Medical Biology

1st Stage

Lab 14

Helminthology
‘Nematodes’

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Helminthology, :

- Helminths are multicellular eukaryotic organisms resembling worm-like bilaterally symmetrical shape with length ranging from few millimeters to several meters.
- They are found in **adult**, **larvae** and **egg** forms with adults being separate sexes (male and female) and some may be hermaphroditic (producing male and female gametes)

Helminths

- Phylum-Platyhelminthes (Flat worms) (flukes, tapeworms etc.)
  - Class-Cestoda (Tape worms)
  - Class-Trematoda (Flukes)
    - Sub-Class Monogenea
    - Sub-Class Aspidogastrea
    - Sub-class Digenea
- Phylum- Nemathelminthes (Round worms) (round worms and their relatives).
  - Class-Nematoda

Nematodes (Round worms) General characteristics:

1. Non-segmented cylindrical worms.
2. The body is covered with a **cuticle** layer for protection.
3. The sexes are separated with males being much smaller than females and have curled posterior ends.
4. The life cycle consists of adult form, larval form and . eggs.
5. Many species of nematodes infect human most importantly:
   - *Ascaris lumbricoides*
   - *Ancylostoma duodenale*
   - *Enterobius vermicularis*

***Ascaris lumbricoides* (Intestinal roundworms)**

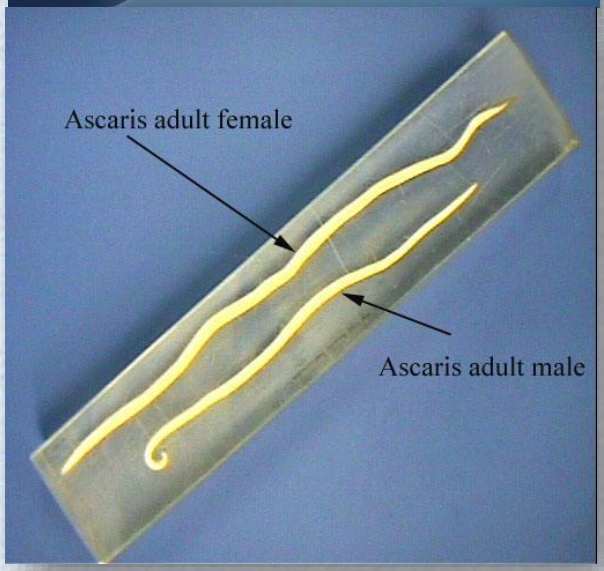
General Characteristics:

1. It is the largest and most common parasitic roundworm infecting human,
2. Belongs to the phylum Nematoda.
3. It causes the disease **ascariasis**.
4. The adult worms live in the **small intestine** of infected person.
5. The digestive tract is complete with prominent muscular pharynx and mouth with three lips.
6. Respiration is achieved by simple diffusion across body wall.
7. The life cycle consists of the adults, eggs and four larval stages (L1 – L4).

Adult morphology

Male :2-4 mm in diameter and 15-31 cm in length.

Female: 3- 6 mm wide and 20-35 cm in length.



Egg morphology

Ascaris lumbricoides eggs are extremely resistant to strong chemical, desiccation, and low temperature. The eggs can remain viable in the soil for several months or even years. Fertilized eggs are oval to round and are 45-75 micrometers long and 35-50 micrometers wide with a **thick outer shell**. Female lays around 200,000 eggs / day.

*Fertilized egg → embryonated egg → larvae → adult.

Unfertilized egg → no further development, they degenerate but they aid in **diagnosis of infection.

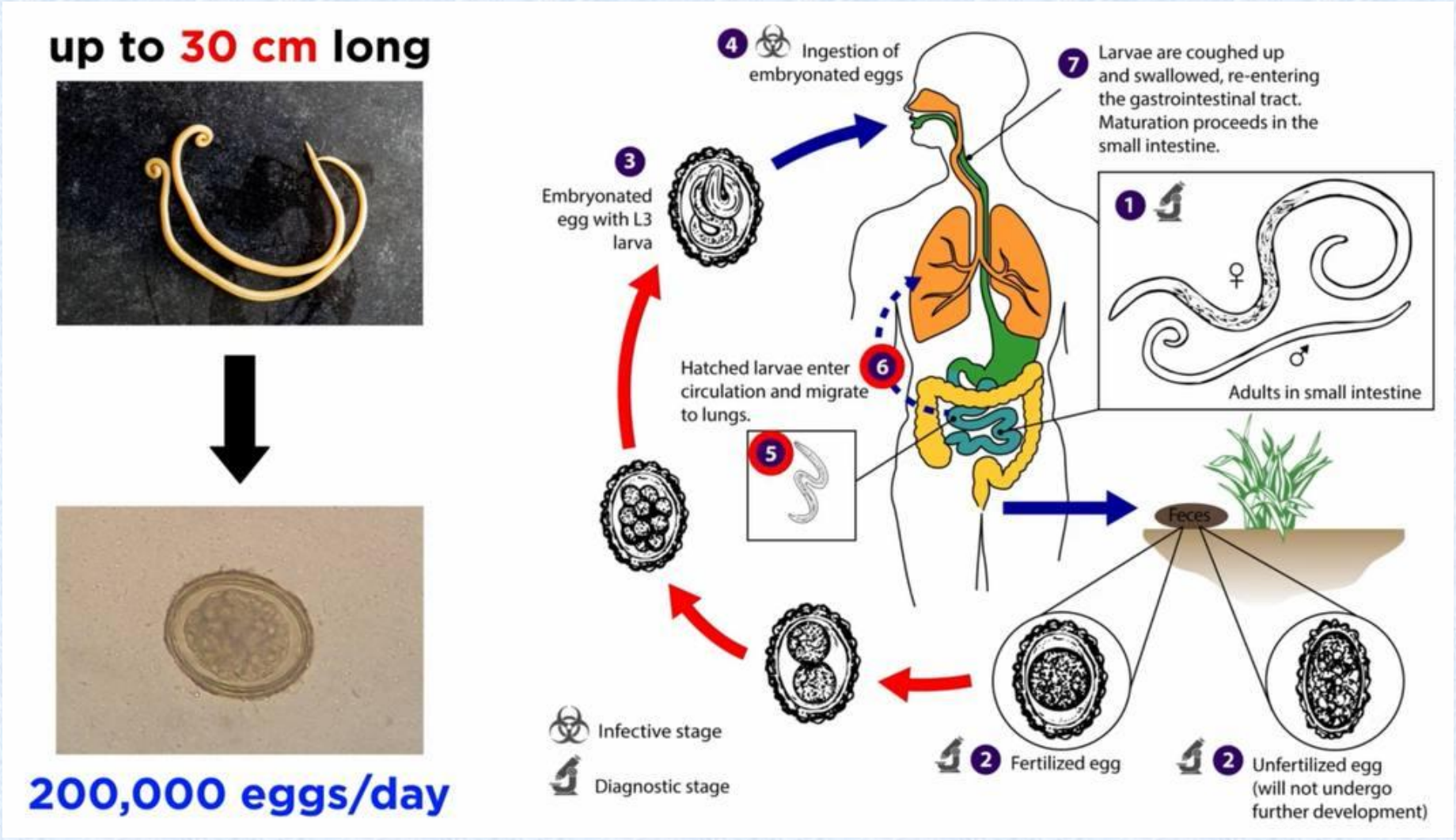
(a)

(b)

a) Fertilized egg of *Ascaris lumbricoides* (roundworm),
b) Unfertilized egg of *Ascaris lumbricoides* (roundworm),

Life cycle simplified

Infective stage: Embryonated eggs containing the L2 larvae.



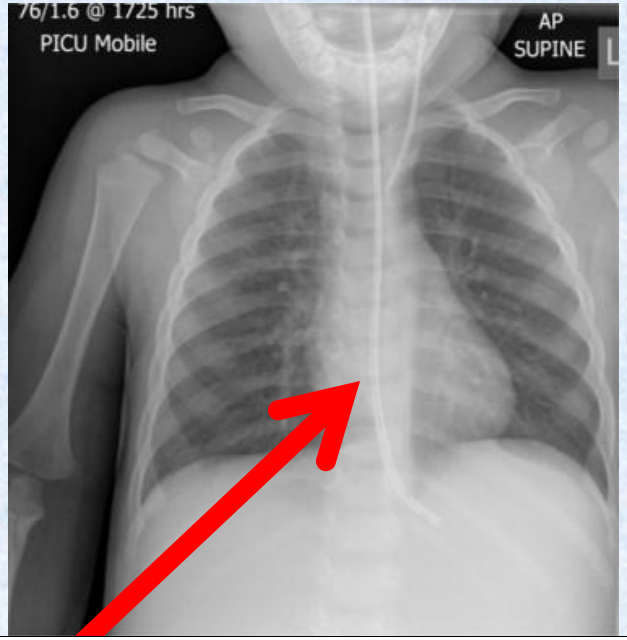
- ***Laboratory diagnosis***

1. Most diagnosis are made by feces (stool) examination and identifying the appearance of:

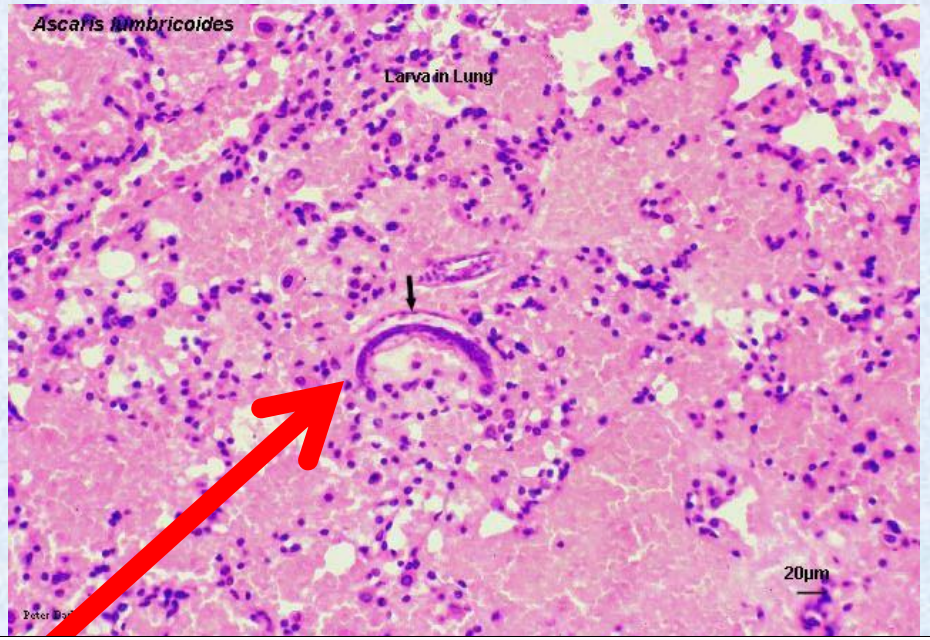
    a. The adult worm.
    b. Fertilized egg.
    c. Unfertilized eggs.

2. Detection of larvae in gastric or respiratory secretions in pulmonary disease .
3. Detection of adult worm in chest X-ray (Trolley car lines).
4. Antibody detection in serum.

Laboratory diagnosis of A. lumbricoides



Adult *A. lumbricoides* in lung of a child



***A. Lumbricoides* larvae in lung**

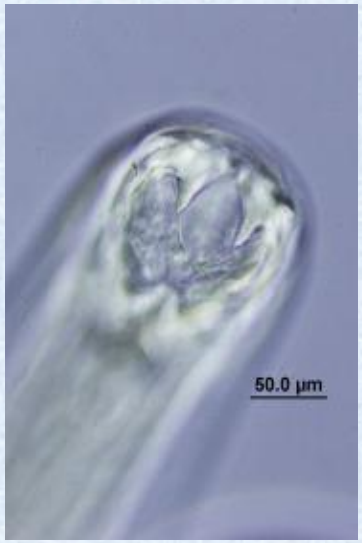
Ancylostoma duodenale

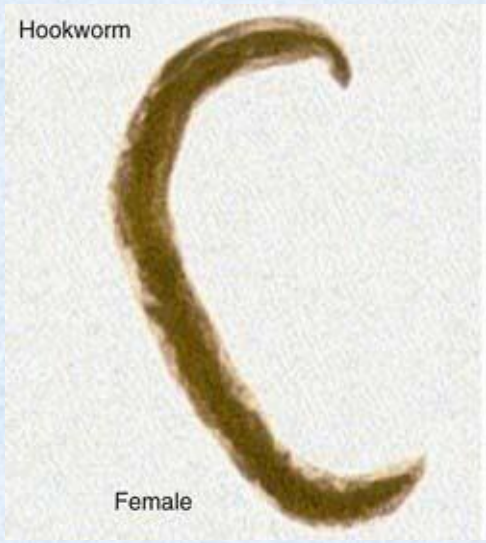
- **Disease**: Intestinal hookworm infection
- **Infective stage**: larvae L3 from the environment

** The hatched **rhabditiform** (non-infective) larvae grow in the feces or soil for 5 to 10 days and mature into **filariform** (infective) larvae

Adults:

- They possess well-developed mouths with two pairs of teeth (hook).
- Males measure approximately one centimeter by 0.5 millimeter.
- Females often longer and stouter, 9-13 mm
- Life span of female 3 4 years

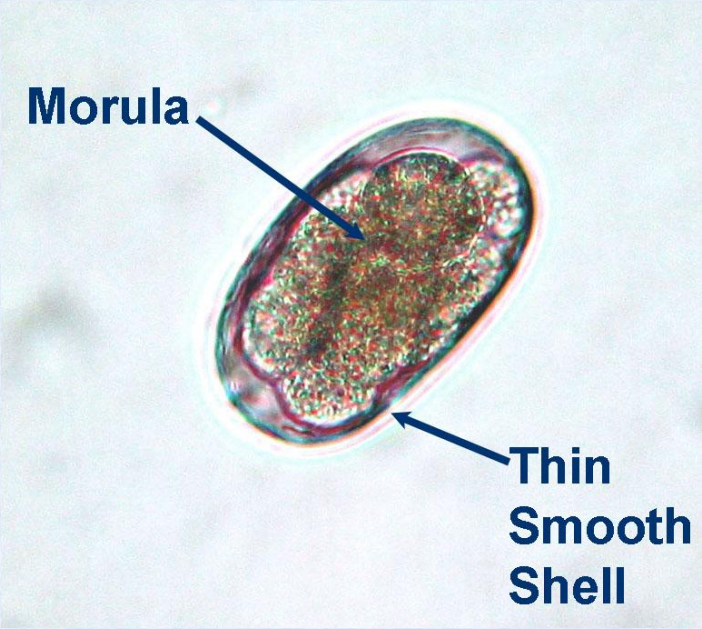




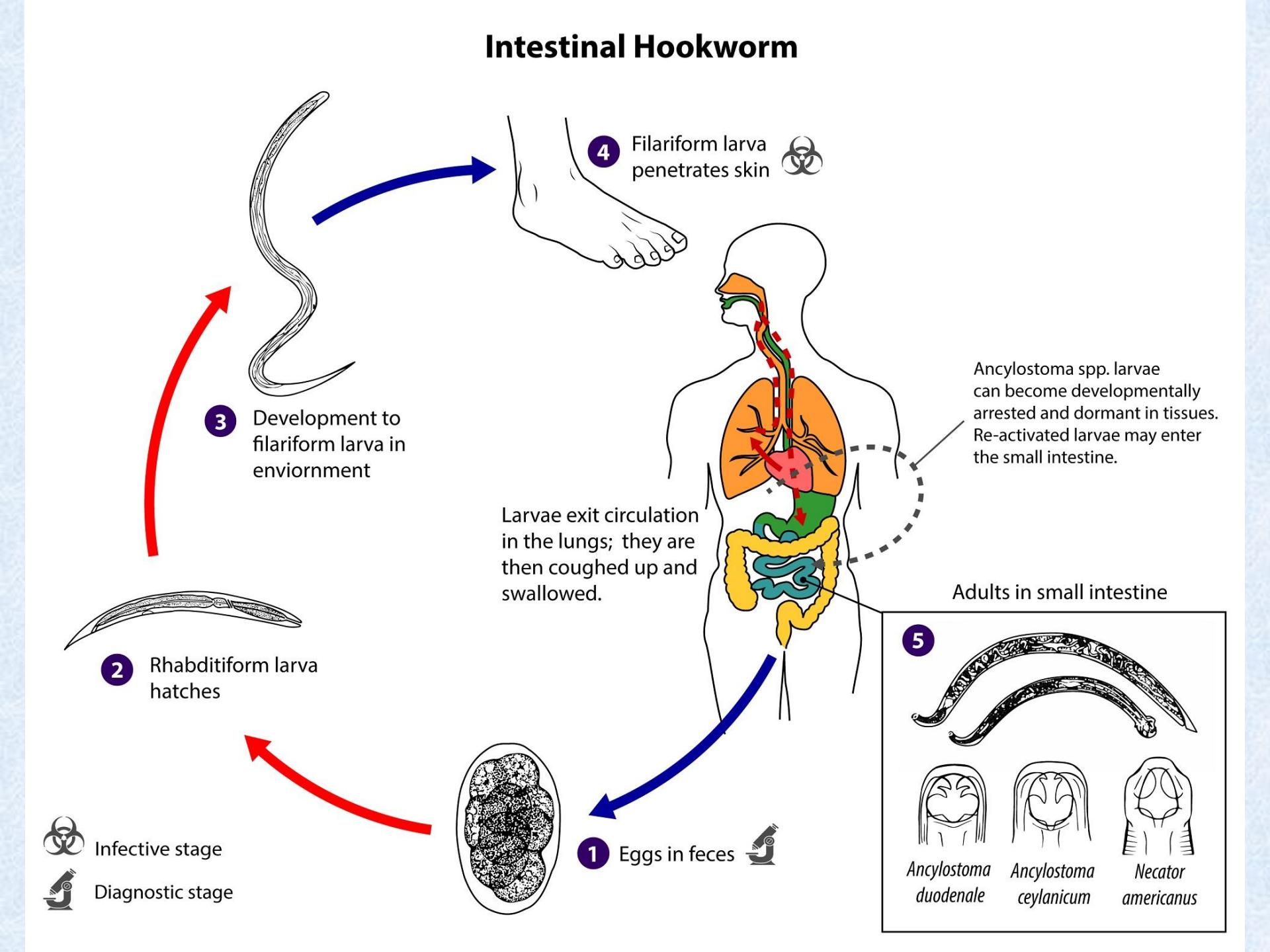
Ancylostoma duodenale

Adults in intestinal mucosa

- **Eggs**
- females laying from 10,000 to 30,000 eggs per day
- eggs are oval or elliptical, measuring 60 by 40 μm, colorless, and with a thin transparent hyaline shell membrane.
- Each egg contains a few cells grouped together “morula”
- the eggs with single ovum develop in the intestine, then passed in feces having a segmented ovum with 4 to 8 blastomeres.
- Eggs → hatch in the environment into L1 → L2 → L3 ready to penetrate human skin



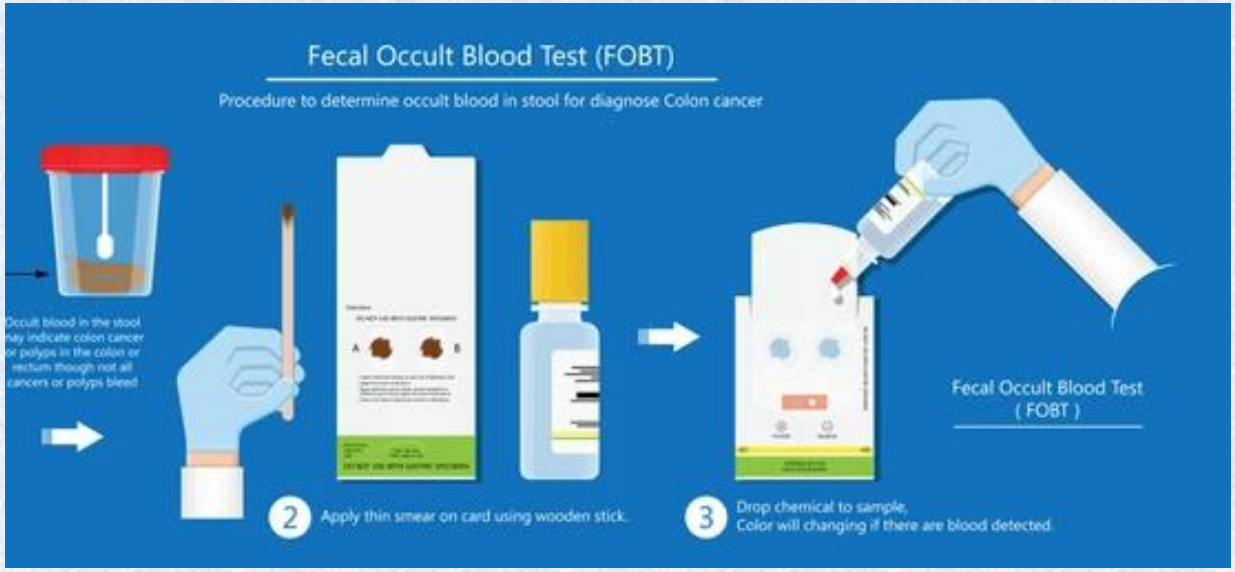
Intestinal Hookworm



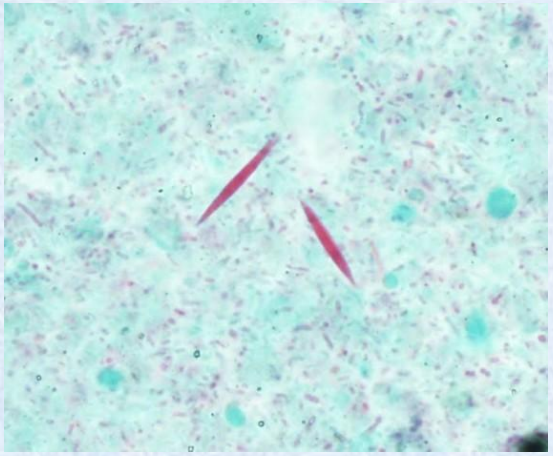
- **Lab diagnosis**
- Microscopy
- Wet mount
- Fecal egg count Adult female hookworms produce 2,500 5,000 eggs/day
- •>2000 eggs/ml in women and > 5,ooo eggs/ml in males -----> Anemia
- Aspiration of duodenal contents by Ryle’s tube
- Adult worms in stool

INDIRECT METHODS :

1. Blood tests and peripheral blood film (PBF) shows microcytic, hypochromic anemia and eosinophilia.
2. Stool examination like fecal occult blood test (FOBT) which checks for blood in stool indicating digestive tract bleeding
3. Charcot Leyden crystals, microscopic crystals composed of eosinophil protein galectin-10

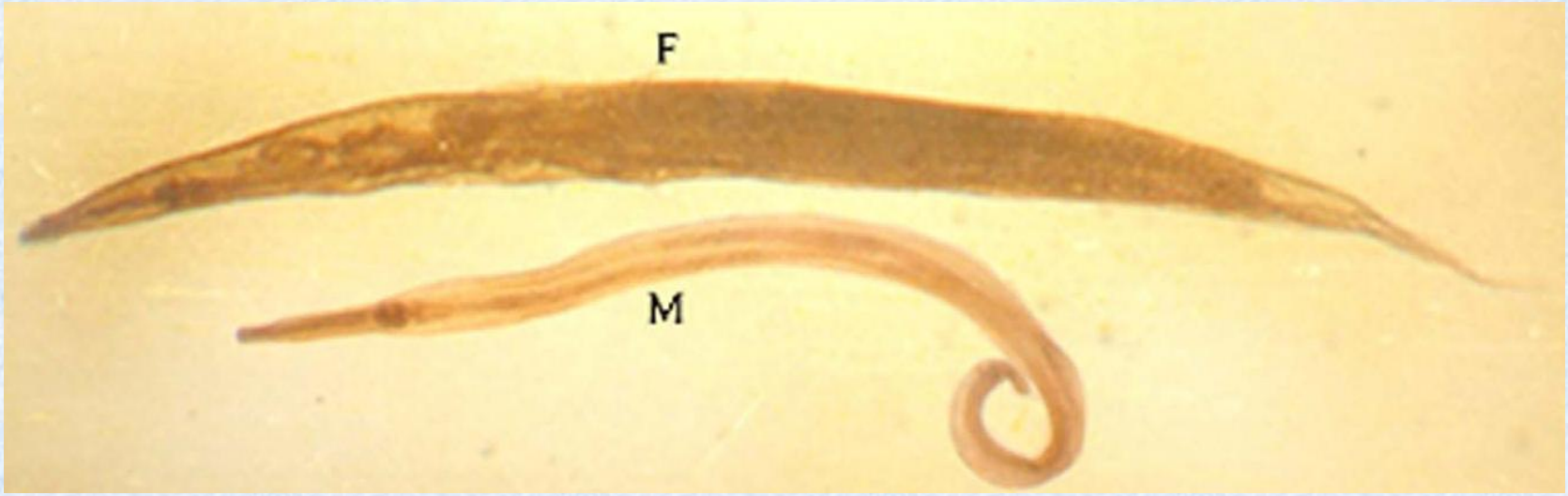


fecal occult blood test (FOBT)



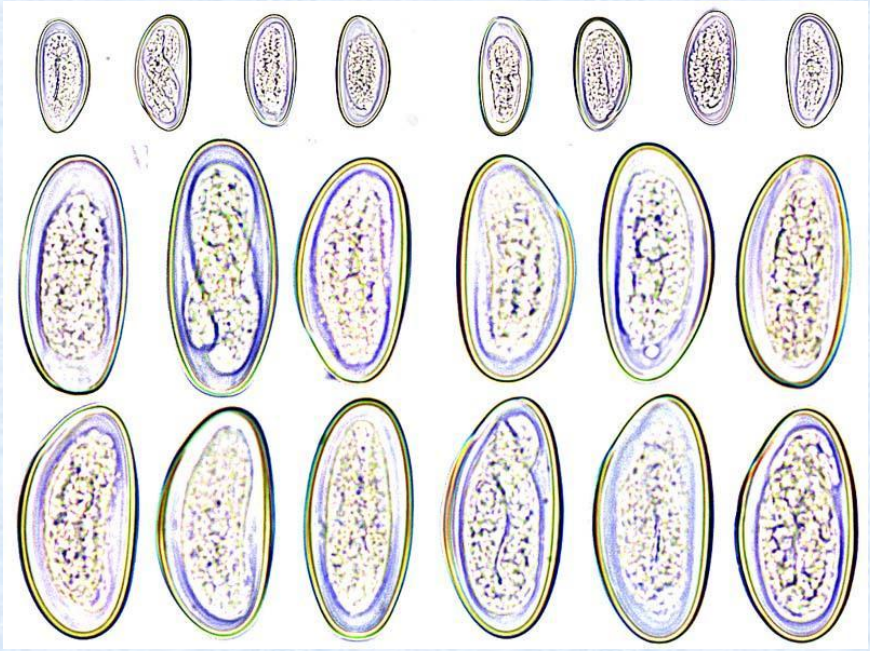
Charcot Leyden crystals

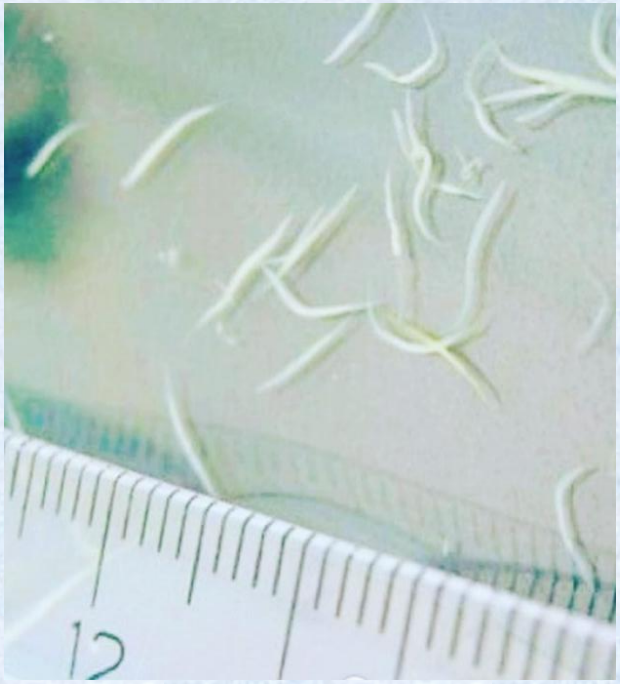
- ***Enterobius vermicularis* - the pinworm**
- •Transmission is direct, person-to-person.
- •Egg is infective immediately or within hours of being shed by the female.
- •Humans are the only known host. Dogs and cats are not infected.
- •*E. vermicularis* is Adults inhabit in cecum ,colon and ileum.



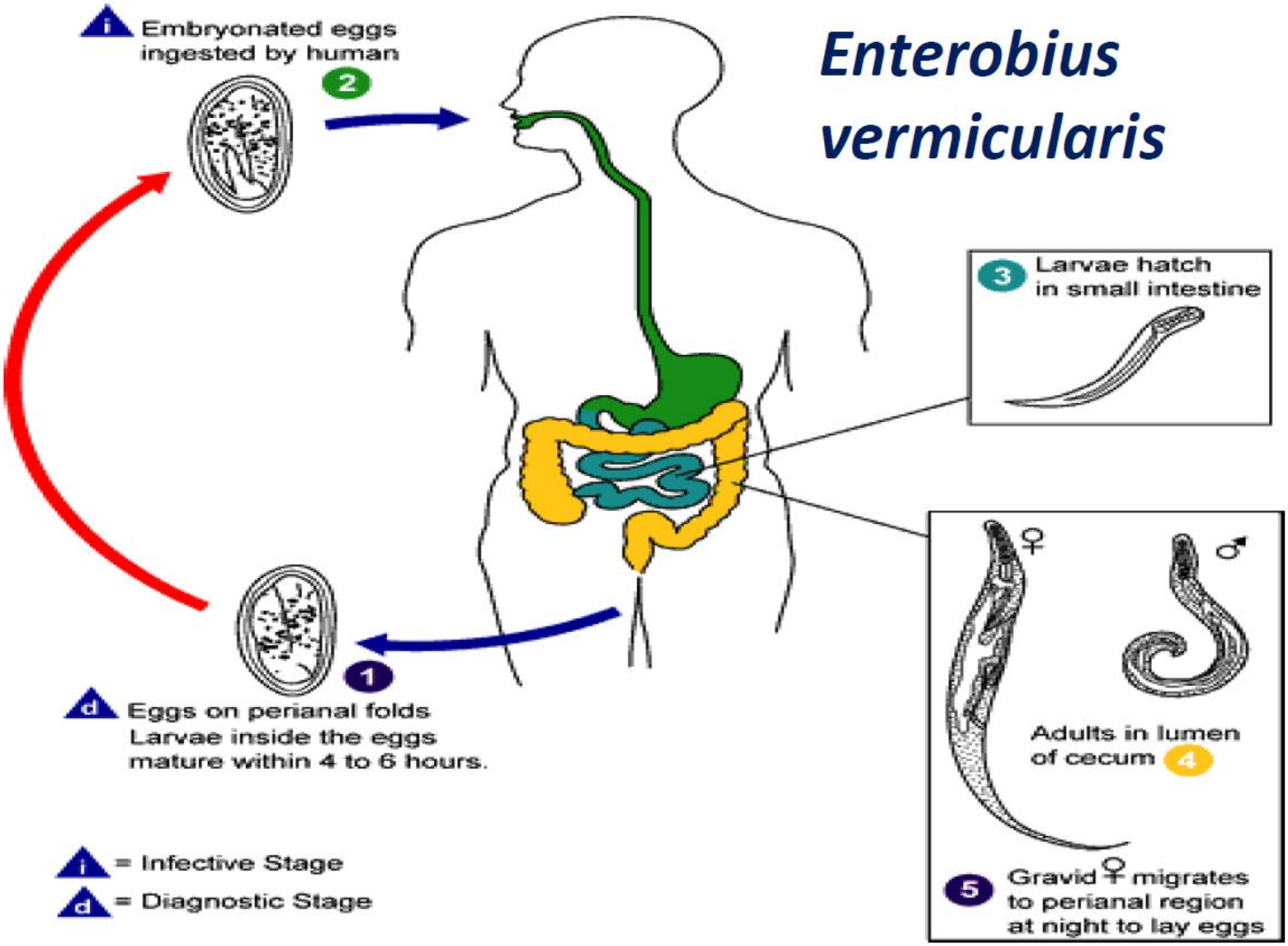
- Adults
- female: creamy white, ~ 8-13 mm long, with sharply pointed tails; Wing-like flaps (cervical alae) at head end.
- Male: small (2-5 mm) with strongly curved posterior.

- •Eggs - 50 to 60 x 20 to 32 microns, broadly oval, and flattened on one side. Compressed laterally; Normally are embryonated (contain a larva).





Enterobius vermicularis



- Laboratory Diagnosis

- Microscopic identification of eggs collected in the perianal area by cellophane (Graham Scotch) tape method or anal swabs. This must be done in the morning, before defecation and washing

Thank You