finest excretory tubules, above mentioned, open by funnels (fig. 1, D), into each of which projects a vibratile cilium, thus constituting the so-called “flame-cells.” These researches have given rise to numerous differences of opinion, as regards questions both of fact (16) and of priority (17).

The liver-fluke contains a complete set of male and female organs, which form the most conspicuous part of its anatomy, and both of which open into the genital sinus which has been described above. *A. The Male Organs.* (i.) The testes (fig. 1, B, *t*) are two in number, situated one behind the other in the hinder division of the median area. They rest upon the ventral cortical layer in the parenchyma of the body, and immediately above them are the ramifications of the digestive tract. Each consists of a large number of ramifying tubes, often with slightly dilated extremities. These unite into three or four, and eventually into two, main excretory ducts *(va, vp),* which terminate at the base of the cirrus-pouch. Within the testicular tubules may be found spermatozoa in all stages of de­velopment; the first stage appears to consist of small roundish membraneless cells with a single nucleus ; the nucleus then divides and the cells become polygonal from mutual pressure. These large cells lie in the middle rather than at the sides of the tube, and among them are a number which, while they possess on one side a smooth evenly rounded contour, are on the other very irregularly and deeply serrated. These serrations elongate until they become the delicate filaments of spermatozoa, the small shining heads of which are still embedded in the protoplasm of the cell. (ii.) The vasa deferentia *(va, vp)* are a pair of slender elongated canals, which lie on the two sides of the middle line, and unite at the inner extremity of the cirrus-pouch, which they penetrate in common. Their walls consist of a very delicate homogeneous but resistant membrane, upon which contractile fibres are disposed, close together and parallel to the axis. (iii.) The cirrus-pouch (cs) is a muscular egg- shaped organ ; the upper pole, which receives the united vasa deferentia, is situated above the ventral sucker and separated by only a very slight interval from the dorsal cortical layer, whilst the position of the lower pole is indicated by the porus genitalis (*p*). The muscles are disposed in two layers, of which the inner is thin and composed of circular fibres ; the outer longitudinal layer is much thicker, and its fibres are disposed in bundles ; furthermore its apex receives a large number of dorso-ventral fibres. Within the cirrus-pouch the two terminal sections of the male conducting apparatus are situated. (iv. ) The first of these is the vesicula semin­alis (fig. 1, B, *vs*; C, *g),* a large, spindle-shaped dilatation of the canal usually more or less curved upon itself. Its wall is somewhat more complex than that of the vasa deferentia, consisting of a layer of tissue with many nuclei but no distinct cell-boundaries, succeeded by a delicate layer of circular muscular fibres, which is again fol­lowed by a layer of longitudinal ones. (v. ) The ductus ejaculatorius (fig. 1, C, *h*), which immediately succeeds the vesicula seminalis, is a long slender tube, disposed in coils, and usually projecting like a papilla into the base of the sinus genitalis. Its walls are furnished with a number of unicellular glands. *B. The Female Organs.* The female reproductive apparatus may be roughly divided into two portions, that which produces the eggs and that which conveys them to the outside of the body ; in the former of these processes three organs take part—one producing the germ, another the second­ary or food-yolk, and a third the egg-shell. (i. ) The germarium or ovary (fig. 1, B, *o*) is situated between the anterior testis and the ven­tral sucker, in about three cases out of four on the right hand side of the body. It has the form of a branching tubular gland, the rami­fication being dichotomous throughout ; in most cases the branches are about as large as the stems which give rise to them. The ovi­duct passes towards the shell-gland, narrowing as it approaches this, and finally unites with the excretory duct of the yolk-glands. (ii.) The yolk-glands *(y)* of the liver-fluke are paired organs of consider­able size ; they extend over both lateral areas, to which they impart the opaque appearance and reddish colour above alluded to. They are composed of innumerable small acini, spheroidal in shape and situated in groups on minute ductules, which unite to form a longi­tudinal canal on either side of the body. These canals are on the whole parallel to the margins of the animal and distant from it about one-fifth of its greatest breadth. At the anterior margin of the testicular area each longitudinal canal gives off a transverse branch, which unites with its fellow of the opposite side in the middle line to form a pear-shaped reservoir, situated just behind the posterior margin of the shell-gland. From this reservoir the common yolk-duct passes forwards in the substance of the shell­gland and there unites with the oviduct. Previously to this, how­ever, it gives off a minute canal, which after an upward course opens on the dorsal surface of the animal ; it is known as the Laurer- Stieda canal, and its function has been the subject of much discus­sion. It has been supposed (1) “ to serve for copulatory purposes,” as has been seen by Zeller (18) in *Polystomum,* and as is supported by its structure in *Axine* and *Microcotyle,* and (2) “ to act as a safety tube for the escape of over-abundant or altered vitelline products and spermatozoa,” the main argument in support of which is that its calibre is too narrow to admit of copulation taking place by

its means; compare Sommer (10), Kerbert (11), Poirier (19), Loose (20), and Lorenz (21). (iii.) The uterus or female conducting appa­ratus (*u*) originates at the union of the ducts of the germarium and yolk-gland. Its first portion, which lies within the shell-gland, is a delicate narrow canal, except when it is distended either by eggs or by semen. The median section of the organ is by far the largest both in length and breadth; it occupies almost the whole of the anterior part of the median area of the animal, between the ventral sucker and the shell-gland, and forms four or five large coils lying alternately right and left, which as a rule are filled with com­pletely formed eggs. The third section of this organ includes the coils which lie above and anterior to the ventral sucker ; it is some­times called the vagina. When it contains eggs these are generally in a single file, and thus give it a moniliform appearance ; it lies en­tirely on the left side of the body, gradually approaching the middle line as it passes forward, until it ends below the cirrus-pouch at the left and posterior aspect of the genital pore (fig. 1, C, *e*). (iv.) The

shell-gland (fig. 1, B, s), which (as its name implies) furnishes the external coating of the eggs, has been already several times men­tioned. In the Trematodes, as in the tape-worms, it forms a kind of central point of the female generative system ; it is a spheroidal mass of unicellular glands, each of which opens by its own special duct into the commencement of the uterus. The secretion of the shell-gland is liberated in the form of small pellucid droplets, which unite to form drops ; afterwards it becomes thick and viscid and of a mahogany brown colour. In this condition the drops are dis­persed through the uterus mixed with the secretions of the other genital glands, and they apply themselves to the recently formed eggs, producing a delicate membrane around them. This process is carried on in those coils of the uterus which lie immediately out­side the shell-gland, corresponding to the “ootype” described by Van Beneden in other Trematodes.

The eggs undergo a gradual development as they pass along the uterus. The ripe primitive ovum, on entering the female conduct­ing apparatus, becomes coated with a larger or smaller number of spherules of secondary yolk, and then undergoes the process of segmentation which leads to the formation of a morula. At this point it receives the secretion of the shell-gland. The completely formed egg (fig. 1, E) has a length of 0∙13 mm. and is ovoid in shape, with a small lid or operculum at the broader end ; its contents consist of a number of roundly polygonal cells, with only a small quantity of secondary yolk remaining among them. All of these but one have a thick granular protoplasm, the exceptional cell having homogeneous and strongly refracting contents. It usually lies immediately under the operculum, and is partly embedded in the other cells. They are often present in the bile-ducts in such quantities as to form a stiff brownish mass resembling wet sand, and the number produced by a single fluke has been estimated at half a million.

The mode of fertilization of the liver-fluke has given rise to much discussion. According to Sommer, the organ which has usually been described as a cirrus or penis is merely the genital sinus eva- ginated by abnormal pressure (fig. 1, C, *d)* ; it is furthermore but ill-adapted to enter either of the canals which could possibly serve as a vagina. He is therefore of opinion that self-impregnation occurs, the external aperture being closed by the oblique muscles, and the semen passing directly from the vas deferens through the genital sinus into the uterus. The whole question of the fertiliza­tion of the Trematodes is a matter on which very varied opinions have been expressed, even by authors who have examined the same forms. The assertion of Von Siebold that a direct internal com­munication exists between the male and female organs has been denied by Stieda (22) and by many subsequent writers, but has been restated by Lorenz (21) and by Zeller in the case of *Polystomum integerrimum* (18) ; however this may be, there can be no doubt that self-impregnation does occur in certain cases. The structure of the organs renders it more than probable in some species (see Poirier, 19, p. 582) ; Zaddach has observed it actually taking place in *Distomum cirrigerum* encysted in *Astacus* (23), and a single *Poly­stomum integerrimum* has been found in a frog’s bladder with sperm in the female passages. Reciprocal fertilization, in which two in­dividuals act both as male and female simultaneously, has been recorded by Zeller in *Polystomum integerrimum,* by Looss (20) in *Distomum clavigerum,* and by Cobbold in *Distomum campula.*

The nervous system consists of a commissure passing round the oesophagus very obliquely, and swelling out into ganglia at three points. *Tristomum molæ* possesses eyes of an extremely simple type, the retina being merely a ganglion cell (Lang, 24).

*Life-History and Development.—*The life-history of *Fasciola hepatica* was worked out independently by Thomas (25) and Leuckart (26) ; regarding the question of priority see Jackson (27).

The development of the embryo can only take place outside the body of the host and at a lower temperature, the most favourable being from 23o to 26o C., at which the process occupies two or three weeks. The free embryo (fig. 2, A) is conical in shape, with a rounded apex, its average length being 0∙13 mm. At the broader anterior end is a retractile head-papilla, with the exception of which the body