

CESTODES

I. Tapeworms

A. General

1. Flatworms
2. The body of the adult tapeworm is usually divided into 3 regions
 - a. The scolex is the holdfast or anchoring organ. May have suckers, grooves, and/or hooks.
 - b. The neck is the area of cell division which gives rise to proglottids or segments.
 - c. The strobila is the rest of the body, which is a chain of progressively mature individual proglottids.
 - Immature proglottids (development)
 - Mature Proglottids (reproductively active)
 - Gravid proglottids (bags of eggs)
3. The tegument is metabolically active and absorbs nutrients.
4. There is NO digestive tract.
5. Monoecious (hermaphrodites), with self-fertilization and /or cross-fertilization.
 - Number and position of the genital openings are useful in identification.
6. All adult tapeworms are found within the digestive system of a vertebrate host.
7. Most tapeworms need 2 to 3 hosts (i.e. 1 to 2 intermediate hosts and 1 definitive host.)

B. Tapeworms of veterinary importance:

1. Order Cyclophyllidea (most are in this group)
Important Families: Taeniidae, Dipylidiidae, Anoplocephalidae, Mesocestoididae
2. Order Pseudophyllidea: *Spirometra*

II. CYCLOPHYLLIDEAN tapeworms in general

A. Life-Cycle:

1. The egg contains an embryo (oncosphere or hexacanth) with 6 hooks.
2. Gravid segments (containing eggs) are detached from the adult worm and are released into the environment.
3. The intermediate host ingests the eggs which hatch to release the first larval stage (L1).
4. The L1 develops into a second larval stage (L2) in the intermediate host. Typically, there is only 1 intermediate host. The definitive host ingests the intermediate host containing the infective L2 (i.e. PREDATOR-PREY TRANSMISSION.).
5. Depending on the tapeworm species the L2 stage will take a specific forms:
 - a. CYSTICERCUS or bladder worm has one scolex invaginated inside a bladder.
 - b. STROBILOCERCUS - cysticercus that is starting to elongate and segment.
 - c. HYDATID CYST - large, encapsulated cyst utilizes asexual reproduction (budding) to produce many protoscolices floating within.
 - d. CYSTICERCOID is unique to arthropod intermediate hosts; the scolex is depressed within a small solid cyst.

B. Treatment of tapeworm infections:

1. Drugs that are effective against cestodes include:
 - a. praziquantel and epsiprantel
 - b. benzimidazoles (fenbendazole, albendazole, etc.)
 - c. pyrantel (with horses)

C. Control of tapeworm infections:

1. Interrupt the life-cycle by preventing access to intermediate host tissue.

D. Cestode Groups

Large Animals

Adult Tapes

Anoplocephala perfoliata (equine)

Moniezia (ruminants)

Larval Tapes (condemnations)

Taenia saginata (ruminants)

Taenia solium (swine)

Small Animals

Adult Tapes

Taenia pisiformis (dog)

Taenia taeniaformis (cat)

Echinococcus granulosus (dog)

Dipylidium caninum (dog & cat)

Mesocestoides (dog & cat)

Spirometra (dog & cat)

Human (Zoonotic concerns)

Adult Tapes

Taenia saginata

Taenia solium

Dipylidium caninum

Larval Tapes

Echinococcus granulosus

Taenia solium

Spirometra sp.

III. Cyclophyllidean Tapeworms of importance

A. Family TAENIIDAE

1. A large group of mammalian tapeworms.
 - a. Definitive host = carnivore or human.
 - b. Intermediate host = herbivore or omnivore
2. Adults: generally not pathogenically significant
3. Larval stages: can cause severe pathology in intermediate or accidental host.
4. General life-cycle: a) Egg is ingested by the intermediate host. b) Larvae develop to infective form in the intermediate host. c) Definitive host, when feeding on the intermediate host, ingests the larval tapeworm. d) The adult matures in the small intestine and pass segments and/or eggs in the host's feces.
5. Important taeniids with dog, cat and human definitive hosts:
 - a. *Taenia pisiformis* -- Dogs, coyotes or wolves get infected by ingesting rabbits or squirrels infected with the larval stage (Cysticercus).
 - b. *Taenia taeniaeformis* -- A common tapeworm of cats which have ingested rodents containing the larval stage (strobilocercus).
 - c. *Taenia saginata* -- Medical tapeworm. Humans get infected by ingesting [cysticercus] larvae (*Cysticercus bovis*) while eating raw beef (aka. measly beef). Measly beef results in condemnation by USDA inspectors. Infected human feces can contaminate cattle grazing pastures.
 - d. *Taenia solium* -- Medical tapeworm. Humans get infected by ingesting [cysticercus] larvae (*Cysticercus cellulosae*) while eating raw pork (aka. measly pork). Measly pork results in condemnation by USDA inspectors. Infected human feces can contaminate swine pastures.

However, humans can also act as the intermediate host and become infected with eh cysticercus larval stage, a condition called Cysticercosis. In this case, a human ingests tapeworm eggs from food contaminated by human feces of someone infected with eh adult tapeworm. Cysticercosis is the aberrant migration of the larval tapeworm in a human and can cause ocular and neurological disease.

- e. *Echinococcus granulosus* -- Important medical tapeworm.
 - Definitive hosts include the dog, coyote, wolf and dingo.
 - Globally sporadic. Endemic areas: Argentina, Peru, east Africa, central Asia, China, southwest US.
 - Hydatid Cyst Disease: Larvae (Hydatid Cyst) develop in the lung, liver, brain, etc. Unilocular hydatid cyst can grow and cause pressure atrophy of near-by organs. Or a ruptured cyst releasing hydatid fluid can cause a severe anaphylactic reaction.
 - Hydatid disease can infect a variety of intermediate host species such as sheep, swine, cattle, moose, caribou, kangaroos and even man.
 - Diagnosis:
 - i. The adult tapeworms are of minimal pathological concern to the dog. To identify, give the dog a mild purgative and examine feces for the small tapeworm. (Avoid self-contamination with ova).
 - ii. Larval stage and hydatid disease in humans: Serology and radiography
 - To control hydatid disease in endemic areas:
 - i. Avoid contact with dog feces.
 - ii. eliminate stray canids
 - iii. regular deworming of dog to eliminate adult stage.
 - iv. avoid feeding uncooked offal to canids

<u>TAPEWORM</u>	<u>Definitive host (Adult worm)</u>	<u>Intermediate host (Larval worm)</u>
<i>Taenia pisiformis</i>	Dog	Rabbit
<i>Taenia taeniaeformis</i>	Cat	Rodent
<i>Taenia saginata</i>	Human	Cattle
<i>Taenia solium</i>	Human	Swine, human
<i>Echinococcus granulosus</i>	Dog	Sheep, human