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Haplodiscus Piger; a new Pelagic Organism from the Bahamas.

By

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With Plate I.

I PROPOSE the name Haplodiscus for a small pelagic organism occasionally found in the tow-net near the island of New Providence, Bahamas.

The specimens found by me were collected between the months of July and November, about fifteen specimens in all having been obtained during this period. As I employed a great part of my time during my visit to the Bahamas in using a tow-net, the creature may fairly be called rare.

The general appearance of Haplodiscus, as seen under a simple lens, is shown in fig. 1. The body is ellipsoidal in outline, the antero-posterior diameter being the shortest. In an average specimen the long diameter measured 1·3 mm., the short 1·1 mm. The dorsal surface of the body is slightly convex; the ventral surface is flat when the animal is at rest, but capable of becoming concave as a consequence of muscular contraction. It is by producing a concavity on its ventral surface that the animal slowly and sluggishly moves through the water; this mode of progression, together with a general superficial likeness to a Protozoon, producing a strong resemblance to the Leptodiscus medusoides of R. Hertwig.

The internal anatomy can only be properly made out by

means of sections. In the living animal all that can be seen is a series of three opacities, one at each end and one in the middle of the antero-posterior axis. Of these, the anterior indicates the position of the brain (fig. 1, *Br.*); the median that of the alimentary tract and reproductive glands; while the posterior is due to the presence of the ductus ejaculatorius and vesicula seminalis (fig. 1, *V. S.*). The relations of these various organs can be easily seen in the diagrammatic longitudinal section (fig. 10). Besides the position of these main organs, the presence of large numbers of "yellow cells," scattered irregularly through the tissues, can be seen in entire specimens, whether fresh or preserved.

The body wall is formed dorsally of two, ventrally of three layers. In both cases the outer layer is a cuticle (figs. 2, 3, 4, and 10, *Cu.*), which again differs in structure on the two surfaces of the body. Dorsally it is an apparently structureless or very finely granular layer about 5 μ in thickness, which appears in section somewhat ragged at its outer edge, being sharply marked off internally from the subjacent tissues. On the ventral surface the cuticle (fig. 4) is divided into two layers; an outer, similar in all respects to the whole dorsal cuticle, and an inner (*i. cu.*), which appears in section as a very narrow transversely striated band. Whether this striation was due to the existence of fine pores or not could not be determined.

A muscle-layer seems to be present on the ventral surface only, and to lie immediately beneath the cuticle. In a longitudinal section through the ventral body wall a clear space, filled with some feebly-staining homogeneous material, is seen to lie in this position, and in this space is a row of rounded dots, the cross sections of transverse muscle-fibres (fig. 4, *m. tr.*). In the region of the ductus ejaculatorius some of these fibres can be seen passing inwards to form part of the sheath of that organ, and here there can be no doubt of their muscular nature (fig. 5, *m. tr.*). Occasionally, but very rarely, a nucleus or two can be seen in sections lying in the neighbourhood of the transverse fibres, but outside them

(cf. fig. 4) ; but whether such nuclei belong properly to the muscle-fibres, or whether they are the remains of an ectodermal epithelium which has otherwise disappeared, I have been unable to determine.

Beneath the layer of transverse fibres is a longitudinal layer, which appears to be much less important, its fibres being fewer and farther apart. These fibres seem in section to be connected with irregular, nucleated protoplasmic elements (fig. 4, *m. ep.*), the distinction of which has been perhaps exaggerated in the figure.

The only other muscles of the body are those round the ductus ejaculatorius (figs. 5, 7, and 10), where their structure is more easily seen. In this region every fibre appears to consist of a thin, wavy, contractile portion, often branched at the extremities, and connected near its middle with a granular protoplasmic body, containing a distinct nucleus. These fibres resemble those described in Tænia by Roboz more than any others with which I am acquainted.

A protoplasmic tunic, perforated only by the ductus ejaculatorius, forms the innermost layer of the body wall, lying immediately beneath the cuticle dorsally, but separated from that structure on the ventral side by the muscles. This tunic (figs. 2, 3, 4, 10, *P. t.*) consists of an irregular layer of granular protoplasm, in which nuclei are embedded at frequent intervals, but which does not show any trace of division into distinct cells. From the inner wall of this tunic numerous processes are given off (figs. 2, 3, 4, 10, *P. r.*) which anastomose with one another in the cavity of the body, forming a reticulum which is either continuous with, or forms an investment for, the remaining organs of the animal.

Embedded in the protoplasmic tunic, and opening from it through the cuticle to the exterior, are numerous mucous glands (figs. 2, 3, *gl.*). These are irregular spaces in the tunic, filled with a deeply-staining, probably mucous substance. The glands often contain, besides mucus, the remains of nuclei.

The brain is a transversely elongated body, lying embedded

in the protoplasmic tunic at its anterior end of the body (figs. 1, 3, 10, *Br.*). It is composed of a mass of fibres, below which is a layer of nerve-cells. From some of these cells processes go downwards to the cuticle, which some, and probably all, perforate. At each side of the brain is a special group of these processes, which stain more deeply than those nearer the middle line, though they seem not to differ from the latter in any other respect. I unfortunately neglected to make macerated preparations of the fresh Haplodiscus while I was in the Bahamas, and I cannot therefore say more about these processes. There can, however, be little doubt that they are in some way sensory.

A nerve having precisely the structure of the brain goes on each side for a short distance round the edge of the creature.

The alimentary tract occupies the centre of the body, communicating with the exterior by a mouth (figs. 2, 10, *M.*), which is simply a small perforation of the ventral cuticle, round which the muscles and other tissues do not seem to have undergone any special modification. The alimentary tract itself consists of a large mass of protoplasm, continuous at the sides of the mouth with the general tunic of the body, and sending processes from every point to join the protoplasmic reticulum. Nuclei seem to be absent, except occasionally at the edges of the mass. Vacuoles are frequently found, containing generally small crustaceans in various stages of disintegration. In one series of sections the alimentary protoplasm protruded from the mouth as represented in fig. 10, and it seems probable that during life it is capable of forming pseudopodia for the capture of prey.

The reproductive glands consist of a single testis, which lies on the dorsal side of the body, vertically over the mouth, and a pair of ovaries, one on each side of the alimentary mass.

The testis (figs. 2 and 10, *Te.*) is a mass of large, deeply-staining cells, lying in a meshwork of processes of the general reticulum, but not separated by any definite investing membrane from surrounding structures. The cells which form

the organ vary in character (fig. 8, *a*—*c*). First are found masses of large, finely-granular cells, the nuclei of which are evidently about to divide, presenting the appearance shown in fig. 8, *a*. Amongst these are masses, one of which is drawn in fig. 8, *b*, which resemble sperm-morulæ, being made up of a number of narrow, elongated pieces of protoplasm, each piece containing an elongated, deeply-staining nucleus, the pieces being spirally grouped around what appears to represent the part of the original cell which remains behind after the formation of spermatozoa. The elements of the third kind (fig. 8, *c*) are free spermatozoa, which lie loosely in a line running from the testis itself to a kind of vesicula seminalis at the posterior end of the body. The spermatozoa are elongated and wedge-shaped, seeming not to be provided with vibratile tails. Their nuclei are apparently always elongated and thread-like, though in most preparations there are individual examples in which no nucleus at all can be detected.

The vesicula seminalis is simply a space in the general somatic reticulum, a little larger than usual, which is filled with spermatozoa; its size varies according to the sexual condition of the animal to which it belongs, but it has not seemed worth while to do more than indicate its position in the diagram (fig. 10).

The ductus ejaculatorius appears to open into the somatic cavity at a point just ventral to the seminal vesicle. It is in the form of a tube, so curved that while its lower half is vertical its upper portion and its internal opening look directly forwards. Near its external opening, which is situated posteriorly in the ventral middle line, the lumen of the duct exhibits a considerable dilatation.

The structure of the walls of the ductus I have not elucidated in a satisfactory manner. So far as I have been able to determine, it is lined by a thick continuation of the ventral cuticle, which, however, exhibits many additional striations and other complications, so as to leave some doubt as to its real nature. Outside the cuticle is a layer of large cells, which may be either an epithelium or more probably a kind of

prostate, and outside these is a thick sheath of loosely-arranged muscular tissue, the circular and longitudinal fibres of which appear to be irregularly mixed.

I have given in fig. 10 a diagram only of the structure described, because in actual preparations the course of the ductus is complicated by small secondary twists, perhaps produced by the contraction of the creature in dying, which so complicate sections as to render many figures necessary if any attempt were made to reproduce the appearance actually seen.

The ovaries lie, as has already been said, one on each side of the mouth. Each contains a comparatively small number (under twenty) of ova, which lie loosely near to one another, but only connected as it were accidentally by the general somatic reticulum.

Each ovum consists of a mass of protoplasm, which is granular and deeply-staining in younger, spongy and coloured faintly by hæmatoxylin in older specimens (cf. figs. 2 and 9). The nucleus is large and vesicular, having a reticulum which in most cases breaks up during the preparation of sections, so that the nucleus appears partly filled with a mass of granular detritus. The nucleolus is a remarkable rounded structure, of considerable size, which appears to consist of a homogeneous substance, with a more or less excentric vacuole. The ova are surrounded, at any rate for a considerable time, by a delicate follicular epithelium, distinct from the surrounding reticulum (fig. 9).

No duct of any kind is observable in connection with the ovary, and the only way of escape which suggests itself for the ripe ova is the mouth.

In one specimen an ovum was found in the condition shown in fig. 9, with a large and conspicuous nuclear spindle, and at one end something which might conceivably be a polar body. Whether the dividing nucleus was in this case a preparation for the extrusion of a second polar body or for segmentation could, of course, not be determined, but this observation points to the existence of some method of internal fertilisation as at least probable.

The yellow cells are, as has already been said, scattered quite irregularly throughout the body. In the protoplasmic tunic they are numerous, lying generally freely in a space which separates them from the protoplasm of the tunic itself. This relation is well seen in horizontal sections through the body wall, such as that represented in fig. 6. It is, of course, probable that the space surrounding each cell is a post-mortem effect produced by the action of reagents on the protoplasm. In any case the appearance in sections is constant and characteristic.

There is generally a considerable group of yellow cells above the brain (fig. 2).

No distinct cell wall is discernible in the cells themselves, which appear to consist of a mass of protoplasm, sometimes solid and finely granular (fig. 6), more often vacuolated as in fig. 2. A rounded concretion was often observed in some part of the protoplasm, as in the cell marked γ, fig. 4. The nucleus is always situated close to one end of the cell, and is in sections somewhat coarsely granular.

The systematic position of Haplodiscus is not easily determined. I regret that my limited opportunities of examining fresh specimens did not permit me to form an opinion as to the presence or absence of an excretory system. But if such a system be present, it may fairly be assumed, from its absence in sections and from the general character of the animal, that it is built up on the ordinary Platyelminth type. And, neglecting the excretory system, the other characters of Haplodiscus seem exactly such as might be looked for in a free-living Cestode, which, owing to the absence of a nutrient fluid in which to bathe the surface of the body, and from which to absorb food, had either retained or acquired a mouth.

At the same time it seems easily conceivable that a Cestode or Trematode larva might, either normally or as the result of exceptional surrounding conditions, acquire reproductive glands of a simple type, and such a process would introduce into the life-history of the species in which it occurred a form which might easily present the characters of the animal before us.

EXPLANATION OF PLATE I,

Illustrating Mr. Weldon's paper on "Haplodiscus piger."

List of Reference Letters.

Al. Alimentary mass. *Br.* Brain. *Cu.* Cuticle. *D. E.* Ductus ejaculatorius. *F.* Food particle in food vacuole. *fo.* Follicle cells of ovary. *Gl.* Gland-cell. *i. cu.* Inner layer of ventral cuticle. *m. l.* Longitudinal muscles. *m. l. ep.* Epithelial portion of muscle-fibres. *m. t.* Transverse muscles. *M.* Mouth. *Ov.* Ovary. *P. r.* Protoplasmic reticulum. *Sp.* Sensory processes in connection with brain. *Te.* Testis. *V. S.* Vesicula seminalis. *Y.* Yellow cells.

FIG. 1.—View of Haplodiscus piger, under a simple lens. (× about 40 diam.)

FIG. 2.—Transverse section through the middle of the body, showing the relations of the mouth and alimentary system, the ovaries, and the testis.

FIG. 3.—Transverse section through the anterior end of the body, showing the brain.

FIG. 4.—Small portion of longitudinal section of the ventral surface, showing the structure of the body wall.

FIG. 5.—From a longitudinal section which cut tangentially the sheath of the ductus ejaculatorius, showing the transition between the muscles of the sheath of that organ and those of the body wall.

FIG. 6.—Small portion of a horizontal section through the peripheral protoplasmic tunic, showing the absence of cell-outlines, and the relations of the glands and yellow cells.

FIG. 7.—Two muscle-fibres, from the neighbourhood of the ductus ejaculatorius.

FIG. 8, *a*.—Young sperm-cells from the testis, lying in the general reticulum.

FIG. 8, *b*.—A sperm-morula from the testis.

FIG. 8, *c*.—Ripe spermatozoa.

FIG. 9.—Ovum observed in one specimen, with nuclear spindle and perhaps a polar body.

FIG. 10.—Diagram of median longitudinal section. For the sake of clearness the yellow cells are omitted.

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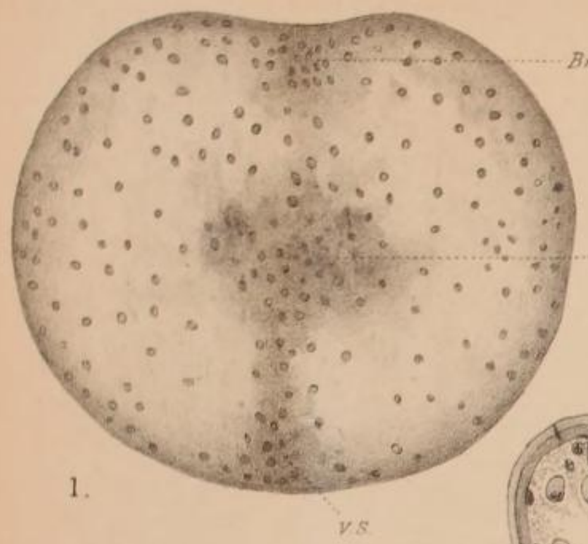

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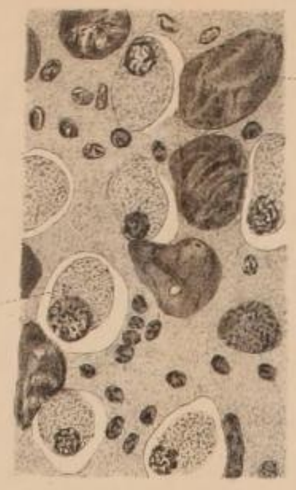

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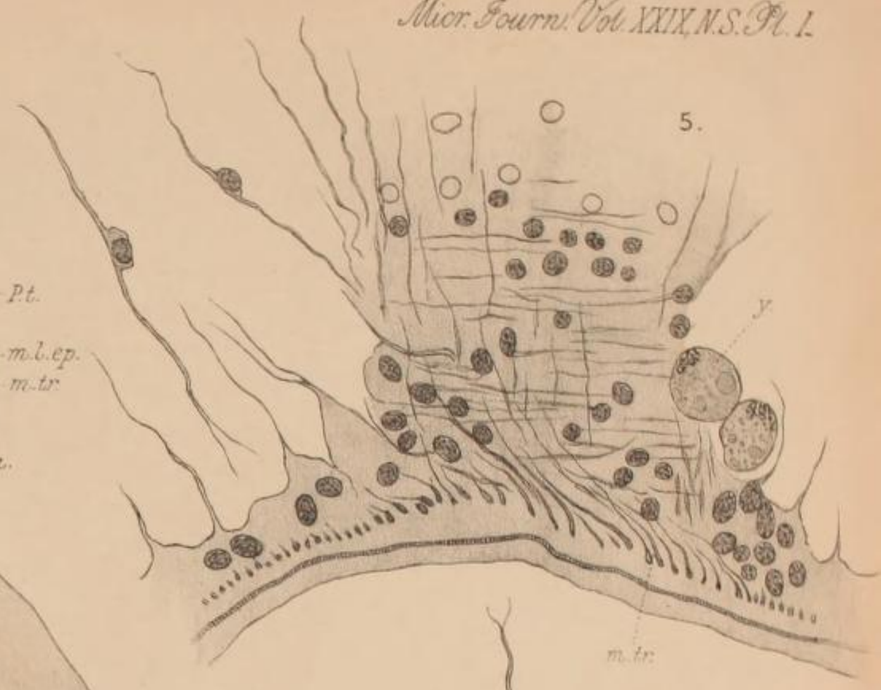

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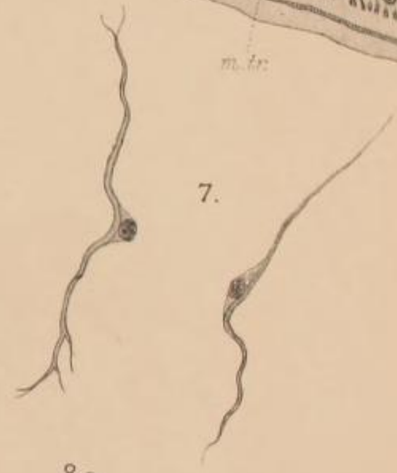

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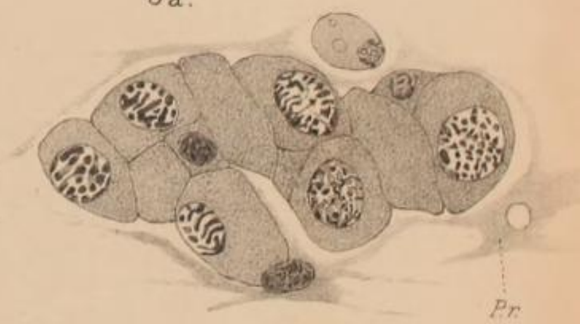

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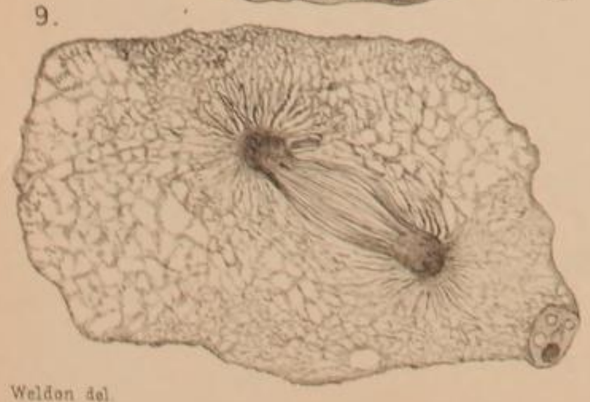

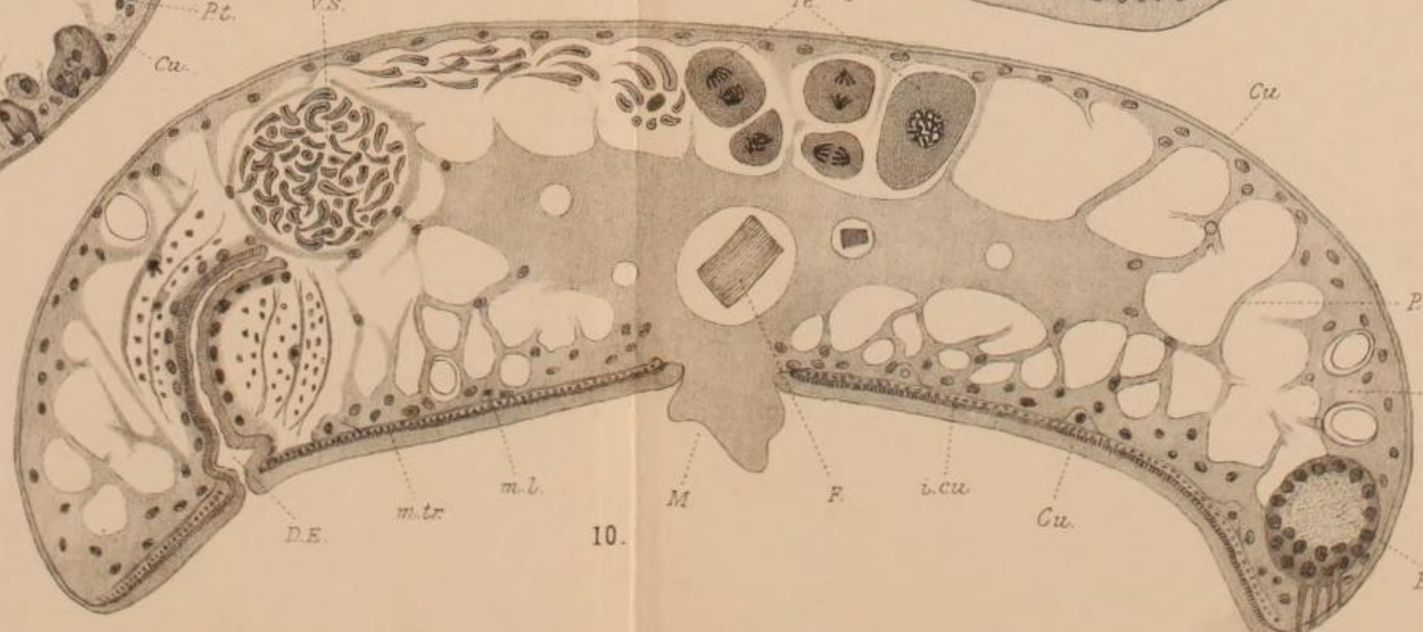

10.

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