CHAPTER 8

Cestodes

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8.1 PREFACE

Cestodes, or tapeworms, belong to the class Cestoidea of the phylum Platyhelminthes. Members of this family vary greatly in size and behavior; however, they share the same basic body plan. They attach to the intestinal wall of definitive hosts by the scolex, or head. The scolex is followed by the neck, behind which grow the body segments, or proglottids. The proglottids together form the strobila, or body, of the worm; the number of proglottids in the adult worm depends on the species. Proglottids have both longitudinal and transverse muscles and are motile. Each proglottid also has both male and female reproductive organs, but mating usually occurs with adjacent segments rather than by self-fertilization. The oldest proglottids are farthest from the scolex and contain the tapeworm’s eggs. Cestodes have no digestive or circulatory system and must absorb nutrients from the lumen of the host’s small intestine through microvilli. These cover the surface of each proglottid and excrete waste through a pair of excretory tubules. Tapeworms do have a rudimentary nervous system consisting of ganglia in the scolex and nerves in the proglottids.

8.2 TAENIA

Three Taenia species, members of the Cyclophyllidea order, claim human beings as their definitive hosts: *T. saginata*, *T. solium*, and *T. asiatica*. Humans acquire intestinal infection with the worms by ingestion of undercooked meat—pork in the cases of *T. solium* and *T. asiatica*, and beef in the case of *T. saginata*—that contains encysted larvae. *T. solium* is presumably the only parasite of the three to cause significant human pathology in the form of human cysticercosis, although the pathogenicity of *T. asiatica* in humans has not been fully characterized. *T. saginata* and *T. asiatica* are morphologically very similar and closely related genetically. They cause limited pathology in humans, but their economic impact on the livestock market is significant.

Cestodes of the order Cyclophyllidea typically require two hosts in order to complete their life cycles (Fig. 8.1). The life cycles of Taenia species are similar, and differences will be highlighted in the “Biology” section in the discussions of the individual species. In general, Taenia eggs are ingested by an intermediate host, allowing larva to mature to the metacestode stage of development. The metacestode stage is the encysted, infective larva that is referred to as a cysticercus. Maturation to the adult tapeworm continues once the cysticercus is ingested by a definitive host, at which point egg production and release into the environment permits the life cycle to continue.
The adult tapeworms of all three *Taenia* species consist of a scolex characterized by four suckers, a short neck, and a strobila of varying length. Morphologic differences detectable by microscopy are the most reliable method of distinguishing between the three species. Injection of India ink into the uterus of the gravid proglottid allows for visualization of uterine branches and provides a means of species identification. *T. saginata* has 15–20 uterine branches per side, *T. asiatica* has 12–30, and *T. solium* has 7–13. Other notable morphologic species differences detectable by microscopy include the presence (*T. saginata, T. asiatica*) or absence (*T. solium*) of the vaginal sphincter muscle and the unilobed (*T. solium*) or bilobed (*T. saginata, T. asiatica*) ovary (Table 8.1). Polymerase chain reaction with restriction enzyme analysis (PCR-REA) can be used to distinguish the species (Mayta et al., 2000). Eggs of all three species are identical and therefore do not permit species identification by microscopy. They are spherical, typically 31–43 μm in diameter, with a thick brown shell easily recognized by its radially striated appearance (Fig. 8.2). Within each egg is an embryonated larva, or oncosphere, with six hooks.

### 8.2.1 *Taenia solium*

8.2.1.1 Biology
The adult *T. solium* tapeworm lives in the human small intestine, attaching to the gut wall by its scolex; causing mild inflammation at the attachment site. The *T. solium* adult has a scolex with four suckers and a rostellum armed with a double row of hooklets followed by a narrow neck. A mature tapeworm can reach a length of