

The following papers were read:—

1. On British Medusæ. By EDWARD T. BROWNE, B.A., F.Z.S., Zoological Laboratory, University College, London.

[Received June 10, 1897.]

(Plates XLVIII. & XLIX.)

The present communication is in continuation of a previous paper read before the Society in March 1896, and published in the 'Proceedings' for that year (P. Z. S. 1896, p. 459).

DIPURENA HALTERATA (Forbes). (Plate XLIX. figs. 2, 2a, 2b.)

*Slabberia halterata*, Forbes (1848); Allman (1867).

*Dipurena halterata*, Haeckel (1879); Browne (1896).

I had the good fortune to capture a fine adult specimen of this species in Valencia Harbour on the 27th of July, 1896. I had occasionally taken young specimens, but never had seen the adult. Before describing the specimen it is best to review the literature relating to the species in order to make clear a most interesting point.

Forbes first found this species in August, 1836, in Mount's Bay, Cornwall, where great numbers were taken, and he described the species in his celebrated Monograph as follows:—"Umbrella deeply campanulate, smooth, colourless; sub-umbrella large, divided into equal parts by four simple vessels, which open into a circular marginal vessel. On the upper third of the sub-umbrella are seen in the course of the vessels four linear ovaries or reproductive glands, pointed at each end. The tentacula are strong, four in number, and colourless, except at their bases and tips. The bulbs at their bases are more or less triangular, coloured above with bright verdigris-green, and across the centre with a band of deep orange, below which, on the root as it were of the tentacle, is seen a conspicuous and rather large jet-black ocellus. The extremity of each tentacle is likewise swollen into a bulb, which is of a rich orange hue. From the centre of the sub-umbrella hangs a long and highly extensile peduncle or stomach, capable of being contracted entirely within the general cavity, but more usually elongated beyond the length of the tentacula. It is of a denser tissue than the other parts, and terminates in a circular orifice. The diameter of the disk does not exceed one-eighth of an inch. The position and form of its ovaries indicate a relationship with *Thaumantias*, whilst the peduncle is that of a *Sarsia*. It thus links together genera which, were it not for such a connecting form, would seem to be far apart."

In 1878 Haeckel captured a specimen at Jersey, which he has described in his 'System der Medusen.' He states that the generative cells are upon the manubrium in three spindle-shaped masses, and he expresses an opinion that the "ovaries" described

by Forbes upon the radial canals may possibly be parasitic *Distoma*.

The specimen which I captured at Valencia helps to clear up these conflicting statements. It has generative cells upon the manubrium, as described by Haeckel, and it has also the linear swellings upon the radial canals, as described and figured by Forbes. There can be no doubt about the swellings upon the manubrium being formed of generative cells, but I am not able to make a definite statement with regard to the swellings upon the radial canals. Sections show that the swelling is formed by a considerable enlargement of the endoderm cells, which are crowded with small nuclei. In general appearance the swelling resembles an immature gonad, as usually seen upon the radial canal of a *Leptomedusa*, but more specimens must be examined to settle the question whether there are generative cells among endoderm cells of the swellings or not. I have a few small specimens in my collection which have again been examined, and I have found in all of them traces of the swellings upon the radial canals. These specimens were preserved before examination and by a method not suitable for histological work.

As the Valencia specimen does not agree exactly with the descriptions given by Forbes and Haeckel, I think it is best to describe it and give a figure of it, especially as Forbes has figured an immature stage:—Umbrella bell-shaped, about 8 mm. in length and 6 mm. in width. Manubrium, when expanded, very slender, about twice the length of the umbrella, with a small apical knob. At the end of each of the four tentacles there are large batteries of nematocysts, forming a large terminal knob when the tentacle is contracted (fig. 2 *b*); but when expanded (fig. 2 *a*) the terminal knob is seen to be composed of three distinct clusters of nematocysts. The basal bulb of the tentacle is of a dark reddish brown, with a large black ocellus. Two masses of spermatozoa surround the manubrium, one extending from the mouth along the stomach, and occupying about one third the length of the manubrium, the other starting a short distance away and occupying another third of the manubrium. On each of the four radial canals, at about one third of the distance from the stomach to the ring-canal, is a small linear swelling, which Forbes regarded as an ovary, but that statement still needs confirmation.

? *CYTÆANDRA AREOLATA*, Haeckel. (Plate XLVIII. figs. 1, 1 *a*, and 2.)

In my Report on the Medusæ of the Isle of Man (Trans. Liverpool Biol. Soc. 1895), I have described under the name of *Cytæandra areolata* several stages of a medusa which has not yet been figured. I erred somewhat in using the name *Cytæandra areolata* for this medusa. It is Haeckel's name for the medusa budded off from the hydroid *Podocoryne areolata* (Alder), but up to the present there is not the slightest proof that my specimens are derived from that hydroid. I have but little doubt that eventually they will

become connected with the genus *Podocoryne* and then the correct name can be assigned to them. I have tried to rear the medusæ budded from *Podocoryne carnea*, but have failed to keep them alive long enough to witness any further development. The specimens of *P. carnea* taken in the tow-net always had eight tentacles and showed no signs whatever of possessing any reproductive organs, so that they may be regarded as quite early stages. The earliest stage taken of the medusa which I have called *Cytaeandra areolata* has sixteen tentacles, which correspond to the number of tentacles possessed by the medusæ liberated from *Podocoryne areolata*. At present I have no reason for doubting that *P. carnea* and *P. areolata* are two distinct species, and therefore expect to find two distinct adult medusæ, but have only seen one.

I give the description of an early stage (Plate XLVIII. fig. 1):— Umbrella about 1 mm. in length and in width, with scattered nematocysts upon the ex-umbrella. Manubrium about two-thirds the length of the umbrella-cavity, and the mouth with four simple oral tentacles terminating with a cluster of nematocysts. Sixteen large tentacles (4 perradial, 4 interradial, and 8 adradial), with brownish basal bulbs; and four slender tentacles which are evidently at an early stage of growth.

I add the description of a late stage (Plate XLVIII. fig. 2):— Umbrella about 4 mm. in width and slightly less in length. Compared with an early stage it shows a change in shape owing to the increase in the mass of mesogloea above the umbrella-cavity. The oral tentacles are bifurcated and have the usual terminal clusters of nematocysts. The number of tentacles in the specimen figured is 25, but 30 tentacles were counted in another specimen. The basal bulbs of the tentacles are very conspicuous, of a rich reddish-brown colour.

I saw ova surrounding the stomach of a specimen of this medusa taken in Valencia Harbour on 22nd April, 1895. The specimen was about 5 mm. in diameter and possessed 24 tentacles.

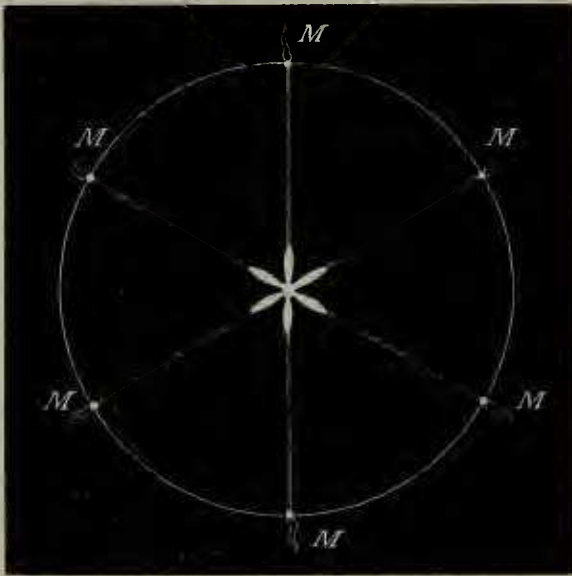
#### LAR SABELLARUM, Gosse.

In my previous paper on British Medusæ (P. Z. S. 1896, p. 468), I showed that the medusa *Willsia stellata*, Forbes, was the adult form of the medusa liberated from the hydroid *Lar sabellarum*, Gosse, and a description was given of the different stages in development. In that paper I described wrongly the branching of the radial canals in the adult, and was led into the error by having seen only one specimen, which has since proved to be an abnormal one. I stated that the third branch of the radial canal was an offshoot of the second branch, but in most specimens the third branch comes off from the first branch. The diagrams (1, 2, 3, 4, pp. 819, 820) show the normal development of the radial canals.

During my visit to Valencia in 1896, I was able to collect a large number of specimens, especially of the later stages, and found some remarkable variations in the branching of the radial canals. Two of these are illustrated by diagrams (5, 6, p. 821). In other

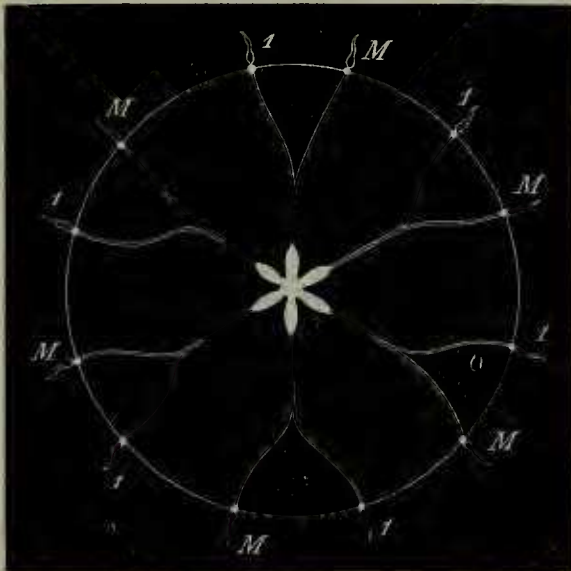
Diagrams to show development of the branches of the radial canals. Aboral view. *M*, main canal. 1, first branch. 2, second branch. 3, third branch.

Fig. 1.

*Lar sabellarum.*

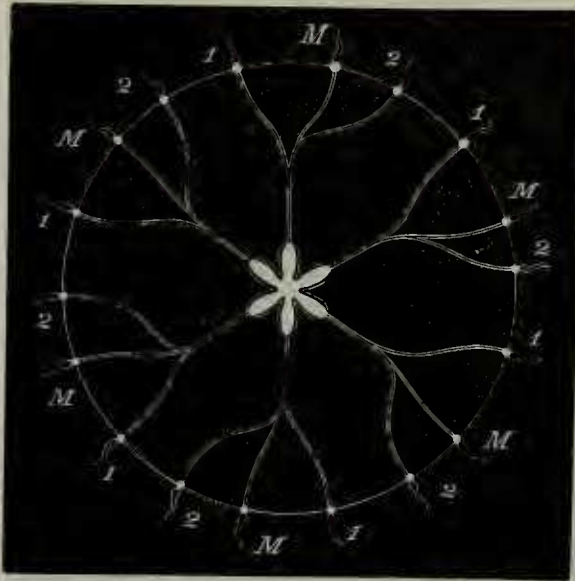
First stage. Six canals without branches.

Fig. 2.

*Lar sabellarum.*

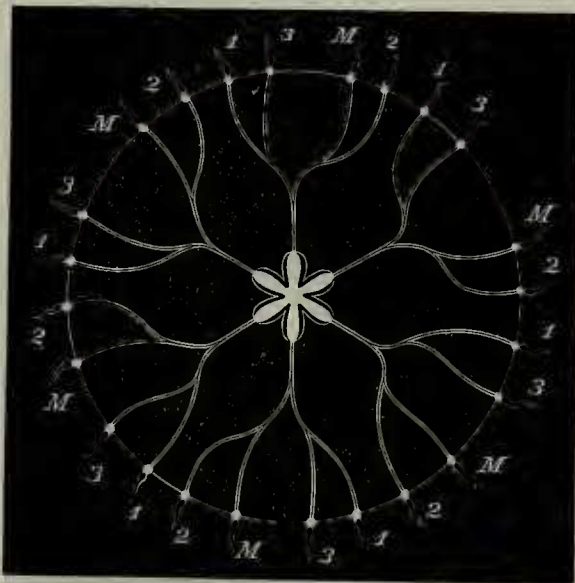
Second stage. Each canal with one branch.

Fig. 3.

*Lar sabellarum.*

Third stage. Each canal with two branches.

Fig. 4.

*Lar sabellarum.*

Adult stage. Each canal with three branches.

Fig. 5.

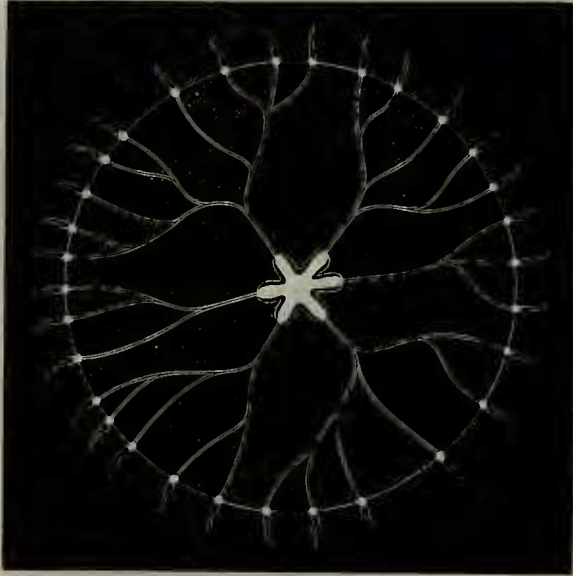
*Lar sabellarum.*

Diagram showing variation in the branching of the radial canals.

Fig. 6.

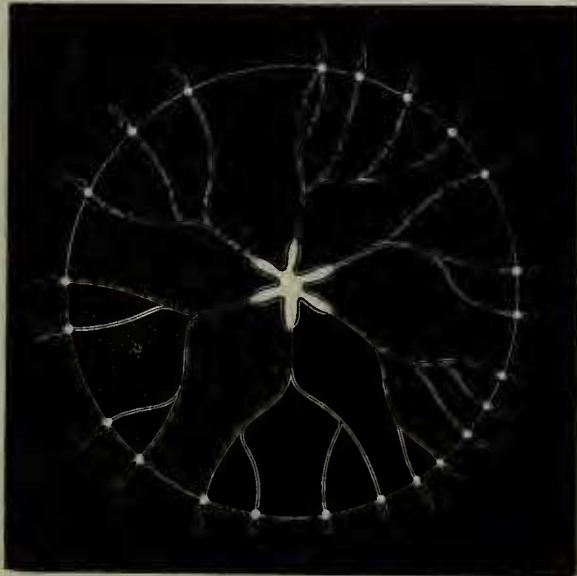
*Lar sabellarum.*

Diagram showing variation in the branching of the radial canals.

Fig. 7.

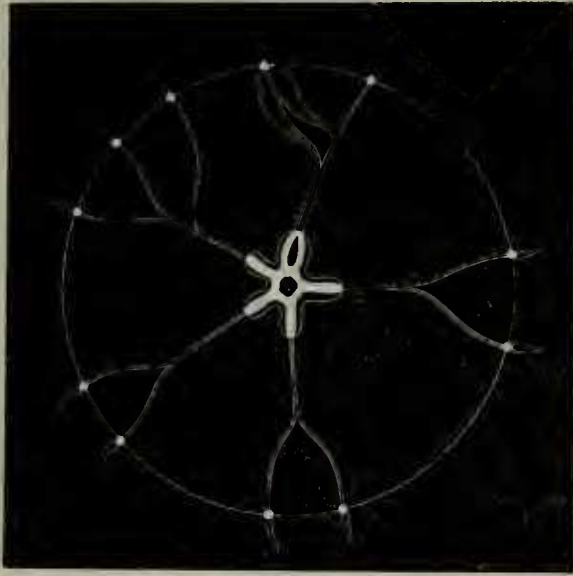
*Lar sabellarum.*

Diagram showing variation in the branching of the radial canals.

Fig. 8.

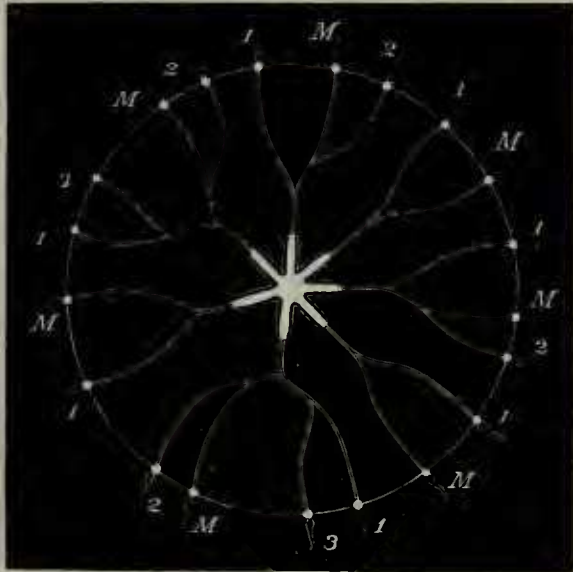
*Lar sabellarum.*

Diagram of a specimen with seven main canals.

Fig. 9.

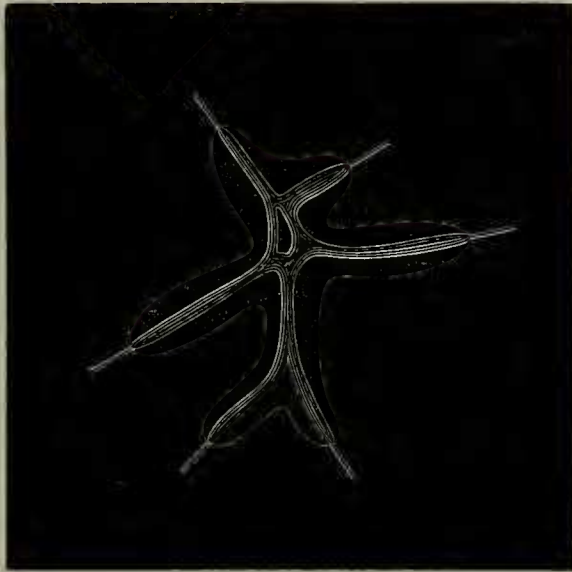
*Lar sabellarum.*

Diagram showing an irregular arrangement of the lobes of the stomach and of the radial canals.

specimens a variation occurred in the number of the canals which leave the stomach; normally six are present. Two specimens possessed five canals: one belonged to the first stage and had five tentacles; the other belonged to the second stage and possessed ten tentacles.

Another specimen showed the union of two lobes of the stomach to form one canal (fig. 7, p. 822), with an abnormal branching of the canal near the margin of the umbrella.

A specimen with seven canals showed that some of the canals had less than the normal number of branches (fig. 8, p. 822). A curious variation of the normal star-shaped stomach is shown in fig. 9 (p. 823).

LAODICE CALCARATA. (Plate XLIX. fig. 4.)

*Laodice calcarata*, L. Agassiz (1862); Haeckel (1879); Brooks (1895); Browne (1895).

*Lafoea calcarata*, A. Agassiz (1865).

According to Haeckel there are four species belonging to the genus *Laodice*, viz. *L. cruciata*, *L. ulothrix*, *L. calcarata*, and *L. salinarum*.

I have already briefly criticised (see P. Z. S. 1896, p. 482) the numerous synonyms and references placed under the name of *Laodice cruciata* by Haeckel, and think that *Medusa cruciata* of Forskål, and the references connected with it, may be safely placed on an obsolete list, as neither the descriptions nor the figures are of any use for even determining correctly the genus to which they really belong.



Some of the other synonyms refer to medusæ which do not belong to the genus *Laodice*, but two of them clearly do, viz., *Thaumantius mediterranea*, Gegenbaur (1856), and *Cosmetria punctata*, Haeckel (1864). Haeckel, however, in his monograph (1879), rightly considers that his species is identical with that of Gegenbaur, and therefore may be regarded as a synonym of it.

It is a matter of considerable difficulty with our present knowledge of the genus to fix upon characters which may be regarded as sufficiently permanent to distinguish one form from another. Although I obtained last year several dozen fine specimens in Valencia Harbour, yet I am not able to determine for a certainty to which species they belong.

I first used the specific name *L. calcarata* for a specimen taken off the Isle of Man in 1894, and at that time had not investigated the literature connected with *Laodice cruciata* of Haeckel. As I do not wish to change again the specific name of the British specimens the name is still retained for the Irish specimens, which would fairly well agree with any of the four species mentioned, except in coloration, which, amongst medusæ, is not usually a good character for the determination of species.

The Valencia specimens ranged from 3 mm. to 27 mm. in diameter and show various stages in development.

The umbrella is changeable in shape, and cannot be relied upon as a specific character. In the smallest specimen the umbrella is bell-shaped, about as long as broad, but it broadens as it grows, as the following measurements show:—9 mm. wide, 7 mm. long; 20 mm. wide, 12 mm. long; 25 mm. wide, 13 mm. long. Amongst the larger specimens, 20–25 mm. in width, the shape of the umbrella is very variable, from bowl-shaped to watchglass-shaped. The velum increases in width along with the growth of the umbrella, measuring 2–2½ mm. in specimens from 20–25 mm. in diameter. The mouth in the smallest specimen has four lips with a slightly folded margin. The size of the lips and the folds of the margin increase with the size of the medusa. In the largest specimens the lips are 2–4 mm. in length and have a beautifully folded margin. The mouth opens direct into a flat stomach, out of which run the four radial canals.

The generative cells develop in the wall of the radial canals, and the ova in the adult are visible, extending nearly from the stomach to within a short distance of the ring-canal. The smallest specimen (3 mm. in diameter) just shows the commencement of the formation of the gonads, by an increase in the size of the wall of the canals, forming a short fold which extends from the stomach and just arches over the top of the umbrella-cavity. It gives to the stomach the appearance of possessing four short lobes. The growth of the gonad continues along the radial canal until it nearly reaches the ring-canal. As the generative cells increase in size, the wall of the canal also increases in size, until it forms a large hollow tube with crumpled sides. In each of the specimens examined there was a short portion of the radial canal, next the ring-canal, free

from generative cells. The gonads in all the specimens were quite colourless.

The margin of the umbrella is thickly beset with long tentacles, the number varying according to the size of the umbrella, as shown by the following examples:—

3 mm. diameter . . . .	About 30 tentacles.	
6 mm.       "       . . . .	"       60       "	
9 mm.       "       . . . .	"       100       "	
11 mm.     "       . . . .	"       120       "	
17 mm.     "       . . . .	"       230       "	
26 mm.     "       . . . .	"       300       "	or more.

The tentacles first make their appearance as bulbs on the inner side of the margin, which is fairly broad. The bulb apparently grows outwards across the margin, and the tentacles develop from the outer end of the bulb. The tentacle gradually tapers from the bulb; it is at least 25 mm. in length, when expanded, and covered with nematocysts. The attachment of the tentacle to the umbrella is further strengthened by an outgrowth which extends from the base of the tentacle for a short distance along the ex-umbrella. The outgrowth is usually triangular in shape and consists of large cells. This outgrowth or "spur" appears after the development of the tentacle, and is absent or scarcely visible in young stages.

When the medusa is motionless in an aquarium, the tentacles are arranged in two positions. The basal portion of one tentacle points upwards, and that of the adjacent one slopes slightly downwards; the basal portion is stiff and straight, the outer portion gracefully curves over, with the free end hanging down and tapering out to an almost invisible thread. On the inner side of the basal bulbs of the tentacles, and just below the ring-canal, there is usually situated a black ocellus. The ocelli show a considerable amount of variation in number. As a rule there is not one opposite every tentacle, but every alternate tentacle. In the same individual several adjacent tentacles may each have an ocellus at their base, then an alternating series, one with, and the next without an ocellus; and followed by two or three adjacent tentacles without ocelli. In one large specimen I counted 228 tentacles, but only 88 ocelli, and in another large specimen I noticed an ocellus opposite nearly every tentacle.

On the inner side of the margin of the umbrella are situated the curious sensory clubs or cordyli—one about midway between every two tentacles; they usually point inwards, and lie close to and below the velum. Brooks has recently given a description and figures of these organs.

In addition to the tentacles and cordyli there are also long filiform cirri, armed with nematocysts: usually one between every two tentacles, but often two are present, and are situated close to the bulb of the tentacle. In a few specimens I noticed that a

filiform cirrus was situated on the outer side of a tentacle-bulb, or upon the "spur." The cause of this abnormal position I was able to trace from the early stages. The tentacles do not all occupy exactly the same position on the margin; some develop very close to the inner side of the margin. The filiform cirri are close to the outer side of the margin, and, consequently, when a tentacle-bulb makes its appearance close to the inner margin and opposite a cirrus, in its subsequent growth it carries the cirrus in an outward direction.

All the Valencia specimens were quite colourless to the naked eye, but under the microscope a narrow band of a yellowish-brown colour is seen at the base of the ring-canal, and a narrow streak of the same colour is also visible in the basal bulbs of the tentacles.

DIPLEUROSOMA HEMISPHERICUM (Allman). (Plate XLVIII. figs. 3, 3a.)

*Ametrangia hemisphærica*, Allman (1873).

*Dipleurosoma irregulare*, Hæckel (1879); Haddon (1885).

During my visits to Valencia in 1895 and 1896 I found a few specimens of this species.

Allman, in the description of the species, states that there are three main radial canals with branches; some of the branches enter the ring-canal and others terminate blindly.

Hæckel found some specimens at Brighton, one of which agreed with Allman's description, and the others showed considerable variation in the arrangement of the canal-system.

The Valencia specimens also show that the canal-system, which I now only intend to describe, is very variable.

The specimen which approaches nearest to Allman's description has three large radial canals, with lateral branches, and also two smaller canals leading from the stomach to the ring-canal (fig. 10, p. 827). The umbrella of this specimen measures 8 mm. in diameter, and the ova are just visible upon four of the canals.

Another specimen, of which I have given a figure (Plate XLVIII. figs. 3, 3a) shows another type of canal-system. There are four large canals, which divide the umbrella into four equal parts, and four smaller canals, interradially situated, one of which has reached the ring-canal and the other three terminate not far off. The gonads have not yet commenced to develop. The umbrella is about 8 mm. in width and 4 mm. in length.

A very irregular system of canals is shown in another specimen (fig. 11, p. 827). This has eight radial canals leaving the stomach and joining the ring-canal, and some of these canals have short lateral branches, which probably by further growth finally reach the ring-canal. In a damaged specimen I have counted as many as eleven canals entering the ring-canal. A slightly damaged specimen of a male shows that the generative cells form a large oval mass, on, at least, five of the radial canals, and that the

Fig. 10.

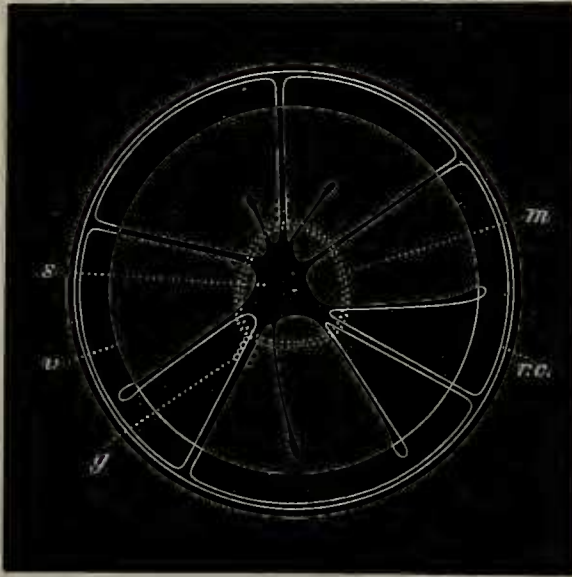
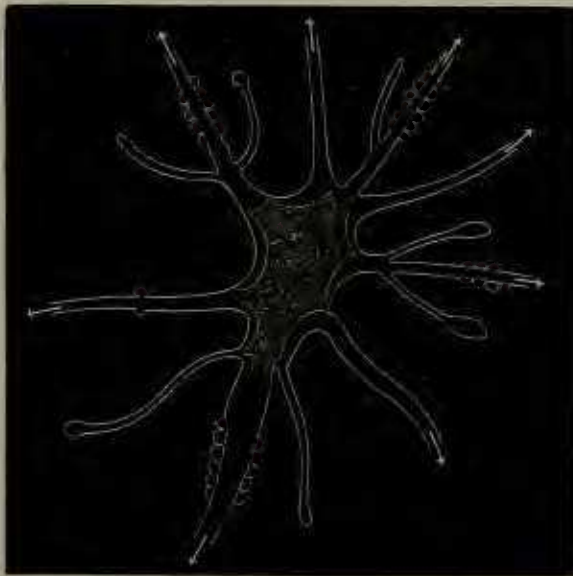
*Dipleurosoma hemisphæricum.*

Diagram of the radial canal-system. Oral view.

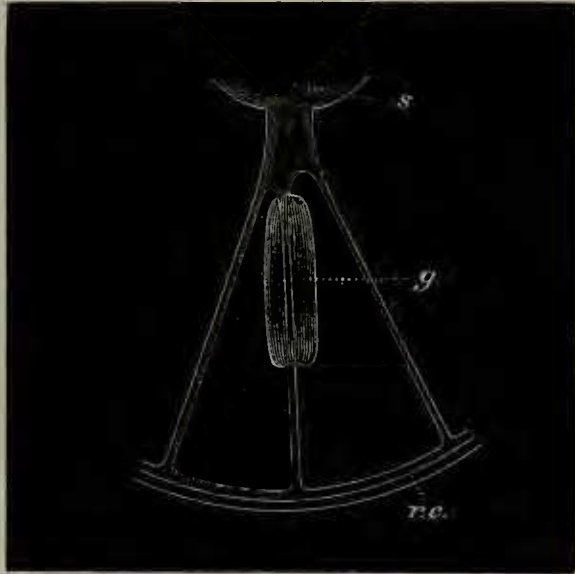
*g*, gonad; *m*, mouth expanded; *r.c.*, ring-canal; *s*, stomach; *v*, velum.

Fig. 11.

*Dipleurosoma hemisphæricum.*Diagram showing the radial canals leaving the stomach. Oral view.  
The canals marked with an arrow enter the ring-canal.

branches of the canals leave the main canal between the generative organs and the stomach (see fig. 12, p. 828).

Fig. 12.



*Dipleurosoma hemisphericum.*

Diagram showing the position of the gonad upon the radial canal.

It is evident that these specimens do not agree with Allman's description of the species. He clearly states that there are only three primary canals, which give off branches, and that the generative cells are confined to these canals and are situated close to the stomach.

I think a fresh description of this species is required, and that a large number of specimens ought to be examined, so as to find out the normal plan of the canal-system and the extent of its variations.

DISTRIBUTION. England—Brighton, *Haeckel*.

Ireland—South Coast, *Allman*. Kingstown, *Haddon*. Valencia Island, *E. T. B.*

#### POLYCANNA FORSKALEA (Forbes).

*Æquorea forskalea*, Forbes, P. Z. S. 1851, p. 272, Rad. pl. iv.

On the 5th September, 1896, five specimens of this beautiful medusa were captured in Valencia Harbour, and others were seen swimming at too great a depth to be taken in a hand-net. On the previous day a large one had been taken by the Misses Delap. All the specimens were in splendid condition, and fortunately belonged to different stages, which are described in the order of their size

No. 1. Umbrella 25 mm. in diameter.

The stomach is very broad at the base, which is slightly convex in shape, and about 13 mm. in diameter. The mouth has about 55 simple folds, and, when expanded, is 7 mm. in diameter. No less than 140 radial canals leave the stomach, and out of these 45 enter the ring-canal, the remainder showing various stages in development. At this stage the generative cells are just visible upon some of the canals. Upon the margin of the umbrella there are four large tentacles, when expanded about 20 mm. in length, situated at about equal distance apart, and there is also a small tentacle, about midway between the large tentacles, in three of the quadrants. The fourth tentacle, to make this series complete, has not yet begun to grow. In addition to the tentacles there are about 100 marginal bulbs, varying in size, from which tentacles develop in the later stages.

The marginal vesicles are very numerous, but not constant in number and position, generally two between every two bulbs.

No. 2. Umbrella 30 mm. in diameter.

This specimen shows a later stage in development as there are 8 large tentacles, but the numbers of marginal bulbs and vesicles are about the same as in the first specimen. The radial canals are not nearly so numerous, only 114 present. About half enter the ring-canal, the others show various stages of growth and usually alternate with the former. In one place on the umbrella there is a union of four adjacent canals, which again branch into three canals.

No. 3. Umbrella 55 mm. in diameter.

The base of the stomach shows a well-marked convexity, 26 mm. in diameter, which is formed by a thick mass of mesogloea. There are 16 tentacles present, which may be divided into three sets—four very long, four moderately long, and eight very short. Nearly all the radial canals (145 in number) unite with the ring-canal. The gonads, owing to their increase in size, are conspicuous, and the marginal bulbs and vesicles are very numerous, as in the preceding specimens.

No. 4. Umbrella 60 mm. in diameter.

The base of the stomach measures 33 mm. in diameter and has a conspicuous convexity. The stomach itself, though very broad, is very short, and the mouth measures 17 mm. in diameter when expanded. There are 28 tentacles, varying in length, eight of which are very long, and about 40 marginal bulbs. The radial canals, about 180, nearly all unite with the ring-canal. One canal on leaving the stomach divides into three branches, and another into two branches. The generative cells show a further stage in development.

No. 5. Umbrella 135 mm. in diameter.

The first four specimens show a gradual increase in size and in development, but there is a slight gap in the series between this specimen and the last one. The umbrella is very flat on the top and about four times as broad as high. The growth of the stomach,

55 mm. in diameter, keeps pace with the growth of the umbrella and becomes longer and more funnel-shaped. The mouth, as in all these specimens, has a considerable number of folds and is capable of considerable expansion (35 mm. in diameter when expanded). There are 43 tentacles of various sizes, and between every two tentacles usually one large and two small marginal bulbs, and between the latter several marginal vesicles. The radial canals (153 in number) nearly all enter the ring-canal. The genital bands are very conspicuous. The velum is about 4 mm. broad.

No. 6. Umbrella 160 mm. in diameter.

This is the largest specimen of the series, and to judge from the immature condition of the ova the medusa has not yet reached its full development and probably grows to a larger size. The diameter of the stomach is 53 mm., and the mouth has a very large number of folds. There are 56 tentacles, and between every pair of tentacles usually one large and two small bulbs, which may develop tentacles later on. The radial canals are only 88 in number and nearly all join the ring-canal, and nearly all have generative cells in different stages of development.

The following is a general description of the different organs of the specimens above described :—

#### *The Stomach and Mouth.*

The stomach is remarkable on account of its size; the upper part, as already stated, is circular and convex in shape; the convexity is more marked in the larger specimens. In shape, the stomach is like a short, broad funnel with the side marked by longitudinal lines, like frosted glass, which alternate with the openings of the radial canals. The lines extend from the base of the stomach up to the edge of the mouth. The closing of the mouth is effected by the wall of the stomach becoming spirally twisted. When the mouth is closed the stomach becomes more elongated and the twisted portion forms a kind of œsophagus (“Schlundrohr” of Haeckel), just as in *Polycanna fungina*, Haeckel (Taf. xiv. fig. 4). The mouth does not always hang in the centre of the umbrella-cavity, but at times moves very slowly round and round the margin of the stomach. The edge of the mouth, in the smallest specimen, has simple folds, which become more complex in the larger specimens.

#### *The Radial Canals and Generative Organs.*

Allman gives in his Monograph (p. 79) an excellent diagram showing the development of the radial canals of an *Æquorea* (probably *Æquorea forskalea*, Forbes). The specimens taken at Valencia show that the radial canals do not develop in any definite order. In the smallest specimen about one-third join the ring-canal, and the remainder show various stages of growth—some of them are only just leaving the stomach. The number of canals appears to be very variable, as the largest specimen has only 88 canals, and

the younger ones vary between 114 and 180. In the smallest specimen the generative cells are just beginning to make their appearance along some of the radial canals. The generative cells are situated in the wall of the canal, and as they develop in size the wall of the canal extends downwards, so that in the largest specimens the wall hangs down as a large fold, about 4 mm. wide, and of a purplish colour. The generative cells extend from the stomach nearly to the ring-canal, terminating in the largest specimens about 2 to 3 mm. from the margin. In this short portion the canal is very broad, several times broader than the parts bearing the gonads.

Hæckel states that *Polycanna fungina* has alternating sterile and fertile radial canals. The Valencia specimens have generative cells on almost every canal, occasionally a sterile canal occurs in one or two places on the umbrella. As the canals are of different ages of growth, so are the generative cells, and consequently the generative folds vary in size.

Strethill Wright was successful in rearing the ova of *Polycanna vitrina* (Gosse), and showed that an alternation of generations existed, but the hydroids died at too early a stage for a satisfactory determination of their generic position.

#### *The Tentacles and Marginal Vesicles.*

The smallest specimen shows that the medusa probably starts its free-swimming life with four tentacles, and later on has eight and then sixteen, which correspond to the perradial, interradial, and adradial sets, as in *Phialidium*. After sixteen are present the tentacles develop in an irregular manner until the maximum number, which is not yet known, has been reached. The largest of the Valencia specimens has 56 tentacles and about 150 marginal bulbs; if the latter develop tentacles, a full-grown specimen would have about 200 tentacles. The first appearance of a tentacle is marked by a very small bulb upon the margin of the umbrella, and the bulb grows to a considerable size before the tentacle begins to grow out from it. The bulbs increase in number as the umbrella increases in size, and consequently, in the later stages, the bulbs and tentacles show various stages in development. A bulb carrying a full-grown tentacle is very large and marked externally with four or more longitudinal ridges. As the wall of the bulb is very thin, there is a large internal cavity which communicates with the ring-canal through a narrow opening. The bulbs and the tentacles are of a light purplish colour. The arrangement of the tentacles on the margin of the umbrella does not coincide with the arrangement of the radial canals.

The marginal vesicles are exceedingly numerous and irregular in position; there are usually two vesicles between every two marginal bulbs, and the number varies between one and three. Each vesicle usually contains four otoliths, but the number varies from two to six. The arrangement of the otoliths inside the



vesicle shows considerable variation; they are usually placed in nearly a straight line, but often form a semicircle, and are occasionally arranged in opposite pairs, as described by Haeckel in *Polycanna fungina*.

*Literature.*—A search into the literature relating to the genera *Æquorea* and *Polycanna* led me to a paper published by Forbes in the 'Proceedings' of this Society for 1851, "On a Species of *Æquorea* inhabiting the British Seas," taken in the Outer Hebrides. The medusæ taken at Valencia closely correspond to the description and figures given by Forbes, who, after a careful investigation of the early literature, decided that his specimens belonged to the species known as *Æquorea forskalea* (Péron). I have examined the earlier references relating to this kind of medusa, and believe that it is not possible to recognize with certainty the species described by the early naturalists.

Haeckel (1879) brings together all the early references relating to *Æquorea forskalea* (Péron), but has omitted Forbes's *Æquorea*.

Claus (1881) describes specimens of *Æquorea forskalea* taken at Trieste, and criticizes Haeckel's classification of the *Æquoreidæ*.

Hartlaub (1894) describes specimens from Heligoland under the name of *Æquorea forskalea* (Péron).

Our present knowledge of this interesting group is certainly not in a very satisfactory condition. Probably, when more is known about them, there will be a considerable reduction in the number of species and Claus's views confirmed.

For the present I think it is best to leave the Valencia specimens under the name of *Polycanna forskalea* (Forbes).

#### A LEPTOMEDUSA (gen. ? sp.?). (Plate XLIX. figs. 3, 3 a.)

This is an interesting little medusa which I have found only in Valencia Harbour: a single specimen in May 1895, and three in August 1896.

*Description.*—Umbrella egg-shaped, about 1 mm. in length and width. Stomach and mouth absent. Four radial canals. Four brownish tentacle-bulbs, without tentacles. Eight marginal vesicles, each with a single otolith. About halfway down each radial canal there are three pairs of dark brownish, irregular lobes, which project into the umbrella-cavity. Velum very broad.

The absence of the stomach and mouth and of the tentacles, and the presence of lobes on the radial canals, were noticed in all the specimens.

Gonads probably develop upon the lobes of the canals, but none were visible in these specimens.

I do not believe that this medusa has been described, and refrain from giving it a name. Most likely it comes from a Calyptoblastic hydroid which has probably already received a name; if so, let it receive its hydroid name<sup>1</sup>.

<sup>1</sup> Since this paper was read Dr. C. Hartlaub has published a description of this medusa from examples taken off Heligoland. It is named *Agastra mira* (sp. et gen. nov.). (Arbeiten biol. Anstalt Helgoland, 1897, Bd. ii. p. 504.)

AGLANTHA ROSEA (Forbes). (Plate XLIX. figs. 1, 1 a, 1 b.)

*Circe rosea*, Forbes (1848); McIntosh (1890); Crawford (1891).  
*Aglantha digitalis*, Hartlaub (1894).

Towards the end of April and during May 1895, I found in Valencia Harbour about a dozen specimens of an *Aglantha* with eight marginal vesicles.

The specimens agreed fairly well with the description given by Forbes of *Circe rosea*, but Forbes has omitted, as usual, the marginal vesicles in the description. During my second visit to Valencia in 1896 I again met with examples of the same species.

Haeckel has placed *Circe rosea*, Forbes, as a synonym of *Aglantha digitalis*, a species first briefly described by Müller (1766) under the name of *Medusa digitale*. Haeckel has again described the species and has stated clearly that there are always four marginal vesicles ("Hörkölbchen") present. The umbrella is 30-40 mm. in length and 10-20 mm. in width.

Maas (1893) has also described *Aglantha digitalis*, taken by the German Plankton-Expedition, with four marginal vesicles.

Hartlaub found in 1894, off Heligoland, specimens of a small *Aglantha* with eight marginal vesicles, which he briefly describes under the name of *Aglantha digitalis* (Müller), and gives *Circe rosea*, Forbes, as a synonym.

I do not think that these small medusæ, about 12-14 mm. in length, with gonads and with eight marginal vesicles, are the young forms of the large medusa with four marginal vesicles described by Haeckel as *Aglantha digitalis*. I believe there are two distinct species, and that Forbes's description corresponds to the smaller one with eight marginal vesicles. I think that the name *Aglantha rosea* (Forbes) ought to be retained for the forms with eight marginal vesicles, and *Aglantha digitalis* for the forms with four vesicles.

#### *Notes on Specimens taken at Valencia.*

The smallest specimen was taken on 22nd July, 1896, about 1½ mm. in length and nearly as wide. It had four marginal vesicles, the only specimen seen with four vesicles, and the tentacles, contracted, were of a bright red colour. The other specimens measured from 5 to 11 mm. in length, and all possessed eight marginal vesicles. The gonads in most of the specimens were just making their appearance and none exceeded 2 mm. in length; all were immature. Several of the specimens possessed tentacles of a reddish colour, and in some the stomach and the lips of the mouth were of a pinkish colour; but most specimens were quite colourless. The tentacles varied in number according to the size of the umbrella, about 60-80 present in the largest specimens.

The description of a specimen taken on 22nd May, 1895:—

Umbrella cylindrical with a cone-shaped summit, 11 mm. long and 5 mm. wide. The manubrium reaches down nearly to the velum, and a slight constriction marks the boundary between the

peduncle and the stomach; mouth with four lips. The stomach and mouth of a delicate pinkish colour. Eight radial canals lead from the stomach, along the peduncle and down the sub-umbrella, to the ring-canal. Upon each radial canal, at the summit of the umbrella-cavity and close to the peduncle, the gonad originates, first as a small oval swelling and at a later stage hangs freely down in the umbrella-cavity. The margin of the umbrella is lined with tentacles, about 80 present, colourless when fully expanded, but slightly reddish when contracted. On the inner side of the ring-canal, near the velum, the marginal vesicles are situated, eight in number, alternating, about midway, with the radial canals. The velum is broad.

An abnormal specimen was taken on 25th April, 1895. It had seven radial canals, seven gonads, and seven marginal vesicles.

DISTRIBUTION. Heligoland, *Hartlaub*.

SCOTLAND—Shetland Islands, *Forbes*; St. Andrews, *M'Intosh*, *Crawford*.

IRELAND—Valencia Island, *E. T. B.*

#### BIBLIOGRAPHY.

- AGASSIZ, A. 1865. North American Acalephæ. (Cambridge, Mass.)
- AGASSIZ, L. 1862. Contrib. Nat. Hist. U.S.A., vol. iv. (Boston.)
- ALLMAN, G. J. 1867. "On *Slabberia*." Brit. Assoc. Rep. p. 77.
- ALLMAN, G. J. 1871-72. Monogr. Gymn. Hydroids. Ray Soc. (London.)
- ALLMAN, G. J. 1873. "On some Recent Results with the towing-net on the South Coast of Ireland." Nature, vol. ix. pp. 73-74.
- BROOKS, W. K. 1895. "The Sensory Clubs or Cordyli of *Laodice*." Journ. Morph. vol. x. pp. 287-304, pl. xvii. (Boston.)
- BROWNE, E. T. 1896. "On British Hydroids and Medusæ." Proc. Zool. Soc. pp. 459-500, pls. xvi. & xvii. (London.)
- CLAUS, C. 1881. "Ueber *Æquorea forskalea*." Arbeit. Zool. Instit. Wien, Bd. iii.
- CRAWFORD, J. H. 1891. "Notes on Medusæ of St. Andrews Bay." Ann. Nat. Hist. ser. 6, vol. viii. pp. 295-297.
- FORBES, E. 1848. Brit. Naked-eyed Medusæ. Ray Soc.
- FORBES, E. 1851. "On *Æquorea*." Proc. Zool. Soc. pp. 272-275, Rad. pl. iv. (London.)
- GEGENBAUR, C. 1856. "Versuch Syst. Medusen." Zeitschr. wiss. Zool., Bd. viii. pp. 202-273, Taf. vii.-x.
- HADDON, A. C. 1885. "On the Fauna of Dublin Bay." Proc. Roy. Irish Acad. ser. 2, vol. iv. pp. 523-531. (Dublin.)
- HAECKEL, E. 1864. "Beschr. Medusen Golfe von Nizza." Jena. Zeitsch. Naturw., Bd. i. pp. 325-342.
- HAECKEL, E. 1879. Das System der Medusen. (Jena.)
- HARTLAUB, C. 1894. "Coelenteraten Helgolands." Arbeiten biol. Anstalt Helgoland (1893), Bd. i. pp. 161-206. (Kiel.)

