Class Cestoda
Tapeworms
common features of Class Cestoda

1. Adult worm is flattened ribbon-like, without body cavity.

2. The body is composed of a head, neck and segmented strobilus. The head has suckers, rostellum and hooklets or sucking grooves. The neck is the budding zone from which segments are formed. The strobilus consists of immature, mature and pregnant proglottides.

3. They are hermaphroditic. There is a set of female and male reproductive organs in every mature proglottid.

4. Digestive tract is absent. Nutrition is absorbed by villi of body surface.

5. All adult worms parasitize digestive tracts of mammals.
6. The developing stages in intermediate hosts are called metacestode, such as cysticercus, hydatid cyst, cysticercoid, procercoid, plerocercoid.

7. Tapeworms are classified into two orders:

**Cyclophyllidea**: The head is spherical with suckers, hooklets. The uterus has no opening. One intermediate host is required. The eggs contain an oncosphere. They are medically important, such as *Taenia solium*, *Taenia saginata* and *Echinococcus granulosus*.

**Pseudophyllidea**: The head is spear-like with sucking grooves. The uterus has an opening. Two or more intermediate hosts are required. The eggs contain a coracidium and have to get into water to develop. Human being occasionally get infection. This worms include *Spirometra mansoni* and *Diphyllobothrium latum*. 
Taenia solium (pork tapeworm)

Adult worms live in human small intestine causing taeniasis. The larval stage (Cysticercus cellulosae) lives in pig or human tissues causing human cysticercosis.
Morphology

1. **Adult** is flattened ribbon-like, creamy white in color, measures about 2-4 m and has 700-1000 proglottides.

   - **scolex**: global, 1mm. With 4 suckers, 1 rostellum and 25-50 hooklets arranged in a double crown.

   It consists of:
   - **neck**: it’s the narrowest part of the body and budding zone containing germinative tissue.
   - **strobila**
     - immature proglottides: width > length
     - mature proglottides: width = length
     - gravid proglottides: width < length
Adult

scolex
neck
strobila
Immature proglottides are transverse rectangles, located in the anterior part of the body and inner organs are developing.

**Mature proglottides** are square in shape and located in the mid part of the body and have 150-200 testes, a centrally straight uterus and 3 lobes of ovary.

**Pregnant (gravid) proglottides** are longitudinal rectangles, located in the posterior part of the body and contain a branched uterus filled with eggs. The number of main branches on each side of the uterus stem is 7-13.
Mature Segments (Proglottids)

Tapeworms are Hermaphroditic
Mature proglottid
India Ink Technique

- Note: less than 13 lateral uterine branches (one side).
2. Egg, The eggs of *Taenia saginata* and *T. solium* are indistinguishable morphologically. The eggs are spherical, diameter 31 to 43 µm, with a thick radially striated brown embryophore. Inside each is an oncosphere with 6 hooklets.
3. Cysticercus cellulose. It is a semitransparent and bladder, like a white pomegranate seed about 0.6-1cm. There is fluid and a white scolex with 4 suckers and hooklets inside it.
The scolex invaginates in the bladder.

Under stimulation of bile

The scolex evaginates.
Cysticerci in myocardium
II. Life cycle

1. final host: man,
2. Intermediate host: pig (or man),
3. Infective stage: cysticercus and egg,
4. Infective mode: eating raw bean-pork,
5. Site of inhabitation: adult in small intestine; cysticercus in tissues,
6. Infective mode of cysticercosis: endogenous, exogenous auto-infection and foreign source;
7. Life span: more than 25 years; cysticercus can survives 5-6 years in human body.
Life Cycle

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

2. Embryonated eggs and/or gravid proglottids ingested by pigs or humans

3. Oncospheres hatch, penetrate intestinal wall, and circulate to musculature in pigs or humans

4. Humans acquire the infection by ingesting raw or undercooked meat from infected animal host.

5. Scolex attaches to intestine

6. Adults in small intestine

Cysticercosis

Cysticerci may develop in any organ, being more common in subcutaneous tissues as well as in the brain and eyes.

= Infective Stage

= Diagnostic Stage

CDC

http://www.dpd.cdc.gov/dpdx
III. Pathogenesis and Clinical Manifestations

• 1. *Taeniasis*: It is caused by the adult residing in small intestine of the man. The adult irritates the small intestine causing discomforts, such as abdominal pain, anorexia, chronic indigestion, diarrhea, emaciation, eosinophilia and etc. The patient is usually no obvious symptom, only complaining passing proglottides.

• 2. *Cysticercosis*: It is caused by the cysticerci living in human tissues. The manifestations vary with the number of cysticerci and the tissues and organs involved.
(1) Subcutaneous type:

The subcutaneous nodules are usually found in head, limbs, neck, abdomen and back. They are painless.
Note this cysticercus in the tongue
(2) Ocular type:

The cysticercus is usually found in the vitreous body or subretina. Visual disturbance often occurs. The died body of worm may provoke local inflammation causing blindness.
(3) Brain type:

The symptoms are related to the site of infection. The patients may manifest headache, nausea, vomiting, epilepsy, paralysis, weakness in limbs, diplopia, dizziness, mental disorder. Epilepsy is the most frequent symptoms of brain cysticercosis.
• Brain type
Diagnosis

1. Taeniasis: Confirmative diagnosis of taeniasis is made by finding gravid proglottides or egg in stool.
   (1) direct fecal smear  (2) brine floatation technique  **(3) cellophane-tape technique

2. Cysticercosis: Biopsy of subcutaneous nodules, X-ray, CT or MR are used for the diagnosis of brain type and ophthalmoscope examination is used for ocular form.

3. Immunological tests are for reference only.
• Treatment and prevention
  1. Treatment of Taeniasis: Praziquantel may be used.
  2. Treatment of cysticercosis: Surgical removal is required for ocular and superficial cysticercoses. Praziquantel may be used to treat brain cysticercosis, but the patients should take praziquantel in hospital.

• Prevention:
  (1) Health education (2) Avoid eating raw bean-pork. (3) Avoid pigs eating human stool. (4) Sanitary inspection of slaughter and sanitary disposal of night soil.

Epidemiology

This disease is prevalent all over the world except Muslim and Jew areas. The infection of T. solium is closely associated with the method of pig-raising and the sanitary condition.
Taenia saginata

Adult worms live in human small intestine causing taeniasis. Larval stage (Cysticercus bovis) lives in cattle tissues. This disease is prevalent all over the world.
Differences between T. solium and T. saginata

1. Body length

T. solium

T. saginata
2. scolex

T. solium

T. saganita
3. Mature proglottid

*T. solium*  
*T. saginata*
4. Gravid proglottid

*T. solium*  
*T. saginata*
5. *cysticercus*

Cysticercus *cellulose*  
Cysticercus *bovis*
I. Morphology:

1. The biological differences between T. solium and T. saginata

<table>
<thead>
<tr>
<th></th>
<th>T. solium</th>
<th>T. saginata</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>length</strong></td>
<td>2-4 meters</td>
<td>4-8 meters</td>
</tr>
<tr>
<td><strong>scolex</strong></td>
<td>1mm in diameter with 4 suckers and hooklets</td>
<td>2mm in diameter, with 4 suckers but no hooklets</td>
</tr>
<tr>
<td><strong>Number of segment</strong></td>
<td>700 to 1000</td>
<td>1000 to 2000</td>
</tr>
<tr>
<td><strong>Mature proglottid</strong></td>
<td>3 lobes of ovary</td>
<td>2 lobes of ovary</td>
</tr>
<tr>
<td><strong>Gravid proglottid</strong></td>
<td>7-13 uterine lateral branches on one side</td>
<td>15-30 uterine lateral branches on one side</td>
</tr>
<tr>
<td><strong>Number of gravid proglottid detached</strong></td>
<td>usually several segments</td>
<td>usually single segment</td>
</tr>
<tr>
<td><strong>Mode of proglottids passing out</strong></td>
<td>passively expelled</td>
<td>actively migrate out of anus</td>
</tr>
<tr>
<td><strong>Cysticercus</strong></td>
<td>scolex with hooklets found in man and pig</td>
<td>no hooklets on scolex only found in cattle</td>
</tr>
<tr>
<td><strong>Disease caused in man</strong></td>
<td>taeniasis and cysticercosis</td>
<td>taeniasis</td>
</tr>
</tbody>
</table>

2. Egg: same as that of T solium
II. Life cycle

The intermediate host is cattle and cysticercus bovis cannot live in human. The others same as those of T. solium.

III. Pathogenesis:

Usually only single worm is present and the patient is no symptom. Some patients may complain of migrating proglottids from anus with pruritus at the perianal region. Abdominal discomfort, nausea, vomiting, constipation or diarrhea may occur.
IV. Diagnosis

Finding of gravid proglottids or eggs at the perianal region by cellophane tape method.

VI. Treatment:

Same as that of T. solium