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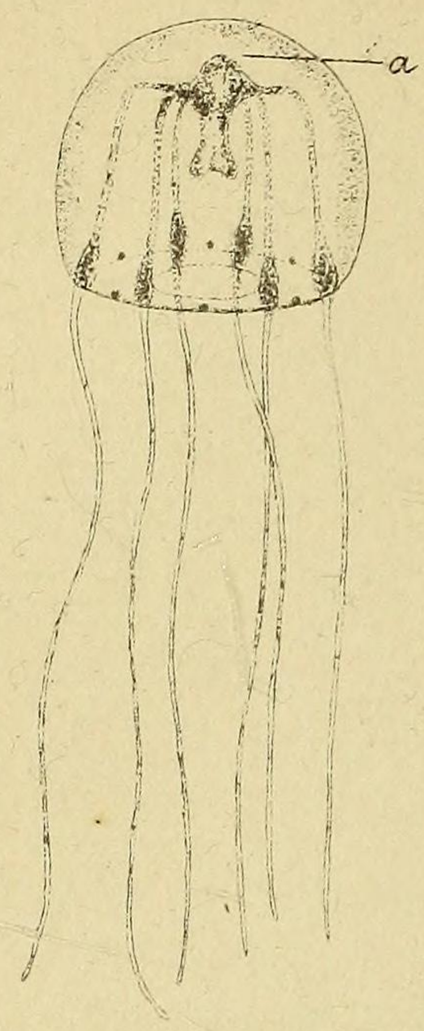


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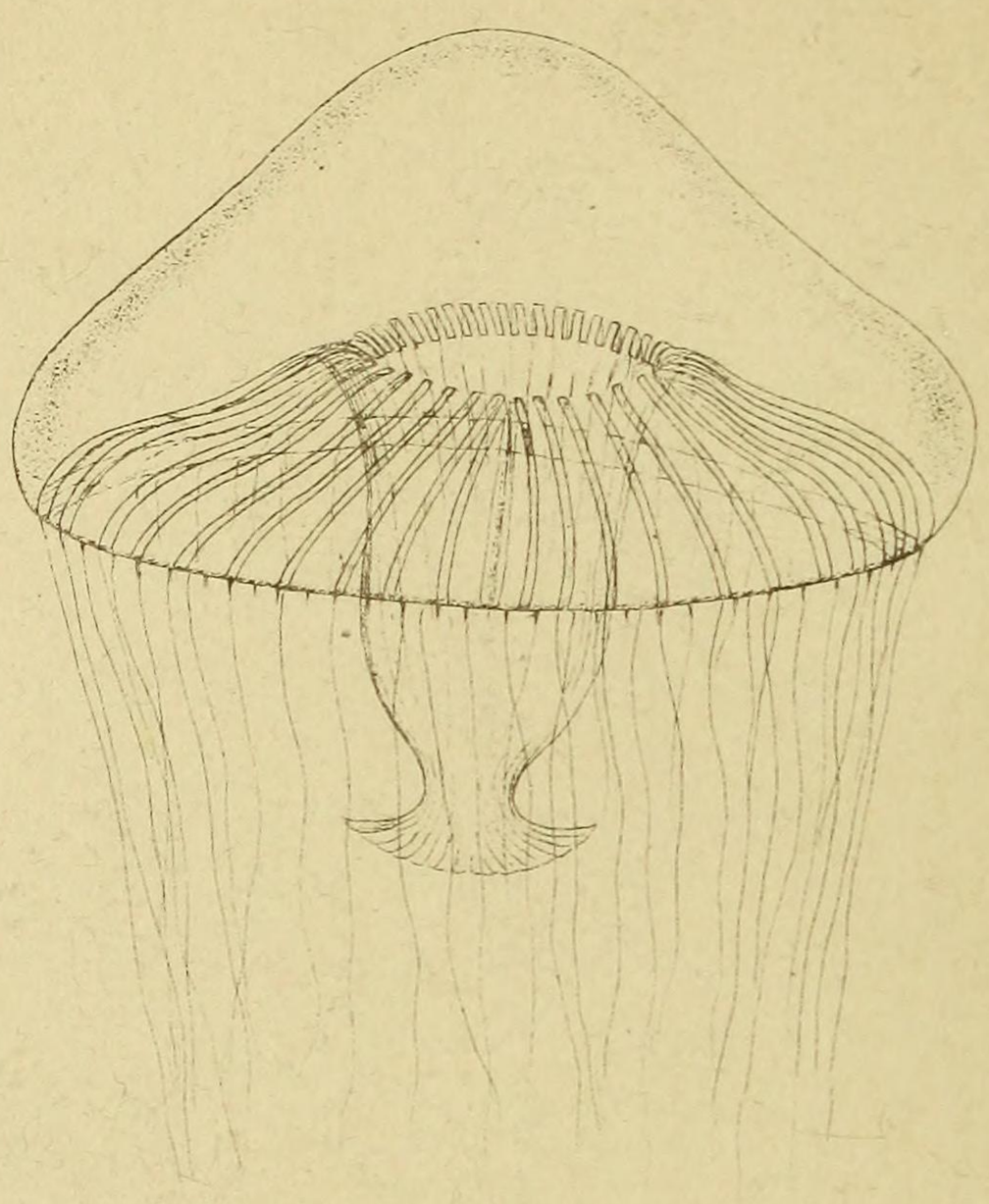

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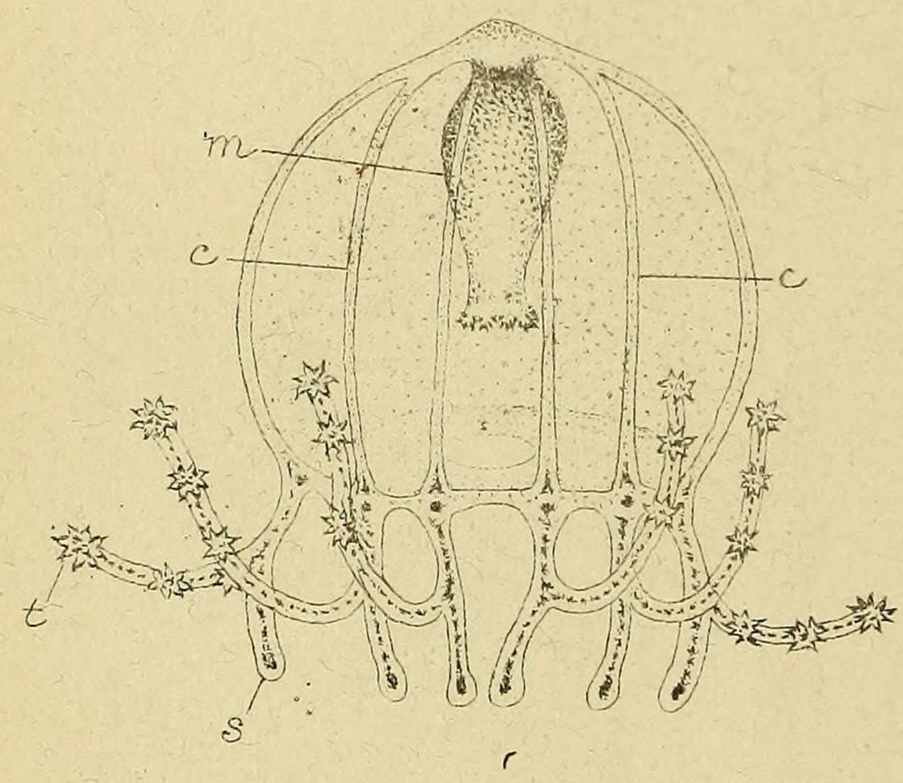


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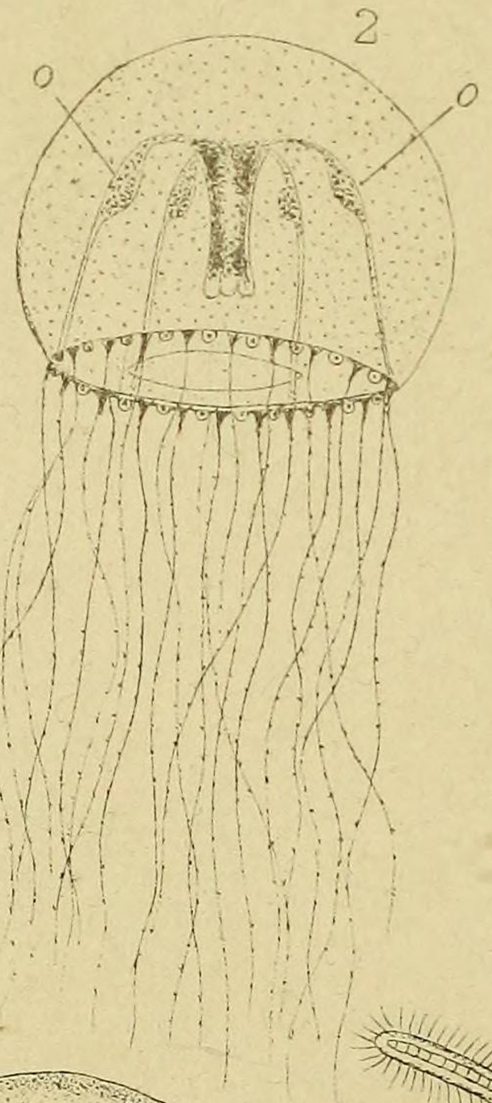


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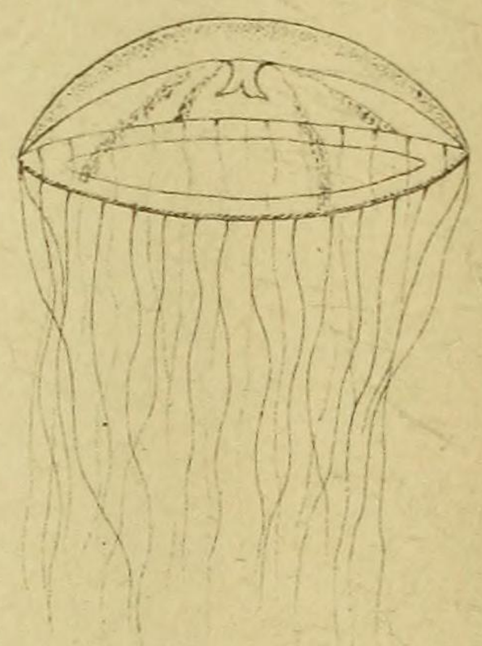

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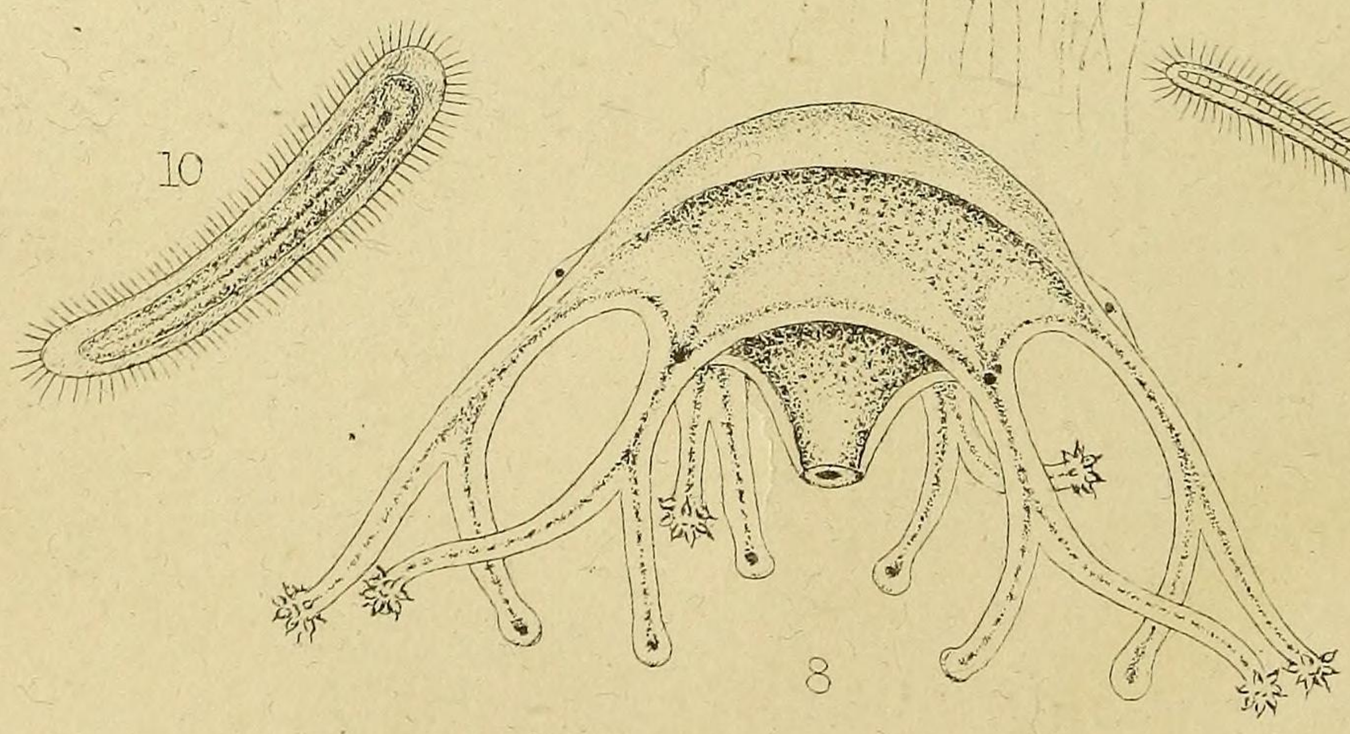

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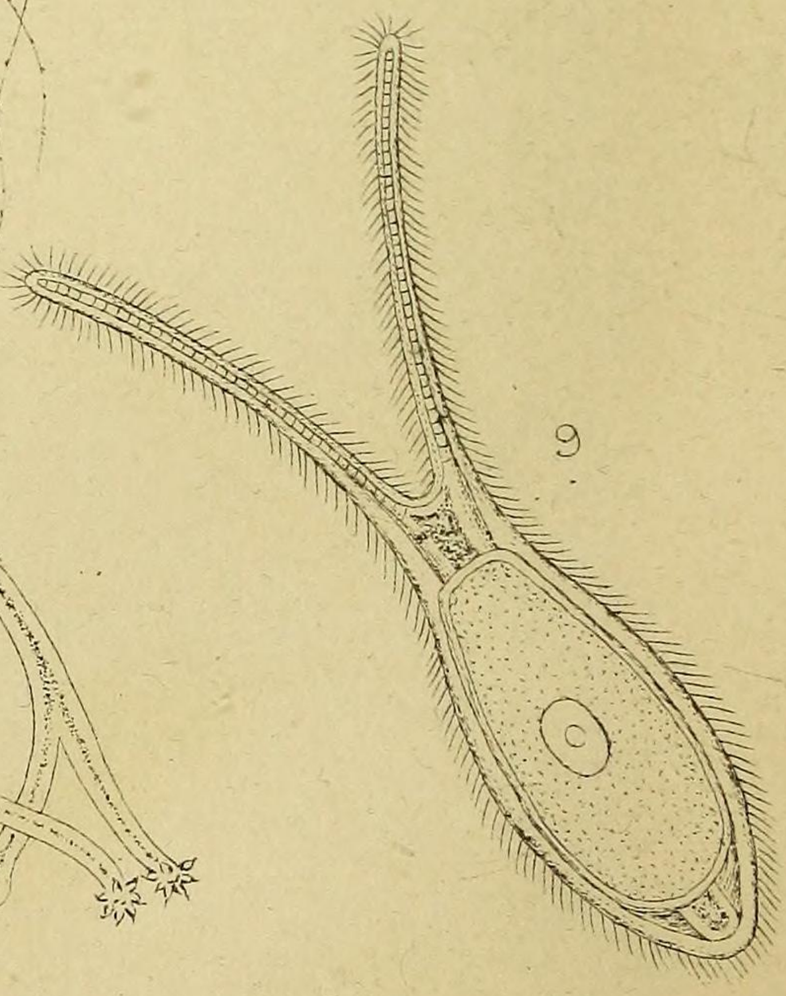

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T. Hincks del.

W. West & Co. imp.

Hydroid Medusæ.

# THE HYDROID MEDUSÆ.

By the REV. THOMAS HINCKS, B.A., F.R.S.

[PLATE LXXXVIII.]

THE title which I have given to this paper is not as strictly accurate as I could have desired, but it is the best that occurs to me. It is my purpose to sketch the history of those exquisite medusiform organisms, which, long regarded as independent animals, are now known to be the wandering reproductive buds of the hydroid zoophytes.* To style them Medusæ, however, is to run the risk of suggesting the idea of absolute individuality, and so concealing their true zoological significance. They are the floating flowers, so to speak, of the plant-like animal, detached from the parent structure at a certain point of their development, but still a mere term in a single life-series; elements of a perfect being, but not themselves complete existences, and only comprehensible when referred to the *whole* of which they form a part. The title must be accepted with this explanation.

Other medusan forms, identical in structure with those to which I have just referred, but which have not yet been traced to any fixed hydroid stock, also come within the scope of the present paper. These are very numerous, and offer a wide field of interesting research to the naturalist. It is remarkable that in the case of so many species the reproductive bodies only should be known, while the plant-like colonies that gave them birth elude our search. Of the forty or fifty forms described by Edward Forbes in his classical Monograph on the "British Naked-eye Medusæ,"† but few have yet been traced to their origin. Of the North American species, so admirably described and figured by Alexander Agassiz, many of which are wonderfully beautiful, the same remark holds good. We know a large proportion of them merely as ocean-wanderers, scattering the seed of new generations, beautiful and ephemeral, like

* Allman has given them the expressive name of "planoblasts"—"wandering buds."

† Published in 1848.

their analogue the flower; but, so far, can neither trace their lineage, nor follow the fortunes of their offspring. These unattached medusæ are mere fragments of a life-history; they are like a few exquisite lines from a lost poem, which make us long to recover the missing context.

Perhaps an apology is needed for isolating one element of the Hydroid, and treating of it apart from the individuality to which it belongs. But inasmuch as the medusiform zooid detaches itself altogether, at a certain stage, from the colony that has reared it, and thenceforth leads a perfectly independent and original life, with marked characteristics of its own; and further, as it is the representative of one grand department of the hydroid economy, it seems permissible, as it is certainly convenient, to make it the subject of a separate study. We do not quarrel with a paper on flowers, apart from the plants that bear them, nor do we resent it as a sin against scientific accuracy. Besides, as I have just mentioned, a large proportion of the hydroid medusæ are still without pedigree, and must be treated provisionally as isolated beings.

A hydroid colony (for associated life is the rule of the order) consists of at least two classes of zooids. They may not both be present at any given time, just as leaves and flowers are not always found together on the plant, but they are both essential elements of the perfect commonwealth. One class is charged with the alimentary, the other with the reproductive function. Both are evolved in the same way, as buds from the common substance of the zoophyte. The polypites or feeders of the colony are always permanently attached to it; the reproductive buds also often pass through their various stages *in situ*, and wither away, like the seed-vessel on its stalk, after the liberation of the ova. But in many cases they take on a more highly specialised form, and are equipped for a free and locomotive existence. Assuming a medusan guise they part from the sedentary colony, and exchange their vegetative ways for the customs of a vagrant life. The structural elements of the polypite are modified and readjusted in the free zooid; the tentacles, which had only served for prehensile purposes, are webbed so as to form a contractile float, and the zoophyte which in its alimentary phase is the most vegetative of animals, appears, in its higher reproductive phase, as a restless ocean-wanderer.

Let us take up the history of the so-called medusa, the "swimming polypite," the reproductive member of the hydroid colony, at the point when it is about to cast itself loose, and enter upon its proper work of maturing and diffusing the winged embryos that are to perpetuate the species. The sexual buds of the zoophyte are borne in various positions; sometimes they

originate on a special offshoot (a *quasi* flower-stalk), which is now naked, and now protected by a transparent urn; sometimes they spring singly or in clusters from the body of the polypite; sometimes they pullulate from a portion of the common substance which links together and binds into one organism the many zooids composing a colony.

Let us examine a cluster of them, hanging from the body of one of the naked polypites. Commonly each bud is inclosed in a delicate capsule, which protects but only half conceals the exquisite structure that is ripening into perfect form and "tender grace" within it. In some cases, however, this envelope is wanting, and the bud is freely exposed through the course of its evolution to the surrounding water. In each cluster we find buds in all stages of development; but one is always much in advance of the rest, and attains maturity while some of its companions are merely rudimentary. And here let me pause for a moment to celebrate the beauty of the group of animal flower-buds, already showing traces of the vivid colouring that adorns the adult medusa; some closely folded up, and giving scarce a hint of the marvellous form that is being moulded within, some heaving with the pulsations of the imprisoned zooid, while one, it may be, has opened, and the full-blown medusa is visible hanging from its slender pedicle, and struggling with the bond that still detains it.

Through the investing capsule the general form and leading features of the contained zooid may be dimly traced; but so tightly is it packed in its little case, and so much are the parts compressed and thrown together, that it is difficult to realize its appearance until it emerges from its captivity. In the later stages of development, the contractile movements that are so characteristic of the tribe become frequent and vigorous, and at length the capsule is ruptured, and the medusa unfolds itself; the tentacles, which had been stowed away within the swimming-bell, are cast forth, the bell itself assumes its true proportions, and it hangs as if on the point of starting into free life. But it is still attached, and arduous and often protracted struggles must precede its final liberation.

Up to this point that portion of the bud which is to form the digestive sac of the medusa has been in direct connection with the common cavity of the zoophyte, and has received from it constant supplies of nutriment. But the communication is now to cease, and all the energies of the zooid are engaged for the time in severing the link that binds it to the common life of the colony. (*Vide* Plate LXXXVIII., fig. 3; *a* marks the point at which the medusa was attached, and in communication with the general chymiferous cavity.) The struggle for freedom is often long, and, to the watching naturalist, wearisome enough; the bell contracts and expands rapidly, jerk succeeds jerk, tug

follows tug, these spasmodic efforts alternating with long periods of quiescence, until at last the connecting link suddenly gives way, and the medusa drops into the water.

Before we finally dismiss it from the colony, and while it still continues an integral portion of it, let us pause to consider the somewhat perplexing question of individuality with reference to these composite organisms, in which many zooids, similar and dissimilar, continuous and discontinuous, are the product of a single ovum.

Philosophically regarded, *the whole series of forms* evolved by budding, and intervening between two generative acts is, no doubt, the equivalent of the "individual" in other classes; and this is the case, even if some of these zooidal forms detach themselves, and lead an independent existence. In this sense the polypite and the medusa are as undoubtedly not "individuals." Yet it must be accounted unfortunate that this term should have been applied to the zoological conception. It would be better, surely, to speak of the *life-series* of the zoophyte, of which the various zooids are so many units, with the understanding that this corresponds with the "individual" of other tribes, than to perplex the ordinary mind by asserting that the free and independent medusa is *not* an individual at all, but that a hundred polypites and a company of a hundred medusæ together constitute an individual! The medusa is not the immediate and single product of an egg. It is developed as a bud from another structure, which *is* the immediate product of the ovum. It is not, therefore, an "individual," biologically considered. But in the ordinary sense of the words, as Professor Allman has remarked,* "every zooid has an individuality of its own," which it is important to recognize. The medusa, with its original and distinctive manner of life, and its independent ways, has a very marked individuality of its own, which I shall endeavour to exhibit in the following pages.

To resume the history, the liberated medusa after a brief period of quiescence begins to move rapidly through the water, propelling itself by the alternate contraction and expansion of the gelatinous disc or swimming-bell, which constitutes its most striking feature. It certainly presents a remarkable contrast to the sedentary kindred from which it has lately parted company. Its whole organisation fits it for active locomotion, the polypite is rooted to one spot for life; is a restless floater, ranging widely through the waters of the sea, the latter is a fixture: it pursues its prey, the latter waits for it; it is mercurial, the latter vegetative; and yet after all it is but a

* In his great work on the "Tubularian Hydroids," 1871.

polypite disguised in a dress which is suitable to the needs of a free existence. The general plan of structure will be best understood by a reference to the plate. It is of this kind. A delicate, more or less transparent disc or bell, serves as a float to which the various organs are attached; it is eminently contractile, and by a regular systole and diastole propels itself through the water. In figure it is variable, but always bounded by lines of beauty; sometimes it is almost globular, sometimes hemispherical, sometimes shaped like a watch-glass, and as translucent, sometimes of more fantastic form. Commonly it is of the slightest, filmiest material, often colourless, and so crystalline as to be hardly visible; as often tinted with the most delicate hues, which only the flower can match; frail as the bubble, and brilliant as the bubble when touched by the sunlight. Within the cavity of the bell, and suspended from its summit (Plate LXXXVIII., fig. 7, *m*), hangs the *digestive sac*, terminating below in a *mouth*, and at its upper extremity opening into a number of delicate *canals* (Plate LXXXVIII., fig. 7, *c*, *c*), which traverse the walls of the swimming-bell longitudinally, and empty themselves into a *circular vessel* running round its margin. We have here the simple nutritive system, which corresponds essentially with that of the fixed and plant-like elements of the hydroid colony. The digested and diluted food is forced from the pendent stomach into the radiating canals, and conveyed by them and the circular vessel that unites them throughout the organism, the stream flowing back periodically to the central depôt for fresh supplies. The number of the canals varies in different species; commonly it does not exceed four (Plate LXXXVIII., figs. 3, 4, 6,), but six (fig. 3), eight, ten (fig. 7), and twelve are met with, and in some cases as many as a hundred (fig. 1). The vessels are generally simple, but occasionally they bifurcate or are slightly branched, and in one rare instance give off short, lateral diverticula; never exhibiting, however, the remarkable complexity which occurs in the parallel group of the *Discophores*.* From the free margin of the bell hang a variable number of tentacles, some of which are a direct continuation of the radiating canals (Plate LXXXVIII., fig. 3); these which are first developed and always present, may be regarded as the primaries, and the spaces between them are often occupied by large numbers of secondary tentacular appendages (figs. 1, 2,), forming a beautiful fringe of delicate interlacing threads. The tentacle is of course a prehensile organ and instrument of offence; it is usually covered

* Vide a paper by the author in the POPULAR SCIENCE REVIEW for April 1871, in which the points of agreement and contrast between the two groups of the *Hydroida* and *Discophora* are fully presented.

with prominent groups of poison-bearing thread-cells, which give it a pretty beaded appearance and a deadly touch (fig. 7, *t*). When the medusa swims, the arms are coiled in a spiral, and are borne "tightly twisted like a corkscrew;" when it is at rest they hang passively pendent, or are cast out to several times the length of the bell, and float in undulating lines through the water. The opening of the bell below is closed by a membranous film (the *velum*), with a circular orifice in the centre, through which the water finds access to the interior. This *veil* is a continuation of the muscular layer which lines the entire cavity of the swimming-bell, and endows it with its remarkable contractility.

There only remain to be noticed the simple organs of sense with which the locomotive zooids of the Hydroid are generally furnished, but which of course are altogether wanting amongst the fixed and vegetative members of the colony. These are of two kinds: the first consists of a collection of pigment-cells, forming a coloured spot or ocellus, and inclosed by a delicate membrane (figs. 7, 8). In some cases a crystalline body, a refracting lens, is embedded in the pigment-mass, and we are naturally led to regard the whole structure as an eye. Even when the lens-like body is wanting, the elements that remain may possibly constitute a light-perceiving organ of the simplest and most rudimentary kind. The ocelli, which are often dark-red or black, are borne on the bulbous enlargements from which the tentacles spring (fig. 3). The remaining organs of sense that occur on the medusa are certain minute sacs developed on the margin of the swimming-bell, in each of which one or more refractile spherules are inclosed (fig. 2; in this species they are very numerous). They have been regarded as organs of hearing, from their supposed resemblance to the auditory sacs that occur in other classes; but there seems to be no real analogy between the two, and accordingly some of the ablest observers assign them a visual function. It may be impossible to determine the precise significance of these primitive structures; but we shall hardly err in viewing them as sense-organs of the simplest type correlated with the habits and needs of a free and active existence. Though almost universally present, there are a few known cases in which they seem to be wanting. The medusa represented in our fig. 3—a remarkable form, which I have lately obtained, and which is still undescribed—is destitute, at least in its earliest stage, of both ocelli and marginal sacs.*

The nervous system of the medusa, if such should exist in any specialised form, has certainly not been detected in the vast majority of known Hydroids; and though such a system

* So far as is known at present, the two sense-organs (the ocellus and the marginal sac) never exist together on the same medusa.

has been described as occurring in a few cases, we are justified, I think, in waiting for further testimony before coming to any positive conclusion on the subject. As sense-organs make their appearance along with a free existence, we should naturally look for the dawn of the nervous system at the same point.

So much may suffice as to the general plan on which the Hydroid medusa is organized. I wish to avoid unnecessary detail, and to fix attention on the cardinal points of structure, and especially to emphasize what may be called the artistic and æsthetic aspects of my subject. No technical description, however minute and accurate, can enable us to realize the distinctive beauty of these fragile beings. Not merely are the forms graceful, and the curves faultless, and the colours vivid, but an additional charm is imparted to all of them by the delicate and transparent material in which they are presented.

Perhaps the portrait of an individual carefully executed may give the best idea of the kind of beauty that belongs to these "wandering buds," and may serve to justify the enthusiasm of the naturalist about them. I will select as my "sitter" a medusa, certainly one of the most lovely of its kind, which made its appearance for two successive years in a friend's tank, but which we were never able to trace to the parent stock (Plate LXXXVIII., fig. 2). No doubt in some chink or cranny a charming little colony of polypites was concealed, which supplied the annual medusan brood, but it baffled our keenest search. I am not aware that the pedigree of the form which I am about to describe has ever been made out; it is probably one of the unattached.* Imagine, then, a minute crystal globe, the surface of which is thickly dotted over with thread-cells, making it appear as if delicately frosted; from the free margin hangs a graceful fringe, composed of twenty beaded tentacles, springing from as many bosses of a brilliant green with metallic lustre, which girdle it as with a belt of emeralds; amongst them are placed a number of the supposed eyes, each with its refractile corpuscle; the pendulous sac in the centre of the dome is dyed with the richest carmine, and tipped with the purest white, while the ovaries on the course of the radiating canals, shower masses of pink through the walls of its translucent bell. The colours are wonderfully brilliant, and the green tentacular bulbs almost glitter like gems. It was the prettiest sight to watch this little hydroid, with its painted and jewelled disc, now darting through the water with contracted arms; now sinking slowly, like a balloon, with some of its tentacles extended laterally as if to regulate its descent, and some hanging

* It is, no doubt, the reproductive zooid of a Campanularian Hydroid, and may belong to the Genus *Campanulina*, or a near ally.

below it; now anchored to the bottom of the vessel and casting out its lines in search of food. When engaged in fishing, it attached itself by means of a few of its tentacles, while the rest were thrown out in all directions and to amazing distances, and appeared as the finest and most attenuated threads. The extremities at such times exhibited a constant tremulous movement, as if they might be feeling about for the minute organisms on which the medusa feeds. Then it would suddenly gather up its fishing-lines, and rise by a series of rapid jerks to the surface of the water. This exquisite species, as I have stated, has not yet been referred to a fixed stock; it is one of a large company, which remains to stimulate and reward the researches of the zoologist. These unattached medusæ are single chapters of as many charming biographies still unread; they suggest to us the existence of a host of graceful forms, which, when discovered, will fill many a gap in our systems, and add many an interesting page to Hydroid history.

The medusa, at the time of liberation, is in most cases far from having attained its perfect form. Remarkable changes subsequently take place in a large proportion of the kinds, which so completely alter its aspect that it might pass, and has often passed, in its adult state for a different species from its young self. Indeed several species have been formed out of the various stages of one and the same hydroid. The changes affect the size and form of the swimming-bell, and the *number* of many of the other organs. In fig. 5 we have the early, and in fig. 6 the adult state, of the same medusa. The deep bell of the one gives place to a flattened and expanded disc in the other. The two tentacles present at birth multiply into about forty, and there is a corresponding increase in the number of the marginal organs of sense. In some cases (Plate LXXXVIII., fig. 1), the change is carried still further; the radiating canals, as well as the tentacles, multiply, so that the *four* with which the young is (probably) furnished, are represented by sixty or eighty in the adult.

One of the largest of the hydroid medusæ (*Zygodactlya*), closely related to the form represented in fig. 1, which measures some fifteen inches in diameter and is furnished with 100 radiating vessels, is not larger than the head of a pin in its early condition, has only four canals, and is moreover developed from one of the smallest of polypites. Growth must proceed rapidly in these ephemeral beings, which run their whole course in a single season; they are like the annuals of the vegetable world, which pass through the entire cycle of their existence and perish in a summer. It must be noted that these changes are merely illustrations of the vegetative tendency to a repetition of parts, which is characteristic of the zoophyte, and is so

strikingly manifested in the complex ramification and the many polypites of its plant-like colonies.

Besides the changes that have been enumerated, others occur in the digestive sac, which sometimes attains an extraordinary development in the adult, and can be extended far beyond the opening of the swimming-bell (Plate LXXXVIII., fig 4). In one genus (*Syncoryne*) it stretches out to two or three times the length of the body, and is capable of the most active movement. This remarkable development of the stomach is accompanied by a voracious appetite.

It is of this form that Edward Forbes writes: "An animal that can pout out its mouth twice the length of its body, and stretch its stomach to corresponding dimensions, must indeed be 'a Triton among the minnows,' and a very terrific one too. Yet is this ferocious creature one of the most delicate and graceful of the inhabitants of the ocean—a very model of tenderness and elegance."

Reproduction by budding is a familiar fact in the history of the zoophyte, and it enters into that of the free as well as of the fixed element. Some of the medusæ produce buds which assume the form of the parent, and probably repeat its life. They are borne in various positions; in some cases springing from the bulbous bases of the tentacles, or from the tentacle itself; in others from the base of the digestive sac; and in one instance, at least, from the margin of the bell between the tentacles. And these buds may themselves produce other buds, so that two generations may hang from the body of the primary zooid before its separation from the parent stock. Development takes place rapidly; three or four days suffice for the completion of a brood, and before it is mature it is itself budding. We do not know the limits of this process, but the number of generations originated by a single medusa is probably very great. With these facts before us, we cease to marvel at the myriads of these organisms that swim in certain seasons near the surface of the sea. Indeed, apart from this reproduction by budding, which has only been noticed in certain species (though probably it is commoner than we suppose), there is ample provision for an abundant supply of these "floating nurseries." They are cast off in incalculable numbers from the hydroid colonies. In some species each polypite bears a brood; in others each shoot is laden throughout with graceful urns, in which not a single medusa, but a whole tribe, is nurtured. Probably there may be more than one brood in a season. Then consider the immense acreage of the zoophyte crop on the shore and the sea-bed, the forests that overspread the algæ, the populations that hide in well-nigh every chink and cranny, and plant themselves on almost every spot where they can get

a footing, and you will understand how the myriads of medusæ cover the surface of the sea beneath the summer sun, and make it glow through the summer night.

Alexander Agassiz tells us that one of the budding kinds, appropriately named "*fulgurans*" ("light-flasher"), is sometimes so abundant off the American coasts, that the sea, when disturbed, is brilliantly lighted by its blue phosphorescence. And of another species he says that he had often found the whole surface of the water, for several miles in the Gulf of Georgia, thickly covered with it.

To return to our budding, the case which we have been considering is simple enough, and in harmony with the whole course of hydroid history. But the facts now to be noticed are anomalous and difficult to interpret. A medusa has been observed to bud off young within the cavity of the stomach, and these, when developed, have taken on a form *which is totally unlike the parent*; which belongs, indeed, to the medusa of another, and very different Family. In other words, two distinct types of medusa originate one from the other and form parts of one and the same life-series. These observations, if correct, are certainly startling; we are scarcely, I think, in a position at present to determine their true significance. It would be satisfactory to have them confirmed, eminent as the authorities are to whom we owe them, and to know more than we now do both of the earliest and of the later stages of the remarkable life-history. If it should prove to be a fact that one hydroid medusa may originate another by gemmation of an entirely different generic type, we must materially enlarge our conception of the polymorphism of the zoophyte, and modify our systematic views. So remarkable a divergence from the direct line of development would open the way for much curious speculation. The observations of Haeckel and others on this point are deeply interesting, and indicate to the zoologist a most fruitful field of research.

I have spoken of the swimming-bell as the characteristic feature of the medusa; but there exists a small group of forms in which it is suppressed, and its place is filled by a totally different locomotive organ. In *Clavatella* (Plate LXXXVIII., fig. 8) the contractile float is wanting, and we have an ambulatory medusa, which moves about leisurely on suctorial feet, or climbs by their aid among the algæ. In this remarkable creature, the general form of the medusa is preserved, the radiating canals are traceable in the walls of the hemispherical body, the ocelli are conspicuous at the base of the tentacles, the portion of the central sac bearing the mouth hangs below the disc; but the beautiful contractile float is missing. In its absence, however, a new compensative element makes its appearance; the tentacle

gives off a branch, which terminates in a sucker, and by means of these suctorial appendages the *Clavatella* traverses the small rock-pools in which it finds a home, or mounting the tufts of sea-weed, seeks its food among their branches. A change in habit, mode of life, and range of distribution, accompanies the modification of structure, and the *Clavatella* appears to be separated from its kindred by a much wider gap than really exists. We have an interesting transitional form in *Cladonema* (fig. 7); in this case the bell is fully developed, and the creature is an active swimmer, but the tentacles (fig. 7 *t*) are furnished with the sucker-bearing branch (fig. 7 *s*), and it thus enjoys the means of rapid locomotion and attachment at pleasure, in combination. It does not appear to use its suckers as feet. In its adult state the tentacles of *Cladonema* bear several branches, and at least two of the suctorial appendages; but, as I have lately had the opportunity of observing, in an early stage they are as simple as those of *Clavatella*, from which they only differ in the presence of a larger number of the groups of thread-cells (vide fig. 7 *t*). It should be remarked in passing that the free zooid of *Clavatella*, though of medusan type, makes a near approach to the polypite, and is an interesting link between the two principal elements of the Hydroid colony.

Besides the ambulatory medusa, only one other deviation from the normal condition is known; it occurs in the locomotive sexual bud of the genus *Dicoryne* (fig. 9). In this extraordinary form the medusan structure seems to have vanished altogether. It consists of a closed sac covered with cilia within which the generative elements are developed, and bearing at one extremity two ciliated tentacles. It is clearly an intermediate form between the *fixed* buds, which in many hydroids discharge the generative function, and the ordinary medusa. In brief it is the equivalent of the central sac (fig. 7, *m*) of the medusa, minus a swimming-bell and its appendages, made locomotive by the aid of cilia; and the two tentacles may be regarded as rudiments of the contractile disc, the development of which has been, as it were, arrested *in limine*.

But I must pass on to notice briefly the most important phase of the life of the medusa. It is its specific function to give origin, directly or indirectly, to the generative elements, and with the scattering of the seed its work is accomplished. In one section of the Hydroid medusæ, the ova and spermatozoa are produced in the walls of the digestive cavity (fig. 7, *m*); in another, they originate in special sacs, developed on the course of the radiating canals (fig. 2, *o*, *o*). These sacs have long been regarded as the *ovaries* (or spermaries); but Allman has shown that in many cases at least, their structure is

identical with that of the sexual buds, which continue attached to the colony, and mature their products *in situ*. He therefore views them as definite zooids, co-ordinate with the polypite and the medusa, and not as mere organs. In such cases the medusa is a mere carrier and nurse of the sexual buds, which form a separate term in the complex life-series of the species. But leaving these transcendental matters, whether in ovaries or zooidal sacs, the medusa originates the seed of new generations; and with the escape of the embryos, and their dispersion through the waters of the sea, its existence probably terminates.

The Hydroid embryo (or *planula*) (fig. 10) is an elongated, cylindrical body, thickly clothed with cilia, which after a short term of free life, fixes itself by one extremity, loses its locomotive organs, and is moulded gradually into a polypite—the first term of a new series, from which by repeated buddings the complex, arborescent colonies, and the graceful medusan forms, will be evolved in due succession.

Towards autumn chiefly the medusæ seem to congregate for the purpose of spawning, and on warm, still days, certain species swarm in immense shoals near the surface. Their fragile forms are ill-suited to face the tumult of the waters, and large numbers of them are found floating dead after storms. The smaller kinds sometimes fall victims to rain-water; and Agassiz has noticed that their total disappearance from the neighbourhood of the wharves, about which they congregate, "uniformly coincides with heavy rainfalls, while the larger species survive." Some are so frail as to be unable to resist the action of the light and heat near the surface, and consequently swim at a considerable depth below it. There seem to be diversities of temperament amongst them, but most of them are vivacious in their habits, moving about "with the greatest freedom and energy;" and it must be added that, with all their grace and tenderness, they are indubitably voracious!

The phosphorescence, for which they have long been celebrated, is confined to certain species; and in them it is localized in certain portions of the structure. The painted bulbs of the tentacles sometimes glow with vivid lights, under the stimulus of irritation, without which the fires refuse to kindle; and the margin of the crystal bell is girt with a wreath of brilliants. The phosphorescence also connects itself specially with the reproductive system, and sometimes the central pendant is all ablaze, and thousands of little lamps illuminate the dark waters around. Some species emit flashes of coloured light.

The Hydroid medusæ, like a host of other marine floaters, can only be obtained in their adult state by the use of the tow-

net. On calm warm days in summer and autumn—*dreamy* days are the best—a bag of fine muslin fastened to a stout ring of wire, and towed at the stern of the boat, will gather a rich harvest of beautiful forms. The student will have a fair chance of obtaining some specimens in which the ova are far advanced towards maturity, and may possibly be fortunate enough to keep them until the embryos are discharged. If he can rear these into polypites he may complete an imperfect life-history, and fill up one of the many gaps in our knowledge of the tribe. This has been done in a few cases; by care and patience it might no doubt be done in more.

And even those who are not prepared for any profound study of the structure and history of the medusæ may find the tow-net a not uninteresting resource during their visits to the sea; and if they have any sensibility to beauty in their souls, can hardly fail to derive the highest gratification from watching the exquisite forms and movements, and the singular habits of these "animated bubbles."

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## DESCRIPTION OF PLATE LXXXVIII.

FIG. 1. *Crematostoma flava*, A. Agassiz.
„ 2. A Campanularian medusa, not yet described (?).
„ 3. The free sexual zooid of *Lar Sabellarum*, Gosse.
„ 4. *Tima formosa*, Agassiz.
„ 5. *Oceania languida*, A. Agassiz (the young). Probably the gono-zooid of a *Campanulina*.
„ 6. The same, in the adult state.
„ 7. *Cladonema radiatum*, Dujardin. The medusa in an early stage of its development.
„ 8. *Clavatella prolifera*, Hincks. The ambulatory zooid.
„ 9. *Dicoryne conferta*, Alder. The female natatory zooid; an ovum, with its germinal vesicle and spot, is visible within the cavity of the body.
„ 10. The Hydroid *planula* or embryo.

[Figs. 1, 4, 5, and 6, are after Alexander Agassiz; fig. 9, after Allman; and the rest from drawings by the Author.]