*Polycercus)* ; or these internal vesicles may bud off a large number of scolices on their external surface *(Staphylocystis).*

*Morphology of the Cestodes.—*With regard to the vexed ques­tions of the morphological nature and of the affinities of the Cestodes, divergent views are still held. One view, the monozoic, regards the whole development as a prolonged metamorphosis; another, the polyzoic view, considers that not only is the Cestode a colony, the proglottides being produced asexually, but that the scolex which buds off these individuals is itself a bud produced by the spherical embryo or onchosphere. On this view, therefore, at least two asexual generations (embryo and scolex) alternate with a sexual one (proglottides); and in the case of *Staphylocystis* the cyst contains two asexually produced generations, so that in such forms three stages (embryo, primary scolex-buds, secondary scolices) intervene between the proglottis of a Cestode and that of its off­spring. The polyzoic view is ably championed by Braun (2) and (3).

The more valuable point of view is undoubtedly the monozoic one. In accordance with this we can regard the development as an adaptive one and the scolex as invaginated for protective

purposes inside the cyst, which is itself an organ comparable to an amnion. On this view, multiple scolices are, therefore, not buds, but an example of the unlocalized organization of the embryo such as occurs in other groups of animals, and is demonstrated by experiment. The evolution of the cysticercoid, cysticercus and other forms of larvae is a varied adaptive phenomenon. With regard to the adult worm we have to remember that its two ex­tremities, scolex and terminal proglottis, are different from the intervening region. The terminal or first-formed proglottis is sterile, and contains the primitive and (except in a few genera) the only excretory pore. The excretory tubes, the nervous system, and the parenchyma and integument are continuous from one end of the worm to the other. The repetition of the genitalia is the real mark of the Cestodes, and we can trace the independence of the somatic from the gonidial metamerism in such forms as *Triaenophorus* and others. In fact, the whole history of the Platyelmia is marked by a great specialization of the reproductive evolutionary history, accompanied by a simple somatic line of evolution. We therefore regard the body of a Cestode as a single organism within which the gonads have become segmented, and the segmentation of the body as a secondary phenomenon associated

with diffuse osmotic feeding in the narrow intestinal canal. The origin of the repetition of the gonads has yet to be investigated.

*The Effects of Cestodes on their Hosts (Shipley* and Fearnsides [4].)—

I. *By their presence.* This depends largely on the station adopted by the parasite. *Cysticercus cellulosae* may be comparatively innocuous in a muscle or subcutaneous tissue, but most hurtful in the eye or brain. Of all parasites the one which by its mere presence is the most dangerous is the larva of *Taenia echinococcus.* Its bulk alone (equal to that of an orange) causes serious disturb­ances, and its choice of the liver, kidneys, lungs, cranial cavity and other deep-seated recesses, gives rise to profound alterations.

2. *By their migrations.* The migration of the Cestode-larvae through the walls of the intestine into the blood of their host is the cause of grave disturbances, due largely to the perforation of the tissues, inflammation of the vessels and peritoneum, and other effects of these immigrants.

3. *By feeding in their host.* The loss of nutrient fluid caused by the presence of intestinal Cestodes is probably slight, indeed, the sharper appetite that accompanies their presence may be the means of fully compensating for it. The tapeworm, *Taenia saginata,* throws off eleven proglottides a day during its mature stage, and if this rate of increase were maintained for a year the total weight of its progeny would be about 550 grammes. The broad worm, *Dibothriocephalus latus,* is similarly estimated to discharge 15 to 20 metres of proglottides, weighing 140 grammes. The loss of substance represented by this growth is probably only of serious account when the host is a young growing animal that needs all available nourishment.

4. *By producing Toxins.* It is generally admitted that Cestodes, both adult and larval, contain toxins of great virulence, though in what way and in what organs these substances are produced is uncertain. Injection of the fluid-extract of such worms into the blood or coelom of their host causes grave disturbance. Thus Echinococci contains a leucomaine which sets up an urticaria; *Cysticercus tenuicollis* occasions anaemia and death if injected into rabbits; and the cystic fluid of the common *Coenurus serialis* is said to be used by Kirghizes to poison wolves. But the evidence in favour of the view that tapeworms normally excrete toxin into the body of their host in such amount as to occasion disease is not generally accepted as conclusive. This evidence is, however, strengthened by the results of recent work on changes in the blood of patients suffering from helminthiasis. The occurrence of the broad tapeworm in man is often associated with anaemia of a most severe type. The coloured constituents of the blood are most affected. New elements appear in addition to degenerative changes in the normal red corpuscles. Large nucleated red blood-cells make their appearance. The white blood-cells, or leucocytes, undergo other changes. In hydatid disease there is, as a rule, a marked increase in the number of those white corpuscles which possess a specially staining affinity with the dye eosin, and are therefore known as eosinophile cells. This change, which is called eosinophilia, indicates the production of a noxious substance in the blood. The fact of this increased leucocytic activity during the early stages, or the whole course of infection by Cestodes, is indirect proof that these parasites do normally discharge toxic substances into their hosts.

*Classification of the Cestoda Merozoa*

Order I.—*Dibothridiata.* Scolex with two “ bothria,” or modi­fication thereof, usually devoid of hooks. Male and female copu- latory ducts open by a common pore. Uterine pore present. The majority parasitic in fish. Selected forms: *Dibothriocephalus latus* in man; Russia, Switzerland, southern France, North America. *Ligula,* unsegmented externally, occurs in birds. *Schistocephalus* becomes fully segmented in *Gastcrosteus* and mature in aquatic birds (ducks, &c.). *Triaenophorus,* indistinctly segmented, occurs in the pike.

Order II.—*Tetraphyllidea* (Tetrabothridiata). Scolex with four outgrowths forming organs of adhesion and probably also of loco­motion. Uterine pore absent. Almost exclusively parasitic in the intestine of Elasmobranch fish. The metacestode-larva occurs free in the intestine of fish, Cephalopods and crabs, and is known as *Scolex polymorphus.*

Order Ill.—*Diphyllidea.* Scolex with a long head-stalk armed with several rows of hooklets. A rostellum and four phyllidia united to form a pair. Few proglottides are developed. Selected form: *Echinobothrium affine* in the intestine of Elasmobranchs. It occurs immature in the gastropod *Nassa.*

Order IV.—*Tetrarhyncha* (Trypanorhyncha). Scolex with four complex eversible proboscides. The adults occur in Elasmobranch fish, the metacestode encysted in Teleosts.

Order V.—*Tetracotylea* (Taeniidae). Scolex with four suckers, rarely hooked, and with a rostellum. Mostly parasitic in homoio- thermic (warm-blooded) vertebrates. Selected forms: *Taenia solium,* intestine of man (fig. 3, C). *T. saginata* (fig. 3) without hooklets on the rostellum; intestine of man. *T. murina,* in the rat and mouse, the adult in the lumen of the intestine, the larvae in the villi. This species therefore undergoes no change of host. *Cysto- taenia coenurus,* intestine of dog and wolf, larva (a coenurus, fig. 11)