adult mollusk is enclosed between two irregular-shaped valves, like an *Etheria,* with the tube and the valves of the young shell on the produced end of the attached valve. (See Proc. Zool. Soc.)

In *Humphreyia,* on the contrary, the small united valves are attached by their ventral edge, and they are extended behind into a free, ascending, subquadrangular tube, like *Vermetus,* which continues to grow in length as the animal increases in size.

The use of the tubules in *Aspergillum* and *Clavagella,* and of the minute perforations in the lower part of the tube of the genera *Furcella* and *Foegia,* has not been satisfactorily explained. They have been supposed to admit water to the front part of the body of the animal, and have been regarded simply as tubes or perforations, as if they were always open; but they can only be formed round the tentacles, and it is most probable that the tentacles fill up the tubular cavity during the life of the animal, though they are vacant, and the tentacles on which they have been formed are not to be observed in the specimens of the animal which are preserved in spirits. The admission of water to the front of the animal does not appear to be necessary for their œconomy, as such tubules or pores are not to be found in the tubes of *Teredo, Gastrochæna,* &c. In some *Clavagellæ* and *Aspergilla,* the tentacles and the tubules which cover them are branched and spread out, as if the mollusk wished to obtain a knowledge of the animals and other bodies in its neighbourhood. They may also serve to steady the tubes, as roots do trees, and prevent their being thrown down by the usual waves of the sea, as it is the kinds which live sunk a small depth in the sand that appear to have the tubules most extended; while those that are sunk deeper, or are fixed on rock, have only perforations in their place,—as trees which have their roots near the surface have them greatly extended horizontally.

It is to be observed, that when these animals have completed their tube, if they extend any more in size, it is only posteriorly in the length of their siphons; and then they extend the length of the shell by the addition of fresh portions to the siphonal end of the tube, as shown by the ruffles in *Warnea* and *Bryopa.*

IV.—*On the Spermatology of a new species of* Nais.

By H. J. Carter, Esq., H.C.S. Bombay.

[With three Plates.]

The following communication contains a description of the development of the spermatozoa in the ovisac with the ovum, in a new species of *Nais,* together with other matter bearing on the origin of the sperm-cells both of the so-called testes and ovisac; also on the functions of the floating-cells of the peritoneal cavity, and that contractile body called by Dr. T. Williams the "segmental organ*;"—to which is appended a short summary of the changes which successively take place in the yelk during the development of the embryo, and the product which frequently results when the yelk fails to fissurate.

This information has been chiefly obtained from a perennial species of *Nais* that, for a year past, has colonized the sediment of a glass jar, in which *Chara* has been growing out of a little saucer suspended a short distance from the bottom; but not having afforded me any opportunity of following the development of the embryo, I have been obliged to take advantage of another species for this purpose, which I found in a gelatinous Alga (*Glœocapsa*), collected during "the rains," for the microscopic *Filariæ* that it also contains, and which species not only furnished me with eggs, but with other observations of a serial nature, that serve to complete those unsupplied by the first species.

Thus the facts contained in the following pages having been the result of investigations carried on under an unusual combination of favourable circumstances, attended with a microscopical examination of upwards of two hundred individuals, it is hoped that they will be found acceptable.

The text, however, is not the consequence of this labour more than the illustrations, which are as true to nature as circumstances would permit, and have been compiled from a great number of sketches taken from the objects themselves.

With these few remarks, let us proceed to the following descriptions of the two *Naides* to which I have alluded, which it is desirable to premise, that the reader may be familiarized with their specific and general characters respectively, before he commences the subsequent observations. They are, I believe, new; and the first that will occupy our attention is that species which has colonized the sediment of the jar of *Chara,* as it is this from which my information has been chiefly derived.

Nais fusca, H. J. C. (nov. sp.) Pl. II. figs. 1–3.

Filiform, of a pinkish-brown colour, subsegmented, setaceous; anterior extremity clavate pointed, posterior extremity slightly attenuated, obtuse; mouth inferior, a little distance from the anterior extremity; anus subterminal. Reproductive band near the head, commencing with the fifth segment. Cirri

* Ann. and Mag. Nat. Hist. vol. xix. p. 393, 1857.

ventral, in pairs in each segment throughout the body; each cirrus composed of 2–4 short, sigmoid, stiff hairs, suddenly inflated in the centre and bifid at the extremity. Setæ (fig. 4) in groups in pairs in each segment after the posterior border of the reproductive band, each group composed of 2–3 straight hairs, of which one is much larger than the rest, and equal in length to the breadth of the body. Œsophagus narrow, without distinct glands, expanding gradually into the intestine at the posterior limit of the reproductive band. Intestine wavy at first, afterwards straight, subsegmented, of a brown colour tinged pink by the vascular system, which contains *red* blood. Androgynous. Testicular sacs immediately in front of the reproductive band; oviducts and ovisacs under and posterior to it respectively; openings of the testicular sacs close to the anterior border of the reproductive band on each side. Spermatozoon (fig. 6 *b*) linear, straight, extremely narrow, with attenuated extremities, 1-160th of an inch in length. Segmental organ single, existing only in those divisions which are behind the reproductive band. Floating-cells of the peritoneal cavity spherical, colourless. Length of body when dry a little less than 1-5th of an inch.

Hab. Tanks and ponds of fresh water among soft, silky *Oscillatoriæ* and decomposing vegetable matter; breeding throughout the year.

Loc. Island of Bombay.

Obs. This worm, which belongs to the genus *Blanonais* (P. Gervais), is very like the figure of *Lumbricus tubifex* (pl. 34. fig. 4 *a*, Encyclop. Méth.), while the setæ of the latter more resemble those of the following species.

Nais albida, H. J. C. (nov. sp.) Pl. III. figs. 47, 48.

Filiform, colourless or white, obsoletely segmented; anterior extremity obtusely pointed, posterior extremity obtuse; mouth subterminal; anus terminal. Reproductive band a long distance from the head, commencing about the tenth segment. Cirrus and setæ (Pl. III. fig. 49) retractile, both composed of minute, short, straight, thick hairs, all alike and of equal length, three in the former and two in the latter, situated ventrally and laterally respectively, in pairs in each segment throughout the body. Œsophagus narrow, surrounded in its first part by four distinct glandular masses, then by hepatic cells, then becoming naked as it passes under the reproductive band, at the posterior border of which it expands into the intestine. Intestine at first wavy, and then straight to the anus. Androgynous. Testicular sacs indistinct, situated just in front of the reproductive band; oviducts and ovisacs in bunches under and posterior to it respectively; openings of testicular sacs undiscovered, those of the oviducts ventral, and passing through the reproductive band. Spermatozoon (fig. 34) capitate, straight, the anterior third or head uniformly enlarged, twice or thrice the thickness of the rest, pointed; the posterior two-thirds gradually alternated to the extremity; total length 1-700th of an inch. Segmental organ double in each segment, with the exception of those under the reproductive band. Floating-cells of the peritoneal cavity colourless, oval, fusiform. Blood *colourless*. Length of body when dry, a little more than 1-5th of an inch.

Hab. Living and breeding in the portions of *Glœocapsa* which grow on the sides of gutters and old walls during the rainy monsoon only.

Loc. Island of Bombay.

Obs.—This species also belongs to the genus *Blanonais*, if it be not absolutely necessary for this, that the hairs of the cirrus should end in hooks.

Having thus premised the specific and general characters of these worms, the reader will be prepared to follow the other observations on them to which I have alluded. In doing this, however, it is desirable that he should remember that they will be entirely confined to *Nais fusca*, except where, for confirmation or to fill up *lacunæ*, it may be necessary to refer to those supplied by *N. albida*.

Integument.

The integument of *Nais fusca* may be stated to consist of two transparent, cylindrical sheaths or layers (fig. 3 *r*, *s*), of which the outermost is composed of cells, and the innermost without apparent structure. Within the latter, again, floats the alimentary canal (which may be viewed as a third cylinder) and the other internal organs of the body.

In the cells of the outer or dermal layer, there is nothing remarkable except the reproductive band (fig. 3 *t*), which especially claims our attention, because it will hereafter be seen to be developed in proportion to the presence of spermatozoa in the so-called "testes," and therefore may perhaps be found to furnish the sperm-cells of these organs.

This band seems to be merely formed by an hypertrophy or inflation of the dermal cells of this part, which, having become distended with vesicles filled with refractive matter (fig. 5), present individually the following composition from without inwards (fig. 5 *c*): viz. a delicate cell-wall, more or less partially lined by a group of vesicles filled with refractive matter, resting on a central sphere equally refractive. There is also a nucleus present (fig. 5 *d*), which in all probability is held in position by a thin layer of endoplasm situated between the vesicles and the central sphere, and from which vital agent or primordial film all the rest of the cell has been produced. For the most part these cells are diffluent in form (5 *a*, *b*), but there are many which are spherical (fig. 7), and the latter average 2- to 3-5600ths of an inch in diameter. The refractive matter with which the vesicles are filled, as well as that which composes the central sphere, appears to be albuminous at first; but while that of the former, in the vesicles of the floating-cells of the peritoneal cavity, which will presently be seen to be identical to all appearance with the cells of the reproductive band, may pass into oil or spermatozoa, that of the latter disappears without further change, or becomes granular in a way which will be better understood hereafter. Certain it is, that the centre of these cells is composed of a solid sphere of refractive substance, which possesses sufficient tenacity to retain its form against the solvent action of water, even after being deprived of the cell-wall (fig. 5 *d*), and which sphere, we shall find by-and-by, in the floating-cells, affords nourishment to the spermatozoa during their development from these cells in the ovisac. We may safely infer, then, I think, that it contains the elements of both albumen and oil, which substances are developed in it at the expense of each other, according to the requirements of the case. Dr. Williams considers the albuminous centre of the floating-cells to be a fibrinous compound*. Thus, then, to recapitulate, we have the cells of the reproductive band composed of a cell-wall, a nucleus, and a number of vesicles surrounding an albuminous sphere, which thus occupies the centre of the cell.

Of the inner sheath or layer (fig. 3 *s*) nothing need be stated further than that it forms the chief skeleton-support of the body of the *Nais*, and may be muscular or fibrous, or both. It becomes separated from the cellular layer under the influence of a solution of bichloride of mercury, and thus may easily be demonstrated. Between it and the alimentary canal is the peritoneal cavity, in the "chylaqueous fluid" of which float the floating-cells, segmental organ, organs of generation, and a good part of the vascular system.

Alimentary Canal.

This (fig. 2 *a*, *f*, *f*) forms, as above stated, a third or central cylinder, suspended inside the second by the delicate loose por-

* Phil. Trans. part 2. p. 625 *et seq.*, 1852.

tions of membrane which compose the dissepiments or partitions of the body, and thus floats freely within this space throughout its whole course, becoming surrounded by the layer of hepatic cells only after it emerges from behind the posterior border of the reproductive band, that is, where the œsophagus ends.

*Floating Cells**.

Throughout the peritoneal cavity, that is, from one end of the *Nais* to the other, are a number of spherical cells (fig. 3 *b, b, b*, and fig. 7), varying in size from 2- to 3-5600ths of an inch in diameter. Most of these are loose, hence the name of "floating-cells," while many adhere to the parietes of the peritoneal cavity through the plasticity of their cell-wall. In composition they are identical, as just stated, with the cells of the reproductive band; and therefore, to avoid repetition, the reader is requested to refer to the latter for this part of their description. How they are produced, I am ignorant; but they make their appearance in the young *Nais* before the hepatic cells and before the reproductive band. If they were reproduced by fissiparation, one ought, among such numbers, to be able to see this taking place in all its stages; but such is not the case: it is true that two, three, or more are often seen adhering together, but this may arise from the plasticity of their coats. As they are seen of all sizes, however, it seems not improbable that their vesicles may sometimes become the young litter, and thus the supply may be kept up; or, indeed, they may be developed from the surface of the peritoneum, which thus acting as a basement-membrane, may have developed them from the commencement. When these cells are subjected to the influence of a solution of bichloride of mercury within the worm, their vesicles expand, burst, and become undistinguishable from the albuminous centre, while the nucleus, remaining, thus becomes distinctly visible (fig. 7 *c*): when also they issue into pure water, from a rupture of the body, the same changes take place; but when the internal vesicles have been formed for some time, or present a yellowish tinge, they remain unaltered; in which case the delicate cell-wall frequently disappears and leaves them adhering to the refractive albuminous sphere, which is just as tenacious as that of the cells of the reproductive band (fig. 7 *b*). Indeed, the composition of the whole cell, as before stated, is exactly the same.

Hepatic Cells.

These are spherical or diffluent in form (fig. 8), and composed

* For an account of these cells generally in the Invertebrate animals, and the "Chylaqueous Fluid" above mentioned, see Dr. T. Williams's excellent paper, Phil. Trans. 1852, p. 595. pt. 2.

of a cell-wall, vesicles, nucleus and albuminous centre, like the floating-cells, but with the following exceptions, viz.—that some of the "vesicles," though retaining their original shape, have acquired a yellowish tinge; others have become of an amber-colour, and have flowed together to form bile-globules; while a third set have apparently shrunk into abortive, brownish, or colourless granules; many also of the hepatic cells have lost their cell-wall, thus leaving nothing but the parts just mentioned adhering to the surface of the albuminous sphere (fig. 8 *a*). The hepatic cells are so loosely attached to the intestine, that, under the slightest pressure, many of them separate from it, and may be observed free among the floating-cells of the peritoneal cavity, when the only difference that can be observed between those which are spherical and the floating-cells, is the yellow tinge of the vesicles: neither is there any earlier stage of development of these cells than this in the hepatic layer; hence it becomes a question, from whence are the hepatic cells originally derived?

To me, the hepatic cells appear to be merely the final stages of development of the floating-cells, for the following reasons: First, from there being no cells earlier in development in the hepatic layer than those of a spherical form, in which the vesicles are already tinged yellow, and in which state, but for the presence of this colour, they would be undistinguishable from the floating-cells. Secondly, from the hepatic cells being enclosed by no general membrane, but attached loosely to the surface of the intestine. Thirdly, from the plasticity of the cell-wall of the floating-cells enabling them to attach themselves to the intestine, as we have seen them adhering to one another and to the surface of the peritoneal cavity. Fourthly, from there being floating-cells in the abdominal cavity of many Infusoria, as well as in the stomach of *Planaria* and the Rotatoria, where the sequence of development from the young cell with uncoloured, to the older cell with coloured vesicles and bile-globules, is always present. And, lastly, from the free microscopic *Filariæ* that have come under my observation, both from the salt- and fresh-water pools of the island of Bombay, having the abdominal parietes of the peritoneal cavity covered with biliary oil-globules as well as the intestine; showing that, if the latter are not derived from the former, both the abdominal as well as the intestinal layer of the peritoneum are capable of producing them.

If, then, we admit that the hepatic cells are derived from the floating cells of *Nais*, then these cells are homologous with the floating cells of the Infusoria, e. g. *Nassula, Prorodon, Otostoma*, &c.*

* See "Spherical Cells," Ann. Nat. Hist. vol. xviii. p. 124, 1856.

With reference to the formation of the bile, it has already been observed, that the vesicles of the floating-cells may form a new generation; and it will also be seen hereafter that they, under other circumstances, may produce spermatozoa. Hence it might be inferred, that where neither of these developments take place, the endoplasm or vital part, which must be present with the oil, perishes; and that the former being thus lost, their oleaginous contents become subject to the laws of inanimate matter, and so more or less flow together, to form the large amber-coloured bile-globules which appear scattered over the intestine.

Segmental Organ.

This (fig. 2 *g* and fig. 3 *n*) is the name proposed by Dr. T. Williams* for a tubular organ that exists in almost all the segments, with the exception of those containing the generative organs, which, as this gentleman has also intimated †, are but mere modifications of it. In some species it is single, in others double (fig. 48 *h*), as will be seen by looking at the figures of the two *Naides* now under consideration.

In *Nais fusca* the segmental organ is single. It is absent in the segments before the reproductive band; attains its maximum size in those immediately behind it; and diminishes gradually towards the tail, where it almost becomes obsolete. Where best developed, it consists of an elliptical body and tubular portion. The former (fig. 3 *p*), which chiefly owes its size to a more convoluted state of the latter at this part, is situated on the right side of the body close to the anterior partition or dissepiment, through which its tubular portion is prolonged for a short distance, and then terminates in an expanded, slightly constricted, and marginated mouth (*o*), furnished with long cilia. From this the tube passes back through the elliptical body, in which it becomes exceedingly tortuous, and after issuing from its posterior extremity, makes two sinuous revolutions round the segment, and then also ends on the right side (*q*), midway between the partitions of the segment, where it opens externally and ventro-laterally. Throughout, this tubular organ floats freely in the peritoneal cavity, except where it is fixed by passing through the partition, and where it opens externally; and throughout, also, it is imbedded in a fine granular substance disposed in lobes around it (into which, on one occasion, I *thought* I could perceive the branching-out of a vessel from the tube). The cilia round the internal opening are much larger than those which line the tube, and the movement of the former sluggish compared with that of the latter, which is very rapid; neither is there any par-

* Ann. and Mag. Nat. Hist. vol. xix. p. 393, 1857. † *Idem.*

ticular direction manifested by the cilia of the internal opening, while that of those in the tube is distinctly backwards, or towards the external opening. What the direction of the contents of the tube may be, I have not been able to determine, for I have never seen anything pass through it; and the floating-cells in contact with the internal opening indicate no current at all, but merely displacement, when struck by the cilia. No current can be seen, either, at the external opening, when carmine is added to the water for ascertaining this; but the tube throughout becomes continually and gradually distended, and every now and then contracts suddenly, to empty itself, after the manner of the contracting vesicle and its tubular system in the Rotatoria and Infusoria, or perhaps, more particularly, in *Lacinularia*, where, according to Prof. Huxley, there is no "contracting vesicle*."

Of the use of this organ I am ignorant, but undoubtedly it is homologous with the "contracting vesicle" and its tubular system, both in the Rotatoria and many of the higher, if not in all the Infusoria. In *Nais fusca*, no current, as just stated, appears to pass into or out of either its internal or external orifice, although there is a rapid ciliary movement going on throughout the whole of the intervening tubular portion; this motion again appears to be from within outwards, from which it might be inferred that the contents of the tube take the opposite direction, and therefore that the fluid with which it becomes filled comes from without. If we direct our attention to the cilia which cover the rectal part of the intestine in *N. fusca*, &c., this movement is evidently from behind forwards, while it is equally evident that the contents of the intestine pass in the opposite direction; and again, if we watch the cilia on the sides of a *Planaria*, their motion will be observed to be towards the head, while the current produced by them, as indicated by the neighbouring particles, is distinctly backwards. This apparent contradiction, however, appears to derive explanation from the single cilium of some of the polymorphic Monads, which, undulating from the base towards the extremity, draws the surrounding particles towards itself, and thus the motion appears one way while the current is another†. Yet some of the larger Rotatoria, in which the contracting vesicle is also very evident, and opens freely into the cloaca, one would think ought to afford us means of proving whether the fluid with which it becomes distended really comes from within or without. I have, however, tried this, by placing carmine in the water with a large species of *Philodina*, but never could detect any in the distended

* Quart. Journ. Microscop. Soc. Lond. vol. i. p. 3, 1853.

† Annals, vol. xx. pl. 1. fig. 10.

vesicle; possibly the opening into it, though freely admitting water, might not be large enough to admit particles of carmine. Then, again, the facts which I have brought forward to prove that the "contracting vesicle" in the Infusoria is filled from the vascular system connected with it*, are also opposed to the view which I have assumed of the manner in which the tubular part of the "segmental organ" in *Nais* is filled; while the latter theory, after all, only rests on the inference that the direction of the movement in the cilia indicates the opposite in the direction of the contents. The question, therefore, is still open for inquiry. It is easy enough to see the large contracting vesicle in the rotifer *Brachionus* become distended and contract, and there can be little doubt that its contents pass outwardly; but the slowness with which it becomes refilled affords us no information as to where the fluid comes from; so that, before this is determined, it is impossible to say to which system this organ belongs, viz. whether respiratory or renal. At one time I thought, from the intimate connexion of the "segmental organ" in *Nais* with the generative system, whose organs, as before stated, are but mere modifications of it, and all equally contractile, that it was the rudimentary form of the kidney in higher animals; but subsequently observing the direction of the ciliary movement in the alimentary canal of *Nais* to be opposite to that of its contents, I am now inclined rather to consider its functions respiratory; at the same time, it is difficult, if this be the case, to conceive why it should have an internal opening—while, again, it is not always that the contents of the tube pass in the opposite direction to the movement of its cilia, as we shall see hereafter, viz. in the floating-cells of the peritoneum, which get into the ovisac through the so-called fallopian tube, which is but a modification of the tubular portion of the segmental organ in *front* of the elliptical body, and has the motion of the cilia in the same direction. Are the functions of this organ both excretory and respiratory? or, in short, what are its functions? and what is the use of the tubular part, and what that of the fine granular matter which surrounds it, respectively? I must leave future inquirers to determine, merely observing that the question is one of much interest, as the organ appears to me to be traceable through the "contracting vesicle" in Infusoria, even into the "vacuole" of the vegetable kingdom†.

* Annals, vol. xviii. p. 126, 1856.

† Since the above was written, I have distinctly observed the motion of the body-cilia of a species of *Spirostoma*, when under a slip of glass, to be whip-like, and the neighbouring particles to follow the *forward* movement of the lash, which of course is the most powerful; while the wave in the cilia in totality was also *forward*, quite contrary to that which is observed

Testes.

The so-called testes (fig. 2 *b* and 3 *d*) are situated immediately in front of the reproductive band, and consist of simple contractile sacs opening externally by a short duct (*d*) close to the anterior border of this band. They may be empty, or contain spermatozoa in bundles (*a, a*), the cause of which bundling will appear hereafter. With the spermatozoa are generally a number of loose, irregular, hard granules (6 *a*), and an albuminous mass, which will be seen, by-and-by, to be the effete remains of the spermatophorous elements. I have also observed cells (*c*) present in the anterior part of the sac, like those of the reproductive band and peritoneal cavity, but with some brown matter in each, which is particularly deserving of attention, because it will be found hereafter to mark the sperm-cell throughout. Lastly, in one instance, four small globular masses of granules (*d*), from which radiated, in all directions, attenuated linear bodies resembling the spermatozoa at an early stage of growth, were forced out from the testicular sacs; but beyond this, the so-called testes in *Nais fusca* have not afforded me any other stage in the growth of the spermatozoa, with the exception of the full development, although many scores have come under my observation. The fully-developed spermatozoon (fig. 6 *b*) is about 1-160th of an inch in length, linear, and so narrow that I have never been able to see its attenuated extremities satisfactorily with a magnifying power of 450 diameters.

It may now be asked, from whence the cells come, from which the spermatozoa are developed,—assuming that which will be proved hereafter, viz. that those cells which were observed in the testes with the brown matter in them were undoubtedly spermatic cells? In reply to which I can only state, that, much as I have sought for a duct in the so-called testis communicating with the peritoneal cavity (and much as, *à priori*, we might expect one to exist like that of the segmental organ (fig. 3 *o*) and the so-called fallopian tubes (fig. 3 *e*′) leading into the ovisacs, from the testicular sac and oviduct being but mere modifications of the segmental organ), I have not been able to find any; while the contour of the testes being so neatly defined, and the contents, on pressure, always escaping through the external orifice, leads me to the conclusion that there is none. Again, the testes being filled with spermatozoa only when the reproductive band is well developed, and empty and contracted when it is absent, leads one further to infer that the reproductive band is in some way connected with the testes; and that the cells of which it is

in *Planaria*, &c. The movement of the cilium in *Spirostoma* was precisely that of the line in fly-fishing.

composed, being to all appearance, as before stated, identical with the floating-cells (from which we shall by-and-by find the spermatozoa to be developed in the ovisac), have some means perhaps of getting into the testes by a channel as yet undiscovered, and there becoming subservient to the same purposes; for, as I have already observed, there are cells in the testes sometimes which bear all the characters of the spermatic cells of the ovisac.

Thus the so-called testis appears to be a sac for holding the sperm-cells during the development of the spermatozoa, rather than for providing these cells; while, should the latter be derived from the reproductive band, this band would be more appropriately termed the testis.

Although, however, I have not been able to trace the development of the spermatozoa in the testes of *Nais fusca*, yet I have been able to do so in *N. albida* (Pl. IV. figs. 31–33); but as the process is the same as that which I shall have presently to detail in the ovisac, it is better not to go further here than barely to mention this fact.

Oviducts; Fallopian Tubes; Ovisacs.

The oviducts (fig. 2 *c* and 3 *f*) are elliptical, transparent, delicate sacs situated under the reproductive band, on each side of the median line; they have wrongly been called "uteri," for they are no more deserving of this name than the oviducts of a fowl. They are endowed with a motile power which manifests itself almost rhythmically, by sudden contraction, so that at first they look like large "contracting vesicles." Each has three apertures, viz. one (*g*) inferior, which opens ventrally, and may be termed the vaginal aperture; another, in the anterior extremity, which is continuous with the so-called fallopian tube (*e*); and the third in the posterior extremity, which is continuous with the ovisac (*h*). It is this saccular duct which probably holds the ovum for a short time, during the addition of the horny shell.

The so-called fallopian tubes (*e'*) are, again, wrongly named, because they do not convey the ova into the ovisac, but, on the contrary, as we shall see presently, convey the floating-cells of the peritoneal cavity into the oviduct, previous to their passing into the ovisac, where they become sperm-cells. They are simple tubular prolongations of the oviduct, which, passing through the partition of the preceding segment, thus become fixed in their position, and open freely into the cavity of the peritoneum close to the testes (*e*). Each tube is ciliated internally, and terminates in an expanded aperture, whose inner margin is also surrounded by a fringe of long, straight, coarse cilia. The direction of the motion of the cilia in the tube is backwards, and very rapid, as in the tube of the segmental organ, while that of the long cilia round the mouth is comparatively slow, and indicates no more current among the floating-cells and other particles of the peritoneal cavity in juxtaposition, than those on the corresponding part also of the segmental organ. Nor have I ever seen any of the floating-cells *in* the fallopian tube, though frequently *in the oviduct* (fig. 3 *f*). It is this instance of the floating-cells passing into the oviduct *with*, instead of against, the movement of the cilia, to which I alluded when speculating upon the functions of the segmental organ.

The ovisacs (fig. 2 *d* and 3 *h, h*) are also extremely delicate, transparent, contractile bags, which, commencing by a narrow neck from the posterior end of each oviduct, extend backwards to the second and third segment behind the reproductive band, where they terminate in round extremities; beyond this there is nothing remarkable in them when empty, except that they are enveloped and partly supported, as they float in the peritoneal cavity, by long loops of the vessels termed "the branchial system" by Dr. Williams in *Nais filiformis**, but which here are evidently of great service in affording nourishment to the ovum and the sperm-cells when they are undergoing development in the ovisac.

Ovary.

We must assume here, as in many similar cases that however thin and attenuated the ovisac may be, the inner surface of its posterior extremity can furnish a point or particle which may become an ovicell; and, for reasons which will be better understood by-and-by, that the ovicell which it can thus produce is composed of a cell-wall lined by a layer of endoplasm, in the periphery of which is the nucleus, consisting of a nuclear cell and nucleolus; that the nuclear cell is filled with endoplasm charged with several points or nuclei, which become surrounded by, or develope around themselves, as many cells; and that finally the nucleolus perishes, and leaves these cells alone, or rather enclosed in a delicate membranous envelope (the nuclear cell expanded?). Thus we obtain a group of ova, (fig. 9 *c*) which, whether developed in the way mentioned or not, make their appearance under this form, free and detached from the surface of the ovisac. In general there is only one of these groups present; but there may be two (fig. 9 *c*), or even three. Each ovum of the group is, as usual, composed of a cell-wall lined or filled with endoplasm, and bearing in one part the nucleus or "germinal vesicle," which consists of a diaphanous cell whose cavity forms the "transparent area," in which again

* Report of the British Association for 1851, p. 183.

is the nucleolus or "germinal spot." There is seldom more than one ovum at a time in an appreciably advanced stage of development (fig. 10 *d*), and, if there be two, one is much more so than the other (fig. 11 *d, e*).

As the ovum, in process of development, increases in size (fig. 10 *d*), yelk-granules are developed in its endoplasm,—in fact, the endoplasm becomes the yelk; the germinal vesicle enlarges; it also presents an endoplasm in its interior, that is, in the "transparent area," in which several distinct granules or points appear (fig. 11 *f*), that become respectively the nuclei of so many new cells (fig. 12 *f*), and when the latter are nearly formed, the germinal spot or nucleolus perishes (*g*). The ovum now appears to have attained its largest dimensions (fig. 11 *d*); but the next stage, viz. the disappearance of the germinal vesicle and the liberation of its contents, I have not witnessed. It is from the germinal vesicle undergoing these changes that I have assumed the single ovicell to undergo similar ones, prior to the development of the "group" of ova; that is, that those of the germinal vesicle are but a repetition of what have occurred in the first ovicell. How far I am right in this matter, is left for others to decide. I would here also remark, that the granules or cells of the yelk appear to be multiplied by that process of cell-formation called "budding" (fig. 51), so beautifully seen in the little *Lemna*-like *Physodictyon* (Kz.), and the so-called "ferment-cells," and that it bears a close resemblance to that which I have described in the "ovules" of *Spongilla** and *Euglena*†.

[To be continued.]

X.—*On the* Winteraceæ. By John Miers, F.R.S., F.L.S. &c.

The only two genera belonging to this small group that were known in the time of Jussieu, were placed by that celebrated

* Annals, vol. xviii. p. 231. pl. 6. fig. 39.

† *Idem*, vol. xx. pl. 1. fig. 16. Since my description of the "Ultimate Structure of *Spongilla*" was published in this volume, I can of course no longer regard the germs in the spherical cells of the "capsule" as "ovules," but as the contents of these cells, which themselves are the ova,—each spherical cell in totality producing an "ampullaceous sac," which appears to me to correspond to the polype of a polypidom. This would make the "germs" analogous to the "yelk-granules" of the ovum of *Nais*, and hence also the analogous budding appearance. I have also described a similar budding in the cells of *Euglena viridis* (*l. c.*), and there is something like this again in the production of the oleaginous and amyliferous cells (?) of the Diatomeæ; while latterly it has struck me that these may be produced by a budding in the first instance from what I have termed the "glair-cell" (Annals, xviii. p. 241).