rupture takes place through the transverse vessel above described, and, as the hinder margin of the proglottis contracts forcibly when the next one has left it, the transverse vessel gives rise to the rounded vesicle which forms the termination of the excretory system.

*Life-History and Development.*

The six-hooked embryo (fig. 1, G) may be conveyed to the inter­mediate host in several ways, but the commonest is for it to be taken into the alimentary canal along with food to which it may have adhered, or with water in which it was swimming ; the infection may take place either by means of free eggs or by whole proglot­tides. In the latter case the soft tissues are first digested by the gastric juice of the host, and in either case the egg-shell is dissolved or rendered so brittle that the embryo readily escapes by the move­ments of its hooks. The proscolex, after spending a longer or shorter time free in the stomach or intestine, proceeds to perforate the wall of these organs by means of active burrowing motions. Although the embryo of a *Tænia* has only once been captured in its progress through the wall of the alimentary canal (Raum, 15, p. 28), there can be no doubt that this is the route by which it usually proceeds, and that its next locality is a blood-vessel, probably some small branch of the portal vein, in the blood of which it has been found by more than one observer. This would explain the frequency with whieh the next stage is found in the liver. There seems, however, reason to believe that many embryos penetrate the intestinal wall completely and reach the body-cavity, in which they can wander freely. When the six-hooked embryo has reached its resting-place, which in addition to the liver may be lung, muscles, brain, connective tissue, or eye, it at once commences its further development, and in a few days becomes visible to the naked eye. Like any other foreign body, it causes a proliferation of cells, which in due time form a sheath of con­nective tissue, with a cellular lining, and smooth like a serous cavity within ; this covering, however, is not found when the parasite is situated in the brain or the eye. The embryo now grows in size, generally becoming somewhat elongated, and the hooks drop off. Sometimes they can be found lying detached in the connective-tissue sheath. The central cells enlarge and become clear, and in all the *Tæniæ* they liquefy, forming a quantity of fluid which fills the centre of the bladder-worm. At this stage the larvæ constitute the so-called “measles” of beef (that of pork being due to *Cysticercus cellulosæ,* the immature stage of *Tænia solium)* ; they are ovoid vesicles lying between the muscle fibres and varying in length from 4 to 8 mm. and being usually about 3 mm. in diameter (fig. 2, A). At a point on one side of the bladder there appears a small thickening, the meniscus or rudiment of the future head ; this is soon followed by an invagination of the cuticle (fig. 2, B). When the rudimentary head thus formed is about 0∙2 mm. in length (the bladder being 1∙5 mm. in diameter) the forma­tion of muscles in its walls commences. At four equidistant points near the bottom of the invagination the suckers are developed, and at the lowest part of the cavity the rostellum (and the double circlet of hooks in the armed species) is formed. Surrounding the head-rudiment on that surface which is towards the cavity of the bladder is a thin layer, known as the “receptacle.” This is best seen in *Cysticercus cellulosæ,* in which there is also a very characteristic bend or kink in the pedicle of invagination, which in most other bladder-worms remains straight (see fig. 2, C). The rudiments of the vascular system of the bladder have already appeared before the formation of the head, and now they extend into it as four longitudinal vessels, which become connected at the bottom of the invagination by a circular vessel. About this time, too, the cal­careous corpuscles above described make their appearance. When the hooks and suckers are fully formed, the head undergoes a process of evagination, so that what was previously a hollow cavity becomes a solid cylinder, and the hooks, which were below the suckers, come to lie above them. Mature bladder-worms vary in size from *Cysticercus fasciolaris,* the size of a pea, to *Cysticercus tenuicollis,* six inches or more in length.

The development into the adult tape-worm takes place only after the *Cysticercus* has been- swallowed by the permanent or definitive host. The course of this metamorphosis has been followed experimentally, and it has been found that first the bladder and next the neck of the worm are dissolved by the gastric juice. The head only is left ; in the moist warmth of the intestine its suckers and rostellum exhibit very lively motions, which serve to bring about its attachment to the intestinal wall. It gradually increases in length, and the formation of segments speedily commences.

The life history of the Cestodes is generally summed up as con­sisting of three different forms :—(1) the proscolex, or six-hooked embryo, which gives rise to the bladder-worm ; (2) the scolex, which develops the chain or strobila by a process of budding ; and (3) the proglottis, or sexual animal, which produces eggs. Each of these three forms has certain claims to be regarded as a zoological “individual.” Van Beneden (13, *Vers Int.,* p. 251) has laid great stress upon the correspondence between a Trematode and a ripe proglottis, and it has been since pointed out that a proglottis may under favourable circumstances (that is, within the intestine) con­tinue to grow after being detached from the parent chain; it cannot be said, however, that the evidence upon which this rests is quite incontrovertible. Regarded from this point of view the life-history of the tape-worms furnishes an admirable instance of the alterna­tion of generations. The individuality of the proglottides, however, although maintained by authorities so eminent as Leuckart, is by no means universally accepted ; a distinction has been drawn be­tween their formation and true budding seen in other animal colonies, such as the *Polyzoa* ; and Riehm, in a recent work (12), has pointed out that the casting-off of these sexual segments is in some respects comparable to the detachment of the hectocotylized arm of a Cephalopod, and the formation of new joints to the de­velopment of an Oligochætous worm from a few segments ; further­more, certain organs—for example, the nervous and excretory systems—are continuous throughout the whole chain, and an isolated proglottis is unable to maintain its existence for more than a very limited period. According to this view, alternation of generations only occurs in Cestodes in forms such as *Cœnurus,*

where there is a proliferation of heads in the wall of the bladder.@@1

The Cestode larvæ corresponding to the stage which has just been described present considerable variations both in form and struc­ture, and upon these classifications of the group have been based, and generic names have been given to the different forms ; Von Lin- stow (36) has, however, pointed out the undesirableness of this, as they are all parts of the life-history of one genus, *Tænia.* The most recent arrangement is that of Villot (16), which is as follows:—

1. The caudal bladder arises from the proscolex by simple growth and structural modification, without the formation of any new parts. A larger or smaller quantity of fluid is present, and also a connective-tissue sheath ; the host is a vertebrate. *Cysticercus* (true bladder-worms), *Piestocystis, Cœnurus, Echinococcus.*
2. The caudal bladder arises from the proscolex by budding, that is, by the formation of new parts ; there is no connective-tissue sheath, and the host is an invertebrate. *Cysticercoidei,* Leuckart. (œ) Caudal bladder formed by endogenous budding; the head is surrounded, not only by the body of the worm and the caudal bladder, but also by the blastogen (proscolex). *Polycercus* (from the earthworm), *Monocercus* (from the black slug, *Arion*). (*b*) Caudal bladder formed by exogenous budding ; the head is only surrounded by the body of the worm and the caudal bladder. *Cercocystis* (from *Tenebrio), Staphylocystis, Urocystis, Cryptocystis.*

Of these the most important are the first group, and regarding some of them a few words must be added. In the great majority of species only one tape-worm head is produced, and such bladder­worms constituted the genus *Cysticercus* of the older helmintho­logists. In certain cases, however, notably in the worm which produces the “ staggers ” of sheep, numerous heads are formed in the wall of each bladder ; such larvæ formed the genus *Cœnurus,* but apart from their polycephalous condition there are no structural peculiarities calling for special notice. The third variety of bladder-

@@@1 At the moment of going to press, Grassi *(Zeitschr. f. Parasitent.,* ii. 11) makes the important communication that *Tænia murina* (=T. *nana)* may develop without an intermediate host.