Intestinal Helminths

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CLASSIFICATION OF PARASITES

PROTOZOA	HELMINTHS
Unicellular Single cell for all functions	Multicellular Specialized cells
1:Aoebae: move by pseudopodia. 2:Flagellates: move by flagella. 3:Ciliates: move by cilia 4:Apicomplexa(Sporozoa) tissue parasites	Round worms (Nematodes): - elongated, cylindrical, unsegmented. Flat worms : - Trematodes: leaf-like, unsegmented. - Cestodes: tape-like, segmented.

Nematodes : General features

1. Elongated worm, cylindrical, unsegmented and tapering at both ends.
2. Variable in size, measure <1 cm to about 100cm.
3. Sex separate and male is smaller than female

Nematodes: Location in the human body

- **Intestinal nematodes**
- **Tissue nematodes**

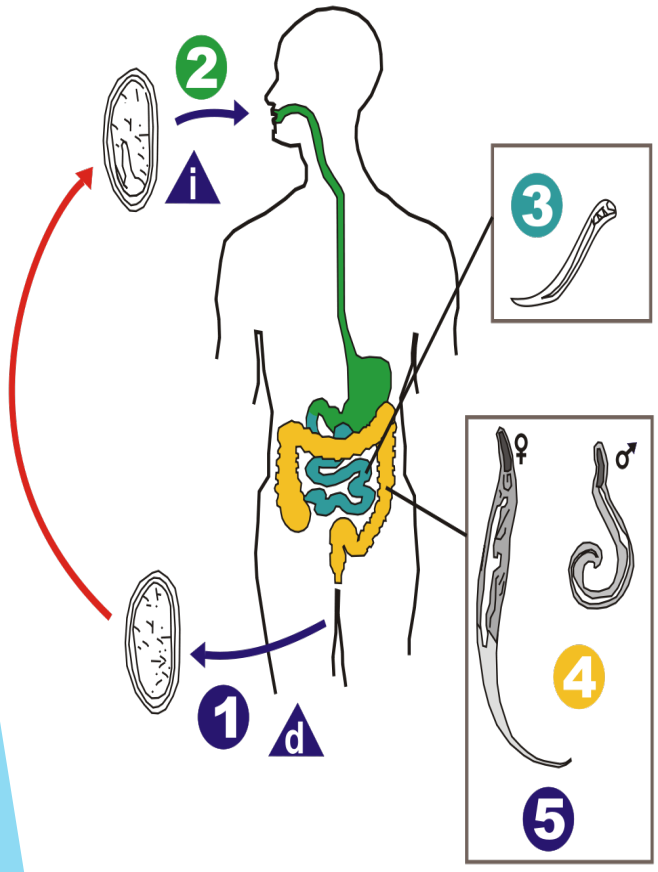
Nematodes: common intestinal infections

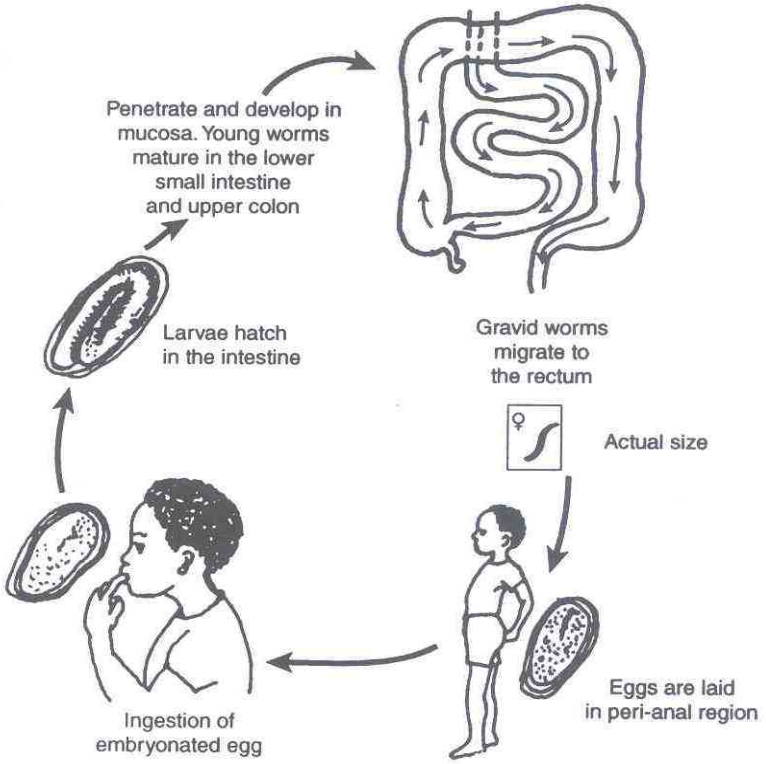
1. *Enterobius (Oxyuris) vermicularis* (Pinworm,seatworm,threadworm)
2. *Trichuris trichiura* (whipworm)
3. *Ascaris lumbricoides* (roundworm)
4. *Ancylostoma duodenale & Necator americanus* (hookworms)
5. *Strongyloides stercoralis*
6. :

1-Enterobius vermicularis (THREAD WORM)

- Found all over the world but more common in temperate regions.
- Children are more often evolved than adults , it tends to occur in groups living together such as families , army camps or nursery.
- Adult worms are mainly located in lumen of cecum and the female migrate to rectum to deposits her eggs on peri-anal skin.
- Direct human to human infection occurs mainly by swallowing the eggs .In addition ,autoinfection occurs by contamination of the fingers.
- It can be seen by naked eye as white thread ± 1cm.
  - Male is smaller than female ± 0.5cm, with coiled end.

Enterobius vermicularis





Enterobius vermicularis (Oxyuris)

Pathology

- Majority of infections are asymptomatic.
- Main clinical presentation pruritus ani which can be very troublesome and occurs more often during the night, persistent itching may lead to inflammation and secondary bacterial infection of the peri-anal region.
- Infected children may suffer from emotional disturbance ,insomnia ,anorexia , loss of weight and loss of concentration and enuresis.

- Ectopic enterobiasis occurs in infected adult female when invade vulva and vagina result in valvovagintis, salpingiti,also adult worm can lodged in the lumen of appendix cause appendicitis.

Enterobius vermicularis (Oxyuris)

DIAGNOSIS :

Unlike other intestinal Nematodes, the eggs are not usually found in feces .The best method is to look for them around the anus by taking an anal swab or by using ***CELLULOSE ADHESIVE TAPE***, the examination should be done before defecation or bathing.

Treatment

Albandazole , Mebendazole

for whole family

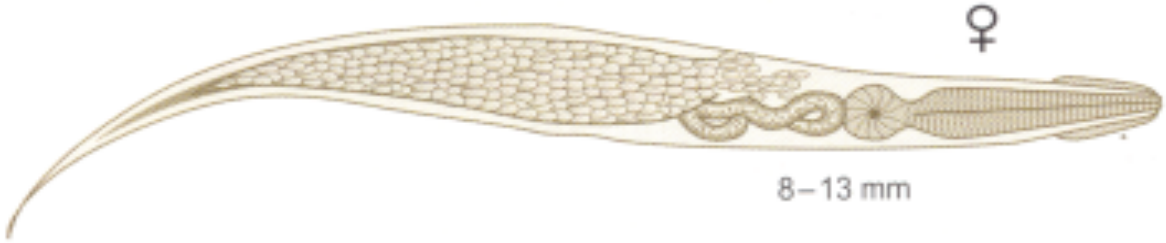
Enterobius vermicularis (Oxyuris)

Clear adhesive tape slide

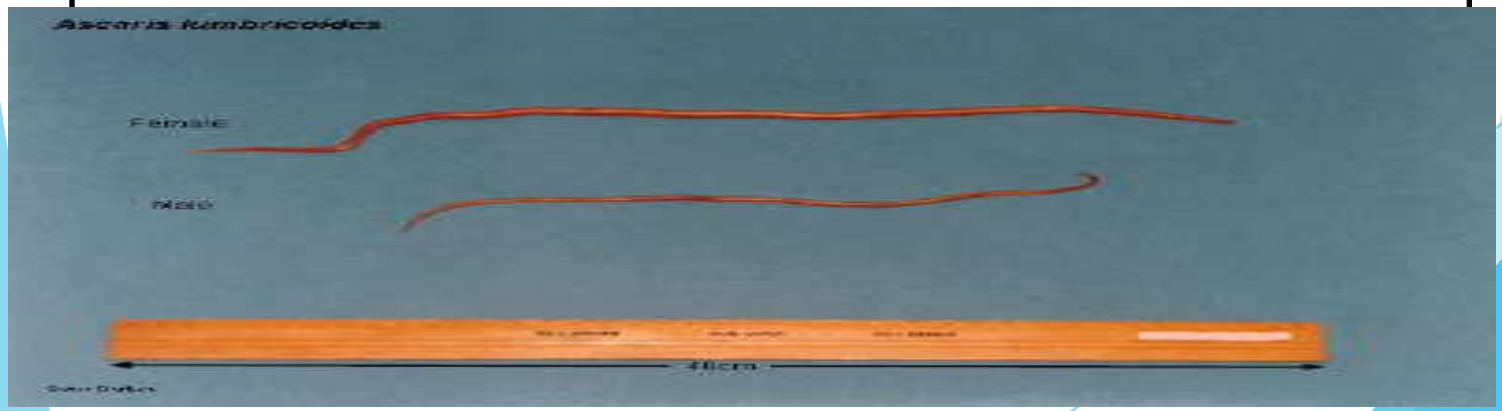
55 x 25 µm

Life size

2–5 mm



8–13 mm

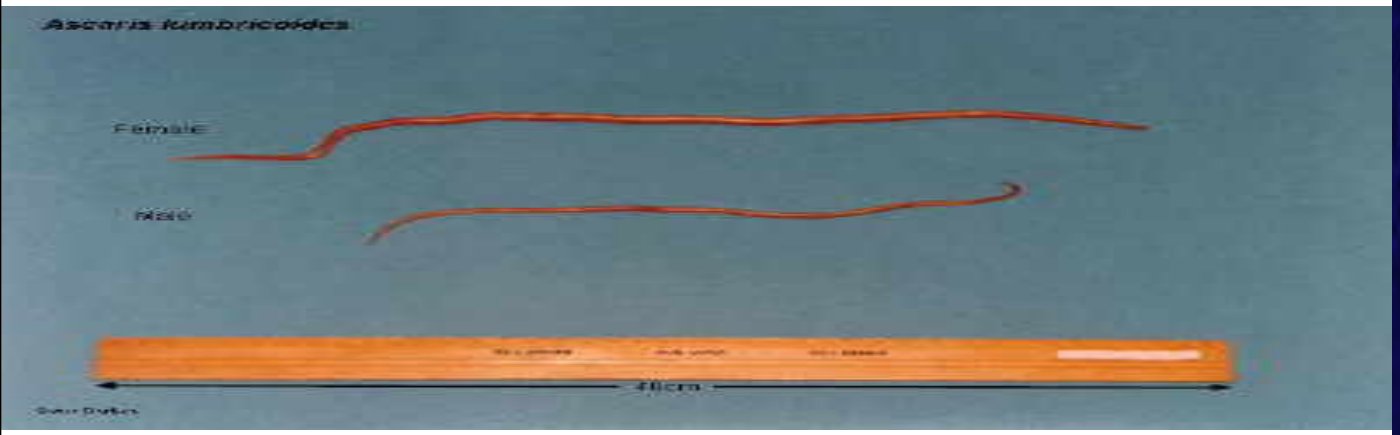


Ascaris lumbricoides (roundworm)

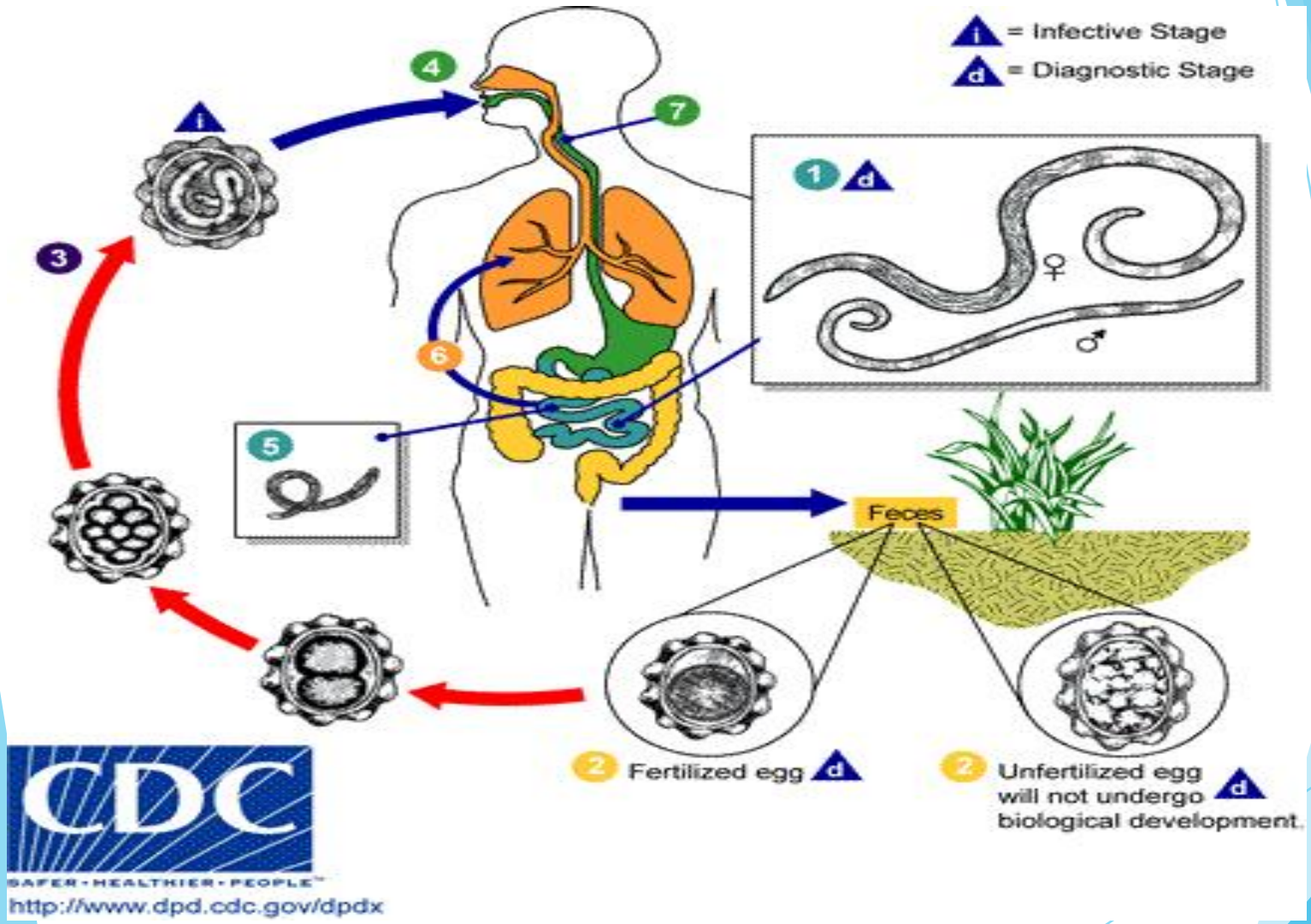
The commonest human helminthes infection all over the world.

The large round worm which is normally located in the small intestine.

- Found in jejunum and upper part of ileum.
- Female ± 20 cm longer than male ± 10 cm
- Feed on semi digested food.



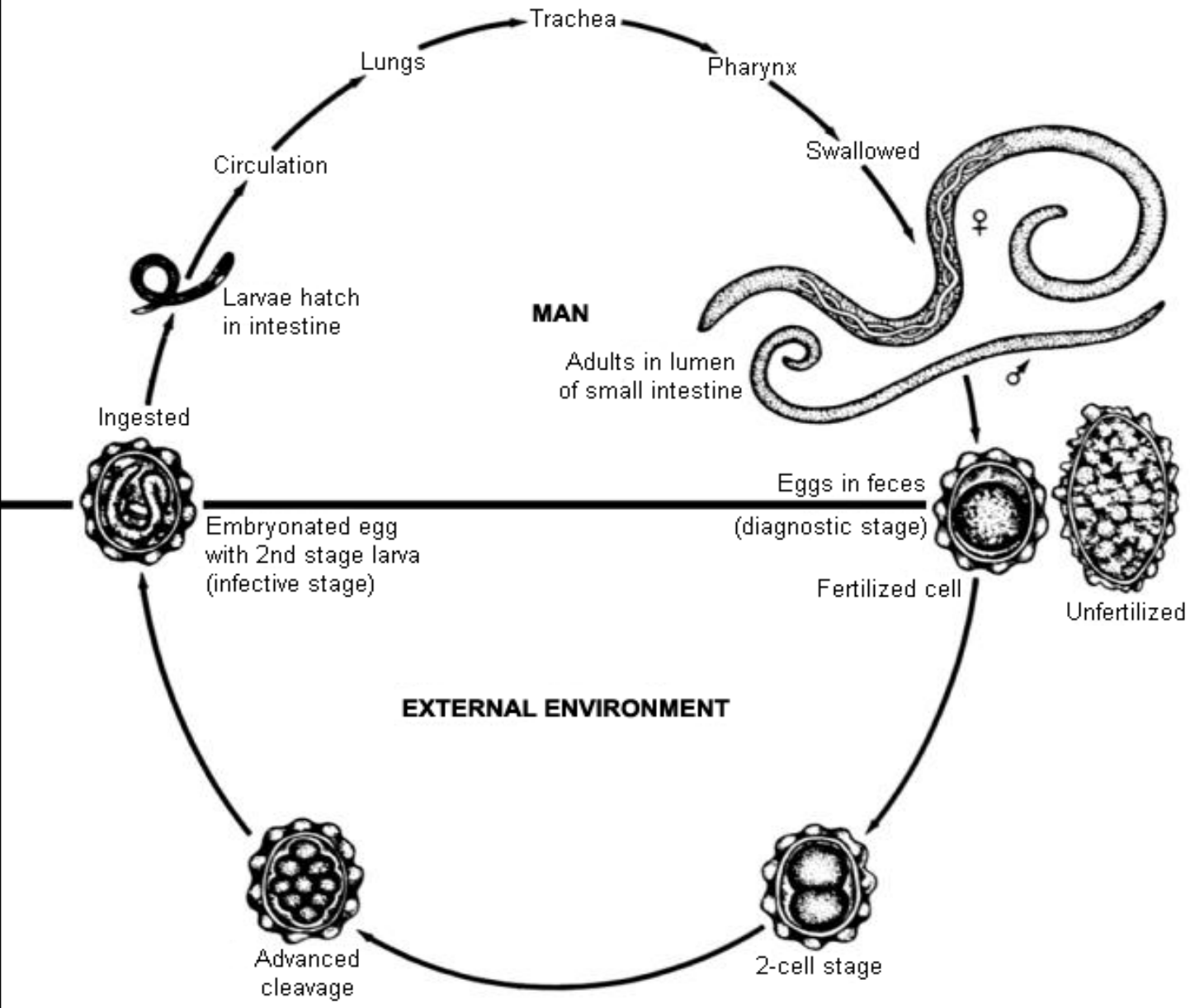
Ascaris Lumbricoidis Life Cycle



Life cycle of Ascais Lumbricoides

Ascaris parasite infect the human after ingestion of food or water contaminated with **Embryonated egg** (infective stage) which pass to the duodenum and then become a **Larva** that penetrate the wall of the **duodenum** and enter the blood stream to the heart , liver and enter the pulmonary circulation and stay in the **alveoli** ,where it grow and molts for three weeks then **Larva** passes from respiratory system to be **coughed up** ,swallowed ,returned to the small intestine where it mature to **adults** male & female ,fertilization take place producing fertilized and unfertilized eggs (diagnostic stage) which pass in stool.

Ascaris lumbricoides life cycle



Ascaris eggs

Diagnostic stage pass in the stool

(embryonated egg infective stage enter the body with food contaminated in the soil)

Ascaris larva emerging from egg hatch from small intestine to circulation go to the lungs causing LOEFFLER`S SYNDROM

Ascaris lumbricoides (roundworm)

Pathology:

- ***1-Adult worm:***

Light infection : asymptomatic.

Heavy infection : intestinal obstruction

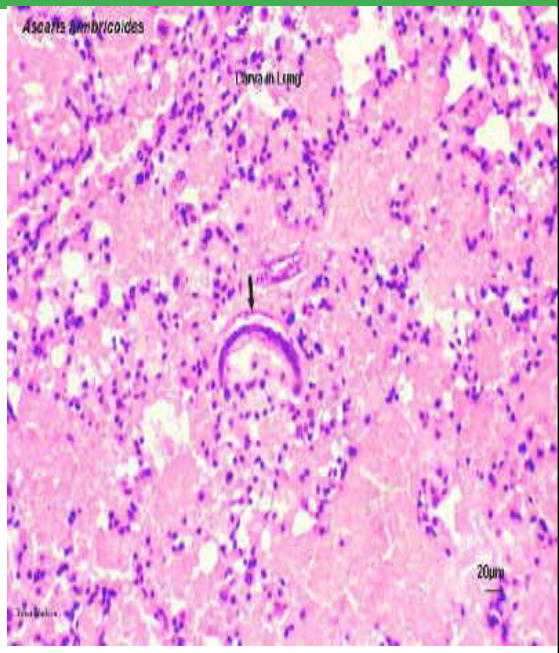
Migrating adult : to bile duct -jaundice

- ***2-Larvae:*** Loeffler`s syndrome

Pneumonitis and bronchospasm, cough with bloody sputum

Eosinophilia, urticaria

Ascaris lumbricoides (roundworm)



Loeffler`s syndrome: Larvae in lung

pnumonia,cough ,bloody sputum

Ascaris lumbricoides (roundworm)

Diagnosis:

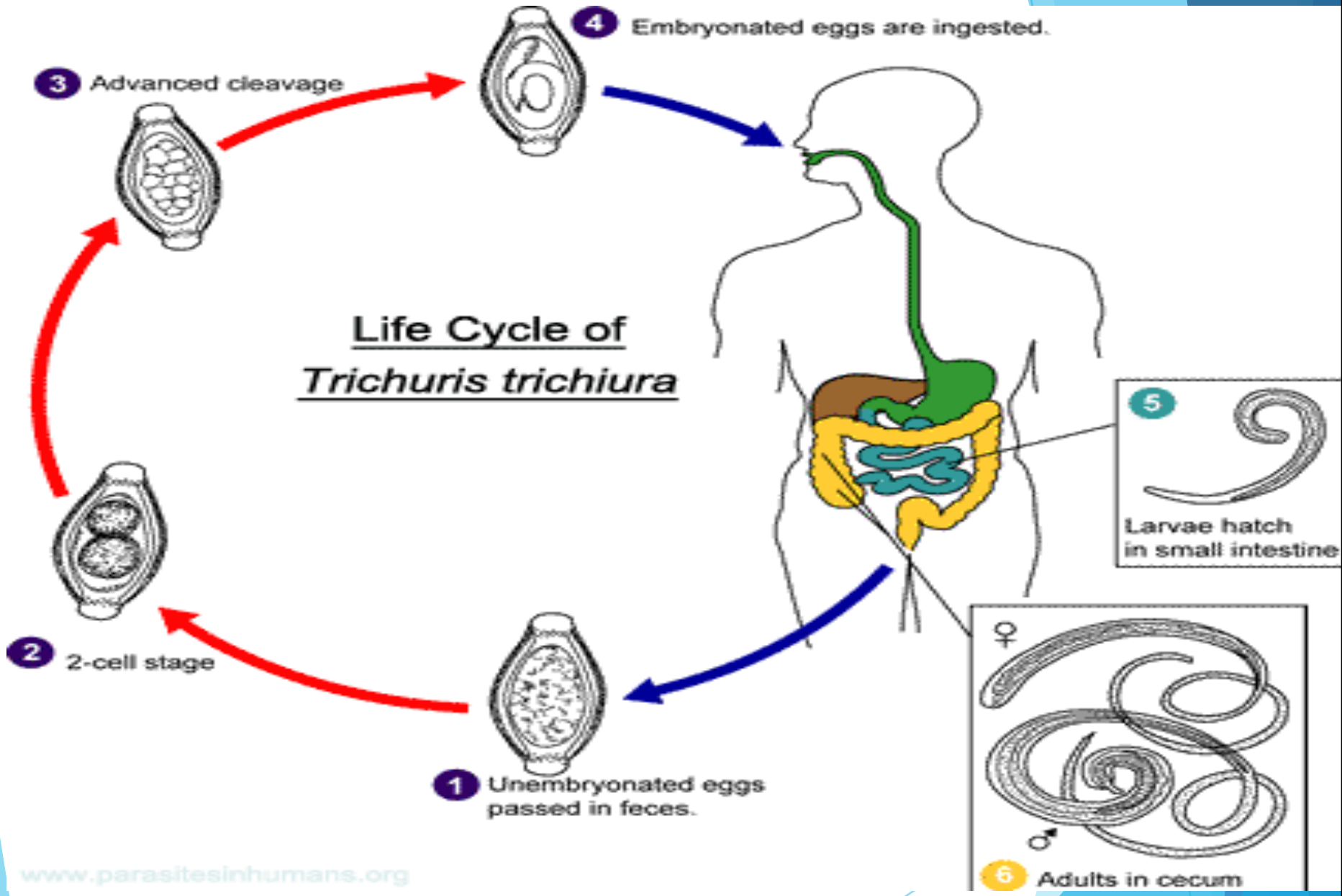
-eggs in stool (fertilized or unfertilized).

-larvae in sputum.

-adult may pass with stool.

Treatment: **Albendazole , Mebendazole**

2-Trichuris trichiura (Whipworm)

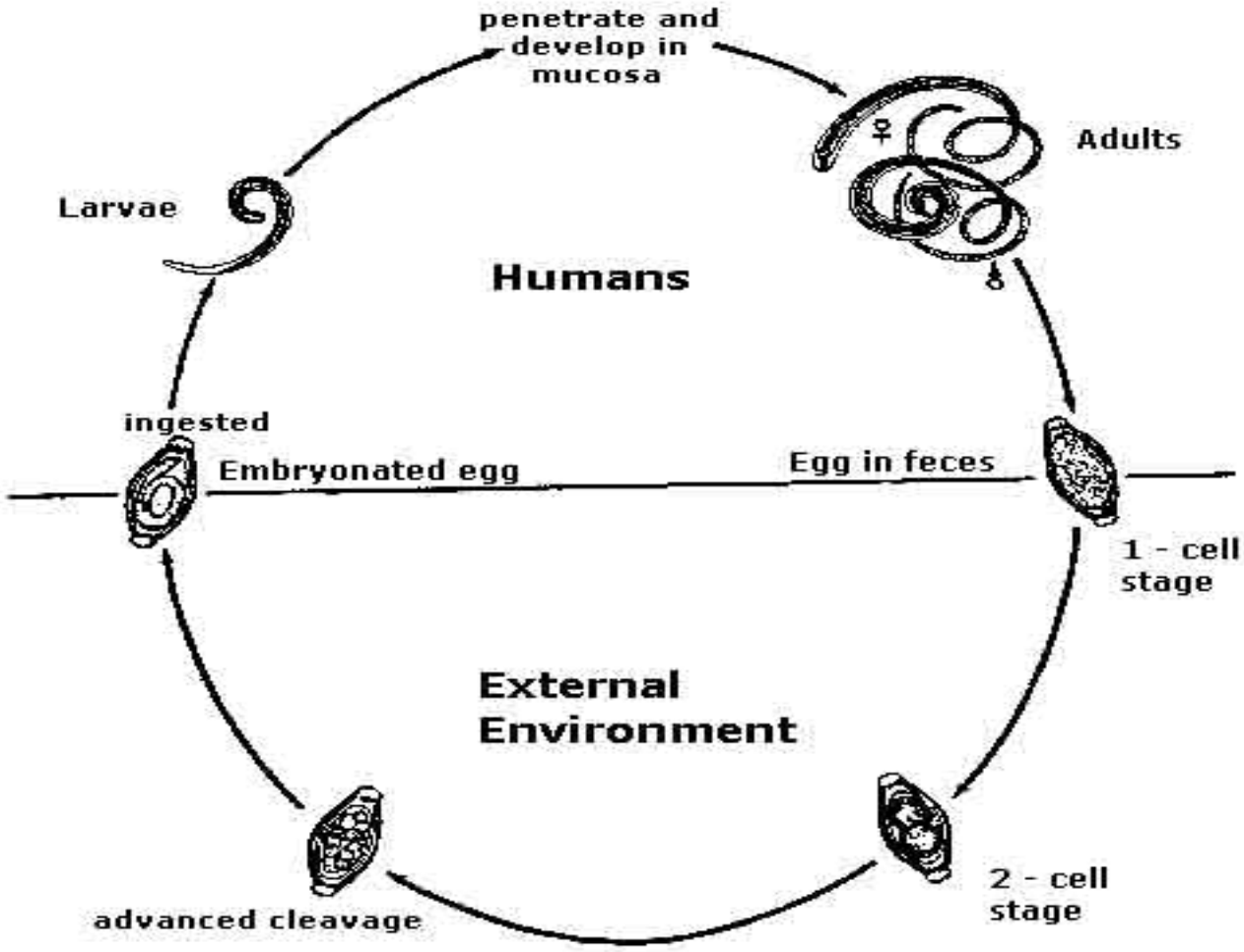

Life Cycle of
Trichuris trichiura
1 Unembryonated eggs passed in feces.
2 2-cell stage
3 Advanced cleavage
4 Embryonated eggs are ingested.
5 Larvae hatch in small intestine
6 Adults in cecum
♀
♂
www.parasitesinhumans.org

Trichuris trichiura (whipworm)

World wide ,common in poor sanitation.

- It coexists with Ascaris because of similar requirement(the eggs to be **embryonated egg** infective stage it needs to be 3 weeks in the soil).
- Adult live in **large intestine** especially **caecum** and **appendix** –in heavy infection the whole length of large intestine affected.

Trichuris trichiura



Trichuris trichiura (Whipworm)

Pathology

- **light infection** : asymptomatic
- **heavy infection** :. **Rectal prolapsed** in children is a common complication.

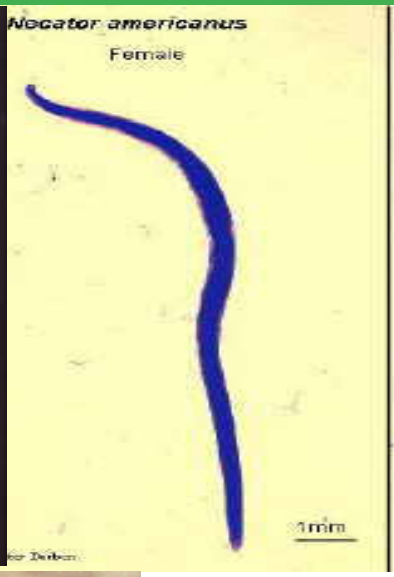
-

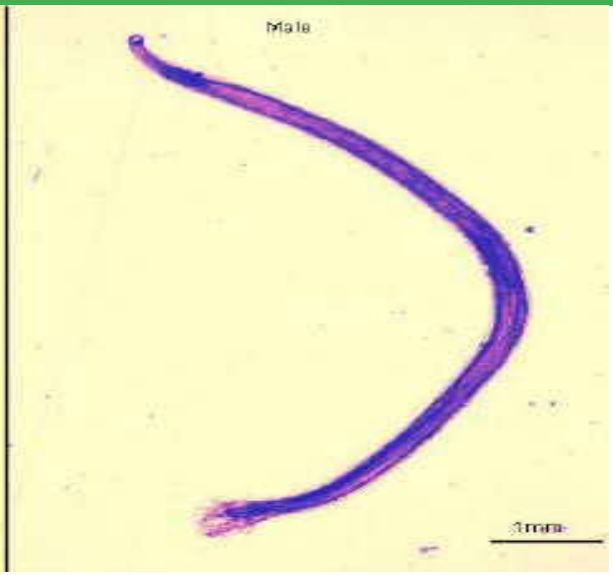
-**Diagnosis:** **Fertilized egg** in stool characterized by its barrel shape with mucoid plugs at each pole

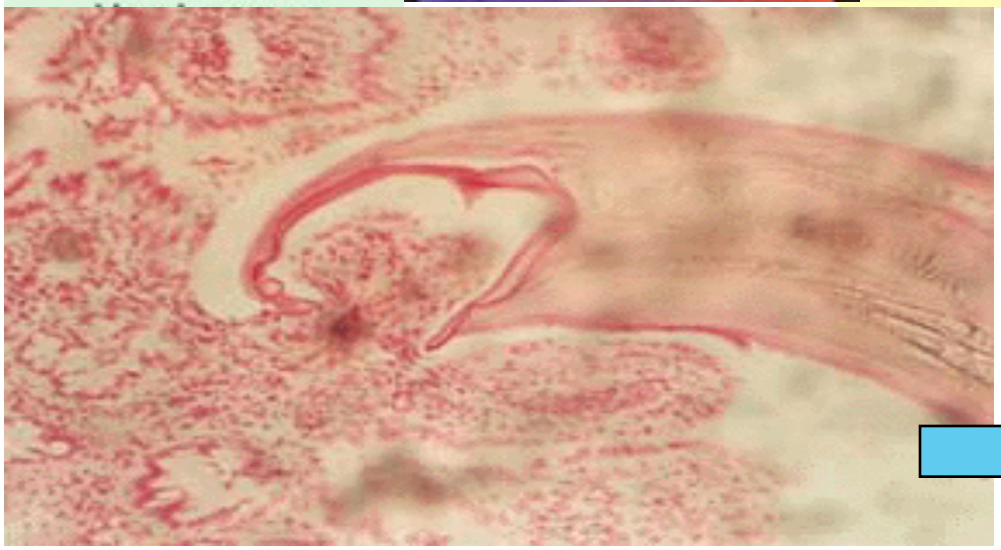
Treatment :Albendazole.

Hook worms

Ancylostoma dudenale &Necator americanus

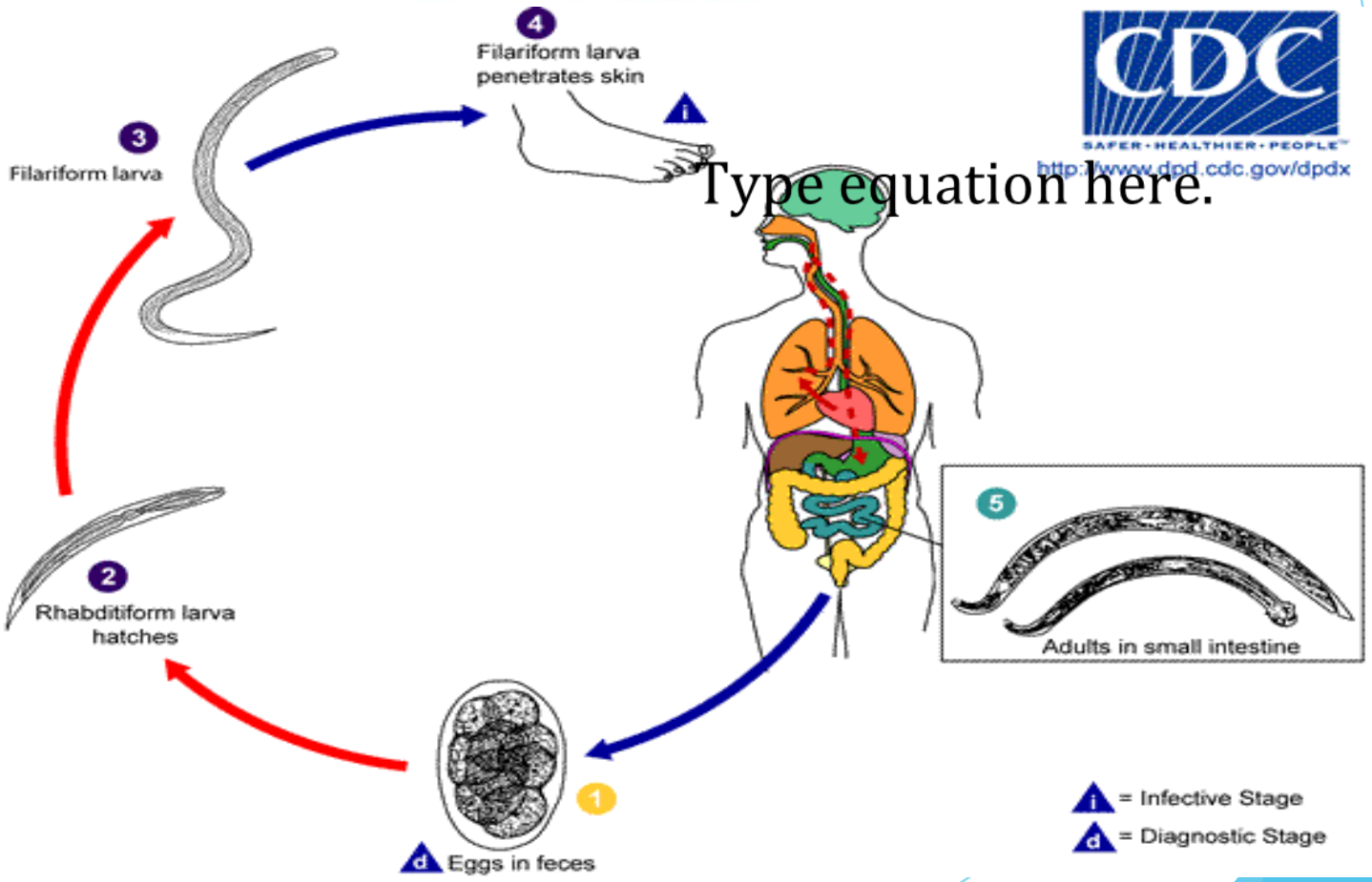




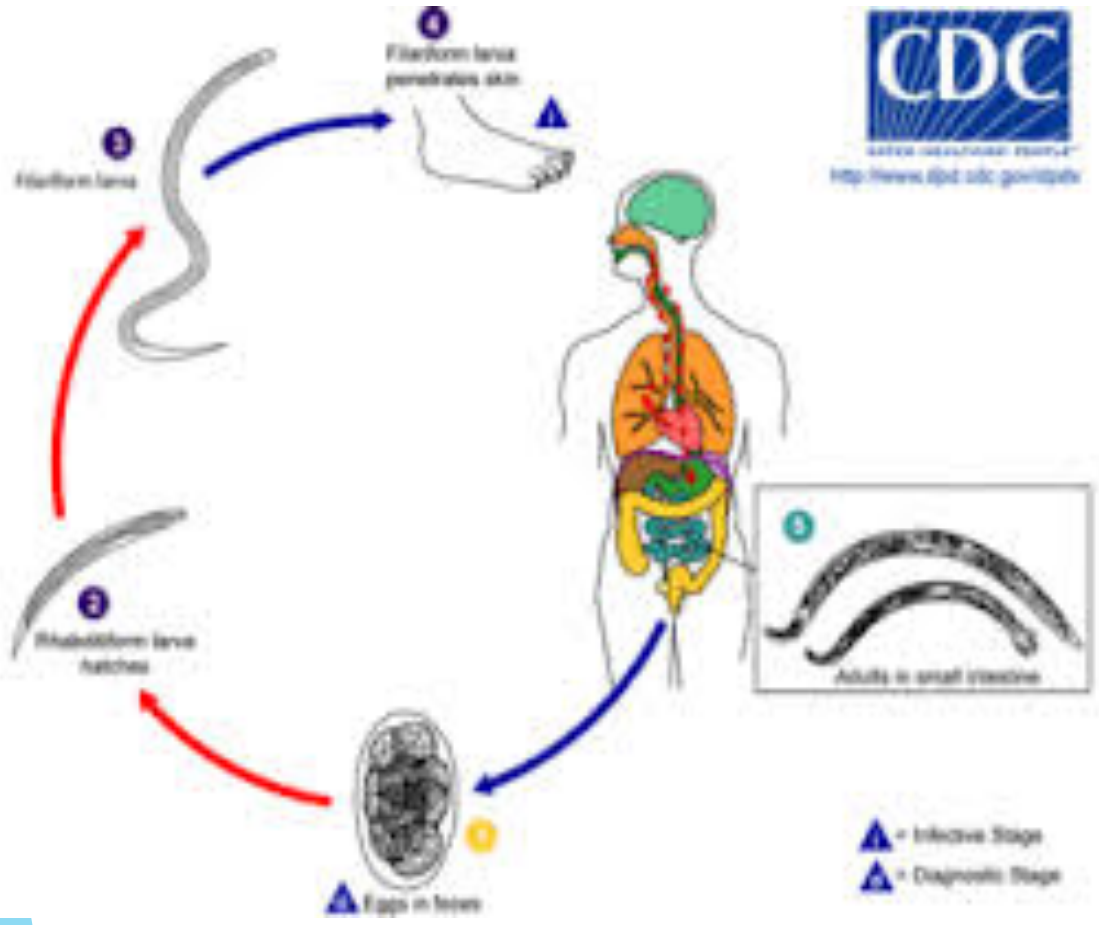


Buccal cavity attached to intestinal mucosa

Life cycle of HOOK WORM (Ancylostoma Duodenale & Nector Americanus)



Life cycle of HOOK WORM (Ancylostoma Duodenale & Nector Americanus)



Life cycle of HOOK WORM (Ancylostoma Duodenale & Nector Americanus)

- **Infective stage** is ***FILARIFORM LARVA*** penetrate the skin cause itching and dermatitis then larva go to the circulation (lungs causes slight pneumonitis and bronchitis) larva then swallowed and go to **small intestine** ,they attach to the mucous membrane where they mature into **adult** and the **female** starts laying **eggs** to be passed in stool(**not infective**).
- The eggs need to be in soil for about one week to become ***FILARIFORM LARVA*** **INFECTIVE STAGE.**

Hook worms

Ancylostoma dudenale &Necator americanus

- A common cause of anemia in endemic areas.
- Found in small intestine mainly jejunum.
- Its buccal capsule (mouth) lined with hard hooks, triangular cutting plates and anticoagulant glands.

Pathology& clinical picture:

- **larvae:**
  - **At the site of entry of larvae intense itching(ground itch) and dermatitis.**
  - **Migration phase:**
    cough with bloody sputum
    pneumonitis and bronchitis but less sever than Ascaris ,eosinophilia urticaria.

- **Adult worm:**
  - **low worm burden (INFECTION): no symptoms.**
  - **Moderate to heavy burden:**
    - **Epigastric pain, vomiting , hemorrhagic enteritis.**
    - **Protein loss: hypo-proteinaemia edema.**
    - ***Anemia*: due to withdrawal of blood by parasites and hemorrhage from punctured sites lead to sever anemia = microcytic hypo chromic anemia .**

Hook worms

Diagnosis and treatment

- Diagnosis:
- -Eggs in stools.;

  -occult blood (+)

Treatment: Albendazol, Mebendazole

Strongyloides stercoralis

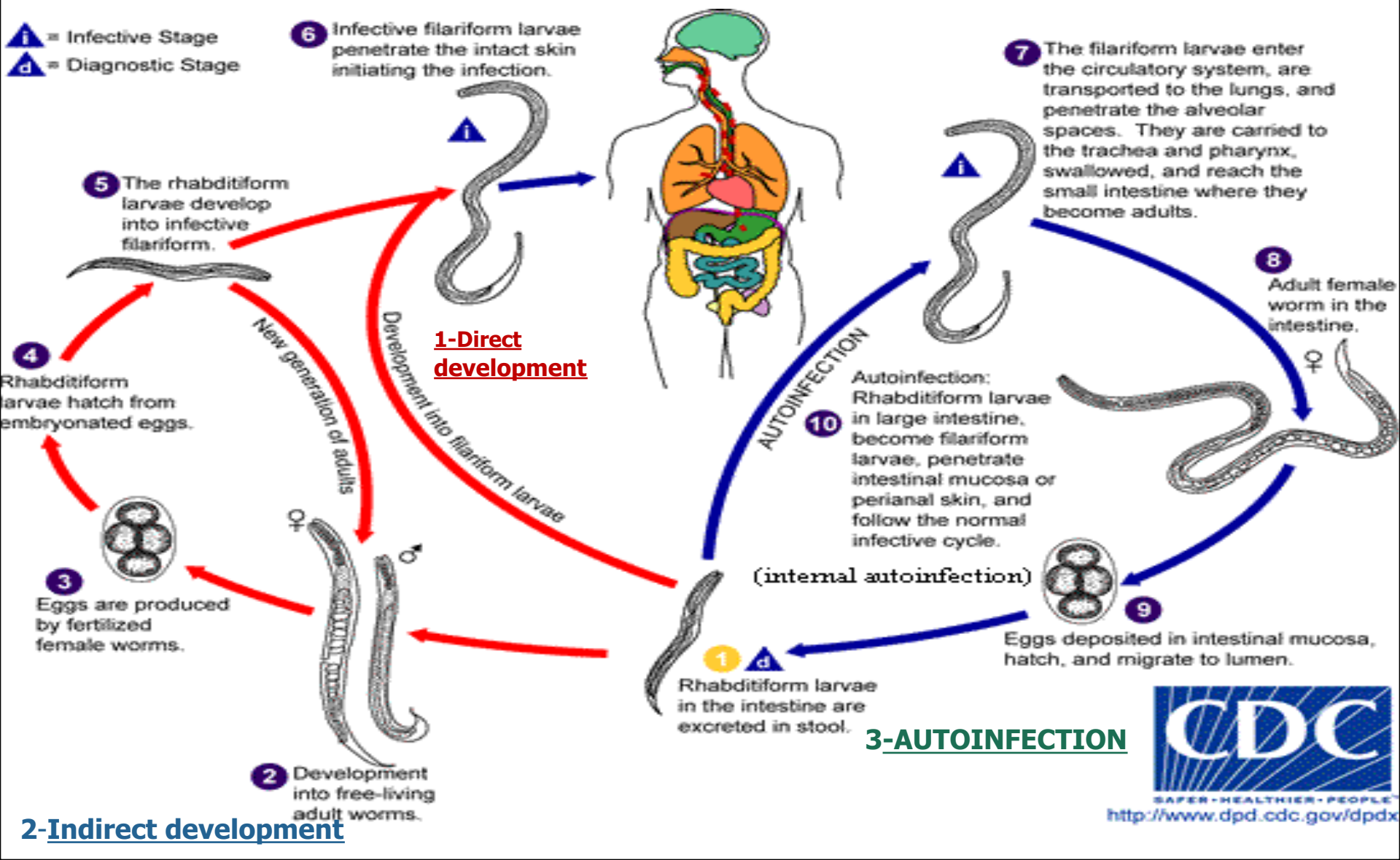
- Widely distributed in tropical area at Asia, Africa & South America .
- fatal dissemination in **immuno-compromised host.**
- It is **smallest** pathogenic nematodes

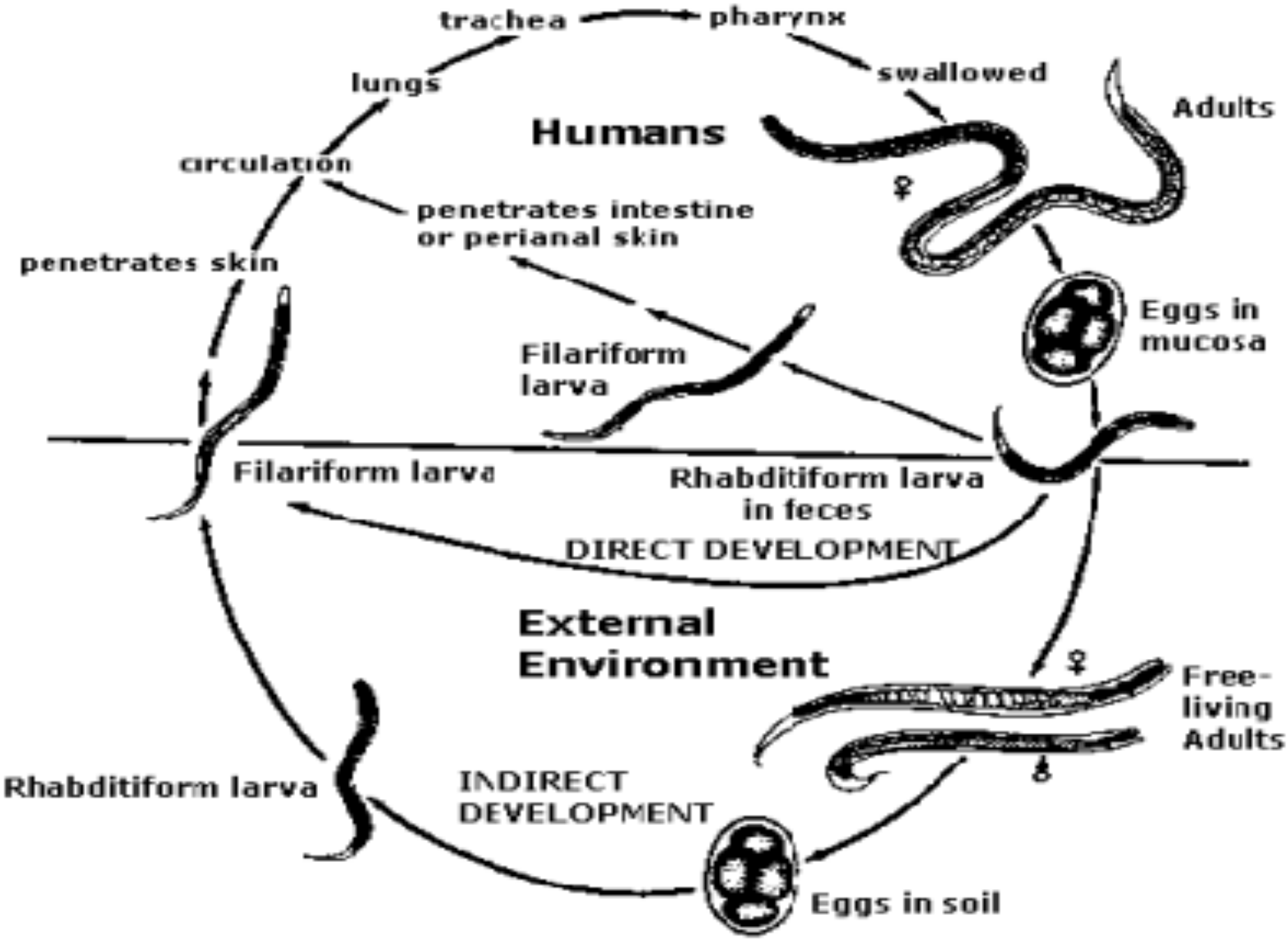
  ± **2.5**mm.
- adult live **in mucous** membrane of duodenum jejunum rarely mucous membrane of bronchus.
- ***AUTOINFECTION IS VERY IMPORTANT CRITERIA*** .

Strongyloides stercoralis life cycle

- The parasite shows 3 different modes of development:
- **1-Direct development:** The **rhabiditiform** larva pass from stool and become directly a **Filariform** larva if the environment of the soil is suitable .
- **2-Indirect development :** in external environment Rh. larva becomes free living adults, produce eggs ⇨ rhabiditiform larva ⇨ Filariform larva(Infective stage).
- **3-AUTOINFECTION:**
  - Internal :when the rhabiditiform larva become a filariform larva in the intestine and penetrate the intestine
  - External : fecal contamination of skin –Rh larva > filariform penetrates the skin

Strongyloides stercoralis




trachea
pharynx
lungs
swallowed
Adults
Humans
circulation
penetrates intestine
or perianal skin
penetrates skin
Eggs in
mucosa
Filariform
larva
Filariform larva
Rhabditiform larva
in feces
DIRECT DEVELOPMENT
External
Environment
Free-
living
Adults
Rhabditiform larva
INDIRECT
DEVELOPMENT
Eggs in soil

Strongyloides stercoralis:
Pathology and clinical picture:

- **Cutaneous:** little reaction on penetration
  sever dermatitis at peri-anal region in
  case of external autoinfection.
- **Migration** :pneumonitis during larval migration.
- **Intestinal:** inflammation of upper intestinal mucosa, diarrhea, upper abdominal pain in the epigastria colicky in nature.
- **Disseminated strongyloidiasis :** in patient with **immunodeficiency** ,uncontrolled diarrhea –granulomatous changes –necrosis–perforation ,peritonitis ,death.

Strongyloides stercoralis

Diagnosis:

rhabditiform larvae diagnostic stage in:

-Stool examination

-Duodenal aspirate

Treatment : Albandazole, Mebendazole

Common intestinal Nematodes

Name	Transmission	Location of adult in human	Infective stage	Diagnostic stage	Clinical picture
1-Enterobius vemicularis	Swallowing the eggs, Autoinfection	Large intestine cecum	eggs	Adult pass in anus at midnight Cellulose adhesive tape we detect adult worm	1- pruritus ani during night 2-perisistant itching 3-inflammation around the anus.********
2-Ascaris lumbricoids	Swallowing of Emberionated egg	Small intestine duodenum	Embryonated eggs food contaminated	1-Fertilized &unfertilized eggs in stool 2-Adult worm in stool 3-Larva in sputum.	**Asymptomatic Intestinal obstruction in heavy infection pneumonitis &bloody sputum*******.**
3-Trichuris trichura	Swallowing of Embryonatsd eggs	Large intestine	Emberyonated eggs	Unembryonated eggs	Asympotomatic in light infection Rectal prolapse in children ********

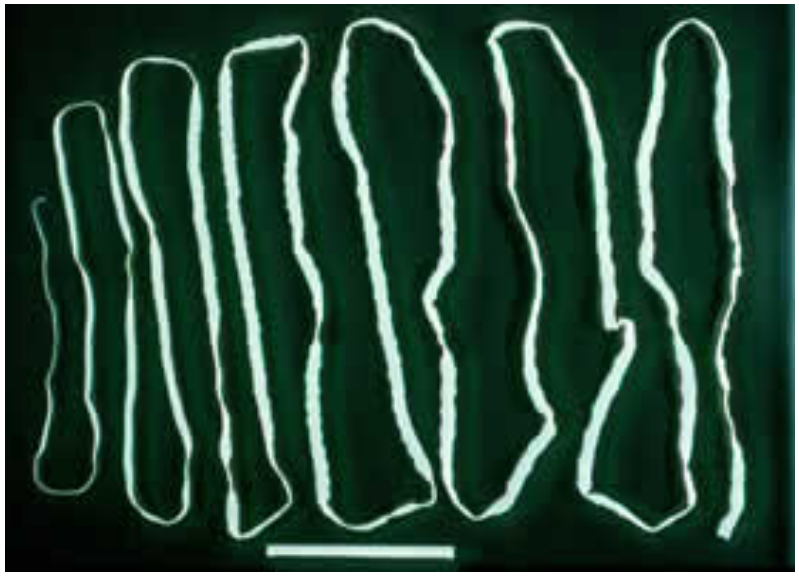
Common intestinal Nematodes

Name	Transmission	Location of adult in human	Infective stage	Diagnostic stage	Clinical picture
4-Hook worm Ancylostom Dudenalle& Nector Amiricanus	Larval penetration of skin	Small intestine	Filariform larva	Eggs in stool	Itching &pruritis at sight of entry. Cough and blood in the sputum at larval migration stage. Loss of blood MICROCYTIC HYPOCHROMIC ANEAMIA*********
5-Strogyloids Stercoralis	**Larval penetration of skin** AUTOINFECTION	Small intestine	Filariform Larva	Rhabiditiform Larva	Pruritus at the site of larval penetration. Inflammation in the small intestine. Disseminated strongyloidiasis and AUTOINFECTION : in patient with **immunodeficiency** ,uncontrolled diarrhea – granulomatous changes –necrosis– perforation ,peritonitis ,death

Common Tapeworm Infections

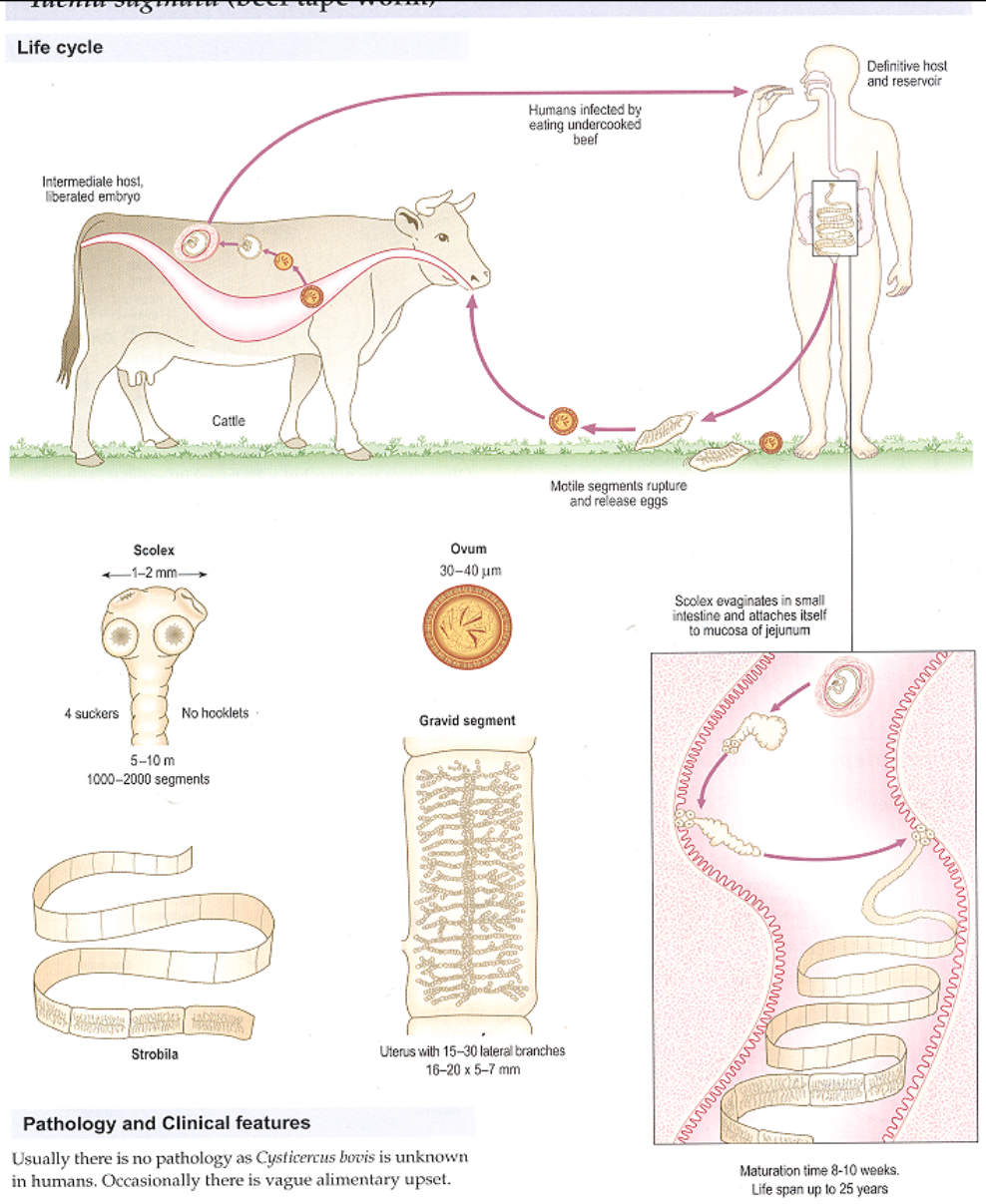
TAPEWORM	DISEASE	TRANSMISSION OF INFECTION	LOCATION OF ADULT IN HUMANS	LOCATION OF LARVA IN HUMANS	CLINICAL PICTURE	LAB. DIAGNOSIS
Taenia saginata	taeniasis	ingestion of larva in undercooked beef	Small Intestine	not present	vague digestive disturbance	eggs or proglottids in stools
Taenia solium- ADULT	taeniasis	ingestion of larva in undercooked pork	Small Intestine	not present	Vague digestive disturbances	eggs or proglottids in stools
Taenia solium- LARVA (cysticercus cellulosae)	Cysticercosis	ingestion of egg	not present (except in autoinfection : ,small intestine)	sub-cutaneous muscles brain,eyes	**depending on locality: from none to epilepsy**	X - ray,CT,MRI Serology
Hymenolepis nana	hymenolepiais	ingestion of egg	Small Intestine	Intestinal Villi	Enteritis diarrhoea	**eggs in stools**
Echinochoccus granulosus	hydatid disease	ingestion of egg	not present	Liver, lungs, Bones etc	depending on locality	X-ray,CT,US Serology Hydatid sand

parasite	Transmission of infection	Location of adult in human	Location of cyst in human	Clinical picture	diagnosis
Taenia saginata	Eating undercooked beef meat contain cyst(larva)	Small in	No cyst or larva in human	Vague digestive discomfort	Eggs or gravid segments in stool (proglottidis)
Taenia solium	Eating undercooked pork meat (pig)	Small intestine	No cyst found.	Vague digestive discomfort	Eggs or gravid segment in stool (proglottidis)
Taenia solium	Eating **eggs** in food contaminate with human feces.	No adult in human	Cyst (cysticercosis) especially in the brain and eyes.	Depending on location of the cyst in brain can lead to epilepsy In eye blindness	X-ray MRI CT scan Serology.
Echinochoccus granulosa	Eating **eggs** in food contaminate with dogs feces	NO adult in human	Hydatid cyst in liver and lung can be fatal .	Depending on location of the cyst can be fatal.	X- rat MRI CT scan Serology



Taenia saginata

Life cycle of *Taenia saginata*



Pathology and Clinical features

Usually there is no pathology as *Cysticercus bovis* is unknown in humans. Occasionally there is vague alimentary upset.

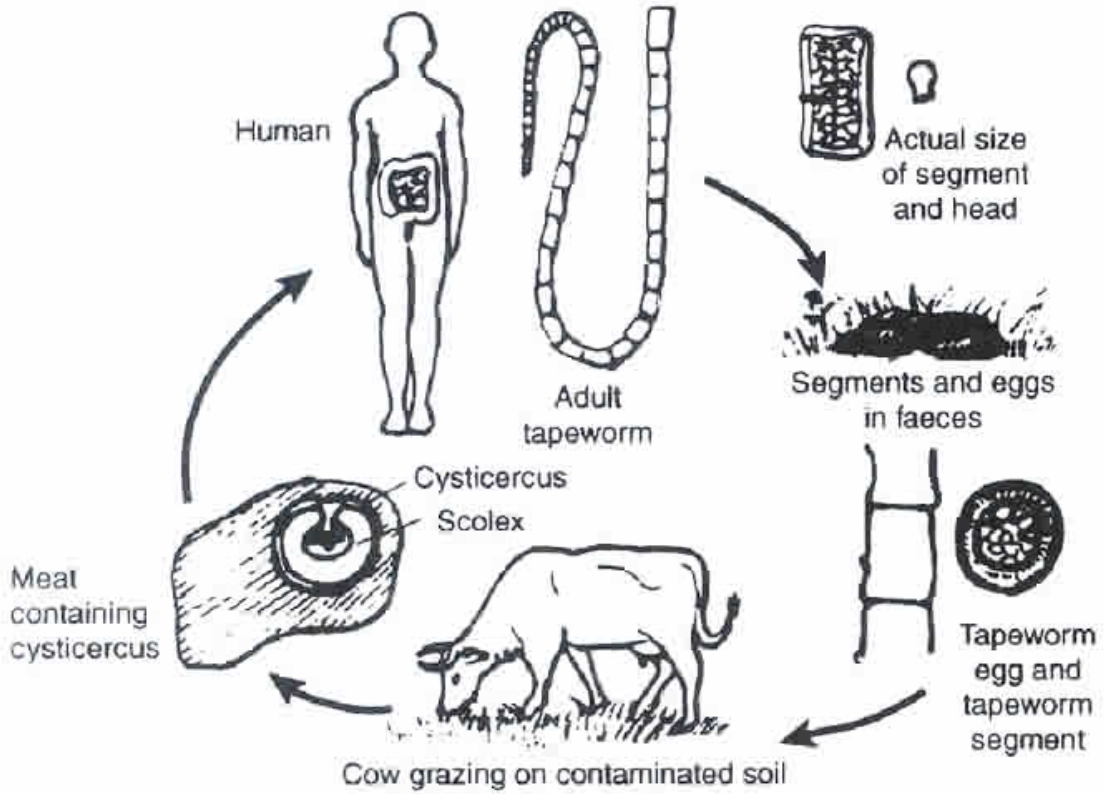
Laboratory diagnosis

Gravid segments, ova and scolex can be found in faeces. Uterine branches of the mature segments may be seen in a crush preparation between two glass slides, or by Indian ink preparation, as in *T. solium*. Ova are also found on the perianal skin (on clear adhesive tape slides).

Distribution

Taenia saginata is found in beef-eating areas, especially in the tropics.

Taenia saginata life cycle



Taenia saginata

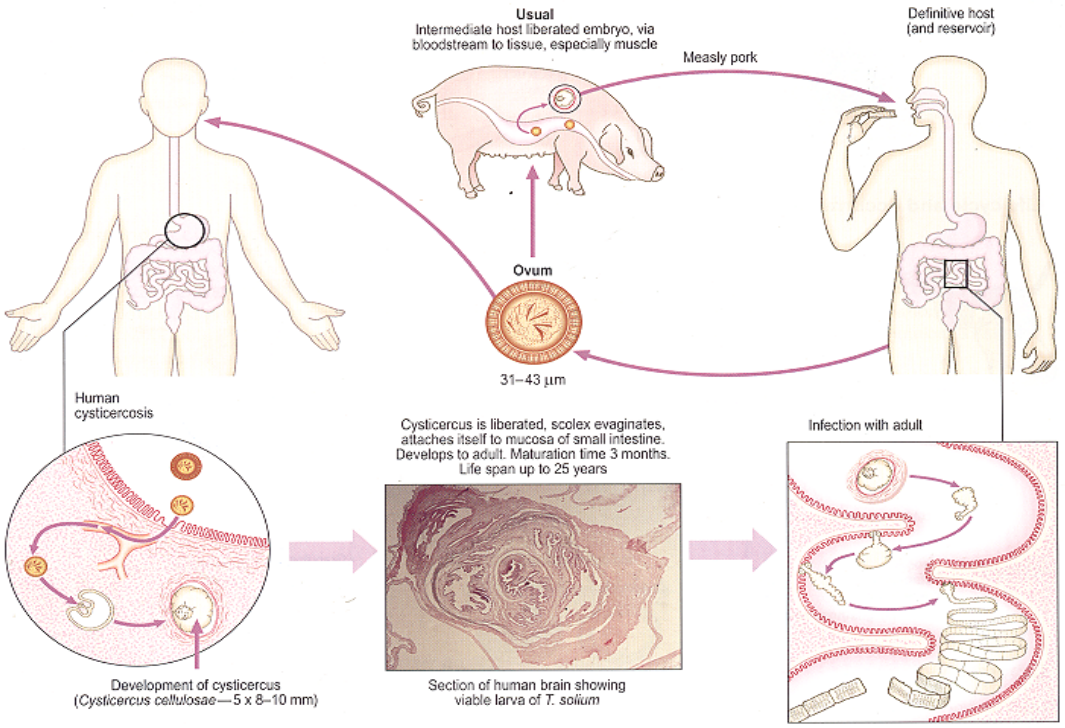
- Is an obligatory parasite of man ,the adult worm live in the **SMALL INTESTINE** .
- **CATTLE** become infected by ingesting grass contaminated with **eggs or gravid segments** which passed from human faeces. In the cattle the onchosphere hatches out go to circulation and transformed to cysticercus stage in the muscle known as **CYSTICERCUS BOVIS**.
- Man become infected by eating **undercooked** or improperly cooked beef , the adult worm lives in **small intestine** of man passing **eggs** and **gravid proglottids** to the environment.
- The majority of cases are Asymptomatic ,some patients have vague intestinal discomfort ,vomiting and diarrhea.

Life cycle of *Taenia solium*

Cestode (tape) worms

Taenia solium (pork tape worm)

Life cycle



Pathology and Clinical features

Infection by larvae (cysticercosis). Cysticerci, generally multiple, may occur in any site but are more frequent in the brain and muscle. They excite reaction in the area, especially when they die, which manifests as inflammation, fibrosis and later some calcification. This leads to focal CNS syndromes, especially epilepsy.

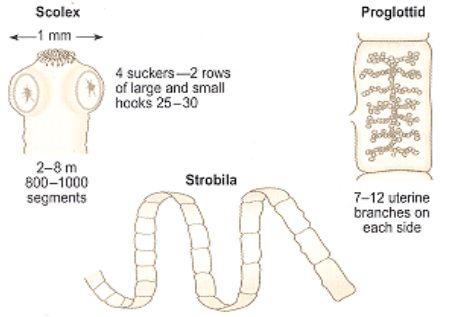
Infection with adults. Often there can be no pathology, but there might be mild irritation of intestinal mucosa.

Laboratory diagnosis

Eosinophilia.

Larval infections. There are several methods, including histological examination of biopsy material, serology (IFAT, ELISA, EITB) and radiology (CT or MRI scan of the brain, X-ray of the thigh muscles).

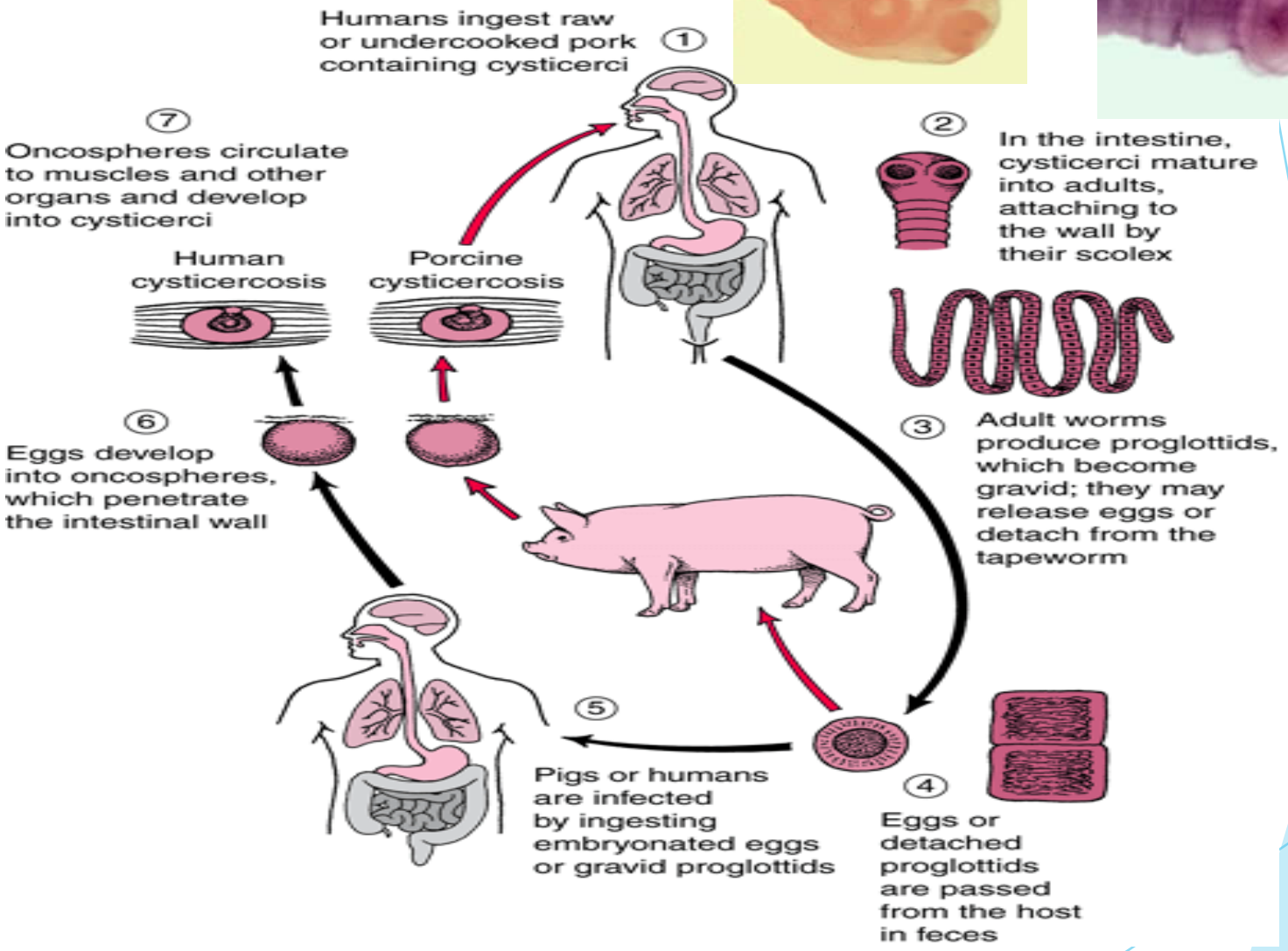
Pure infection with the adult. Gravid segments, ova and scolex can be found in faeces. The uterine branches of the mature segments can be demonstrated by injection of Indian ink through the uterine pore.



Distribution

5 million people infected worldwide. *Taenia solium* is endemic in pig-rearing areas of the world where hygiene and animal husbandry are poor.

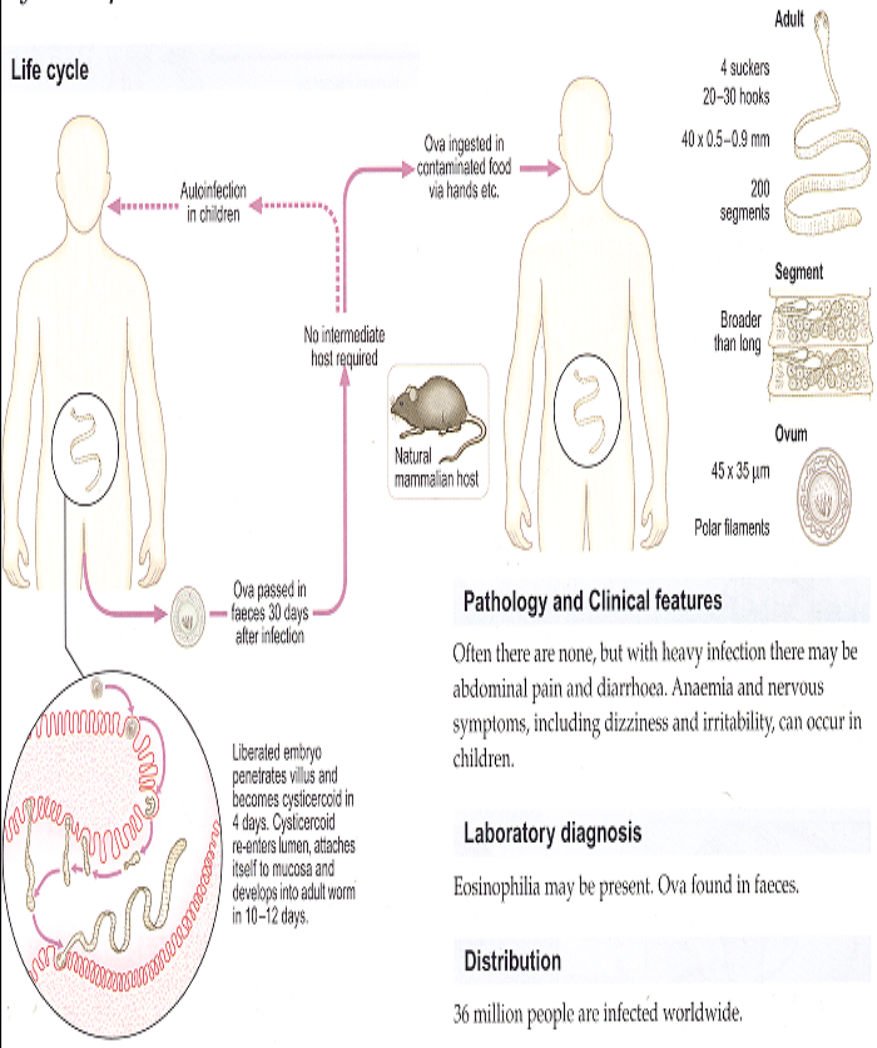
Taenia Solium



HYMENOLEPIS NANA

Dwarf tape worms

Hymenolepis nana



Pathology and Clinical features

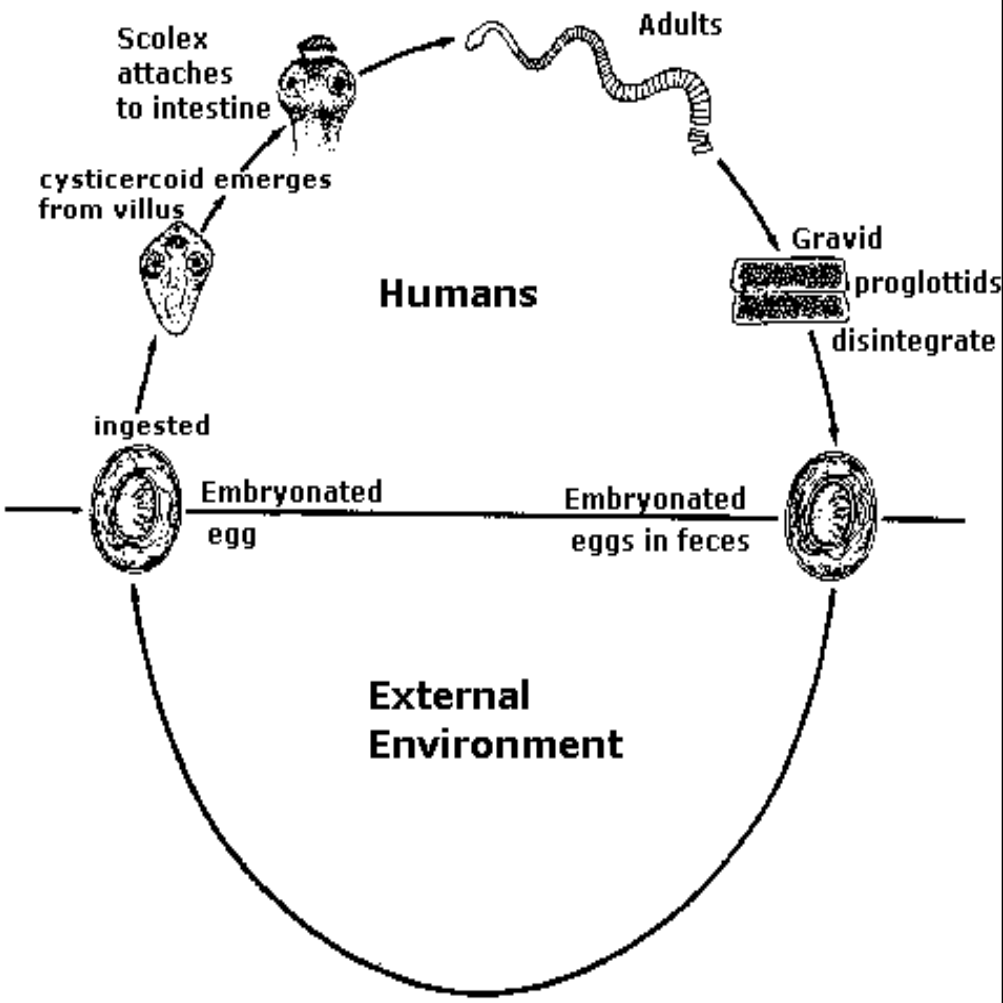
Often there are none, but with heavy infection there may be abdominal pain and diarrhoea. Anaemia and nervous symptoms, including dizziness and irritability, can occur in children.

Laboratory diagnosis

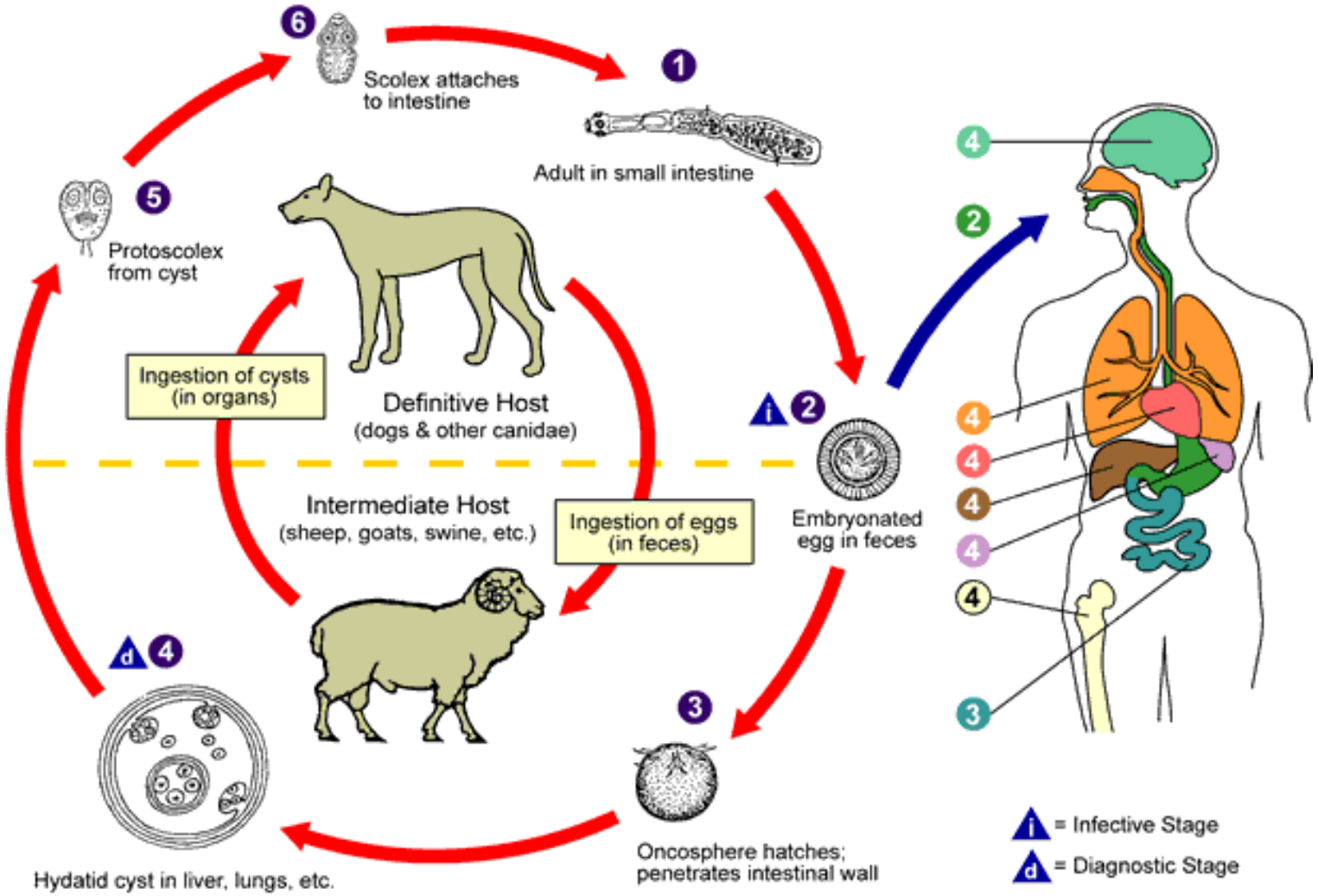
Eosinophilia may be present. Ova found in faeces.

Distribution

36 million people are infected worldwide.

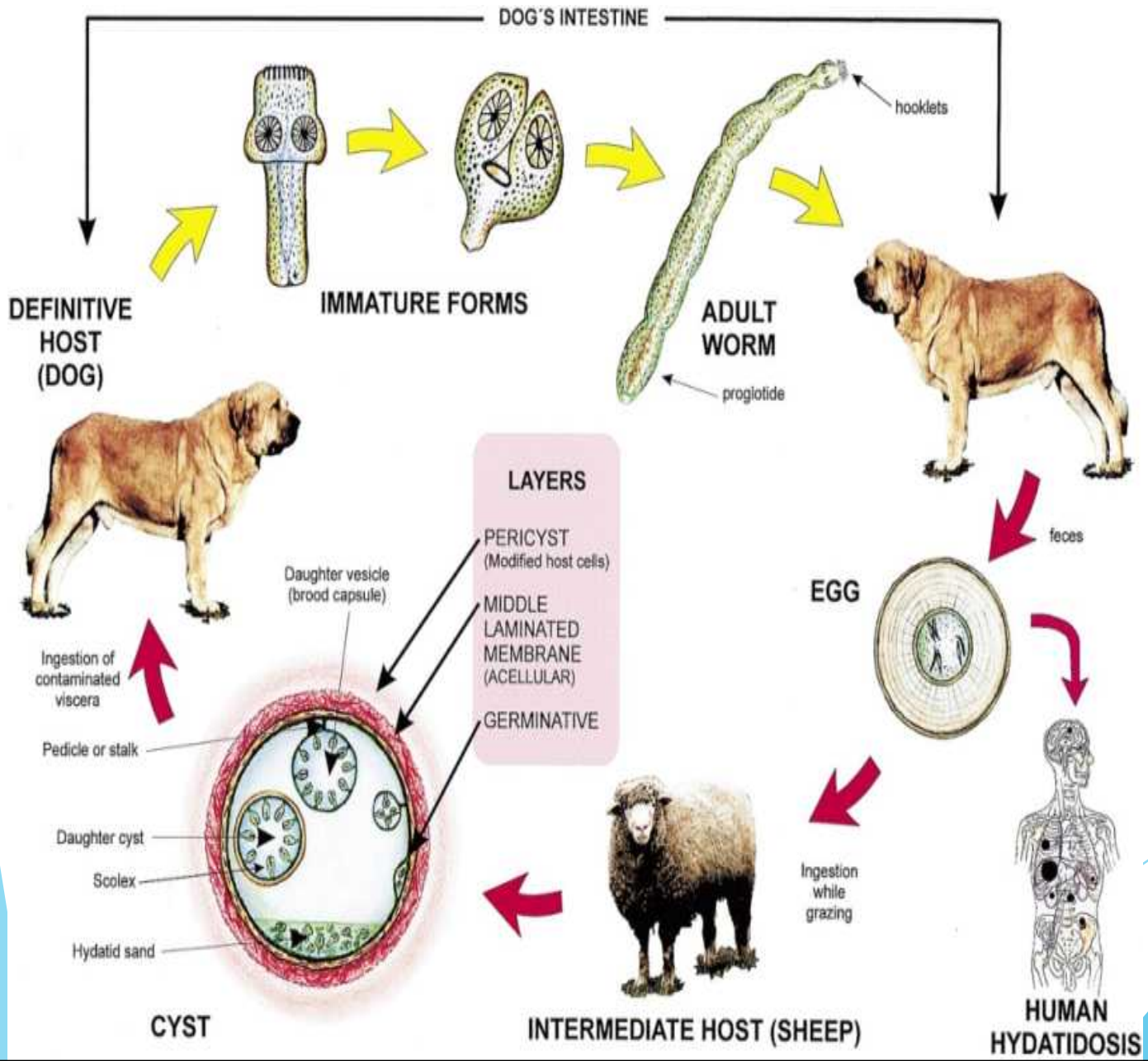


Hymenolepis nana

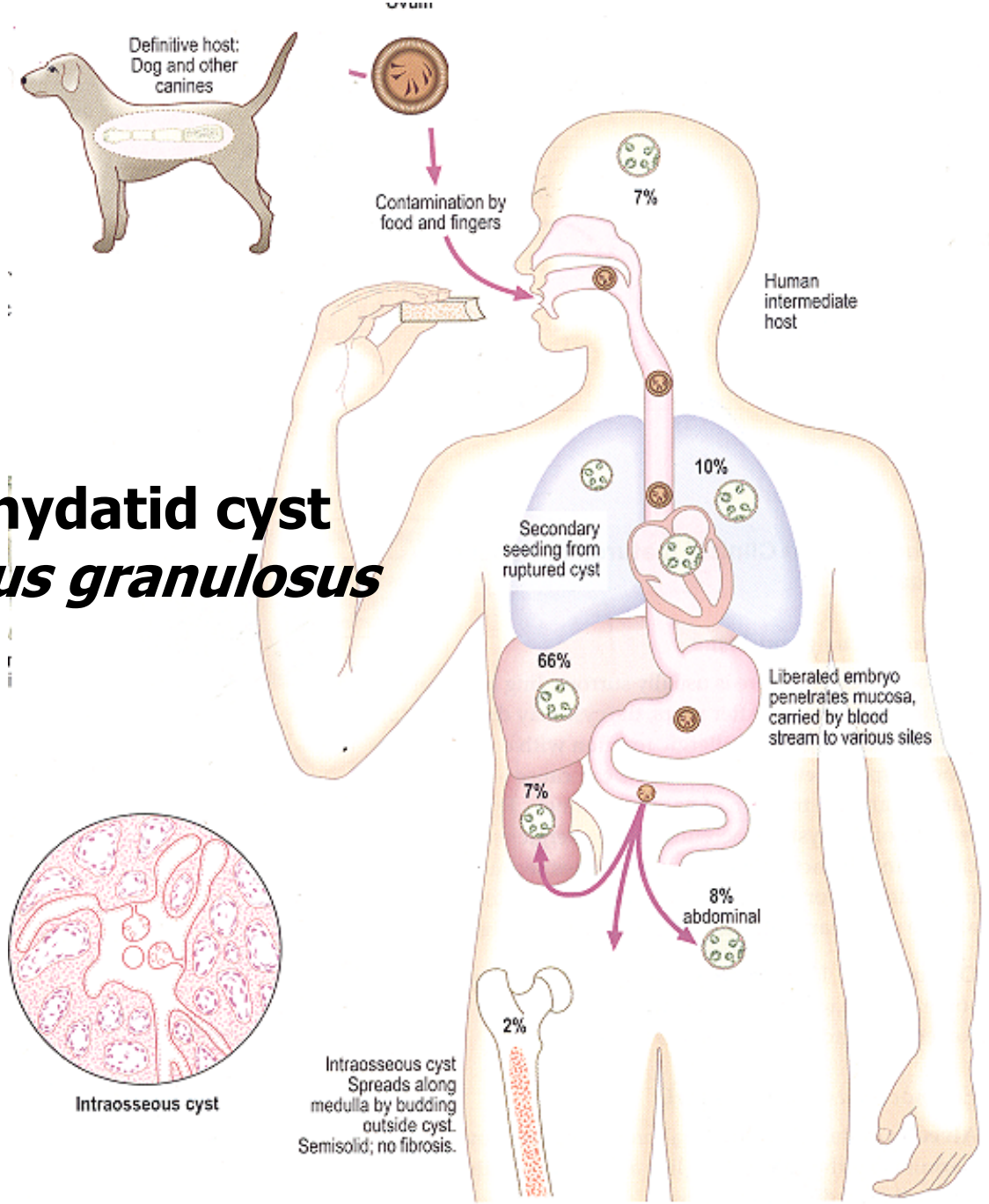


Life cycle of *Echinococcus granulosus*

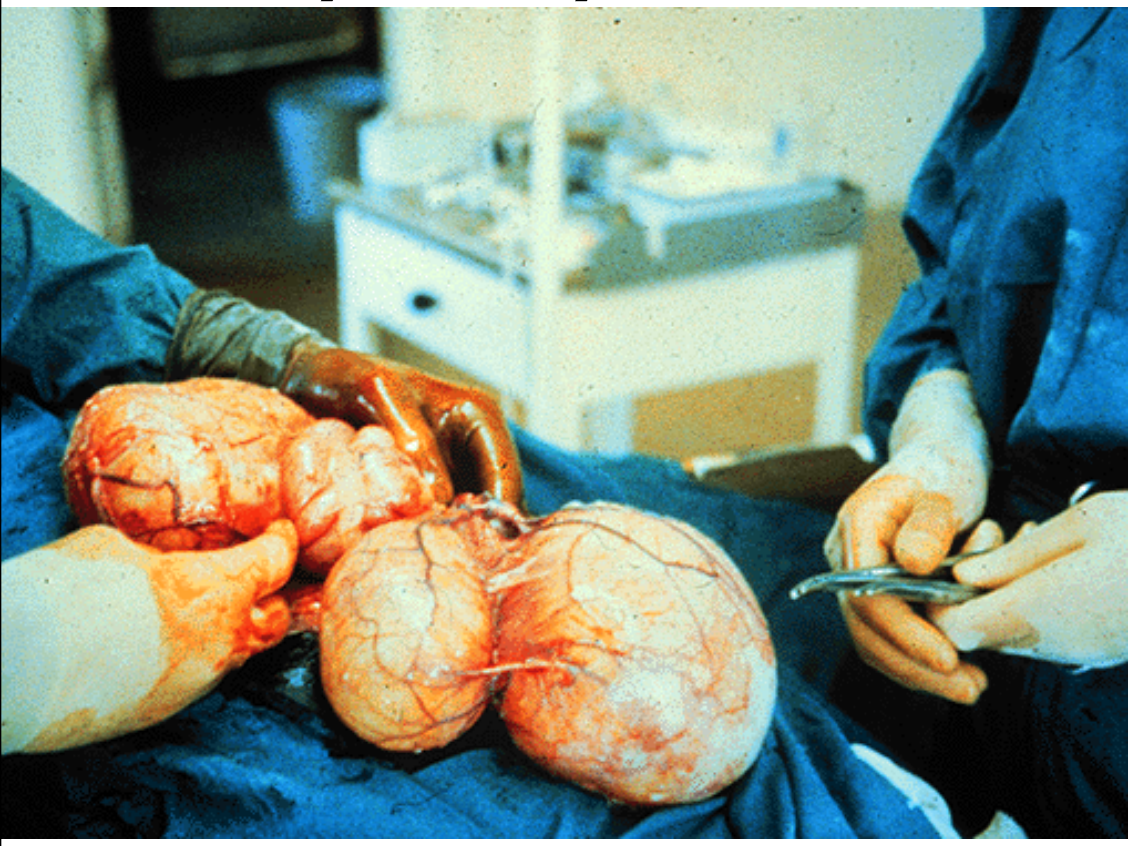
Echinococcus granulousus

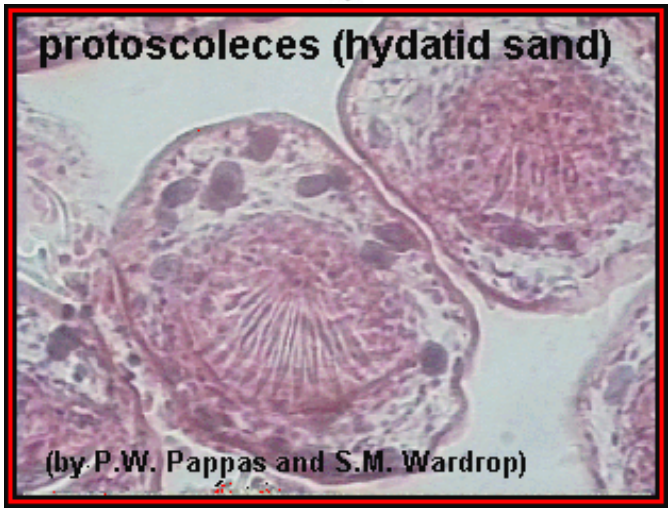


Location of hydatid cyst
Echinococcus granulosus

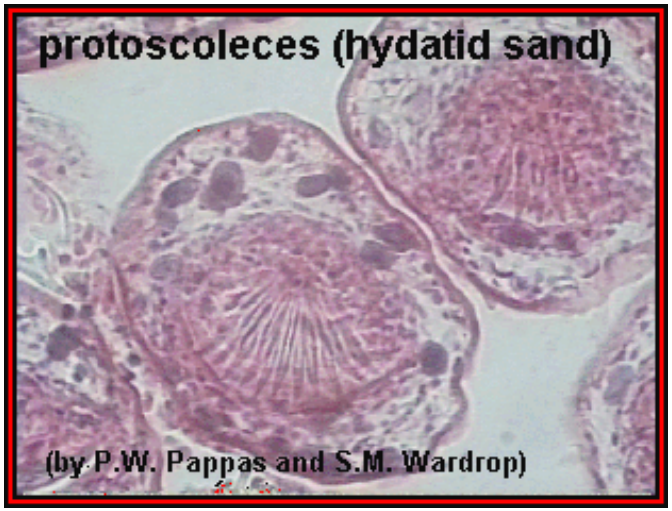


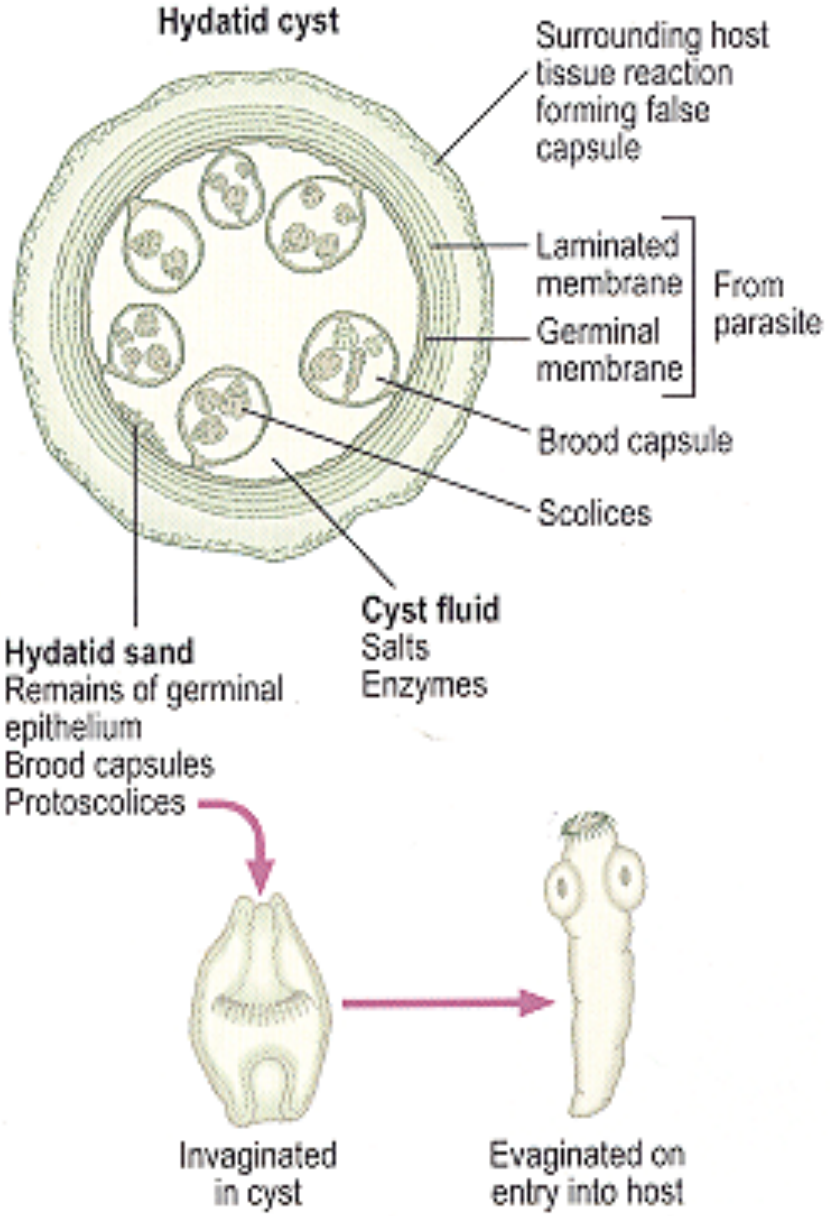
Hydatid cyst



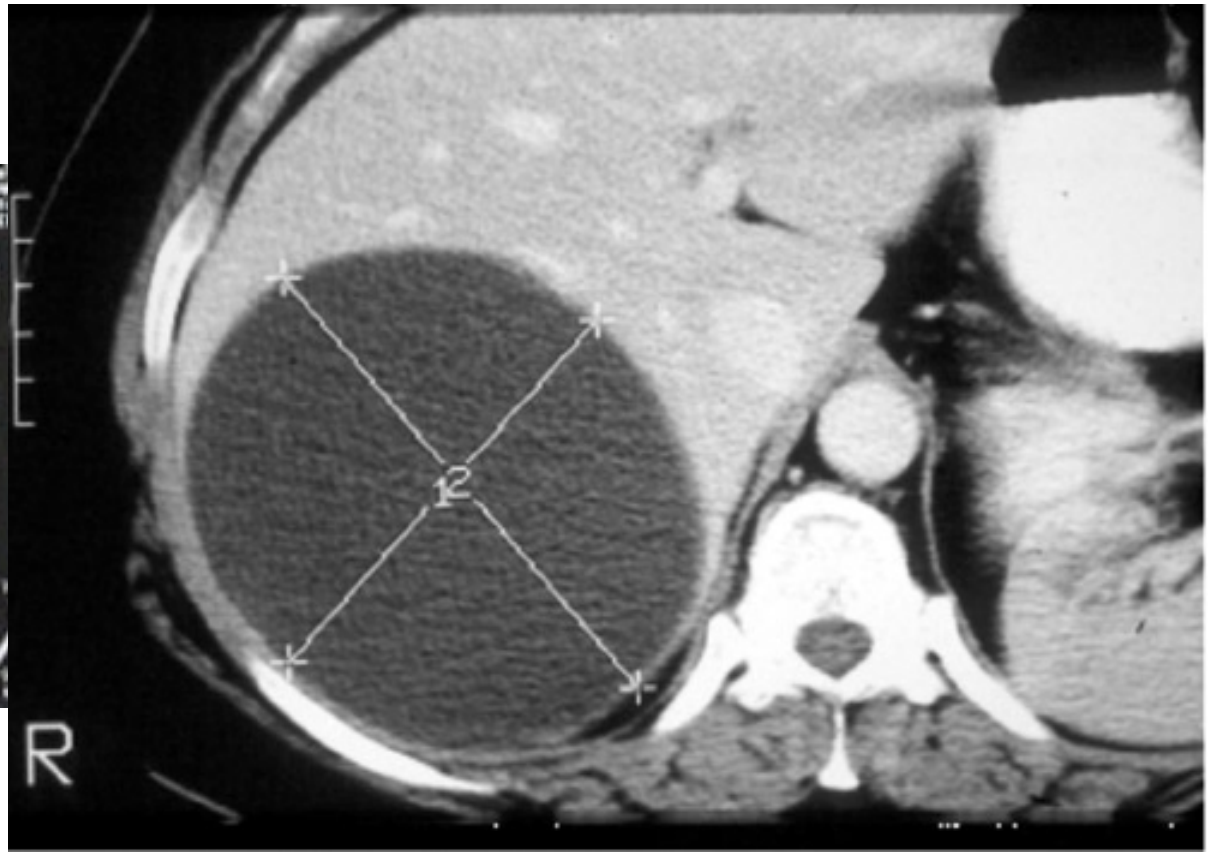


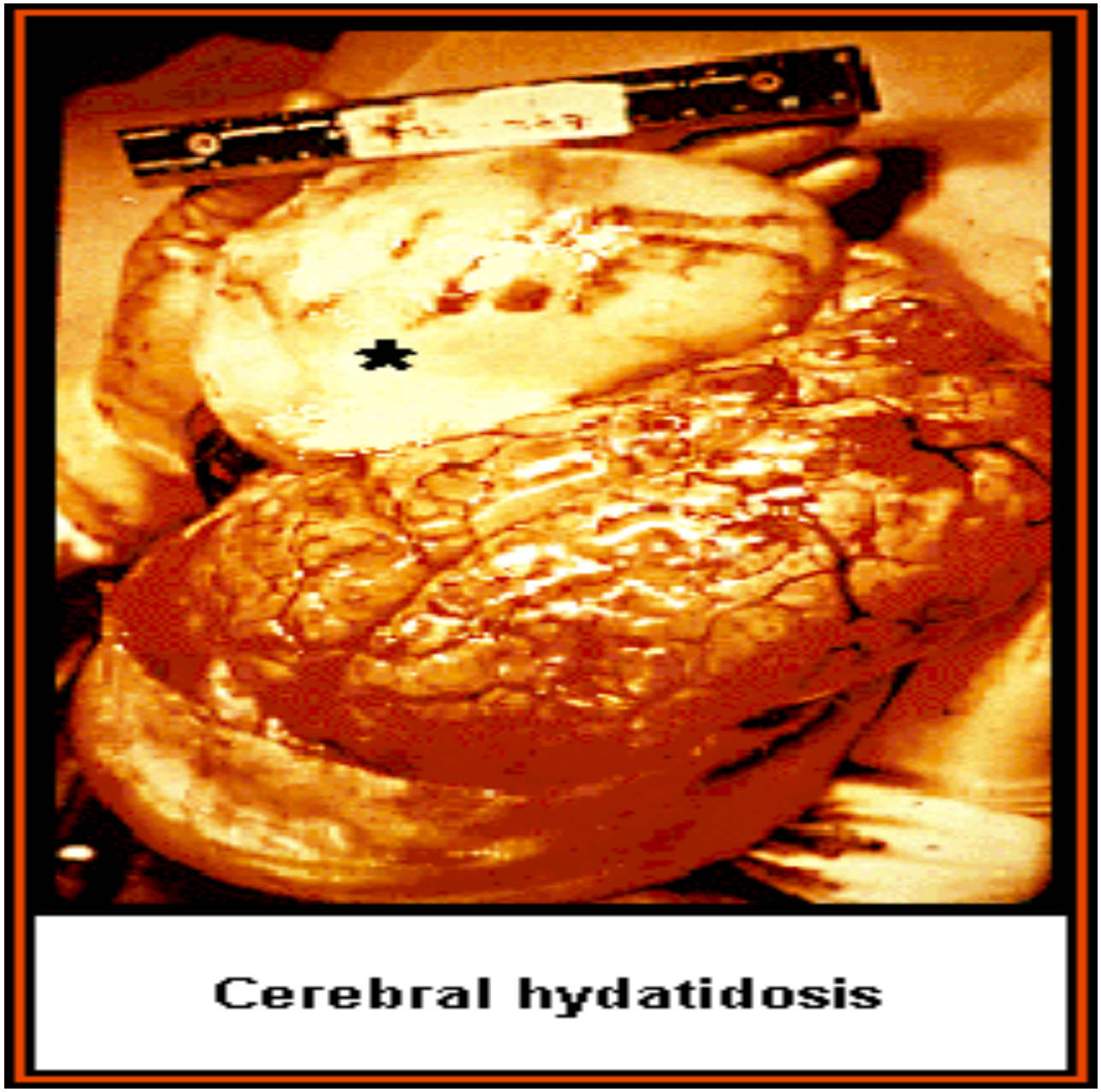
Hydatid cyst





Hydatid cyst





Cerebral hydatidosis

Diagnosis of Hydatid cyst

- Imaging : computed tomography (CT), magnetic resonance imaging (MRI) revealed a cystic swelling with smooth outline.
- Microscopy: hyadtid sand
- Serologic tests; to detect specific antibodies

Treatment of Tapeworms

- Intestinal stages: Praziquantel
- Tissue stages (Hydatid , cysticersosis):
  - Depends on clinical condition : Surgical and/or Albendazole

parasite	Transmission of infection	Location of adult in human	Location of cyst in human	Clinical picture	diagnosis
Taenia saginata	Eating undercooked beef meat contain cyst(larva)	Small in	No cyst or larva in human	Vague digestive discomfort	Eggs or gravid segments in stool (proglottidis)
Taenia solium	Eating undercooked pork meat (pig)	Small intestine	No cyst found.	Vague digestive discomfort	Eggs or gravid segment in stool (proglottidis)
Taenia solium	Eating **eggs** in food contaminate with human feces.	No adult in human	Cyst (cysticercosis) especially in the brain and eyes.	Depending on location of the cyst in brain can lead to epilepsy In eye blindness	X-ray MRI CT scan Serology.
Echinochoccus granulosa	Eating **eggs** in food contaminate with dogs feces	NO adult in human	Hydatid cyst in liver and lung can be fatal .	Depending on location of the cyst can be fatal.	X- rat MRI CT scan Serology