HELMINTHS

Nematodes (round worm)
- Intestine
- Blood

Cestodes (tape worm)
- Intestine

Trematodes (Flat worm)
- Intestine
- Blood
- Liver & Lungs
Helminths (worms)

Flat worms
- Platyhelminthes
  - One piece Trematoda Flukes
  - Segmented Cestoda Tape worms

Cylindrical worms
- Nemathelminthes
  - Nematoda

Intestinal, Blood & tissue

in different areas

intestine & Tissue
General Characters of Cestodes

Flat and segmented.

Hermaphrodite.

6 adult cestodes live in the small intestines of man: intestinal cestodes.

3 adult cestodes live in the small intestines of animals and their larvae are found in tissues of man: extraintestinal cestodes.
General Characters of Cestodes

1- The adults are parasites of the small intestine.

2- Flattened, ribbon-shaped and segmented (Tape worm).

3- Covered with a protective cuticle.

4- Flattened dorso-ventrally with no body cavity.

5- Its body (strobila) is provided with a head (scolex) and is segmented into (proglottids).

6- Proglottids proximal to the scolex are immature, they get mature as they grow away from the scolex.

7- Distal segments are gravid (except in pseudophyllidae)

8- The scolex or head fixes to the wall of the intestine.
General Characters of Cestodes

9- The scolex may be armed with hooks or spines.

10- Scolex has either suckers or bothria (grooves) for fixation.

11- Segments (proglottids) are hermaphrodites.

12- The neck region is responsible for the formation of new segments.
General Characters of Cestodes

- **2 subclasses:**
  - *Pseudophyllidae*
  - *Cyclophyllidae*

- **In members of *Pseudophyllidae***:
  - Organs of fixation are grooves (bothria)
  - Eggs are operculated.
  - Water is necessary for its life cycle.
  - There are 2 larval stages in 2 intermediate hosts.
  - Larval stages are solid (not cystic)

- **Members are:**
  - *D. latum*
  - *D. mansoni*
In members of *cyclophyllidae*:
Eggs (not operculated) are laid mature (the embryo has 6 hooks)
One larval stage in one IH.
Larval stages are cystic.
**Members are:**
*T. saginata.*
*T. solium.*
*H. nana.*
*H. Diminuta.*
*D. caninum.*
*E. granulosus & E. multilocularis.*
*Multiceps multiceps.*
*Diphyllobothrium latum* causes *Diphyllobothriasis*
Sparganosis

Infection of human tissues by the plerocercoid larva of *D.mansoni* or *D.proliferum.*

**Mode of Infection in man:**

Eating raw or undercooked flesh of frogs, snakes and birds infected with plerocercoid larva.

Applying infected flesh of frogs and snakes as foment or poultice to inflamed tissues as skin or eye.

Drinking water containing Cyclops infected with procercoid larva.
Ingestion of improperly cooked infected meat containing cysticercus larvae

Cysticercus larvae are formed in muscles

Eggs or gravid segments in stools

Eggs swallowed by cow

Adult worm in intestine of man
Ingestion of improperly cooked infected pork containing cysticercus cellulosae

Cysticercus larvae are formed in muscles

Eggs hatch in intestine, larva penetrates its wall to reach circulation

Eggs of T. solium swallowed by man

Eggs or gravid segments in stools

Eggs swallowed by pigs

Adult worm in intestine of man

cysticercosis
Cysticercosis

Means: Invasion of human tissues by cysticercus cellulosae, the larval stage of *T.solium*.

**Mode of Infection:**

- Ingestion of *T.solium* eggs in contaminated food or drink.

  **Heteroinfection**

- Hand to mouth infection in a patient having adult worms in his intestine.

  **External autoinfection**

- In a patient having adult worms in his intestine, some detached segments ascend by *anti-peristaltic movements* to the stomach then descend again to the intestine where eggs hatch and cause cysticercosis.

  **Internal autoinfection**
How is man infected with **H. nana**?

**Final host:** infected human

**Mode of infection:**

1. **Ingestion of H. nana egg**
   - In contaminated food or drink
   - Hand to mouth (autoinfection)

2. **Ingestion of infected rat flea**

- Cysticercoid *nana* in submucosa
- Adult in small intestine (habitat)

**Two Infective Stages:**

1. **Egg of H. nana**
2. **Cysticercoid nana in Rat flea**

**Diagnostic stage**

- H. nana egg in stool
1. Embryonated egg in feces

2. Egg ingested by insect

3. Humans and rodents are infected when they ingest cysticercoid-infected arthropods.

4. Embryonated egg ingested by humans from contaminated food, water, or hands

5. Oncosphere hatches. Cysticercoid develops in intestinal villus.

6. Scolex

7. Adult in ileal portion of small intestine

8. Eggs can be released through the genital atrium of the gravid proglottids. Gravid proglottids can also disintegrate releasing eggs that are passed in stools.

9. Autoinfection can occur if eggs remain in the intestine. The eggs then release the hexacanth embryo, which penetrates the intestinal villus continuing the cycle.
How is man infected with \textit{H. diminuta}?

Final host: infected human

Mode of infection:

Ingestion of infected rat flea

One Infective Stage:

Cysticercoid diminuta in Rat flea

Cysticercoid diminuta

Adult in small intestine (habitat)

Diagnostic stage 

\textit{H. diminuta} egg in stool
How is man infected with *D. caninum*?

Final host:
infected human

Mode of infection:
Ingestion of infected
  dog  flea

One Infective Stage:
Cysticercoid caninum in
DOG flea

Cysticercoid caninum

Adult in small
intestine (habitat)

Diagnostic stage
Egg capsules in stool
**Echinococcus granulosus** causes Hydatid disease

Geographical Distribution: cosmopolitan especially in sheep raising countries.
Hydatid Cyst

- Fibrous layer
- Laminated layer
- Germinal layer

Hydatid sand
Hydatid fluid

Individual scolices
Brood capsules
Exogenous daughter cyst
Daughter cyst
Echinococcus multilocularis and Alveolar Hydatid Disease

Geog. Distribution: North America, Siberia & Eskimos

Foxes, Cats, Wolves

Adult E. multilocularis in small intestine
E. multilocularis eggs are infective stage to man
Eggs form Alveolar cyst in human body (>90% in liver)
Life cycle

Life-cycle of *Echinococcus multilocularis*

- **Definitive host**
  - Foxes
- **Intermediate host**
  - Voles

1. **Predation of voles**
2. **Egg**
3. **Ingestion of eggs**
4. **Larva (alveoral hydatid)**
5. **Voiding of eggs**
6. **Adult stage**
Multiceps multiceps cause Coenurosis

Geog. Distribution: worldwide

Coenurus cyst develops in human brain Germinal layer

Adult in small intestine

Eggs

Few macroscopic scolices

How man gets infected with M. multiceps

Plate with vegetables
**E. granulosus**

In Small intestine of dogs

Mode of infection
- Ingestion of egg similar to *Taenia* egg
- Forms **Hydatid cyst**

Favorite site in man is the **LIVER** (66%)

**E. multilocularis**

In Small intestine of foxes, wolves

Mode of infection
- Ingestion of egg similar to *Taenia* egg
- Forms **Alveolar Hydatid** cyst

Favorite site in man is the **LIVER** (90%)

**M. multiceps**

In Small intestine of dogs

Mode of infection
- Ingestion of egg similar to *Taenia* egg
- Forms **Coenurus** cyst

Favorite site in man is the **BRAIN**
Hydatid cyst

Unilocular cyst

Fibrous, laminated & germinal layers

Many microscopic sclerotic (100-1000)
scolices

Coenurus cyst

Unilocular cyst

Germinal layer

Few macroscopic sclerotic (30-60)
scolices

Alveolar cyst

Unilocular cyst

Germinal layer

Multilocular cyst

Germinal layer

Septa

No sclerotic (Sterile)

Fibrinous, laminated germinal layers