

# Introduction of Cestodes (Tapeworms)

Phylum Platyhelminthes

Class Cestoda

Order Pseudophyllidea

Order Cyclophyllidea

## Morphology

- Flat, segmented body with various length (several mm ~ several meters)
- 3 regions of worm body:
  - Scolex: suckers, hooklets, grooves
  - Neck: germinal portion
  - Strobila: immature, mature, gravid proglottids (segments)

- Monoecious (each segment): reproductive system highly developed
- Digestive system degenerated
- All species are parasitic

### Medically important species of cestode.

*a. Diphylobothrium latum* has a **SCOLEX** with elongated, slit-like attachment organs Fish tape worm

*b. Taenia saginata* has four muscular **SUCKERS** Beef tape worm.

*c. Taenia solium* has similar muscular **SUCKERS** Pork tape worm.

*d. Hymenolepis nana* Dwarf tape worm. *e. Echinococcus granulosus* Dog tape worm.

### **TAPEWORM LIFECYCLE :**

The DEFINITIVE HOST ingests the larval form. Worms mature from larval forms in the intestine of definitive host. The definitive host harbors ADULT WORMS in the intestine. EGGS are passed in the stool.

Eggs are ingested by the INTERMEDIATE HOST . LARVAE develop from eggs in the intermediate host and penetrate the host intestinal mucosa.

Larvae develop into ENCYSTED FORMS in tissues of intermediate host. The CYSTICERCUS is the encysted form of the *Taenia species*. The HYDATID is the encysted form of the *Echinococcus*.

**NOTE:** *Diphyllobothrium latum has two intermediate*

## **Tapeworms**

***Taenia solium***

Pork tapeworm / Hook tapeworm

***Taenia saginata***

Beef tapeworm / Hookless tapeworm

Morphology

	<i>T.saginata</i>	<i>T.solium</i>
Size	4-8 m	2-4 m
Scolex	4 suckers	4 suckers, rostellum & hooklets
Mature proglottid Ovary	2 lobes	3 lobes
Testes	300-400	150-200
Gravid proglottid: Uterine branches	15-30	7-12



***Taenia spp.* adult worm**

The chain of proglottids is called the strobila, and may be composed of over 1,000 proglottids. *T.saginata* may measure 9 m, whereas *T.solium* may reach 6 m.



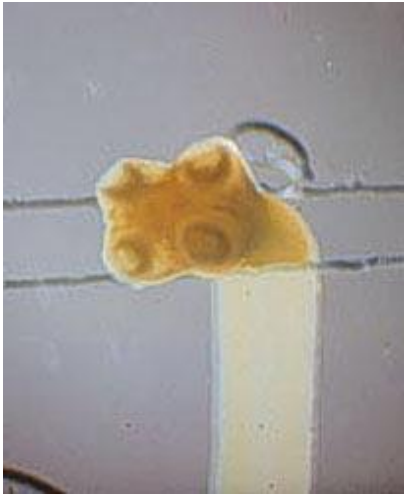
**The beef tapeworm (Living specimen)**



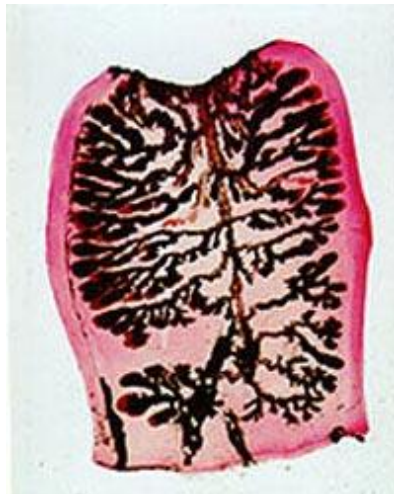
The scolex of *T. solium*



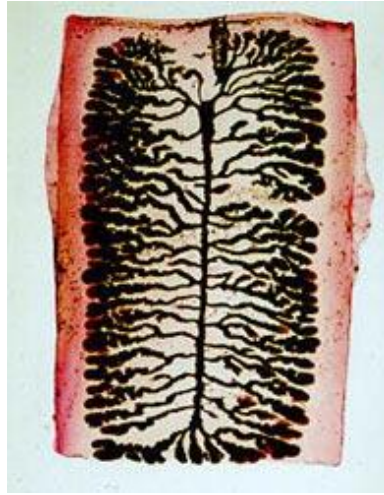
The scolex of *T. saginata*



*Taenia saginata*, fresh specimen



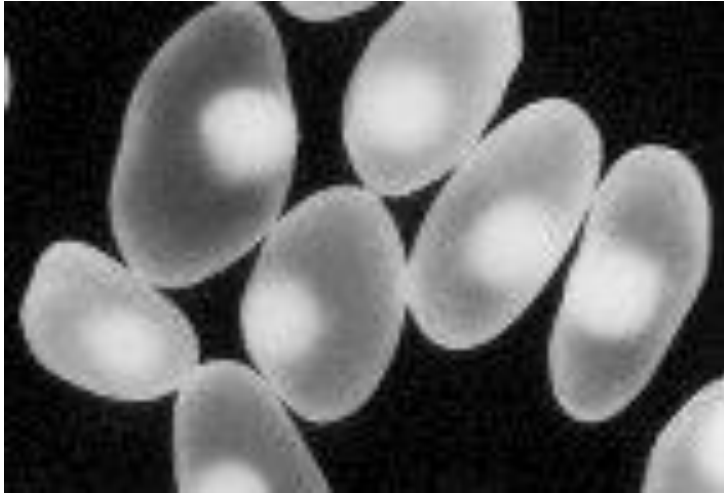
Gravid proglottid of *T. solium*



**Gravid proglottid of *T. saginata***

- Larva
  - Cysticercus bovis*
  - Cysticercus cellulosae*
    - Ovoid, cystic, size = a bean
    - Invaginated scolex and neck





***T.solium*: cysticercus cellulosae with invaginated scolex**

- Egg
  - Indistinguishable in two species
  - Ovoid
  - < Ascarid egg
  - Radically striated embryophore
  - Content: hexacanth embryo (oncosphere: 6 hooklets)



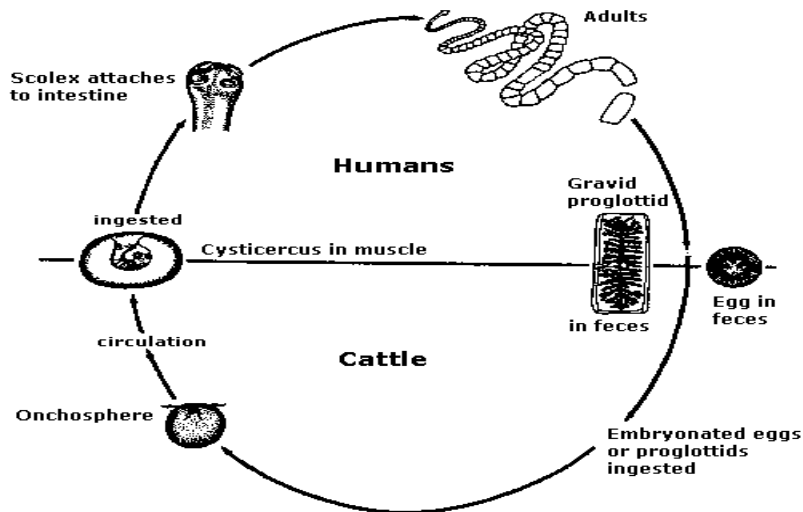
*Taenia spp. egg*  
Can not differentiate *T. saginata* from *T. solium*



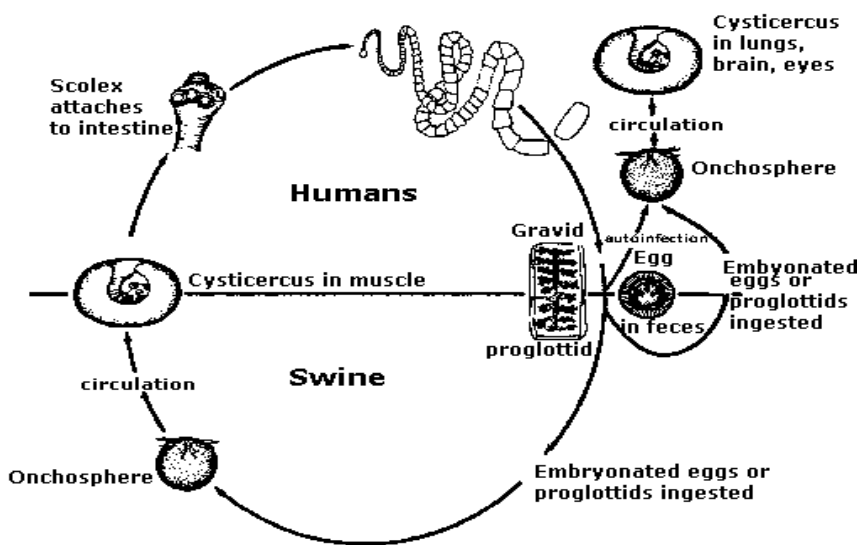
*Taenia spp. egg*

# Life Cycle

- Definitive host
  - Human being; No reservoir host
- Discharged stage
  - Eggs or gravid proglottids in feces



Life cycle of *Taenia saginata*



**Life cycle of *Taenia solium***

	<i>T.saginata</i>	<i>T.solium</i>	
<b>D.H</b>	Human	Human	Human
<b>I.H</b>	Cattle	Swine	Human
<b>Habitation</b>	Small intestine	Small intestine	Tissue(brain, eye, skin etc.)
<b>Infective stage</b>	Cysticercus bovis	Cysticercus Cellulosae	Egg
<b>Disease</b>	Taeniasis	Taeniasis	Cysticercosis

# Pathogenesis

- **Taeniasis** ( Infected by eating cysticercus; Pathogenic factor: adult worm)
  - Deprivation of nutrition
  - Dysfunction of the intestine: vomiting or diarrhea
  - Allergic reactions
  - Appendicitis
  - Obstructions of the intestine
  
- **Cysticercosis** (Intrinsic or extrinsic auto-infection; Cross infection due to *T.solium* egg only; Pathogenic factor: cysticercus cellulosae)
  - Symptoms vary with site & intensity of infection
  - Clinical aspects: headache, dizziness, epilepsy, blurred vision, subcutaneous nodule etc

## Diagnosis

- Taeniasis
  - Anal swab: to find egg at perianal region
  - Fecal exam: to find segment (species identification)
- Cysticercosis
  - Biopsy (subcutaneous nodule)
  - X-ray/CT/MRI: cerebral cysticercosis
  - Ophthalmoscopy: ophthalmic cysticercosis

## Epidemiology

- Distribution
  - Cosmopolitan
  - In china: mainly in minority regions

- Epidemic factors
  - Egg or gravid proglottid contamination of grass and soil
  - Method of raising domestic animals
  - Unhygienic dining habit of eating raw or undercooked meat

## Control

- Treatment
  - Paziquantel
  - Areca nut + pumpkin seed+ purge
- Scientific cattle and pig raising
- Avoid to consume raw meat
- Meat inspection

## *Echinococcus granulosus*

### Morphology

- Adult worm
  - 3-6 mm long with 4 segments
  - Scolex & cervical portion (2 rows of 28-40 hooklets and 4 suckers)
  - Immature, mature, gravid segments
- Egg
  - Similar to the Taenia egg





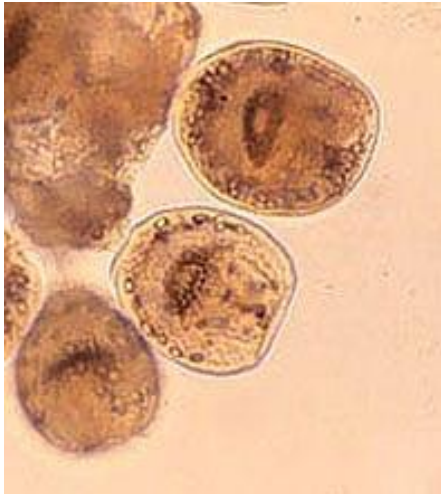
***Adult of Echinococcus granulosus***

- Hydatid cyst
  - Round & cystic
  - Cyst wall: laminated layer, germinal layer
  - Contents: cystic fluid, brood capsules, protoscolex, daughter & grand daughter cyst, (hydatid sand)

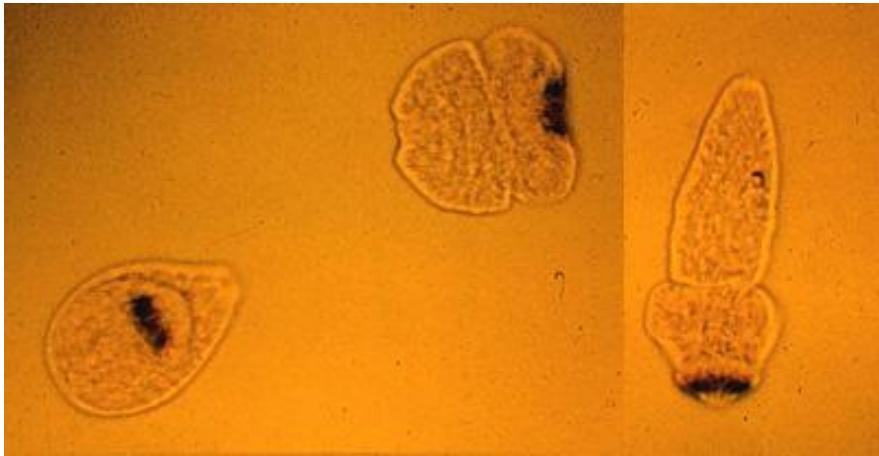
- Hydatid sand
  - The protoscoleces generally settle down at the bottom of the cyst and are known as hydatid sand.



**Protoscoleces with double row hooklets and calcareous corpuscles**



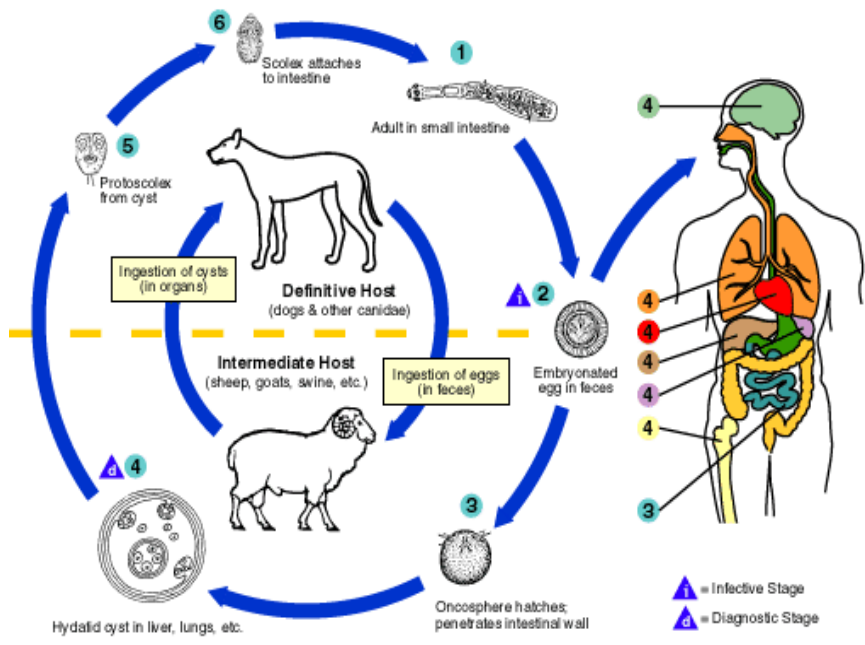
**Protoscoleces**



**Hydatid sand**

# Life Cycle

- Adult worm
  - In the small intestine of the dog and other carnivores
- Larva (hydatid cyst)
  - In the tissue of human being, sheep, horse, pig, etc.



- Infective stage: egg
- Infective route: mouth
- Location: liver, lung, brain, eye, kidney, muscles, bone and heart
- Zoonotic parasite

## Pathogenesis

- 'Echinococcosis', 'Hydatidosis'
  - Depend on the location and the number of hydatid cysts
- Pressure: liver, pulmonary, etc
- Allergy: anaphylactic shock
- Regeneration: secondary infection

# Epidemiology

- Distribution
  - Forest type (human are seldom involved)
    - Wolf-moose/reindeer
    - Dingo-wallaby
  - Animal raising type (human are involved)
    - Dog-sheep/cattle/pig
  
- Endemic factors
  - High resistant egg
  - Intimate contact between dog, animals and man in local district
  - Contamination of the feces by infected dogs
  - Improper the viscera disposition

## Diagnosis

- Physical (hepatic hypertrophy)
- History of residence in endemic area
- X-ray/Ultrasonography
- Immunological means
- Biopsy and puncture are forbidden unless during operation

## Treatment and Control

- Surgical removal of the cyst
- Long-term Mebendazole therapy
  - 40 mg/kg/day × 1-6 months
- Personal protection
- Reasonable disposition of the viscera from infected animals
- Treatment of sheep dogs periodically

