

Nematode = Roundworms

1- *Ascaris lumbricoides*



Description

1. Adults: largest intestinal nematode infecting humans,
2. Elongated, cylindrical body which tapers at both ends
3. creamy-colored **OR** pink tinge.
4. The integument is a chitinous layer of nonnucleated cuticula with circular striations.
5. Sexes are dioecious
6. some evidence suggests pheromones play a role in mating

Q: How can be differentiated between male and female of ascaris?

NO.	Male Ascaris	Female Ascaris
1.	Body is about 15-30 cm long.	They are longer (20-40 cm) than males.
2.	body is narrow.	body is wide.
3.	The posterior end is slightly tapering and curved downward or hooked	The posterior end is blunt and straight
4.	There is no separate genital aperture.	There is a separate mid-ventral genital aperture of vulva at about one third of the body from the anterior end.
5.	Two penial spicules or penial setae project from the cloacal aperture.	absent.
6.	There are pre-anal and post-anal papillae in front and behind the cloacal aperture.	There are no such papillae.
7.	During copulation, the male coils itself around the female.	During copulation, the female remains straight without coiling.
8.	Reproductive organ is represented by a single straight tube.	Reproductive organs are represented by two tubes present in a Y-shaped structure



Eggs of ascaris

There are three forms of eggs:

- 1. Fertilized eggs:** are golden brown in color and ovoid in shape, measuring 30-40 μm by 50-60 μm .
- 2. Decorticate egg** بيوض عديمة القشرة: if the thick, external mamillated layer is absent.
- 3. Unfertilized eggs** :are larger (reaching 90 μm in length) and more elongated in shape, have a thinner shell and are poorly organized internally, being a mass of variably sized granules.

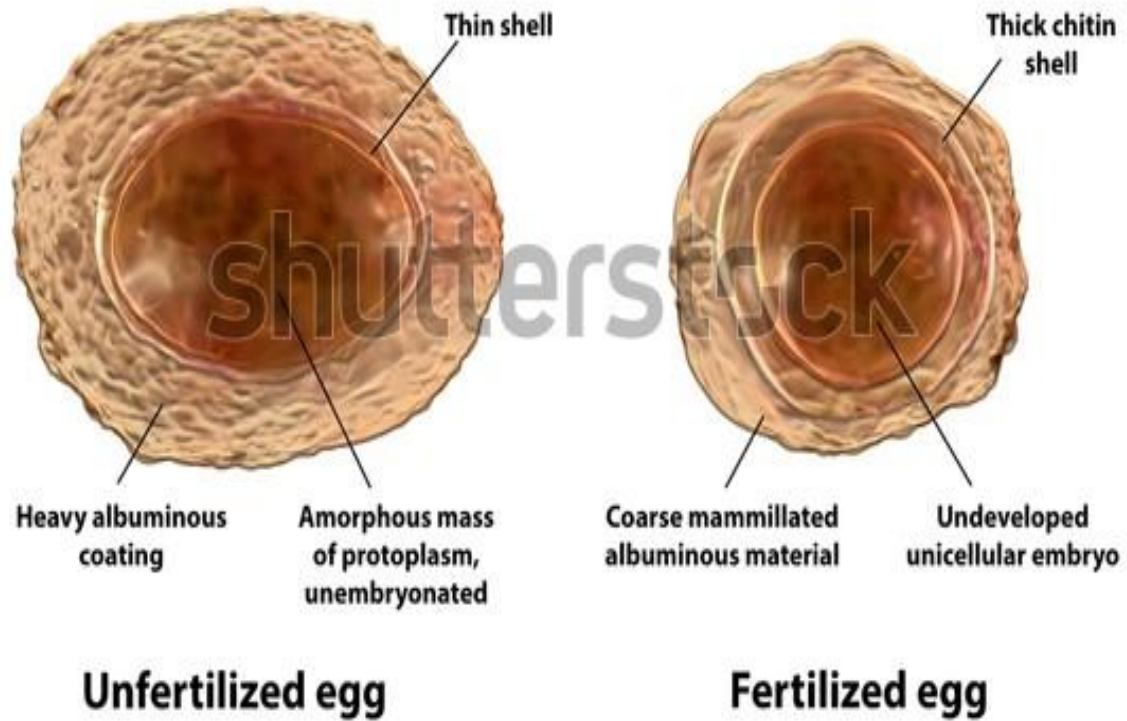
The eggs have a lipid layer which makes them resistant to the effects of acids and alkalis, as well as other chemicals. This resilience المرونة helps to explain why this nematode is such a ubiquitous كلية الوجود parasite.

Fertile eggs

Ascaris

- Typically golden brown color for mammilated eggs and clear for decorticated eggs
- Oval shaped or slightly rounded
- 45-75 μm X 30-50 μm
- Smooth, decorticated shell or bumpy, mammilated shell
- Shell has two layers, one thicker outer shell and one thinner inner shell
- Viable eggs have defined space between inner cells and outer shell

Ascaris lumbricoides eggs



Saline wet mount preparation of feces showing **fertilized but decorticated egg** of *Ascaris lumbricoides*

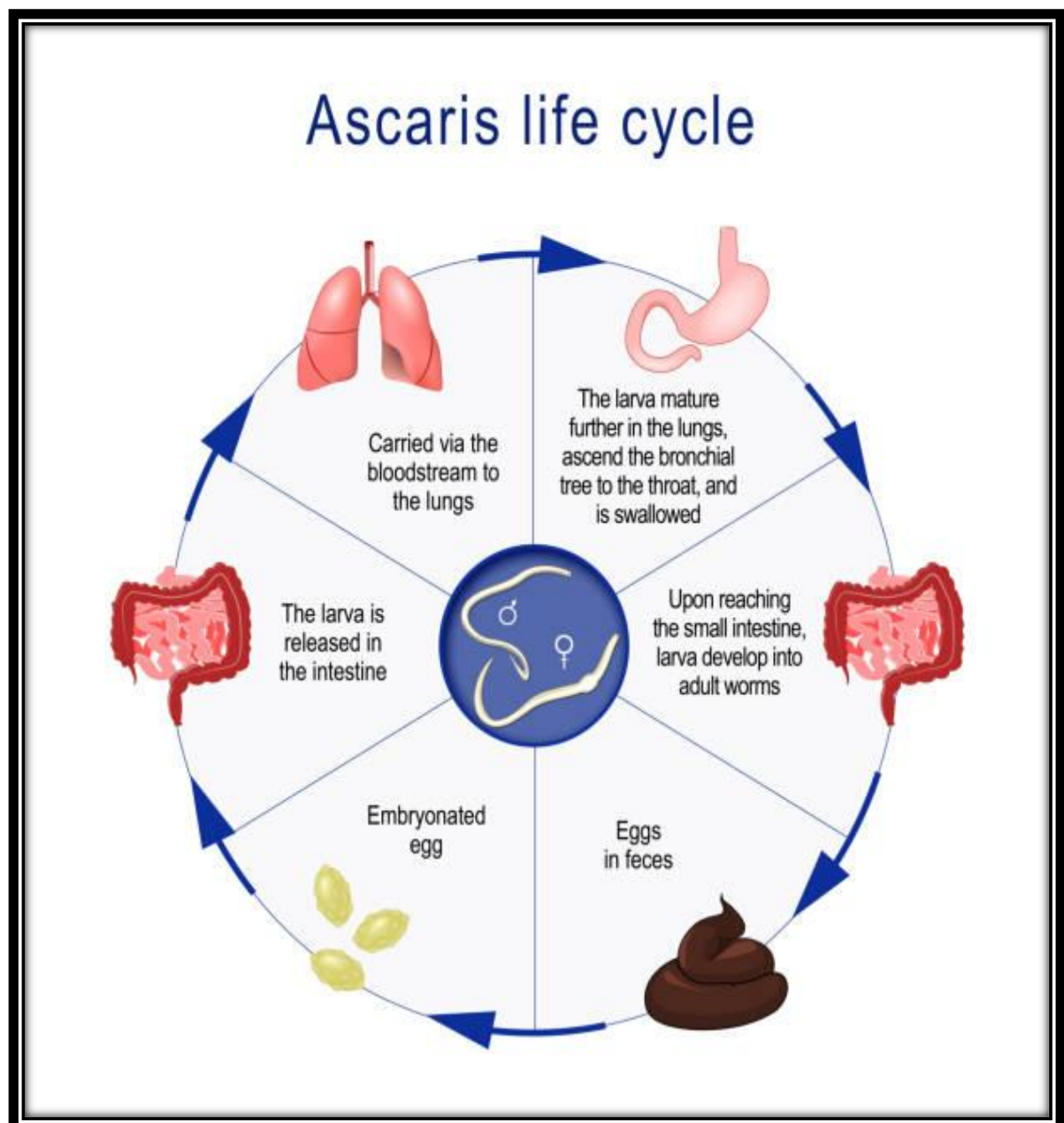
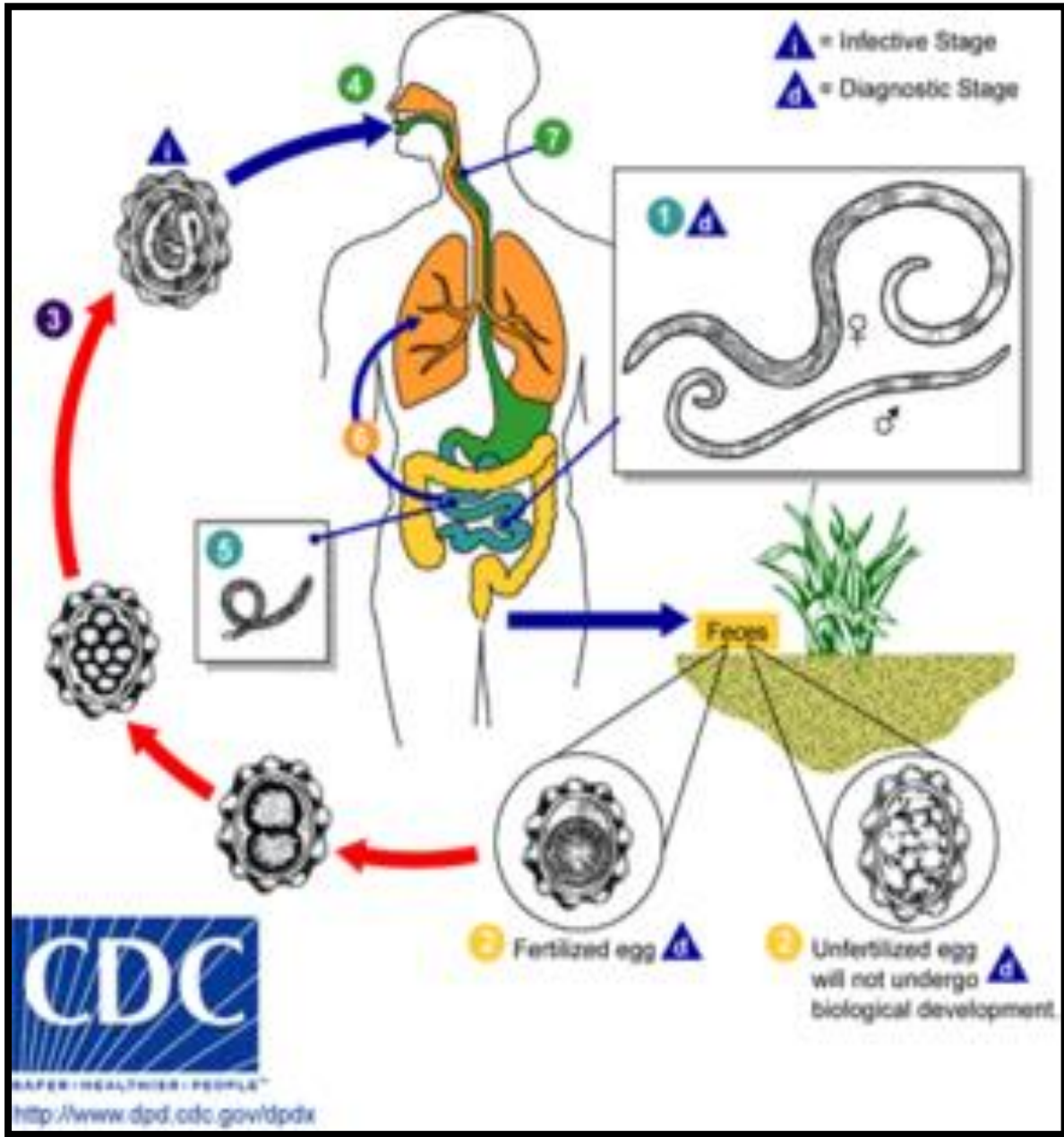
Life cycle

Infective stage: embryonated eggs with L3 larva.

Diagnostic stage: L3 larvae migrate in tissues.

In environment ... { Unembryonated eggs → embryonated egg → molt (L1) → (L2) → (L3) }

In human..... (egg contain L3) is ingested by human , larva hatches then penetrates the wall of the gastrointestinal tract and enters the blood stream → liver → heart → pulmonary circulation → alveoli → small intestine and matures into an adult worm until it emerges through the abdominal cavity.



Symptoms

1- Bloody sputum, cough, fever, abdominal discomfort, intestinal ulcer(s).

3- Ascariasis is the most common cause of [Loffler's syndrome](#) worldwide. Accompanying [مرافقة](#) pathological symptoms include pulmonary infiltration, eosinophilia.

Diagnosis

1- The diagnosis is usually incidental when the host passes a worm in the stool or vomit.

2- The eggs can be seen in a smear of fresh feces examined on a glass slide under a microscope and there are various techniques to concentrate them first or increase their visibility, such as the ether sedimentation method or the [Kato technique](#). **The eggs have a characteristic shape: they are oval with a thick, mamillated shell قشرة مملوءة (covered with rounded mounds or lumps مقطوع او مستدير تشبه تل), measuring 35-50 micrometer in diameter and 40–70 in length.**

3- [X-ray](#)

Treatment = Medications

1- [Albendazole](#), [Mebendazole](#), [Levamisole](#)

2- [Pyrantel pamoate](#)

3- **Surgery:** In cases of [bowel obstruction](#)



2- Toxocara

Disease:- Toxocariasis

Infective stage: embryonated eggs with L3 larva.

Diagnostic stage: L3 larvae migrate in tissues.

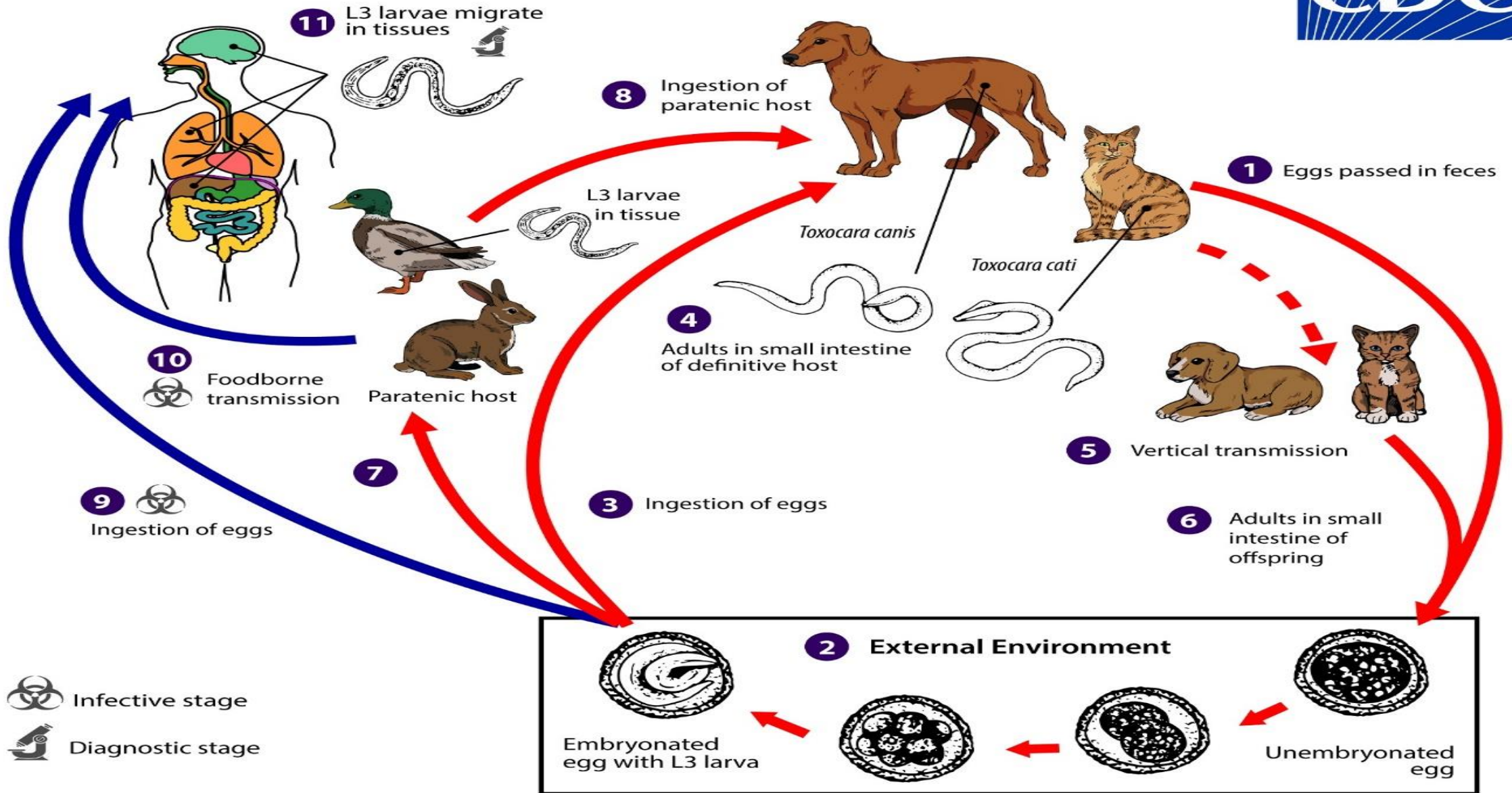
1- Humans illness caused by larvae (immature worms) of either the dog roundworm (*Toxocara canis*), the cat roundworm (*Toxocara cati*)

2- Toxocariasis is often called visceral larva migrants (VLM). Depending on geographic location, degree of eosinophilia, eye and/or pulmonary signs, the terms [ocular larva migrants (OLM), Weingarten's disease, Frimodt-Møller's syndrome, and eosinophilic pseudo-leukemia] are applied to toxocariasis.

3- This zoonotic, helminthic infection is a rare cause of blindness rheumatic داء المفاصل, neurologic, or asthmatic ربو symptoms.

Life cycle

Humans are { accidental hosts } who become { infected by ingesting embryonated infective eggs containing third-stage (L3) larvae or undercooked meat/viscera of infected paratenic hosts birds.} After ingestion,{ the eggs hatch and larvae penetrate the intestinal wall and carry by the circulation to a variety of tissues (liver, heart, lungs, brain, muscle, eyes)}. While the{larvae do not undergo any further development in these sites }, they can { cause local reactions and mechanical damage } that causes clinical toxocariasis.



Diagnosis

- 1- [PCR](#), [ELISA](#), and [serological testing](#) are more commonly used to diagnose *Toxocara* infection. Serological tests are dependent on the number of larvae within the patient, and are unfortunately not very specific.
- 2- [OLM](#) is often diagnosed after a clinical examination. Granulomas can be found throughout the body and can be visualized using **ultrasound, MRI, and CT technologies**.

Treatment

- 1- Corticosteroids in severe cases of VLM or OLM.
- 2- [Albendazole](#) or [mebendazole](#), [tiabendazole](#) or [diethylcarbamazine](#).
- 3- Anti-helminthic therapy is reserved for severe infections (lungs, brain).
- 4- Granulomas can be surgically removed.

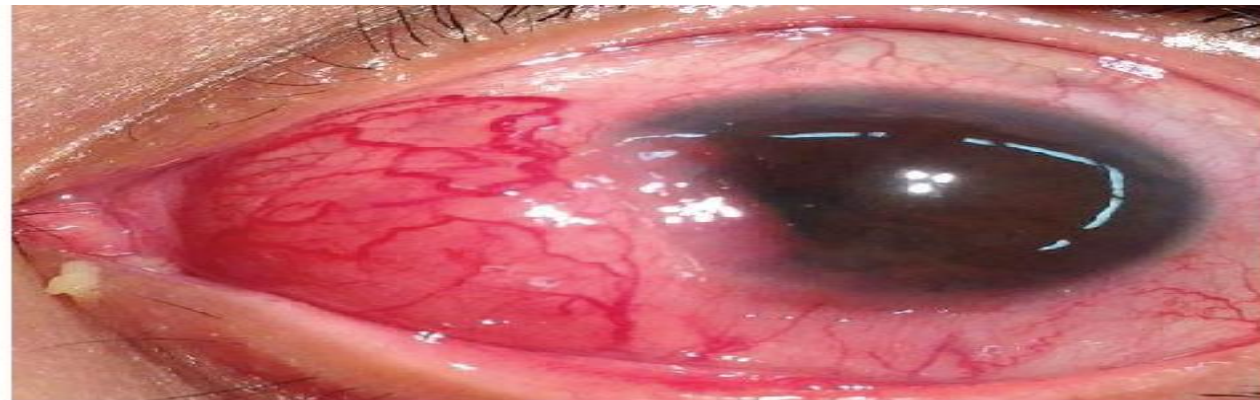
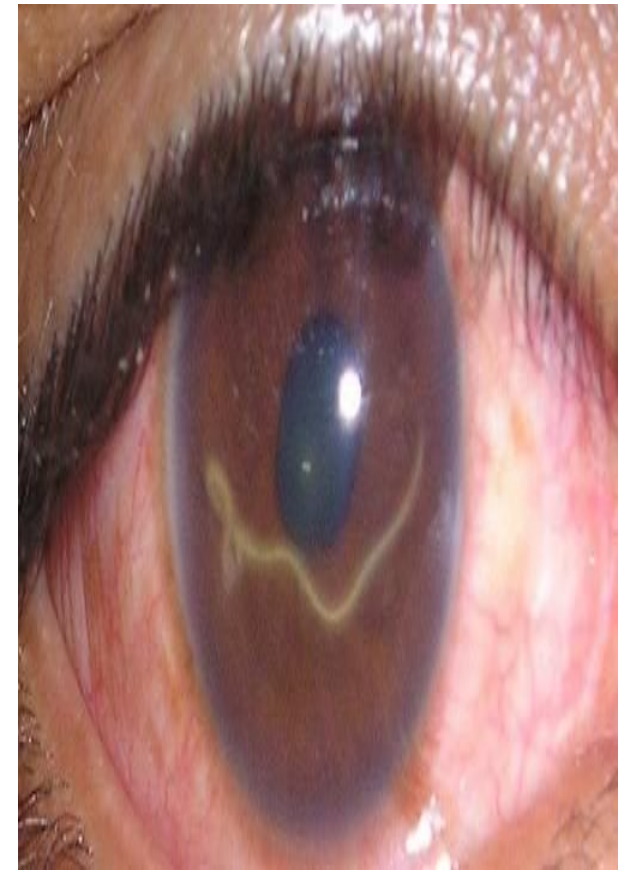


Figure 2: The anterior scleral mass of the left eye has grown

3- *Ancylostoma duodenale* and *Necator americanus*.

"Ground itch" = "sand worms" = plumber's itch.

Characteristics

The two species that commonly infect humans have a similar morphology and they are intestinal, blood-feeding parasite.

A. duodenale worms are pale grey or slightly pink. The head is bent a little in relation to the rest of the body, forming a hook shape – hence the name. The hook is at the front end of the body. They have well-developed mouths with two pairs of teeth. Males measure approximately 10 by 0.5 mm, and females are often longer and stouter. Males also have a prominent copulatory bursa posteriorly.

N. americanus is generally smaller than *A. duodenale*, with males usually being 5 to 9 mm long and females about 10 mm long. Instead of the two pairs of teeth in *A. duodenale*, *N. americanus* has a pair of cutting plates in the buccal capsule. Also, the hook is much more defined in *Necator americanus*.



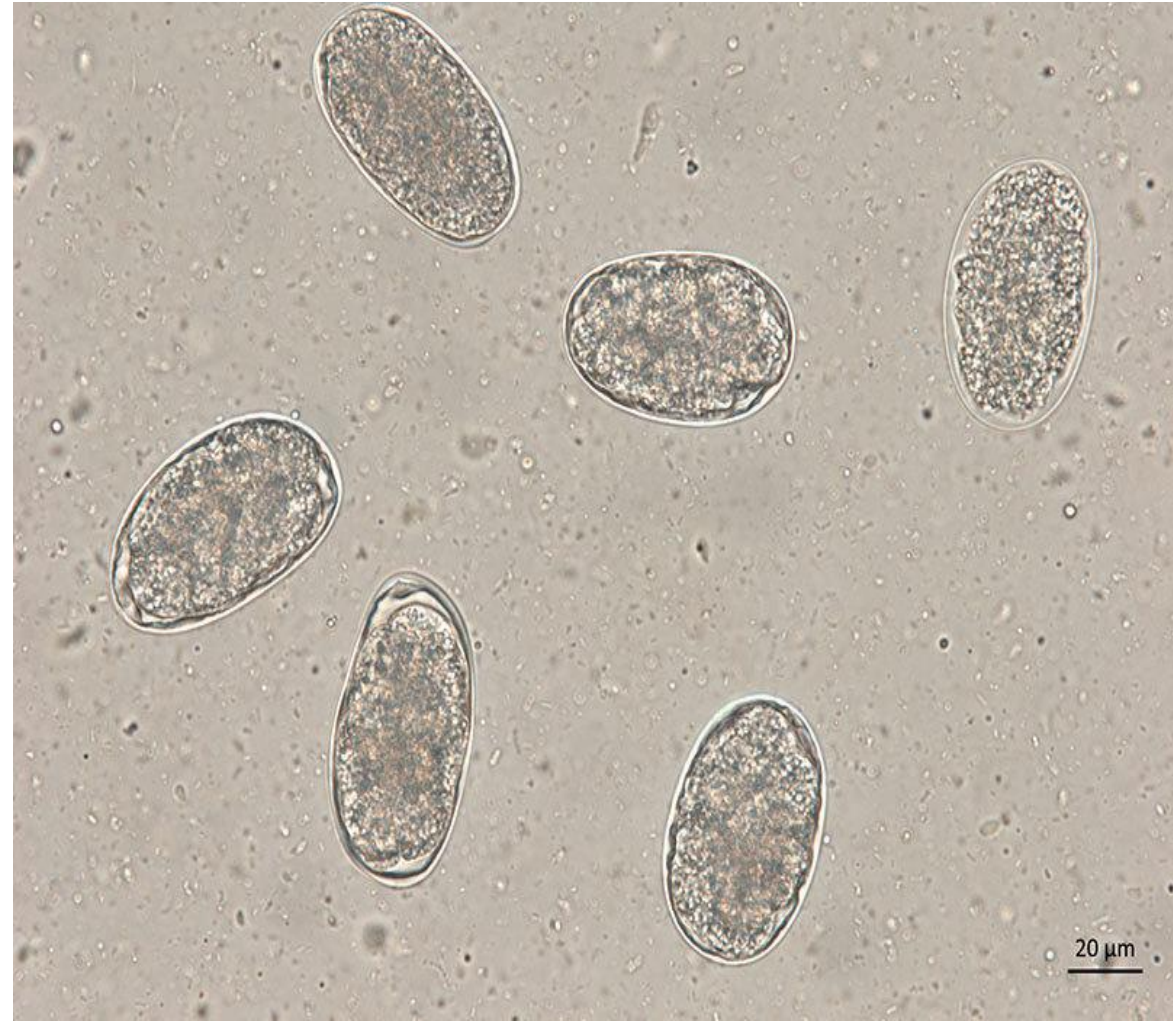
Posterior end of hookworms



Anterior end of hookworms

Hookworm

- Clear color
- Oval shaped
- 65 μm X 40 μm
- Smooth shell
- A lot of space between inner cell and outer shell
- Outer shell appears as single, thin, black line
- Inner ovum is clearly segmented (often into 4 to 8 parts)



Q: What is cutaneous larva migrants (CLM) ?

Cutaneous larva migrants (CLM):- is a parasitic skin infection caused by hookworm larvae namely { *Ancylostoma duodenale* and *Necator americanus* }.

that usually infest cats, dogs and other animals. Humans can be infected with the larvae by walking barefoot on sandy beaches or contacting moist soft soil that has been contaminated with animal faeces. It is also known as creeping eruption as once infected, the larvae migrate under the skin's surface and cause itchy red lines or tracks.

What Is a Creeping Eruption "wandering larvae in the skin"? (with pictures)

Creeping eruption is a skin infection. It is caused by [hookworm](#) larvae, the eggs of which are commonly found in the feces of animals such as dogs and cats. The condition is also commonly known as sandworms and ground itch or by the scientific term cutaneous larva migrants. It is characterized by a red, stringy rash [طفح جلدي](#) that spreads across the skin.

The rash develops when hookworm larvae burrow under the top layers of epidermis. As they spread across the skin, groups of curling red marks will appear. The larvae is not able to penetrate the lower layers of human skin because parasites lack the collagenase [enzymes](#) required to penetrate through the [basement membrane](#) deeper into the dermal layers of the skin.



"Creeping eruption" associated with cutaneous larva migrants

Life cycle

- Infection of the host is by the larvae, not the eggs.
- Infective stage: L3 larvae
- Usual route is through the skin.

Hookworm larvae need warm, moist soil, above 18 °C, in order to hatch. They will die if exposed to direct sunlight or if they become dried out.

Necator larvae can survive at higher temperatures than Ancylostoma larvae.

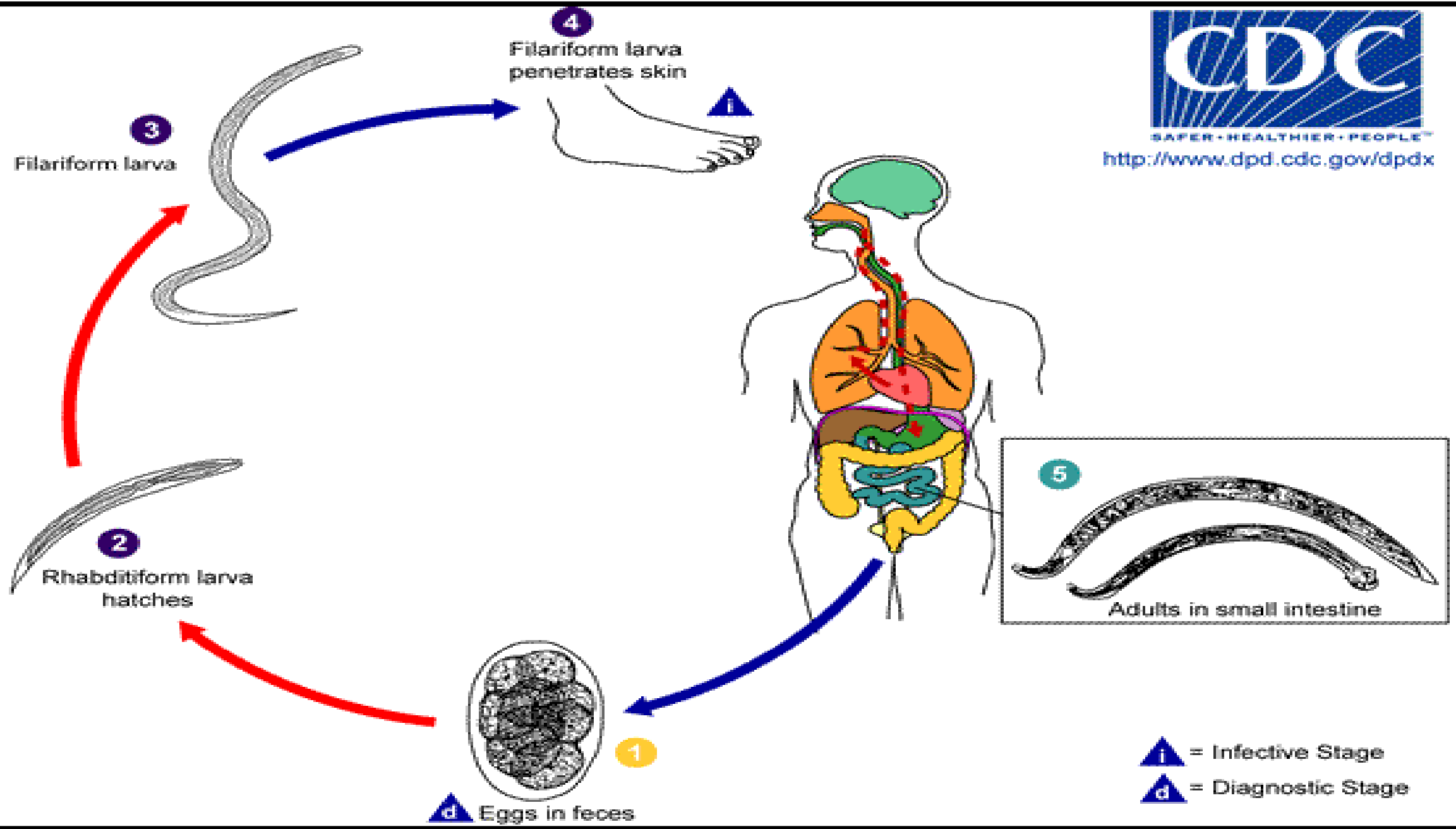
First stage larvae (L1) are non-infective, and once hatched in the deposited feces, they feed on that, and then feed on soil microorganisms until they moult into second stage larvae (L2). First and second stage larvae are in the [rhabditiform](#) stage. After feeding for seven days or so they will moult into third stage larvae (L3) known as the [filariform](#) stage, which is the non-feeding, infective stage. Filariform larvae can survive for up to two weeks. They are extremely motile and will move onto higher ground to improve their chances of finding a host.

3- *N. americanus* larvae only infect through penetration of skin, *A. duodenale* can infect both through penetration and orally, but the usual method of infection is through the skin, this is commonly caused by walking barefoot through areas contaminated with fecal matter. The larvae are able to penetrate the skin of the foot, and once inside the body, they migrate through the subcutaneous venules and lymphatic vessels of the human host. Eventually, the L3 larvae enter the lungs through the pulmonary capillaries and break out into the alveoli. They then travel up the trachea to be coughed and swallowed by the host. After being swallowed by esophagus, the L3 larvae are then found in the small intestine, where they molt into the L4, or adult worm stage



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i = Infective Stage
d = Diagnostic Stage

Symptoms and signs

1- Red, intensely pruritic (itchy) eruption, look like twirling lesions.

2- The itching is very painful and if scratched may allow a secondary bacterial infection to develop.

3- in heavy infections may have abdominal pain, diarrhea, loss of appetite, weight loss, fatigue and anemia.

Children may have their physical and cognitive growth be affected.

4- Blood sucking parasite cause anemia and lead to death like Normocytic Hypochromic Anemia (iron deficiency anemia)

3- This is separate from the similar cutaneous [larva currents](#) which is caused by [Strongyloides](#). Larva currents is also a cause of migratory pruritic eruptions but is marked by 1) migratory speed on the order of inches per hour

2) perianal involvement due to autoinfection from stool and 3) a wide band of urticaria الشرى .

Diagnosis

1- Diagnosis depends on finding characteristic worm eggs on microscopic examination of the stools, the eggs are oval or elliptical, measuring 60 by 40 μm , colorless, not [bile](#) stained and with a thin transparent [hyaline](#) shell membrane. When released by the worm in the intestine, the egg contains an unsegmented [ovum](#). During its passage down the intestine, the ovum develops and thus the eggs passed in feces have a segmented ovum.

2- The eggs of both *Ancylostoma* and *Necator* (and most other hookworm species) are indistinguishable, to identify the genus, they must be **cultured in the lab** to allow larvae to hatch out. If the fecal sample is left for a day or more under tropical conditions, the larvae will have hatched out. In such a case, it is essential to distinguish hookworms from [Strongyloides](#) larvae.

3- Adult worms are rarely seen (except via endoscopy, surgery or autopsy). It cannot be used to identify [hookworm](#) eggs because they collapse within 30 to 60 minutes of preparation using this method.

4- [PCR](#)

Treatment

1- [albendazole](#) and [ivermectin](#)

2- [thiabendazole](#)

3- It is recommended to use Benadryl or some anti-itch cream (i.e. Cortisone or Calamine lotion). This will help relieve some of the itch.

4- Wearing shoes in areas where these parasites are known to be endemic offers protection from infection.