

**On the co-existence of ovigerous and spermatic capsules on the same individuals of the hydra viridis / by Allen Thomson.**

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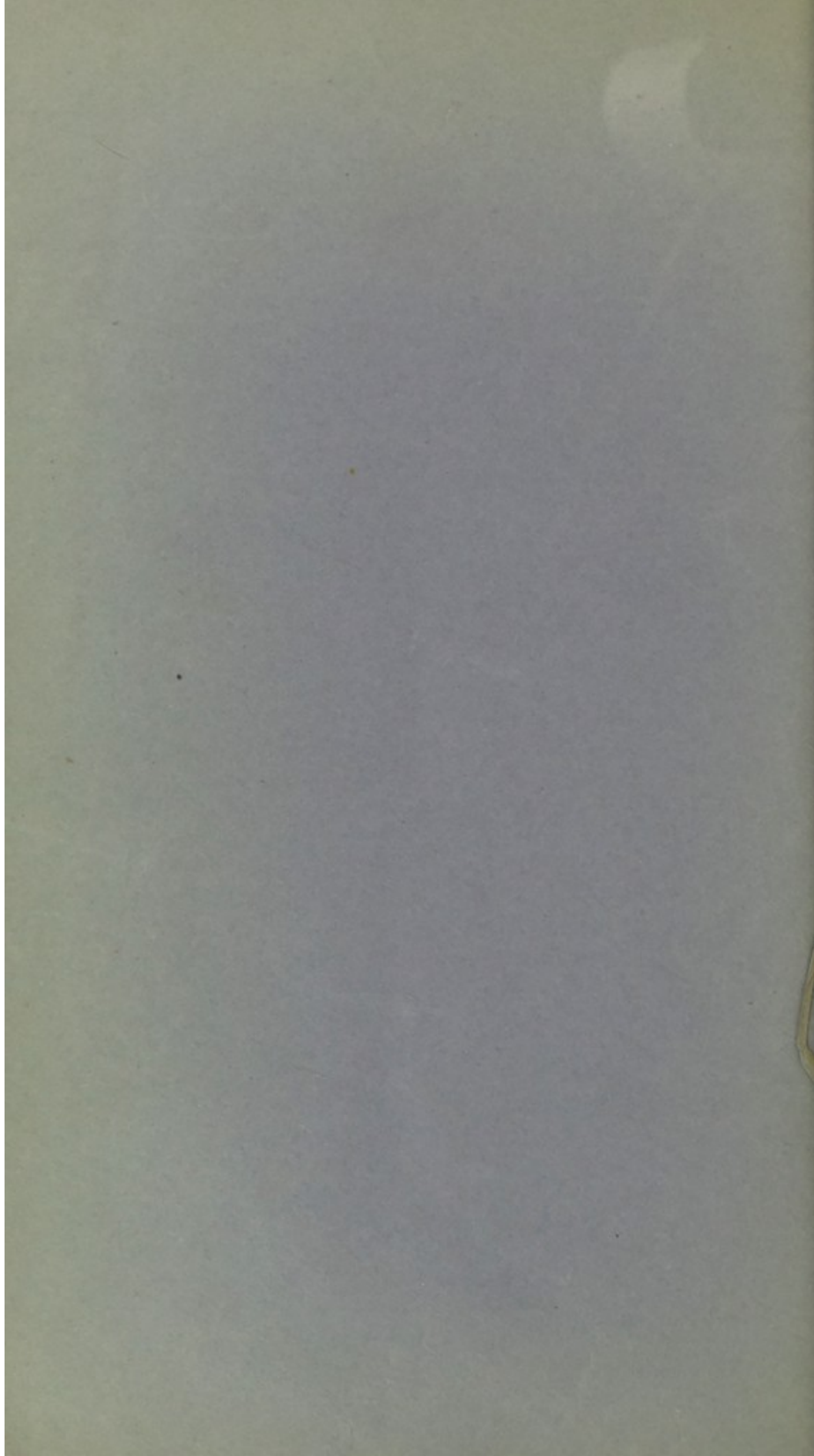
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ON THE  
CO-EXISTENCE OF OVIGEROUS  
AND SPERMATIC CAPSULES

ON THE SAME INDIVIDUALS OF THE

HYDRA VIRIDIS.

BY ALLEN THOMSON, M.D., F.R.S.E.,

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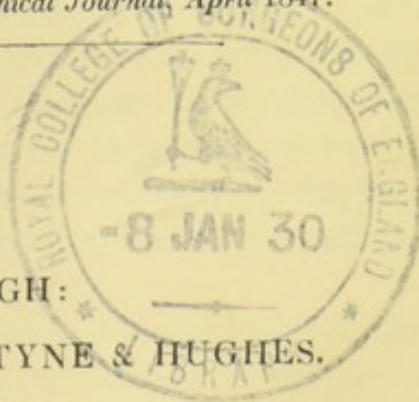
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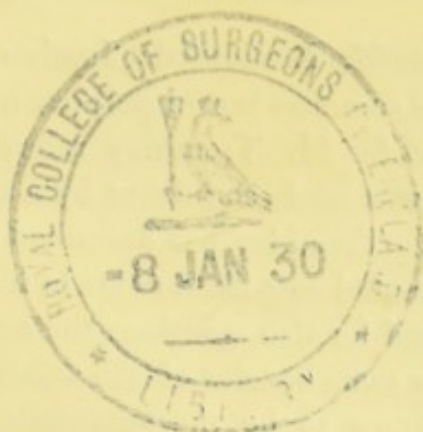
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ON THE CO-EXISTENCE OF OVIGEROUS AND SPERMATIC  
CAPSULES ON THE SAME INDIVIDUALS OF THE  
HYDRA VIRIDIS.

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The object of the following communication is to lay before the Royal Society a few observations which I made in the months of October, November, and December of 1845, upon the occasional reproduction of the common green polype of fresh water (*hydra viridis*) by means of fecundated ova; and in particular upon the existence of spermatic and ovigerous capsules in the same individual.

I may be permitted to explain, in reference to these observations, that at the time they were made, I conceived them to be new, in so far as the bisexual condition of single individuals of the polype is concerned; but I have since found that I have been anticipated by other observers in the announcement of the fact; and I have therefore to request the Society to receive this communication rather as confirmatory and illustrative of the circumstances to which it refers, than as intended to bring forward any new discovery.

I have further to express my regret that accidental circumstances, and the only occasional occurrence of the phenomena, should have prevented me from making the observations as complete as might have been desirable.

It appears that M. Bernard de Jussieu was the first to observe ova of the common brown polype, which he did when travelling in 1743.\* M. Trembley refers to this observation, of which he was made cognizant by a private letter from M. de Réaumur. Trembley has described from his own researches these rounded egg-like bodies in his *Mémoires*, published in 1744; and he also mentions the occurrence on other individuals of the same species of the small conical tubercles which we now know to be the spermatic capsules. Some years later, Rösel gave an excellent coloured figure of both these bodies as they occur on separate individuals; and they were also later described by Pallas in 1766. Although the nature of the ova was suspected by Trembley, yet he expressed himself doubtingly regarding them; by some they were considered as parasites, and by others both the ova and spermatic capsules were regarded as possibly of the nature of morbid excrescences.

This state of uncertainty appears generally to have prevailed till 1836, when the nature of the ova was ascertained with greater precision by Ehrenberg, who took occasion to examine them with care in reference to a resemblance alleged by M. Turpin, to exist between the ova of *Cristatella vagans* and the fossil *Xanthidia*.

This resemblance Ehrenberg disproved, and showed that even the greater similarity that might be alleged between *Xanthidia* and the ova of the common polype, was only of a very general kind; considerable differences in size, form, and structure being observable between the two bodies. He further succeeded in 1838, as is stated by Mr Owen in his lectures on *Comparative Anatomy* (vol. i. p. 85), in detecting the existence of spermatozoa in the conical tubercles before referred to as existing on other individuals of the *Hydra*, and observed on some occasions the co-existence of the ovigerous and spermatic capsules on the same individuals. Notwithstanding these observations, the nature of the bodies

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\* An account of this observation was afterwards published in *Abhand. der Swed. Akad.*, 1746, B. viii, p. 211.



in question was misrepresented by Laurent so lately as in 1842.\* But very recently the fact of the occasional bisexual generation of the common polypes has been fully confirmed and described by V. Siebold† in his text-book of comparative anatomy.

I have not been able to refer to the original of the second notice regarding this subject, by Ehrenberg, which was published in the *Mittheil. aus d. Verhandl. d. Gesellschaft Naturf. Freunde in Berlin*, 1838, p. 14; and I only became acquainted with his and V. Siebold's observations a considerable time after I had observed carefully the two bodies, and distinguished their nature. The naturalists I have referred to appear to have had under observation principally the *Hydra fusca* and *H. aurantiaca*; and V. Siebold only once makes mention of having seen the ova in the *Hydra viridis*; and it is on this last species, the organization of which is the simplest of the tribe, that my observations have been made.

It appears to me of some importance, that the fact of the co-existence of the two generative elements in an animal of the extremely simple structure presented by the *Hydra*, should receive every confirmation; and the interest created by the variety of modes in which that animal is capable of being reproduced, may, perhaps, warrant my detaining the Society a few minutes with a short notice of the phenomena to which I have referred.

Through the greater part of the year the common polype is reproduced by gemmation, or by the growth of buds upon the parent stock; and occasionally, but much more rarely, by cleavage, or in the fissiparous mode; the division being sometimes longitudinal, at others transverse. These processes have been described so fully by Trembley and others, and are so familiar to most naturalists, that it seems unnecessary to dwell upon them here. Suffice it to say, that, in so far as we are

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\* Forster's Neue Notizen, p. 104.

† *Lehrbuch der Vergleich. Anatomie*, Von V. Siebold und Steninius, B. I. p. 46.



yet informed from direct observation, the process of budding appears to consist in the gradual projection and growth of a portion of the entire thickness of the wall of the body in the parent polype, without its being possible to detect any peculiar structure in the bud, such as a germinal vesicle at its commencement; or without there being any evidence of fecundation by a male generative element. Whatever probability, therefore, may belong to the view held by some, that buds require fecundation as ova do, this opinion cannot be considered as founded on observation in the polype; an animal, it may be remarked, in which a most favourable opportunity presents itself of detecting such a fecundation were it to occur.

Buds are formed upon those polypes in which the spermatic capsules exist; but they are much more frequently observed in those individuals which do not possess them, and I regard the assertion of Professor Owen, that the process of gemmation is preceded by the fecundation of an ovum below the integument, as not yet warranted by observation. I have never, at least, been able to detect any appearances which would lead me to believe that such was the case. In regard to this matter, however, it may be proper to notice that the place from which, in the gray polype, the buds almost always sprout, is the same with that in which the ova are developed—viz., at the union of the pedicle and body of the animal; the spermatic capsules being in general nearer the head, and removed from the ova or buds.

From Trembley's interesting researches, it appears necessary, in order that germination should go on briskly, that the polypes should be well nourished; and when this is the case, and the weather is fine, a very considerable number of buds, and even a second generation, may appear on some of the progeny of the first parent: and that, on the other hand, when food is withheld for some time, there is an increased tendency to the separation of the buds, so that some occasionally leave the parent stalk, while yet very imperfectly developed.

It is in the autumn principally that the formation of ova and spermatic capsules occurs; and it is at this season or in winter that almost all observers have described the process. Ehren-



berg is, however, an exception, mentioning that he has seen the ova formed in the month of June. A succession of ova are observed to be formed on, and detached from, the same polype; and according to V. Siebold, the parent generally dies after the separation of the last of the series. The development of fecundated ova, therefore, at the approach of winter, may be regarded as a means of security against the extinction of the species through the death of the entire animals by cold or want. The ova probably remain for a considerable time in an undeveloped condition.

The extreme simplicity of the organs in question is a feature of some interest. In order to explain this, I may state that the wall of the body of the hydra, though endowed with a digestive and assimilative faculty, and possessed of sensitive and motor powers to a remarkable degree, is yet composed of no other structure than organised cells united together by their adjacent parietes, so as to form two layers; of which the innermost contains the green granules, which give colour to the most of the animal; and the outer presents, studded over its surface, those peculiar forms of cells from which the stinging or poison filaments protrude, with which the animal, in seizing its prey with its tentacula, appears at once to stupify and to fasten them. No nervous or muscular fibre, no special glandular organs, are visible; but every cell for itself, and the whole mass of them in concert, appear to be capable of the acts of assimilation, and to execute their movements under the influence of sensations by a texture of a similar cellular organization throughout.

The development, therefore, from so simple a texture of organs possessing so obvious and peculiar a form and structure as the spermatic and ovigerous capsules, is a very striking phenomenon.

The conical eminences which constitute the spermatic capsules appear to consist, in the greater degree of development, of one or more of the superficial cells in the vicinity of the base of the arms. These capsules sometimes occur in considerable numbers, as from eight to sixteen on the brown polype;



but in the green species I have in general seen only two or three, placed alternately on opposite sides of the body. The interior of the capsule has a slightly ribbed or striated appearance, and at the summit a small aperture is sometimes perceptible, through which, when the development is complete, the spermatic filaments are observed to issue. In breaking up the capsule, under the microscope large numbers of these filaments are seen united in bundles by their minute globular heads, the filamentous part being free, and vibrating with great rapidity, in the manner which is known to be characteristic of these bodies in all animals.

I have noticed more than once, when an ovum was developed on the same individual which bore the spermatic capsules, the animal bend its body suddenly round, so as quite to double it, and to bring the spermatic capsules and ovum close together; and as this is an attitude rarely observed in the polype at other times, I am inclined to regard it as related to the act of self-fecundation.

The spermatic capsules, with lively movement of their filaments, were observed on many individuals in which no ova existed.

The rounded body, which I have hitherto termed, indiscriminately, ovum and ovigerous capsule, is, when fully developed, of such a size as to be seen with the naked eye. It is attached to the side of the polype, nearer the foot than the spermatic capsules, and is distinguished from the rest of the animal by its spherical form and yellowish-brown colour. In the *Hydra viridis* I have never seen more than one of these ova developed on the body of the polype at the same time; but a number varying from four to seven have been observed by others upon the *Hydra fusca*.

This body appears at first as a small granular mass in the thickness of the wall of the animal. A germinal vesicle was not apparent; but as I found it impossible to burst the capsule to examine the contents without injuring them greatly, it may still have existed within the granular mass. As the spherical yolk mass enlarged, it projected from the side, seeming at first to carry along with it the outer or clearer



layer of the animal's body; then the cells of this layer seemed to become thinner, and to recede from the outer covering or capsule enveloping the egg-like mass, which had at the same time become much thicker, and was now left attached to the animal by a narrower portion or pedicle. In the further progress of development a similar solution or atrophy of the cells of the pedicle was followed at last by the separation of the spherical mass, which fell from the body of the polype to the bottom of the vessel in which it was contained.

The outer covering of this mass or capsule is described by Ehrenberg as presenting in the *Hydra aurantiaca*, on its outer surface, a remarkable set of blunt prickles, many of which are bifid at the end. In the *Hydra viridis* it forms a very strong, elastic, and almost horny-like capsule, the surface of which is rather tuberculated than spinous. The divisions between the tubercles are irregularly hexagonal or pentagonal, and their walls appear to contain a fibre, wound spirally round them.

In different capsules, while still attached to the parent animal, I observed the internal yolk or granular mass to become subdivided into a number of smaller portions, each of which was of a rounded form, and had a darker centre or nucleus. From similar observations by V. Siebold, I am inclined to regard the fluid granular mass within the capsule as the yolk of a single ovum, and the smaller masses into which I have mentioned it became divided, as the result of that peculiar process of cleavage of the substance of the yolk, and the arrangement of the distinct portions round separate centres, which was first discovered by Prevost and Dumas in Batrachia, and by Barry in Mammalia, and which is now known to occur under certain modifications in the ova of all animals previous to the formation of an embryonic membrane. I am, therefore, disposed to consider the whole mass which is developed from the side of the polype in the manner before stated, as constituting a single ovum, and as thus different from the multiple ovigerous capsules of the Coryne, and some other allied polypes.

I preserved several of the separated ova for some time, but



was not so fortunate as to succeed in tracing the development of a young polype from any of them; having accidentally lost two, in which I hoped to have had an opportunity of watching the process. Trembley\* mentions his having observed, as he conceived, the formation of a young polype from the egg; and Pallas† and Laurent‡ make a similar statement; but none of these naturalists express themselves with sufficient confidence, nor describe the process with sufficient detail, to satisfy us fully of the fact.

Dr Thomas Wright, of this place, who has recently devoted some time to the study of the structure and habits of these interesting animals, informs me that he examined the ovigerous capsules of the long-armed polype (*Hydra aurtiaca*) last autumn, and watched their gradual formation on the body of the animal. He observed two of these capsules, of a cream colour, developed on one individual, one of which became detached. From this, when it was burst artificially some days afterwards, there issued a number of ovoidal ciliated bodies, which moved with vivacity through the water, and which, he at first imagined, might be separate ciliated ova, like those of some other polypes. This appears to me, however, extremely doubtful; and Dr Wright states, in a communication he has made to me on the subject, that the polype appeared to be in an unhealthy state; and I am inclined to think that the ciliated bodies were polygastric animalcules such as I have repeatedly seen preying with avidity upon the bodies of polypes when in a very weak condition, or in commencing decomposition.

Lastly, it may be stated that while some of the individuals of the species *Hydra* are, as I have now described them, bisexual or hermaphrodite, others appear to bear the organs of one sex only.

The observations I have detailed suggest some general reflections of interest. With many others of the same kind, they point out the multitude of the resources of Nature, and almost

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\* Memoires.

† Pallas, *Karakteristik der Thierpflanzen*, p. 53.

‡ Laurent, in *Frorieps Neue Notizen*, No. 513, p. 101.

lavish expenditure of her care in providing secure means for the continuance of the species of animals. They call our attention to the remarkable fact of the existence of two distinct kinds of generative elements, even among the simplest of animals. They thus add probability to the view deducible from an extended consideration of the recent observations in the vegetable as well as the animal kingdom, that in no instance is a new organized structure, under the form of an ovum, seed, or spore, separated from a parent, and made capable of producing a new being, without the concurrence of generative elements of two kinds—one of these being itself a cell, or in a vesicular form; the other being a peculiar product of cell development, and most frequently assuming the form of minute filaments endowed with a power of rapid vibratile motion. Lastly, in contemplating the alternate production of buds and ova from the same situation in these polypes, they suggest the interesting speculative inquiry whether the concurrence of a male element is necessary to give fecundity to the germ of a mere bud—a view in regard to which, although some circumstances appear to give a show of probability, the want of sufficient observations forces us in the meantime to suspend our judgment.

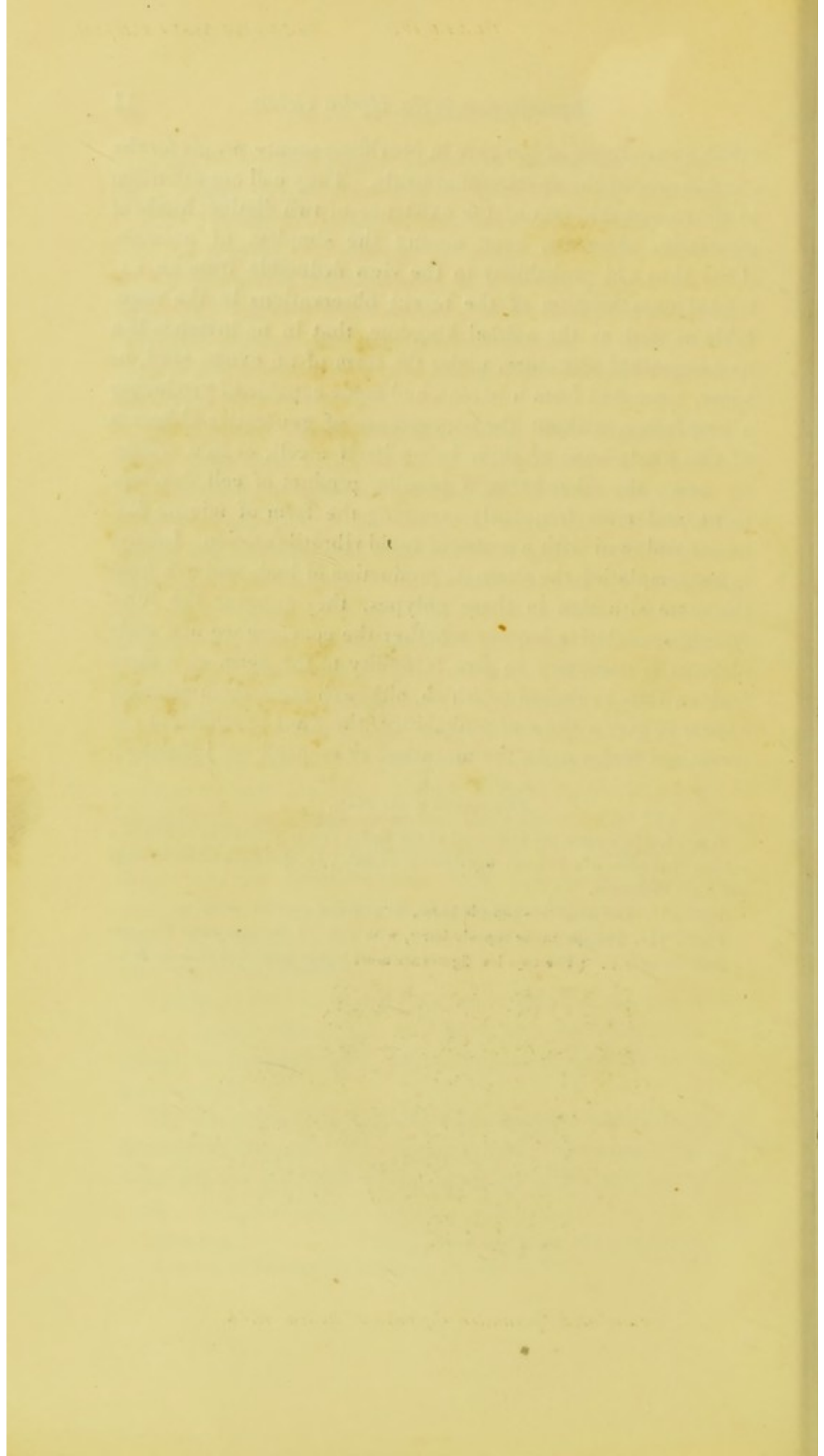
*Description of the Plate.*

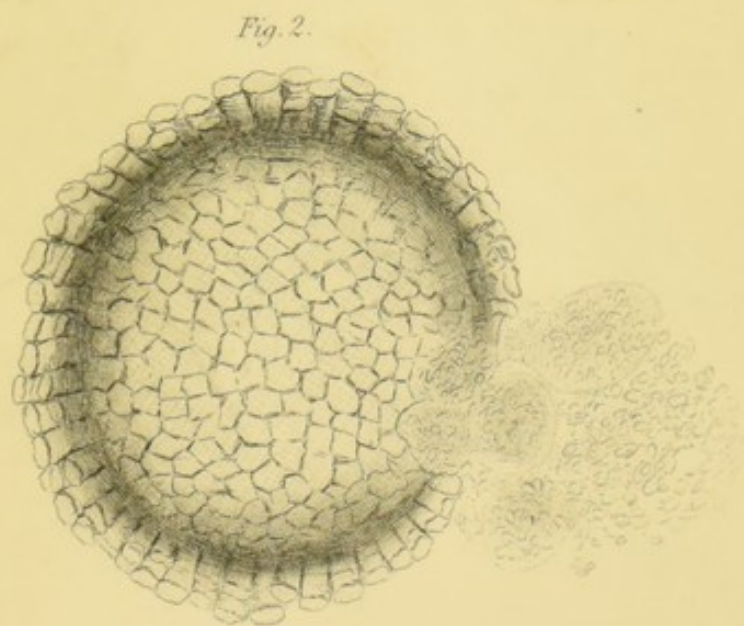
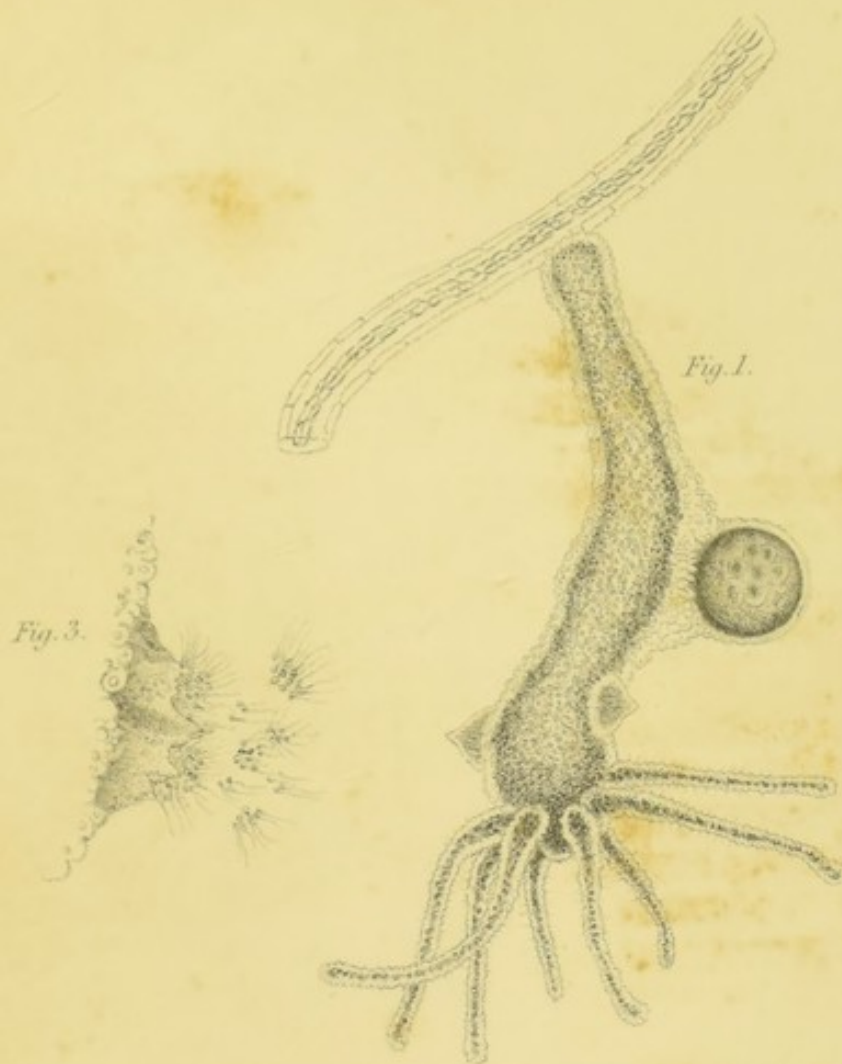
Figure I. Hermaphrodite individual of the *Hydra viridis* attached by its foot to a portion of the root of a *Lemna*; *a*, ovigerous capsule; *bb*, spermatie capsules, magnified ten diameters.

Figure II. The ovigerous capsule burst, its granular contents escaping.

Figure III. The spermatie capsule burst, with some of the spermatie filaments in fasciculi near it. (The two last figures are more highly magnified than the first.)







*Ovum and Spermatic Capsules of Hydra viridis.*

