



Cestodes, *Diphyllobothrium latum* and *Echinococcus granulosus*

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Cestodes (tapeworms)

Cestodes can be classified into 2 orders— Pseudophyllidea and Cyclophyllidea

The adult worm consists of 3 parts:

1. **Head (Scolex)**: it is the organ of **attachment** to the intestinal mucosa of the definitive host.
 2. **Neck**: it is the part, immediately behind the head and is the **region of growth** from where the **new proglottids** are being formed.
 3. **Proglottids** (strobila): consist of immature followed by mature and gravid proglottids.
- Tapeworms are **hermaphrodites**.
 - Tapeworms **do not have a body cavity** or **alimentary canal**.
 - **Nutrients** are absorbed via the **cuticle**. Rudimentary excretory and **nervous systems** are present.

The eggs of Cyclophyllidea and Pseudophyllidea are different from each other.

- In **Pseudophyllidea**, the egg is **operculated**.
- In **Cyclophyllidea**, the embryo inside the egg is called the **oncosphere** (hexacanth embryo). It is spherical and has 3 pairs of hooklets.

Diphyllobothrium latum

- **Common name:** Fish tapeworm
- **Distribution:** Its infection occurs in **central** and **northern Europe**, particularly in the Scandinavian countries. It is also found in **Siberia, Japan, North America** and **Central Africa**.
- **Habitat:** the adult worm is found in the **small intestine of human**, usually in the ileum.
- **Morphology:**

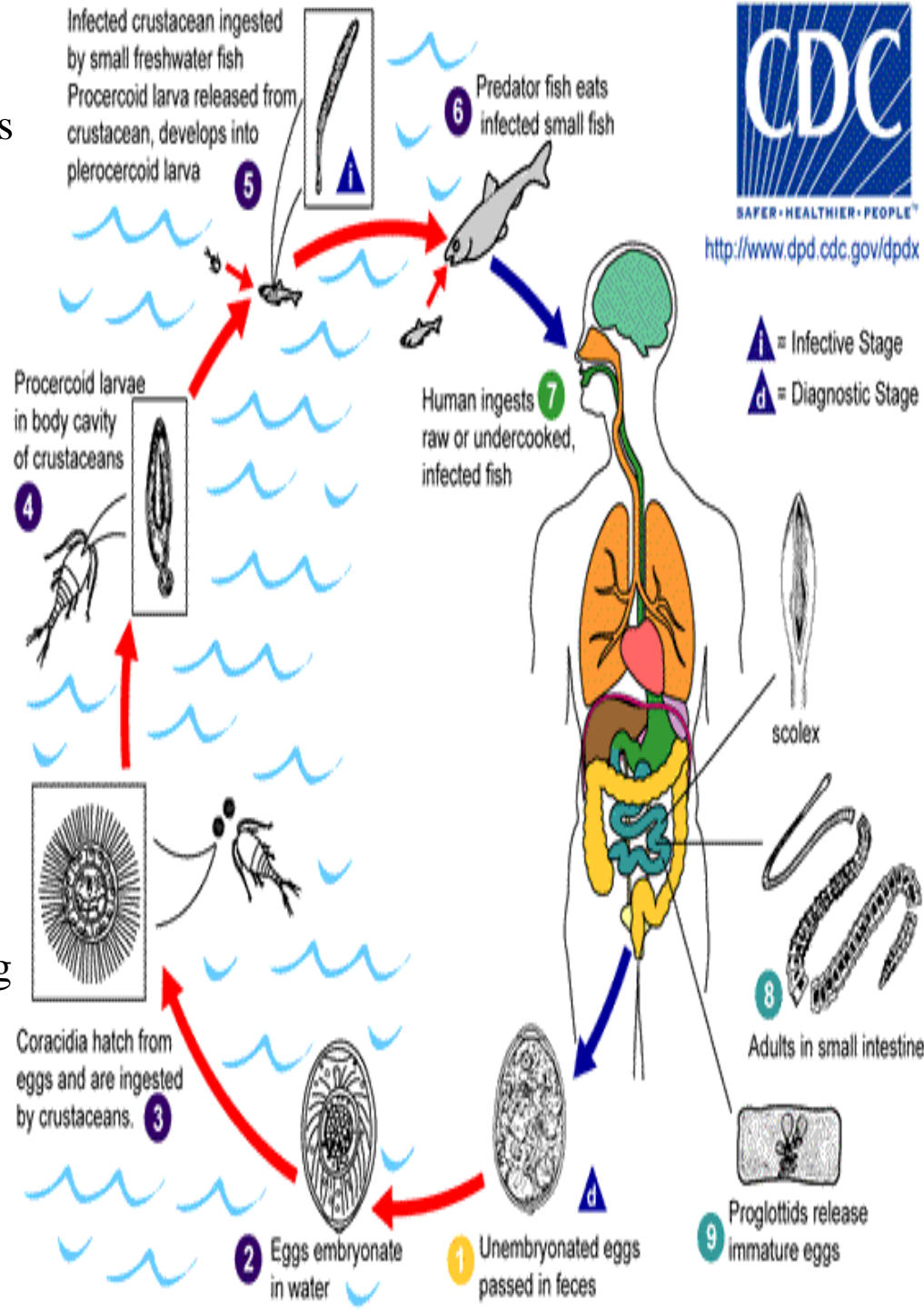
Adult is the **largest tapeworm** inhabiting the **small intestine of human**.

Scolex is spatulate or **spoon shaped**. It has 2 slitlike longitudinal dorsoventral **sucking grooves** (**bothria**). **Neck** is thin and unsegmented. **Strobila** consists of 3000–4000 proglottids.

Egg is broadly **ovoid**, with a **thick**, light **brown shell**. It has an operculum at one end. **The egg is not infective to humans**.

There are 3 stages of larval development: first stage larva (**coracidium**), second stage larva (**procercoid**), and third stage larva (**plerocercoid**).

▲ = Infective Stage
 ▲ = Diagnostic Stage



Life cycle of *Diphyllobothrium latum*

- (1) Unembryonated eggs** are passed in faeces of infected human.
- Eggs **embryonate in water**.
- Coracidia hatch from eggs and are **ingested by crustaceans**.
- Proceroid** larvae develop in body cavity of **crustaceans**.
- The infected crustaceans are **ingested** by small **freshwater fish** and the proceroid larvae develop into **plerocercoid larvae**.
- Predator fish eats the infected small fish.
- Human** acquires infection via **ingesting raw or undercooked infected fish** containing **plerocercoid larvae**.
- Adults develop in the small intestine.
- Proglottids release immature eggs which are passed in the faeces.

Diphyllobothriasis

- **Pathogenesis and Clinical Features**

- Infection may be asymptomatic, while some patients may present with intestinal obstruction. **Abdominal discomfort, diarrhoea, nausea, weakness, weight loss and anaemia** and **vitamin B12 deficiency anaemia**.

- Diagnosis: Microscopic examination, Molecular diagnosis PCR.

- Treatment: **Praziquantel** and **Parenteral vitamin B12** should be given in vitamin B12 deficiency anaemia.

- **Prevention and Control**

1. Proper cooking of fish

2. Deep freezing of fish (−10 °C for 24–48 h)

3. Proper sanitation

4. Periodical deworming of pet dogs and cats as they can be infected by eating contaminated raw fish

5. Treatment of positive cases

Echinococcus granulosus

- Common name: **Dog tapeworm**

- **Distribution**

The **hydatid disease** caused by *Echinococcus granulosus* is prevalent in **most parts of the world** and is most **extensive in** the **sheep** and **cattle rearing countries**.

- **Habitat**

The **adult** worm lives in the **small intestine of dogs** and other canine.

The **larval** stage (hydatid cyst) is found in **humans** and **herbivorous animals** (sheep, goat, cattle and horse).

- **Morphology**

- Adult worm consists of a **scolex**, **neck** and **strobila**. The scolex is pyriform, with **4 suckers** and **a rostellum** bearing 2 circular rows of **hooklets**.
- The strobila is composed of 3 proglottids; immature, mature and gravid proglottids. The gravid proglottid contains branched uterus filled with eggs.
- The eggs of *Echinococcus* are **indistinguishable** from those of *Taenia* species.
- The larval form (hydatid cyst) develops in various organs of the **intermediate host**

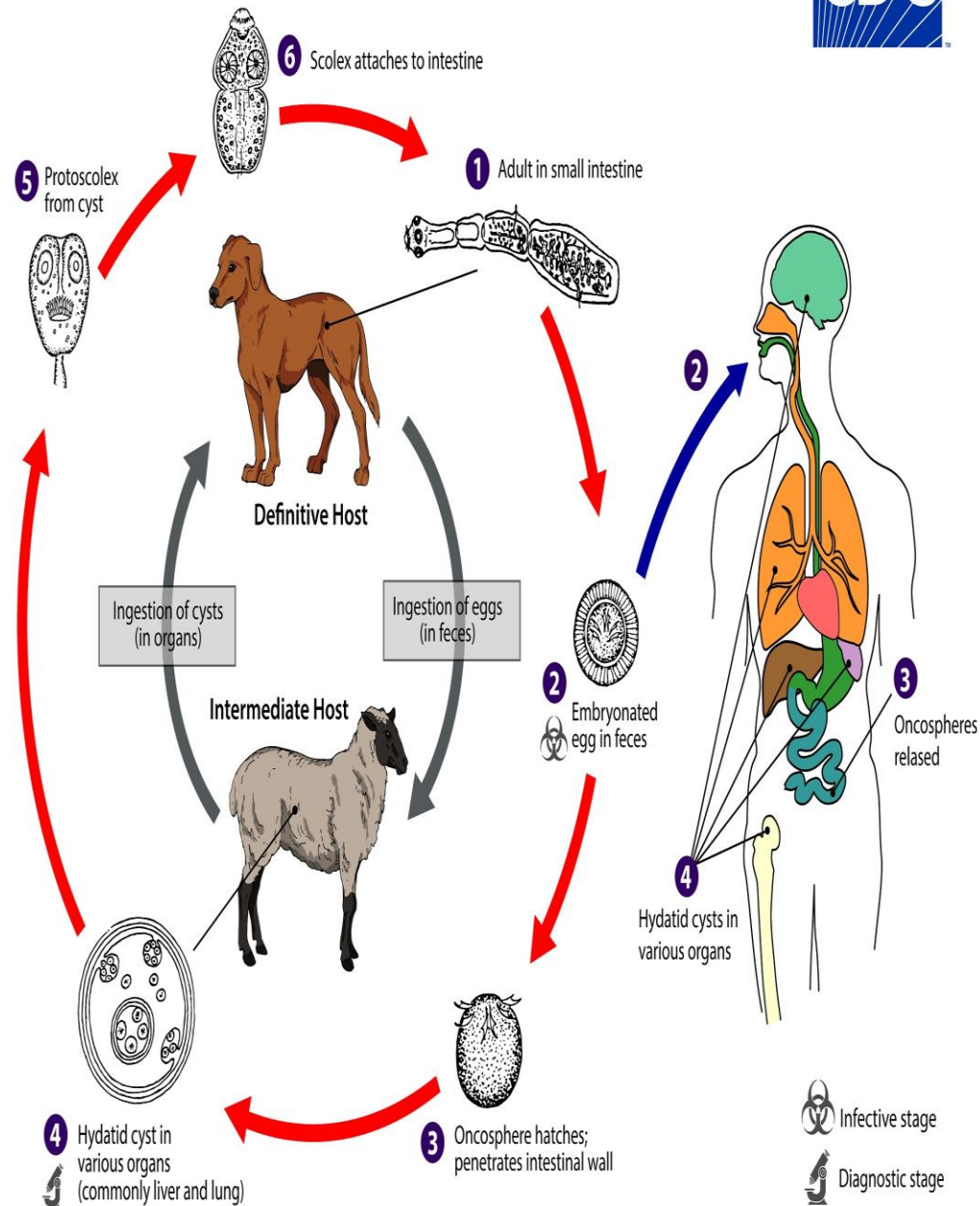
Life cycle of *Echinococcus granulosus*

(1) Adult worm is found in the **small intestine** of **definitive host** (**dogs** and other canidae).

(2) **Embryonated eggs** are passed out in the faeces of the definitive host. **Intermediate hosts** (**human, sheep, goats, etc.**) acquire **infection** by ingesting embryonated eggs.

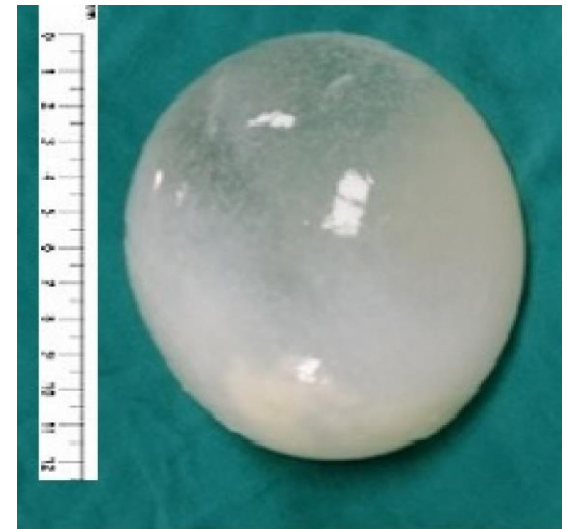
(3–4) The egg hatches **releasing oncosphere** which **penetrates** the intestinal wall and is carried by the **blood circulation** to various organs (liver, lungs, heart, spleen and bones) where it develops into **hydatid cyst**.

(5–6) When the **definitive host ingests** hydatid cyst in **organs of intermediate host**, the **protoscolices** from the cyst are released and the **scolex attaches** to the intestine to develop into adults.



Pathogenesis and Clinical Features

- Hydatid cyst infection is **often asymptomatic**.
- Clinical illness develops when the hydatid cyst causes **obstruction** or **pressure** effect.
- In majority of cases, the primary hydatid cyst occurs in **liver**, mostly in the right lobe. Clinical manifestations are **hepatomegaly**, pain and obstructive jaundice.
- The next common site is the lower lobe of the right **lung**. **Cough**, haemoptysis, chest pain, pneumothorax and dyspnoea are the usual presentation.
- In the **kidney**, hydatid cyst causes pain and **haematuria**.
- Other sites affected include spleen, brain, pelvic organs, orbit and bones.
- Hydatid cyst in **bones** may cause **pathological fractures**.



Intact hydatid cyst



Hydatid cyst infection in the liver and lung of a wild herbivore

Echinococcosis

- **Diagnosis**

Microscopic examination, Serodiagnosis, Molecular diagnosis PCR, Imaging Radiological examinations and other imaging techniques such as ultrasonography (USG), CT scan and MRI.

- **Treatment**

1. Puncture, aspiration, injection and reaspiration (**PAIR**) is carried out in **early stages** of the disease.

2. **Surgical treatment** in cases where the cysts are accessible.

3. Patients with small or **multiple cysts** can be treated with **albendazole**. **Praziquantel** may be useful prior to surgery or in cases of spillage of cyst contents during surgery.

- **Prevention and Control**

1. Prevent dogs from eating animal carcass or offal

2. Periodical deworming of dogs

3. Personal hygiene