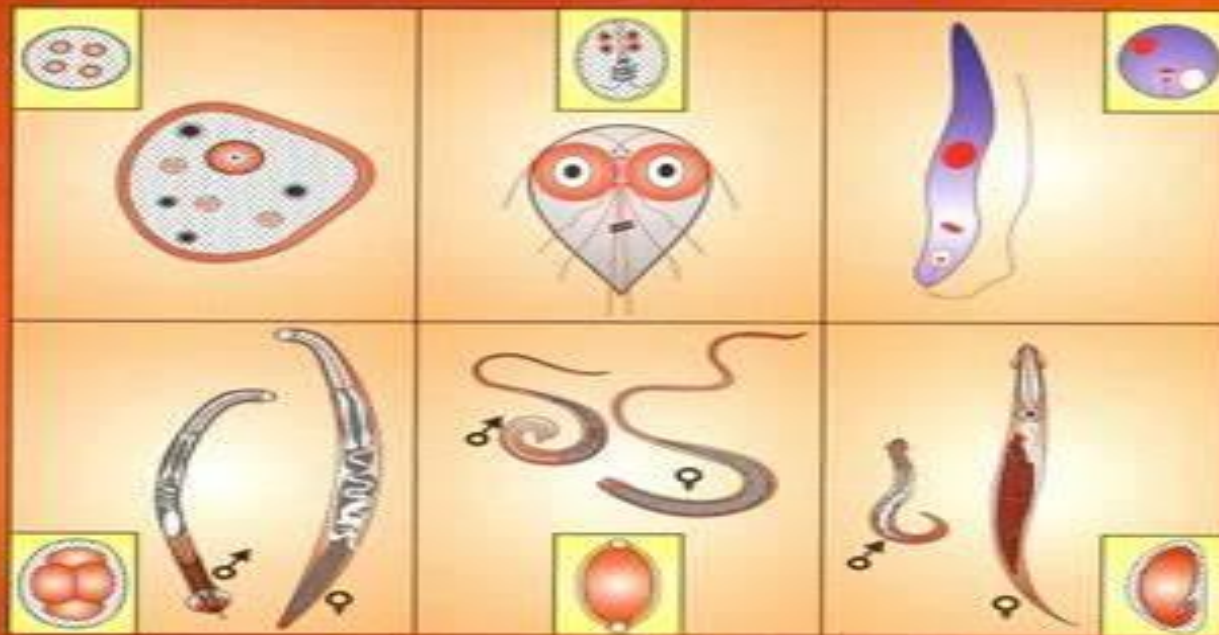


# MEDICAL PARASITOLOGY

## lec.8: Cestodes



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## **Helminthes**

Helminths or parasitic worms belong to the kingdom Animalia. They are multicellular, bilaterally symmetrical, elongated, flat or round animals.

Helminths which occur as parasites in humans belong to two phyla: **Phylum Platyhelminthes** and **Phylum Nematelminthes**.

The **platyhelminths** or flatworms are dorsoventrally flattened, leaf-like or tape-like. Their alimentary canal is incomplete or entirely lacking and body cavity is absent. They are mostly hermaphrodites (monoecious). Human pathogenic helminths of this phylum belong to two classes: the **Cestoidea** and the **Trematoda**.

**Nematodes** are unsegmented, dioecious worms which are usually filiform. They have a body cavity with a high hydrostatic pressure, complete alimentary canal with an anteriorly terminal mouth and posteriorly subterminal anus, no circulatory system, a simple excretory system and a body wall consisting of an outer layer of longitudinal muscles. Phylum Nematelminthes is divided into 2 classes: the **Adenophorea** and the **Secernentea**. Both these classes have parasitic members though the majority of animal parasites belong to the latter.

### **General characteristics of helminths**

Most helminthic worms are macroscopic in size and often visible to the naked eye.

Larval forms of these worms include:

1. Rhabditiform, filariform and microfilaria in nematodes.
2. Cysticercus, cysticercoid, coenurus, coracidium, procercoid, plerocercoid and hydatid cyst in cestodes.
3. Miracidium, sporocyst, redia, cercaria and metacercaria in trematodes.

## I - Introduction: Cestodes

Platyhelminthes (*platy* means flat; *helminth* means worm) are divided into two classes: Cestoda (tapeworms) and Trematoda (flukes).

Tapeworms consist of two main parts: a rounded head called a **scolex** and a flat body consisting of multiple segments. Each segment is called a **proglottid**. The scolex has specialized means of attaching to the intestinal wall, namely, suckers, hooks, or sucking grooves. The worm grows by adding new proglottids from its germinal center next to the scolex. The oldest proglottids at the distal end are gravid and produce many eggs, which are excreted in the feces and transmitted to various intermediate hosts such as cattle, pigs, and fish.

Humans usually acquire the infection when undercooked meat or fish containing the larvae is ingested. However, in two important human diseases, cysticercosis and hydatid disease, it is the eggs that are ingested and the resulting larvae cause the disease.

## ***TAENIA***

There are two important human pathogens in the genus *Taenia*: *T. solium* (the pork tapeworm) and *T. saginata* (the beef tapeworm).

### **1. *Taenia solium***

#### **Disease**

The adult form of *T. solium* causes taeniasis. *T. solium* larvae cause cysticercosis.

## Important Properties

The life cycle of *T. solium* is , *T. solium* can be identified by its scolex, which has **four suckers and circle of hooks**, and by its gravid proglottids, which have 5 to 10 primary uterine branches . The eggs appear the same microscopically as those of *T. saginata* and *Echinococcus* species. In taeniasis, the adult tapeworm is located in the human intestine. This occurs when humans are infected by eating raw or undercooked **pork** containing the larvae, called **cysticerci**. (A cysticercus consists of a pea-sized fluidfilled bladder with an invaginated scolex.) In the small intestine, the larvae attach to the gut wall and take about 3 months to grow into adult worms measuring up to 5 m. The gravid terminal proglottids containing many eggs detach daily, are passed in the feces, and are accidentally eaten by pigs. Note that pigs are infected by the worm eggs; therefore, it is the larvae (cysticerci) that are found in the pig.

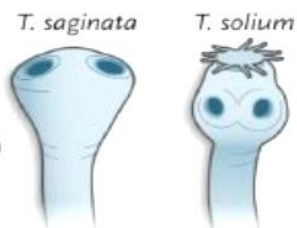
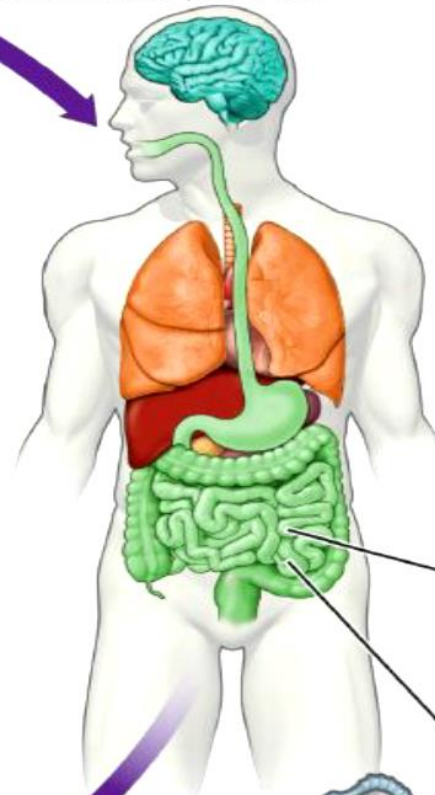
# Taeniasis

(*Taenia solium*)  
(*Taenia saginata*)

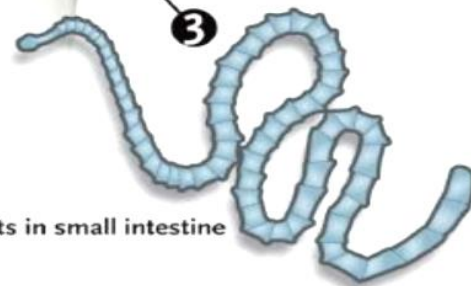
**I** Oncospheres develop into cysticerci in muscle



**1** Humans infected by ingesting raw or undercooked pork or beef

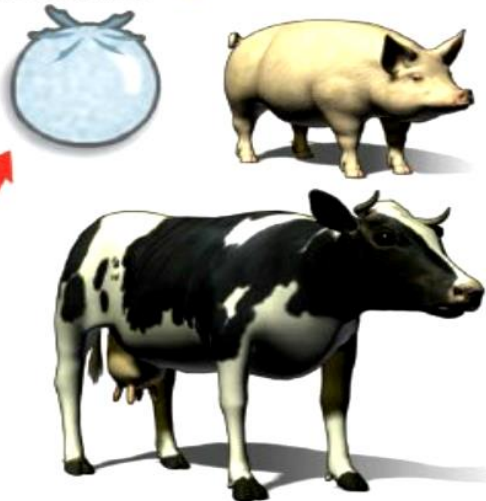


Scolex attaches to intestine



Adults in small intestine

**6** Oncospheres hatch, penetrate intestinal wall, and circulate to musculature



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



**D**  
**4**



Eggs or gravid proglottids in feces and passed into environment

## KEY

- I** Infective stage
- D** Diagnostic stage

The embryos burrow into a blood vessel and are carried to skeletal muscle. They develop into cysticerci in the muscle, where they remain until eaten by a human. Humans are the definitive hosts, and pigs are the intermediate hosts.

In cysticercosis, a more dangerous sequence occurs when a person **ingests the worm eggs** in food or water that has been contaminated with human feces. Note that in cysticercosis, humans are infected by eggs excreted in human feces, *not* by ingesting undercooked pork.

Also, pigs do not have the adult worm in their intestine, so they are not the source of the eggs that cause human cysticercosis. The eggs hatch in the small intestine, and the oncospheres burrow through the wall into a blood vessel. They can disseminate to many organs, especially the eyes and brain, where they encyst to form cysticerci . Each cysticercus contains a larva.



## Pathogenesis & Epidemiology

The adult tapeworm attached to the intestinal wall causes little damage. The cysticerci, on the other hand, can become very large, especially in the **brain**, where they manifest as a **space-occupying lesion** . Living cysticerci do not cause inflammation, but when they die, they can release substances that provoke an inflammatory response. Eventually, the cysticerci calcify.

The epidemiology of taeniasis and cysticercosis is related to the access of pigs to human feces and to consumption of raw or undercooked pork. The disease occurs worldwide but is endemic in areas of Asia, South America, and Eastern Europe. Most cases in the United States are imported.

## **Clinical Findings**

Most patients with adult tapeworms are asymptomatic, but anorexia and diarrhea can occur. Some may notice proglottids in the stools. Cysticercosis in the brain causes headache, vomiting, and seizures. Cysticercosis in the eyes can appear as uveitis or retinitis, or the larvae can be visualized floating in the vitreous. Subcutaneous nodules containing cysticerci commonly occur. Cysts also are commonly found in skeletal muscle.

## Laboratory Diagnosis

Identification of *T. solium* consists of finding gravid proglottids with 5 to 10 primary uterine branches in the stools. In contrast, *T. saginata* proglottids have 15 to 20 primary uterine branches. Eggs are found in the stools less often than are proglottids. Diagnosis of cysticercosis depends on demonstrating the presence of the cyst in tissue, usually by surgical removal or computed tomography (CT) scan. Serologic tests (e.g., enzyme-linked immunosorbent assay [ELISA]) that detect antibodies to *T. solium* antigens are available, but they may be negative in neurocysticercosis.

## Treatment

The treatment of choice for the intestinal worms is praziquantel. The treatment for cysticercosis is either praziquantel or albendazole, but surgical excision may be necessary.

## 2. *Taenia saginata*

### Disease

*T. saginata* causes taeniasis. *T. saginata* larvae do not cause cysticercosis.

### Important Properties

*T. saginata* has a scolex with four suckers but, in contrast to *T. solium*, **no hooklets**. Its gravid proglottids have 15 to 25 primary uterine branches, in contrast to *T. solium* proglottids, which have 5 to 10 . The eggs are morphologically indistinguishable from those of *T. solium*. Humans are infected by eating raw or undercooked **beef** containing larvae (cysticerci). In the small intestine, the larvae attach to the gut wall and take about 3 months to grow into adult worms measuring up to 10 m . The gravid proglottids detach, are passed in the feces, and are eaten by cattle.

The embryos (**oncospheres**) emerge from the eggs in the cow's intestine and burrow into a blood vessel, where they are carried to skeletal muscle. In the muscle, they develop into cysticerci. The cycle is completed when the cysticerci are ingested. Humans are the definitive hosts and cattle the intermediate hosts. Unlike *T. solium*, *T. saginata* **does not cause cysticercosis** in humans.

### **Pathogenesis & Epidemiology**

Little damage results from the presence of the adult worm in the small intestine. The epidemiology of taeniasis caused by *T. saginata* is related to the access of cattle to human feces and to the consumption of raw or undercooked beef. The disease occurs worldwide but is endemic in Africa, South America, and Eastern Europe. In the United States, most cases are imported.

## **Clinical Findings**

Most patients with adult tapeworms are asymptomatic, but malaise and mild cramps can occur. In some, proglottids appear in the stools and may even protrude from the anus. The proglottids are motile and may cause pruritus ani as they move on the skin adjacent to the anus.

## **Laboratory Diagnosis**

Identification of *T. saginata* consists of finding gravid proglottids with 15 to 20 uterine branches in the stools. Eggs are found in the stools less often than are the proglottids.

## **Treatment**

The treatment of choice is praziquantel.