

Cestodes (Tapeworms) Lecture 19

**General Microbiology
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2022-2023
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Cestodes are classified according to habitat into

Intestinal cestodes

(Adult in the small intestine of man)
(Man is the D.H)

- 1- *Diphyllobothrium latum*
- 2- *Taenia saginata* (Beef tapeworm).
- 3- *Taenia solium* (Pork tapeworm).
- 4- *Hymenolepis nana* (Dwarf tapeworm).

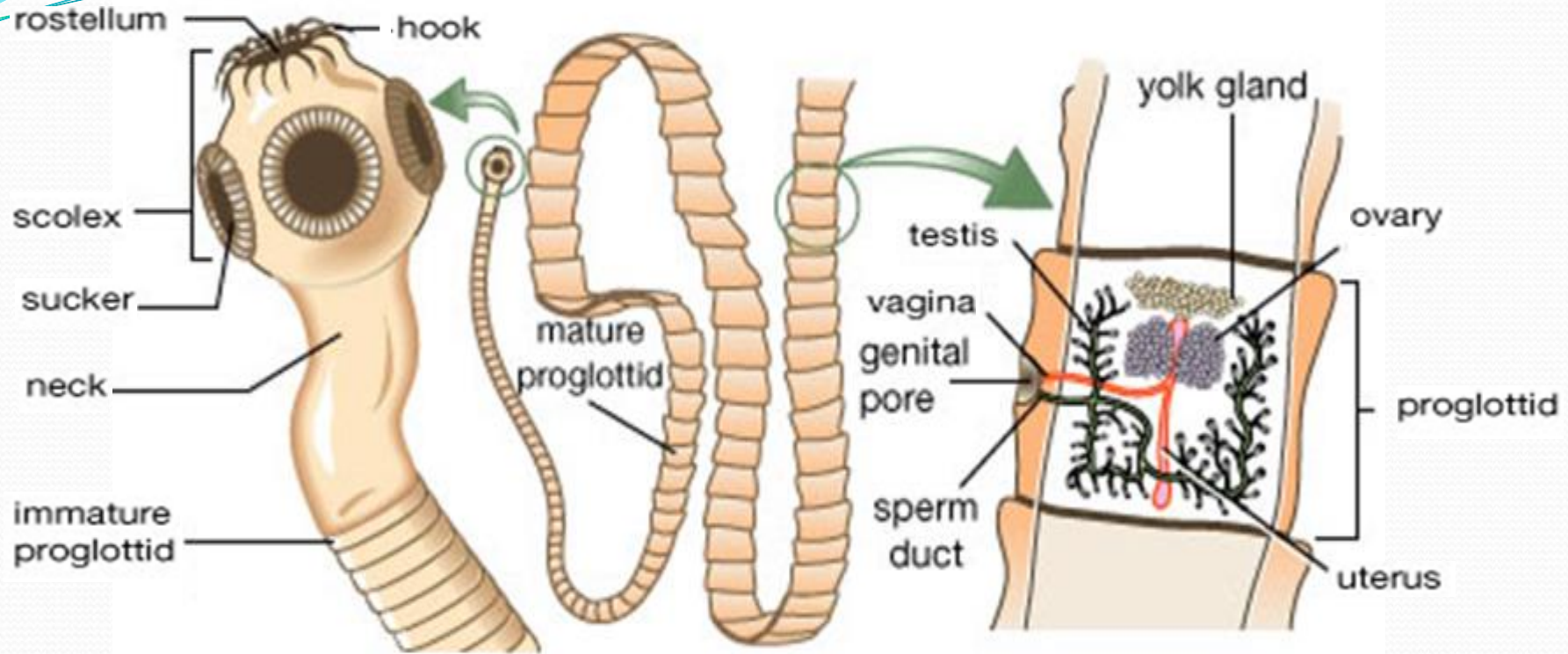
Tissue cestodes

(Larvae in the tissues of man)
(Man is the I.H)

- 1- *Cysticercus cellulosa*) ⇒
Cysticercosis
- 2- Hydatid cyst (larva of *Echinococcus granulosus*) ⇒ **Hydatidosis**
- 3- *Cysticercoid nana* (larva of *H. nana*)
⇒ **Cysticercoid nana**

⚠ **N.B:** *H. nana* & *T. solium* are considered as intestinal and tissue cestodes

General characters



Adults:

- Flat, ribbon like and segmented.
- Cestodes have **neither a body cavity nor an alimentary tract.**
- Cestodes are **hermaphrodites.**

General characters

➤ The body is formed of :-

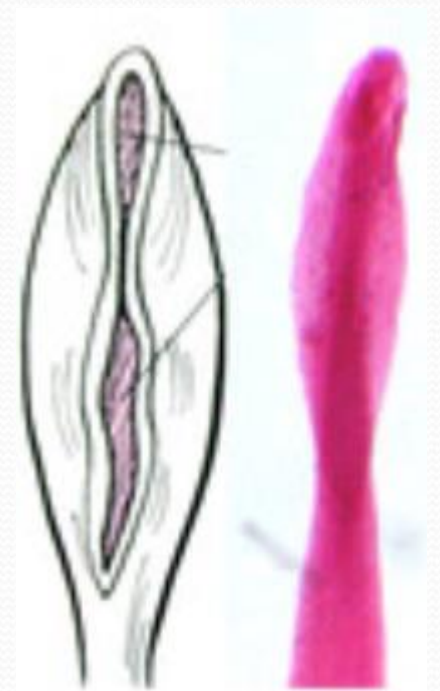
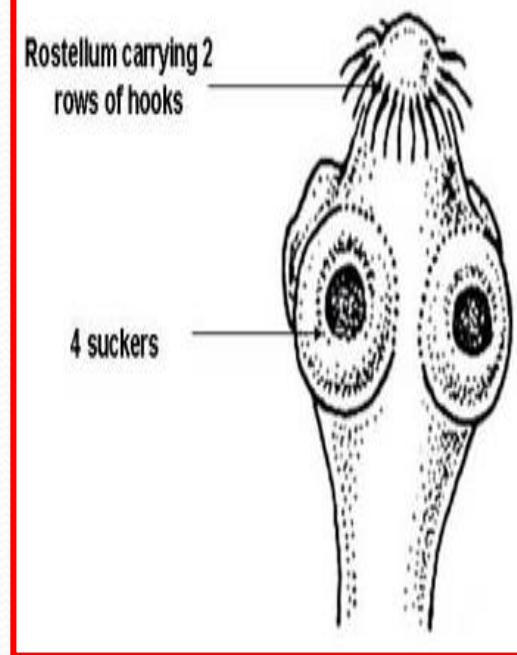
1- Scolex (head) with organs of fixation :-

A. Suckers either :-

- 4 true cup shaped muscular sucker , or
- false suckers as grooves (bothria).

B. Rostellum with one or more circles of hooks.

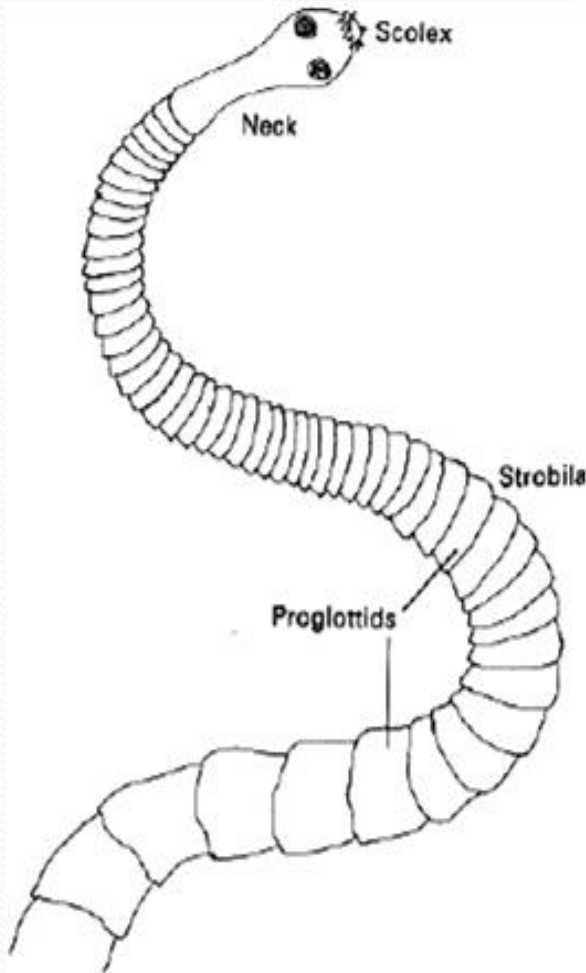
2- Neck is the region of growth.



General characters

- 3- Strobila:** the segmented part of the body of a tapeworm that consists of a long chain of segments.
- **Immature segments:** They lie anterior and contain immature genital organs.
 - **Mature segments:** Follow the immature ones and contain fully developed genital organs.
 - **Gravid segments:** They lie posterior and contain uteri filled with eggs.

General Body Shape of a Tapeworm

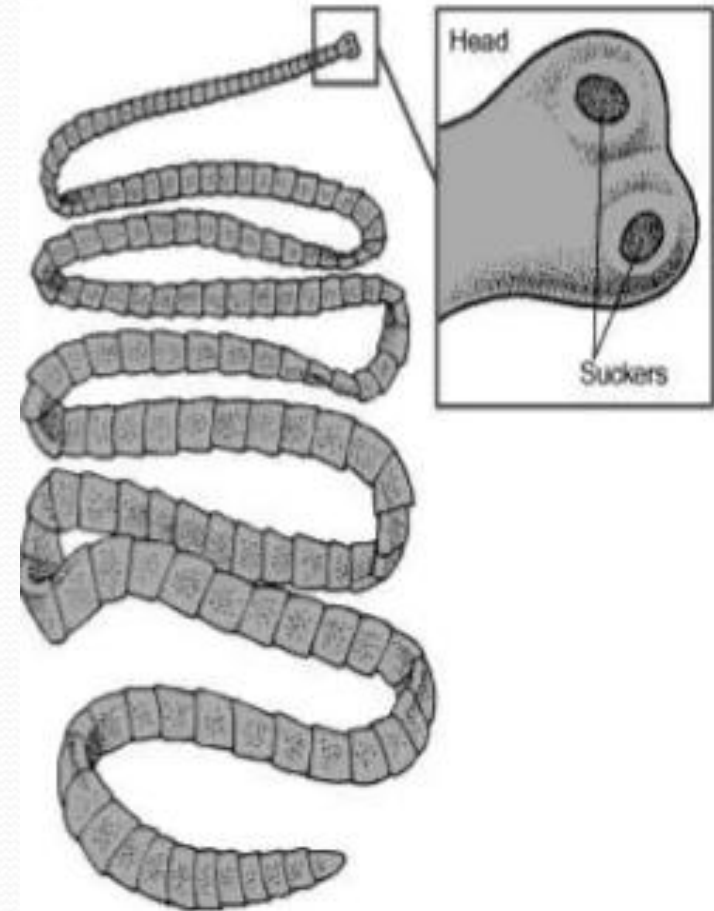


'head'
(scolex)

neck

body
(strobila)

segments
(proglottids)



Life cycle of cestodes :-

➤ Habitat :-

a- Intestinal: The adult worm lives in the small intestine of man (D.H).

b- Extra-intestinal (tissues): The larval stage founds in the tissues of man (I.H).

➤ They require one or two intermediate host (I.H).

➤ Gravid segments or eggs are passed in faeces of the D.H.

① Intestinal cestodes

1) *Diphyllobothrium latum* (broad tapeworm , fish tapeworm)

➤ Geographical distribution :-

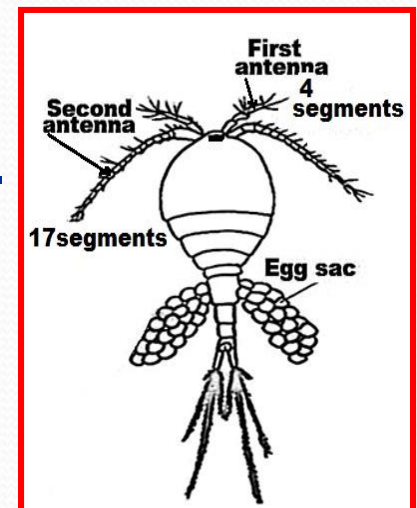
Lake regions in Europe, America, Russia, Japan and Central Africa.

➤ Habitat : Small intestine.

➤ D.H : Man and fish eating animals e.g. dogs and cats.

➤ I.H : • 1st: *Cyclops*.

- 2nd: Fresh water fish (Salmon).



Cyclop

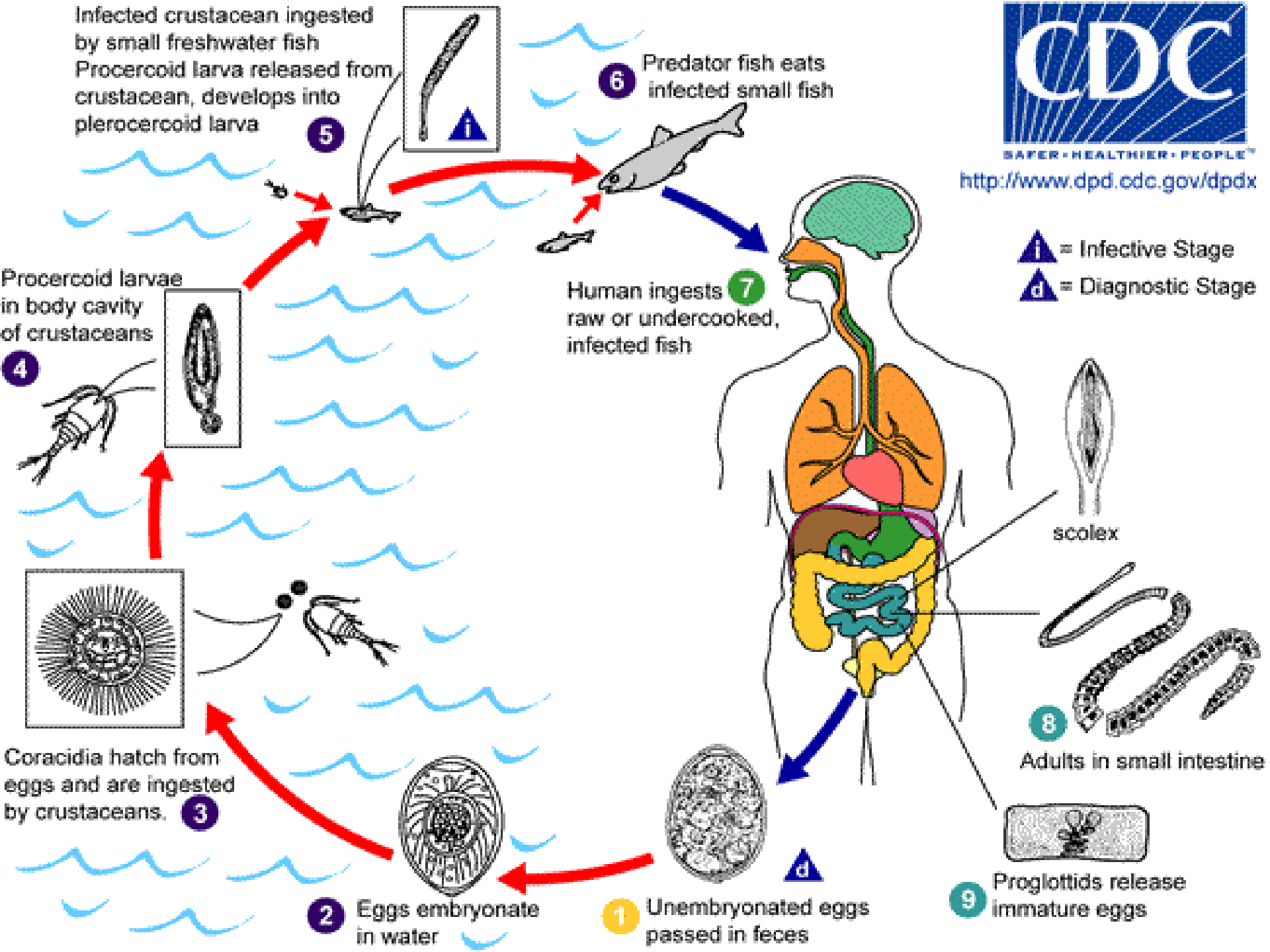
Morphology

Adult :-

- **Size** : 3 - 10 meters.
- **Scolex** : Elongated, almond like with two grooves (bothria), one dorsal & one ventral.
- **Strobila** : More than 3000 segments:
 - a- Immature segments
 - b- Mature segments
 - c- Gravid segments: Not present.



Scolex



Pathogenesis and Symptomatology

Disease: Diphyllbothriasis.

- 1. General toxic manifestations and intestinal disturbances** in the form of nausea, vomiting, hunger pain, dyspepsia, diarrhea & loss of weight.
- 2. Manifestations pernicious anaemia** due to consumption of vit.B12 and folic acid by the parasite.
- 3. Intestinal obstruction** by large number of worms.
- 4. Neurological manifestations** are common (headache, insomnia & convulsions).

Diphyllobothrium latum

Laboratory Diagnosis

➤ **Direct:-**

1. Stool examination for detection of eggs (direct and concentration methods).
2. Finding mature segments in faeces.

➤ **Indirect:** Blood picture for anaemia.

Treatment

- 1) Niclosamide.
- 2) Praziquantel (Biltricide).
- 3) Atebrine.
- 4) Vitamin B12 & folic acid for **pernicious anaemia**.

Taenia saginata

(Beef tapeworm, Bald tapeworm)

Taenia saginata (Beef tapeworm)

➤ **Geographical Distribution:**

Cosmopolitan, especially in cattle-raising countries.

➤ **D.H : Man**

➤ **I.H : Herbivorous animals (cattle, sheep and camels).**

➤ **Habitat: Small intestine.**

Taenia saginata

Morphology

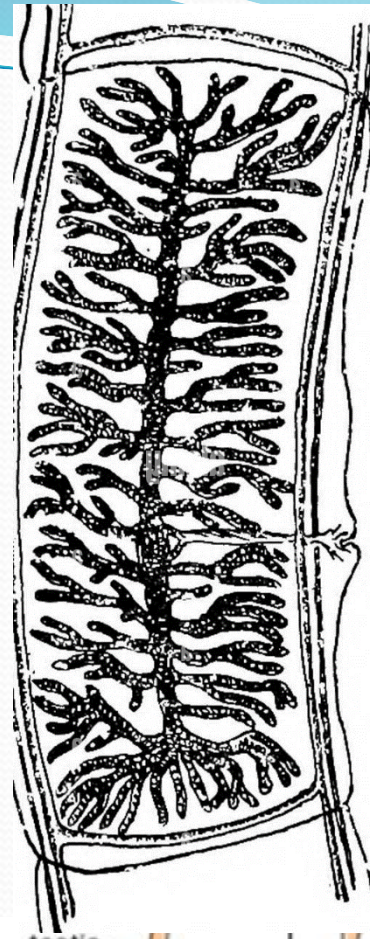
Adult :-

- **Size** : 4-10 meters.
- **Scolex** : Globular, with 4 cup shaped suckers at at the angles of the head. **No rostellum or hooks.**
- **Strobila**: 1000 - 2000 segments.
 - **Immature segments.**
 - **Mature segments.**
 - **Gravid segments.**

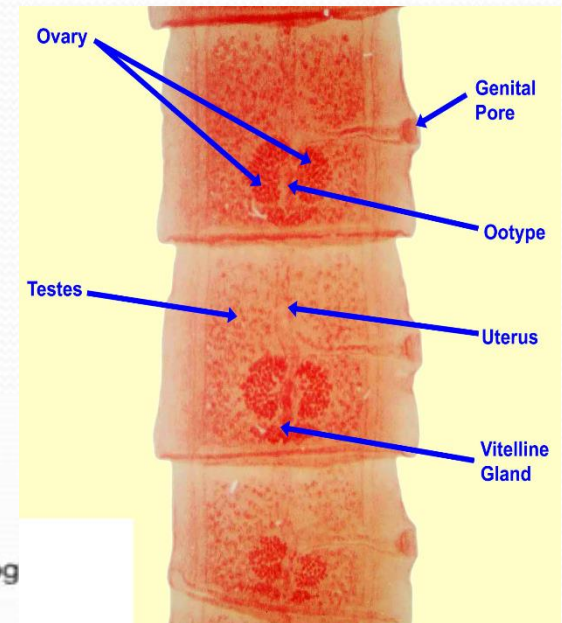


Gravid segment

- Longer than broad
- Uterus with 15 - 30 (18) lateral branches on each side
- Full of eggs.
- Detached singly out of the anus(with feces).

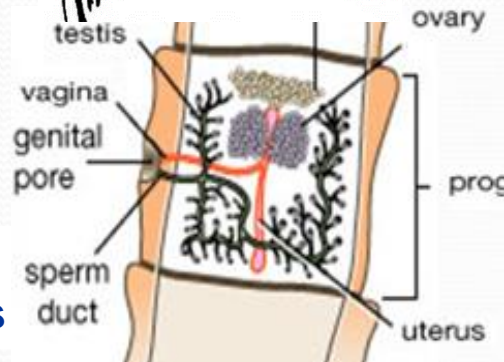


Egg (D.S)

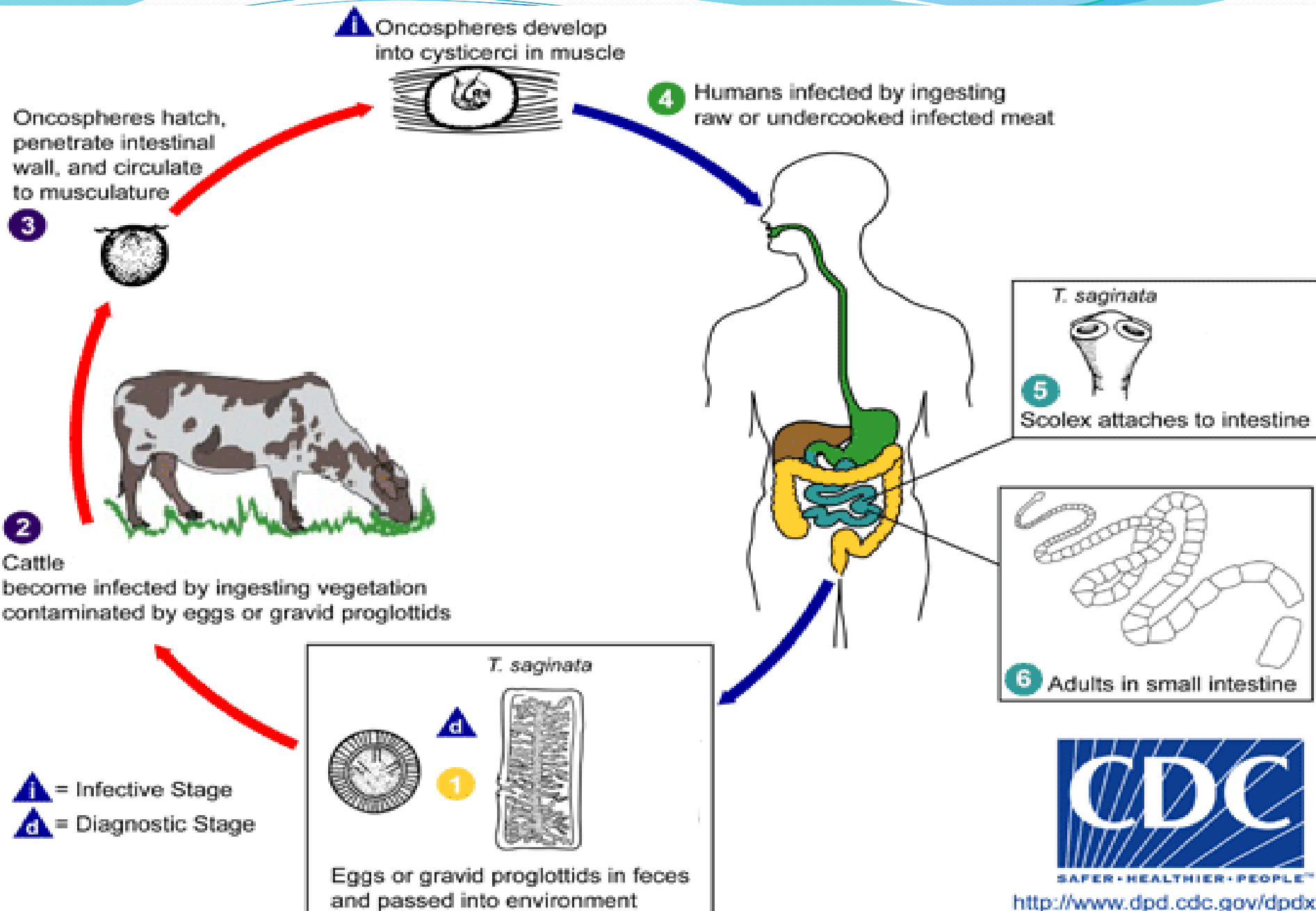


Mature segment

Squarish in shape
Contains male & female genital systems



Taenia saginata life cycle



Taenia saginata

Mode of Infection

- Man infected by **eating beef** either raw or improperly cooked e.g. steaks, hamburgers or grilled (kabab) containing **viable *cysticercus bovis***.

Pathogenesis and Symptomatology

- **Disease** :*Taeniasis saginata*

- 1) **Intestinal disturbance** e.g. nausea, vomiting, hunger pains, colic, diarrhea or constipation.
- 2) **Toxic manifestations**: Due to worm products e.g. dizziness, headache, insomnia & delirium.
- 3) **Intestinal obstruction**.
- 4) **Loss of weight**.
- 5) **Anxiety and nervousness** due to continued migration of G. segments out of the anus ➔ irritation & itching.

Diagnosis

- 1- Detection of eggs by stool examination (direct and concentration methods).
- 2- Detection of gravid segments in the stool to differentiate between *Taenia* species.

Treatment

- 1) Niclosamide (Yomesan).
- 2) Praziquantel (Biltricide).
- 3) Atebrine.



Taenia Solium
(Pork Tapeworm)

Taenia Solium

➤ Geographical distribution :-

-Pork-eating countries e.g. America, Europe.

➤ **D.H:** Man.

➤ **I.H:** Pigs and occasionally man.

➤ **Habitat:** Small intestine.

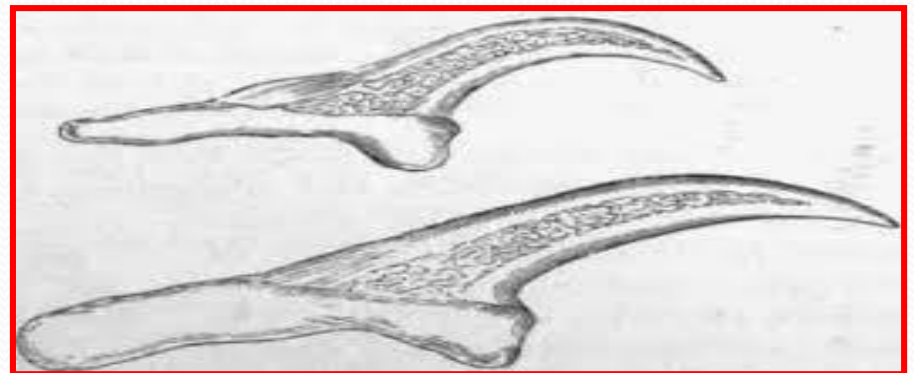
Morphology

Adult :-

➤ **Size:** 4-6 meters.

➤ **Scolex :-**

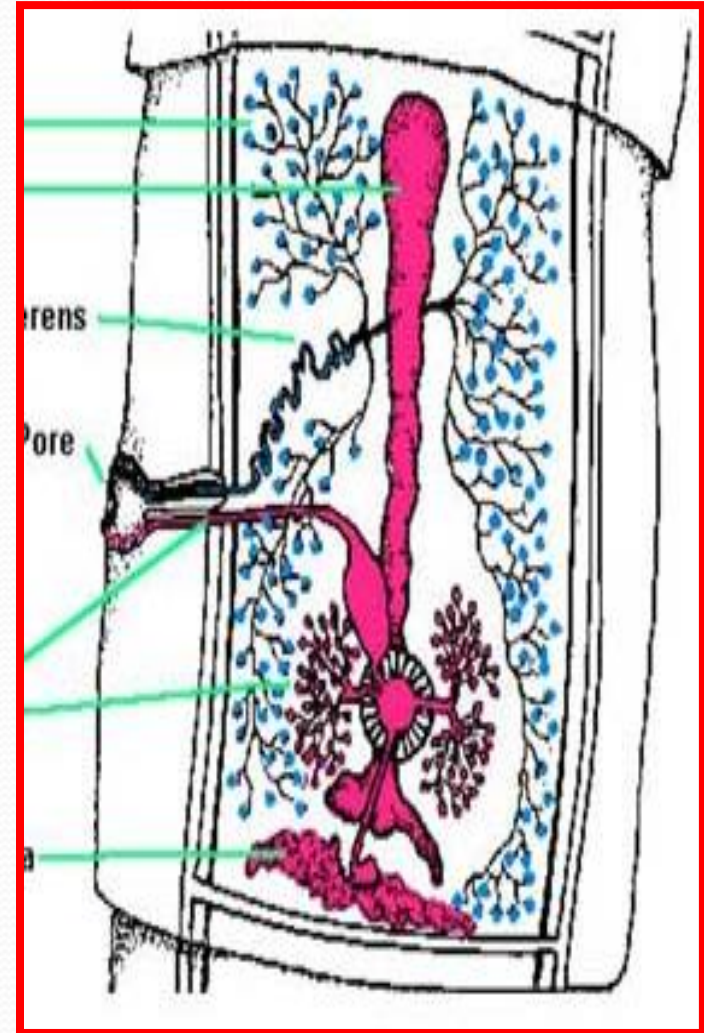
- Globular.
- 4 cup shaped suckers.
- Rostellum with 2 rows of taenoid hooks (short handle, guard & long blade).



Taenia Solium

Strobila : About 1000
segments:-

- Immature segments.
- Mature segments :
- Similar to *T. saginata* except :-
 - *Smaller.
 - *Testes : Fewer.
 - *Ovary : Trilobed.



T. solium mature segment

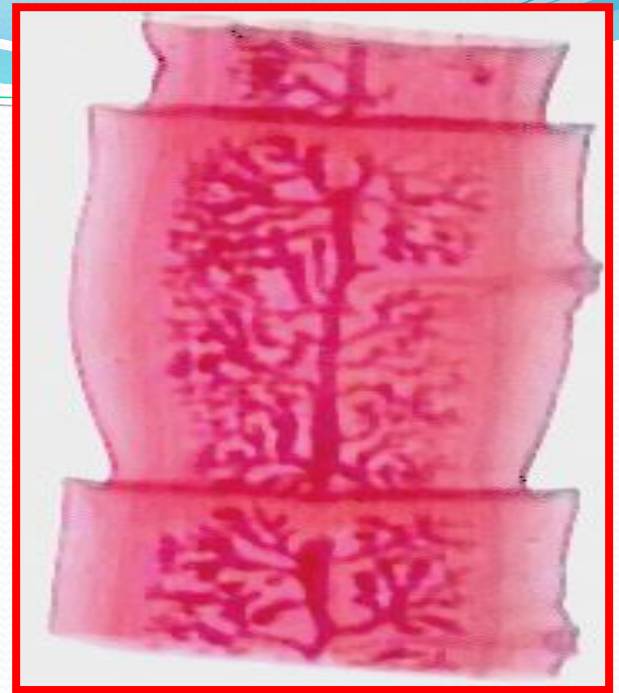
➤ **Gravid segments :**

➤ **Similar to *T. saginata* except:-**

1 - Smaller.

2 - Uterus: About 9 lateral branches on each side.

3 - Segments detach in groups.



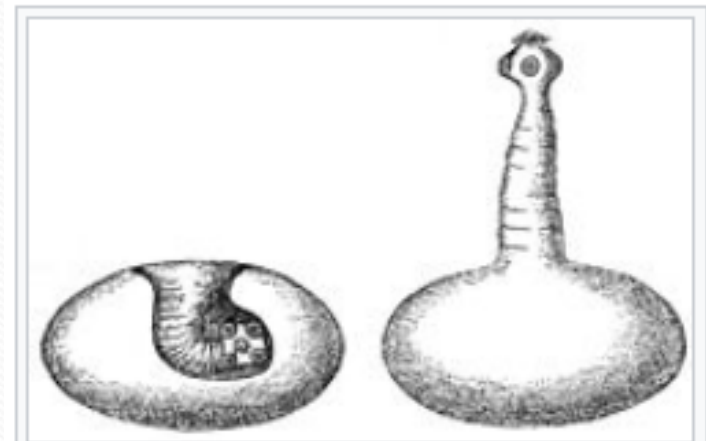
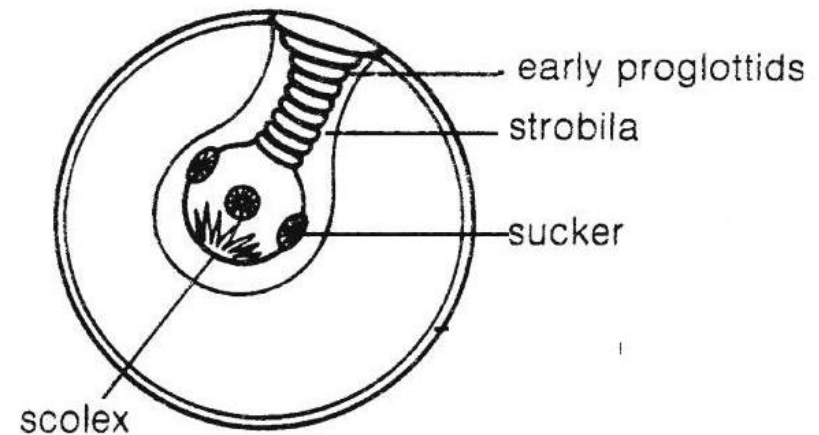
➤ **Egg (D.S) & (I.S for pigs & man):**

Similar to *T. saginata* but highly infected to human.

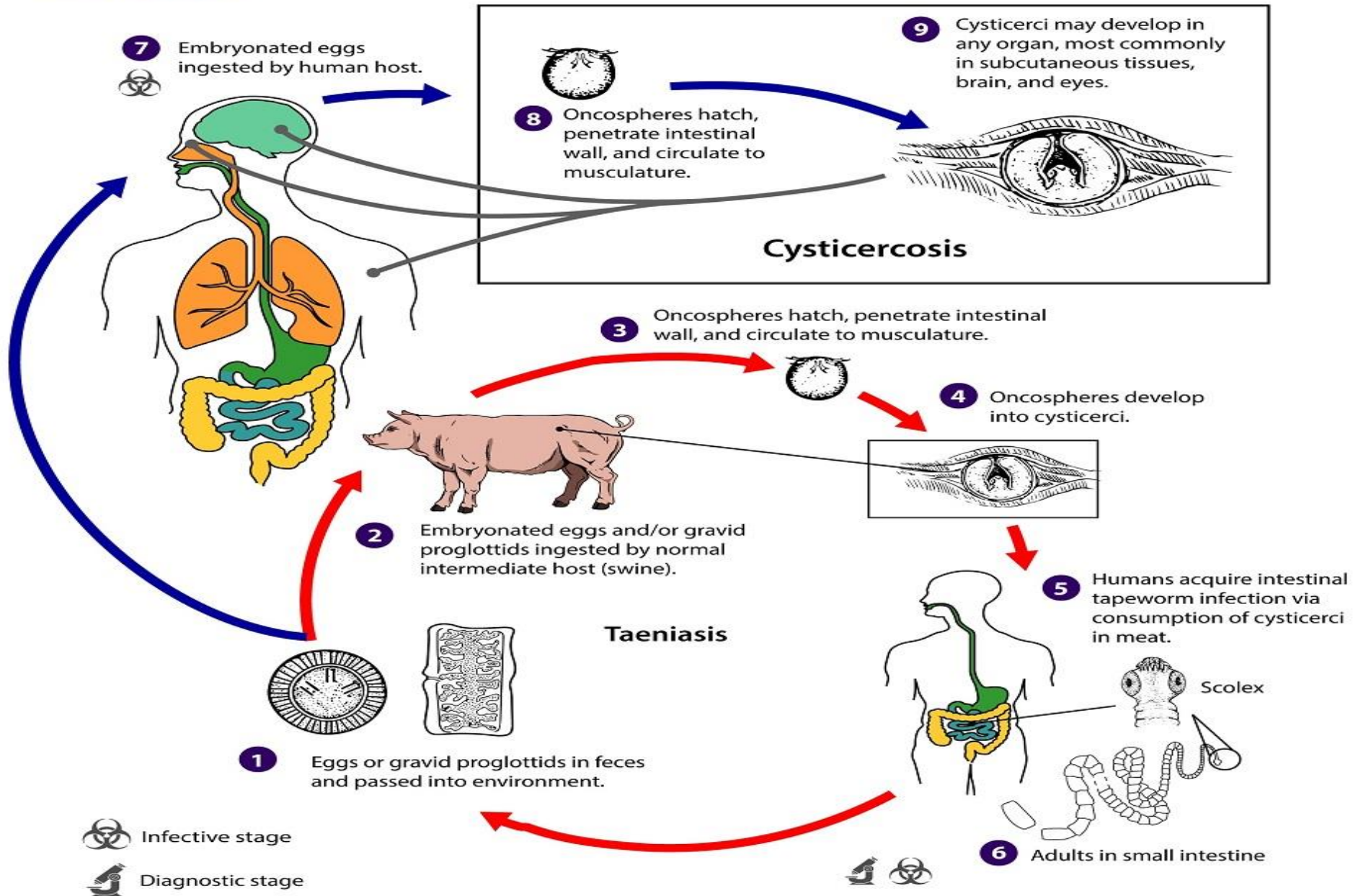


Cysticercus cellulosa (I.S):

Similar to cysticercus bovis, but detected in pork and the invaginated scolex carries 4 suckers, rostellum and hooks.



Drawing of *Cysticercus cellulosae*:
Left one from the pig showing an invaginated scolex. Right one from human intestine showing the evaginated scolex.



Pathogenesis and Symptomatology

Taeniasis *solium*: Due to ingestion of undercooked pork containing *cysticercus cellulosa* (the same clinical pictures as *taeniasis saginata*).

Cysticercosis: It develops when man ingested the *T. solium* eggs with food or drink or autoinfection → development of larvae (*cysticercus cellulosa*) in his tissues (ms, brain, eye, cutaneous tissues).

Symptomatology of cysticercosis

Symptoms depends on the size of cyst, number & site affected:

- **Muscle:** Myositis with fever, muscle swelling → later, progresses to atrophy and fibrosis.
- **Brain :** Increase of intracranial pressure, epileptic fits and headache.
- **Eye :** Retinal oedema, haemorrhage, decreased vision or even visual loss.
- **Subcutaneous tissues:** Firm, mobile painful nodules mainly on the trunk and extremities.

Diagnosis of Cysticercosis

A. Direct methods:

- Biopsy from nodules for detection of larvae.
- CT and MRI for brain infection.
- X ray for calcified cyst.
- Ophthalmoscope for eye infection.
- Surgical removal for detection of the larvae.
- Stool examination for detection of eggs or gravid segments (only in patients having the adult worm).

B. Indirect methods:

- Serological tests.
- Eosinophilia.

Treatment of Cysticercosis

- 1) **Brain cyst:** Anticonvulsant and antiparasitic drugs as praziquantel in combination with corticosteroids to reduce inflammatory reaction.
- 2) **Eye cyst:**
 - Cyst within the eye → surgical removal.
 - Cyst outside eye globe → antiparasitic drugs with corticosteroids.
- 3) **Subcutaneous cyst:** Surgical excision.
- 4) Vitamin D and calcium to help calcification.

Treatment of *Taeniasis solium*

Anti-cestodal drugs for adult as taeniasis *saginata* but:

1) **Niclosamide** is contraindicated because it disintegrates the worms, releasing large number of eggs in the intestine which increase the possibility of cysticercosis (internal autoinfection).

2) **Atebrine** causes nausea and vomiting. Anti-emetic must be given one hour before administration of Atebrine to avoid antiperistalsis and internal autoinfection.

***Difference s between *T. saginata* and *T. solium*:**

Item		<i>T.saginata</i>	<i>T.solium</i>
Life cycle	D.H	Man in both	
	Egg	Morphologically similar	
		Infect cattle only	Infect pigs & man
I.H	Cattle, sheep & camel only	Pigs & occasionally man	
Larva	<i>Cysticercus bovis</i>	<i>Cysticercus cellulosa</i>	
I.S to man	<ul style="list-style-type: none"> • <i>Cysticercus bovis</i> in undercooked beef 	<ul style="list-style-type: none"> • <i>Cyeticercus cetllulosa</i> in undercooked pork • Eggs → cysticercosis. 	

