THE STANDARD

NATURAL HISTORY.

EDITED BY

JOHN STERLING KINGSLEY.

VOL. I.

LOWER INVERTEBRATES.

Illustrated

BY FIVE HUNDRED AND ONE WOOD-CUTS AND TWENTY-TWO FULL-PAGE PLATES.

Boston:
S. E. CASSINO AND COMPANY.
1885.

has no known differences from the parents which produced the egg or spermatozoon. The principle is a wide-spread one in the animal kingdom, and is known as the alternation of generation. It is evident that the Scyphistoma and Strobila, more especially the latter, have a wide difference in shape from the form of the adult *Cyanea*. They develop directly from the egg and are asexual, while the adults which are developed from them are sexual. Sexual animals produce ova which develop into Strobilæ as before. Here then is an alternation of sexual with asexual forms of the same animal, and the technical name of the anomalous development is "Alternation of Generations," nowhere better illustrated than in the Hydroidea and Discophora.

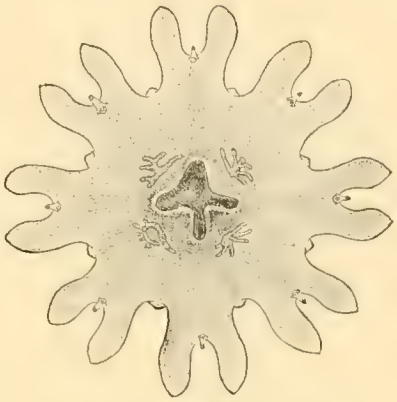

FIG. 91. — Ephyra of *Aurelia flavidula*.

The development of the ovum of *Cyanea* into the adult by a process of alternate generation, in which intermediate larvæ are fixed to some foreign body and reproduce the adult by self-division, is not found in all the Discophora. As this method of growth may be said to be indirect in character, another, called the direct from the absence of these intermediate asexual conditions, also exists. In a direct development among the discophorous medusæ we have simply a continuous growth from the egg to the adult. One egg produces only one adult. Such a development takes place in *Pelagia* and one or two related genera.

CLASS III. — SIPHONOPHORA.

Among the most beautiful of all the medusæ is the group called the Siphonophora, the tube-like jelly-fishes. These animals are all marine and free swimming, and although they often have a hydroid-like shape, which resemblance becomes more marked when we study their anatomy, they are never attached to the ground as are the members of the Hydroidea. They are found in all oceans, although the tropics seem to be richest in the variety of these animals, and those from the Mediterranean have up to the present time been the most carefully studied and described.

As their name signifies, the Siphonophora are characterized by a tube-like body, which is generally so much elongated that it takes the form of a small axis or stem. Although there are several genera in the group where the body does not assume a tubular form (of which one of the most common is *Physalia*), a tubular body seems as a rule characteristic of the group.

The relationships of the Siphonophora to other medusæ have been variously interpreted by different authors. By the majority they are regarded as comparable to the Hydroidea, and are often called the free-swimming hydroids, in distinction from those already considered which are fixed. Others still compare them with the gonophores of the hydroids, some of which as the genus *Lizzia* bud off from the side of their manubrium new individuals, which later develop into medusæ like their parent. The Siphonophora would be regarded by them as similar to the parent with many attached young. While many facts can be mentioned in support of either of these theories, it may be said that the differences which exist between a free medusa and an attached

hydroid are not very great, and although at first sight it might seem as if the two theories involve very different comparisons, they are in reality identical.

Order I. — Physophoræ.

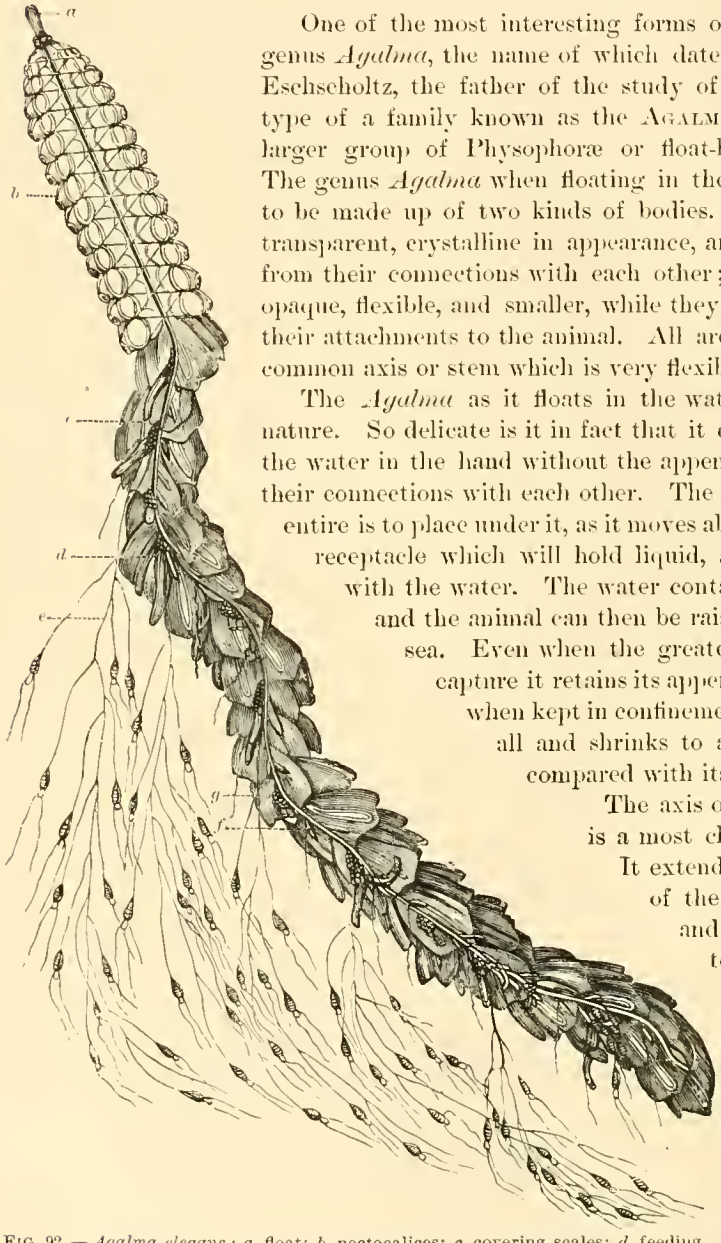

Fig. 92. — *Agalma elegans*; *a*, float; *b*, nectocalices; *c*, covering scales; *d*, feeding polyps; *e*, tentacles and tentacular knobs; *f*, tasters; *g*, sexual bells.

One of the most interesting forms of Siphonophora is the genus *Agalma*, the name of which dates back to the days of Eschscholtz, the father of the study of actinology. It is the type of a family known as the Agalmidæ, and belongs to a larger group of Physophoræ or float-bearing Siphonophora. The genus *Agalma* when floating in the water, will be found to be made up of two kinds of bodies. The first of these are transparent, crystalline in appearance, and are easily detached from their connections with each other; the second are more opaque, flexible, and smaller, while they are more tenacious in their attachments to the animal. All are strung together on a common axis or stem which is very flexible in its character.

The *Agalma* as it floats in the water is of a very fragile nature. So delicate is it in fact that it cannot be raised out of the water in the hand without the appendages being torn from their connections with each other. The only way to capture it entire is to place under it, as it moves about in the water, some receptacle which will hold liquid, allowing it to float in with the water. The water contained in the receptacle and the animal can then be raised together out of the sea. Even when the greatest care is shown in its capture it retains its appendages but a short time when kept in confinement, and soon loses them all and shrinks to an insignificant size as compared with its former proportions.

The axis or stem of the *Agalma* is a most characteristic structure. It extends from one extremity of the animal to the other, and affords an attachment to all the appendages which make up the whole. It is very flexible, colored a rosy pink, is hollow throughout, and about the diameter of a knitting-needle. At one end, which may be called the upper extremity of the axis, the stem is enlarged into a small globular body which is called the air-bladder or float. This float contains a little sac filled with gas, and in some related genera

has for a function the support of the axis in the water. In *Agalma*, however, it is so small that its functional importance in this respect is very slight. The axis of the *Agalma* is divided into two regions, one of which lies adjacent to the float, and is called the nectostem, and the other, more distant from the same, the polypstem. In larger specimens the length of the nectostem is about one-third that of the polypstem. The former bears a number of appendages of interesting character called the nectocalices. These bodies are situated in two rows or series, and are glassy clear in their transparency. Their union with the stem is of a very fragile nature, and easily ruptured when the animal is raised out of the water. If we examine a single nectocalyx we shall find that it resembles closely a medusa bell (hydroid gonophore) in which the walls have a more or less polygonal shape. This form is the result of a flattening of two opposite sides of the nectocalyx in order that it may fit closely in the series of which it is a member. Each nectocalyx has a cavity within, which opens into the surrounding water through a circular orifice, partly closed by a thin, washer-shaped body called the veil. The apex of the nectocalyx is situated opposite the external opening, and marks the point of union of the bell and the nectostem. On either side of the apex, embracing the nectostem, the bell walls are continued into gelatinous horns which closely interlock with similar projections from nectocalices situated in the opposite series.

The arrangement of the nectocalices on the nectostem is as follows: There are two rows or series of these bodies placed diametrically opposite each other on the axis. Each series is composed of a number of nectocalices placed one above the other, fitting closely together by the flat faces on the outside of these bodies. The gelatinous horns already mentioned interlock with corresponding bodies from the opposite series. By the close approximation of adjacent bells on their flat faces, and the interlocking of bells from opposite series, a certain rigidity is given to this portion of the animal, notwithstanding the delicate attachment to the stem.

The disposition of the nectocalices causes all the bell openings in each series to point in the same direction, or almost at right angles to the length of the axis. The action of the nectocalices is as follows: They are, as their name implies, structures for a propulsion of the *Agalma* from place to place through the water. When water is taken into their bell cavities, by a violent contraction of the bell walls it is violently forced out through the opening into that cavity against the surrounding water in which the medusa is floating. The necessary result of this action is that the animal is forced through the water in an opposite direction from that in which the resistance takes place. By a nice adjustment of the different bells, acting in concert or independently, almost any motion in any direction can be imparted to the *Agalma*. Just below the float on the nectostem there is a small cluster of minute buds in which can be found nectocalices of all sizes and in all conditions of growth.

The attachment of the nectocalyx or swimming bell to the nectostem, not only serves to move the animal from place to place, but also renders it possible for the swimming bell to receive its nourishment. Although the nectocalyx resembles very closely a medusa, it is a medusa bell without a mouth or stomach. It is not capable of capturing nourishment for itself, but is dependant upon others for that purpose. The nectocalyx has a system of tubes on its inner bell walls which communicate with the cavity of the nectostem by means of a small vessel which lies in the peduncle by which it is attached. Through this system of tubes the nutritive fluid is supplied to the nectocalyx from a common receptacle, the cavity of the stem. In the largest

specimens of *Agalma* which I have studied, there were seventeen pairs of well-developed nectocalices.

The appendages to the polypstem are somewhat different in character from those of the nectostem, and are of several kinds, differing in character, size, and shape. The first and most prominent of these are known as the covering scales. They are transparent, gelatinous bodies, and are found throughout the whole length of the polypstem. Their shape is quadrangular or almost triangular, and they are united to the axis by one angle. The upper and lower faces are flat, and the whole appendage has a thin, leaf-like appearance. Through its walls from the point of attachment to the distal angle there runs a straight unbranched tube which communicates freely with the cavity of the stem. The covering scales are easily detached, and are incapable of voluntary motion. Their function seems to be to shield the structures which lie beneath them.

Below the covering scales three kinds of bodies hang from the polypstem. They are known as the polypites or feeding stomachs, tasters, and sexual bells. The polypites are the most conspicuous of these bodies. They have a flask-like shape, and are united to the polypstem by one extremity, while the free end has a terminal opening which is a mouth. The walls of the cavity of the polypite are crossed longitudinally by rows of cells which have been compared to a liver. In the cavities of the polypites the half-digested food can be seen through the walls. The nutritive fluids formed in these bodies are poured into the cavity of the axis, there to be distributed throughout the different appendages of the animal. When indigestible substances, as the hard parts of Crustacea, are taken into the stomach they are thrown off again through the mouth-opening. I have never seen the polypites more than seventeen in number, and they hang at regular intervals along the whole length of the polypstem.

One of the most prominent bodies next to the nectocalices and covering-scales in the *Agalma* are the so-called tentacles, which hang from the base of the polypites, and which when extended are very long. The tentacles of *Agalma* are long, highly flexible, tubular filaments whose function is the capture of food. At times widely extended their length is little less than that of the *Agalma* axis itself. At other times they are drawn up under the covering-scales at the base of the polypite, and have a very diminutive size. Along their whole length they are dotted with crimson pendants of minute size which are called the tentacular knobs. These will be found, on close study, to be of a very complicated structure. Their true function is somewhat problematical, but they are supposed to assist in the capture of the food. In addition to the well-developed tentacular knobs which dot the whole length of the tentacles, there are many half-grown bodies of the same character clinging to the base of the polypite.

Alternating with the polypites at intervals along the polypstem are found very curious bodies called tasters, which have a close likeness to the flask-shaped feeding zoöids. These bodies are without a mouth-opening at their free extremity, while from their base hangs a long, highly-contractile filament which is destitute of tentacular knobs. The tasters have an internal cavity which is in free communication with that of the axis of the animal. Various functions have been assigned to the tasters, but none without objections seems yet to have been hit upon. Their usual position is in clusters midway between the adjacent polypites. The term taster is somewhat misleading, for these bodies do not have gustatory functions.

The sexual bells are of two kinds, male and female, and both are found in grape-like clusters, the male near the base of the tasters and the female near the polypites. If we isolate one of the members of a cluster, we find that it has a bell-like shape, and that the ova or spermatozoa are found on a proboscis within. Each bell hangs from the cluster by a tender peduncle which arises at its apex, and each female bell contains a single ovum.

The growth of the young *Agalma* from the egg to the adult is of a rather complicated nature. When cast in the water the egg is a tiny, transparent sphere barely visible to the naked eye. After fecundation, and obscure changes similar to a segmentation of the yolk, a slight protuberance arises at one pole. This prominence is formed of two layers between which, in a short time, a third layer is also formed. The outer layer is the ectoderm, the middle the mesoderm, and the internal the endoderm. Between the endoderm and the remainder of the egg there is a cavity called the primitive cavity. As the embryo grows older the elevation at one pole increases in size, and the proportion in thickness of the middle layer, as compared with the ectoderm and endoderm, becomes very large, while the ectoderm becomes very thin. The prominence has now assumed a helmet-like shape, and fits like a cap over the remnant of the yolk. The whole larva in this stage of growth is called the primitive larva or *Lizzia*-stage, and the cap-shaped covering, the primitive scale. The primitive scale is an embryonic organ which is lost in subsequent development of the larva.

Immediately after the primitive larva stage there is found to develop under the primitive scale an air-bladder or float, which first appears as a little bud near the opening into the primitive cavity, which has now taken the form of a tube in the primitive scale lined with endoderm. At about the same time also there appears a covering-scale of very different form from either the cap-like primitive scale or the covering-scale of the adult *Agalma*, which have already been described. The float is the permanent float of the adult, while the second formed covering-scale, like that of the first, is also embryonic and larval in character. The larva has now the following parts: 1, The remnant of the yolk; 2, a cap-shaped covering-scale; 3, a second embryonic covering-scale, and 4, a float. As the larva grows older more covering-scales like the second appear, and the beginnings of a tentacle and tentacular knobs are seen at the adjacent end of the growing larva. At the same time the yolk becomes elongated, and in its walls appear reticulated masses of red or crimson pigment.

The tentacle first formed as well as its pendants, the embryonic tentacular knobs, are transient in character. They differ essentially from the adult knobs, and are confined to this stage in the development of the larva. Meanwhile the primitive scale is lost, and a circle of covering-scales of the second kind appears at the base of the float. This larva is called the Athorybia larva from its remote resemblance to a related adult genus called *Athorybia*. The appendages of this larva are: 1, a float; 2, a crown of embryonic covering-scales; 3, the remainder of the yolk-sac with an attached tentacle and temporary pendants.

The next following larval condition of *Agalma* is one in which the embryonic covering-scales have disappeared and new scales like those of the adult have formed. Four well-developed nectocalices appear on a nectostem, and an adult polypite bearing the characteristic pendants of the adult has grown on the extremity of the short polyp-stem. A remnant of the yolk-sac, however, still persists, and from it depends an embry-

onic tentacle and its characteristic side branches. The Physophora larva resembles the adult in all particulars, except size, and the presence of the last of temporary organs later to disappear in the growth of the *Agalma*, viz., the embryonic tentacle.

Fig. 93. — Tentacular knob of *Agalmopsis*.

Several other genera of Physophores are so closely allied to *Agalma* that they are placed in the same family. One of the most interesting of these is the genus *Agalmopsis*, which differs from *Agalma* in its slighter form and the intimate structure of its tentacular knobs. *Halistemma* has also a peculiar tentacular pendant which differs from those of *Agalma* or *Agalmopsis*. In the adult knob of *Agalma* the following structures are found: 1, an involucrum; 2, a sacculus; 3, terminal filaments and vesicle. The involucrum is a membranous sac which covers the knob when the other parts are retracted. The great mass of the knob is made up by the sacculus, which is corkscrew-shaped and dark crimson in color. At one extremity it is fastened to the inner walls of the involucrum, the free end bearing two terminal filaments and a vesicle. The various genera of Agalmidæ differ in the character of this knob. *Agalmopsis* has a sacculus and involucrum, but no vesicle, and only one terminal filament. *Halistemma*, probably the type of another family, has no involucrum, while it possesses a spirally-coiled sacculus and a single terminal filament. The genus *Crystallodes* has tentacular knobs like those of *Agalma*, and is by some authors made a species of this genus. It differs, however, from *Agalma* in the rigid nature of the axis, in the shape of the covering-scales, and in minor points in the anatomy of the nectocalices.

Fig. 94. — *Agalmopsis picta.*

The genus *Stephanomia*, a name which has been applied to genera of Siphonophora of widely different form, was given by the elder Milne-Edwards to a Physophore in which there are many series of nectocalices appended to the nectostem. *S. contorta* is one of the most beautiful and graceful of all the Siphonophores as by the combined movement of its many swimming-bells it gaily swims along in the water. It is peculiar in this respect, that the polypites are mounted on a long pedunele, which also bears the covering-scales and the tentacles. The tentacular knobs resemble more closely those of *Halistemma* than of *Agalma*. It may be regarded as the type of the family Forskaliadæ.

One of the most beautiful genera of Physophoridæ is the interesting animal known as *Physophora*, called in the dialect of the Messina fishermen, "Bognetti." *Physophora* is remarkable in possessing no polypstem, but in place of this

structure the axis is enlarged into a bag-like inflation. There is, however, a well-developed nectostem and two series of nectocalices as in *Agalma*. Around the circumference of the inflation, which takes the place of the polypstem, the tasters with their short, tentacular filaments are arranged side by side. The polypites and sexual

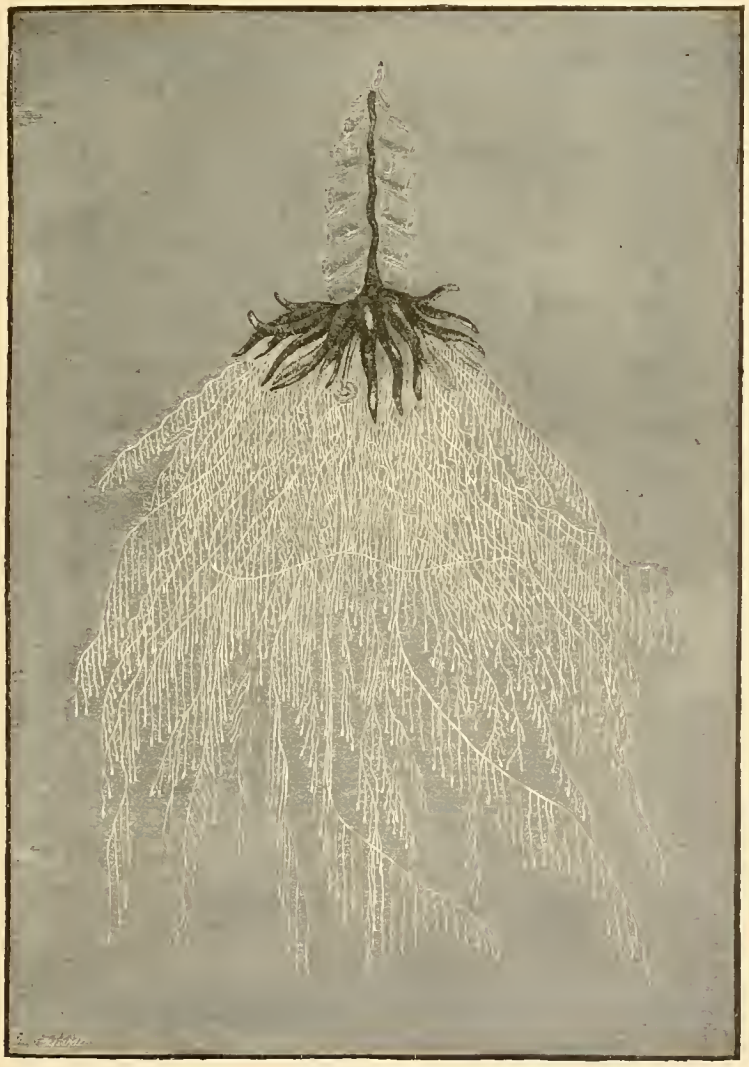

FIG. 95. — *Physophora hydrostatica.*

bodies are found below these structures. No true covering-scales exist in the genus *Physophora*.

One of the largest of all the Physophoræ is the genus *Apolemia*, the type of the APOLEMIADÆ, which is called by the Italian fishermen by the suggestive name of "lana di mare." In this beautiful Siphonophore we have, as in other float-bearing medusæ thus far considered, a double row or series of nectocalices, but unlike the last mentioned genera, there arises from the nectostem, small bodies resembling

minute tasters which wave about in the water with great freedom. The polyp-stem also, instead of being covered throughout its whole length with covering-

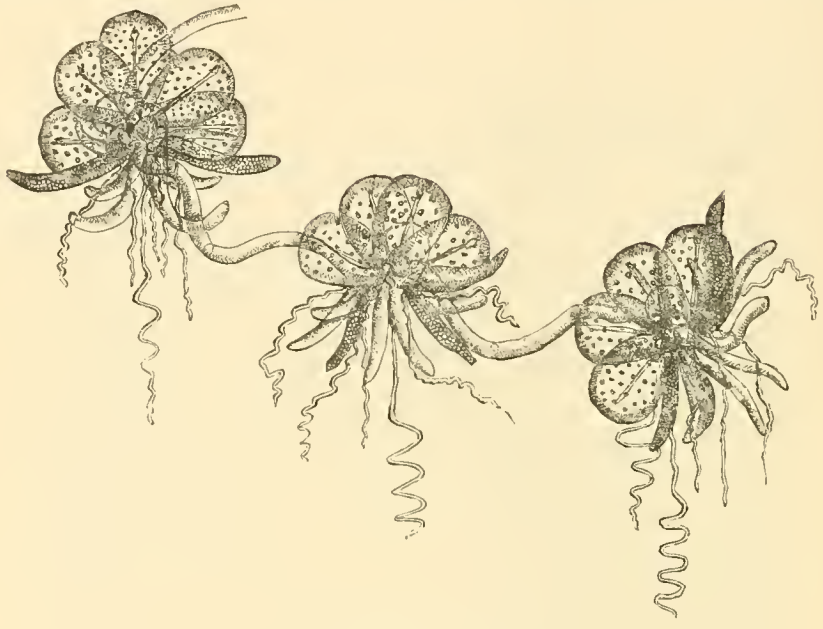

FIG. 96. — Portion of *Apolemia*.

scales, has these structures arranged at intervals and in clusters, each with tasters, polypites, and sexual bodies.

ORDER II. — PNEUMATOPHORÆ.

There are two genera of Siphonophora closely related to each other and to the group of Physophoræ already studied, which are now looked upon as forming a group by themselves. These genera include the well-known Portuguese Man-of-War or *Physalia*, often erroneously called by sailors the Nautilus, and a less common genus, *Rhizophysa*, one of the most bizarre forms of these animals.

Physalia is one of the most common of all the Siphonophora in tropical oceans. The most conspicuous part of this animal, as it floats along on the surface of the water, is an enlarged air-bladder, six or eight inches in length. On the upper side of this float there is a raised crest colored by brilliant blues, yellows, and pinks. On the under side of the same there hang a great variety of appendages of several kinds. There are feeding-mouths or polypites, flask-shaped bodies resembling tasters with long tentacles, which, as the animal floats in the water, extend far behind it in the water as magnificent streamers, and grape-like clusters of sexual bodies. The *Physalia* is wholly destitute of a tube-like axis, and as it floats on the surface of the water, resembles more a bladder with richly variegated walls, than the tube-like forms which we have already considered.

The closest relative to *Physalia*, as far as anatomy goes, to which affinity also what is known of their development adds additional evidence, is the strange genus *Rhizophysa*. *Rhizophysa* is a simple skeleton of a siphonophore. It is the axis of an

Agalma stripped of all its appendages, except feeding polyps and sexual bodies. There is in it no distinction between nectostem and polypstem, and no means of voluntary motion. The float is particularly large and has an apical opening through which its contents communicate with the surrounding water. The feeding polyps hang from the stem at regular intervals when extended, and midway between them appear on the same axis botryoidal clusters which are called the sexual organs. Tentacles hang from the bases of the polypites as in other related siphonophores. The tentacular knobs have, however, a highly characteristic form which varies with different species in number and general anatomy.

FIG. 97.—*Physalia arethusa*, Portuguese man-of-war, one-fifth natural size.

ORDER III.—DIPHYÆ.

In all the genera thus far studied, there is always a float at one extremity of an axis when such was present. In no case is a float missing, although oftentimes it is functionally unimportant. In none of the remaining Siphonophora, on the other hand, is a float present. These last medusæ may conveniently be divided into the Diphyæ, in which there are one or two nectocalices, and the Hippopodiæ, floatless forms in which there are several or more than two swimming-bells.

FIG. 98.—*Rhizophysa*.

One of the best marked families of the Diphyæ is the DIPHYIDÆ, of which *Diphyes* is a typical genus. This genus and most of its relatives is smaller than the majority of those already studied, and are easily distinguished from the former by the absence of a float, and the presence of but two nectocalices. The two swimming-bells which are possessed by *Diphyes* are of somewhat different form. The anterior is conical in shape in order to facilitate rapid progression through the water, while the posterior which lies behind it, seems to perform the greater part of the work in the progression of the medusa. As in *Agalma*, onward motion is caused by the resistance of the water as it leaves the bells on the surrounding medium in which the animal swims. The motions of the nectocalices are spasmodic and not long continued as in the *Agalma* and other Physophoræ. The axis of *Diphyes* hanging from the interval between the two bells, is a long, filamentous, flexible structure not unlike that of *Agalma*. It is highly contractile, and has a cavity throughout its entire length. The polypites arise at intervals along the length of the stem, and are in no respect peculiar. Each polypite bears a tentacle and tentacular

knobs, or pendant side-branches. At the point of attachment of the polypite to the axis, we also find a transparent bell-shaped covering-scale and a cluster of sexual bells with eggs and spermatozoa. Each cluster of bodies near a polypite ultimately separates from its attachment to the *Diphyes* axis, lives independently, and is called a diphyizoöid.

Fig. 99. — *Diphyes.*

There are several families related to the Diphyidæ which might be mentioned. They differ from it in the character, size, and general anatomy of the two nectocalices. One of the most marked of these is *Praya*, a solitary genus composing a family called the Prayidæ. In *Praya* there are two nectocalices which are of about equal size, and have a rounded or semi-ovate form. The bell walls are not as rigid as those of *Diphyes*, and their motion less spasmodic. The axis is very long and flexible, and the polypites, found at intervals along its length, are protected by a helmet-shaped covering-scale, beneath which are found clusters of sexual bells mounted on short peduncles. The genus is one of the most striking of the many beautiful genera which characterize the Siphonophore fauna of the Mediterranean Sea. I have also observed a fragment of a large *Praya* near Fort Jefferson, Tortugas, Florida.

Fig. 100. — *Praya.*

The fourth of the large groups into which the true Siphonophora may be divided is called the Hippopodiæ from a genus sometimes called *Hippopodius*, which has a highly characteristic and peculiar structure. *Gleba* (*Hippopodius*) is in most respects related to the Diphyæ, but unlike them has more than two nectocalices. There is no float and no extended axis with individuals found at intervals in its length. No polyp-

stem is developed, and the nectostem has little in common with that of *Agalma*. The nectocalices are of characteristic shape and different from those of any other siphonophore. Each bell has the shape of a horse's hoof, and has a very shallow cavity and rigid walls. As far as yet known the Hippopodiæ have no diphyizoöids such as exist in several genera of the Diphyæ.

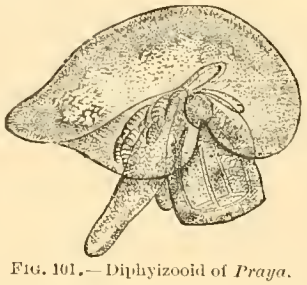

FIG. 101.—Diphyizooid of *Praya*.

ORDER IV.—DISCOIDEÆ.

Among the many interesting forms of Medusæ related to, and by most naturalists included in the Siphonophora, are two beautiful genera called *Velella* and *Porpita*. These, with a genus *Rataria*, which is probably the young of one or the other, make up a group called the Discoideæ.

Velella has borne the name which designates its most striking peculiarity since the middle of the fifteenth century, on account, perhaps, of a somewhat fanciful likeness to a little sail. It is commonly called in Florida, where it is sometimes very abundant, the "float," and is likewise commonly confounded with the *Physalia* or Portuguese man-of-war. The body or disk of *Velella* has an oblong shape, flattened upon its

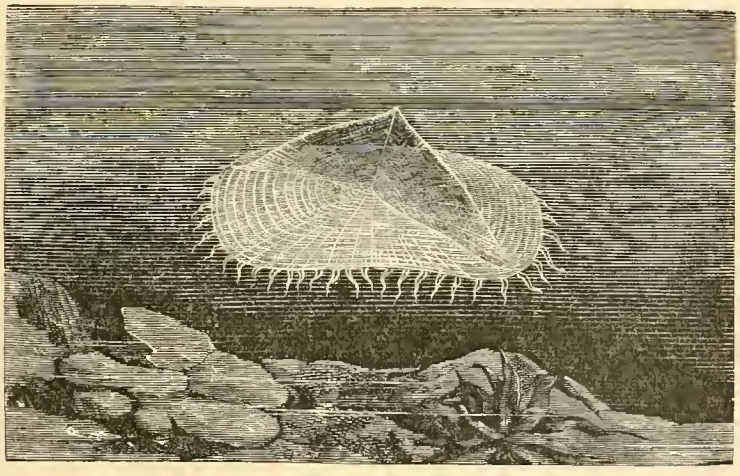

FIG. 102.—*Velella limbosa*.

upper and lower sides. The float is composed of a number of concentric compartments in free communication with each other, seven of which open externally in a line extending diametrically across the disk. In the whole diameter there are fourteen such openings, seven in each radius.

A triangular sail rises on the upper side of the *Velella* disk and extends diagonally across its surface. It is firmly joined to the upper plate of the float. Over the triangular sail as well as the float, there is stretched a thin, blue-colored membrane, which is continued into a variegated soft rim along its border and around the rim of the float. In our most common American *Velella*, which often reaches a length of four or five inches, the portion of the rim of this membrane around the disk is entire; in some species, however, it is continued into elongated appendages.

The most important appendages are found on the under side of the *Velella* disk

which is commonly submerged as the animal floats on the surface of the water. Of these perhaps the most prominent is a centrally placed body which hangs downward below the remaining appendages, and is open at its unattached extremity. This structure is the feeding-mouth or polypite, and is single in both *Velella* and *Porpita*. In the zone just surrounding the polypite we find a large number of small appendages, each of which has a thread-like shape bearing along its sides a number of little transparent buds in all conditions of growth. Each of these little bodies ultimately separates from its attachment, and in the form of a minute jelly-fish, not larger than a pin-head, swims about endowed with independent powers of life for a considerable length of time. The medusa which has thus separated is known as a Chrysomitra. Surrounding the bodies last mentioned on the lower surface of *Velella*, there is a circle of feelers of bluish color which are commonly in constant motion. One of the most prominent superficial differences between *Porpita* and *Velella* is the total absence of a triangular sail in the former genus. They are commonly found associated together, and often accompanied by a third jelly-fish allied to both, called *Rataria*.

Class IV. — CTENOPHORA.

The highest of the jelly-fishes, both on embryological and anatomical grounds, are known as the Ctenophora. In these animals that characteristic of higher forms of life known as bilateral symmetry appears for the first time. An obscure symmetry which has been called by some naturalists bilateral, appears among the Siphonophora, and even in the Hydroidea. In the Ctenophora, however, it is more plainly indicated than in either of these groups.

One of the earliest mentions which we have of the ctenophorous medusæ we owe to Martens. Freiderich Martens was a ship's physician or a ship's barber, as he styles himself, who accompanied Captain Scoresby in a voyage of exploration into the Polar Seas. He first found one of these beautiful medusæ in the neighborhood of the island of Spitzbergen. Eschscholtz was the first to recognize the common likenesses between the different members of the group, and gave to them the name of Ctenophora or comb-bearing medusæ.

The Ctenophora take their name, as he first pointed out, from the existence on the external body walls of eight rows of vibratile plates called combs. These combs are arranged in such a way that in flapping they strike upon the water, and by their motion the jelly-fish is driven along through the water. We find here for the first time since our studies of the Cœlenterata began, a large group of animals where movement in the water is produced both by special locomotive organs and contractions of the body.

The varieties in form in the bodies of different Ctenophora is very great. In some genera they appear as long ribbon or belt-like creatures which move through the water with serpentine movements, in others as transparent caps or globular gelatinous masses over which the rows of combs shine with most lovely iridescent colors. No greater variety of more beautiful genera is to be found anywhere among the medusæ.

Cestus, called also the Venus Girdle, is perhaps the most striking genus of the Ctenophora. Its shape departs the most widely of all the Ctenophora from that of the medusoid types. In *Cestus* the body of the jelly-fish has a girdle or belt-like form, and is moved more by the contractions of the body than by the rows of combs which fringe its edges. The animal is very transparent and extremely tender, so that it is with the