5.
Fig. 6.

三〇セメ以上、感觸體の長さ二〇セメもあつたと云ふ。之れが今日迄に報告せられたる中の、最大なるものである。又カツヲノエボシの氣胞内の瓦斯の成分はシユレッシング、リチヤード二氏の分析によると、百分中炭酸瓦斯一・七、酸素一五・一、窒素及びアルゴン八三・二であると云ふ。

一般管水母の餌食は甲殻類其他極細微な物であるが、ビゲローはカツヲノエボシが鯡を捕へて食ふのを目撃し其有様を記載して居るのを見れば、如何にカツヲノエボシの觸手が猛烈なる武器であるかゞ推知せられるのである。

第十四版圖解

第一圖ボウズニラ一種（Rhizophysa eysenhardtii Gegbr.）×1.

第二圖　右の觸手側枝　×15.

第三圖ボウズニラ一種（R. filiformis Forsk.）の觸手側枝　×30.

第四圖カツヲノエボシ　×2.

第五圖右の幹群一個　×3.

第六圖主觸手の一部　×15

内外彙報

形態學

●南極探險隊の齎したる奇なる沙噀

一九〇一年より同四年迄「デイスカヴアリー」號に搭じて南極地方を探險せるスコツト氏が齎し來標本につきての諸學者の研究報告は載せて（National Antarctic Expedition）のうち博物之部動物學の卷にありいまその第四卷を見るを得たればその中興味ある一部を摘録すべし。

卷中『棘皮動物の幼蟲』なる一章ありマックブライド教授及びシムプソン氏の研究せる所にして材料は四十個の管瓶に保存せられ其大多數は分裂しつゝある卵の内容にのみ限られあり種類は *Asterias brandti* Bell, *Cucumaria acrocea* Lesson, *Echinopluteus*（新名）及び *Ophiopluteus*（亦恐らく新しきものなるべしといふ）の四あり今こゝに云はんとするは *Cucumaria crocea* のことなりとす。

標本は Coulman Island（略ぼ南緯七三度半東經一七〇度の所にあり）の附近百ファゾムの底よりと、Winter Quarters"の附近"Hut Point"の四一ファゾム以内の所より獲たるものにして幼蟲の他に一個の成熟せる雌蟲あり後

が生じて特に刺細胞の多く集まつた部分が出來る（第五圖d）樣になる、R. filiformisの觸手に見る構造即ち之れである。

右の程度よりも猶發達すると、側枝末端に立派な刺細胞叢が出來且其構造も頗複雜となる。或は刺細胞叢が敵の體に附着して引き張られた時に容易に切れない樣に彈力性ある糸が出來たり、或は敵の近づいた事を知つて刺細胞叢に發射を警告する爲めの細い糸が先端に出たり、或は刺細胞叢が上方に向く樣に浮袋が附いて居たり、或は使用しない時に刺細胞叢を納めて置く爲に鐘の形をした物が被さつたり、或は完全に袋となつて刺細胞叢を包んだり、又其袋が二重三重にもなる等、實に色々の分化が見られるのであるが、之れは後日複雜な觸手を有する種を記載する時に讓り茲には唯ボウズニラとカツヲノエボシの觸手を比較するに止めて置く。

更にボウズニラとカツヲノエボシとで、著しい類似を示すものは生殖體の摸樣である。即ち共に盛に分岐して樹狀をなせる柄部に附着し、生殖感觸體、及び水母形附屬器を伴ふのである。さて此生殖體に雄性生殖素が發達することは、ボウズニラに於てもカツヲノエボシに於ても古くから認められた事で之れは雄生殖體と云ふ事になつて居る。して見ると雌生殖體が無い譯であるが、ヘツケルは水母形附屬器を雌生殖體であると想像し、此水母が母體を離れて後卵を成熟せしめるものと考へた。之れに反對した說はブルクスとコンクリンの說で水母形附屬器は決して雌生殖體ではなく、從つて今迄のボウズニラ及カツヲノエボシは皆雄で雌は未だ全く知られない後者は多分餘程異つた形をして居るのであらうと云ふのである五島敎授もカツヲノエボシに就て、之を研究せられた。然るに三四年前にステツヘ、リヒテル二氏が獨立に研究した結果では從來雄生殖體と云はれたものは常に雄ではなく生殖體叢中の生殖體が雄である時と雌である時とがあると云ふ事である。

此外にも學者の說の一定しない組織學上の問題がある其一はボウズニラの氣胞の氣嚢下部にある組織で之れはクーン、シユナイダー二氏研究の結果を異にし、從つてボウズニラの氣胞を他の管水母の氣胞と比較する仕方も二氏見る所を異にして居る。

ボウズニラもカツヲノエボシも共に甚だしく人を螫すので、漁夫等の甚だ恐れるものである。殊にカツヲノエボシは全管水母中無比の猛烈なるもので皮膚の所によつては火傷の樣に水腫れとなるといふ。

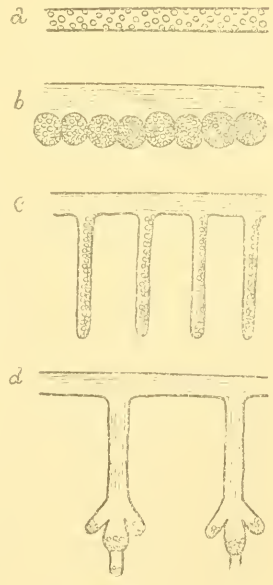
ボウズニラも漁夫が夜間繩を手繰る時に繩に纏ひ附いて來て漁夫を困らすと聞いて居る。

此兩屬は共に熱帶の海面に產するものである。ヘツケルが記載した或大西洋のカツヲノエボシは、氣胞の長徑

直な位置を保つて、氣嚢（ps）の下部に瓦斯腺を發達せしめ、カツヲノエボシに在つては、(2)(3)と次第に横に倒れて、先づ後端に營養體（s）觸手（t）及び感觸體（p）よりなる基部幹群（bc）を作り、次に右の三者に加ふるに生殖體叢（g）を以てしたる底面幹群（vc）を作ると同時に、氣胞（pn）は膨大し、氣嚢（ps）は益横に延びて氣胞の内腔を充たすに至るのである、而して兩者共氣嚢が氣孔（st）を以て外に開口せることは同じである。

ボウズニラの觸手は營養體の基部から起つて居る、之れは一般の管水母に見る構造である、然るにカツヲノエボシの觸手は感觸體の基部から起つて居るので其形態學上の解釋は一寸六ヶ敷い、カツヲノエボシ感觸體に就ては古人も其解釋に勉めたので、エシユショルツは之れを棘皮動物の管足の基部にある嚢に比し、ロイカルトは之れを觸手嚢（Tentakel- Bläschen）と云ひ、ハックスレーは基嚢（Basal sac）と呼んだ。之れを感觸體と呼んだのはヘッケルであるが、實際其生理的作用は感觸體と同一である。ヘッケルは之れは二次的に觸手の基部に出來た嚢と云ふことも出來るし、又初め一對の營養體が共通の基部を以て出芽して、其一は觸手を失つて、他の一は觸手を失はざる代りに先端の口と内壁の突起（hepatic villi）とを失つたものと見ることも出來ると云つた。

ボウズニラの觸手とカツヲノエボシの觸手とを比較して見ると、前者の側枝は細長い管であるのに、後者の之れに相當する部分は腎臟形の小球である差はあるが、共に管水母の觸手の中でも最も原始的な構造である、元來刺細胞を待つた絲狀の保護器官が取り得べき第一の形は、單に細長に管の壁に點々刺細胞を有するもの（第五圖a）で之れは緣膜水母等の觸手に見る構造である。管水母には此種の觸手はないが、或種類の管水母の感觸體の基部から出て居る感觸絲（Palpacle）は全く此構造を有するのである。其次に簡單な形は細長い管には筋肉があつて點在せる刺細胞なく、刺細胞が管壁の一方に集塊をして存するもの（第五圖b）で、カツヲノエボシの觸手に見る形である、其次に少しく變化したものは、刺細胞の集まつた部分が側方に延びて棒の様な側枝となつたもの（第五圖c）で、ボウズニラの内 R. eysenhardtii に見る形である、之れから少しく進むと、側枝の中に再び分化



第五圖

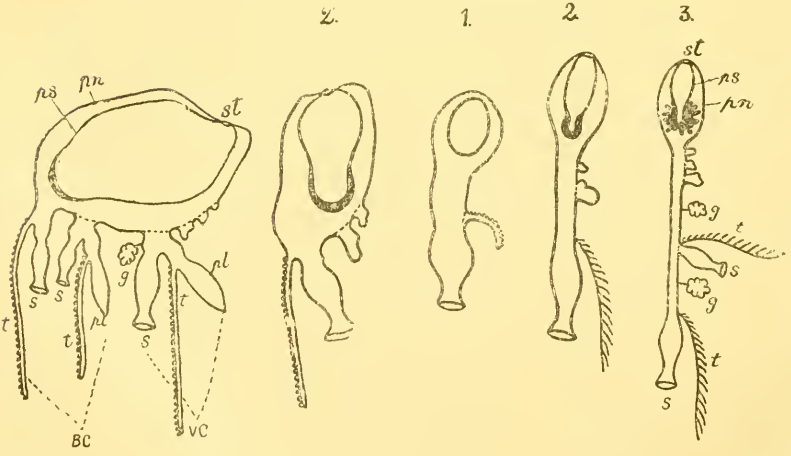
通り、太平洋種では從來若いものが主として採集せられた爲めの誤りであらうか。然し今大西洋種の記載を彼是讀み合せて考へると、一般に彼の方が主觸手が多い樣であるし、又太平洋種とても從來十人が十人若い標品を取つたと云ふこともちと無理な考へ方であるから、太平洋種では主觸手の數を增し始める時期が、大西洋種の場合よりも遲いと考へるのが最穩當ではあるまいか。兎に角余は主觸手の單複は絶對的の區別ではないと信ずるから太平洋種と大西洋種とは同種とし、然し主觸手の多少と云ふ差は確かにある樣だから、假りにシユナイダー氏に從つて前者を後者の變種として置く。

余の驗し得たカツヲノエボシの標品は頗る多かつた。其中七個は大島近海で採集し、他は岸上敎授故弘田氏等が志摩安房及び三宅島小笠原島で採集せられ敎室標本室に保存せられたものである。氣胞は余の得たる七個の標本では水平の長徑四十乃至六十五ミメ、水平の最大幅十二乃至二十ミメ、主觸手の幅は最も大きな標本で二ミメ其長さは何れも人工的に切斷せられてあつた。其他の標品中最大なものは三宅島で取れたもので氣胞は長八〇ミメ、幅三八ミメであつた。

ボウズニラとカツヲノエボシとの比較

ボウズニラとカツヲノエボシの構造上の類似は、先づ其發生を見ればよい。第四圖(1)は Physophorae 目の管水母に特有な幼蟲の形で、ボウズニラに在つては、之れより(2)(3)と次第に垂直に延びて、營養、體(s)觸手(t)並びに生殖體叢(g)より成る幹群が出來、氣胞(pn)は依然垂

第四圖



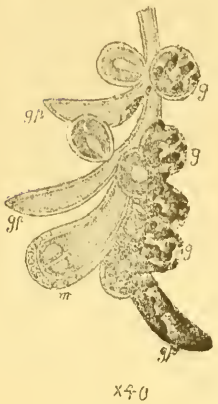
中には多數の大きな營養體や感觸體及び觸手が雜然と密集して居るのである。

營養體は若いものでは單に紡錘狀の管であるが、よく發達したもの（腹面幹群のみに見る）では三つの部分に分かれて居る。基部に近い所は、他の管水母の營養體の柄部と底部とに相當する所で極短い。中央の胃部は長く太く、非常に伸縮し易く、其內壁は黑い突起に富んで居る、先端の吻部は筋肉に富んだ壁を有して、最も伸縮自在で其緣には刺細胞を含んで居る。

營養體の基部に近く起る所の生殖體叢は樹枝狀に分岐し、其末梢の一枝（第三圖）は一個の大きな水母形附屬器(m)多數の生殖體(g)並びに三本乃至五本の生殖感觸體(gp)がある。猶生殖體の事に就ては、後にボウズニラの生殖體と併せて、委しく論ずることゝする。

營養體の基部に密接してと云ふよりも寧ろ共同の基部より起るものは觸手を伴ふ感觸體である、其一個を取つて驗すると、單に圓筒狀の管で先端盲狀に終り、內壁に黑色なる小突起を有すること營養體に同じく其柄部からは一本の觸手が出て居る。觸手は非常に細長い眞田紐の樣に扁平な紐で、筋肉よく發達して居る。其扁平な面は觸手の左右側面に相當するので、背側には、腎臟形な刺胞叢が一列に並んで附着し、腹側は筋肉が發達して緣を取つた樣に膨れて居る。

第三圖

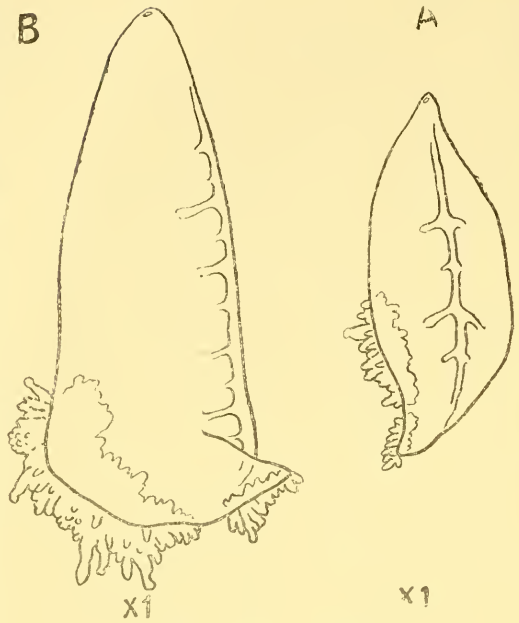


底面に附着する幹群の中、一本の觸手と之れを吊下げて居る感觸體とは、早くから非常に大となり、且氣胞の之れに接する部分も延び垂下して管の如くに成る。此爲めに底面幹群が前後の二部分に分割される。此大きな觸手を他の觸手と區別する爲めに主觸手又は大觸手と云ふ、此大觸手の外に更に一本乃至數本大さ前者に亞ぐ觸手の存することもある。

此主觸手の數が昔から太平洋種と大西洋種との區別とせられて居る、即ち大西洋種は數多の主觸手を有し、太平洋種は只一本を有する計りとせられた。然し予が伊豆大島近海で得た標品中二個は二つ一個は四つの主觸手の出て居るもので其形狀大さ全然相同じことは云へないが、小さい方でも小觸手とは明かに區別することが出來た。又敎室に保存された三崎產の標本にも二本の主觸手を有するものが一個あつた、此等の標品は皆比較的に老成したものであつたから、主觸手の數は、動物が成長するに從つて增すものと思はれる、夫れ故太平洋種の主觸手唯一本とするのは誤りで之れを以て太西洋種との間の明確なる區別は出來ない、之れはシユナイダー氏が推察した

極生長した標品では、第三次隔壁の出來て居るのが見られる。稜の位置も亦多くは生長の進むに從つて變化する。若い間は稜は正しく上面正中線に在るが、氣胞の左（稀に右）側の方が右側よりも成長が激しいのと氣胞體の正中面が傾斜するので、稜は次第に右方に移り、遂には右側面に位する樣になる。稜と其隔壁の部分は氣胞の他の部分と少しく色を異にして綠色を呈して居る。

氣胞の全形は、若いものでは紡錘形であるが上に稜が有るから一寸網笠の形である（第二圖A）。生長するに從つて後方（即ち元氣胞の下方に當りし側）が前方よりも活



第二圖

潑に膨大するから、次第に卵形に近き、更に後方の尖端が右（稀に左）側に位置を轉ずるので遂に三角形となる。（第二圖B）。併し氣胞の形には色々あつて決して一定しては居ないから之れは一般の形と知るべきである。

多數の個蟲は氣胞の下面に密集して附着し、全く不規則に集合して居る樣に見える、併し先人の研究によると、若い標品に於ては比較的規則正しく並んだ幹群が在つて各は一個の營養體一個の感觸體並に一個の觸手から成つて居るとの事である。此幹群の出來て來る順序を云ふと、先づ氣胞體の後端に當る處に幼蟲時代からの幹群が一つ有つて、營養體感觸體及び觸手から成つて居る、之れは終りまで生殖體叢を作らぬ。次いで此幹群の前に隣つて、若干數の幹群が出來る。然し此等は孰れも弱く發達するだけでヘツケルは之れを基部幹群（Basal corm ilium）と呼び、後に生ずる腹面幹群（Ventral cormidium）と區別して居る。

腹面幹群は強く發達して、永久に活動するもので、基部幹群とは少し飛び離れた前方に密集して現はれるが、氣胞體の中央よりも前に出ることは無い。丁度氣胞體の背側にある稜が第一次隔壁で區分せられた頃若しくは第二次隔壁の生じかゝつた頃には、腹面正中線に位して居るが、一層進んで、正中面が傾斜し、後端が右に折れる樣になると、左の後ろの偶に位する樣になる。而して其

其先端にも小さな刺細胞を備へて居る。

今迄に見た本種の標本は三個、一は余が三崎で獲たものである。非常に收縮して保存せられて居るが、氣胞は高さ凡そ五ミメ幅四ミメ弱である。他の二は千八百八十九年城ヶ島沖採集として敎室に保存せられてあつたもの其大さ共に殆んど前の一個に同じであつた。

カツヲノエボシ

Physalia とは千八百十六年ラマークが撰んだ屬名で、其以前には Medusa 又は Holothuria の名を以て記載せられた。其後澤山の種が記載せられ、皆Physalia の中に入れられたが、ヘッケルに至つて、Alophota, Arethusa, Physalia, Caravella の四屬に分けられた。併し此第一は第三の若い形、第二は第四の若い形らしいのと、第三と第四とは、同一屬とすべきものらしいので、今では再び Physalia 一屬に歸つてつまつた。種の數も同樣に、近頃非常に減せられて、シュナイダーは凡てを同一種 Physalia physalis L. とし、太平洋の種類は其一變種 utriculus とした、クーンは此變種を別種として、大西洋種 P. arethusa Brown と太平洋種 P. utriculus との二種とした、此屬の分類上の位置を擧ぐれば次の如くである。

Suborder Cystonectae Hkl. 1888.

Family: Physalidae Brdt. 1835.

幹短く膨れ、大なる氣胞の腹面に添ひ水平に横はり、幹群密集して存す。

Genus: Physalia Lamarck 1816.

Physalia physalis var. utriculus La Martinière.

(第十四版第四、五、六圖)

體は甚だ大なる氣胞と、其腹面に接着せる幹より成る。但後者は密集せる幹群によつて僅に其位置を指示されて居る。

氣胞の氣囊は廣大で、水平に延び、其腔は前端にある氣孔を通じて外界と交通して居る。氣孔のある所は元來は氣胞の上端であるが、幹の生長が非常に不對稱的である爲めに垂直な、氣胞が倒れて水平になるから從つて横の方に位する樣になつたのである。氣囊は氣胞の內に自由に懸垂し、其れと氣胞の外壁との間には隔壁の樣なものが無い。又此內外二囊の間の腔隙は、氣囊が大きい爲めに殆んど見ることが出來ぬ。從て氣胞は一見二重の囊でなくて、唯一層の囊の樣に見える。氣囊の後方下面は少しく不透明となつて居る。之れは瓦斯腺である。

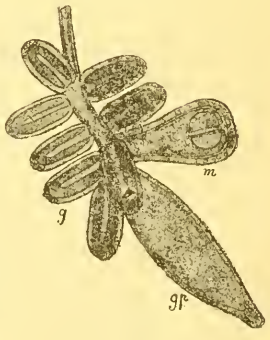
氣胞の外壁は藍青色で外に縱走筋纖維內に横走筋纖維がある、氣胞の背側に當る部分は、水平な稜をなして居る。之れは若い間は單に氣胞壁の褶であるが、次第に數個の隔壁によつて丁度櫛の樣に區分せられて、若干個の室を作ることゝなり、更に此第一次隔壁の間に各室一個宛の第二次隔壁が現はれて、各室を二個の小室に區分する。

體は收縮した時には紡錘狀、伸張した時には圓筒狀で口は朝顏の花の如くに廣がる。其壁には筋肉よく發達し、且內腔に向つて澤山の突起（之れをHeptic villiと云ふ）が有る。但し通常管水母の營養體に見る柄部底部胃部吻部の區別は全く見られない。

觸手は營養體の基部上側から起り、圓筒狀の長い紐であるが、其全長の背側即ち上側から、刺胞叢に匹敵する一列の側枝を出す、この側枝は單に圓筒狀で、背側に大きな刺細胞を澤山備へて居る。

生殖體は黃金色を呈し通常一節間部一個所にあるが、稀に同一節間部に二個所に見ることがある（ヘッケルは此性質を屬の區別に用ゐたが之は誤りだ）。生殖體は、幹から一本の柄を以て出で、二回三回分岐して樹枝狀をして居る、生殖體叢の一枝（第一圖）を取つて見ると、末梢にある一個の生殖感觸體(Gonopalpon)(gp)と五個乃至十個の卵形なる生殖體(g)と一個の水母形附屬物(m)とがある。

余が驗し得た此種の標品は五個、其中一個は內山柳太郎君三個は石田收藏君二個は田原正人君が採集して贈られたものので、其餘二個は自分が採集したもので凡て相州三崎臨海實驗所で取れたのである。其中內山氏の採集せられたものは最も大きく且最も巧妙に固定せられてゐつた。前にも述べた如く、收縮の度合によつて、體の大さに大差があるから精確な大さを擧げ難い。余がフオルマリンで固定保存せられた標本で測定した所、氣胞の高さ十乃至十七ミメ幅五乃至九ミメ 幹の太さ〇●五乃至一●五ミメ、其他の部分は非常に收縮して到底測定する價値が無かつたのもある、又極微細な局部の測定は玆には略することゝする。



×40

第一圖（×10）

乙 Rhizophysa filiformis Forskal.

（第十四版第三圖）

此種が前種と異なる所は、唯生殖體叢が節間部に無くて、營養體の直下に附着して居ることゝ、觸手の側枝の末端が三本に分岐して居ることゝの二つで其他別に變つた所が無い。玆には唯觸手のみを記述しやう。

觸手には澤山の側枝があるが、觸手の基部に近に所に至るに從つて側枝が若い事は云ふ迄もない。出來上つた側枝を取つて驗すると、之れは圓筒狀の細い管で外部に絨毛を備へ、且先端は三本に分れて居る。一本は大きな囊狀の枝で、中に大きな刺細胞を含有し、又末端に細い突起を有し突起の先端に小さな刺細胞がある。他の二本は對をなして前者の兩側に出で、前者よりも短く終る

のである。其後澤山の種が記載せられ、皆同じRhizophysa屬に入れられて來れるが、中には深海産のものもあつた。ヘッケルは其等を分つて、六屬、Aurophysa, Cannophysa, Linophysa, Nectophysa, Pneumophysa, Rhizophysa）十一種とした。シュナイダーは此分類に從はないで、二屬（Rhizophysa, Pterophysa）四種とし、クーンは三屬（Rhizophysa, Bathyphysa, Perophysa）とした。併し今記載せんとするボウズニラの二種は右の三氏も等しく Rhizophysa 屬に入れたものである。此屬の分類上の位置は左の如くである Suborder: Cystonectae Hkl, 1888.

（本誌第二百五十九號「管水母類の分類」參照）

Family: Rhizophysidae Brdt, 1835.

幹細長く、管狀にして垂直に延び、數多の幹群は節間部を挾みて幹上に次列す。

Genus: Rhizophysa, Péron & Lesueur 1807.

各幹群一個の營養體及一個の觸手を有す。

甲　Rhizophysa eysenhardtii Gegenbaur.

（第十四版第一、二圖）

體は頗大なる氣胞と甚だ細長き管狀の幹部より成り、幹の上には、幹群の列次が有る。氣胞幹營養體等の諸部は一樣に淡紅色なるを常とするが、少しく紫色又は黃色を帶ぶることもある。幹は非常に伸縮自在で、伸びて數米突のものが、縮んで尺に滿たない事がある。

此屬には泳鐘が無いから、氣胞が唯一の運動器官で、其調節により、動物は單に上下に浮沈し運動を爲すのである氣胞は大きくて卵形、外壁は縱橫の筋肉に富む、壁の上部三分の一乃至四分の一に紫赤色の色素細胞の蓄積せるものがあつて、上方に至るに從つて密となり、上端中央氣孔の周圍に至つて最も濃い、氣孔に依つて外氣と交通する氣囊（Pneumatosac）は氣胞の內腔に懸垂して居るが、兩者の壁の間の腔隙即ち圍囊腔（Pericystic cavity）を縱に區劃する隔壁が無いから、外部より見て、氣胞の壁に數條の線條を見ることが無い（多くのPhysophorae目の管水母には之れが有る。）圍囊腔の下部、氣囊の直下は、指の形をしたものが澤山集合した樣な附屬器官で充塡せられて居るのが肉眼でも外から見える。之れは氣囊の方から出た組織で囊下絨毛（Hypocystic villi 又は Würzelisten）と云はれて居る。氣胞は其外壁に發達せる筋の伸縮によつて、非常に大さを變ずるものである。

氣胞の直下、幹の始まる所には、出芽帶があつて、數多の若い營養體が附着して、下に至るに從つて大さを增して居る、之れは先づ幹から乳首の樣な膨らみとして現はれ、後に其先端口を開いて管狀となるので、其上面基部から、同樣にして觸手の幼芽が出る。

各幹群には一個の營養體と一個の觸手とがある。營養

Rhizopoda 中の Reticularida にては、原形質の流動によつて養分が體中に配布せらるゝことあり。

簇虫の内肉原質流動も、幾分、かくの如き作用をなすものなるべけれど、この運動は、元來、受動的に生じたるもの故、之に依りて起る作用も亦從的なり。

一般に、簇虫の表はす種々なる運動の中、其の意義の明瞭なるものは、前進運動と接合子の舞踏運動とのみなり。其他のものは多くは意義不明にして、或は系統的の意味を有し、或は筋樣纖維の有する收縮性の一表現に過ぎず、又、或は、單に、他の運動に隨伴して起る副生的の現象なるが如し。猶ほ、所謂、内肉顆粒の分子運動は生理的と云はんよりは寧ろ病理的の一症狀なるべし。

余は、又、奇異なる内肉流動運動を、Carabidae のある仔虫の腸より得たる一簇虫に於て見たることあり。即ち最初、内肉顆粒は盛なる分子運動をなしつゝありしが、程なく虫體の後端破裂し、こゝより内肉原質溢出せり。普通簇虫の體壁破裂して内容流出する時は、直に四方に散亂して外圍の物質中に混ずれど、この場合には一も散亂することなく、内肉は恰も薄き膜狀物を以て抱擁せらるゝが如く、一處に集合して、體の後端に針頭狀の膨出を形成せり。かくて、體内の内肉原質漸次この中に注入し核も下降し來るに及び、簇虫の體形は、以前よりは幅廣く且つ短くなれり。この現象は *Amoeba blattae* 等に於て見らるゝ "Eruptives Buchstücklobopodium" の形成によく類似すれど、然し乍ら、之も亦内肉顆粒の分子運動と同じく、病理的のものなるべし。シャウヂンも之に似たる現象を *Coccidium schubergi* の胞子小體にて見たれど彼も亦、かゝる現象の現はるゝは、皆な死に瀕せる個體に於てのみなりとせり。

ボウズニラとカツヲノエボシ

理學士　川村多實二

（明治四十三年八月二十九日受領）

ボウズニラとは日本産 Rhizophysa 屬管水母に向つて余が撰びたる和名、カツヲノエボシとは Physalia 屬管水母の呼稱として既に行はれつゝあるものである。今此兩屬を併せて記述する所以は、兩者は其外觀頗る異れるにも拘らず、比較的近緣のもので其構造を對比せんむるに便利な爲めである。玆に記載に用ふる個蟲及其部分の稱呼は本誌第二十卷拙稿「管水母に就て」に用ひたものに從ふことゝする。

ボウズニラ

Rhizophysa 屬は千八百〇七年ペロン及ルーソーの作れるものなるが、千七百七十五年にフォルスコールが Physophora 屬に入れて記載したる一種は、疑もなく此屬のも