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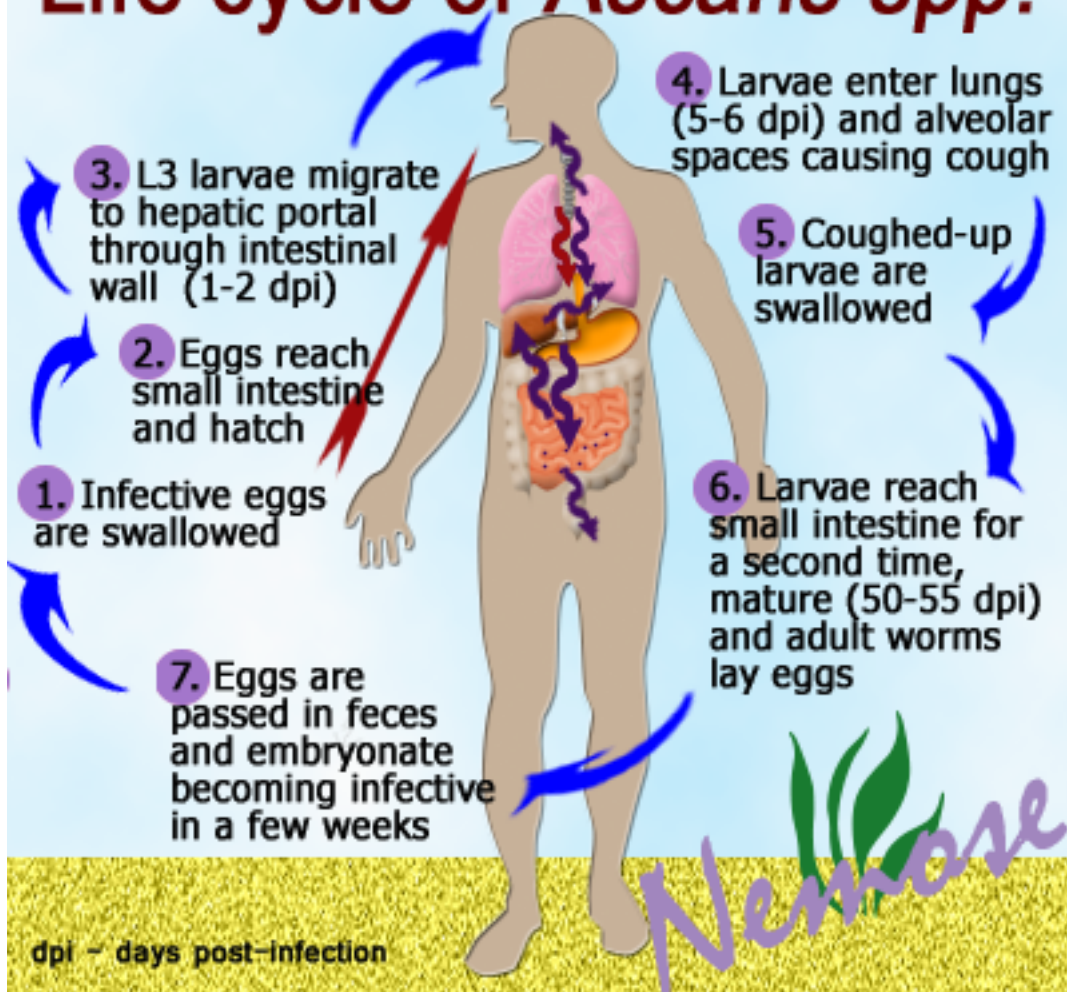
## Human roundworm, *Ascaris lumbricoides*

- *Ascaris lumbricoides* taxonomy
- Brief facts
- Developmental stages
- Treatment
- References

### *Ascaris lumbricoides* taxonomy

cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa -  
Bilateria - Pseudocoelomata - Nematoda - Chromadorea - Ascaridida -  
Ascaridoidea - Ascarididae - Ascaris - *Ascaris lumbricoides*

# Life cycle of *Ascaris spp.*



## Brief facts

- Together with human hookworms (*Ancylostoma duodenale* and *Necator americanus* also **described at MetaPathogen**) and whipworms (*Trichuris trichiura*), *Ascaris lumbricoides* (human roundworms) belong to a group of so-called **soil-transmitted helminths** that represent one of the world's most important causes of physical and intellectual growth retardation.
- Today, **ascariasis** is among the most important tropical diseases in humans with more than billion infected people world-wide. Ascariasis is mostly seen in tropical and subtropical countries because of warm and humid conditions that facilitate development and survival of eggs. The majority of infections occur in

Asia (up to 73%), followed by Africa (~12%) and Latin America (~8%).

- *Ascaris lumbricoides* is one of six worms listed and named by Linnaeus. Its name has remained unchanged up to date.
- Ascariasis is an ancient infection, and *A. lumbricoides* have been found in human remains from Peru dating as early as 2277 BC. There are records of *A. lumbricoides* in Egyptian mummy dating from 1938 to 1600 BC. Despite of long history of awareness and scientific observations, the parasite's life cycle in humans, including the migration of the larval stages around the body, was discovered only in 1922 by a Japanese pediatrician, Shimesu Koino.
- Unlike the hookworm, whose third-stage (L3) larvae actively penetrate skin, *A. lumbricoides* (as well as *T. trichiura*) is transmitted passively within the eggs after being swallowed by the host as a result of fecal contamination.
- *Ascaris lumbricoides* is the largest human intestinal nematode, growing up to 35 cm in length and 0.5 cm in diameter.
- Ascariasis is classified by severity of manifestations, which usually correlates with parasite burden. Five types are recognized: type A is often asymptomatic, type B causes permanent growth retardation in children, type C is clinically overt and is characterized by intermittent abdominal pain, nausea, anorexia, diarrhea, type D includes acute complications that often require hospitalization (intestinal obstructions, biliary ascariasis, appendicitis, etc.), type E is most severe frequently fatal disease.
- The occurrence of *As. lumbricoides* usually peaks in childhood and early adolescence.
- **Soil-transmitted helminths do not reproduce within the host: in order to be infective their eggs have to be released into environment where they are embryonated (roundworms, whipworms) or hatch into infective larvae (hookworms). Usually the eggs as well as the**

larvae do not enter the same host (the host, who released them). This feature is crucial for understanding of the epidemiology and methods of control (compare with pinworm, *Enterobius vermicularis*, (pinworm) at MetaPathogen).

## Developmental stages (life cycle)

### Life Cycle Stages

Roundworms are dioecious, with male and female organs in separate individuals, and have a **direct** life cycle (no intermediate hosts). They mate in host's small intestine and the females produce eggs.

- egg

single female roundworm can lay up to 240,000 eggs per day. Eggs are passed to the environment with feces.

- non-infective egg

non-infective, non-embryonated eggs, are released into environment in the feces

- infective egg

in about 20 days, after embryo development, the eggs becomes infective; under adequate conditions, these eggs maintain their viability for up to 1 year; they are resistant to many noxious chemicals including acids and a number of commercial detergents; eggs are disseminated by rain, wind, with insects (flies), birds, and other animals; infection in human occurs by ingestion of eggs through contaminated food or water, or lack of personal hygiene

- larva

worms hatch in intestine and undergo several moltings before developing into egg-laying adults

- larvae in small intestine

eggs hatch upon reaching the host's small intestine and penetrate the intestinal wall

- larvae in liver

larvae migrate to the hepatic portal circulation invading liver in ~1-2 days after infection

- larvae in lungs

L3 larvae migrate up the trachea and are swallowed after induced coughing

- larvae in small intestine

L3 larvae reach the intestinal lumen after 8-9 days after infection where they molt twice and mature at 2-3 months after infection

- mature adult

after 2 moltings the parasites mature into adults and mate; life span of actively feeding and egg-laying adult females is up to 2 years; dead or paralyzed worms are expelled from the anus

## Treatment

Active agent	Formulation	Advantages	Disadvantages
Albendazole	Tablets (200 and 400 mg); oral suspension	Single dose of 400 mg is effective; ovicidal; poorly absorbed by the host - acts directly on parasites; similarly effective against pinworm and somewhat effective against other helminths	fetal toxicity was reported in animals
Mebendazole	Tablets (200 and 500 mg); oral suspension	Single dose of 500 mg is effective; ovicidal; poorly absorbed by the host - acts directly on parasites; effective against other helminths	Fetal toxicity was reported in animals
Levamisole	Tablets (40 mg)	Single dose; highly effective against ascariasis	Not that effective against other helminths; not ovicidal; contraindicated during first trimester of pregnancy

Pyrantel pamoate	Tablets (250 mg)	Also highly effective against pinworm	Not that effective against other helminths; not ovicidal; contraindicated during first trimester of pregnancy
Ivermectin	Tablets, suspensions	Broad spectrum antiparasitic; convenient; few side effects	Expensive; lack of sufficient safety data

## References

### PubMed articles

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### Websites

- **Free full text articles in PubMed: major topic "*Ascaris lumbricoides*"**
  - **Center for Disease Control and Prevention: Ascaris infection**
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