**General characters**

- Tapeworms have flat, segmented bodies, consisting of a
  - Head (scolex)
    - the organ of attachment with 4 suckers.
    - Rostellum and hooks may be present in some species.
  - Neck
  - A series of segments known as proglottids or strobila
    - consists of immature, mature & gravid segments.
- Cestodes are hermaphroditic worms, each mature segment possesses both male and female sex organs.
- Tapeworms lack body cavity or digestive system.
- Adult worms inhabit the small intestine of the definitive host.
- They need intermediate host (except Hymenolepis nana).

**Life Cycle**

- Eggs contain hexacanth embryo (embryo with 6 hooklets called onchosphere)
- When swallowed by intermediate host, the onchosphere changes into larval stage in the host tissues.

**Larval Stage**

- Cysticercus
  - C. bovis : larval stage of Taenia saginata.
  - C. cellulosae: Larval stage of Taenia solium.
- Cysticeroid : Larval stage of Hymenolepis nana.
- Hydatid cyst : Larval stage of Echinococcus granulosus

**Host**

- Definitive : Human
- Intermediate : Cattle

**Habitat**

- Adult worms are found in small intestine of the definitive host.

**DISTRIBUTION**

- Cosmopolitan in countries in which beef is eaten raw or insufficiently cooked.

**Morphology**

- Size : 4 – 10m long
- Scolex : Globular in shape with 4 cup shaped suckers. No rostellum, no hooks.
- Mature Segment
  - Slightly broader than long (nearly squarish)
  - Ovary : bilobed in the posterior part of the segment.
  - Uterus : simple tube in the median plane.
  - Vitelline glands : compact and posterior to the ovary.
  - Vagina : opens in the genital atrium.
  - Testes : numerous, spherical and scattered throughout the segment.
- Gravid Segment
  - 2 X 1 cm in size.
  - Uterus : consists of median longitudinal stem with 15 – 30 main uterine branches (on each side).

**Egg**

- Spherical
- 30 – 40 mic. in diameter.
- With an outer brownish, radially striated embryophore which surrounds a hexacanth embryo or onchosphere.

**Cysticercus bovis**

- invaginated scolex (left)
- evaginated scolex (right)
- The scolex is similar to that of adult worm in morphology

**Life Cycle**

- Single gravid segments (containing thousands of eggs) detach from the strobila and pass to outside with or without faeces.
- The eggs are ingested by intermediate host (cattle).
- Onchosphere liberated, penetrates the intestinal wall and carried by the lymphatics or blood circulation to muscular tissues.
- It develops into Cysticercus bovis (infective stage).
- Humans become infected by ingesting cysticerci in raw or undercooked beef.
- In the intestine the scolex evaginates and the worm develops to maturity in 8 – 10 weeks.

**Symptom**

- Most infected people are asymptomatic.
- Abdominal pain, diarrhoea, weight loss.
- Moderate eosinophilia.

**Diagnosis**

- Recovery of eggs or gravid segment (15 – 30 uterine branches) in the faeces.
- Single gravid segments may crawl outside the anus (without stools)

**Treatment**

- Niclosamide is usually effective in a single dose of 2 grams to be chewed on an empty stomach.
- Praziquantel, also effective, the dose of 2.5 mg/kg has been recommended.

**Prevention & Control**

- Prevent soil contamination with human manure.
- Proper cooking of beef.
- Deep freezing of meat for one week.
- Proper meat inspection in slaughter houses.
**Taenia Solium (Pork Tapeworm)**

<table>
<thead>
<tr>
<th>Host</th>
<th>Definitive: Human</th>
<th>Intermediate: Pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>Cosmopolitan in areas where pork is eaten raw or under cooked.</td>
<td></td>
</tr>
<tr>
<td>Morphology</td>
<td>Size: 3-4m long</td>
<td>Scolex: Globular in shape with 4 cup shaped suckers, a rostellarium with 2 rows of hooks.</td>
</tr>
</tbody>
</table>

**Life Cycle**
- It is similar to that of *T. saginata* except in:
  - Human becomes infected by ingesting raw or under cooked pork containing *Cysticercus cellulosae*.
  - Man sometimes acts as an accidental intermediate host for *T. solium* when eggs of this parasite are swallowed causing Cysticercosis.

**Diagnosis**
- Detection of eggs or gravid segments (with 7 – 13 uterine branches) in stool.
- Gravid segments usually come out in chains of 2 – 3 segments; only with faeces

**Treatment**
- As *T. saginata* but antiemetic drug should be administered one hour before treatment to prevent the possible vomiting which might lead to cisticercosis.

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**Cysticercosis**

<table>
<thead>
<tr>
<th>Def</th>
<th>The presence of <em>cysticercus cellulosae</em> (the larval stage of <em>T. solium</em>) in human tissues.</th>
</tr>
</thead>
</table>

**Cysticercus cellulosae**
- It is soybean-like in shape
- Has a small scolex invaginated into the translucent cyst (left)
- The scolex evaginated from the cyst (right)

**Mode of Infection**
1. Accidental ingestion of eggs of *T. solium*.
2. Autoinfection:
   - External autoinfection;
     - when infected person with adult *T. solium* contaminates his fingers with eggs in stools, and ingests these eggs with food (hand to mouth infection).
   - Internal autoinfection:
     - When gravid segments of *T. solium* are regurgitated into the stomach due to antiperistaltic movement of the intestine. The segments disintegrate releasing eggs which hatch allowing hexacanth embryos to penetrate the gut. The embryos migrate to form larval stage in any organ or tissue as, eye, heart, liver, brain, lung, muscles.

**Pathogenesis**
- Depend on the tissue invaded by *Cysticercus cellulosae*.
- Serious symptoms occur when these larvae invade vital organs as brain, eye.

**Diagnosis**
- X-ray in case of calcified larvae.
- Radiographic, computed tomography (CT) or magnetic resonance imaging (MRI).
- Eosinophilia.
- Serological tests as ELISA and indirect haemagglutination.

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**Clinical Manifestations**
- Symptoms may be different
- Depending on the:
  - (Site) where infection with cysticerci occurs
  - (Number) how many cysts are there
  - (viability) whether the cyst is viable, dying or dead and calcified.
- Most cases are asymptomatic.
- Incubation: 3-5 years

**Clinical Features**
- 2/3 of patients have nodules.
- Number of nodules: 1-1000
- Subcutaneous tissues:
  - nodules on arms and chest.
  - small, movable, painless
- Muscular involvement:
  - rarely painful;
  - seen as calcifications following muscle bundles in thighs or arms.
- Massive parasite burden:
  - limb muscular enlargement (Pseudohypertrophy).
- Cardiac involvement.
- 1-5% of patients
- typically asymptomatic
- Abnormal rhythms or heart failure (rare)
- Ophthalmic involvement:
  - solitary lesion: freely float in the vitreous humor
  - large parasitic burden: visual disturbance and visual loss.
  - Neurocysticercosis (NCC).

<table>
<thead>
<tr>
<th>Symptom</th>
<th>- frequently asymptomatic.</th>
<th>- similar to those found with other intracranial mass lesions</th>
<th>- consistent with elevation of ICP.</th>
<th>- has gained increased recognition in the last 2 decades</th>
</tr>
</thead>
</table>

**Diagnosis**
- X-ray in case of calcified larvae.
- Radiographic: computed tomography (CT) or magnetic resonance imaging (MRI).
- Laboratory studies
- Eosinophilia.
- Serological tests as ELISA and indirect haemagglutination.

**Lab Studies**
- Complete blood count (CBC)
- Serology to detect ag or antibodies
- Stool for ova and parasite
- Lab. studies: inferior to imaging in diagnosis but may play an adjunctive role

**Treatment**
- Surgical removal of cysticerci.
- Therapeutic treatment as praziquantel 50mg/kg, in divided doses for 2 weeks.
- Steroids to prevent serious reactions of the body due to dying cysts.

**Prevention**
- Treatment of infected persons with *T. solium*.
- Avoid using nauseating drugs in infected persons.
- Avoid using human manure as fertilizer.
- Periodic examination of food handlers.