PAPERS.

12. Contributions to the Anatomy and Systematic Arrangement of the Cestoidea. By Frank E. Beddard, M.A., D.Sc., F.R.S., F.Z.S., Prosector to the Society.

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VIII. On some Species of *Ichthyotænia* and *Ophidotænia* from Ophidia.

(Text-figures 33–38.)

Index.

In the present communication I lay before the Society the result of an investigation into the anatomy of a number of species of tapeworms which I have obtained during the last three years from the gut of serpents, and all of which are members of the family Ichthyotæniidæ.

The parasites of serpents are obviously but incompletely known at present. The only well-known genera which have been seen in those reptiles are *Solenophorus* from certain pythons *, a few species of *Ichthyotænia* † from various species of serpents, *Crepidobothrium* ‡ from boas, *Ophidotænia* § from the Indian cobra, *Oochoristica* || from *Zamenis viridiflavus*.

Ichthyotænia gabonica, sp. n.

I obtained on June 21, 1912, a number of tapeworms from *Bitis gabonica*, which I refer to a new species and name as above. I am not able to give the exact length of the worm, but the largest piece which I measured was 150 mm. We are safe, therefore, in allowing its length to be not less than 160 mm., and probably rather more. The *scolex* is intermediate in size between that of such species as *Crepidobothrium gerrardi*, which has a particularly large scolex, and such species as *Ophidotænia naiæ*, which has a particularly small one. The transverse diameter is about two-thirds of a millimetre. As the greater part of the scolex is taken up by the suckers, each of these is fully a quarter

* Bronn's 'Thierreichs,' Bd. iv. Abth. 1 B, and literature therein cited.
† v. Linstow, "Helminthen von Java," Notes Leyd. Mus. xxix. 1908, p. 85.
‡ Monticelli, Atti Soc. Nat. e Mat. Modena (4) i. 1899, p. 9.
§ Beddard, P. Z. S. 1913, p. 25; also Schwarz, "Ichthyotænien d. Rept.," Inaug.-Diss. Basel, 1908.
|| Zschokke, "Das Genus *Oochoristica*," Zeitschr. wiss. Zool. lxxxiii. 1905.

of a millimetre across. The rostellar region of the scolex is very small in the contracted condition, as is the case with other Ophidian Ichthyotæniids. The suckers look outwards and rather upwards. The length of the scolex is not more than half its breadth. Immediately after the scolex there is a neck in which no segmentation is visible; it is as wide as the scolex, and the body rapidly attains to its greatest width, there being thus no long and thin anterior region.

The segments become elongated as they mature, and attain to a length of four or five times their breadth, or even perhaps rather more. In this species, as in others of the genus, the genital pores alternate in position from side to side of the body, and the relative positions of the cirrus-sac and vagina also alternate.

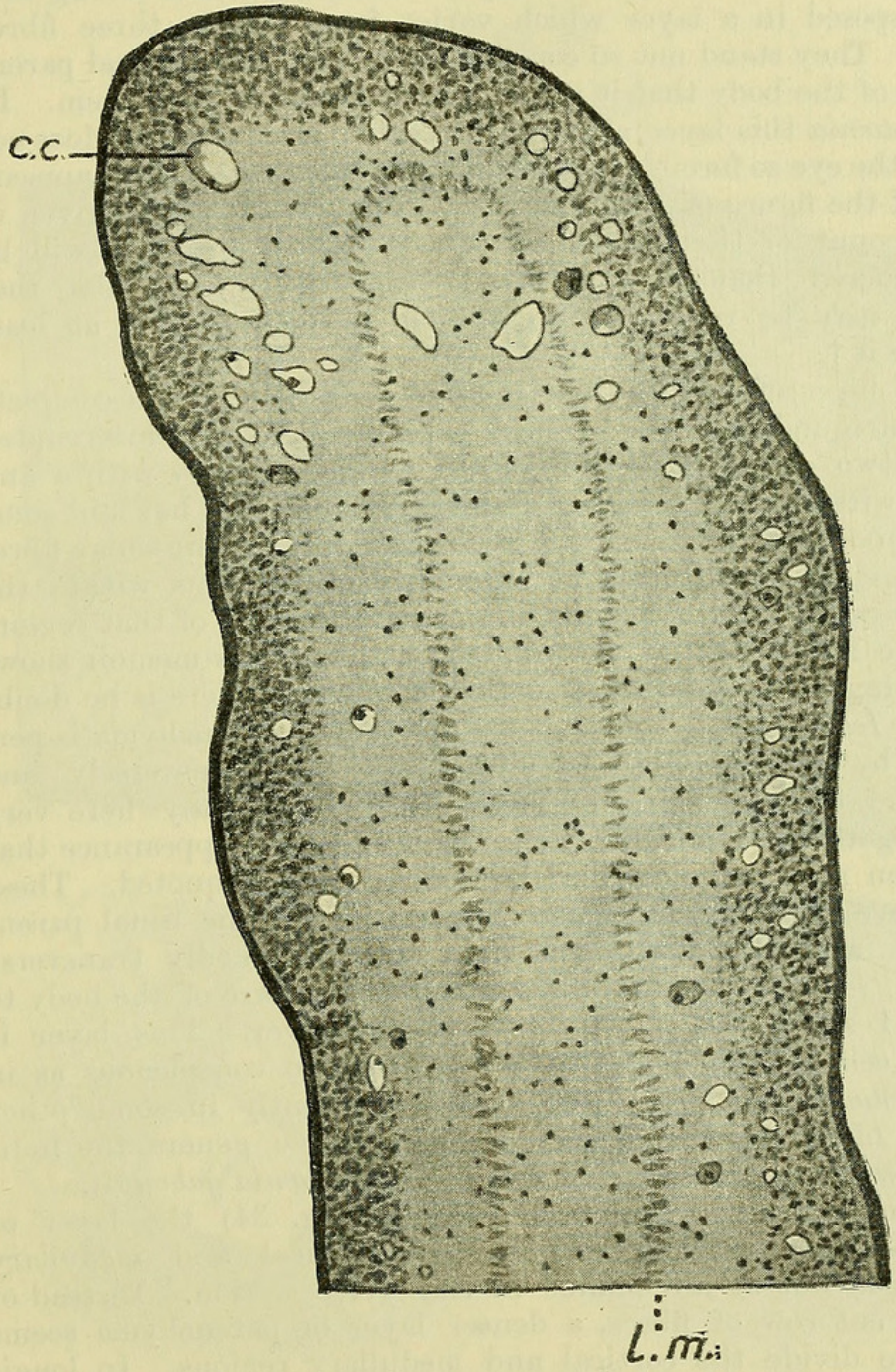
The *calcareous bodies* in this species are very abundant; they extend into the neck region, where they are very plain, in transverse sections, forming a layer in the cortical parenchyma, not very far below the subcuticular layer. They are also apparent in the scolex. I have frequently observed in posterior segments of the body that the centre of the calcareous bodies is deep black, due to pigment. In sections through the scolex the four suckers are seen to occupy nearly the whole of the area available, there being but little space between them. The thickness of the suckers is much greater actually and relatively than in the allied *Acanthotænia*, which I have recently described *. An examination of these sections failed to show any spiny covering of the body round or in the suckers such as is so conspicuous in *Acanthotænia*. I am convinced that such a spiny covering is entirely absent.

Sections through the scolex also show the slender muscular fibres which effect the movements of the latter. These fibres do not form bundles, but pervade singly the region lying between the suckers. I have pointed out in a previous communication † that the stout muscles of the suckers in the genus *Acanthotænia* concentrate themselves in the neck into very marked and thick bundles of rather thick fibres, which are continued back for a short distance only. It appeared to me when comparing that genus with *Ichthyotænia*, that *Acanthotænia* was to be probably distinguished from *Ichthyotænia* by, *inter alia*, this presence of a thick layer of longitudinal muscles in the neck and by the absence of such a layer in the trunk region, this latter layer being present in *Ichthyotænia*. The examination of the species which forms the subject of the present memoir confirms that opinion; for in *Ichthyotænia gabonica* I have not been able to detect a longitudinal layer of fibres in the neck region; the slender fibres already referred to which effect the movements of the suckers do not become concentrated in the neck into a thick series of bundles as in *Acanthotænia*; nor indeed could I discover any layer at all of such muscles in this part of the body.

* P. Z. S. 1913, p. 8, text-fig. 1.
† P. Z. S. 1913, p. 9, text-fig. 2.

In the posterior part of the body, however, (see text-fig. 33) behind the neck a longitudinal layer of muscles was very clear in

Text-fig. 33.



Transverse section through part of proglottid of *Ichthyotænia gabonica*.

l.m. Longitudinal muscles. *c.c.* Calcareous bodies.

Ichthyotænia gabonica as in other Ichthyotænias from serpents, including my genus and species *Ophidotænia naiæ* *. This layer

* P. Z. S. 1913, p. 25.

divided off the cortical from the medullary parenchyma and lay therefore at a distance from the outside of the body of about one-third of the entire vertical diameter on each side; that is to say, the medullary parenchyma in this species is of about the same diameter as the cortical layer. The fibres are strong and are disposed in a layer which varies from one to three fibres thick. They stand out so conspicuously from the general parenchyma of the body that it would be impossible to miss them. In *Ophidotœnia* this layer, although in reality plain enough, does not strike the eye so forcibly. I am indeed reminded by their appearance of the figure of the same muscles in *Palaia varani* given in his account of that species by Dr. Shipley*; and it will be remembered that I have myself ventured to consider that *Palaia* may be really identical with *Ichthyotœnia*, or at least near to it †.

This layer of longitudinal muscles does not form a complete layer surrounding the medullary parenchyma. It is interrupted at its two ends by the nerve-cord which is partly within and partly without the medullary region. Dr. Schwarz has laid some stress upon the fact that the transverse layer of muscular fibres in the genus *Ichthyotœnia* at least occasionally runs within the medullary parenchyma, occupying the greater part of that region, and the figure already quoted from Dr. Shipley's memoir shows something of the same kind in *Palaia varani*. There is no doubt that in *Ichthyotœnia gabonica* the medullary parenchyma is pervaded by slender muscular fibres running transversely and scattered through it fairly uniformly, but not anywhere very close together. I imagine that this is the same appearance that has been seen and described by the two authors quoted. These fibres are definitely muscular fibres, and not the usual parenchymal meshwork arranged in a more markedly transverse fashion. The last point in the general structure of the body to which I shall refer is the subcuticular layer. This layer is several cells thick; but it is by no means so conspicuous as in *Acanthotœnia* and *Ophidotœnia* and apparently in some other species of *Ichthyotœnia*, since in these three genera the individual cells are much larger than in *Ichthyotœnia gabonica*.

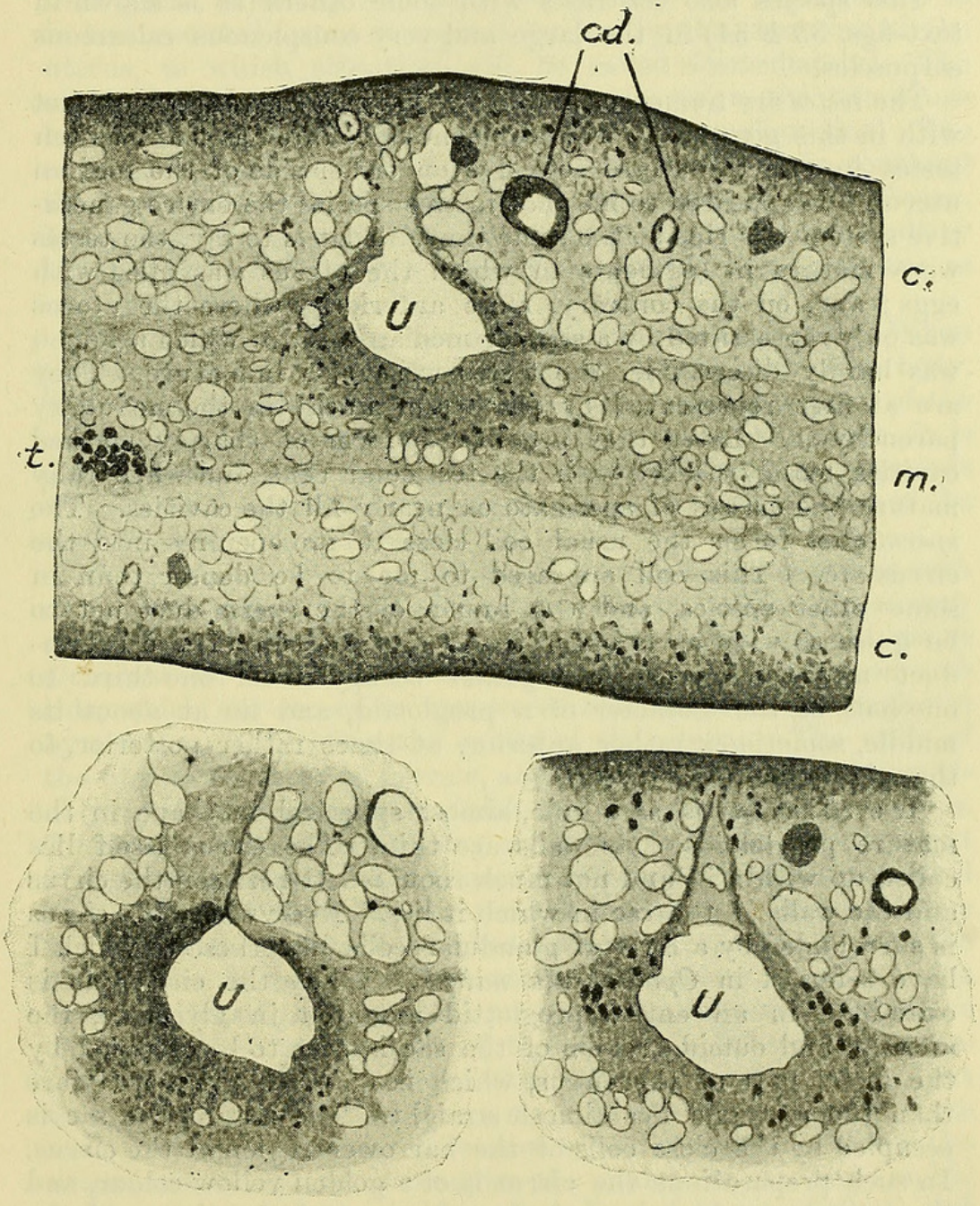
In more mature segments (see text-fig. 34) the layer of muscular fibres lying between the cortical and medullary regions is not at all defined in transverse section. Instead of a clear cut row of fibres, a denser layer of parenchyma seems alone to divide the cortical and medullary regions. In longitudinal sections, however, this dense layer is seen to be traversed by delicate longitudinal fibres one or two deep; these are not apparent at all in transverse sections unless the latter happen to be cut rather obliquely, in which case the fibres become visible. This difference between the longitudinal muscular layer in

* "Zoological Results . . . from New Britain, New Guinea, etc.," by Arthur Willey, Cambridge, pt. v. 1900, pl. lv. fig. 18.

† P. Z. S. *loc. cit.*

various regions of the body of *Ichthyotænia gabonica* is not at all due to the differences in the mode of preservation and staining. The pieces of worm from which the various sections described above were cut had been treated in precisely the same manner.

Text-fig. 34.



A series of sections of *Ichthyotænia gabonica* to show rudimentary uterine pores.

c. Cortical layer. *c.d.* Calcareous bodies. *m.* Medulla. *t.* Testis. *u.* Uterus.

The *medullary parenchyma* also changes its character in different regions of the body. Anteriorly it is dense throughout; later the cortical region is composed of a lax parenchyma while the

medullary parenchyma is more dense. In the fully mature segments towards the end of the body both the cortical and the medullary parenchyma are equally lax in structure. This renders it very difficult to follow the excretory tubes the calibre of which is not greater than that of the spaces between the fibres of the parenchyma.

This species also contrasts with some others (as is shown in text-figs. 33 & 34) in the large and very conspicuous calcareous corpuscles.

The *testes* are numerous and show the usual arrangement met with in this genus. In ripe segments I counted as many as ten testes in one transverse row, five on either side of the median uterus. It appeared to me that in this species the entire generative system was ripe at the same time. That is to say, the testes were mature in segments in which the uterus was filled with eggs; and, on the contrary, more anteriorly, where the uterus was only represented by a slender median cord, in which a lumen was hardly discernible, the testes were also immature. They are at first represented by patches of nuclei in the medullary parenchyma. Later they are in the form of sharply marked cavities, loosely packed with the testicular cells, and when fully mature the masses of spermatozoa nearly fill the cavities. The *sperm-duct* forms the usual coil close to its opening into the cirrus-sac. This coil appeared to me to be denser than in some other species, and the lumen of the sperm-duct not to be quite so wide as is often the case. The coil of the sperm-duct and the cirrus-sac together occupy from one-third to one-half of the diameter of a proglottid, and lie at about its middle, sometimes rather anterior, at times rather posterior, to the middle line.

The *cirrus-sac* is, as a rule, almost spherical in shape in the mature proglottids. Its walls are thin. The cirrus itself lies coiled up within it, and not much room is left between the cirrus and the walls of the sac in which it lies. Everywhere the cirrus is surrounded by a layer of glandular cells like those to which I have referred in *Ophidotænia naiæ* *. When the cirrus-sac is examined in an entire proglottid mounted in glycerine, the anterior and outside region of the sac is seen to be occupied by the distal part of the cirrus, which is of much greater calibre than the rest and lies almost straight. The rest of the sac is occupied by the close coils of the narrower region of the cirrus. In such preparations the cirrus is of a golden yellow colour, and thus stands out conspicuously from the rest of the tissues of the worm. I have never observed the cirrus in a state of protrusion; but, on the other hand, I have seen the whole sac itself partially protruded in a way commented upon by Schwarz † in other species of this genus. I found no spines upon the cirrus anywhere. The *vagina* runs at first straight and parallel with

* P. Z. S. 1913, p. 29.

† "Ichthyotænien d. Reptilien," Inaug.-Diss. Basel, 1908.

the cirrus-sac; in this region it is wider than posteriorly. It then bends towards the median line of the segment and passes straight down the middle line until near to the ovary. The rest of the vagina, both in front of and behind the ovary, forms a close coil. I did not find any conspicuous shell-gland; but the "Schluckapparat" was quite conspicuous. The absence of the shell-gland, or at any rate its inconspicuous size if present, is to be accounted for, as it appears to me, by the structure of the uterus, to which attention will be called immediately. The *ovary* of *Ichthyotænia gabonica* is a single organ, the two wings being continuous with each other across the median line. The ovary is flat and lies on the ventral side of the body, touching the border-line between the cortical and medullary parenchyma. It extends to near to the lateral boundary of the medullary layer. The *vitelline glands* show no peculiarities, and are as usual lateral.

The *uterus*, however, is in some ways remarkable. When immature it is a solid rod running throughout the body. This is soon excavated, and even in ripe segments parts of the uterus are still simply a narrow tube, while elsewhere it is dilated and full of eggs. In the most fully mature segments which I have seen the uterus seems to fill the greater part of the medulla from side to side.

There are no very marked lateral diverticula of the uterus such as occur in other species of *Ichthyotænia*, and which are so very markedly differentiated from the median stem in my genus *Ophidotænia*. But there are here and there outgrowths on each side, which are shown in transverse sections of a ripe proglottid by a trabecula dividing the cavity of the uterus. The walls of the uterus where it is narrow, and as a rule though not invariably without any eggs, are thick and of glandular appearance. These walls are darkly staining and granular, and seem to consist of a glandular epithelium which very possibly secretes the shell of the egg. But it must be remarked that this layer of tissue is not like the numerous stalked glandular cells which form the cells of the diverticula of the uterus in *Ophidotænia naiæ*. The drawing (text-fig. 34, p. 157) presents the appearance which is shown by the uterine walls of this species. Where the uterus is wider and full of embryos the walls are much thinner; but this appearance may be due simply to the stretching of those walls and not due to any difference of real structure. When the uterus is widened out it occupies the middle of the body and is in close contact with the boundary-line of the medullary and cortical regions above and below.

This is not, however, always the case: in some parts of the same proglottid the uterus extends further towards the outside of the body ventrally than dorsally. In sections of the uterine tube which have a narrower calibre it is plain that that tube occupies a ventral position. There is more medullary parenchyma above than below it. I have observed in such places a

state of affairs which is represented in text-fig. 34. It will be there seen that the uterus gives off a slight diverticulum towards the exterior of the body which is visible for at most three consecutive sections. This outgrowth, however, does not reach the exterior, for it is plugged with cortical tissue. But one can readily see in the sections, of which the drawings referred to are copies, that a denser fibrous layer surrounding the uterus is prolonged towards the exterior, in the same fashion as, but further than, the uterine cavity. This peculiarity seems to me to be explicable on the hypothesis that we have here either a vestige of, or the beginning of, separate uterine pores such as exist in the undoubtedly closely allied, if not identical, genus *Ophidotænia*. I am, however, convinced that there are not in the present species any actual pores.

The uterus in the ripest proglottids is very full of eggs which have a narrower and thicker outer shell and a wider and thinner inner shell. There are no external processes such as Schwarz has figured in *Ichthyotænia nattereri* *. The eggs are not in any way massed into balls such as occurs in the allied genus *Acanthotænia* †; they lie, as it were, anyhow, but with some granular material between them. This tends to aggregate them into a continuous mass.

I believe this species to be different from any that have been described. Its general size and the size of the scolex are perhaps nearest to those of "*Tænia*" *racemosa*, as described by Schwarz. But the material belonging to this latter species, which was examined by Schwarz, was not in a satisfactory state of preservation. And, moreover, *Ichthyotænia racemosa* seems to frequent South American snakes, while that which forms the subject of the present communication is African in range. Moreover, the cirrus is unlike that of my species in not being coiled and only pursuing an undulating course through the cirrus-sac. The testes in *I. gabonica* do not appear to be so large as those of *I. racemosa*. Nor are the diverticula of the uterus so well marked as in *I. racemosa*.

Ophidotænia russelli, sp. n.

Of this species an example was obtained from a Russell's Viper (*Vipera russelli*) in June 1911. The general appearance of the worm is that of a typical *Ichthyotænia* or *Ophidotænia*, which genera do not differ to the naked eye unless it be ultimately proved that a small scolex characterises *Ophidotænia* and a large, or at any rate larger, scolex characterises *Ichthyotænia*. The worm was very active when alive, and the specimen when extended was a foot or so in length. The scolex, as already mentioned, is very small and not more than one-half of the width of that of *Ichthyotænia gabonica* just described. It is of

* *Loc. cit.* Taf. iii. fig. 7.

† Beddard, P. Z. S. 1913, text-figs. 6, 7, p. 20.

course unarmed. The neck is long. The posterior proglottids are longer than broad and from 2–3 mm. wide. The generative pores alternate, but there are often as many as four or so consecutively on one side. The external anatomy of this species indeed hardly differs from that of *Ophidotænia naiæ*, for which I have recently founded the genus *Ophidotænia* *.

The internal structure, too, is very similar. In transverse sections the calcareous bodies are by no means so plain as in *Ichthyotænia gabonica* just described. But in pieces of the body mounted entire in glycerine the calcareous corpuscles are quite obvious, and appear to be restricted to the lateral regions of the segments, being absent or very few in the median dorsal and ventral regions. It appeared to me that the glandular subcuticular layer of the present *Ophidotænia* does not consist of such large cells as that of the other species of the genus. But the arrangement of the longitudinal muscles was quite similar. It is possible that the existence of the strong internal longitudinal fibres in *Ophidotænia* in the sexual proglottids and their very feeble development in *Ichthyotænia gabonica*, may prove to be a generic distinction between these types.

I could find in this worm only a single water-vascular trunk on each side of the body. In this the two species of *Ophidotænia* (if there be two) agree; but there is a small difference to be observed which helps to justify a separation.

In the present species the water-vascular tube lies further away (towards the centre of the proglottid) from the vitelline strip than in *Ophidotænia naiæ*. And this difference is even greater than appears by a mere inspection; for the transverse diameter of the sections of *Ophidotænia naiæ* was greater than that of those of *Ophidotænia russelli*. In the latter species I observed two and a half to three ripe testes to lie between the water-vascular tube and the vitelline strip, whereas there was only room for one or a little more in *Ophidotænia naiæ*.

The *reproductive organs* also show some slight difference in the present species from what I have observed in its congener. The *testes* are quite absent from the middle of the proglottids, and are laterally pressed up close to the strip of vitelline glands. They seem to me to extend further towards the middle line in *Ophidotænia naiæ*. The cirrus-sac and the coil of the vas deferens together reach to nearly the middle of the segment. The *cirrus* is not by any means long and the coil within the cirrus-sac is disposed in one or two loops only, thus contrasting with that of *Ichthyotænia gabonica* described above. It appears to me that the coiled region of the male duct lying within the cirrus-sac in *Ophidotænia naiæ* was rather larger than in the present species. There is no doubt that the cirrus-sac is larger in the first-named species. In any case, the small number of the coils lying within the cirrus-sac of the present species contrasts very markedly with

* P. Z. S. 1913, p. 25.

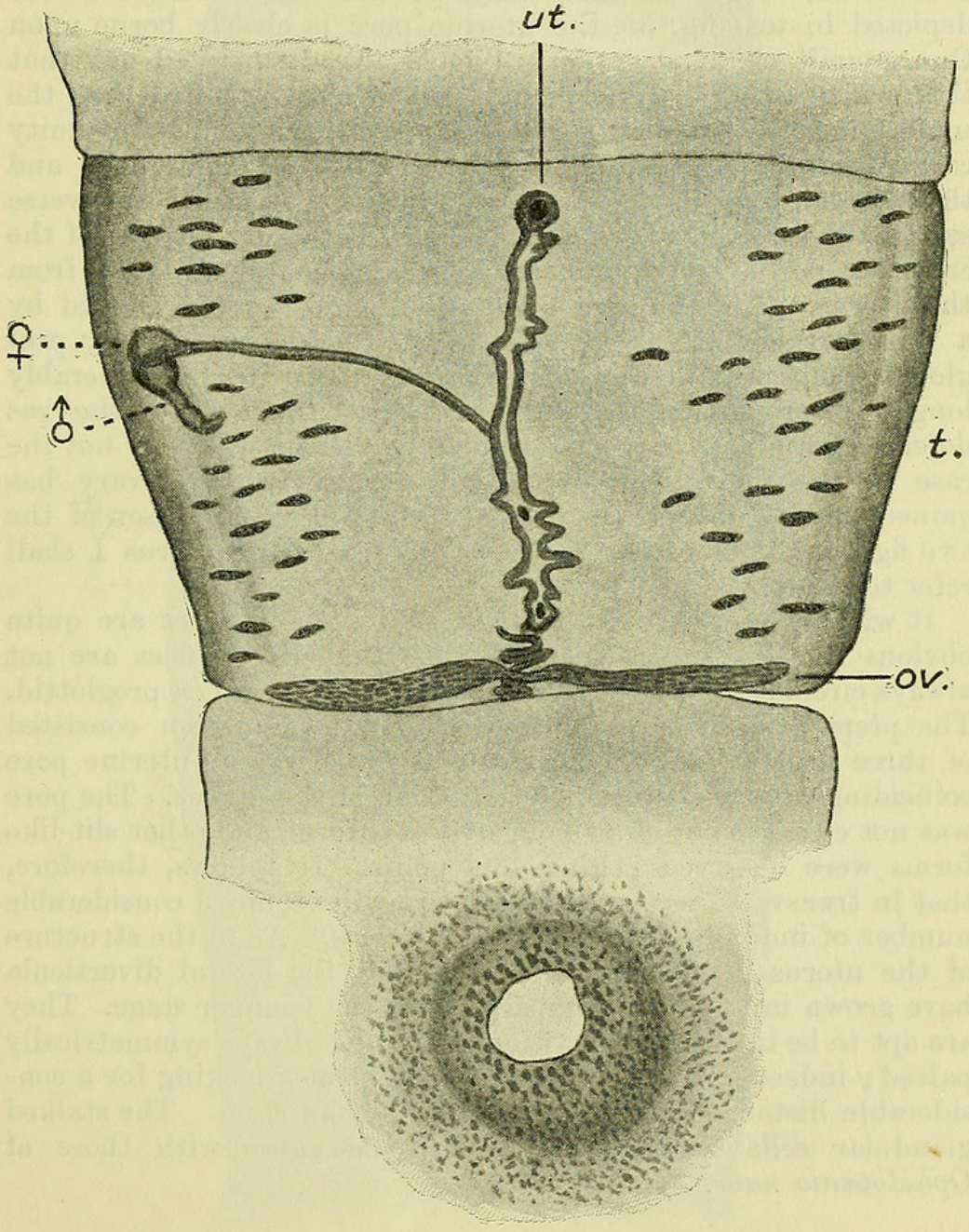
what I have observed in *Ichthyotœnia gabonica*, and glycerine preparations of the proglottids of the two species are very easy to distinguish. There are no special comments to make concerning the ovary and the female ducts in the neighbourhood of the ovary; they appear to agree entirely with those of *Ophidotœnia naiæ*. The oviduct widens to form the end of the vagina, and the latter suddenly dilates at its external orifice to form a muscular sac quite as large at the terminal section of the cirrus. It is nearly always in front of the opening of the cirrus; I found it posterior only in one case. I could not find a definite sphincter muscle surrounding the terminal section of the vagina, such as exists in *Ophidotœnia naiæ*. The preparations that I have made of the present species which illustrate the structure of the *uterus*, serve rather to increase our knowledge of this organ in the genus *Ophidotœnia* than to accentuate differences between the two species of the genus.

The accompanying drawing (text-fig. 35) shows the uterus in an incompletely mature proglottid, which is therefore not very long in proportion to its breadth. The uterus seems to lie exactly in the middle line and to extend from near the posterior to near the anterior border of the proglottid. In this young proglottid the lateral diverticula of the median stem of the uterus were only just beginning as inconspicuous buds. At the anterior end the uterus opens directly on to the exterior by a large and very conspicuous pore, which can be easily seen by careful focussing to have clear-cut outlines due to the cuticle. It is quite circular in contour. It is a noteworthy fact to find one definite uterine pore only. For the fact brings the peculiarities of this genus *Ophidotœnia* more into line with the Bothriocephalids and tends to show that, as might be expected, the frequent pores of later stages are a secondary state of affairs, and thus not inimical to the main point of resemblance urged between this genus and the lower tapeworms. But, although there is only one large definite external uterine pore to be seen in this preparation, the subsidiary pores, much smaller, are to some extent recognisable prolongations of the uterus approaching to very near the surface, if not actually opening on to it.

In the proglottid in front of and in that behind the one which is figured in the annexed drawing and has just been described, there is not a large anteriorly situated uterine pore. But a few rather indistinct pores are visible, like the subsidiary ones noticed in the case of the first proglottid to be examined. The indistinctness of these pores leads me to infer that they can be temporarily closed and, perhaps, indeed they may become permanently closed, thus approximating to the conditions that I have described above in *Ichthyotœnia gabonica*. I have naturally examined these pores in transverse sections. In such sections a depression in the outer layer of the body which forms the external part of the uterine pore is conspicuous and relatively large. Nearer to the centre of such a depression the cuticle is seen to

cease rather rapidly, leaving an obvious discontinuity. As I have pointed out in *Ophidotænia naiæ*, there is in the present species no question of an artificial rupture of the cuticle due to

Text-fig. 35.



The upper figure represents an incompletely mature proglottid of *Ophidotænia russelli*.

The lower figure is of the anterior uterine pore more highly magnified.

ov. Ovary. *t.* Testes. *ut.* Uterus, the external orifices of which are represented black. ♂ & ♀. Male and female terminal organs.

an accident in the processes of section cutting. The cuticle is seen to become thinned to a point on both sides of such an orifice

viewed in transverse section. But the break in the tissues beneath the cuticle was not in my sections coextensive with the area of this pore.

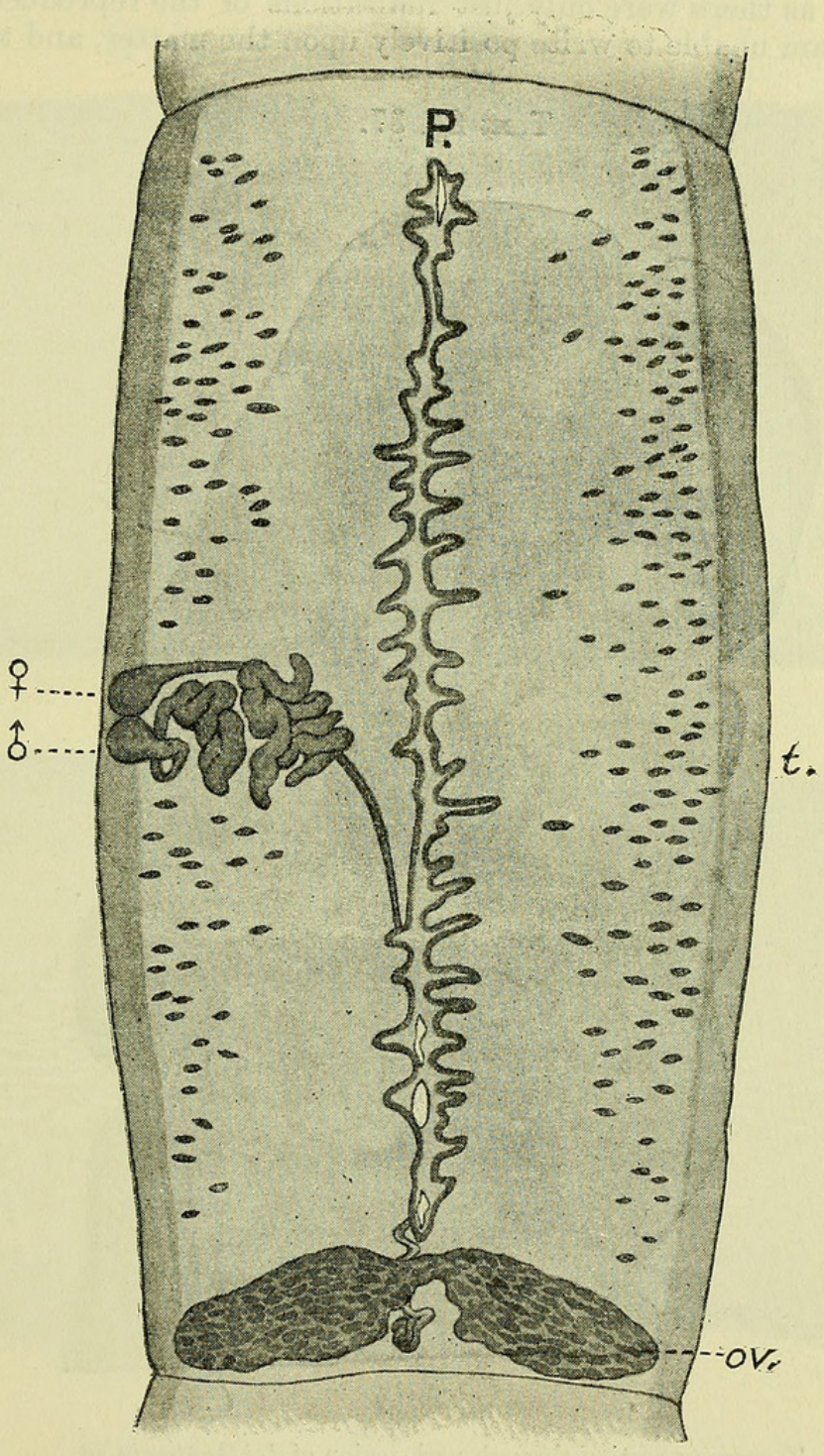
In such sections the area of the body upon which the pores lie does not appear to be raised above the general surface of the body. But in the large terminal orifice of the uterus which I have depicted in text-fig. 35, the uterine pore is clearly borne upon the summit of an elevation. I have already pointed out that this orifice is circular in outline, and it may be added that the underlying soft tissues correspond to this, the discontinuity corresponding with that of the cuticle I have just mentioned ; and there is here an apparent contradiction—that in my transverse sections there is no such correspondence between the areas of the cuticular pores and the narrow canals leading thereto from the uterus. This apparent contradiction will be reconciled by a consideration of text-fig. 36, which represents an older proglottid than that illustrated in text-fig. 35. It is considerably longer in proportion to its breadth, and the coils of the vas deferens gorged with sperm are plainly visible, which is not the case in the shorter proglottid. Furthermore, the ovary has gained greatly in bulk, as will be noticed in a comparison of the two figures. Differences in the structure of the uterus I shall refer to later.

It will be observed that the external uterine pores are quite obvious on this superficial view, but that the orifices are not always circular as has been described in the younger proglottid. The preparation from which text-fig. 36 was drawn consisted of three proglottids. In all of them there was an uterine pore coinciding with the anterior termination of the uterus. The pore was not circular but of an elongated oval form, and other slit-like forms were observed behind this point. It follows, therefore, that in transverse sections a given pore will occupy a considerable number of individual sections of the series. As to the structure of the uterus itself, it will be seen that the lateral diverticula have grown in length as compared with the younger stage. They are apt to be irregular in position, not being always symmetrically paired ; indeed, the diverticula are sometimes lacking for a considerable distance on one side of the median stem. The stalked glandular cells covering the diverticula agree with those of *Ophidotænia naiæ*.

Ichthyotænia sp. ?

Of this species a number of examples were obtained from the Mocassin Water Viper (*Ancistrodon piscivorus*). The living worms reached 14 inches in length and they measured 8 to 10 inches when in spirit. The unarmed suckers were quite mobile and independent of each other. The neck region can contract and move like the whole body. The scolex is large and measures in the contracted state 2 mm. in width or even rather more.

Text-fig. 36.



Ripe proglottid of *Ophidotænia russelli*.

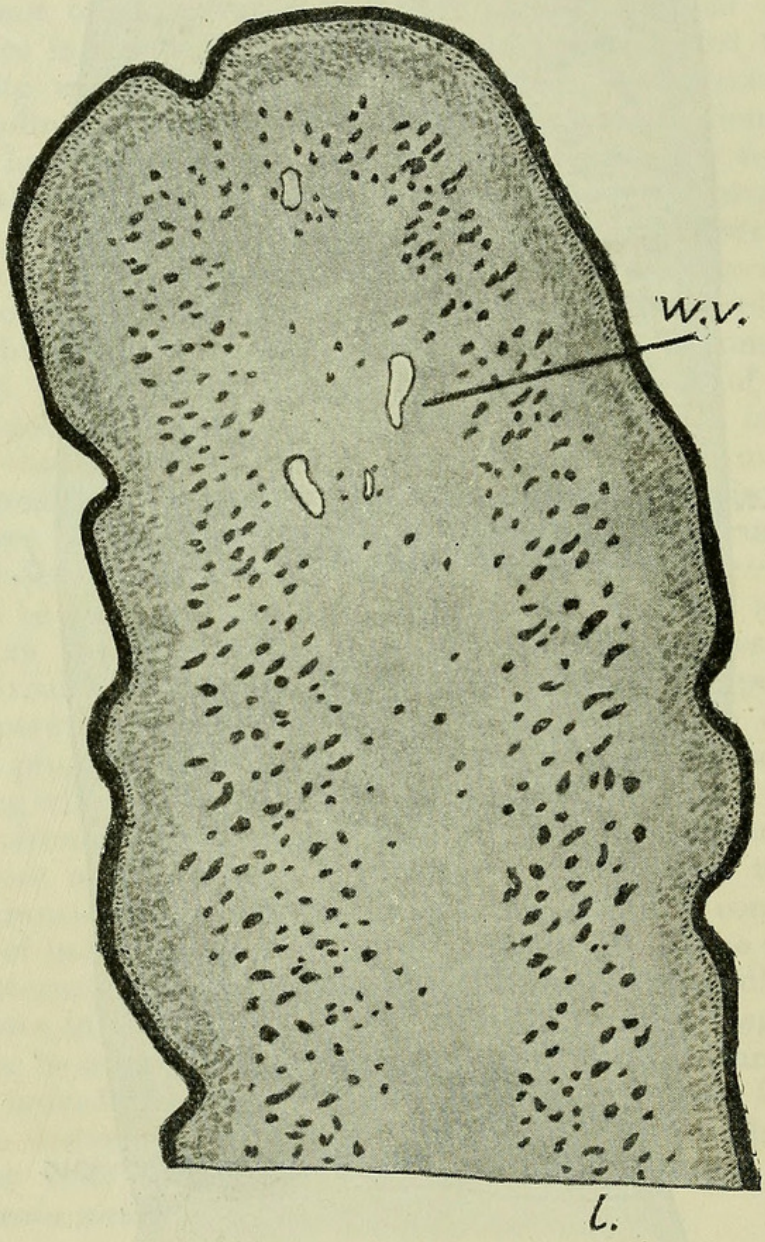
P. Anterior uterine pore.

Towards posterior end of uterus three other uterine pores, also left white, are seen. Lettering as in text-fig. 35.

I am disposed, on account of the external characters of this worm, to regard it as in all probability identical with *Ichthyotænia*

marenzelleri described by Barrois *, and later by Schwarz †, which was obtained by Calmette from the same species of snake ‡. But, inasmuch as there were only just indications of the reproductive organs I am unable to write positively upon the matter, and thus

Text-fig. 37.



Transverse section through neck-region of *Ichthyotænia* sp.

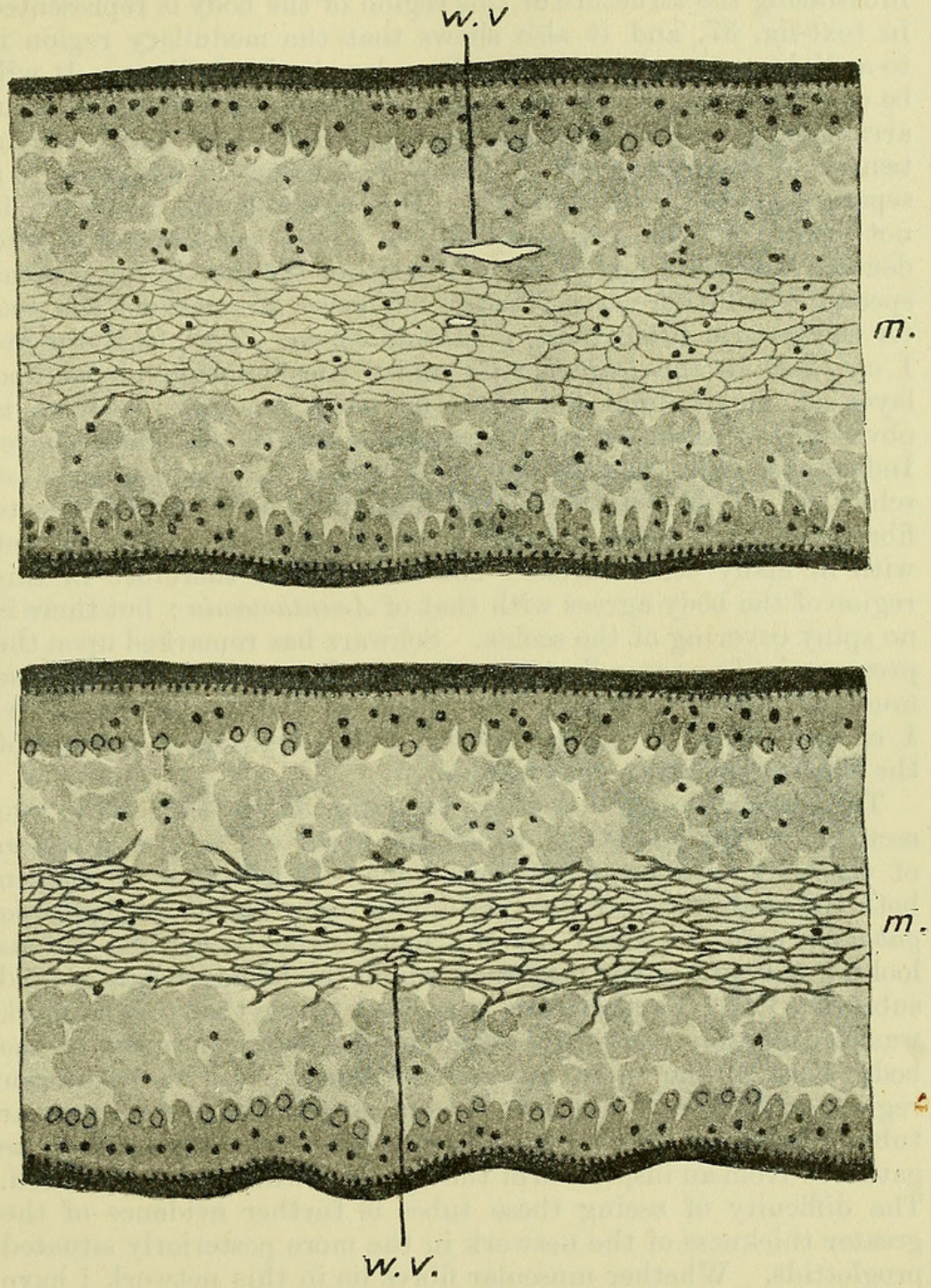
l. Longitudinal muscles. *w.v.* Water-vascular tubes.

prefer not to give it a name. It is rather remarkable that in proglottids situated 8 inches or so from the scolex, there were merely traces of the reproductive organs—in fact, only the

* Bull. Soc. Sci. Agr. Lille, 1898.
† "Die Ichthyotænien der Reptilien," etc., Inaug.-Diss. Univ. Basel, 1898.
‡ "*Trigonocephalus piscivorus* (*Erigonocephalus piscivorus*)."

beginning of the formation of the ducts passing between the two water-vascular tubes.

Text-fig. 38.



Transverse sections through portions of proglottids of *Ichthyotænia* sp.

m. Medulla. *w.v.* Water-vascular tubes.

I have, however, a few remarks to add to Schwarz's description of this worm. This author does not mention the fact that the neck region, at any rate just behind the scolex, is provided with a very thick layer of longitudinal muscle fibres occupying the whole of the space between the subcuticular layer and the medullary

parenchyma. The number of fibres in a single vertical row was about 12; and they were not associated into bundles. The individual fibres were, indeed, rather far apart. The section illustrating the structure of this region of the body is represented in text-fig. 37, and it also shows that the medullary region is to a slight extent invaded by these longitudinal fibres. It will be observed that we can detect in this species of *Ichthyotænia* an arrangement of the muscular system like that of the Ichthyotæniids of *Varanus*, which I follow v. Linstow in assigning to a separate genus *Acanthotænia* *. The resemblance, however, is not exact; for in *Acanthotænia* the fibres are associated into definite bundles, which is as definitely not the case in the present species. Still there is a likeness which so far weakens the case for the generic distinctness of *Acanthotænia*. And, furthermore, I can find in the *Ichthyotænia* under consideration no marked layer of longitudinal fibres in the body generally, such as is obvious, for example, in *Ophidotænia russelli* described above. Indeed, Schwarz, remarks that "die innere Längsmuskulatur ist schwach." I do not assert that there may not be some delicate fibres here; but there is nothing so conspicuous as is to be met with in many other forms. The musculature therefore in this region of the body agrees with that of *Acanthotænia*; but there is no spiny covering of the scolex. Schwarz has remarked upon the presence in *I. marenzelleri*, as well as in *I. calmettei*, of transverse muscular fibres occupying the whole of the medullary layer. I cannot interpret the appearance of the transverse sections of the present species in that fashion.

The accompanying drawings (text-fig. 38, p. 167) show two sections of this species, of which the upper one is from a region of the body anterior to the lower one. It will be seen that in both the medullary parenchyma differs from that of *Ichthyotænia gabonica* figured above † by the more strongly marked fibrous looking network in the meshes of which the homogeneous ground substance lies. Furthermore, it seemed to me that this network was considerably more emphasized in the posterior region of the body than in the more anterior segments. In the posterior region, moreover, I did not always detect the water-vascular tubes, which are quite easy to see more anteriorly as is to be gathered from an inspection of the figure to which I have referred. The difficulty of seeing these tubes is further evidence of the greater thickness of the network in the more posteriorly situated proglottids. Whether muscular fibres lie in this network I have not been able to see; but I am of opinion that the network is not a transverse muscular layer, but merely an exaggeration of the network which is always visible in this situation in these and other tapeworms, and in which may lie muscular fibres independent from it. I have already directed attention to the presence of such muscular fibres in *Ichthyotænia gabonica* described above.

* P. Z. S. 1913, p. 5.

† *Supra*, p. 155, text-fig. 33.