

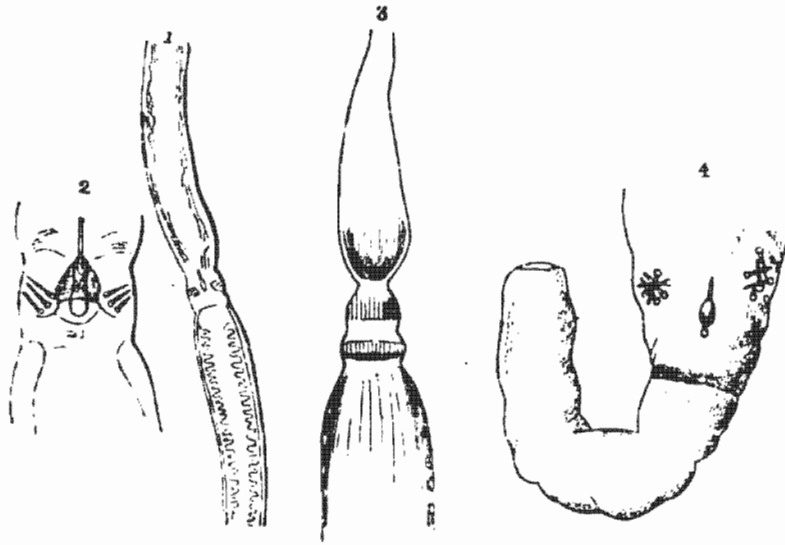
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the exact resemblance of these points to the eyes of the annelidans,* and from the very obvious manner in which the worms evince their sensibility to the impressions of light. The species have no other visible exterior organs: they move in an even continuous manner by undulations, frequently imperceptible, propagated along the body, which they often throw into knots and strictures, or extenuate to that degree, that the ordinary breadth shall be more than four times its diameter when in this state of extension.

The internal structure is most easily seen when the worm is slightly pressed between plates of glass, and placed under the microscope. It is more beautiful and complex than the plainness and simplicity of the exterior would lead us to believe, nor indeed can I unravel or describe it with the accuracy that is desirable. The mouth is difficult to be detected, and its position and form are generally indistinct, but sometimes it becomes evident enough, and in other cases, its exact place is often shown by a slight sinus or emargination in the anterior extremity in which it is placed: it is a simple circular pore without any hard parts. (Plate XVIII. Fig. 5, *m*.) From it an intestine descends down the centre of the body, in a straight or undulating line, according to accidental circumstances of position, to the opposite extremity, where it opens outwardly by a pore similar to the mouth, and equally simple. The intestine (Pl. XVII. Fig. 5 *i. i.*) is a cylindrical tube of a firmish texture, and of nearly equal calibre throughout, though subject to partial and temporary constrictions and dilations, and, as just remarked, its course can be made straight or tortuous at the will of the animal, evidently to accommodate it to the length of the body in its extreme variations, for being apparently of a much less contractile tissue than the body itself, the intestine is doubled in sinuous folds when the worm contracts and shortens, but when this draws itself out in a long line, the intestine becomes a straight canal, with something of the character and office of a vertebral column. In tracing the intestine from the mouth downwards, the structure appears to be homogeneous, and alike throughout in the species placed in the second section of the genus, but in the true Nemertes, we meet with some remarkable peculiarities towards the middle of its course. First, we perceive on each side a small circular spot or cavity, in each of which are three spines (Fig. 1, 2, 4,) with their sharp points directed outwards; beneath these there is a cup-shaped organ (Fig. 3,) encircled above with a faintly plaited

* See Muller "sur les yeux problématiques des Annelides," in the *Annales des Sciences Nat.* xxii. p. 19; and Grant's *Outlines of Comparative Anatomy*, p. 252-3.



membrane, and armed in the centre with a strong spine, which can be compared to nothing more aptly than to a cobbler's awl in miniature, the part representing the handle being very dark, and the point transparent and crystalline, (Fig. 2, 4.) This apparatus is placed within the intestine, is visible only when this is compressed, and is, as I believe, stomachical, having some distant analogy with the proper digestive organs of the *Laplysia* and *Bulla*; and in confirmation of this view it may be remarked, that the œsophageal part of the intestine appears to be simple, while the inferior portion exhibits a plaited structure internally, (Fig. 1, 3.) In our Pl. XVII. Fig. 5, this part is represented as being suddenly narrowed, and after descending a little it bends and ascends for some way, when it is again deflected and ends abruptly in the body; and such undoubtedly were the appearances in the specimen from which the drawing was made, and in others which I have examined; but such a disposition of parts is rather uncommon, the usual course being for the intestine to descend tortuously to the anus. I believe that in the contrary instances, the natural adhesions of the alimentary tube have been ruptured by the compression to which the body had been subjected, and that by its contractions, the intestine was then forced into this unnatural position, for that the intestine terminates and opens at the posterior extremity is certain, the contents having repeatedly been seen to be evacuated there through a small pore. While examining specimens, a large portion of the intestine will occasionally be seen rolling itself from the mouth, like a very long proboscis, until perhaps fully one half of the tube is evolved,—a fact which I also attribute to the compression of the plates of glass, for I have

never observed the worm naturally to evolve a proboscis, though every pains may be taken to force it to do so, by irritations, by keeping it in sea water until it corrupts, by immersion in fresh water, or in spirits.*

The intestine lies loose in a distinct abdominal cavity (Pl. XVII. Fig. 5, and Pl. XVIII. Fig. 1,) or canal excavated through the centre of the body. This canal seems to contain besides a grumous fluid, which may frequently be observed moving rapidly up and down in irregular currents dependent on the contractions of the worm or intestine, and not at all analogous to the currents within the tubes of zoophytes. It is fringed along each side with a close series of vesicles or cells formed, in the true Nemertes, apparently by the folds of a membrane, while in the sub-genus *Borlasia*, they are separate, and as it were excavated in the parenchyma of the body, (Pl. XVIII.) The resemblance between this structure and what have been called *cæcal appendages* in some allied worms is obvious, † though not very exact, for they are not produced from, nor in organic connection with the alimentary canal, as is manifest from their remaining unaffected during the motions of the latter, which moreover may be removed entirely from the body without bringing with it, or tearing away, the presumed cæca. These are always full of some opaque matter in the Nemertes, and some observations lead me to believe, that it varies in intensity at least according to the nature of the animal's food, whence I conclude they belong chiefly to the digestive system; while the ova appear to be developed in their interstices, and in the space between them and the skin, (Pl. XVII. Fig. 2.) But in *Borlasia* the cæca are more distinctly vesicular and isolated, and although the depth of colour of their contents varies also, yet they are usually clearer and paler than the surrounding parenchyma, or as it were empty, and I have plainly seen in them, not often, indeed, oviform bodies, which again have not been detected in the interstices, (Pl. XVIII. Fig. 3.) We seem, then, to have combined in them a duplicity of function,—they are both nutrient and

* In some cognate species, Otho Fabricius observed the intestine to be extruded when no compression was used, but still under circumstances easily reconcilable with our explanation. "De officio antico infero tubulum pallidum in agone mortis exserit:" *i. e.* *Planaria rubra*, Faun. Grœnl. p. 324; also p. 325.

† Compare our figures of this structure with that of the *Diplozoon paradoxum* of Nordmann in Ann. des Sciences Nat. V. xxx. p. 362, pl. 20. This figure, on a reduced scale, is copied into the Cyclop. of Anat. and Physiology, i. p. 654, fig. 328; and into Kirby's Bridgewater Treatise, pl. 1. B. fig. 4. The comparison may be usefully extended to the *Annelides*, Cyclop. of Anat. and Phy. i. p. 169, fig. 70; Roget, Bridgew. Treat. ii. p. 103, fig. 260; and to the *Tenia*, *Ibid.* ii. p. 83, fig. 247.

uterine cells,—but how far this view can be admitted, I must leave to the determination of some better observer.*

Many specimens, and several species, had been examined before a trace of a nervous system could be detected, and I was ready to conclude that these worms were truly acritous, when I was prevented falling into this error by the discovery of it in the *Nemertes octoculata*. In this species the nervous system is distinct, and I have been able since to see it in several others more obscurely. It consists of a single oblong or ovate ganglion laid over and above the œsophagus posterior to the heart; and from this ganglion nervous threads radiate in every direction, which are unbranched, of nearly equal sizes, and soon lost in the body. (Pl. XVIII. Fig. 2.) The system has obviously a nearer relation to that of some of the lower Molluscs than to any of the typical annelidans, a fact which, however, is not anomalous, for Mr Owen has made the same remark in reference to some intestinal worms.†

The circulating system appears to be complete, though very simple. Immediately behind the eyes there may be observed a roundish spot on each side of a reddish colour, indicating the position and figure of organs which are perhaps the centres of this system. These organs are connected by a cross vessel; and from their inferior aspects a fine vessel departs which, running along each side between the intestine and skin, encircle the body with a continuous canal of equal calibre in every portion of its long circuit. (Pl. XVII. Fig. 5.) It is uncertain whether these side-vessels are connected by smaller transverse inosculation: I believe they are, and that the pale lines which we observe to cross the body in some species, at short and regular intervals, are produced by these vessels of communication. (Pl. XVII. Fig. 1.) On examining Fig. 5. another vessel will be seen winding down the middle, along the surface of the alimentary canal, in an undulating line. That it has any connection with the centre of circulation or lateral vessels I cannot affirm, for I could neither trace its origin, nor its place of termination, nor can I perceive that any vessel goes from it, but we may be allowed

* Since this was written, farther observations have almost satisfied me that the apparent differences in the formation of the cœca in these subgenera are dependent, in a great measure, on the state of the worm in regard to repletion,—the distinct vesicle-like spaces being formed by the extension and coalescence of the cœca around a space filled with ova, which would seem therefore to be always exterior to the cœca.

† Proceedings of the Zool. Soc. of London, pt. lii. p. 28; and Trans. of the Zoological Society, i. p. 328-9.

to infer, from its analogy with the Planariæ,* that it belongs to the circulating, and not to a nervous system. I have never detected the slightest appearance of a fluid in motion in any of the vessels; and were I to call the central vessel an aorta, and to decide that the lateral vessels were for the purpose of returning the refluxing fluid to the heart, I might justly be censured for indulging in a fancy which has no observation in its support. We are too liable to assign to the organs of these lower creatures the names of what we deem their analogues in higher classes, and with the name to associate an idea of sameness or identity in their functions,—a propensity which has not seldom led to error.

The Nemertes live under stones and in mud between tide marks: they avoid the light, and love obscurity. They are numerous in individuals, but how they are propagated is yet conjectural. At certain seasons I have seen within the body small roundish oviform grains lying unconnected with any particular viscus, but of the real nature of these, no observation has enabled me to form an opinion. Specimens have also occurred in which there seemed to be a beginning separation of the body into two or more parts, but these marks of division might be the effect of injury. The species are very tenacious of life: if cut into several pieces, each lives and moves, and perhaps in time each will grow up to a complete and perfect worm. When placed in fresh water they shew, by instant contortions, how painful and poisonous is this fluid to them. They soon break into pieces, disgorge portions of the viscera, and speedily die and dissolve into a soft jelly.

* *A gizzard near the centre of the alimentary canal, armed with spines.*—Subgenus NEMERTES.

1. *N. gracilis*, of a uniform olive-colour, very long and filiform; eyes numerous. (Plate XVII. Fig. 1.)

HAB. Under stones near low water-mark. Berwick Bay.

This worm, when drawn out to its ordinary length, as in the act of creeping, measures about 20 inches, while it is not more than a line in breadth: body linear or somewhat attenuated at the posterior extremity, compressed, smooth, soft and glutinous, very contractile, of a uniform olive-green colour, lighter on the ventral surface; when viewed through a common magnifier it is seen to be marked with numerous pale cross lines, and the sides appear lighter than the centre: head obtuse, rounded in front, tinted with yellow, and dotted with numerous eyes along each side reaching to the two orange-co-

* See figures illustrative of this in Roget's Bridgew. Treat. ii. p. 250, fig. 346; and in Cyclop. of Anat. and Physiology, i. p. 653, fig. 327.

loured spots, which are about one-eighth of an inch from the extremity.

2. *N. lactiflorea*, of a uniform cream-colour, often dusky down the middle, linear-compressed; eyes many. (Plate XVII. Fig. 2.)

Planaria lactiflorea, *Johnston*, in *Zool. Journ.* iii. 489.

HAB. Under stones between tide-marks—common in Berwick Bay.

Body linear, vermiform, about three inches long when extended, but very contractile and polymorphous, smooth, of a uniform cream-colour in general, sometimes flesh-red, often dusky down the centre from the opaque contents of the intestine, marked with two red spots near the head, anterior to which are the ocelliform specks arranged on the sides in two more or less perfectly separate clusters: the eyes are unequal in size, and about 12 in number on each side: mouth subterminal: anus terminal.—When compressed, or otherwise irritated, this species has been repeatedly noticed to exude a milky fluid from its whole surface.

There is what I consider to be a variety of this species of a reddish orange-colour, with dusky undulations down the middle from the interranea. (Plate XVII. Fig 3,) It is comparatively rare, and the depth of its colour may proceed from some difference in food, or in its state of repletion. The resemblance between it and the *Planaria rosea* of Muller (*Zool. Dan.* tab. 64. fig. 1, 2,) is sufficiently great to suggest a suspicion of their identity, but Muller expressly states that the latter is destitute of eyes. (See the *Prod. Zool. Dan.* p. 221.)

3. *N. quadrioculata*, of a yellow colour tinted with green; narrow, elongate: eyes 4, remote. (Pl. XVII. Fig. 4.)

Planaria quadrioculata, *Johnston*, in *Zool. Journ.* iv. 56.

HAB. Sea shore under stones, rare. Berwick Bay.

Body $1\frac{1}{2}$ inch long, soft, flattened, contractile, narrowed towards the tail, of a yellowish maculated colour, with a dirty greenish intestinal line down the middle; mouth rounded; eyes 4, placed in a square form and rather distant.—The maculated appearance proceeds from white oviform bodies.

4. *N. melanocephala*, yellow or yellowish-green, linear-elongate; head with a dark transverse spot, and 4 eyes. (Plate XVII. Fig. 5.)

HAB. Between tide marks. Berwick Bay, not common.

Body from 1 to $1\frac{1}{2}$ inch long, narrow and vermiform, tapered at

the tail, of an olive or yellowish colour, the latter tint most predominant in front, which is marked with a black spot of a quadrangular form, and 4 eyes placed nearly in a square. It was in this species that the structure peculiar to the genus was most easily to be traced.

5. *N. pulchra*, linear-elliptical; of a flesh-red colour, with a series of scarlet spots along each side, or of a uniform aurora-red; eyes numerous, unequal. Plate XVII. Fig. 6.

HAB. Amongst corallines, and in old shells, &c., in deep water. Coast of Berwickshire, frequent.

Body about an inch in length, and two lines in breadth, compressed, narrow, elliptical, the front marked with numerous black specks, irregularly arranged and visible with the naked eye. Many specimens are of a uniform aurora-red colour, considerably paler on the ventral aspect, while others are beautifully marked along each side with a series of large scarlet spots; the former are perhaps males, or more probably individuals in a barren condition, while the others seem to be full of mature ova, for an examination of the spots through the microscope shows that they are produced by clusters of oviform bodies lying in the interstices of the coecal appendages.

This and the first species contrast remarkably in their form, and show the extremes to which this character is subject. The structure of the stomach is like that of its congeners, excepting in there being five or six spines on each side of it, instead of three, which is the usual number. Immediately under the hearts, we observe a large, somewhat muscular viscus, apparently hollow, and lying in the course of the intestine, but apparently unconnected with it, for in the individual which served for our figure, the intestine had been extruded from the body, and entirely expelled by the contortions of the worm produced by impure sea-water. Of its office and nature I can offer no opinion, but I may remark that in all the species a greater duskiness in its site shows that a similar organ exists in all.

* * *Alimentary canal apparently homogeneous throughout.* Subgenus, *BORLASIA* *

6. *N. olivacea*, of a dark olive colour; eyes four, placed in a square. Plate XVIII. Fig. 1.

* A name given by Oken to the *Lineus* of Sowerby, co-equal therefore with the *Nemertes* of Cuvier, equally unnecessary, and as originally applied altogether inadmissible. Because it commemorates a worthy naturalist, Dr William Borlase, author of the History of Cornwall, I rejoice in being able to affix it to a group hitherto uncharacterized.

Planaria bioculata, Johnston, in Zool. Journ. iv. 56.

HAB. Between tide-marks. Berwick Bay.

Of a dusky olive colour, often tinted with purple in front, and paler at the posterior extremity, which is more acuminated than is common in the genus: body linear and narrow, from three to six inches long, a line or so in breadth; smooth and compressed: anterior extremity rounded, obscurely marked with a red spot over the site of the heart. In the Zoological Journal, I have described this species as having only two eyes, but as this appears to be a mistake, or at least not constant in the species, it has become necessary to alter its designation.

When pressing a portion of the body between the plates of glass, I have occasionally seen some bodies escape, of a curved fusiform shape, acute at both ends, and marked towards one of them with a pale circular spot. Plate XVIII. Fig. 1. They have shown no signs of life, nor can I say what they are, though it has occurred to me, that they may be embryo-young; and that the worms may in fact be ovo-viviparous.

7. *N. octoculata*, of a uniform light reddish-brown colour; eyes 6 or 8, placed in opposite pairs on the sides of the head. Plate XVIII. Fig. 2.

Planaria octoculata, Johnston, in Zool. Journ. iv. 56.

HAB. Under stones, between tide-marks. Berwick Bay.

Body linear, narrowed posteriorly, 3 inches long, and about $\frac{1}{8}$ th of an inch broad, compressed, of a light reddish-brown colour, with a darker spot in front over the hearts: eyes 6 or 8, and in some specimens I have seen 7, three on one side, and four on the other. It appears therefore, that the number of the eyes, on which Muller and others have reckoned confidently as a good and invariable character, is not to be implicitly relied on.

8. *N. purpurea*, of a uniform purplish-red colour, paler underneath; eyes 6-8. (Plate XVIII. Fig. 3.)

HAB. The sea shore under stones. Berwick Bay.

Worm 2 or 3 inches long, smooth and glutinous. From the darkness of its colour, the spot indicating the position of the heart is scarcely visible until the body has been compressed. The number of eyes is the same as the preceding, and liable to the same variety. In this species the ova were distinctly seen to be contained within the cœcal vesicles, which, when compressed, assumed a pyriform shape, having the slender end toward the intestines.

9. *N. rufifrons*, of a yellowish colour verging on rose-red anteriorly; mouth dark red; eyes none; body very slender. (Pl. XVIII. Fig. 5.)

HAB. Under stones between tide-marks, in Berwick Bay, frequent.

When fully stretched out in creeping, this worm is fully two inches long, but very narrow and filiform, or rather tapering to a point posteriorly; it is of a yellowish colour for the greater part, but the anterior extremity is a rose-red, while the apex or mouth forms a dark red speck. When slightly compressed between plates of glass the intestine may frequently be seen unrolling itself from the circular and terminal mouth in the manner that some annelidans unroll their proboscis. The worm will thus sometimes nearly disembowel itself. The intestine is white, round and filiform, without any appendage.

Explanation of Plates.

Plate XVII. Fig. 1, *Nemertes gracilis* of the natural size. 1. * Anterior portion of the same magnified; Fig. 2, 2, *N. lactiflorea*, both figures of the natural size. 2. * Anterior portion magnified. 2 * * Caudal extremity magnified, shewing the ova exterior to the cœca; Fig. 3, *N. lactiflorea*, var. *brunnea*. 3. * The head magnified; Fig. 4, *N. quadrioculata*, natural size; Fig. 5, *N. melanocephala*, natural size. 5. * The same magnified; Fig. 6, *N. pulchra*, natural size. 6. * The head of the same magnified.

Plate XVIII. Fig. 1, 1, 1, *Nemertes (B.) olivacea*, of the natural size. 1. * The anterior and middle part magnified. 1 * * Embryo young? of the same contained in the body of some specimens. Fig. 2, *Nemertes (B.) octoculata*, natural size. 2. * The anterior portion magnified; Fig. 3, *Nemertes (B.) purpurea*, natural size. 3. * The head, and a portion of the middle, and the tail magnified, shewing the ova within a kind of vesicle. Fig. 4, *Nemertes (B.) rufifrons*, natural size. Fig. 5, A portion of the anterior extremity magnified.

Of the wood-cut Figs. 1, 2, represent the stomach and a portion of the intestine of *Nemertes lactiflorea*; 3, and 4, of the *N. pulchra*; 3, shewing it previous to being compressed, 4, after being compressed between plates of glass.

