2nd stage / Medical Laboratory Technology

Class

Nematoda

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Phylum: Nemathelminthes

Classe : Nematoda (cylindrical worms)

General characters

- Nematodes are elongated, cylindrical, unsegmented worms with tapering ends.
- The name ‘nematode’ means‘thread-like’, from *nema*, thread. They are bilaterally symmetrical, with a secondary triradiate symmetry at the anterior end.
- The adults vary greatly in size, from about a millimeter to a meter in length.
- The body cavity is a pseudocoele in which all the viscera are suspended.
- The digestive system consists of the anteriorly mouth, leading to the oesophagus which characteristically varies in shape and structure in different groups.
- Nematodes have simple excretory and nervous systems.
- The sexes are separate. The male reproductive system consists of a single delicate tubule differentiated into testis, vas deferens, seminal vesicle and ejaculatory duct which opens into the cloaca.
- The female reproductive system consists of the ovary, oviduct, seminal receptacle, uterus and vagina.

- Nematodes may produce eggs (oviparous) or larvae (viviparous). Some lay eggs containing larvae which immediately hatch out (ovoviviparous).
- The life cycle consists typically of four larval stages and the adult form. The cuticle is shed in passing from one stage to another.
- Unlike trematodes and cestodes, all of which are parasitic, most nematodes are free-living forms found in soil and water. Several species are parasites of plants, of great economic importance.

Egg

Adult (male and female)

Round worm

Ascaris lumbricoides

Ascaris lumbricoides

- It’s the largest nematode (roundworm) parasitizing in the human intestine.
- Name as giant intestinal round worms cause disease Ascariasis

Habitat

The adult worms live in the small intestines of infected persons.
Larva in lung.

Transmutation

- Mainly via ingestion of water or food contaminated with embryonated eggs.
- Children playing in contaminated soil may acquire the eggs from their hands.

Morphology

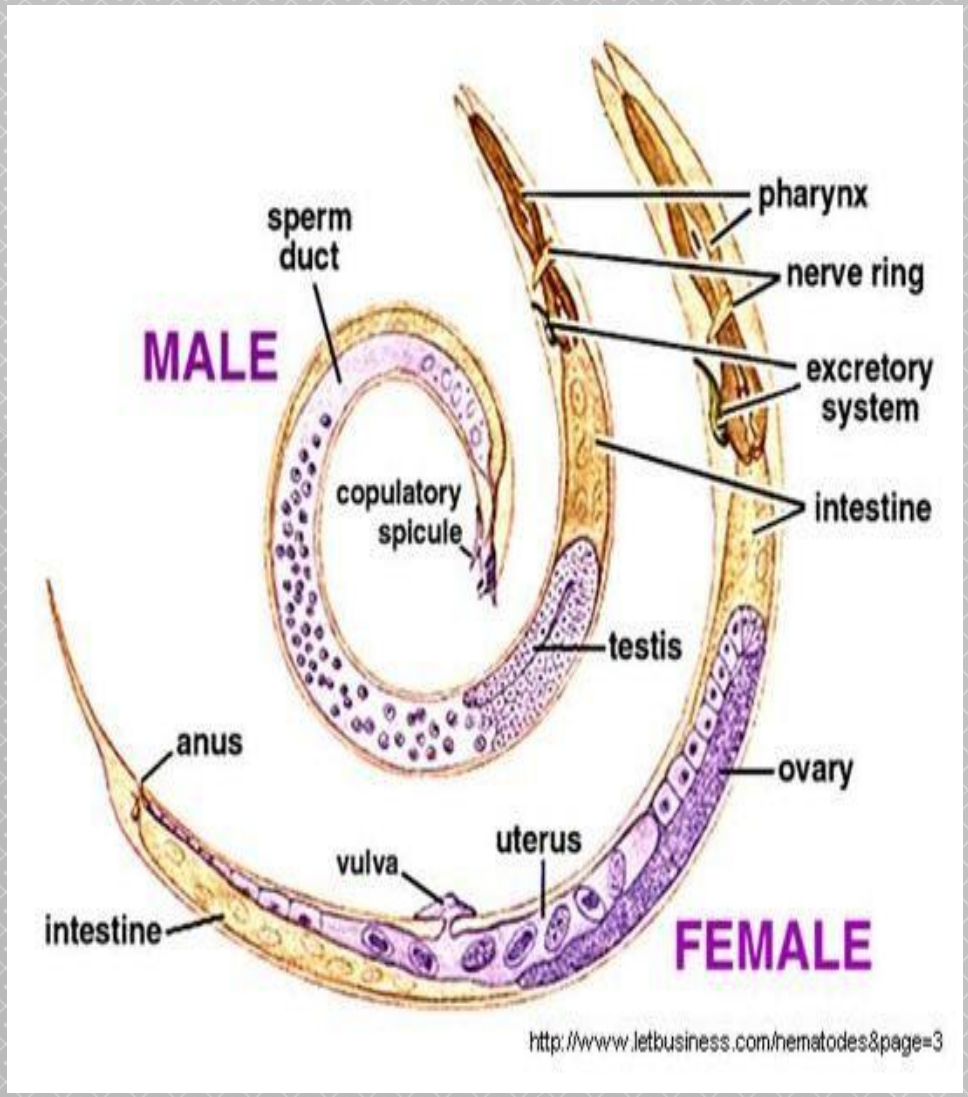
- They are large cylindrical worms, with tapering ends, the anterior end being more pointed than the posterior.
- They are pale pink or flesh coloured when freshly passed in stools, but become white outside the body.
- The mouth at the anterior end has three finely denticulate lips, one dorsal and two ventro-lateral.

Male

- The male measures 15 to 30 cm in length and 2 to 4 mm in thickness.
- Its posterior end is curved ventrally to form a hook and carries two copulatory spicules.

Female

- Female is larger, 20 to 40 cm long and 3 to 6 mm thick. Its posterior extremity is straight and conical.
- The vulva is situated middle thirds of the body and leads to a single vagina.
- The genital tubules of the gravid worm contain an enormous number of eggs as many as 27 million at a time. A single worm lays up to 200,000 eggs per day.



Eggs

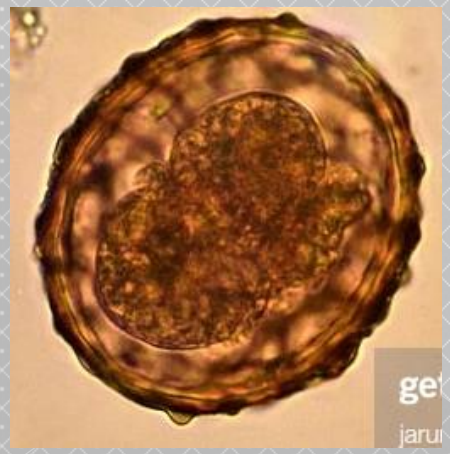
- Can survive for prolonged periods, its resistant to low temperatures and strong chemicals, but killed by boiling.
- Its can remain viable for up to 10 years, resistant to usual methods of chemical water purification,
- Eggs embryonate do not hatch until ingested by man

Morphology of Eggs

Two types of eggs are passed by the worms.

A- The fertilized eggs

- They are embryonated and develop into the infective eggs.
- is spherical or ovoid, bile stained to a golden brown colour.
- Measures 60 to 75 μm in length and 40 to 50 μm in breadth.
- Mammillated, have thick external layer



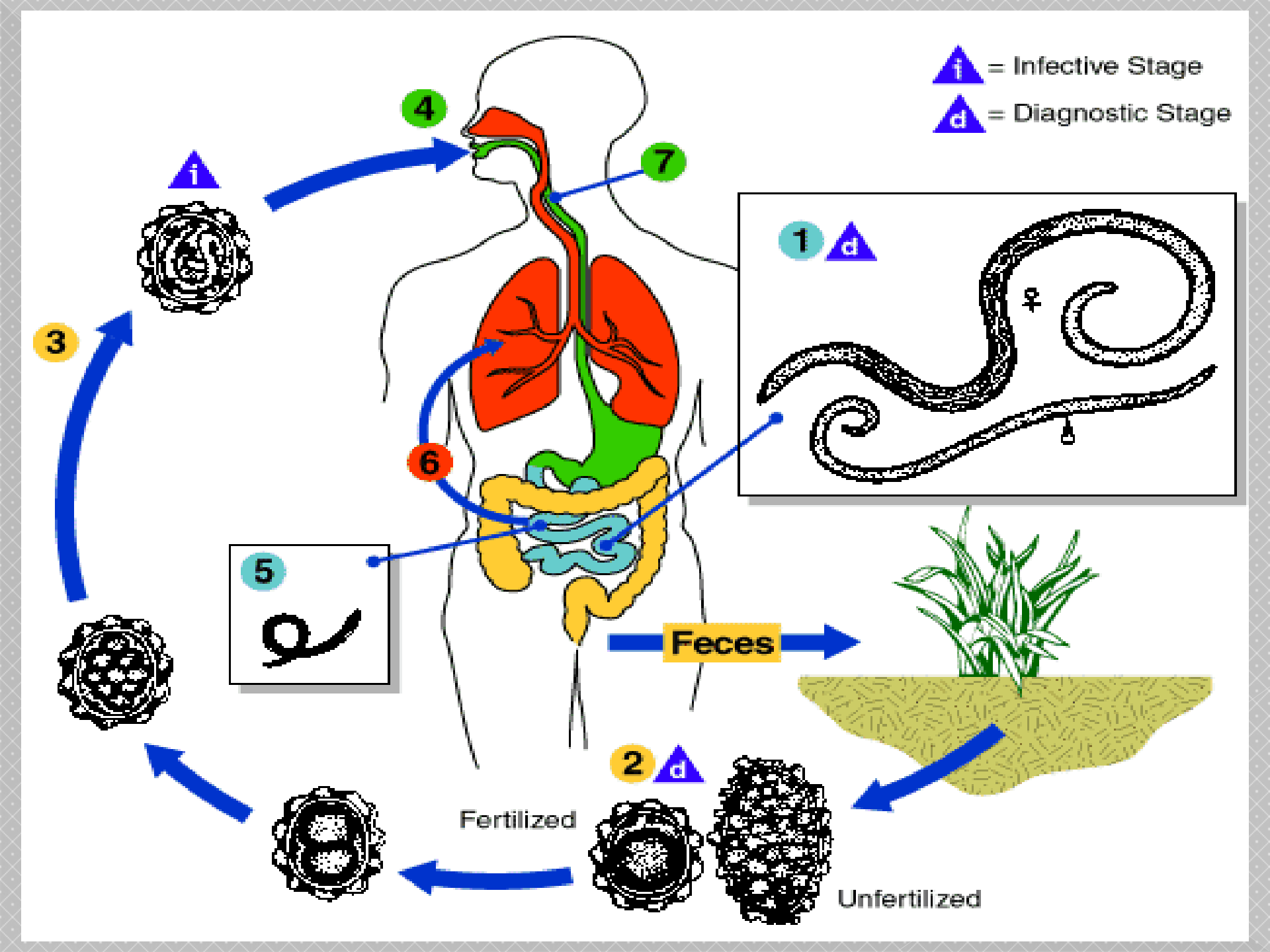
B- unfertilized eggs.

- They are non-embryonated and cannot become infective.
- Elongated and larger than fertilized egg.
- The shell is thinner with the outer mammillary coat scanty and irregular

Egg in soil depends on the nature of the soil and various environmental factors. A heavy clayey soil and moist shady location, with temperature between 20° and 30°C are optimal for rapid development of the embryo. The development usually takes from 10 to 40 days, during which time the embryo moults twice and becomes the infective **rhabditiform** larva, coiled up within the egg.

Life Cycle

- Female lay eggs in small intestine and shed in feces
- After 14 days L1 (**filariform**) larvae develop in eggs
- When the swallowed eggs reach the duodenum, the L2 (**rhabditiform**) larvae hatch out, and become actively motile. They penetrate the intestinal mucosa, enter the portal blood stream and migrate to the liver, heart and lungs in 10 to 15 days,
- the larvae pierce the lung capillaries and reach the alveoli, then carried up the respiratory passage to the throat and are swallowed.
- The larvae moult twice to become L4
- Then develop into adults in the upper part of the small intestine, and become sexually mature in about 6 to 12 weeks and repeat the cycle.
- The adult worm has a lifespan of 12 to 20 months.


i = Infective Stage
d = Diagnostic Stage
1 d
2 d
3
4
5
6
7
Feces
Fertilized
Unfertilized

Pathogenicity and clinical features

- Cause disease name as Ascariasis
- The pathogenicity can be caused by either the migrating larvae or the adult worms.

A- Migration of larvae

- The pathogenic effects of larval migration are due to allergic reaction and not the presence of larvae as such. Therefore, the initial exposure to larvae is usually asymptomatic, except when the larval load is very heavy .But when reinfection occurs subsequently there may be intense cellular reaction to the migrating larvae in the lungs

In the lungs

- Larve destroy capillaries in the lungs, causing hemorrage
- Heavy infections can lead to pools of blood which block air sace
- Migration of white blood cells lead to more congestion, this condition known as Ascaris pneumonitis (Loefflers pneumonia)
- Lung tissue destroyed and bacteria infections occur may be fatal.

B- Adult worm

- Overcrowding leads to wandering
- If worms migrate to stomach, acid irritates them leading to nausea, abdominal pain, and allergic reaction
- Penetration the intestine can lead to peritonitis which is often fatal.
- If worms migrate to lung, they can cause extensive damage and possible death.

Diagnosis

- Macroscopic examination by see the adults passed in stool or throat the mouth or nose.
- Detection larva stage in sputum.
- Demonstration of eggs in feces.

(Pinworm)

Enterobius vermicularis

Enterobius vermicularis

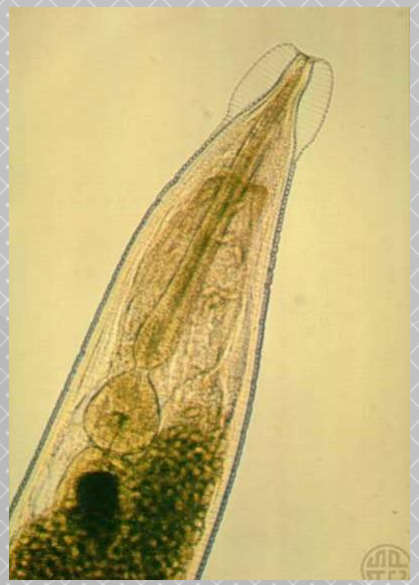
Morphology

- The adults are short, white, fusiform worms with pointed ends, looking like bits of white thread.
- The mouth is surrounded by three wing-like cuticular expansions (cervical alae) which are transversely striated.

Male

- The male is 2 to 5 mm long and 0.1 to 0.2 mm thick.
- Its posterior end is tightly curved and carries a prominent copulatory spicule.

Female



- The female is 8 to 13 mm long and 0.3 to 0.5 mm thick.
- Its posterior third is drawn into a thin pointed pin-like tail.
- The vulva is located just in front of the middle third of the body.
- In the gravid female, virtually the whole body is filled by the distended uteri carrying thousands of eggs.

Eggs

- The egg is colourless and not bile stained, elongated, ovoid. flattened on one side and convex on the other.
- measuring 50 to 60 μm by 20 to 30 μm, its shell is double layered and thick.
- The outer albuminous layer makes the eggs stick to each other and to clothing and other objects.
- Its contains coiled-like embryo which is fully formed, but becomes infectious only some 6 hours after being deposited on the skin.
- Under cool moist conditions, the egg remains viable for about 2 weeks.

Habitat

The adult worms live in the caecum, appendix and adjacent parts of the ascending colon

Transmutation

- Contaminated fingers
- **External autoinfection** from anus to mouth: when female lay eggs on the perianal area with fingers leads to the deposition of eggs under nails.
- **Internal autoinfection** from anus to colon: when eggs laid on the perianal skin immediately hatch into infective stage of larva then migration through the anus and develops into worms in the colon

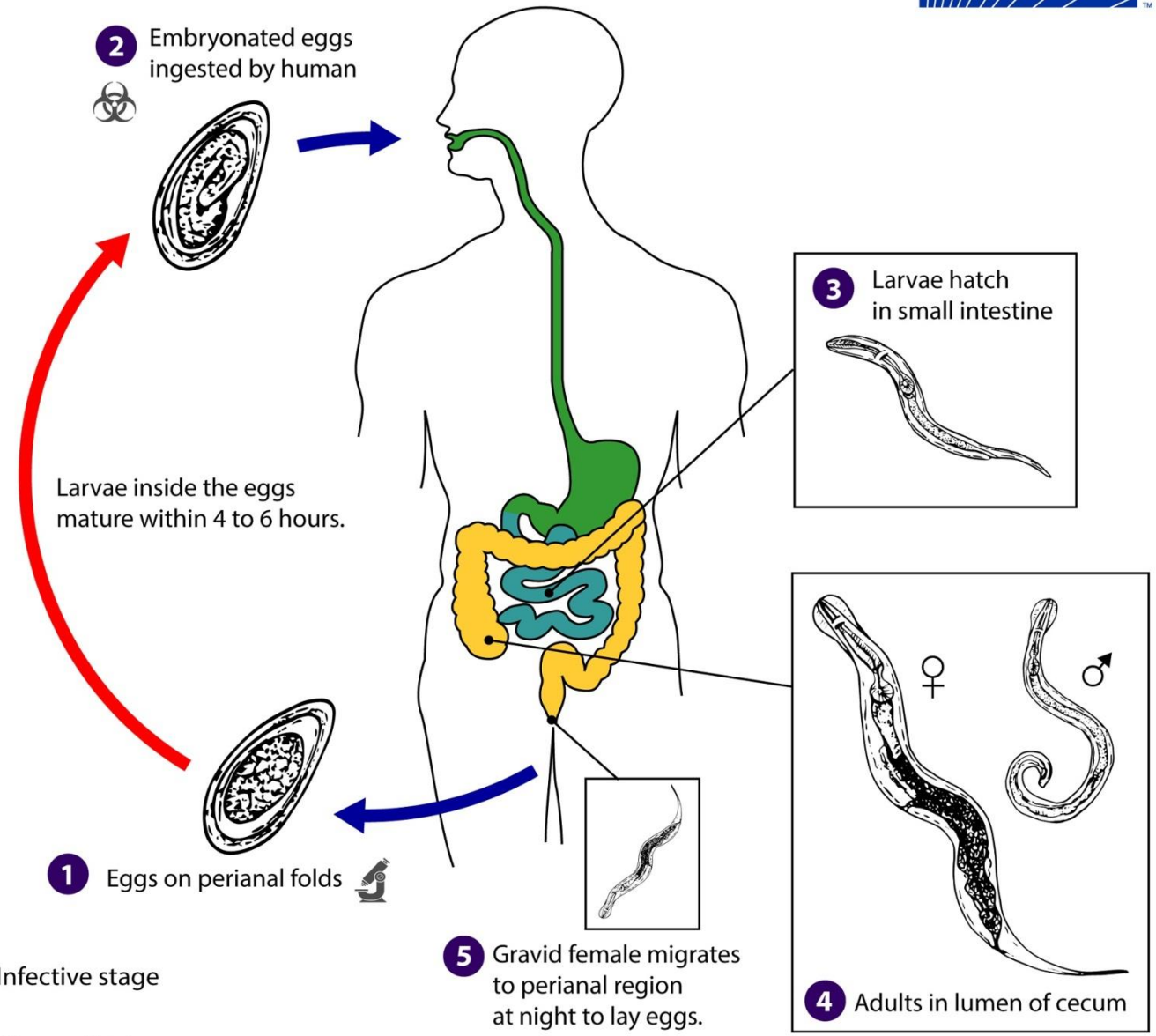
Life Cycle

- *E. vermicularis* is monoxenous, passing its entire life cycle in the human host. It has no intermediate host.
- The male is seldom seen as it does not migrate. It usually dies after mating and is passed in the feces.
- The gravid female migrates down the colon to the rectum at night and crawls about on the perineal skin to lay its sticky eggs. The worm may retreat into the anal canal and come out again to lay more eggs.
- A single worm lays from 5000 to 17,000 eggs, when the eggs are all laid, the worm dies or gets crushed by the host during scratching, the eggs, however, are only infrequently found in feces.
- When eggs containing infective larvae are swallowed, they hatch out in the intestine. They moult in the ileum and enter the caecum, where they mature into adults.
- It takes from 2 weeks to 2 months from the time the eggs are ingested, to the development of the gravid female, ready to lay eggs.

DPDx

Enterobius vermicularis

CDC



The clinical features

- Enterobiasis occurs mostly in children and most common in female than in males.
- About 3rd infection are asymptomatic
- Irritation and pruritus of the perianal area, when female crawls out of the anus to lay eggs, this leads to scratching and excoriation of the skin around the anus.
- As the worm migrates out at night, it disturbs sleep. Nocturnal enuresis is sometimes seen.
- The worm crawling into the vulva and vagina causes irritation and a mucous discharge. It may migrate up to the uterus, fallopian tubes.
- The worm is sometimes found in surgically removed appendix and has been claimed to be responsible for appendicitis.

Diagnosis

- Pinworm infestation can be suspected from the history of perianal pruritus.
- Diagnosis depends on the demonstration of the eggs or adult worms, but eggs are present in the feces only in a small proportion of patients and so feces examination is not useful in diagnosis.
- They are deposited in large numbers on the perianal and perineal skin at night and can be demonstrated in swabs collected from the sites early morning, before going to the toilet or bathing.
- The beast method for collection of specimens is with **Scotch tape** (adhesive transparent cellophane tape) held sticky side out, The mounted tape is pressed against the anal margin, covering all sides. The tape is transferred to a glass slide, sticky side down, with a drop of toluene for clearing and examined under the microscope.
- The eggs may sometimes be demonstrated in the dirt collected from beneath the finger nails in infected children. The adult worms may sometimes be noticed on the