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FITZ (R. H.)

ANATOMY  
OF THE  
FASCIOLA JACKSONI.

BY  
R. H. FITZ, M. D.



[REPRINTED FROM THE NEW YORK MEDICAL JOURNAL, NOV., 1876.]



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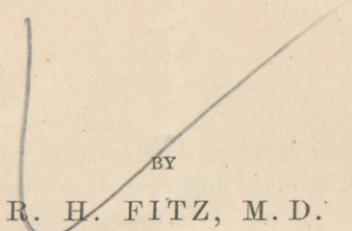
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## ANATOMY OF THE FASCIOLA JACKSONI,<sup>1</sup>

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DR. COBBOLD has applied this name to a fluke discovered by Dr. J. B. S. Jackson in the gall-ducts of an East Indian elephant. In his "Descriptive Catalogue of the Medical Improvement Society's Cabinet," published in 1847, Dr. Jackson records his observation, speaking of the parasite as a *Distoma hepaticum*, but gives no account of its minute anatomy.

Diesing ("Systema Helminthum," 1850, vol. ii., p. 560") had noticed this statement, and, according to Cobbold, allowed it to appear in his "Revision der Myzelminthen" as the *Distomum elephantis*.

In 1868 Cobbold received two of the parasites from India, which were compared with a number of others, shown by Prof. Huxley, and he was thus enabled to ascertain that they represented a distinct species, which he has described somewhat in detail as follows ("Entozoa," supplement, p. 80, London, 1869):

"Body armed throughout with minute spines, orbicular, usually folded at either end toward the ventral aspect, thus presenting a concavo-convex form; oral sucker terminal, with reproductive papilla about midway between it and the ventral acetabulum, intromittent organ one-fourth inch in length; digestive apparatus with two main zigzag-shaped canals, giving

<sup>1</sup> Read before the Boston Society of Medical Sciences.

off alternating branches at the angles thus formed, the ultimate caecal ramifications together occupying the whole extent of the body; length, when unrolled, from one-half to five-eighths inch; breadth, one-third to one-half inch."

In the book referred to, Cobbold suggests "that (if, happily, the flukes are still preserved in the Boston Museum) it will be found that they specifically correspond with those now in our possession."

Dr. Jackson has preserved a large number of the flukes, and has generously placed them at the disposal of Dr. H. P. Quincy, who has made and presented to the Warren Museum the series of admirable preparations in which the following observations were made:

The sections are longitudinal, transverse, and horizontal, and are so arranged that the entire length, breadth, and thickness, of the animal are preserved as numerous thin sections arranged in the natural sequence.

The sections have been stained in carmine, rendered transparent in oil of cloves, and are preserved in dammar varnish. A study of them has not only enabled me to confirm Dr. Cobbold's surmise, but has also brought to light certain features in the anatomy of the fluke of which I find no mention in the authorities I have consulted.

The special characteristic of the *Fasciola* is its dendritic or branched intestine—the *Distoma* having a simple, bifurcated intestine. The *Distoma hepaticum* or *Fasciola hepatica*, the common liver-fluke, the *Fasciola gigantea* found by Cobbold in the giraffe, and the present *Fasciola Jacksoni*, are the only forms of *Fasciola* yet described.

With regard to the latter, it may be stated in brief that its general shape and dimensions are as mentioned by Cobbold, and the intestinal canal has the distribution as stated by him. Instead of there being a reproductive papilla, there is rather a pocket, or depression, midway between the pharynx and ventral sucker, into the lower part of which opens the oviduct, or vagina, while in the posterior wall nearer the ventral surface is the opening for the penis. The length of the intromittent organ could not be ascertained, as it was either wholly retracted or destroyed.

Instead of finding the "body armed throughout with minute spines," the cuticle covering the abdominal surface presents a series of ridges pointing backward, and extending the entire length of the animal. Traces of a similar formation are present on the dorsal surface of the neck—elsewhere the back is quite smooth.

The cellular structure of this fluke and the arrangement of the muscular bands do not differ from the statements made by Leuckart ("Die Menschlichen Parasiten," 1863, vol. i., p. 536) with regard to the *Distomum hepaticum*.

Just beyond the terminal oral sucker is a voluminous, bottle-shaped, muscular pouch, the pharynx, with which a short tube, the œsophagus, communicates. The latter has a crenated outline, as if capable of a considerable elongation. This tube bifurcates at its lower end; the two short branches thus formed pass respectively to the sides of the animal, and enter the main intestinal canals, which extend, one on either side, along almost the entire length of the body. These canals are widely separated from each other until they approach the tail, and between them lie the sexual organs, male and female, toward the front, the remaining space, between, behind, and around, being filled in by the yolk-glands or tubes, and the cæcal pouches of the intestine. The latter arise as primary, secondary, and even tertiary divisions from branches given off more or less alternately from the main canals, and their general direction is backward. Those running toward the median line are short, with comparatively few branches, while the external tubes are considerably longer, often bifurcating before the secondary and tertiary canals arise. The largest number of cæcal pouches are thus observed in the outer portions of the parasite. Another peculiarity of the external canals is, that their secondary branches are almost invariably given off from the posterior aspect of the tubes from which they arise. The intestine is lined with a cylindrical epithelium said to be ciliated, but in the specimens covered with a material resembling inspissated bile.

Another system of tubes, the excretory apparatus, is merely indicated in the specimens, which have been preserved in alcohol, by occasional clumps of delicate, finely-granular

epithelium arranged in a somewhat tubular form, the tubules often being branched. Leuckart describes a diverticulum passing from the posterior end of the oral sucker below the pharynx. I find also this condition, though it is present in the longitudinal and horizontal sections, on both sides of the pharynx. I am, therefore, inclined to agree with Mehlis, who regards this appearance as representing a furrow which encircles the projecting end of the pharynx, the nose of the bottle, and seems to promote the process of suction.

The sexual organs are male and female. The former include the penis and its sac, the seminal vesicle—*vasa deferentes* and testicles. The female organs are the oviduct through which the ova are discharged, the uterus, ovaries, yolk-glands, shell-gland (Leuckart), and vagina, through which impregnation probably takes place. The existence of the latter tube has attracted my special attention, as I have found elsewhere no mention of its presence, and it suggests another complication in the very obscure propagation of the flukes.

The shell-gland may be regarded as the centre of the female sexual organs, as it receives from above the formative and impregnating material, and discharges its contents into the uterus below. It is a rounded, glandular body, of considerable size, lying toward the back of the fluke, and behind the seminal vesicle. Its interior is a globular cavity, somewhat pear-shaped, becoming narrow below where it is continuous with the convoluted tube representing the uterus. Above it communicates, by a short, narrow tube, with the conjoined yolk and ovarian ducts, into the ovarian part of which the vagina enters. The ovaries lie toward the ventral surface of the animal, a short distance behind the ventral sucker, and are two large convoluted tubes with blind projections. These tubes unite near the median line into a single tube or duct, which passes upward toward the front of the shell-gland, becomes very narrow, and at one point sharply constricted. Into this narrow duct, beyond the constriction, enters the vagina, and the tube then unites with the yolk-duct, forming a T-shaped figure, the lower arm of which enters the interior of the shell-gland, as before stated.

The yolk-glands are clusters of cells widely distributed throughout the body, and which are apparently connected, eventually two main tubules being formed on either side of the shell-gland. These are connected behind the latter by a transverse tube, from the middle of which arises the narrow yolk-duct, which unites with the ovarian duct.

The vagina is a delicate, convoluted tube which extends vertically upward in the median line over the shell-gland opening upon the back of the fluke. The upper portion of its course has a circular coat of muscular fibres.

The uterus passes downward from the shell-gland as a convoluted tube, which soon becomes very voluminous, and is filled with ova in various stages of development, and granular masses, largely yolk, and partially, probably, spermatozoa. The convolutions of the uterus lie rather behind and around the ventral sucker, toward the ventral surface. The tube finally becomes narrow, with a strong muscular wall, and is thus continued forward on the left, between the seminal vesicle and the ventral sucker, emptying into the genital pouch.

The testes are large convoluted tubes lying chiefly behind the uterus and shell-gland toward the abdominal surface. The vasa deferentes pass forward on either side of the shell-gland and enter separately the posterior and lower end of the seminal vesicle. The latter lies near the dorsal surface of the animal, and extends from just behind the posterior border of the ventral sucker nearly to the genital pouch. Broad behind, it becomes narrow and eventually pointed toward the front, where it is separated on the right by a partition, from a space in which lies, slightly convoluted and imbedded in loose cellular tissue, the muscular tube leading to the penis. This space forms the beginning of the cirrus pouch, which is continued downward and then forward, to terminate in the genital depression.

Leuckart, in describing the anatomy of these parts, calls attention to the difficulties in the way of self-impregnation—a view advanced by some writers. He further considers the apparent difficulties of copulation between two flukes, owing to the relative positions of penis and vagina (oviduct), the spiral

shape of the former and the direct course of the latter, and the marked difference in their volume.

Cobbold has actually observed sexual congress in case of *Distoma conjunctum*, so that self-impregnation is not a theoretical necessity in case of the hermaphroditic flukes. In considering the physiological purpose of the dorsal tube I have spoken of as a vagina, it seemed to me most likely to serve as a channel for the passage of spermatozoa, from its intimate relation with that part of the sexual organs where the ova were found. That the eggs might be impregnated, they should be without shells, and the only place where such are found is between the ovarian duct and the upper part of the uterus. Did the spermatozoa ascend from the genital pouch, a very long distance would have to be gone over, through a tube narrow and firmly contracted at its lower end, tortuous and distended with eggs beyond. The mechanical difficulties were so marked on the one hand, and so simple and direct an apparatus existed on the other, that I feel no hesitation in speaking of this dorsal tube as a vagina. An additional argument in favor of this view is derived from the presence in the tube of a small amount of finely-granular material resembling the contents of the seminal vesicle.

APPENDIX.—Soon after the above communication the third and final Lieferung of Leuckart's "Menschlichen Parasiten," just published, was received. I find that Stieda<sup>1</sup> has described the dorsal tube alluded to. He at first considered it as a channel for the removal of superfluous yolk, but later<sup>2</sup> regards it as the true vagina, and shows that it exists largely among the Trematoda. The presence of a special vagina, distinct from the oviduct, has since then been determined by other investigators so often, "that it may be regarded as a general characteristic of the Trematoda."

<sup>1</sup> "Archiv für Anatomie und Physiologie," 1867, pp. 52-59.

<sup>2</sup> *Op. cit.*, 1871, p. 31.

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