Boletim da Faculdade de Filosofia, Ciências e Letras. Zoologia 13
1948

Glória Moreira

ON VALLENTINIA GABRIELLAE, N. SP. (LIMNOMEDUSAE)

by **Marta Vannucci Mendes**

(With 2 plates)

1. Introduction.

I am greatly indebted for this material to Mrs. Eveline du Bois-Reymond Marcus who observed the first medusae and polyps in an old aquarium of hers and placed them at my disposal. The medusae were first noticed by Mrs. Marcus in a sea-water aquarium that had remained for about two months in the laboratory and that contains *Ulva, Sargassum, Enteromorpha,* empty mollusc shells and detritus. Other inhabitants are mainly anthozoans, nemerteans, polychaetes, amphipods, copepods, bryozoa and, at a time, some small gastropods and one specimen of *Phoronis*. The copepod supply has been kept high by occasional additions of boiled lettuce leaves and the water level has been maintained constant by the addition of distilled water to replace losses by evaporation. The aquarium is a cylindrical glass jar of 20 cms. of diameter and 9 cms. of height and about half full with water.

The original material of algae and detritus was gathered in october 1946 by Mrs. Marcus and her husband, Prof. E. Marcus, in S. Vicente in the bay of Santos not much below low water-line. The first medusae were noticed towards the end of november 1946, and some were still present in april 1947 when they disappeared altogether for a lapse of about 5 months. They were seen again in october 1947 and are still present in may 1948. All the preserved material has been gathered after october 1947.

The animals have been preserved in "Susa", either hot or cold, or in 4% formalin, and were stained with paracarmin (whole mounts) or haematoxylin-eosin (sections). It has been found however, that the contraction and dehydration of the tissues is practically none when they are killed in distilled water before being preserved in the fixative. The drawings have all bene taken from preserved specimens not previously killed in distilled water, in order to make them more readily comparable to other figures in the litterature. For comparison, Fig. 12 was drawn from a medusa killed in distilled water and then preserved in 4% formalin.

2. Polyps and frustules.

The polyps (Fig. 1) are small, about 0,6-0,8 mm. high, always solitary and they do not wander on the substratum. They are ovoid, with a short conical proboscis and a circular mouth wich is usually kept closed but is also capable of great distension. They have 3-5 solid tentacles, very thin and long and provided with numerous scattered nematocysts. The body and the tentacles are capable of a quick contraction and of great distension, but this is slow and the movements of the polyps are clumsy. They feed mainly on copepods, and when unable to swallow them whole they suck them while holding them fast with their tentacles. The pedal disk is provided with high glandular cells; the body wall is everywhere formed by the epiderm with a few nematocysts and by the gastroderm with glandular cells. Among the two layers there are many contractile fibrils. Some polyps have been individually known for a period of over three months.

No detailed histological study of the polyp has been undertaken, but the different regions as described by Joseph (1925, p. 398) for the polypoid generation of *Gonionemus* (*Haleremita*) can be recognised also in the present form.

The polyps are usually covered with a mucous secretion incrusted with microorganisms such as algae and bacteria, on which some other animals like to nibble. The nematocysts are alike both in the polyp and in the medusa and are all of one type: heterotrichous microbasic euryteles (Fig. 4). In a general way the present polypoid individuals are very similar to "*Haleremita*", even the nematocysts are of a similar type. Only one medusa-bud was observed that could surely be interpreted as such. Differently from what is the case for instance in *Gonionemus* the bud is not located basally on the polyp, but immediately below the proboscis. It is very large and confers to the whole polyp a crooked, hunchback-like appearance. Perkins' (1902) opinion that the polyps can transform directly into medusae is long surpassed and cannot be maintained. The medusae are always produced by medusa-buds in the regular hydroid fashion: as an evagination of the two fundamental body layers. As Kramp (1939) has predicted, the existence of a polypoid stage can be expected in the life-cycle of all the Limnomedusae.

The frustules (Fig. 3) are built by the two tissue layers, both present also in the frustula bud. The epidermal layer is relatively low, with sparse nematocysts, and with sensory bristles at the anterior end. The gastrodermal cells are large and have thick drops of nutritive material, strongly basophilic. The frustules are always formed from the basal region ("fundus") of the polyp, the gastrodermal cells of which contain large inclusions of reserve material. Differently from what Joseph (1925) observed in *Gonionemus* the frustrules are usually produced one at a time in *Vallentinia*. The gastrodermal cavity is virtual, enlarged anteriorly into a small chamber whose size eventually increases when the frustule fixes itself on the substratum with the posterior end. According to Joseph (1925, p. 410) the same is true for *Gonionemus*. At the anterior end there are some highly refractive spots, usually two in number that are probably of a sensory nature. Perkins, however, describes solid frustules in *Gonionemus murbachii*. On the whole, both the polyps and the frustules of the present material agree very closely with Joseph's description of the same phases of the cycle of *Gonionemus vindobonensis*. However, I never observed the budding of secondary frustules, in other words the budding of frustules from frustules, half the normal size in the second generation, as Schaudinn (1894, cit. acc. Joseph 1925) reported. Neither Perkins nor Joseph were able to give a confirmation of this fact.

3. Medusae.

The largest medusae (Fig. 5) have a diameter of 5,5 mm., as a rule, however, no more than 4,5 mm. The umbrella is about two thirds as high as broad. The four radial canals are large and the ring canal runs close to the umbrellar margin. The content of the canals and of the stomach floats in the lumen and is propelled by flagellar action. The stomach is hemispheric and the manubrium relatively long and thin and very motile. The orifice of communication between the stomach and the manubrium is very narrow. The mouth has four lips (Fig. 5) that are continued on the manubrium as shallow ridges tapering gradually towards the stomach. The mouth rim is provided with numerous nematocysts; the lips are separated from one another by deep furrows that allow a great distension of the mouth during the ingestion and egestion of food. There are two different types of tentacles. Those of the first are larger, have few scattered nematocysts in the epidermis and are provided with a strong terminal sucker, they arise from the exumbrellar surface above the bell margin and are in connection with the ring canal by a hollow endodermal core that passes through the mesogloea. There are always at least four such tentacles, and they are always located slightly to the left of each radial canal (viewed from the aboral pole). As the medusa increases in size, a second quartet of such tentacles may be formed that are located simmetrically between those of the first quartet. The tentacles arise from the bell margin, and in large medusae there may be 15-16 in each quadrant. In large marginal tentacles (that is in the older ones) a small sucker may appear on the external side (Fig. 11) near its apex. The tip of the tentacles, specially that of the ex-umbrellar ones, is closely packed with nematocysts. All the tentacles are hollow in their whole length and food particles may be found up to the end. The marginal tentacles are very contractile, highly extensible and very motile. There are large nematocysts depots on the internal side at the base of each marginal tentacle. The velum has a thick muscular layer and an annular ring around its broad central opening. The velum is always held perpendicular to the main axis, it is never drooping as in some Trachy- and Narcomedusae. The nervous system has only one marginal nerve ring located at the base of the velum, and the nerve net is especially concentrated at the mouth rim, at the base of the batteries of the tentacles and at the base of the suckers of the umbrellar tentacles. The statocysts (Fig. 7, 8, 9) are numerous, there is almost always one or even two between two successive marginal tentacles. They are hollow closed vesicles that contain a statolith of endodermal origin, a strongly refractive bluish sphere, formed by numberless crystals, all evenly distributed radially. The smallest medusae that have been seen had 4 umbrellar tentacles, 4 marginal tentacles per quadrant, 2 complete statocysts and 4 in the process of being segregated. The statocysts are easily regenerated and their number increases with the age of the individual. The gonads are pendent sacs from the upper half of the radial canals close to the stomach. Only females were found.

As a whole the medusae are highly transparent and pale. Their colours are dull and light. The tentacles are milky white and not transparent when they are contracted. The ring canal, the sucker of the umbrellar tentacles and in a lesser degree the radial canals are of a light brownish-brick colour. The gonads are of the same colour and become darker as they ripen. The colour is mainly due to the accumulation of excretory particles in the endodermal cells. The habits of the medusae are sedentary, some individually known specimens have been recognized for a period of over 3 months.

4. Histological notes.

As stated before, the histology of the polyp was not worked out in detail. Therefore, all that follows refers to the medusa. The epidermis of the ex-umbrella is everywhere formed by flattened polygonal cells with a small nucleus, numerous acidophilic granulations and muscular fibrils at their basal surface. The cells of the epidermis of the velum are cuboidal with a dense cytoplasm; on the tentacles their shape is greatly variable according to their condition of greater or minor contraction, they are all provided with abundant circular muscular filaments. The nematocysts bearing cells of the tentacles are larger than the remainder and may contain numerous capsules, they are all placed along closed transverse rings, at irregular intervals. The cnidocil is long and stout. Only mature nematocysts are on the tentacles and they are of the same type as those of the polyps. They are produced in the tentacular bulbs or swellings located internally and at the root of the marginal tentacles. From the bulbs the capsules are seen migrating towards the batteries through the mesogloea in a manner very much like that described by Boulenger (1911, p. 85) for *Limnocnida tanganyicae*. Scattered nematocysts are also found on the ex-umbrellar tentacles and some on the oral lips. However they are entirely absent on the ex- and sub-umbrellar surfaces. The tentacles are always hollow, the gastrodermal cells produce longitudinal muscular filaments on their basal surfaces and are large and vacuolated. Food particles are found up to the tip of the tentacles, the cells are large and glandular enzymatic secretory cells and among them there are some common nutritive cells (absorption cells). The furthermost cells of the tip of all the tentacles accumulate waste material (Fig. 6) that confers upon them a light brownish tinge. The gastrodermis of the stomach, of the radial canal and of the ring canals is flagellated and a current of food particles is easily recognized in the living animal. The various secretory cells and the different regions of the gastro-vascular system are in *Vallentinia* very much like in the other well-known medusae. Fig. 10 is a transverse section of the distal region of the manubrium and shows two types of glandular cells, presumably mucous cells. All of them have a large basal vacuole optically empty and not previously recorded in other medusae, as far as I know. Its function is entirely unknown. The roof of the stomach in the fundus region, opposite to the orifice of the gastric cavity, has strongly vacuolized nutritive cells. Similar ones are present on the internal side (in relation to the oral-aboral axis of the animal) of the wall of the ring canal (Fig. 9) while the external is made up by common low lining cells. All the cells of the radial canals and of the gonad's cavity are large and vacuolated. The gastrodermis of the gonad is capable of storing excretory particles.

The statocysts (Fig. 7, 8, 9) are closed ectodermic vesicles into which the endoderm pushes a solid core of a few cells, the furthermost of which secretes the statolith. This will therefore result as a small pebble at the tip of a column of a few cells and is entirely covered by a low lining of cover cells. The statolith lies on a sensory cushion that is simply an enlargement of the pedicel's base; the sensory cushion is innervated directly by the nerve ring. No sensory bristles have been recognized here, as also in no other Olindiidae. Statoliths have a short life the oldest are discharged and replaced by newly-built ones (Fig. 8) even before sexual maturity is attained (medusae of about 3-3,5 mm. in diameter). The whole vesicle may occasionally be substituted by a new one. The statolith has a cristalline structure (determined in the polarization microscope) and the minute cristals are arranged radially.

5. Behaviour and life-cycle.

Usually the medusae remain attached to the wall of the aquarium or to algae during one or even several days. The various individuals show diferrent preferences for different substrata, some select algae and others are seen almost exclusively on the glass wall. Their position is either vertical, with the oral-aboral axis held horizontal or with the manubrium directed vertically, either up or downward. They attach themselves with the perradial tentacles while all or nearly all of the marginal ones are completely extended, every now and then one may contract independently of the others. The tentacles are used in driving to the mouth the captured prey, which is, most often, copepods, other crustaceans or flagellates. The manubrium is always very motile and rarely remains inactive; it moves continually, cleaning the velum and the sub-umbrellar cavity, and licking the tentacles from the base to the tip with the four oral lips. A great quantity of food can be stored in the capacious stomach, in which up to 6 or 8 medium sized copepods may be found. Whole copepods can be ingested and stored in the radial canals as far down as the gonad's cavity. When the animal has swallowed a great quantity of food, the tentacles are not held as far extended as when it is starving, and it's reaction to mechanical stimuli is slower. I never saw medusae wandering on the substratum, as do the representatives of the anthomedusan family Cladonemidae; on the contrary, they only let go their hold after a strong stimulus. The pumping action of the suckers is quite efficient and it is impossible to detach even a small medusa by aspiring it with a medecine dropper even when it holds with only one umbrellar tentacle. As most Olindiidae, it has a strong positive tigmotaxis. After stimulation, swimming freely, the medusae proceed rapidly by irregularly timed strokes. At each umbrellar contraction they cover from 1 to 2 cm. and they can contract up to twice per second at a water temperature of 25°C. The medusae rarely contract more than 15 or 16 times in sucession, usually after 10 or 12 times they slowly drop to the bottom. While swimming, they always hold the tentacles contracted at their greatest capacity. Swmming is not oriented except by gravity; it does not seem oriented at all when they swim horizontally; in this case, they seem capable of avoiding foreing bodies up to a certain extent, although they occasionally hit them. When they swim vertically; in what has been called the "feeding" or "surface" reaction, they are evidently oriented by gravity, since they only slightly digress from the vertical direction. This "surface" reaction is the same as has been described by several authors in *Gonionemos murbachii.* The animal swims upwards and when it reaches the surface film it abruptly turns over and slowly falls, ex-umbrellar surface down, with its tentacles and manubrium as far distended as possible. The necessary stimulus for the 180° rotation of the oral-aboral axis of the animal when it reaches the surface is most probably of a tactile nature and acts on the ex-umbrella. Probably also a tactile sensibility of the ex-umbrella enables the medusa to avoid the foreing bodies it its way, when they swim in various directions. In this case, swimming of the animals produces waves that are reflected by the objects and so are perceived as counter currents. Unfortunately the methylene blue staining reaction that has been attempted here, has not given any positive result that can definitelly support this view-point. The supposition of sensory cells on the aboral pole however, is perfectly reasonable since there are numerous instances of sensory areas on the ex-umbrella of Hydrozoans (several actinula larvae, like those of Tubularia; sensory areas of *Hydroctena;* the sensory plate of *Solmundella,* larvae and adults). The medusae also exhibit frequent strong and abrupt contractions of the umbrella, while they are anchored with the perradial tentacles. These irregular contractions have probably digestive and respiratory significance since they are repeated at shorter intervals in an O_2 poor medium. Some species, belonging to *Gonionemus,* which is the best studied Limnomedusan genus, have been reported optically sensitive (Yerkes, 1903; Murbach, 1909) by several authors. That is certainly a most noteworthy fact, since no light perception organ is known in this genus. It must be explained by assuming a general photodermatic sense (Hesse 1929, p. 3). The experiments of the mentioned authors surely seem irrefutable, but nothing similar could be confirmed in *Vallentinia* that seems to be entirely insensitive to light and even to abrupt variations of light intensity. They inhabite the illuminated and dark side of the aquarium indifferently, and spawning is continuous, independently of the light conditions.

Vallentinia gabriellae has a high regeneration capacity, although it is different in the various regions of the body. Any wound heals easily and quickly (summer time, water temperature about 20 ± 5° C). The apical sucker of the perradial tentacles takes 72 hours to be regenerated. When V-cuts are made in the umbrellar margin, the wound is rapidly closed and then the ring canal, the marginal tentacles and the statocysts are easily restituted. As is the case in the normal production of new tentacles and statocysts the marginal tissue of the umbrella supplies the material for the regeneration of the lacking organs. However 10 days after the mutilation there are still visible signs of the excision. The high regeneratory capacity is perfectly clear if we remember that during the normal life-history of the medusa, new tentacles and statocysts are continually produced by the umbrellar marginal tissue. Also *Gonionemus* shows a high degree of regenerative capacity (Hargitt, C. W. 1899, Hargitt, G. T. 1902). The tentacles normally increase in number during the life of the medusa, and also the umbrella grows continually until it reaches a diameter of 5,5 mm. at most. Since there is a close relation between the size of the umbrella and the number of tentacles, the distance between adjacent tentacles remains about constant, independently of the size of the medusa. Since new tentacles are always produced between the two oldest preexisting ones wich are long in the mature medusae, the old tentacles are always followed by short or young ones. As has been mentioned before, a second quartet of exumbrellar tentacles can be developed as the animal grows older; this second set of tentacles is always formed equidistantly between the old ones. The production of the second quartet of ex-umbrellar tentacles is independent of sexual maturity.

The lips help in the ingestion of food after the tentacles have adduced the prey to the mouth. They hold the food fast and assist the manubrium in its pumping movements that tend to ingulf the prey. At the moment of the egestion of waste material, the manubrium and the oral lips are extremely dilated and the mouth opening becomes square and almost as wide as the stomach. The process of egestion of food is long; it usually takes from 1 to 2 hours for a medusa to get entirely free from its residues which are only inefficiently helped out by frantic contractions of the umbrella. As a rule the animals ingulf as much food as they can possibly hold, and after digestion is completed, they freed themselves entirely from the wastes that have accumulated in the meanwhile.

In the whole about 24 or 25 medusae were observed, and not a single one of those that attained sexual maturity was a male. Parthenogenesis is not known in the Hydrozoa, as far as I know. What is described under the term "sporogony" is its closest approach (Broch 1924, p. 468). This restricted phenomenon occurs in some Cuninidae (Narcomedusae) whose germinal cells can undergo development without fertilization in the mother organism and later pass through a polypoid stage or not. However, comparing the dates of the appearance of the different generations of medusae, the possible explanation of the present fact is as follows: The polyps are hardy creatures with a long life, which can produce medusa-buds repeatedly in successive seasons. In this manner they give rise to the medusae which appear at intervals in swarms and then die off completely. The medusae cannot reproduce asexually nor by parthenogenesis. Therefore all the animals of the present material derive from the first unique parental stock (1 polyp or a few, all of the same sex) which was introduced in the aquarium and that rapidly invaded the new habitat by asexual reproduction. The observed medusae are blind-ends in the cycle, since their eggs cannot be fertilized. Similar phenomena are known in nature in a larger scale. It is the case of *Craspedacusta* that first invaded the northern hemisphere transported passively in the polypoid stage (*Microhydra*) from the Amazon basin to London with the water-lily *Victoria regia*. Also in this case the polypoid generation has its sex already invisibly determined; the newly infested areas have frequently been known to produce only male or female medusae (Payne, 1926). In *Craspedacusta* it is experimentally known that when the two sexes are brought together they produce fertilized eggs that give rise to polyps which reinitiate the cycle.

Vallentinia gabriellae has no definite time for spawning, as is the case in *Gonionemus murbachii* (Perkins 1902, p. 755). The number of eggs is much smaller in the present species, and they are freed as soon as they become mature. The eggs have a diameter of 85-90 micra, and although several were separated and observed, none was seen to develop; they all decomposed after a few days, thus reinforcing the view-point that they require fertilization to develop. They are laid by rupture of the gonadial epiderm and fall to the bottom. They have a gelatinous membrane that glues them to the glass wall.

The polyp has an entirely sedentary mode of living. None was ever known to dislocate itself from the spot to which it had once become attached. It does not produce other polyps by budding, nor it was ever seen to undergo direct division.

Usually the larva or frustule attaches to rough surfaces, f. ex., empty mollusc shells. The polyp is always seen with the tentacles widely distended and keeps them moving slowly. It is insensible even to strong photic stimuli. Strong mechanical stimuli cause a contraction of the polyp. Next to the tentacles the proboscis is the most active part, it assists the polyp efficiently in the capture of the prey which consists, as in the medusa, of copepods and other small crustaceans as well as flagellates. After the ingestion of food the polyp remains contracted and the tentacles are not as far distendend as usually. When the prey is too large to be ingested whole, it is held firmly by the tentacles while the mouth surrounds it as much as possible. It is then gradually sucked. Such a situation lasts for several hours.

Any strong mechanical stimulus, or even the observation of a polyp between slide and cover-slip, can cause the break-down of the animals into frustrules. Such a roughly treated specimen closes itself, so to speak; the mouth seals up, the tentacles are retracted and near to the pedal disk the frustules are given off; they require from 24 to 50 hours and a length of 0,5-0,6 mm. to become entirely detached from the mother polyp. They slowly withdrow from the polyp by a motionless gliding movement that allows them to cover about 1 cm. in 24 hours. Some of them remain for even 2 or 3 days attached to the polyp by a long extensible mucous filament. The frustules progress always with the anterior slightly dilated pole forward; during locomotion the anterior third of the frustule gradually contracts and expands, slowly progressing by this means. It usually moves along a straight line and leaves after iteself a slender mucous trail that intensely attracts the same flagellates that gather around the eggs. A single polyp can become entirely broken down into frustules giving rise to four of them. If the transformation of the polyp into frustules is not complete and it goes on living along with frustule production, it can produce a much larger number of them. The frustules never detach from the substratum and show strong positive tigmotaxis; only after 2 to 4 days of an independent life they become definitely attached with the posterior pole that is very rich in glandular cells. After becoming attached the anterior cavity greathy expands, and so the anterior pole of the frustule becomes lighter and the body assumes a vertical position in the water. Its transformation into a polyp is direct. Frustulation as a type of reproduction is evidently very efficient, as can be inferred by the already reported cases of intense population of sometimes large areas in a short lapse of time merely by means of vegetative reproduction. However, a much larger number os frustules is produced than ever succeds to develop into polyps. The main factor of death of the frustules is exhaustion. A very great number of them was observed to wander and wander about. They finally finished off before settling down and transforming into polyps and so becoming able to acquire food. The slime that covers polyps and frustules is searched for by *Dinophilus* and several flagellates who greadily feed on it, without appearently disturbing the coelenterate. The medusa buds are produced in this species below the tentacle circle and not as low as in Gonionemus (Joseph 1925, p. 416) in which they appear near the pedal disk. The frustules never produce neither secondary frustules nor medusa-buds directly.

6. Systematic discussion.

The generic characters of *Vallentinia* Browne 1902 can be summarized as follows: Olindiidae with four radial canals and no centripetal ones. Four or eight hollow exumbrellar tentacles with a terminal adhesive disk and numerous (24 or more) marginal hollow tentacles, evenly distributed around the umbrella, with complete nematocyst rings. They can develop non apical adhesive pads. There are at least 16 marginal statocysts.

The Olindiidae belong to the Limnomedusae (Leptolina), they have enclosed endodermal statocysts and gonads on the radial canals. The development is a metagenesis with an inconspicuous polypoid generation.

My specimens represent a new species of the genus *Vallentinia* with hitherto only two described species: *Vallentinia falklandica* Browne (1902, p. 283) and *Valletinia adherens* Hyman (1947, p. 264). Vallentinia *gabriellae* (1) differs principally in the following characters from *Vallen-*

---

(1) The name was chosen in remembrance of my very best friend GABRIELLA ZUCCARI.

tinia falklandica: the umbrellar tentacles are not perfectly perradial but slightly displaced towards the left side; occasionally suckers are formed on the marginal tentacles; there is a greater number of tentacles and sensory vesicles; sometimes a second quartet of exumbrellar tentacles is produced; there are no nematocysts on the exumbrella. The two species differ also in the shape and size. However, both these last mentioned factors may have been altered by preservation in Browne and Kramp's material (1939, p. 317) of *Vallentinia falklandica.* According to these author's description, *V. falklandica* is taller than wide, while the reverse is true for the present species; furthermore the largest size of their specimens is at most 2x3 mm. and therefore smaller than *V. gabriellae.* It is possible, although not probable, that all the specimens of the Discovery Expedition described by Browne and Kramp (l. c.) had not yet attained their largest size.

The three species are not widely different, but the diversities that have been mentioned are surely sufficient for a specific separation.

Of the most closely related genera I begin with *Aglauropsis. Aglauropsis* however has no umbrellar tentacles with apical adhesive pads, so that all the tentacles are alike and not provided with suckers.

On the other hand the description of the present species enhances the near relations between *Vallentinia* and *Cubaia* (Olindiidae). In both *Cubaia* and *Vallentinia* there are four radial canals and no centripetal ones; also the shape of the stomach, the manubrium and the mouth is very similar and both have two different types of tentacles. In *Cubaia* the exumbrellar tentacles have non terminal adhesive disks and are very numerous, while only 1 or at most 2 quartets are present in *V. gabriellae* where they have terminal suckers. Furthermore the common marginal tentacles may develop adhesive pads in *Vallentinia.* The principal difference between the two genera lies in the statocysts which are external in *Cubaia.* Summarizing, as Mayer puts it (1910, p. 351), the two genera are closely related but separate. The genus *Vallentinia* is included in the family Olindiidae that along with the Moerisiidae constitutes the sub-order Limnomedusae.

The sub-order Limnomedusae has been proposed by Kramp (1938a, p. 57; 1938b, p. 107) to include some queer Hydroids that had previously been distributed at random among the Trachylina and the least typical family of the Leptomedusae, the Thaumantiadae, which are themselves an heterogeneous assemblage.

The name has evidently been chosen for the reason that all the Moerisiidae are brackish or fresh-water medusae, and several species of the Olindiidae are also fresh-water inhabitants. This habitat is otherwise rare among the hydrozoans. The marine species of the Olindiidae are all coastal forms, inhabiting harbours, shores and bays, shallow waters in general, and they show a tendency to become fresh-water inhabitants. Both species of *Vallentinia* have been found in bays, where the submarine vegetation, specially algae, is very abundant.

Presumably all Limnomedusae have a complete metagenetic developmental cycle as was presumed by Kramp (1938, p. 57). The polyps are small, athecate, produce medusa-buds and other polyps asexually and the tentacular gastroderm is continuous with the gastrodermal lining of the body cavity. They may grow in small stolonial colonies. The medusae are craspedote with gonads either on the manubrium (Moerisiidae) or on the radial canals (Olindiidae). In the first case, the sense organs may be ocelli, in the second they are generally enclosed marginal statocysts with an internal axis of endodermal origin.

These characters mark a clear-cut distinction between this suborder and the remaining Leptolina: Antho- and Leptomedusae and separates them from the Trachylina on the other side.

Kramp (1939a) has pointed out some features of the group that might indicate their primitive position in the phylogenetic development of the Coelenterates. It may also be added that some Laodiceidae, which are usually included in the Leptomedusae on account of their ocelli, are also not too distantly related with the Limnomedusae; *Laodicea* and *Thaumantias*, for instance, resemble the Olindiidae in the general shape of the body, manubrium and stomach, in the number and localisation of the radial canals and gonads; they also are generally small coastal forms. On the other hand, the sensory clubs of *Laodicea* and related genera are similar to the sense organs of some Narcomedusae, f. ex., *Aegina*. *Gossea* (Olindiidae) and *Moerisia lyonsi* (Moerisiidae) have ocelli comparable to those of the Anthomedusae which they also resemble in the body shape and in the colonial budding of the polyps (Moerisia). The sensory vesicles of the Limnomedusae have repeatedly and reasonably been compared to similar structures of the Trachymedusae. The actinula larva of the Geryonidae and Cuninidae which live parasitically in the maternal radial canals, have a polypoid structure which seems very significant in the attempt to show how great is the parallelism of the evolutionary trends that have been followed in the two groups: Leptolina (specially Limnomedusae) and Trachylina. In other words, the Limnomedusae and the Trachylina not only seem to have evolved along comparable lines, but also in a very similar manner. For instance the mentioned "actinula larvae" of the Geryonidae and Cuninidae (Broch 1923, p. 467) represent more than simple ontogenetical stages in the development of the respective species, they can easily be interpreted as representants of a different generation, since they produce a stolon on which are developed medusa-buds.

Such an interpretation becomes even more logical if one remembers Kramp's (1943) analysis of the hydrozoan metagenesis. According to Kramp it is not merely an alternation between a polypoid and a medusoid generation but a more complex type of alternating generations since the polypoid stage passes through a new generation at every new succession or side-line budding. If we consider, as Kramp does, the gonophores of the hydroids as a distinct generation also the budding "actinula-polypoid" individual must be judged not merely as a "larva", but as a true generation. This generation is as little alimentary independent from the preceding one as are the gonophores of the hydroids. It can therefore be concluded that not only the Limnomedusae, but also some Trachylina have not completely lost the vestiges of a metagenetical development. It does not seem to be a "proof" that the polyp is merely a larva, as some authors are inclined to think (Broch 1923, p. 473).

Among the Trachymedusae some genera resemble very closely the Limnomedusae, as for instance *Petasus*. Any defender of the "actinula-theory" of descent of the Hydrozoa ought to take into consideration the existence of a metagenetic development in the Limnomedusae, their relationship to "primitive types" of the Leptomedusae, their relationship to some Anthomedusae and specially their great resemblance to some Trachylina.

Tetraplatia, Solmundella and *Hydroctena* that are usually assigned to the Narcomedusae have many points of contact with the Ctenophora. Several Trachymedusae (for instance *Botrynema*) show a tendency to develop regular and simmetric gastric pouches which are a convergence to what is the rule among the Ctenophora. Although it is perhaps an excessive simplification to admit a direct descent of the recent Ctenophora from the recent Trachylina that are a specialized group in spite of their numerous primitive characters, a parallelism or convergent evolution has undoubtedly ocurred in these two groups. I cannot deny all evolutionary significance to these relations between Trachylina and Ctenophora although it would be much easier to begin the origin of every taxonomic unity with an interrogation mark followed by a long stippled line through all geological layers.

7. Resumo.

O ciclo evolutivo de *Vallentinia gabriellae*, spec. nov. é metagênese típica, como é regra nos Hydrozoa. A fase polipóide é representada por polipos solitários de 0,6-0,8 mm. de comprimento, que vivem durante alguns meses e produzem outros polipos, assexualmente, por meio de frústulas. Os polipos dão origem a medusas por brotamento. Estas alcançam 5,5 mm. de diâmetro, são transparentes, teem manúbrio curto quadrilabiado, estômago cônico, 4 canais radiais, dos quais pendem as gônadas saculiformes, e um canal circular com divertículos para todos os tentáculos. Êstes são de dois tipos, os mais numerosos (até 15-16 por quadrante) longos e muito contráteis estão dispostos na margem e brotam continuamente durante o crescimento; podem formar uma ventosa na sua superfície externa a pequena distância do ápice. Os tentáculos do segundo tipo, não muito contráteis, saem da ex-umbrela a certa distância da margem, teem um comprimento determinado, uma ventosa apical e são em número de 4, raramente 8. As medusas teem hábitos bentônicos, fixando-se a qualquer substrato, inclusive o espelho da água. Mostram-se insensíveis à luz e a mudanças bruscas da intensidade luminosa. Podem nadar livremente e conseguem evitar obstáculos, provavelmente devido ao sentido táctil. Frequentemente nadam verticalmente para a superfície da água e, aí, invertem-se rapidamente deixando-se então cair ao fundo lentamente com o manúbrio voltado para cima. Alimentam-se sobretudo de pequenos crustáceos.

Vallentinia gabriellae pertence à família Olindiidae que, juntamente com as Moerisiidae, perfaz a sub-ordem das Limnomedusae. Esta sub-ordem instituida por Kramp (1938) compõe-se de numerosos gêneros de pequenas medusas costeiras, de água salobre ou doce, anteriormente atribuidas aos Trachylina e às Thaumantiadae, família pouco típica e heterogênea das Leptomedusae. As Limnomedusae teem, geralmente, vesículas sensoriais (estatocistos) de origem endodérmica e um ciclo evolutivo metagenético (ainda não verificado em todos os gêneros). O trabalho presente compara os caracteres de *Vallentinia* com os das subordens e ordens dos Hydrozoa, discutindo principalmente os elementos de importância filogenética.

Vallentinia falklandica Browne (1902) difere da espécie atual pela posição dos tentáculos adesivos, pelo número dos tentáculos marginais e vesículas sensoriais, e pelas dimensões e proporções. *Vallentinia adherens* Hyman (1947) distingue-se pela forma das gônadas, pelo número dos tentáculos e, sobretudo, pela presença de pequenos tentáculos, os chamados cirros, dispostos ao longo da margem da umbrela que alternam com todos os outros tentáculos inseridos acima da margem umbrelar.

8. Bibliography.

Boulenger, C. L. 1911, On some points in the Anatomy and bud-formation in *Limnocnida tanganicae.* Quart. J. Micr. Sc. v. 57, p. 83-106 t. 15. **Broch, H. 1924,** Trachylina. Kükenthal & Krumbach's Hadb. d. Zool., v. 1, p. 459-484. **Browne, E. T. 1902,** A Preliminary Report on the Hydromedusae from the Falkland Islands. Ann. Mag. Nat. Hist. ser. 7, v. 9, pp. 272-284. London. **Browne, E. T. & P. L. Kramp, 1939,** Hydromedusae from the Falkland Islands. Discovery Reports. v. 18, p. 265-322, t. 14-19. **Hargitt, C. W. 1899,** Experimental Studies upon the Hydromedusae. Biol. Bull., v. 1, p. 35-51. **Hargitt, G. T. 1902,** Notes on the Regeneration of *Gonionema,* Biol. Bull., v. 4, p. 1-12. **Hesse, R. 1929,** Photoreceptoren. A. Bethe, Hadb, norm. u. pathol. Phys., v. 12, part. 1, p. 2-16. **Hyman, L. H. 1947,** Two new Hydromedusae from the California Coast. Trans. An. Micr. Soc. v. 66, p. 262-268. **Kramp, P. L. 1938a,** Die Medusa von Ostroumovia inkermanica (Pal.-Ostr.) und die systematische Stellung der Moerisiiden und Olindiiden. Ann. Univ. Sofia, Fac. Physico-math., n. 7, part 3, p. 45-68. **1938b,** Die Medusa von *Ostroumovia inkermanica* (Pal.-Ostr.) und die systematische Stellung der Olindiiden. Zool. Anz., v. 122, p. 103-108. **1939,** Ocassional Notes on Coelenterates, III. Vidensk. Medd. fra Dansk. naturh. Foren. v. 103, p. 503-516. **1943,** On Delevopment through alternating generations, especially in Coelenterata. Vidensk. Medd. fra Dansk. naturh. Foren. v. 107, p. 13-32. **Joseph, H. 1925,** Zur Morphologie und Entwicklungsgeschichte von *Haleremita* und *Gonionemus.* Ein Beitrag zur systematischen Beurteilung der Trachymedusen. Zeits. wiss. Zool. v. 125, p. 374-434, t. 8. **Mayer, A. G. 1910,** Medusae of the World. 2 vol., 498+XV p., 55 t. Washington. **Murbach, L. 1909,** Some light reactions of the medusa *Gonionemus.* Biol. Bull. v. 17, p. 354-368. **Payne, F. 1926,** Further Studies on the Life-history of *Craspedacusta ryderi,* a fresh-water Hydromedusan. Biol. Bull., v. 50, p. 433-443. **Perkins, H. F. 1902,** The Development of *Gonionema murbachii.* Proc. Acad. Nat. Sc. Phil. v. 54 p. 750-790, t. 31-34. **Yerkes, R. M. 1903,** The Reaction-time of *Gonionemus murbachii* to Electric and Photic Stimuli. Biol. Bull., v. 6, p. 84-95.

9. Plates.

PLATE I

Fig. 1 — Polyp. 1A, enlarged view of tentacle.

Fig. 2 — Frustule. a, anterior sensory bristles; f. flagellates; n, nematocysts; r, droplets of reserve material; s, slime.

Fig. 3 A-E — Progression movement of frustule. b, bright anterior pigmented spots; c, anterior cavity; e, epidermis; g, gastrodermis. Fig. 3 F, fixation of the frustule on the substratum.

Fig. 4 — Nematocyst.

Fig. 5 — Mature medusa, with full stomach. k, umbrellar tentacles.

Fig. 6 — Umbrellar tentacle. e, epidermis; g, gastrodermis; n, nematocyst; p, apical adhesive pad; v, waste particles in gastrodermal lining.

Fig. 7 — Immature statocyst. d, endodermal cell of the peduncle; e, epidermal lining of the statocyst; g, gastrodermal lining of the ring canal; o, endodermal statolith-secreting cell.

Fig. 8 — Old statolith in the process of being replaced by a new one. h, sensory cushion; m, mesogloea.

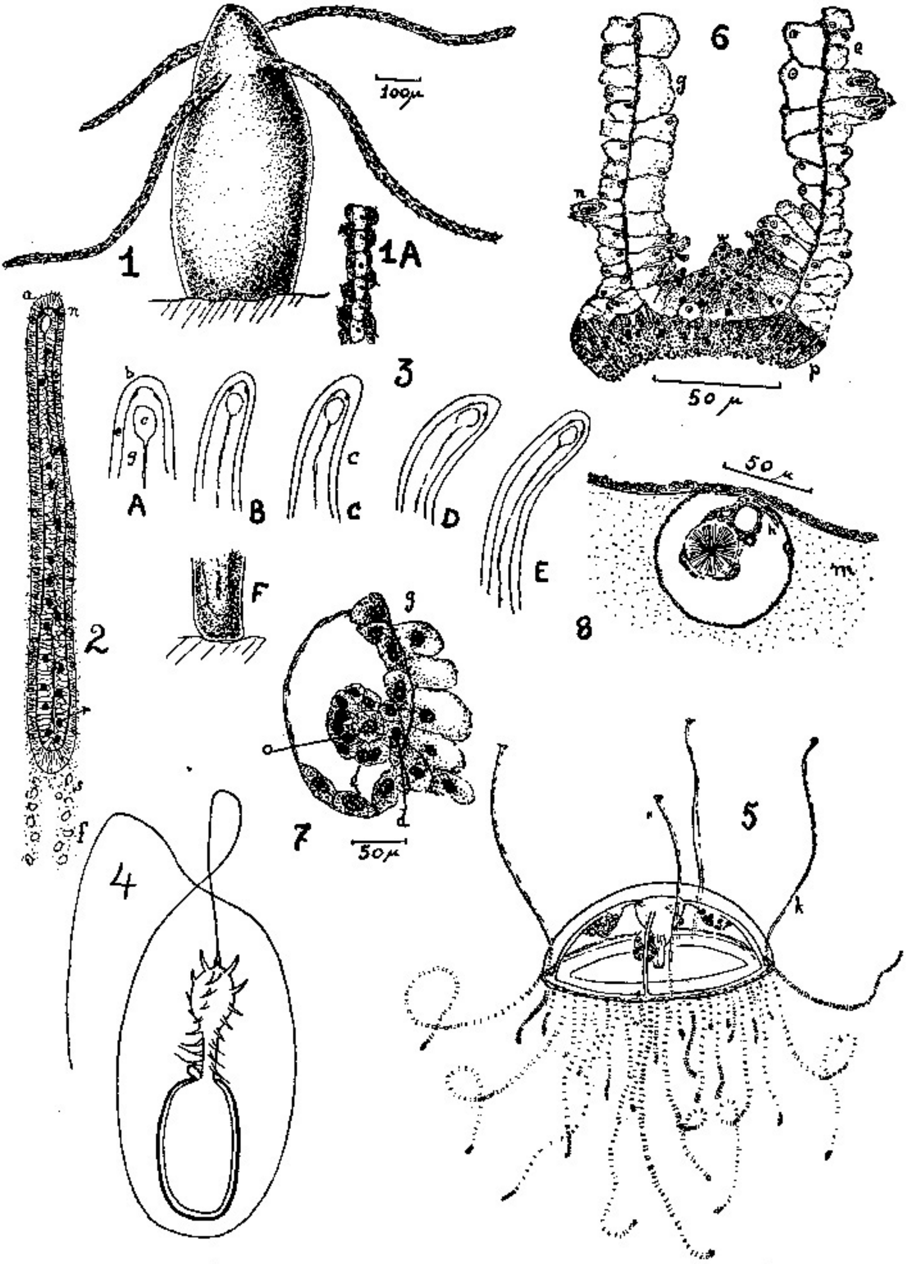

1
1A
100μ
6
g
e
n
w
p
50 μ
a
n
2
r
s
f
3
b
c
e
g
A
B
c
C
D
E
F
8
50 μ
h
m
7
g
o
d
50μ
4
5
k

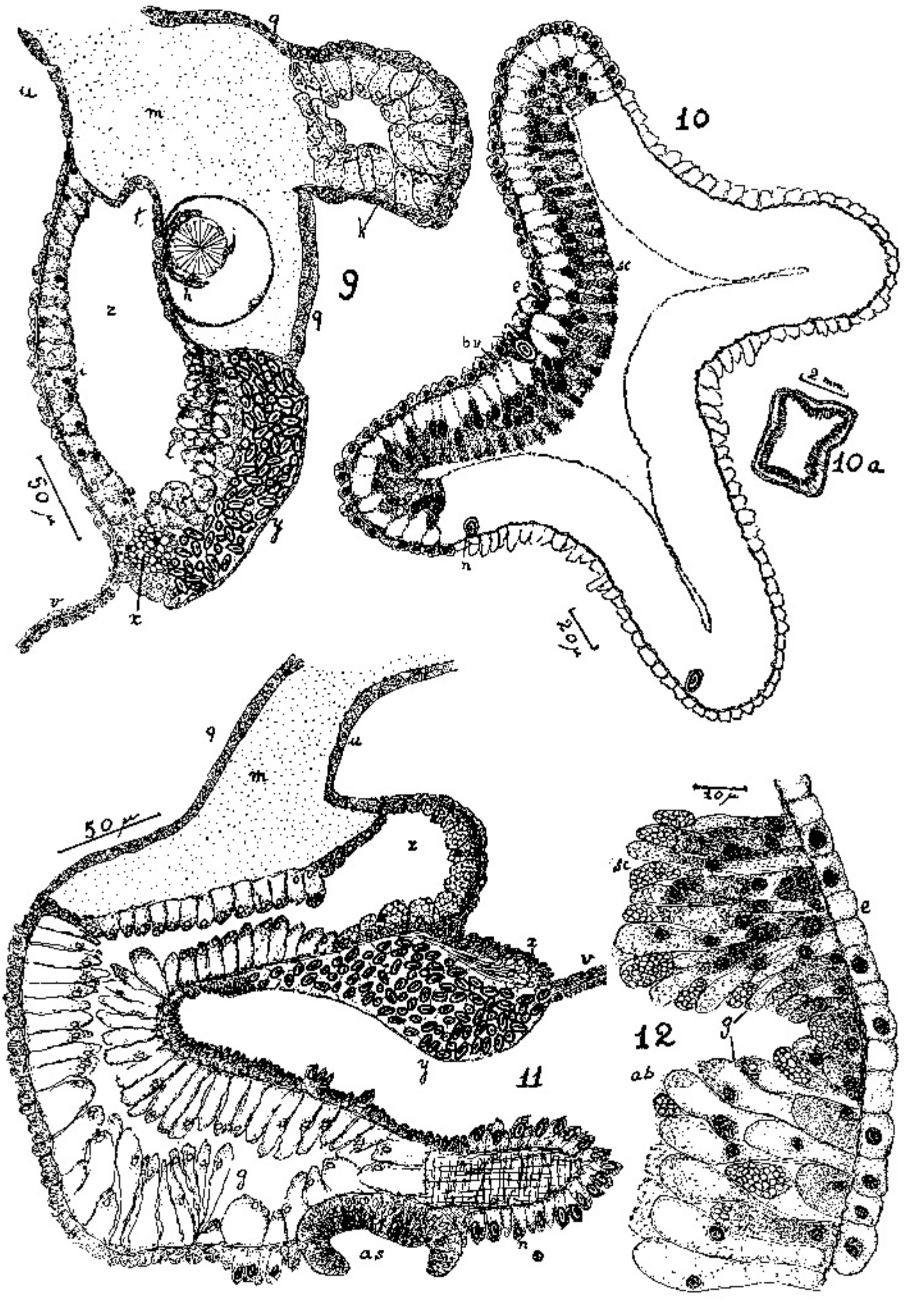
PLATE II

Fig. 9 — Vertical section of the umbrellar margin, h, sensory cushion of statocyst; i, nutritive cells of the internal wall of the ring canal; j, statolith; k, umbrellar tentacle; l, secretory cells of the external wall of the ring canal; m, mesogloea; q, exumbrella; t, lining cells; u, subumbrella; v, velum; y, nematocyst depot; z, radial canal.

Fig. 10 — Transverse section of the manubrium; bv, basal vacuole of the glandular gastrodermal cells; e, epidermis; n, nematocyst; sc, mucous secretory cells. 10a - open mouth.

Fig. 11 — Vertical section through an old marginal tentacle with an external adhesive pad. as, accessory sucker; m, mesogloea; n, nematocyst; q, exumbrella; u, subumbrella; v, velum; x, nerve ring; y, nematocyst depot; z, radial canal.

Fig. 12 — Longitudinal section of the transition region between manubrium and stomach. Medusa killed in distilled water beforee preservation. ab, glandular cells of stomach, probably enzymatic cells; e, epidermis; g, gastrodermis; sc, mucous secretory cells of manubrium.


u
q
m
t
h
z
9
q
k
i
50 μ
l
j
v
x
10
sc
e
bv
n
20 μ
2 mm
10 a
q
m
u
z
50 μ
z
v
y
11
g
as
n
10 μ
sc
e
12
g
ab