Cyclophyllidae

Contains most of the medically important tapeworms
Scolex has 4 suckers and compact vitelline gland are characteristic
Range from mm to >10m

Family Taeniidae

Taenia saginata: beef tapeworm
Taenia solium: pork tapeworm
Scolex has 4 suckers and double row of hooks
Taeniidae (mammals swallow eggs)
Four types of larval stages. Produce scoleces asexually.

- **coenurus** (single bladder with numerous scolices attached to the inside of the bladder wall)
- **cysticercus** (large bladder with single invaginated scolex)
- **strobiolocerus** (small bladder with long everted strobilus with an invaginated scolex)
- **hydatid cyst** (large capsule containing many smaller ones called brood capsules, each being attached by a slender stalk to the germinal layer of the mother cyst)
Taenia saginata - beef tapeworm

Humans are the only definitive host
Intermediate hosts include Bovidae and Cervidae

Adults exist in the intestine of definitive hosts
Cysticerci exist in striated muscle of intermediate hosts

Possibly the most common tapeworm in humans
Little serious disease unless hosts are nutritionally deprived
Economic costs in cattle
Taenia saginata, The Beef Tapeworm

Clinical Manifestations
The clinical manifestations of infection with adult *T. saginata* tapeworms are confined to occasional nausea or vomiting, appetite loss, epigastric or umbilical pain, and weight loss.

Moderate eosinophilia may develop. A disturbing manifestation of *T. saginata* infection is the active crawling of the muscular segments out of the anus. Rarely, intestinal perforation may occur from the scolex of *Taenia*, or proglottids may be vomited and then aspirated.
T. saginata: unlike other taeniids this species has no rostellar hooks
Humans are infected by eating a cystercus in raw/uncooked beef
Scolex evaginates in the small intestine, attaches, grows
  3-4 months later proglottids appear in feces
Proglottids shed irregularly, may “crawl” out of the anus
Proglottids are weakly motile, most active in the evening

Abdominal discomfort, diarrhea, frequent hunger pangs
Best diagnostic feature is presence of parasites
ID- eggs all look alike
Taenia saginata. The adult tapeworms (length: usually 5 m or less, but up to 25 m) reside in the small intestine, where they attach by their scolex. Each worm may have 1,000 to 2,000 proglottids, which detach from the tapeworm, and migrate to the anus or are passed in the stool (approximately 6 per day). The eggs in the gravid proglottids (80,000 to 100,000 eggs per proglottid) are released after the proglottid becomes free and are passed with the feces. The eggs can survive for months to years in the environment. In the new host, the eggs release the oncosphere, which evaginates, invades the intestinal wall and migrates to the striated muscles, and develops into a cysticercus. The cysticercus can survive for several years in the animal. Humans become infected by ingesting raw or undercooked infected meat. In humans, the cysticercus develops over 2 months into an adult tapeworm, which can survive for more than 30 years.
Taenia solium

Taenia saginata
1. Eggs or gravid proglottids in feces and passed into environment

2. Cattle (T. saginata) and pigs (T. solium) become infected by ingesting vegetation contaminated by eggs or gravid proglottids

3. Oncospheres hatch, penetrate intestinal wall, and circulate to musculature

4. Humans infected by ingesting raw or undercooked infected meat

5. Scolex attaches to intestine

6. Adults in small intestine

⚠️ Oncospheres develop into cysticerci in muscle

T. saginata  T. solium

△ = Infective Stage
△ = Diagnostic Stage
**A. Human ingests raw or poorly cooked pork**

**B. Adult tapeworm in small intestine of human**

**C. Gravid proglottids detach and pass with feces**

**D. Oncosphere in intestine migrates to muscles of pig**

**E. Egg**

**F. Oncosphere develops into cysticercus in muscle**

If eaten by human, the oncosphere hatches, migrates to some site in body and develops into cysticercus.
The life cycle of *Taenia solium*. The adults (length 2 to 7 m; less than 1,000 proglottids; longevity up to 25 years) develop not only in humans but also some other animal species (monkeys, hamsters). Humans develop taeniasis when they ingest undercooked pork meat containing cysticerci.

They may become infected by ingesting *T. solium* eggs, either by ingestion of fecally contaminated food, or by autoinfection. In the latter case, a human infected with adult *T. solium* ingests eggs produced by that tapeworm, either through fecal contamination or, more arguably, from proglottids carried into the stomach by reverse peristalsis.

The cysticercus develops not only in striated muscle, but also in the brain, liver, and other tissues of pigs and other animals, including humans.
Taenia solium- pork tapeworm
Humans are definitive host
Pigs are the most common intermediate host
Many animals including humans can harbor cysticerci- usually in striated muscle, but often in other tissues/organs
Neuro-cysticercosis common in Latin America

In N. America prevalence is lower than with T. saginata, but T. solium is a more serious problem

Humans have cysticercus and adults: not so common for one host to act as definitive and intermediate host
Little abdominal damage: ingested cysticerci can develop in liver, kidney or CNS
Life cycle similar to T. saginata
Typical rostellum, 2 rows of hooks
Scolex evaginates, in intestine, attaches, strobilates
Gravid proglottids passed in feces- almost no motility (vs T. saginata)
Eggs resistant for months
Eggs ingested by intermediate host- hatch, penetrate gut, enter mesenteric veins, carried by circulatory system, lodge anywhere

About 30% of human infections involve the brain

Control: cook pork, freeze pork, sanitary disposal of human wastes, & education
Taeniid eggs. The eggs of Taenia saginata and T. solium are indistinguishable morphologically (morphologic species identification will have to rely on the proglottids or scolices). The eggs are rounded or subspherical, diameter 31 - 43 µm, with a thick radially striated brown shell. Inside each shell is an embryonated oncosphere with 6 hooks. The egg in B still has the primary membrane that surrounds eggs in the proglottids
Gravid proglottids of (left) Taenia saginata and (right) T. solium. Injection of India ink in the uterus allows visualization of the primary lateral branches. Their number allows differentiation between the two species: T. saginata has 15 - 20 branches on each side, while T. solium has 7 - 13. Note the genital pores in mid-lateral position.
Taenia solium cysticercus, whole and in section of muscle (H&E)
Cysticerci develop in pig muscle tissue.

Humans acquire adult tapeworm infection by ingesting raw or undercooked meat with cysticerci.

Cysticerci can lodge in human tissues such as brain, eyes, and skeletal muscle.

Pigs and humans acquire parasites by eating food and water contaminated by eggs or by autoinfection.

Proglottids (bundles of tapeworm eggs) pass into the environment via feces.
Dipylidium caninum
("double-pored tapeworm")
Dipylidium caninum

1. Cysticercoid

2. Egg packets containing embryonated eggs are ingested by larval stage of flea.

3. Oncospheres hatch from the eggs and penetrate the intestinal wall of the larvae. Cysticercoid larvae develop in the body cavity.

4. Adult flea harbors the infective cysticercoid.

5. Host is infected by ingesting fleas containing cysticercoid.

6. Animals can transmit the infected fleas to humans.

7. Humans, normally children, acquire the infection by ingesting the infected flea.

8. Adult in small intestine

- i = Infective Stage
- d = Diagnostic Stage
Proglottids of *Dipylidium caninum* compared to a paper match. These are often passed intact in the feces of an infected dog. When the proglottids dry, their appearance is similar to grains of rice.
*Dipylidium caninum* ("double-pored tapeworm")

egg balls or capsules
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<td>Epigastric pain, vomiting, diarrhea</td>
<td>Proglottids or eggs in stool or perianal area</td>
<td>Praziquantel</td>
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<tr>
<td>T. solium</td>
<td>Cyst in pork</td>
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<td>Proglottids or eggs in stool or perianal area</td>
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<tr>
<td>D. latum</td>
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<td>Proglottids or eggs in stool or perianal area</td>
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<tr>
<td>E. granulosus</td>
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<td>Large cysts produce various symptoms depending on the location of the organism</td>
<td>Roentgenography, anti-hydatic fluid antibody (EIA), Casoni skin test</td>
<td>Surgery, formalin injection and drainage, Praziquantel</td>
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<tr>
<td>E. multilocularis</td>
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<td>As above</td>
<td>As above</td>
<td>Surgery, Albendazole</td>
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