



**Medical Analysis
Department**

Cestoda, Fecal Fat test & Concentration technique

Medical Parasitology (MA302)

Summer School

Lab 5

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Cestoda

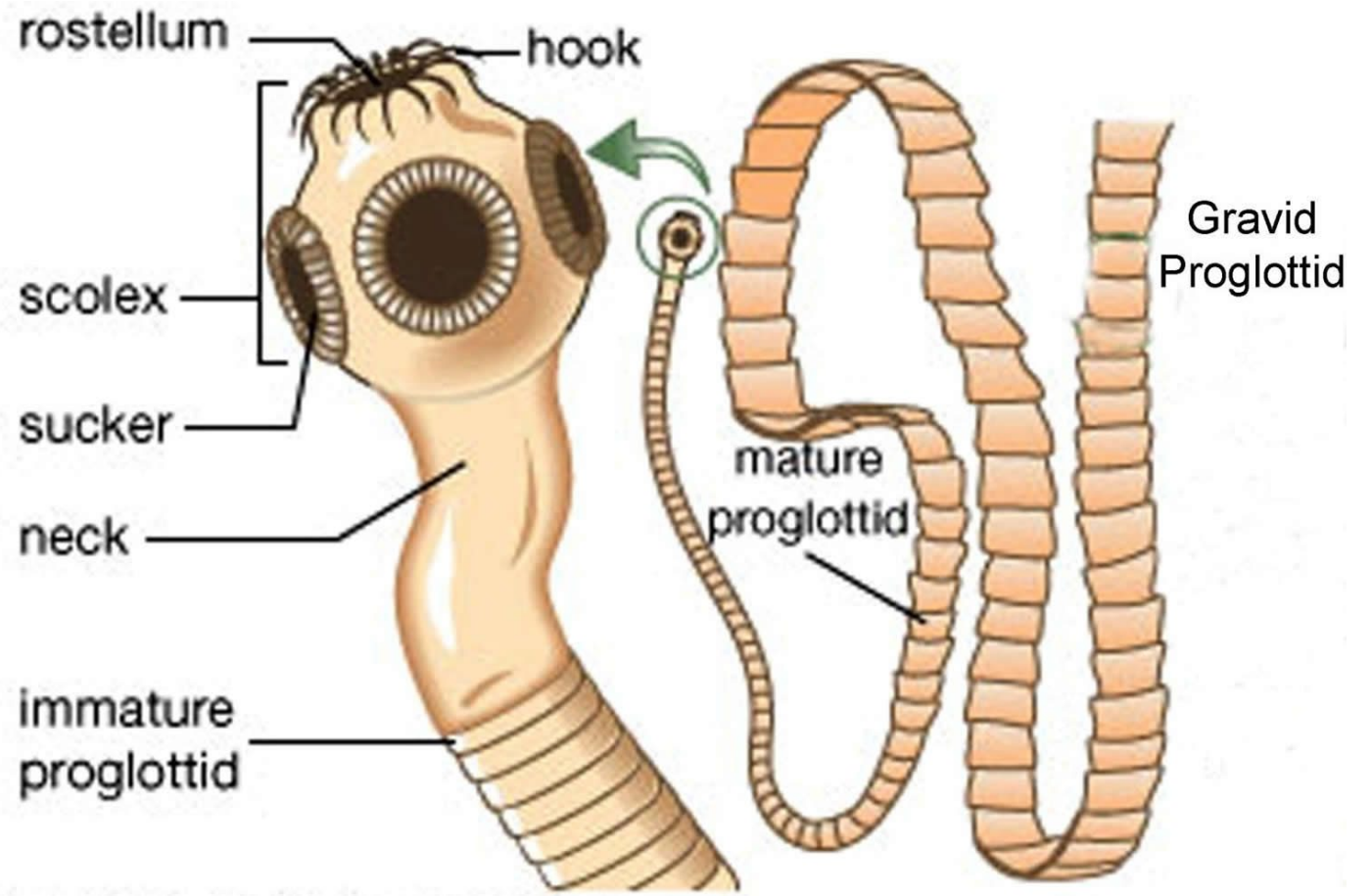
Cestodes are multisegmented, dorsoventrally flattened tape -like worms whose sizes vary from a few millimeters to several meters. The adult worms are found in the small intestine of humans.



Tapeworms: General characteristics

Adult worm consist of three parts:

- Scolex
- Neck
- Trunk(proglottids)



Taenia Saginata and Taenia Solium

Common Name

- *Taenia saginata*: Beef tapeworm
- *Taenia solium*: Pork tapeworm.

Morphology

	<i>Taenia Saginata</i>	<i>Taenia solium</i>
Length	5-10 meter	2- 3 meter
Scolex	Large quadrate	Small and globular
	Rostellum and hooks are absent	Rostellum and hooks are present
	Suckers may be pigmented	Suckers not pigmented
Neck	Long	Short
Proglottids	1,000-2,000	Below 1,000
Measurement (gravid segment)	20mmx 5mm	12mmx6mm

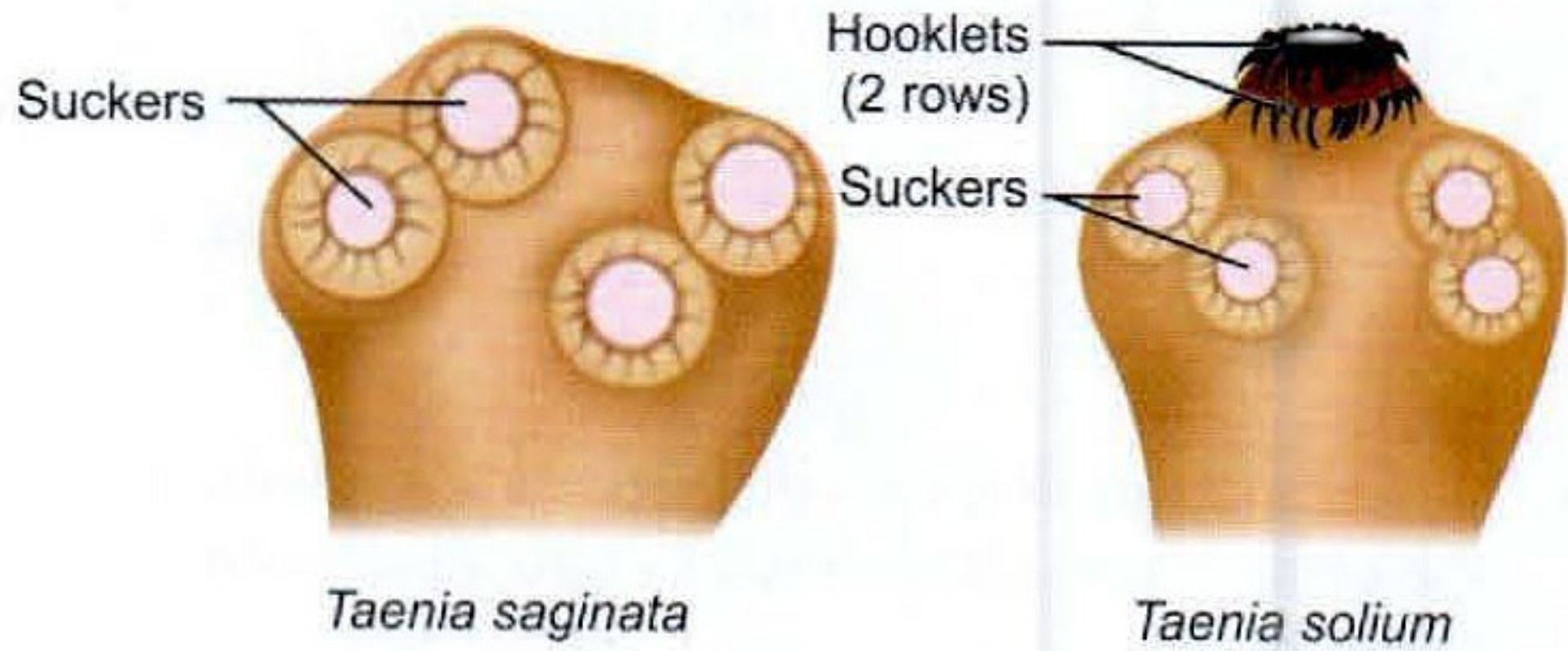


Fig. 8: Scolex of *Taenia saginata* and *Taenia solium*

	<i>Taenia Saginata</i>	<i>Taenia solium</i>
Expulsion	Expelled singly	Expelled passively in chains of 5 or 6
Larvae	Cysticercus bovis; present in cow not in man	Cysticercus cellulosae; present in pig and also man
Egg	Not infective to man	Infective to man
Definitive Host	Man	Man
Intermediate Host	Cow	Pig, occasionally man
Disease	Causes intestinal taeniasis	Causes intestinal taeniasis and cysticercosis

***Cysticercus bovis*:**

- It is the larval form of *T. saginala*.
- The larva (*cysticercus bovis*) is the *infective stage* for humans.
- They can be seen on visual inspection as shiny white dots in the *infected beef*.

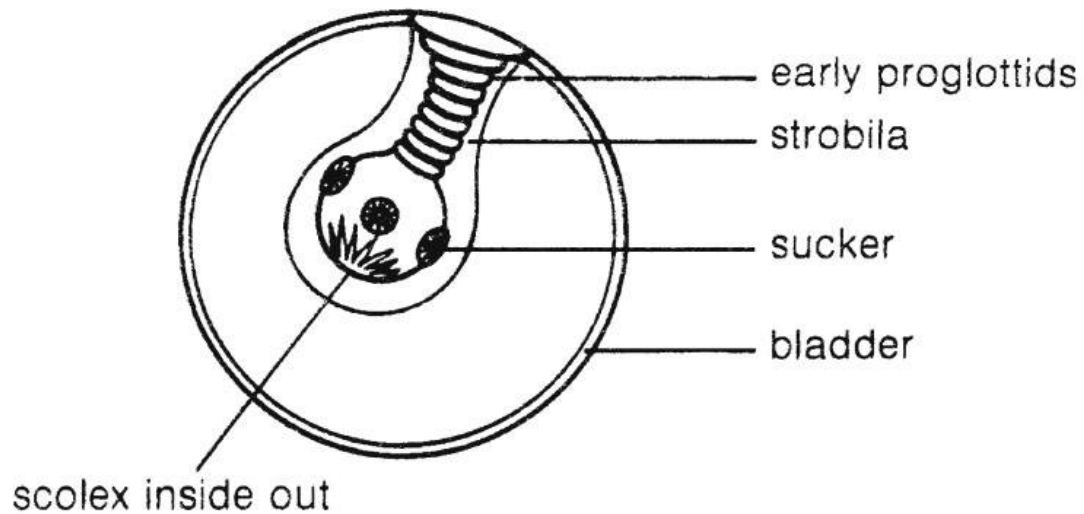


Fig. 126 **Cysticercus**. Generalized structure.



***Cysticercus cellulosae*:**

- It is the larval form of *T. solium* and also the *infective form* of the parasite.
- It can develop in various organs of pig as well as in man.



Transmission

Taenia saginata:

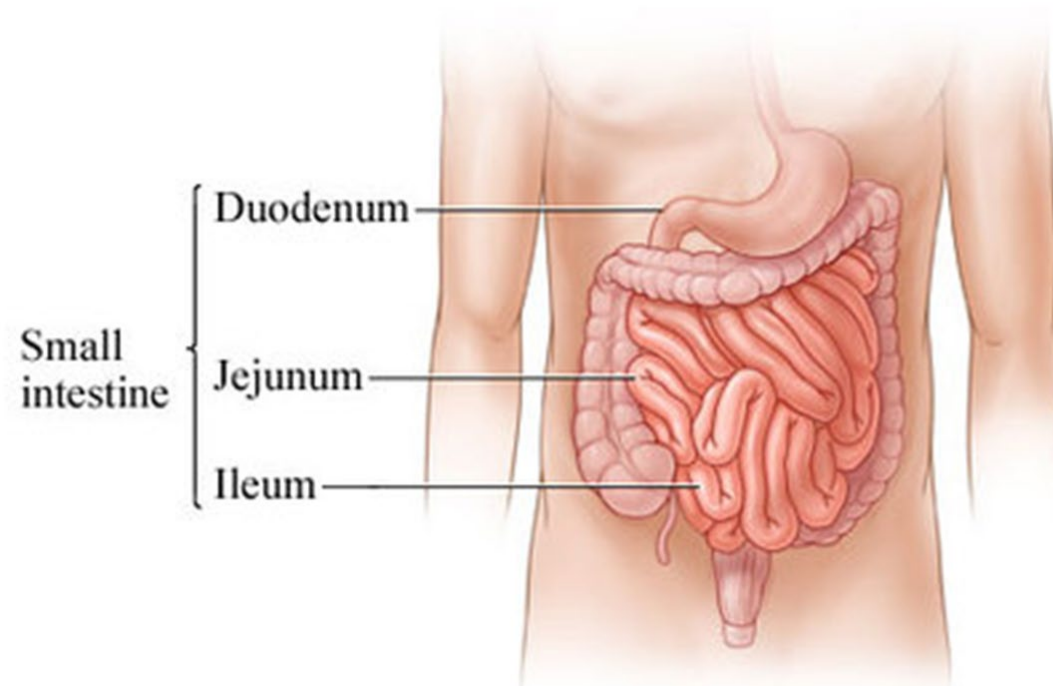
Ingesting undercooked (raw) Beef meat infected with *Cysticercus bovis* that cause **(Taeniasis)**

Taenia solium:

- ingesting undercooked pork meat infected with *Cysticercus cellulosae* **(Taeniasis)**
- Ingesting the egg of *taenia solium* that cause **(cysticercosis)**

Habitat

Both *Taenia saginata* and *Taenia solium* Adult worms live in the small intestine.



Life cycle

Taenia saginata passes its life cycle in two hosts:

1. **Definitive host:** Humans are the definitive hosts and harbor the adult worm.

2. **Intermediate host:** Cattle (cow or buffalo) are the intermediate host and harbor the larval stage of the worm. *Infective stage:* Cysticercus bovis (larval stage)



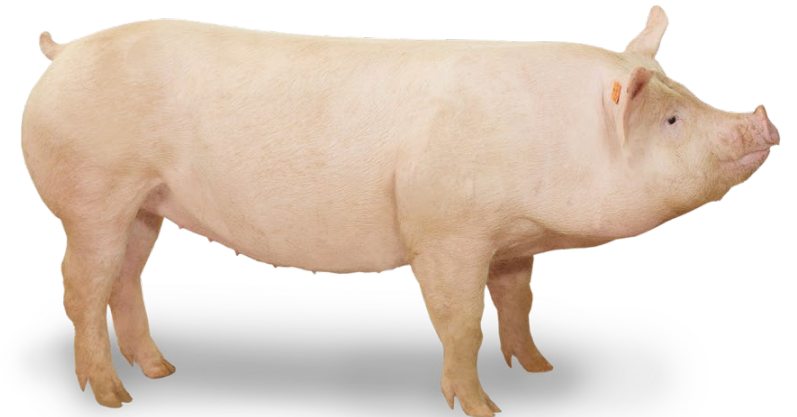
Life cycle

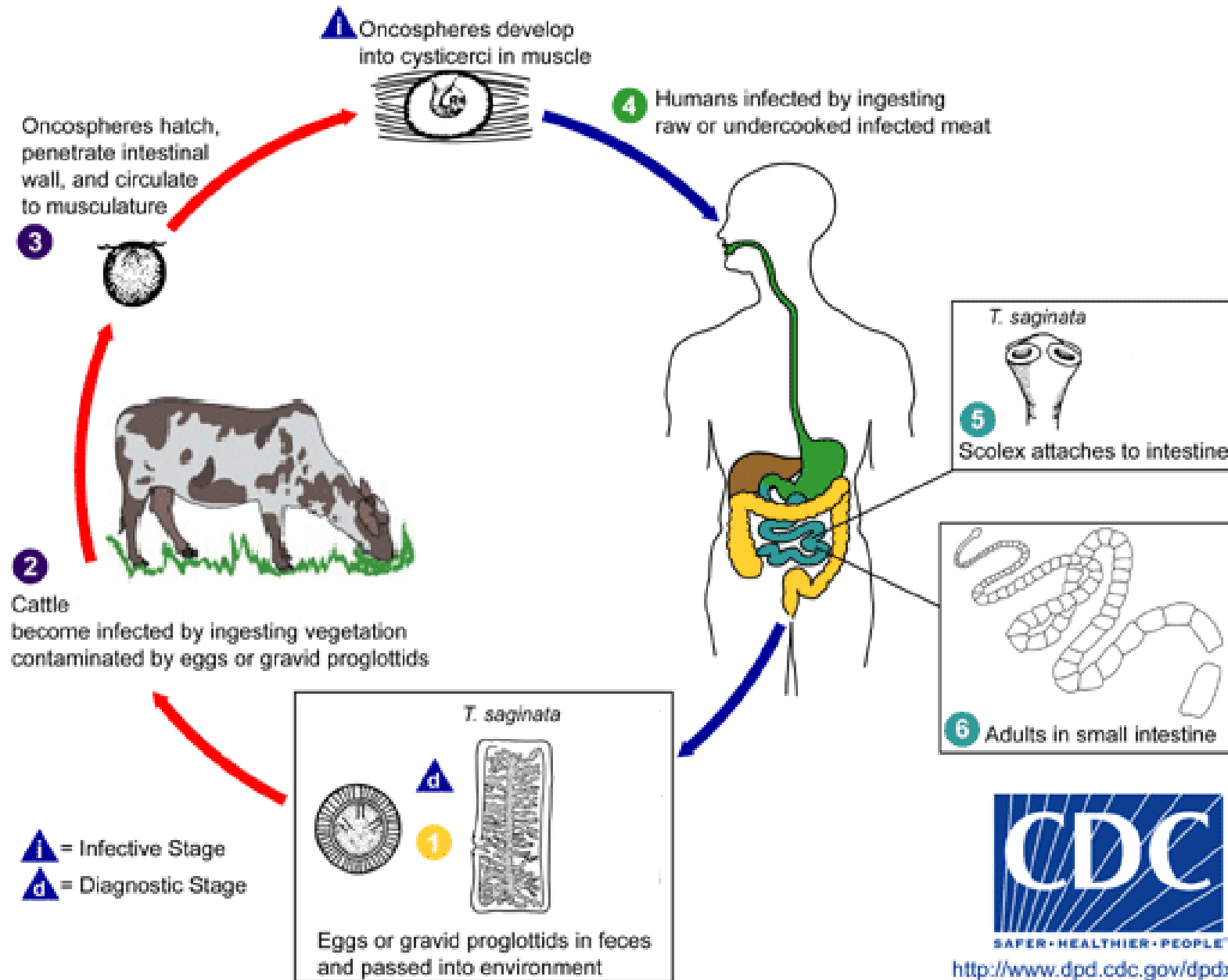
Taenia solium passes its life cycle in two hosts:

1. **Definitive host:** Humans are the definitive hosts and harbor the adult worm.

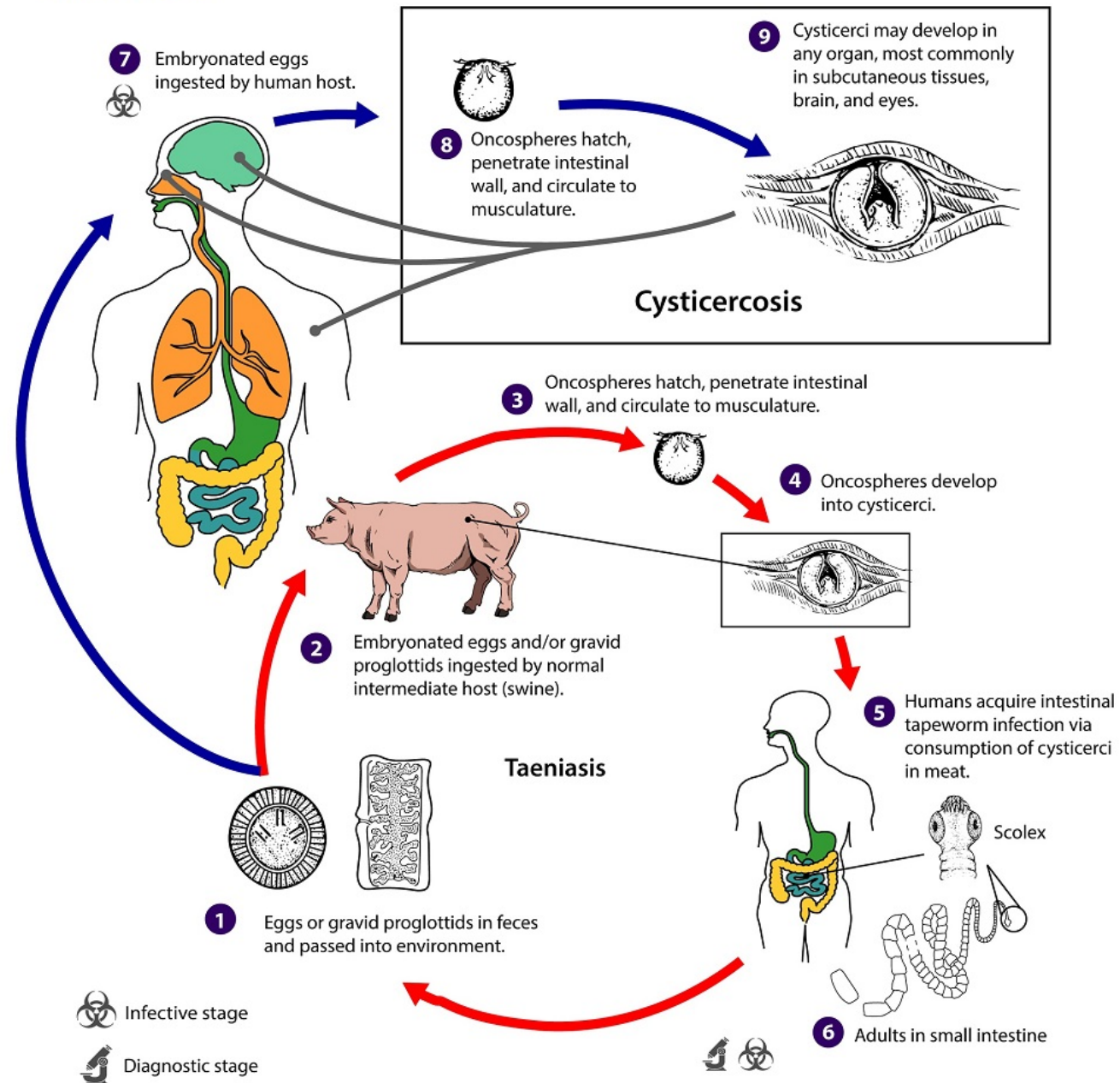


2. **Intermediate host:** Pigs are the intermediate host and harbor the larval stage of the worm.





<http://www.dpd.cdc.gov/dpdx>



Laboratory Diagnosis

1- Taeniasis:

- **Microscopy:** Diagnosis of *Taenia* tapeworm infections is made by examination of stool samples; individuals should also be asked if they have passed tapeworm segments. Tapeworm eggs can be detected in the stool 2 to 3 months after the tapeworm infection is established.
- **Serodiagnosis:** Specific antibodies to adult stage antigen in serum can be demonstrated by ELISA,

2- Cysticercosis:

Muscle Biopsy

Neurocysticercosis usually requires imaging (MRI or CT brain scans)



Echinococcus granulosus

Habitat

The adult of *Echinococcus granulosus* live in the small intestine of carnivores (specially canids) and the larval stage hydatid cyst are found in various organ of mammalian intermediate host.

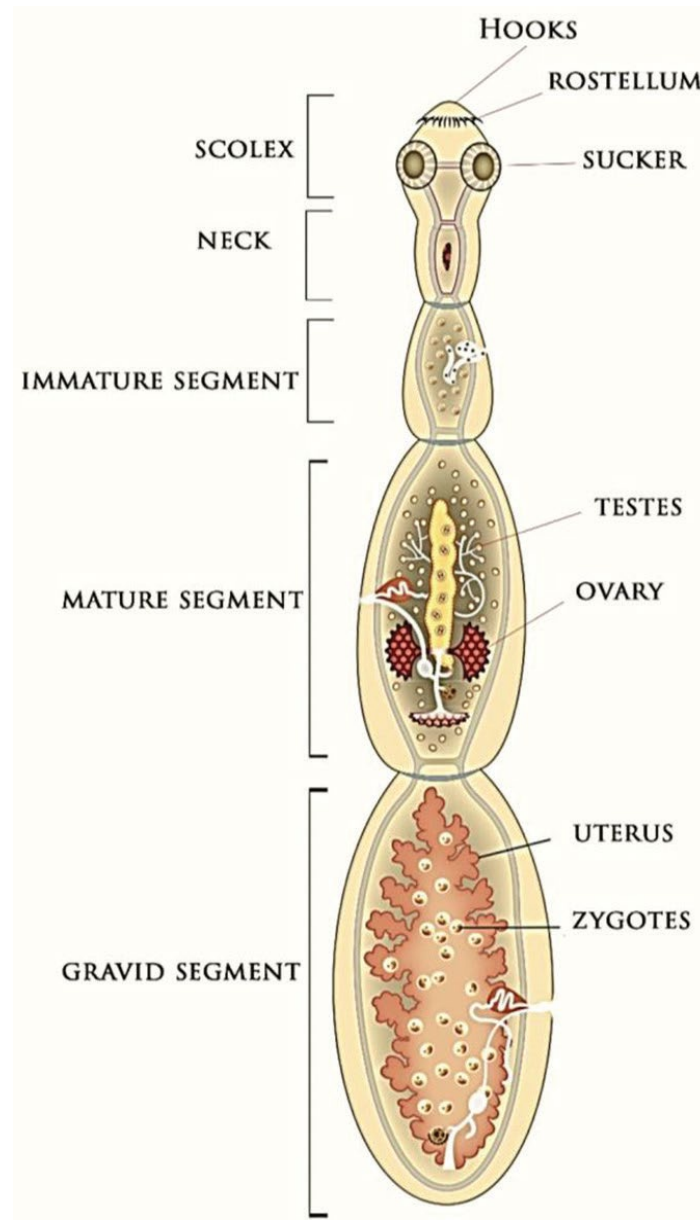


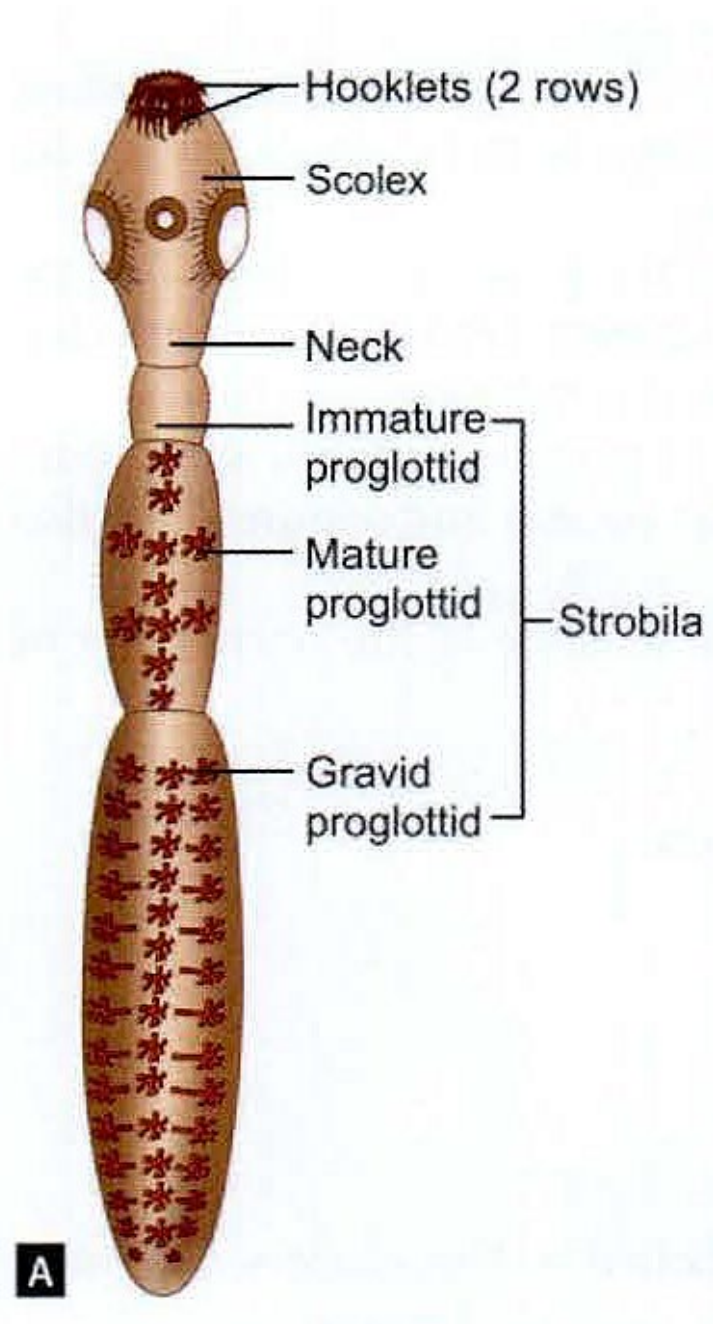
Morphology (adult)

- 1- Adult worm is a small tape worm and measures 2-9mm in length.
- 2- The scolex is pyriform provided with 4 suckers and a rostellum with double crown of large and small hooklets.
- 4- Larva is known as hydatid cyst



Echinococcus granulosus (adult)

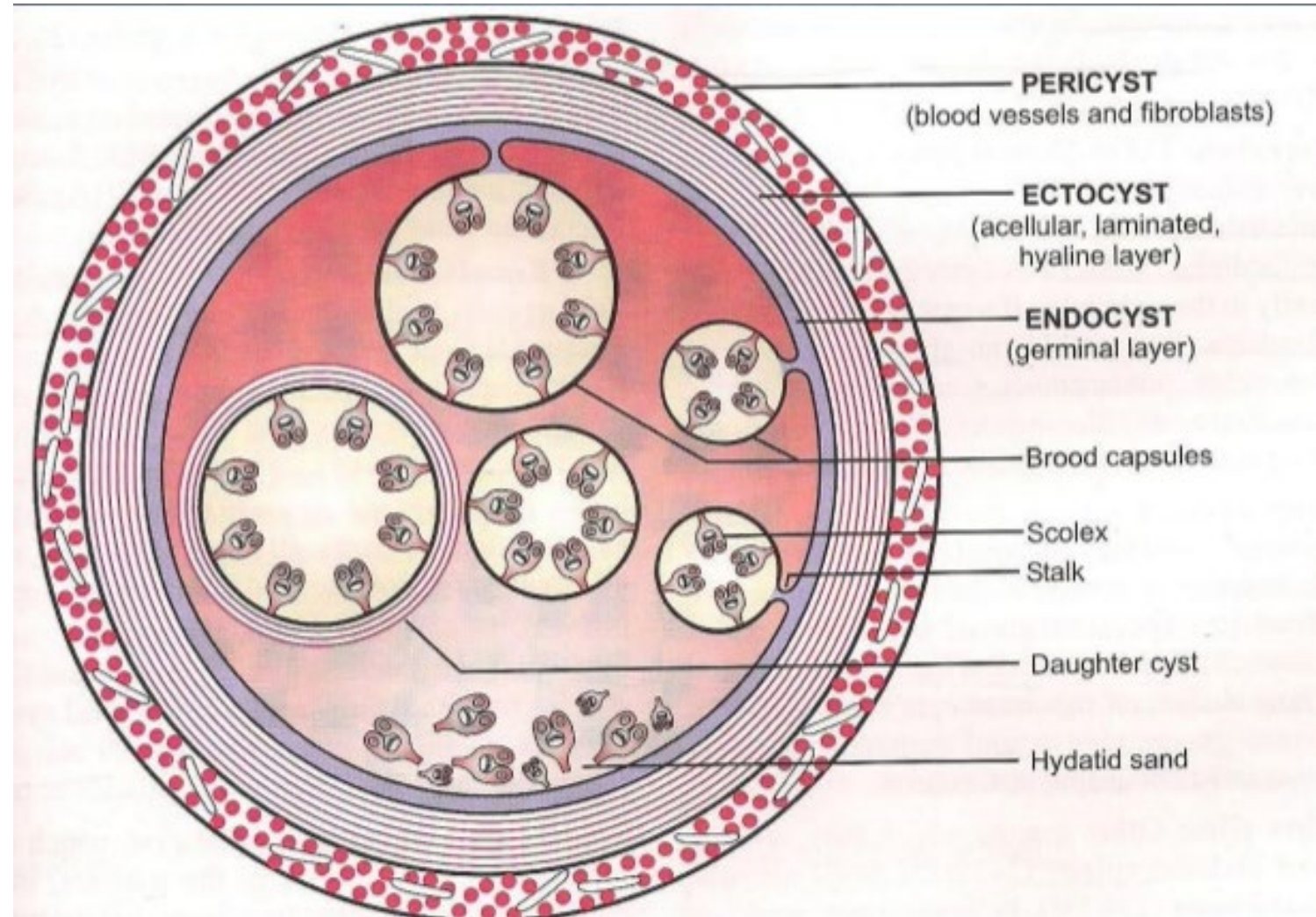


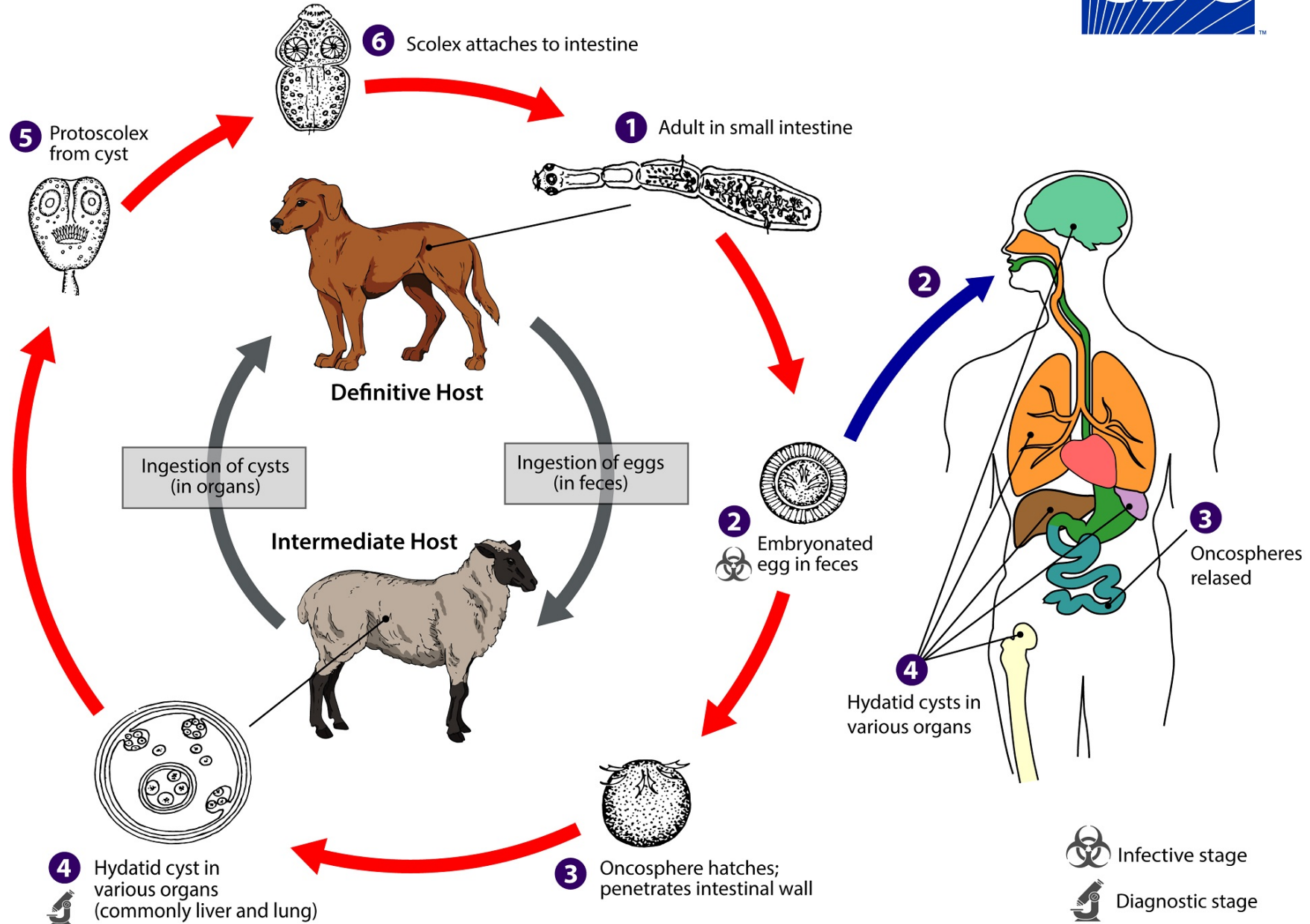


Hydatid cyst (larvae)

1. When egg swallowed by a suitable intermediate host, it will hatch in the duodenum, the oncosphere migrate through the intestinal wall, enters the mesenteric venules bed in various organs tissues. They begin to develop a cystic cavity and it becomes young hydatid cyst.
2. After 5 months the hydatid cyst has reached a diameter of 1cm and has differentiate to (outer layer and inner layer)

Hydatid cyst





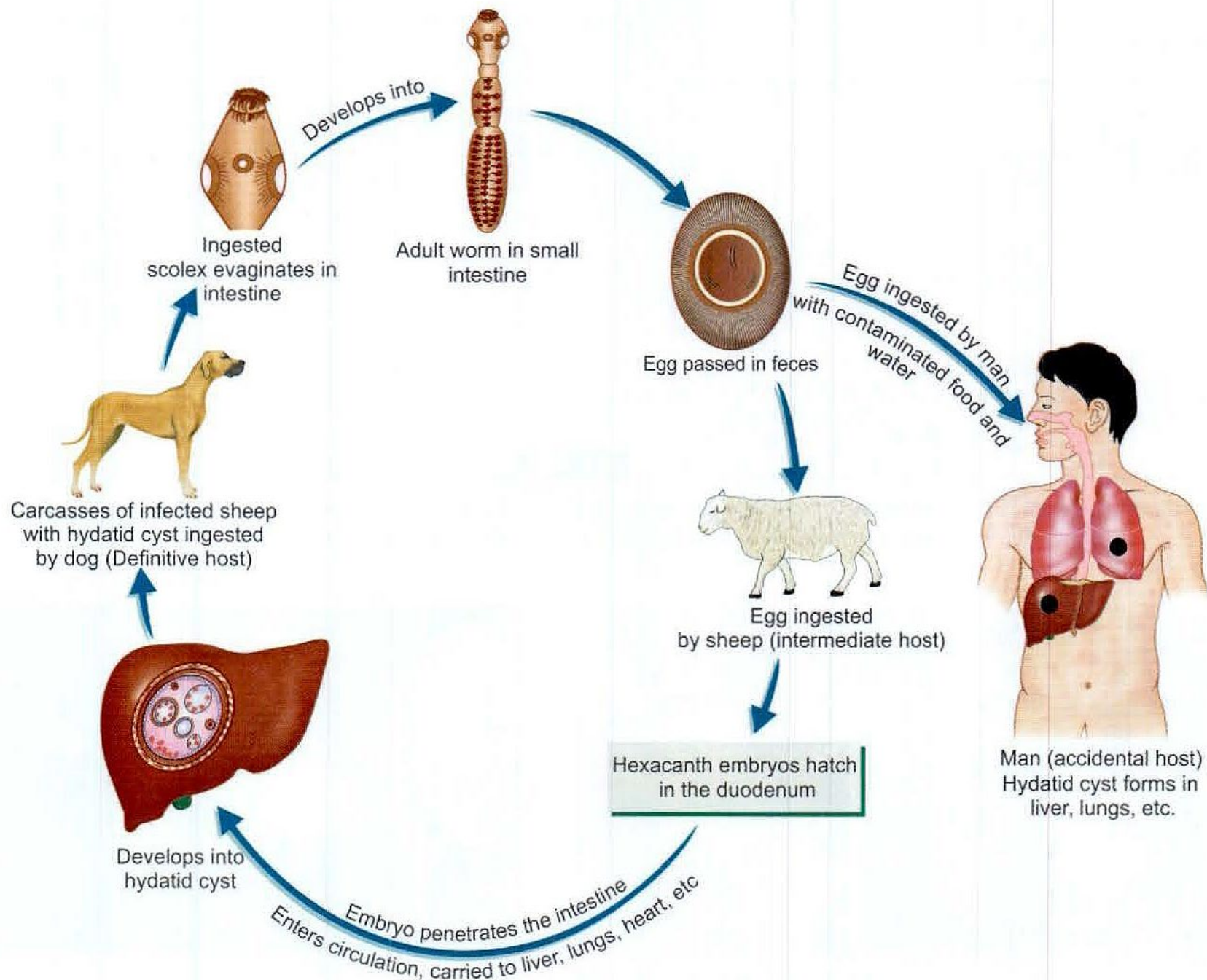
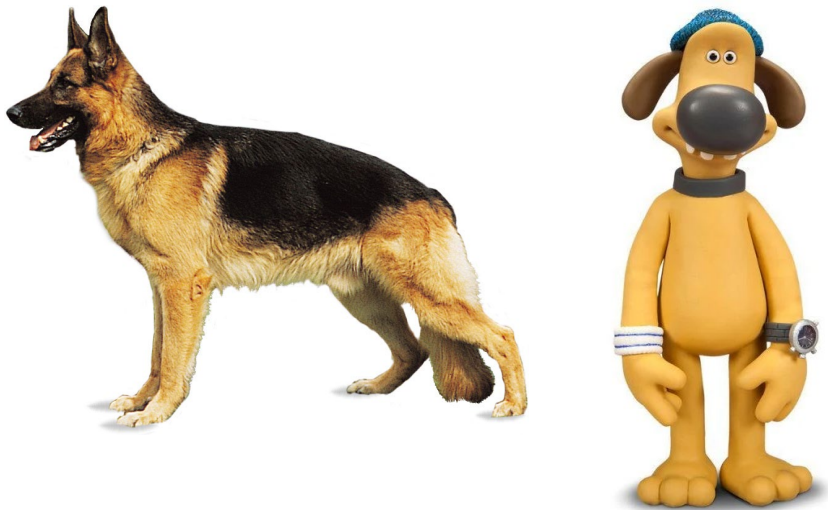


Fig. 17: Life cycle of *Echinococcus granulosus*



Definitive host



Adult worm

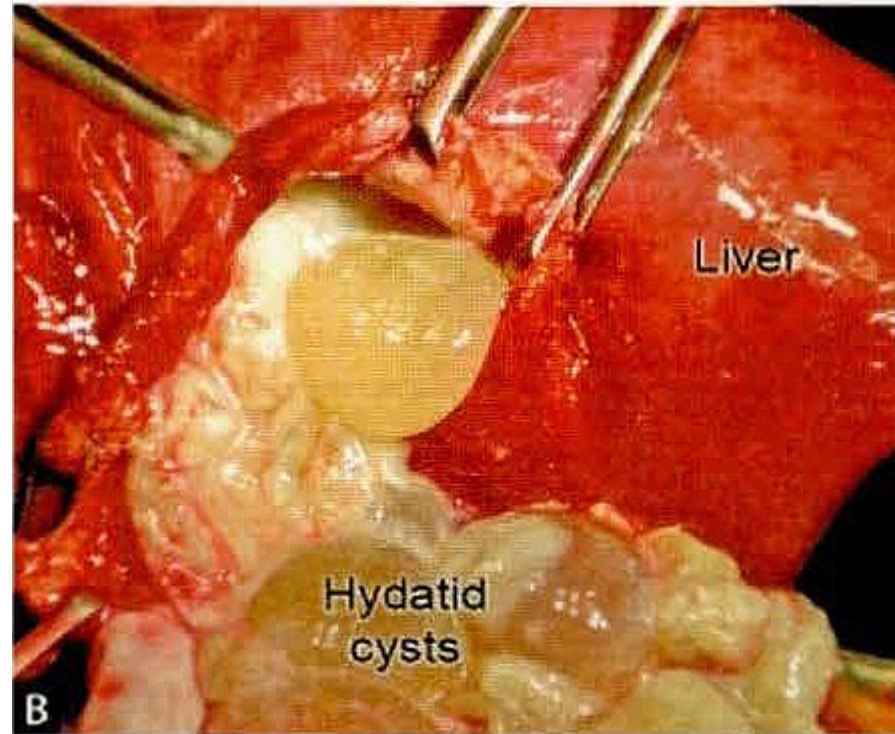


Intermediate hosts

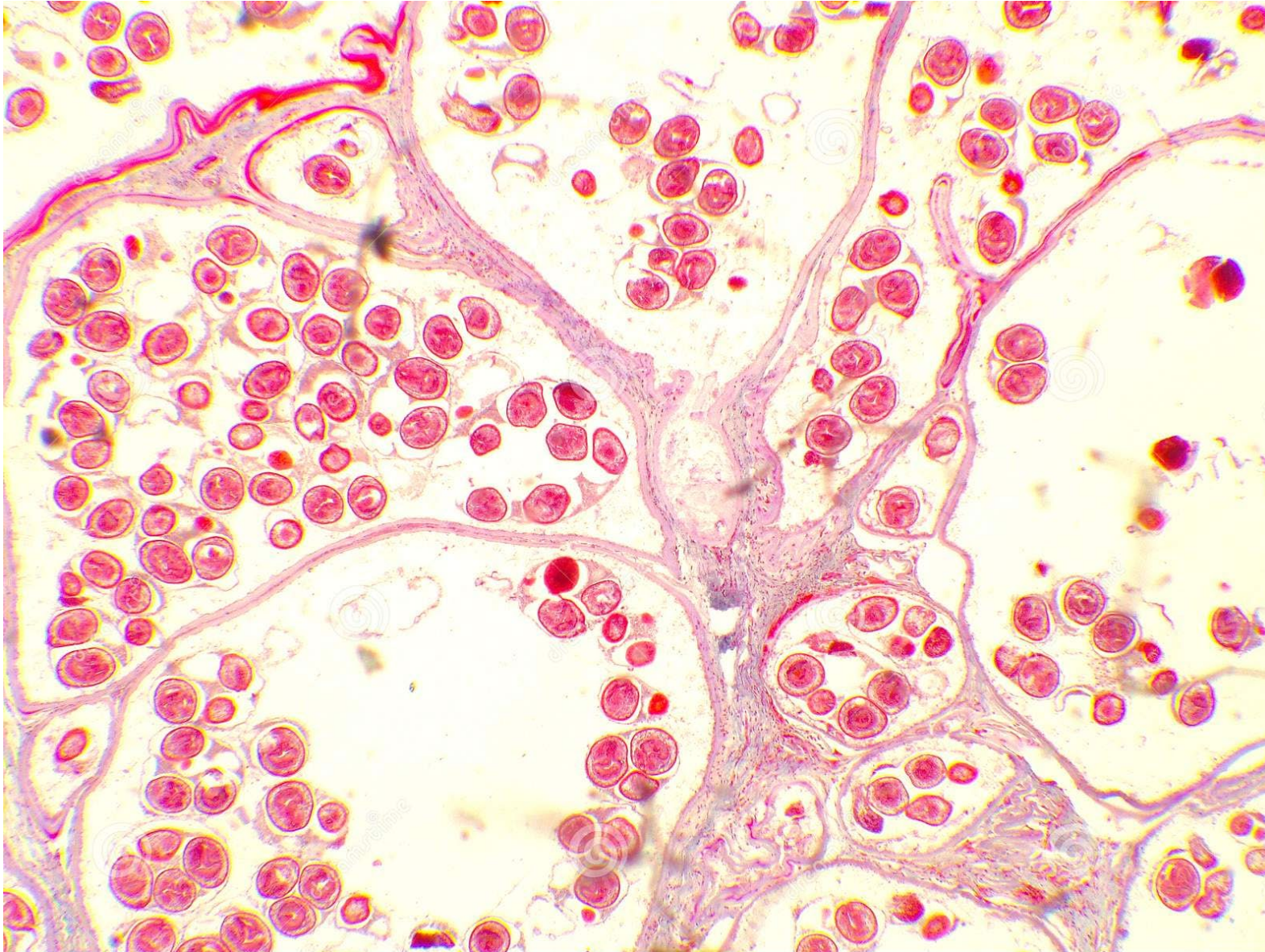


Hydatid cyst (larvae)

Hydatid cyst in Liver

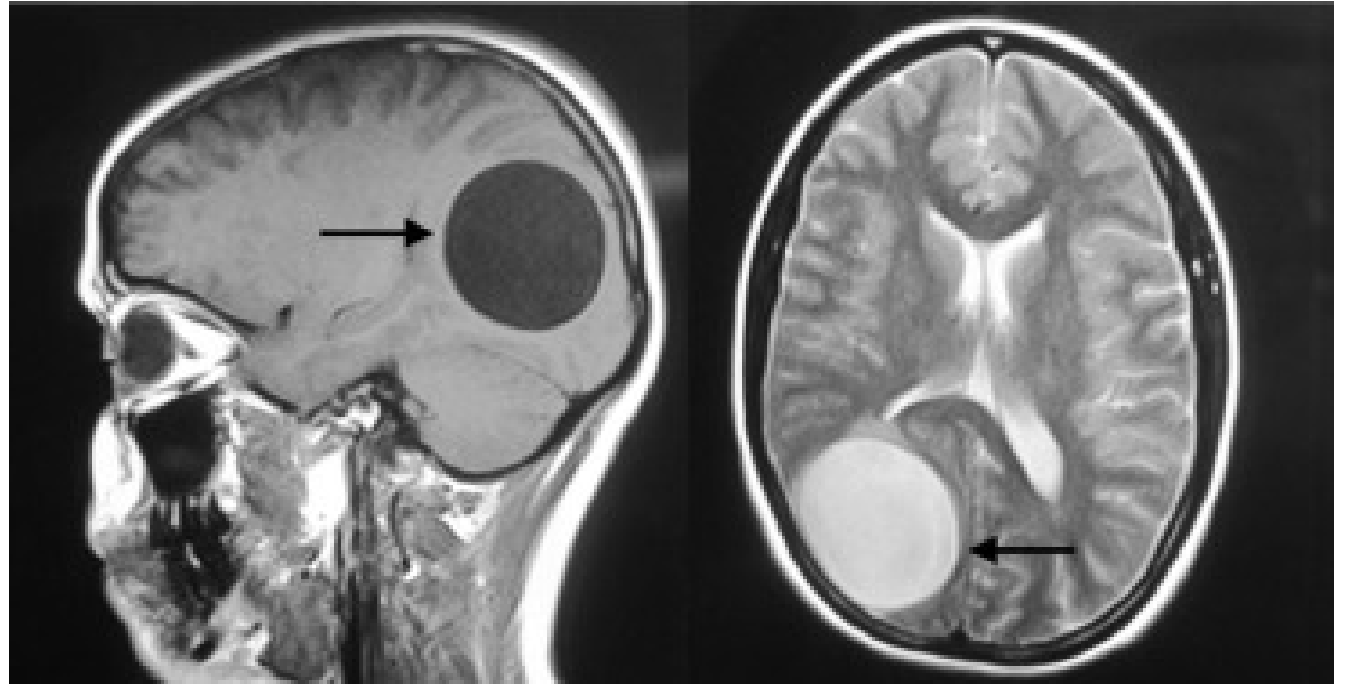
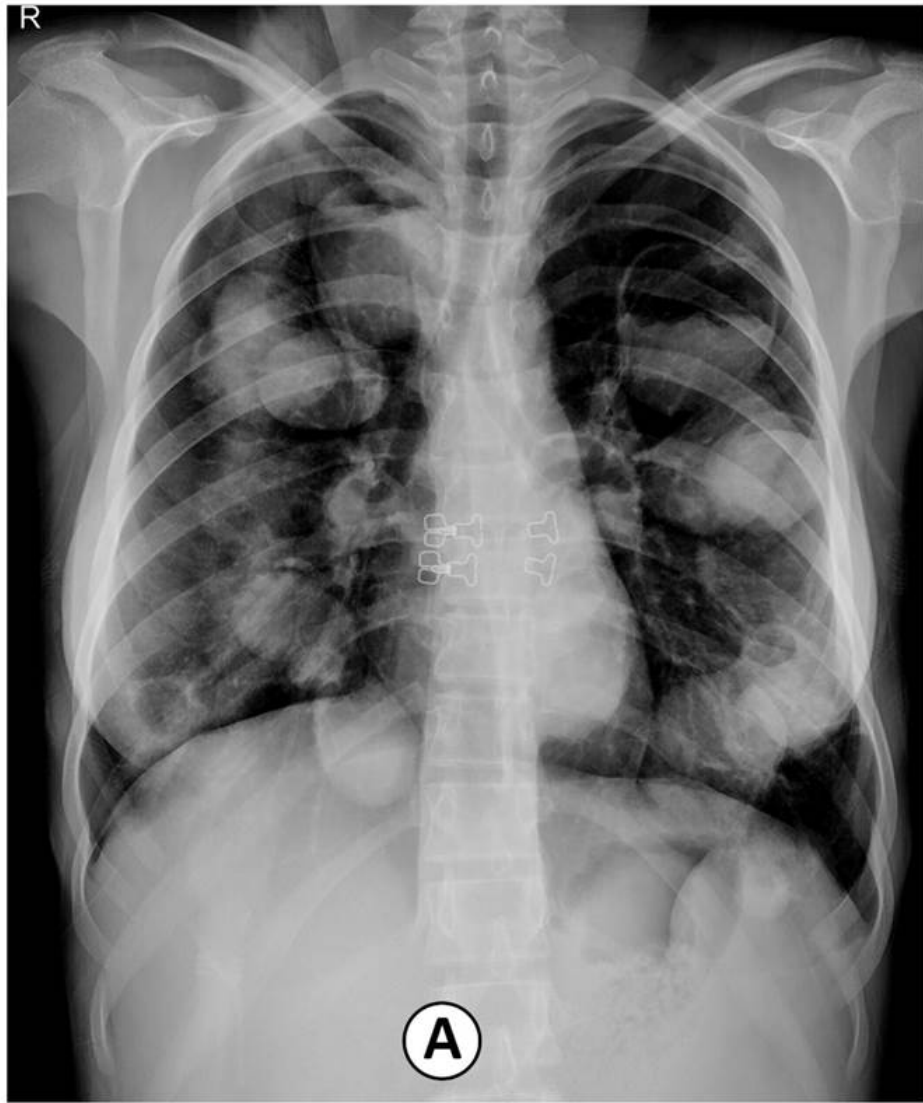


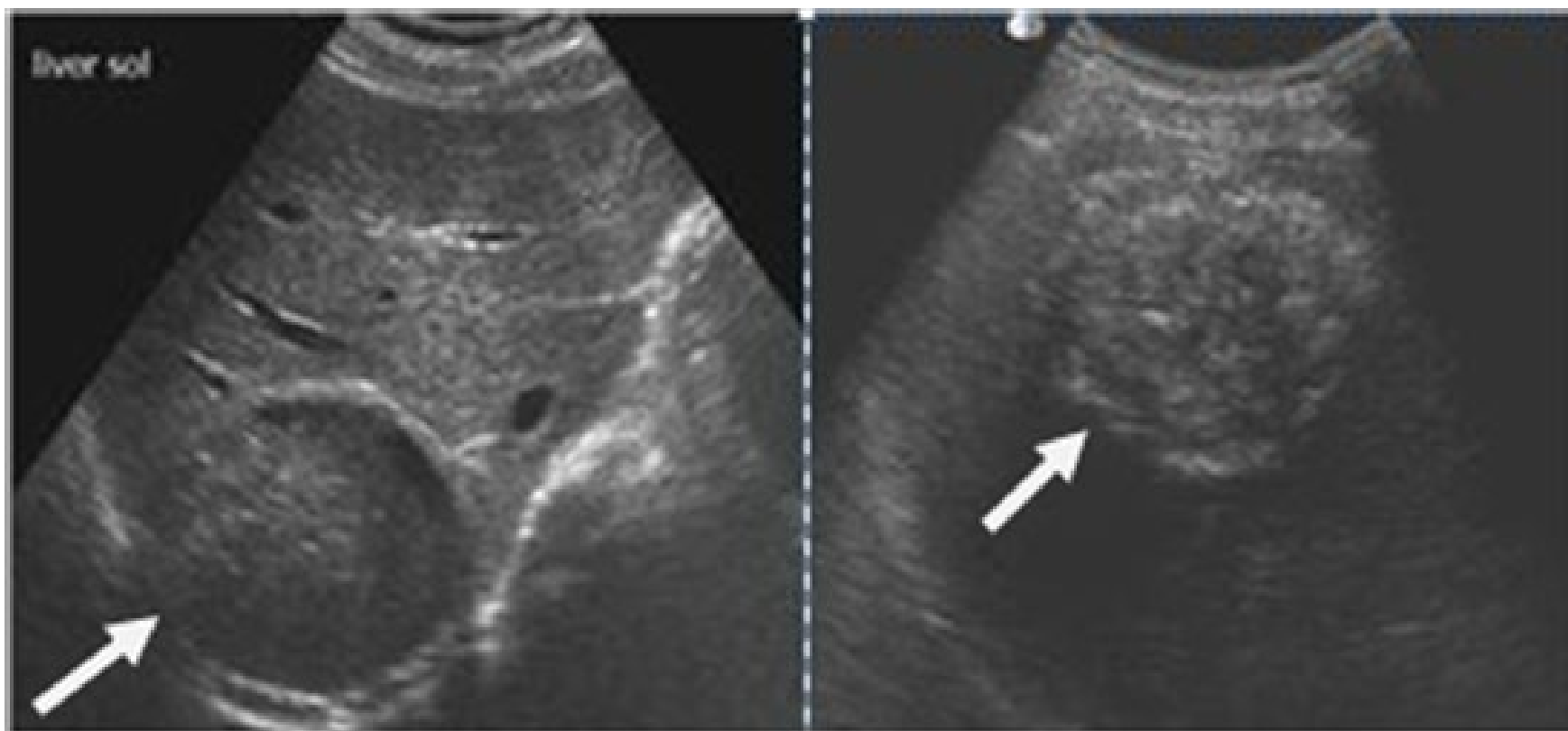
Hydatid cyst: *Ecchinococcus granulosus* larvae



Diagnosis of hydatid disease

1. X-ray examination
2. ultrasound
3. CT scan
4. MRI scan
5. examination of blood, urine, sputum, faeces or other bodily fluids if a burst hydatid cyst is suspected
6. blood tests for antibodies to the cysts.





Wuchereria bancrofti

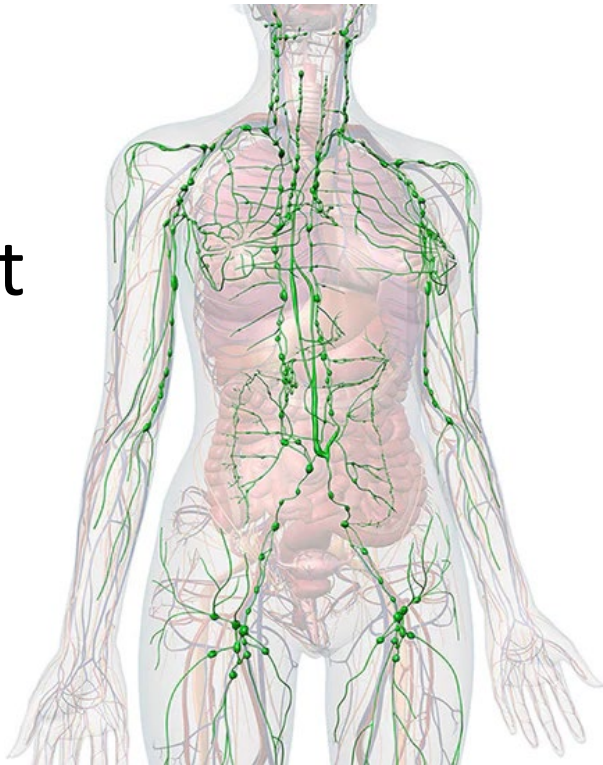
Morphology

- **Adult worm:** The adults are whitish, translucent, thread-like worms with smooth cuticle and tapering ends.
- The female is larger than the male.
- The posterior end of the female worm is straight, while that of the male is curved vertically and contains two spicules of unequal length.
- Males and females remain coiled together usually in the abdominal and inguinal lymphatics and in the testicular tissues.
- The female worm is **viviparous** and directly liberates sheathed microfilariae into lymph.

Habitat

The adult worms reside in the lymphatic system of man. The microfilariae are found in blood.

Adult



Microfilaria
(Larvae)



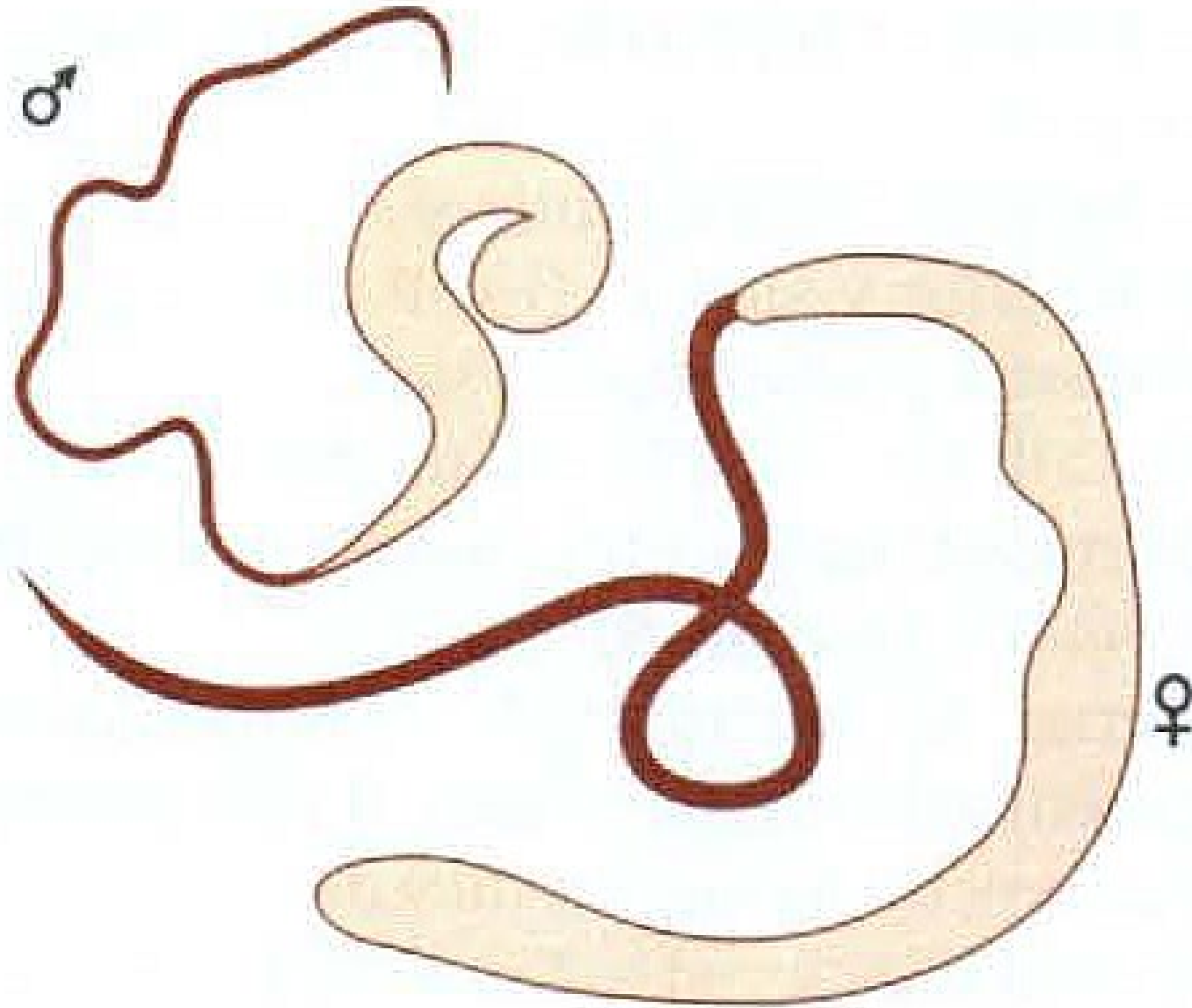


Fig. 2: Adult worm of *Wuchereria bancrofti*

Microfilariae:

The microfilaria has a colorless, translucent body with a **blunt head**, and **pointed tail**

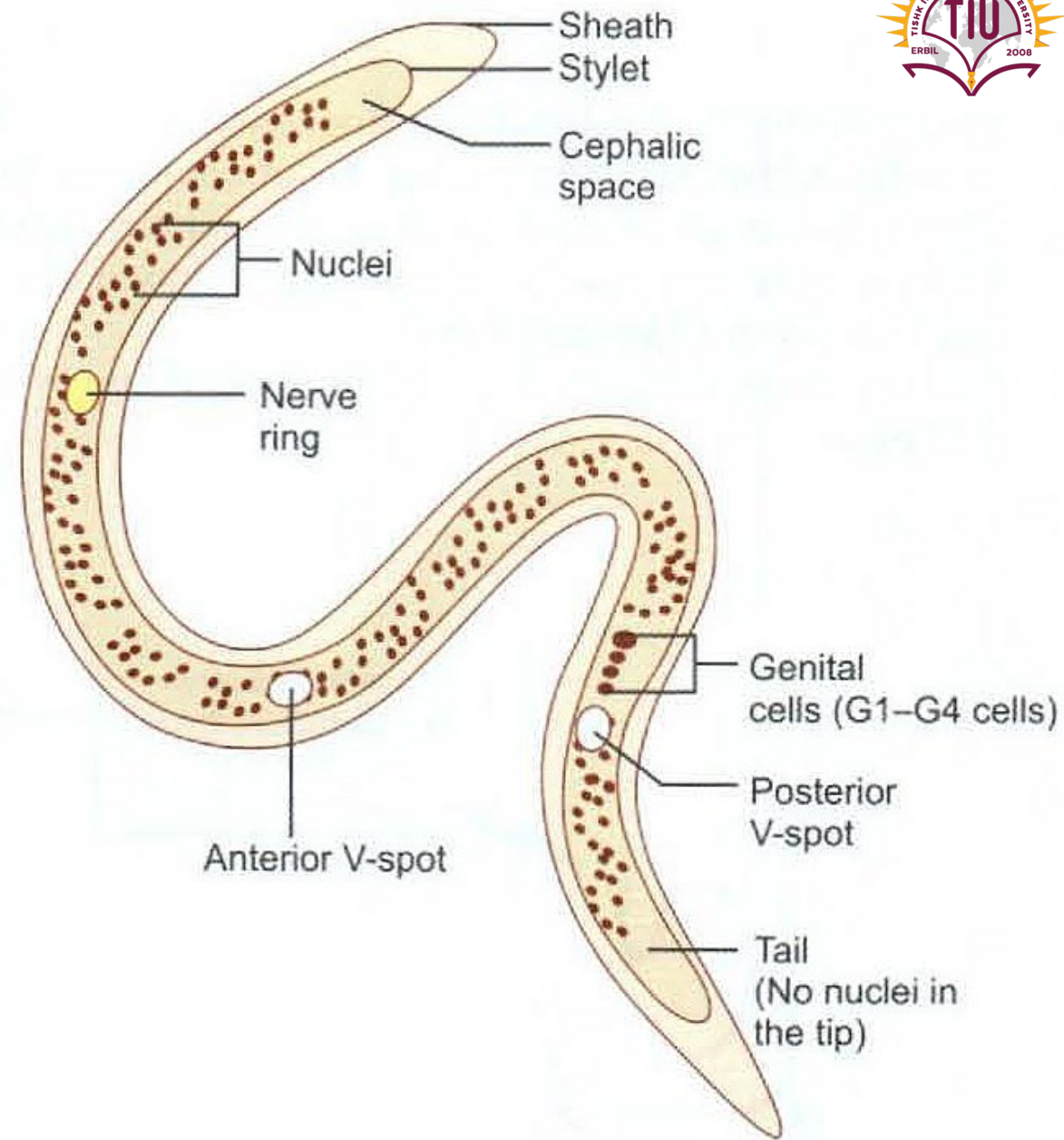
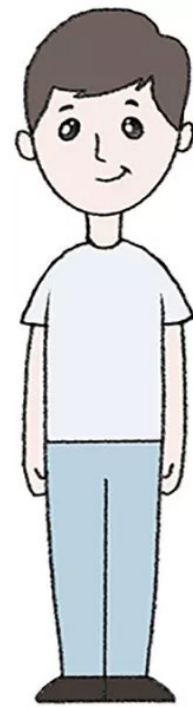


Fig. 3: Morphology of *Microfilaria bancrofti*

Life cycle

- **Definitive host:** Human
- **Intermediate host:** Female mosquitoes of different species act as vectors in different geographic areas.

Ex/*Culex* sp.



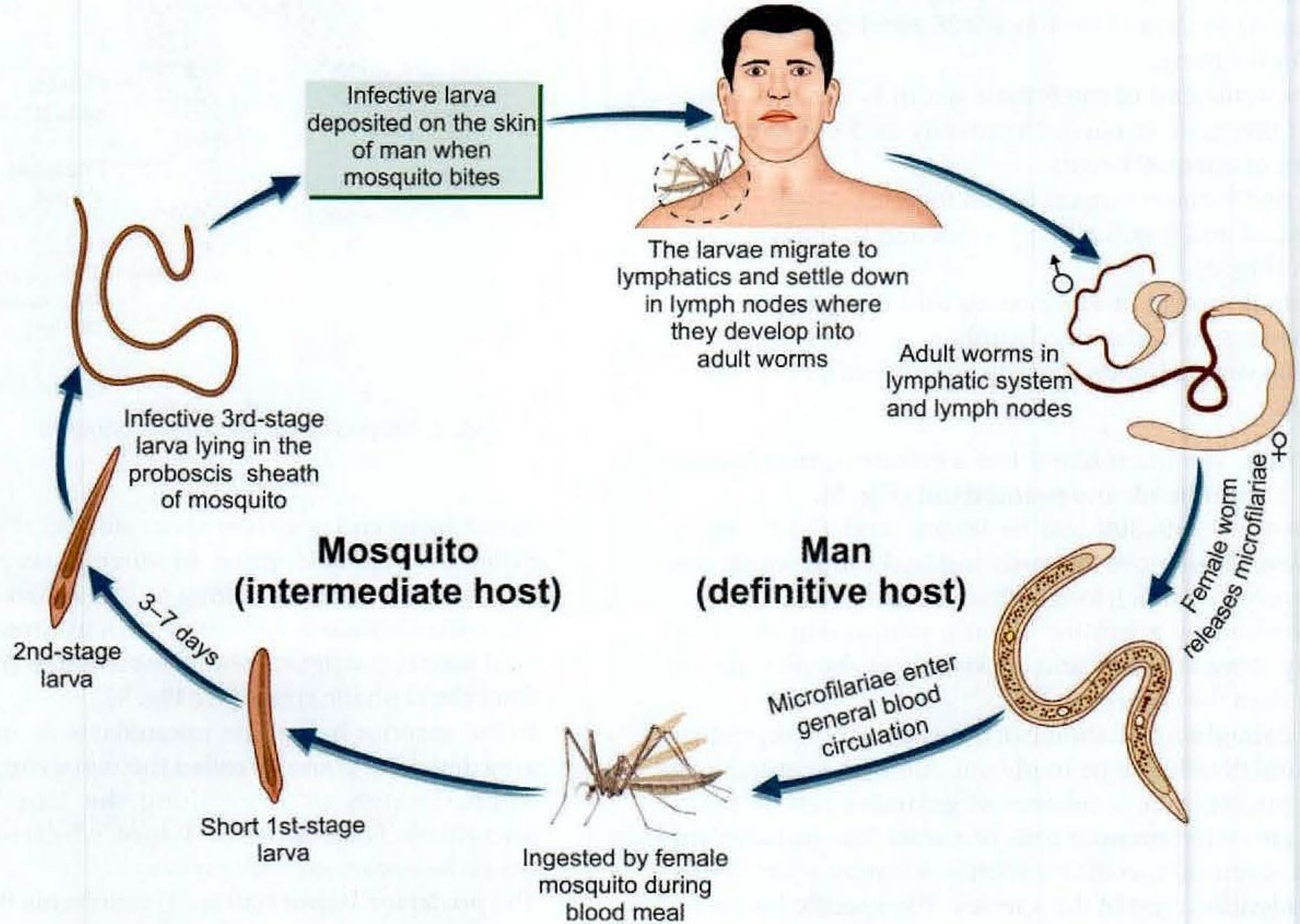
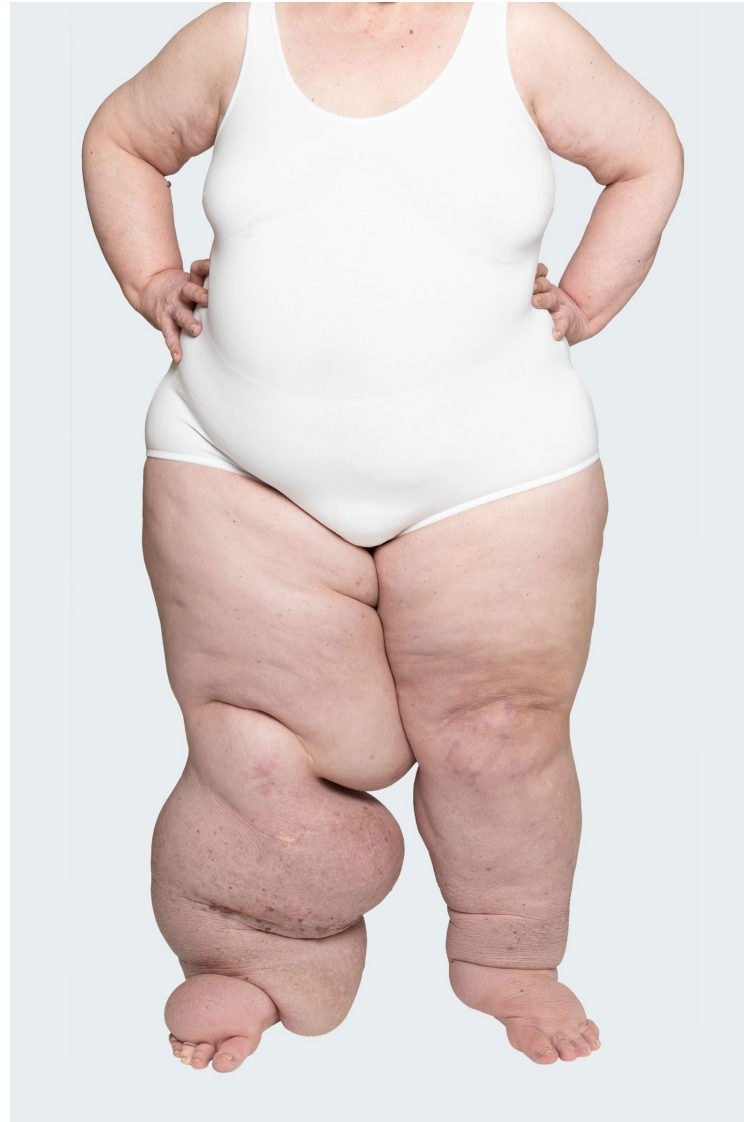


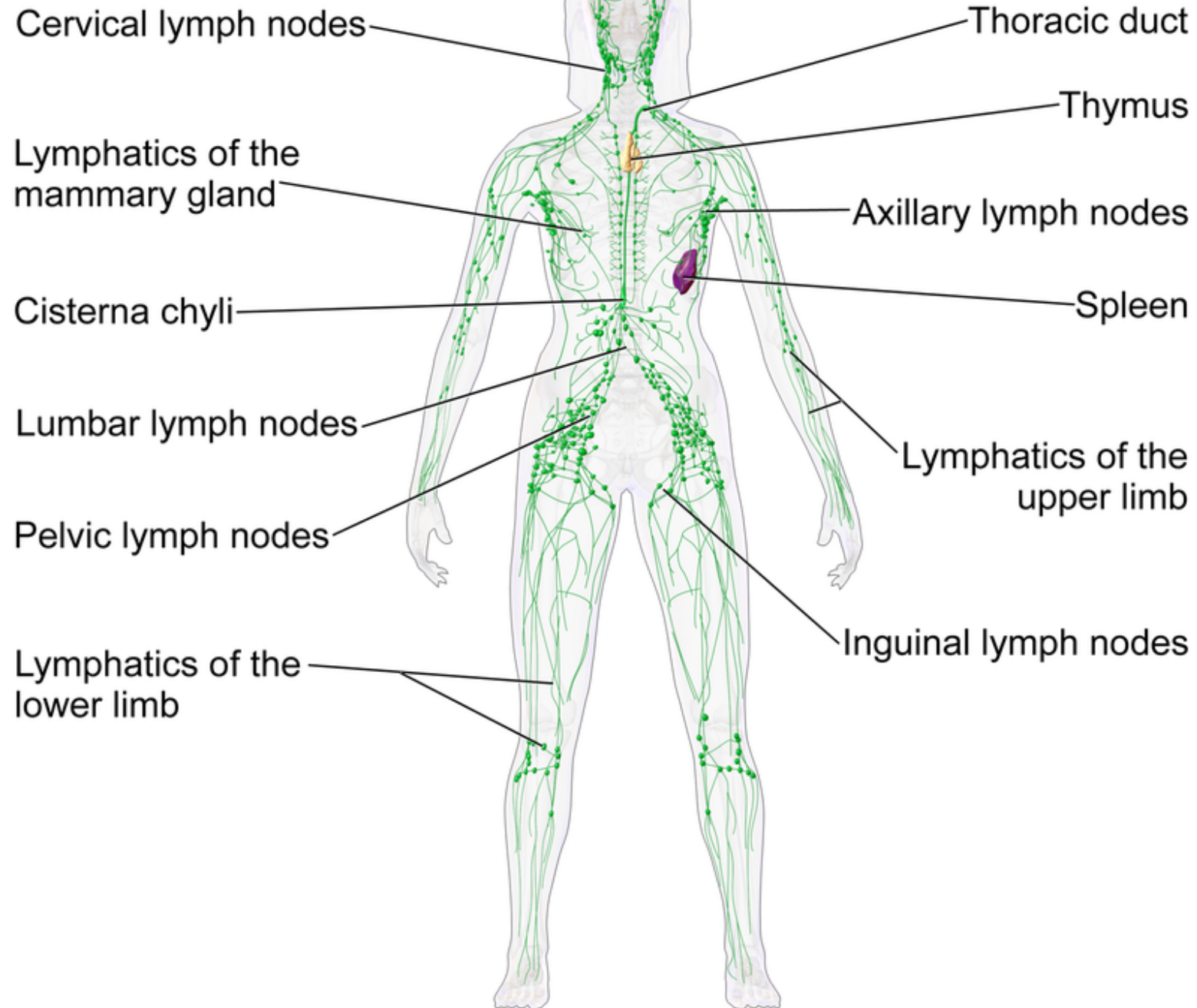
Fig. 4: Life cycle of *Wuchereria bancrofti*

Elephantiasis



Chyluria





Diagnosis

Direct Method

1- Detection of Microfilariae

- By examination of a thick and thin blood smear, stained with Giemsa stain
- By examination of unstained mount of blood under microscope

2- Detection of adult worm

- Lymph node biopsy
- On X-ray (if worms are calcified)
- High frequency ultrasound and Doppler within the scrotum



Indirect Methods

Immunodiagnosis

- ELISA

Molecular diagnosis

- PCR



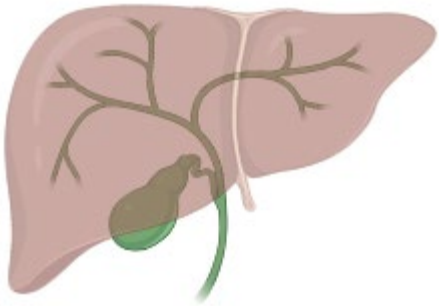
Fecal fat test

Background

The fecal fat test is used to detect excess fat in stool, indicating fat malabsorption or steatorrhea. It helps identify conditions affecting fat digestion and absorption, such as pancreatic insufficiency, bile duct obstruction, or intestinal damage from parasites like *Giardia lamblia*.

Normal digestion requirements:

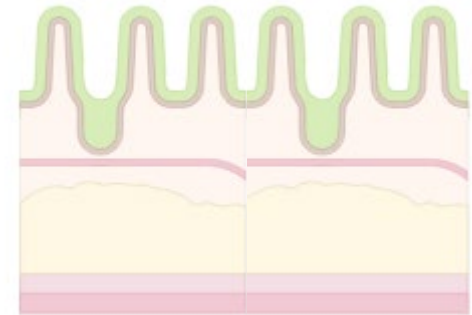
Bile (from the Liver and Gallbladder)



Pancreatic enzymes
especially **lipase**



Intact
intestinal
mucosa



Disruption in any of these → steatorrhea

Digestion of Fat



Fat

+



Lipase

=



No digestion



Fat

+



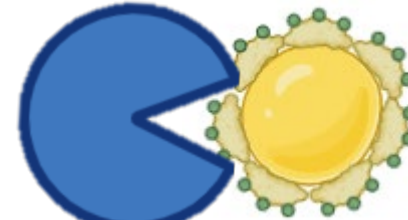
Bile

+



Lipase

=



Digestion



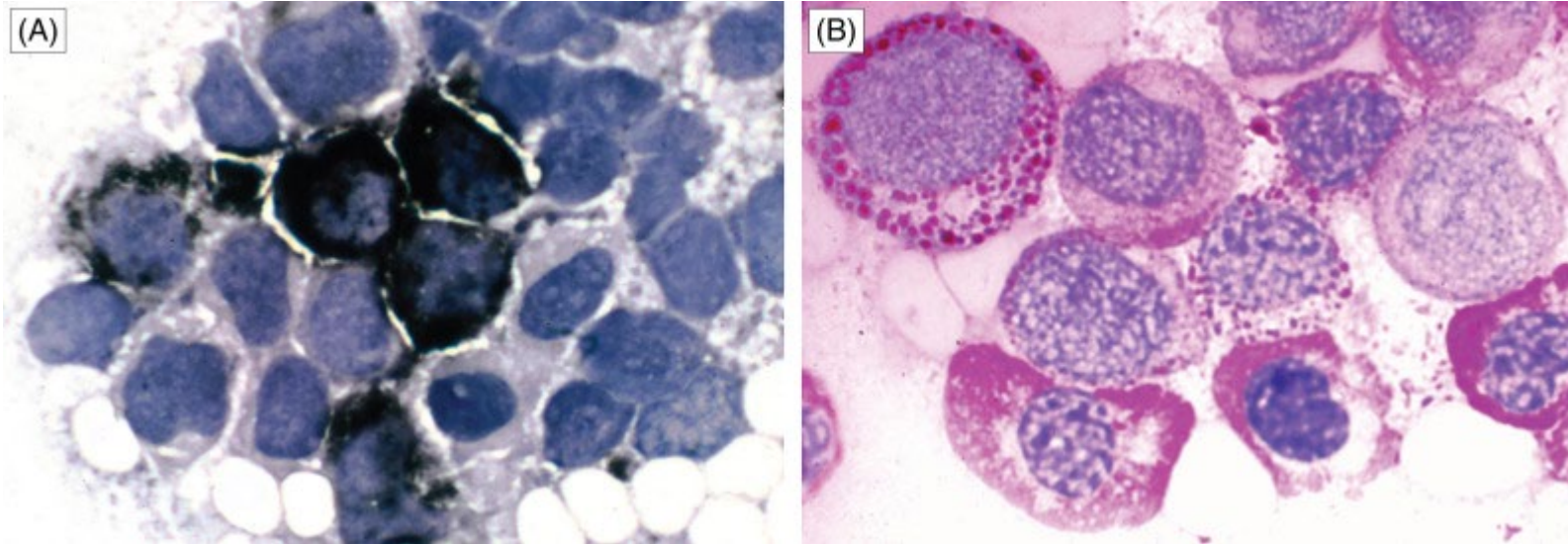
Clinical Significance

Elevated fecal fat is seen in:

1. Parasitic infections.
 - Giardia lamblia damages the small intestinal lining.
 - Strongyloides stercoralis (chronic cases may lead to malabsorption).
2. Pancreatic insufficiency (e.g., chronic pancreatitis, cystic fibrosis)
3. Bile obstruction (e.g., gallstones)
4. Celiac disease, Crohn's disease

How to test Fecal fat

1. Qualitative test: by using Sudan Stain



2. Near-infrared spectroscopy (NIRS): by using InfraAnalyzer 2000



Concentration technique

Separate parasites from fecal debris and increase the chances of detecting parasitic organisms when these are in small numbers. They are divided into:

- flotation techniques
- sedimentation techniques.

Flotation techniques

most frequently used: (zinc sulfate or sugar solution) use solutions which have higher specific gravity than the organisms to be floated so that the organisms rise to the top and the debris sinks to the bottom.

Sedimentation techniques

Uses solutions of lower specific gravity than the parasitic organisms, thus concentrating the latter in the sediment. Sedimentation techniques are recommended for general diagnostic laboratories because they are easier to perform and less prone to technical errors. The sedimentation technique used at CDC is the formalin-ethyl acetate technique.