ON THE ANATOMY OF CESTODES.


[Received February 9, 1915: Read March 23, 1915.]

(Text-figures 1–8.)

XVI. ON CERTAIN POINTS IN THE ANATOMY OF THE GENUS AMABILIA AND OF DASYUROTÆNIA.

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Although several observers, especially Cohn and Diamare (whose memoirs will be referred to later), have collected a large number of facts relating to the structure of the genus Amabilia, there still remain a few points upon which these authorities have not definitely pronounced, or concerning which their opinions differ. It is with these that I deal in the present communication to the Society. My notes are based upon numerous sections taken through different regions of the body of one example of the species (the only species) Amabilia lamelligera, which I was able to preserve in a satisfactory condition for microscopic purposes.

§ Scolex.

Concerning the scolex of Amabilia lamelligera some differences of opinion have been expressed in published accounts. These have been dealt with by Dr. Ludwig Cohn up to the period at which his own memoir on the species appeared*. The original describer of the species, Sir R. Owen, defined it† (inter alia) as “capite sub-globoso, rostello cylindrico obtuso,” as duly quoted by Cohn. Owen’s paper, however, contains no further description of the scolex; nor is it represented in his figures of the worm‡. The figure, however, illustrating the worm represents it as tapering gradually at the head end; the scolex therefore was doubtless quite visible—which was not the case with the specimen studied by myself until it was examined by sections.

von Linstow’s § description of the worm is, according to Cohn, not of Amabilia at all, but of Hymenolepis megalorchis, known to be a parasite of the Flamingo. The first part of this statement seems to be undoubtedly correct; the rest is certainly probable.

‡ Plate xli. figs. 21 & 22.
More recently* v. Linstow has described under the name of *Aphanobothrium catenata*, a worm which is really *Amabilia lamelli-gera*, as Fuhrmann was able to state † from an examination of the original material. It is clear from the figures and description given by v. Linstow, that the scolex of the individual represented by him was in the same retracted condition that it presented in my example. It is stated by this author that the "scolex [is] not visible externally," and that there are four suckers and a median fifth sucker which "opens outwards through a dorso-ventral slit." Hooks are stated to be absent. In spite of the correct description of four suckers and a median sucker (which is of course the retracted rostellum), this author states that the worm is "destitute of scolex"!

Diamare, the founder of the genus, in a communication‡ dealing with *Amabilia*, published subsequently to Cohn's memoir, gave no further information about the scolex; in the earlier description§ his examples had been stated to lack a scolex. There is thus no information || about the scolex of *Amabilia* other than that contained in the memoirs of Cohn and v. Linstow. I find myself to be not absolutely in accord with either of those zoologists in every detail.

In my specimen the head (text-fig. 1) was so completely retracted as to have no external sign of its existence save a slit-like gap anteriorly. It was not until the head end of the Cestode had been investigated by horizontal sections that the scolex could be studied. The first remarkable fact about it is its very small size. It is hardly more than an eighth of a millimetre in breadth and is, as Owen said, of a subglobular shape. In view of the fact that the diameter of the widest segments is 8 or 9 millimetres, the minute size of the head is noteworthy. It can hardly form an effective anchor for the unwieldy body; and the condition of the rostellar armature, to which I shall refer immediately, bears out the same idea. While v. Linstow denies the existence of hooks, Cohn describes—not hooks it is true, but "Hakentaschen." It is on this authority, I imagine, that the genus *Amabilia* is defined by both Ransom and Fuhrmann as possessing an armed rostellum.

In my quite complete series of sections through the scolex, which was fully retracted, the outer sheath of the rostellum was composed of muscular fibres running in a direction transverse to the longitudinal axis of the rostellum. Between individual fibres were here and there spaces which seem to be the "Hakentaschen" of Cohn. Like Cohn, I could discover no evidence of hooks within these spaces, which certainly, as he says, must, if present, be

* Spolia Zeylanica, iii. 1906, p. 185.
‡ CB. Bakt. u. Paras. xxvi. p. 780.
§ Ibid. xxi. p. 802.
|| Assuming of course that *Tania macrorhyncha* of Rudolphi (see Wedl, SB. Akad. Wien, xviii. 1856, p. 18) is not an *Amabilia* but, as generally held, a *Schistotania*.
very small. I do not believe, however, that these spaces actually ever held hooks; their irregularity of form and size is against such a supposition. Nor is there so regular a ring or row of them as would suggest the implantation of hooks. Finally I have ascertained the presence of a chitinous structure which appears to me to represent the otherwise missing hooks, which, at any rate, is difficult to understand on any other hypothesis. This is shown in the accompanying figure (text-fig. 2). It will there be seen

Text-figure 1.

![Text-figure 1](image)

Horizontal section through anterior end of *Amabilia lamelligera*, to illustrate very small scolex, which is retracted.

*sc.* Scolex showing rostellum and two suckers.

that the interior part of the rostellum is occupied by a thick ring of apparently chitinous consistency. It is this part which would be external when the rostellum is fully protruded; and a circular ring suggests in this case a ring of hooks fused together. The armed suckers of the Davaineids present somewhat an approximation to this state of affairs. The minute hooks are so close that they give the collective appearance of a continuous chitinous ring; and it has, I believe, been described as such.
In the rostellum of *Amabilia*, however, there is no trace of any separate hooklets; the material of which the cup-like ring is formed is continuous throughout. I am inclined to believe that the shape of the entire ring is represented in the figure referred to. For it has the appearance of an unfractured body and there are no further traces in adjacent sections. It has, I think, been uncut by the razor and slightly displaced.

Text-figure 2.

More highly magnified view of horizontal section of *Amabilia*.

*a.* Chitinous ring, possibly representing a fused row or rows of hooks, lying within rostellum (*r.*). *s.* Sucker.

§ *Muscular Layers of Body.*

The longitudinal layers of the musculature are depicted by Cohn *as arranged in two series of bundles of fibres disposed with fair regularity, and as continuous right round the body. Here and there the row of longitudinal muscles consists of but a single

*Loc. cit. Taf. xiv. fig. 1.*
bundle; in other places one might reckon three in a dorso-ventral row. So far as the more anterior proglottids are concerned, I agree on the whole with Cohn's representation of the facts. He is, I think, also correct in representing a rather thin cortical layer, which is exceeded in diameter by the

Text-figure 3.

Part of a transverse section through an anterior proglottid of Amabilia.

l.m. Longitudinal muscle-bundles not forming everywhere a continuous layer. t.m. Transverse muscles of dorsal and ventral sides of proglottid. v. Vagina. v.t. Near to dorsal opening of vertical tube of water-vascular system; the tube is shown and the superficial depression which bears the actual pore.

medullary portion. I find, however, that the regularity of the muscle-band is not absolute. In many sections (text-fig. 3) there are gaps or intervals where the muscle-bundles are absent; these are never large and, as a rule, the longitudinal muscular layer is continuous.
In the posterior and riper proglottids the muscular layers of the body differ from the same layers in the more anterior proglottids; and what is highly interesting to observe is the fact that the alterations in structure do not appear to be due to mere turgescence caused by the accumulation of ova in the uterus, but are a distinct modification associated with a ripe proglottid. The state of affairs in these proglottids is indeed comparable with the modification of generative segments in certain Annelids. One may frequently observe a degeneration of the muscular layers in ripe proglottids of tapeworms which seems to be a matter of pressure; but the anatomical features met with in *Amabilia* seem to me to belong to a different category. In transverse sections through such proglottids, it is to be noted that, though the uterus is well developed, it is not so huge as to occupy more space than is available in immature proglottids further forwards in the body. The network of tubes which constitute this organ are, in all the proglottids that I have studied, of quite small calibre, and though in places full of ova, are not over full, and indeed here and there empty; moreover, the eggs are not fully developed: the shell has not yet been formed. There is thus no tension at all, and no mechanical explanation to be advanced.

Moreover, the relative thickness of the medullary and cortical layers is not altered, as it would have to be under such circumstances. Instead of the cortical layer being thinned by expansive pressure from the medullary layer within, it is in places actually thicker in proportion, as may be seen by a comparison of text-figs. 3 & 4. It has in fact undergone an alteration which is quite the reverse of degeneration, though accompanied here and there by a disappearance of the bundles of longitudinal fibres, which may of course, in a sense, be termed degeneration. In addition to tracts from which the longitudinal muscle-bundles have disappeared, but—be it observed—without any thinning of the cortical layer as a whole, there are tracts where the cortical layer has undergone a remarkable reduction, and this reduction occurs rather suddenly as is shown in the accompanying figure (text-fig. 4).

Near the letter "l" in the figure the cortical layer is quite normal; the subcuticular layer, the bundles of longitudinal muscles, and the transverse muscular layer are all obvious and duly lettered in the figure. At a certain point there is a more or less sudden alteration in the cortical layer. The dorsoventral diameter is reduced to not more than one-quarter of its original diameter. The longitudinal muscles disappear a little before the cortical layer is more abruptly reduced, and at or about the same place the transverse muscular layer becomes slightly expanded and vanishes. The cortical layer is thus reduced to the subcuticular layer only. Later on, this layer itself apparently vanishes and the medullary layer appears to form the exterior of the body. I find, however, that the cortical layer is really
continued on, at any rate for some way, as a fine nucleated lamella. Possibly this always covers the apparently naked medullary layer.

Text-figure 4.

Part of transverse section through a mature segment of *Amabilia*, to show changes in structure of cortex in these proglottids.

1. Longitudinal muscles suddenly ending. *tr*. Transverse muscles also suddenly disappearing before the point *x*, where cortex itself practically vanishes. *u*. Uterus.

On a hasty examination of such sections as are represented in text-fig. 4, it might be held perhaps that the absence of an obvious cortical layer was simply due to imperfect handling of
the sections and tearing away of an outer layer. This, however, cannot be the case—for the reason that every section through one of these patches showed the same state of affairs, and for the additional reason that the gradual tapering away of the cortical layer is plain when followed by the microscope. It is not, however, easy to recognise everywhere in these bare patches the remnants of the cortical layer; this certainly may be a matter of inferior fixing of the material.

It is to be noted that in the ripe proglottids, where this remarkable condition of the cortical layer is effected, the patches may be both dorsal and ventral or dorsal or ventral; that is to say, both surfaces of the proglottid may be affected in the same region or only one. The space taken up by such a patch is very considerable, occupying the greater part of the segment in some cases. It accounts largely for the lack of intersegmental furrows remarked upon in this species by previous observers. The disposition of the cortical layer in the ripe proglottids of *Amabilia* is very remarkable, and is not quite paralleled in any Cestode known to me.

In these mature proglottids the longitudinal layer, which fully developed, consists—as anteriorly—of two principal rows of bundles. That nearest to the transverse muscular layer is the largest, *i.e.*, each bundle is composed of a much larger number of fibres than the peripheral layer. There is, however, no great regularity in the arrangement of the bundles in two rows, nor in the form or size of the individual bundles. The transverse muscular layer is made up of about a dozen fibres in section, and is thus about as wide as a medium-sized bundle of the longitudinal layer. The two muscle-layers together are of about the same diameter as the cortical layer outside of the muscles.

The longitudinal muscular layer is continued into the lateral outgrowths of the proglottids. These appendages, so characteristic of the family Amabilidæ, show in transverse section strands of muscle passing from side to side, which must permit of a considerable movement of these appendages. It may be that by these means the worm is permitted to fix itself to the wall of the intestine more securely, as well as to move from place to place; and their existence, as functional parapodia, may supplement the feeble scolex to which attention has been drawn.

§ The Water-vascular System.

Diamare, in his account of this genus, figures* the vertical canal with the internal water-vascular vessels opening into it, and rightly represents the place of opening as being near to the dorsal surface of the worm. He figures each of these as a single tube and describes them in the legend of the cut as "Can. deferens," and they are described in the text of the paper as the two vasa deferentia, and are represented in another figure † as

† Ibid. p. 864, figs. 3, 4.
communicating on each side with the cirrus-sac. This erroneous statement, however (made upon the examination of poor material), is corrected in accordance with the criticism of Cohn in a later note.

A more correct account of the water-vascular system of Amabilia is given by Cohn in his memoir. This is also illustrated by three figures. In many respects I find myself in agreement with Cohn; but differ in some important respects. As he has stated, the dorsal vessel is of much less calibre than the ventral, a usual occurrence among the Cestodes; and between the two the cirrus-sac makes its way to the exterior. Thus the dorsal and ventral vessels are at opposite sides of the proglottid and are, in fact, respectively dorsal and ventral in position, as is also frequently, but by no means always, the case. The transverse vessel that is figured by Cohn is alleged by him to be a single vessel which on each side enters the vertical trunk (described originally, and correctly, by Diamare) near to the dorsal external pore of the latter. It bends upwards to reach this point on either side not far from its opening into the vertical tube. During the rest of the proglottid the transverse vessel is fairly median in position; it lies also near to the posterior boundary of the segment. There is not the least trace in Cohn's figure of a double transverse vessel; nor does he describe such. But this tube is most obviously double.

Cohn has described in the posterior region of each proglottid a union between the dorsal and ventral vessels; this "verbindende Kanal" is, he says, continued into the transverse vessel which ultimately opens into the vertical canal. My own preparations do not confirm this statement. There is certainly a communication between the dorsal and ventral lateral vessels where it is described by Cohn as occurring; but the larger ventral and the very much smaller dorsal vessels are in each case near the point of communication between them, continuous with a dorsally placed and narrower and a ventrally placed and wider transverse vessel. These lie (text-fig. 5) very close together and retain the same mutual position until they open into the vertical vessel. They do not, however, as would be inferred from Cohn's drawing, enter this tube laterally, but on the posterior surface, as is indeed shown by Diamare, though, as I have already pointed out, he mistook at first the nature of the tubes in question. I should add that the dorsal and ventral separate moieties of the transverse vessel unite just before their opening into the vertical tube.

In their comprehensive works upon the genera of Taeniae, both Fuhrmann and Ransom accept with a query the statements of Cohn concerning the vertical tube. This doubt is, as I think, caused by the fact that Cohn in figuring that tube only indicates

‡ Loc. cit. Taf. xiv. fig. 6.
one orifice to the exterior, the dorsal. His statements in the text as to the double opening seem plain enough. I confirm these statements as to the presence of both a dorsal and ventral orifice of the vertical tube. Moreover, I may point out that there is no histological difference between the two. In both cases the actual orifice is small and guarded by an involution of the outer cellular layer of the body; it is obviously formed in fact by an involution from the exterior. The identity of structure shown by the two openings is a further proof of the truth of

Text-figure 5.

Part of a horizontal section through a proglottid of *Amabilia*.

- d. & v. Dorsal and ventral transverse vessels.
- o. Ovary.
- t. Testes (forming in this particular proglottid a continuous band unbroken in the middle line).

the view that this tube is a part of the water-vascular system, and that its connection with the generative system is entirely secondary. It has, in fact, nothing to do with either a uterus or a vagina. Cohn has directed attention to the probability that this point of view is also supported by the fact that the vertical tube is fully developed in anterior segments where the generative system is either invisible, or if visible to be seen only in its earliest rudiments, as well as by the general structure of the walls
of the tube, which is like that of the water-vascular vessels. I may add to these arguments the additional one that even in fully mature proglottids—proglottids at any rate in which the uterus is fully developed though not yet distended with ova—this vertical tube is of the same dimensions as in earlier segments. If a part of the generative system, some change would have been expected in this tube associated with the general maturity of the proglottid.

Text-figure 6.

Diagrammatic representation of water-vascular system of Amabilia, for purposes of comparison with a Ctenophore.


I may finally point out in reference to the water-vascular system of Amabilia, but without going into further detail, the
likeness shown by the vertical, radiating and lateral tubes to the canal-system of a Ctenophore, while recalling the views of Lang, Willey, and others as to the Ctenophoran affinities of the Platyhelminths; I illustrate this by the accompanying text-figure (text-fig. 6).

I have verified other facts in the anatomy of this genus which have been dealt with by Diamare and Cohn, but have not found it necessary to treat of them at length. Inasmuch as both Fuhrmann* and Ransom † query certain characters in their definitions of the genus Amabilia, I have thought it worth while to append a fuller definition, derived from my own first-hand knowledge of the Cestode, which is of course confirmatory in great part of Diamare and Cohn, but which contains some fresh characters described in the present paper. I do not distinguish between family and generic characters as I do not think that the systematic position of Tatria is yet fully settled. I am unable, of course, to differentiate between generic and specific definitions since but one species is known.

Genus Amabilia Diamare.

Scolex very small; rostellum armed with a chitinous ring; suckers four, unarmed. Proglottids with a lateral ridge on each side, not of great length, continuous dorsally and ventrally. Longitudinal muscle-layers disposed in two and occasionally three rows of bundles; modified in their arrangement in fully mature proglottids. Water-vascular system consists of a median stem opening by a pore both dorsally and ventrally, of two transverse vessels on each side connecting this with two lateral longitudinal vessels, one lying above the other; these communicate at the orifice of the transverse vessels; there is no network of small tubes. Testes one or two horizontal rows, four to six deep, disposed in two groups separated by ovary, rarely forming a continuous row. Cirrus-sac large and muscular, two in each proglottid, opening on each side of body between lateral water-vessels and dorsal to nerve-cord; cirrus armed with numerous spinules‡. Vas deferens short, without coil, opening into an oral vesicula seminalis connected by a short duct with cirrus-sac. Ovary single, consisting of fine filamentous threads radiating out from base where oviduct arises. Vagina opens into an anteriorly placed diverticulum of vertical water-vascular tube. Uterus consists of a dorsal and a ventral network connected by vertical tubes. Ripe eggs long and spindle-shaped.§

‡ When the cirrus-sac is protruded in ripe segments it is accompanied by the intervening cortical layer which forms a sheath.
§ Fide Lühe. I have not been able to observe ripe eggs.
§ On the Uterus and Uterine Pore of Dasyurotaenia.

Three years ago I described to the Society the general anatomy of a new genus and species of Cestode from the Tasmanian Devil (Dasyurus ursinus), which I named Dasyurotaenia robusta*. Since that date I have examined the intestines of several examples of the same Marsupial without finding any more examples of that worm until December of last year, when a specimen was found to contain a number of fragments of a worm which I believe to be of the same species. They were associated with a few examples of Anoplotenia dasyuri, which latter was also described by myself as a new genus and species in the year 1911 †. Since that date I have found Anoplotenia dasyuri to be a not uncommon parasite of the Dasyure, and to be present in the majority of the examples examined for parasites. But the two genera have only occurred together in the one specimen of the Dasyure referred to above. It may be useful to state certain particulars of the Dasyures examined with a view to gathering such facts as they reveal with regard to infection by these worms. Out of nine examples of the Dasyure, only two were without the tapeworm. One of these had been four years and four months in the Gardens and might have got rid of them ; the other had lived less than three weeks, and thus might not have contracted the helminthiasis. But the fact that the infected Dasyures died after being in the Gardens for only 9 days, 7 months, or 14 months, etc., seems to argue that the parasites are Australian.

I cannot be positive as to the identity of the worms to be described here with Dasyurotaenia robusta. But I feel confident that they are of the same species, by reason of the general correspondence of internal structure of the two series of worms. The second lot of worms, however, had among them no scolices, and the scolex of Dasyurotaenia is, as I have duly pointed out in my memoir, a highly characteristic feature of the genus and one indeed which quite prevents its confusion with any other genus hitherto described. But even without this important means of identification there are some other features which, collectively at any rate, leave no doubt upon my mind that the specimens which I found more recently are the same species as that which I formerly described. I rely more particularly upon the following facts of structure, which I take this opportunity of confirming as they are of importance:—The unilateral genital pores; the very large water-vascular vessel on either side with septa running across: the absence (or, if present, minute size) of the usually present smaller dorsal vessel. The total absence of the transverse vessel in each segment. The existence of at any rate four rows of longitudinal muscular bundles, all separated from each other by transverse strands of muscle. These facts are as it

appears to me of sufficient weight to imply generic, if not specific identity.

I have now to direct attention to a few additional facts in the anatomy of this species. With reference to the water-vascular system, I confirm my former statements as to the numerous folds which project now from this side and now from the other into the lumen of the large ventral tube. It is to be noted, however, that when the segments are more stretched—as they are in individuals which I have just finished examining—the depth of these folds is diminished. Nevertheless, they are still present, and I have never seen the tube to be bounded for any considerable length by straight parallel lines such as are usually seen in most Cestode worms. I have omitted to mention in my earlier paper, that at the boundary line of each proglottid the tube is much dilated; it is just at this point that the transverse tube might be expected to arise, were it present, at any rate judging from the conditions figured by Braun (after Zschokke in Brown's "Thierreichs" *), where the dilatation appears to that author to be the physiological equivalent of a valve. I have ascertained that there is also a valve present in this situation in Dasyurotania robusta. I have mentioned in the paper referred to that a closed septum occludes the lumen at these points. This statement is partly true, for such a septum can readily be seen. But when followed out through its whole superficies the diaphragm is seen to be free in the middle region, and thus to form a flapping valve which arises from the internal side of the tube (as usual but not universal), and to rest against the opposite side in such a fashion that it entirely occludes the lumen of the water-vascular tube in this area. In parts it is, as already said, a veritable fixed diaphragm. In view of the existence of the swelling upon the course of the ventral water-vascular tube and the presence of a valve, I looked very carefully to ascertain whether a transverse vessel might not be found; but I have quite failed to make out such a tube, although there is in the proper position a slight process of the tube directed inwards.

In connection with the above remarks upon the water-vascular system of this Cestode, it should be mentioned that the recent specimens examined by myself show that the ripe proglottids are longer relatively to their breadth than I originally described. They attain to a length rather greater than their breadth.

The uterus in the more fully ripe proglottids has not the simple form which I found and described in the first specimens of this worm which I investigated and reported upon. As the proglottids grow in length the uterus grows into outgrowths and completely but irregularly fills the available room in the proglottid. It does not appear to form a network, but merely an irregularly shaped sac. The generic definition of Dasyurotania must therefore be slightly amended. The mature uterus contained mature ova,

i.e. with embryos, and fully formed egg-shell. These ripe eggs are spherical, and the contained embryo lies in the centre at some distance from the shell which is moderately thick. A fine layer may surround the embryo, constituting a second inner shell; but I can find no evidence of a third shell lying between this and the

Text-figure 7.

Compartments of ovary of Dasynurotania.

\( e \). Ripe eggs. \( o \). Immature ova.

obvious outer shell. To make one among many possible comparisons, the eggs of the present genus resemble those of Oochoria marmosce and differ so far from those of Linstowia ameicae*. And finally, they are in no way remarkable for a worm which

* See Beddard, P. Z. S. 1914, p. 268, fig. 3; p. 278, fig.8.

is undoubtedly very abnormal as a Cyclophyllidean Cestode in the form of its scolex.

It is a circumstance to be noted, that in this tapeworm (see text-fig. 7) the apparently fully mature uterus containing abundant fully mature ova is nevertheless not entirely filled by these ova. In fact, among the ripe ova are many cells which are, as I believe, immature ova. Inasmuch as there is not to be observed a series connecting the two extremes, it would appear that the immature ova do not become mature, but perhaps serve as nutriment for a

Text-figure 8.

Uterine pore (ut.p.) of Dasyurotaenia.

ut. Uterus. w.v. Lateral water-vascular tube.

few cells destined to ripen fully. One does not see in this tapeworm what is so usual, namely the uterus filled simply by a densely packed mass of fully mature ova ready to be shed. The ripe eggs are scattered, now frequently, now more sparsely, among a mass of small cells. This circumstance may be connected with the method of evacuating the ripe eggs. It is a commonplace of knowledge, that among the Cyclophyllidea the uteruses does not communicate with the exterior through a "preformed" orifice, but that the eggs are finally liberated by the decay of the ripe and detached proglottids, or are never liberated at all, but swallowed while yet within the proglottid by
the intermediate host. There is no known exception to this, if we exclude the Ichthyoteniids from the Cyclophyllidea *.

I direct attention to the annexed text-figure (text-fig. 8), which represents a portion of a horizontal section through a ripe proglottid of Dasyurotenia robusta. It will there be seen that a very definite orifice on to the exterior runs from the uterus and also from the adjacent ventral water-vascular tube. There is here no question whatever of a rupture due to pressure and the consequent formation of a lateral orifice. The inflection of the layers of the body, and the mode of communication with both the water-vascular tube and the uterus, seem to me to be decisive upon the matter. It is possible that the numerous obstructions upon the course of the water-vascular vessels which I have referred to above, permits of an opening of this kind without undue pouring out of the fluid contained in those vessels; besides, any opening of the uterus on to the exterior in this region would seem necessarily to involve the vascular tubes. As to the uterine opening, we note that it is lateral instead of dorsal or ventral as is the case in those Cestodes where a separate uterine orifice occurs. In view of the remarkable characters of the scolex of Dasyurotenia which render its inclusion in any of the recognised groups of the Cestodes difficult (as I have already pointed out in my original paper upon the genus), it is interesting to observe this difference.

The uterine orifice lies on the side remote from that which bears the genital orifice; these latter orifices are unilateral. While there can be, as I think, no doubt that the uterine pore is a preformed orifice, and not an accidental tear such as occurs, but on the ventral surface, in various tapeworms belonging to the Tetraphyllidea, I have not by any means been able to prove its universal occurrence in mature proglottids. Indeed I have only twice found these lateral orifices. In three other pieces of the same tapeworm (whether of different or the same individual I have no means of knowing) I have seen no such openings, at most a process of the lateral water-vascular vessel deflected towards the periphery. But, on the other hand, I have observed them in one segment in two other pieces of worm. This, however, is not necessarily an argument against the normality of the occurrence, though it does not fully prove that the formation of these pores is normal. It is at least clear that they may be formed.

* See Beddard, P. Z. S. 1913, p. 256 et seq.