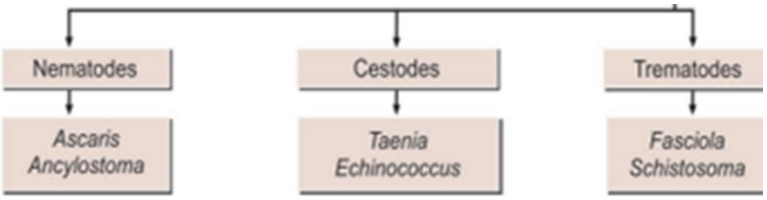
Helminths Lec.1



The term 'helminth' (Greek helmins-'worm') originally referred to intestinal worms, but now found other worms, including tissue parasites and free-living species

Helminthes are multicellular (metazoa) bilalerally symmetrical animals , kingdom Metazoa.

Helminths, which occur as parasite in humans belong to 2 phyla:

Phylum Platyhelminthes (flatworms)

It includes 2 classes:

1- Class – Cestoda (tapeworms)

2- Class – Trematoda (fl ukes)

Phylum Nemathelminthes – It includes class

3-Nematoda

It includes 2 subclasses:

Subclass – Adenophoraea (Aphasmidia)

Subclass – Secernentea (Phasmidia).

General Features of Helminths

Adult Worms

Helminths have an outer protective covering, the cuticle or integument, which may be tough and armed with spines orhooks. The cuticle of live helminths is resistant to intestinal digestion.

- The mouth may be provided with teeth or cutting plates. Many helminths possess suckers or hooks for attachment to host tissues.

-They do not possess organs of locomotion, but in some species the suckers assist in movement

- Locomotion is generally by muscular contraction and relaxation.

-Many helminths have a primitive nervous system.

-The reproductive system and the excretory system is better developed

Notes...

The adult Female

1- monoecious (with functioning male and female sex organs in the same individual) the hermaphroditic helminths, both male and female reproductive systems are present in the same worm and self-fertilization as well as cross-fertilization take place. (e.g. Taenia solium)

2-diecious (the two sexes, male and female, separate).

In the diecious species, males and females are separate, the male being smaller than the female. (e.g. Ascaris lumbricoides)

Rarely the femal is parthenogenic, being able to produce fertile eggs or larvae without mating with males (e.g. Strongyloides).

Eggs

The eggs or larvae are produced in large numbers— as many as 200,000 or more per female per day.

Various helminths have distinct morphology of eggs, which can be used to diff erentiate the helminths

Larval Forms

There are various larval forms of helminths found in man and other hosts. These forms are as follows:

1-Cestodes: The various larval forms are cysticercus, coenurus, coracidium, cystecercoid, procercoid, hydatid cyst, and plerocercoid forms.

2-Trematodes: The various larval forms are miracidium, cercaria, redia, metacercaria, and sporocyst.

3-Nematodes: The various larval forms are microfi laria, filariform larva, and rhabditiform larva

Helminths differ from protozoans in their inability to multiply in the body of the host.

Protozoans multiply in the infected person, so that disease could result from a single infection.

But in the helminths a single infection does not generally leads to disease Heavy worm infection lead to disease .

Notes...

Class Trematoda

Trematodes have flat or fleshy, leaf-like unsegmented bodies.

-The alimentary canal is present but is incomplete i.e., without an anus.

-They possess suckers but no hooks.

- The sexes are separate in the schistosomes, while the other flukes are hermaphroditic.

-They are oviparous.

Class Cestoda

Cestodes have tape-like, dorsoventrally flattened segmented bodies.

-They do not possess an alimentary system.

-The head carries suckers and some also have hooks.

- They possess scolex, neck, and proglottids.

- They are monoecious and body cavity is absent.

-They are oviparous

(Nematoda)

Nematodes are elongated, cylindrical worms with an unsegmented body

-They possess a relatively well-developed complete alimentary canal, with an anus.

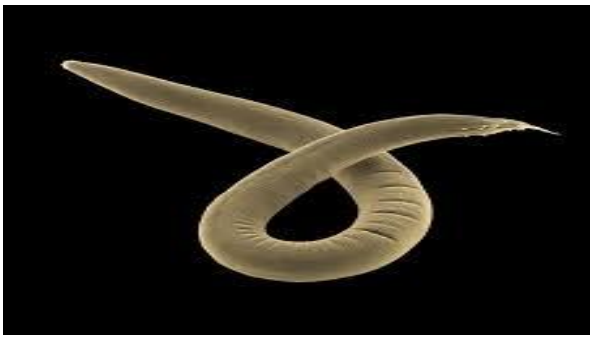
- Body cavity is present.

- The head does not have suckers or hooks, but may have a buccal capsule with teeth or cutting plates.

-The sexes are separate (diecious).

-They are either oviparous or Viviparous

Nematodes are generally resemble the common earth worm in appearance,However, taxonomically earthworms are not nematodes .



The name nematode means thread-like (nema meaning thread)

Nematodes are elongated, cylindrical, unsegmented worms with tapering ends.'.

Unlike trematodes and cestodes the most nematodes are free-living forms found in soil and water.

Notes...

Several species are parasites of plants, many nematodes parasitize invertebrate and vertebrate animals. (economic importance).

Their body is covered with a tough outer cuticle, which may be smooth, striated, or spiny.

The middle layer is hypodermis and the inner layer is the somatic muscular layer.

The body cavity is a pseudocele, in which all the viscera are suspended.

The digestive system is complete, consisting of a anteriorly placed mouth leading to the esophagus, which characteristically varies in shape and structure in different groups.

The intestine is lined with a single layer of columnar cells and leads to the rectum, opening through the anus.

In the male the rectum and the ejaculatory duct open into the cloaca.

Nematodes have simple excretory and nervous systems

The nematodes are diecious i.e. 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.

It also includes copulatory structures such as spicules or bursa or both.

The female reproductive system consists of the ovary, oviduct, uterus, and vagina.

Female nematodes may produce eggs (oviparous) or larvae (viviparous).

Some lay eggs containing larvae which immediately hatch out)(ovoviviparous

Life Cycle

The life cycle of nematodes consists typically of larval stages and the adult form.

Man is the optimum host for all the nematodes.

The life cycle need only one host, except the superfamilies

Filarioidea and Dracunculoidea, where two hosts are required. Insect vectors and Cyclops constitute the second hosts in these superfamilies, respectively.

Nematodes localize in the intestinal tract and their eggs pass out with the feces of the host.

They undergo few developmental changes before they enter new host.

Modes of Infection

1-By ingestion of:

- Eggs: Ascaris, Enterobius. Trichuris

- Larvae within intermediate host: Dracunculus

-Encysted larvae in muscle: Trichinella

Notes...

2-By penetration of skin: Ancylostoma, Necator, Strongyloides

3- By blood-sucking insects: Filariae

4- By inhalation of dust containing eggs: Ascaris, Enterobius

The female nematodes may be divided as follows:

1- Oviparous (laying eggs):

A- Unsegmented eggs: Ascaris, Trichuris

B-Segmented eggs: Ancylostoma, Necator

C-Eggs containing larvae: Enterobius

2- Viviparous (producing larvae): Trichinella, Wuchereria, Brugia, Dracunculus.

3-Ovoviviparous (laying eggs containing fully formed larvae, which hatch out immediately): Strongyloides

The largest number of helminthic parasites of humans belong to the class of nematodes species

About one-half of the nematodes parasitic for man are intestinal, the others are found in various tissues.

Pathogenicity of intestinal nematodes may be due to larval migration through tissue, piercing of intestinal wall, blood loss, or allergic reactions to secretions of adults or larvae

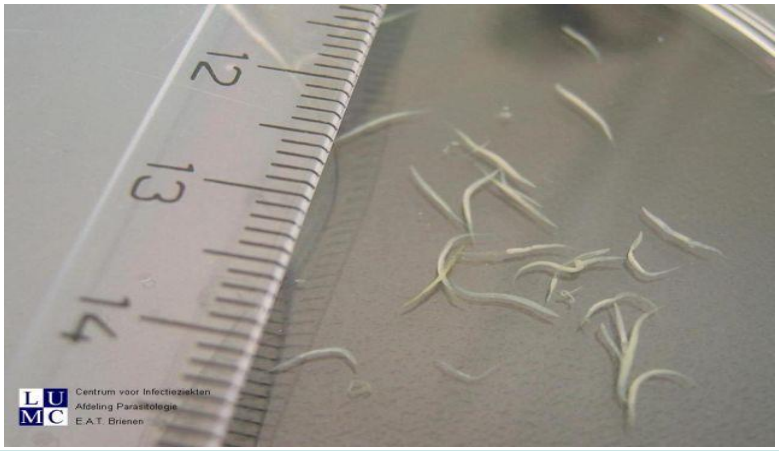
Nematodes on the Basis of the Habitat of Adult Worms

Intestinal Human Nematodes	Somatic Human Nematodes
Small Intestine • *Ascaris lumbricoides* (Common round worm) • *Ancylostoma duodenale* (Old world Hook worm) • *Necator americanus* (American or New World Hook worm) • *Strongyloides stercoralis* • *Trichinella spiralis* • *Capillaria philippinensis* **Large Intestine** • *Trichuris trichiura* (Whip worm) • *Enterobius vermicularis* (Thread or pin worm)	**Lymphatics** • *Wuchereria bancrofti* • *Brugia malayi* • *Brugia timori* **Skin/subcutaneous tissue** • *Loa loa* • *Onchocerca volvulus* • *Dracunculus medinensis* (Guinea worm) **Mysentery** • *Mansonella ozzardi* • *Mansonella perstans* **Conjunctiva** • *Loa loa*

Enterobius vermicularis

Enterobius vermicularis ,human pinworm , threadworm or seat worm,previously called Oxyuris vermicularis)

Human is the only host of E.vermicularis.



Notes...

The name Enterobius vermicularis means a tiny worm living in the intestine (Greek enteron—intestine, bios— life, and vermiculus—small worm).

The term Oxyuris means ‘sharp tail’, a feature of the female worm, from which the name ‘pinworm’ is also derived.

Leuckart (1865) first described the complete life cycle of the parasite.

Habitat

Adult worms are found in the caecum, appendix, and adjacent portion of ascending colon.

It has worldwide distribution

E. vermicularis is more common in temperate countries than in the tropics.

In the United States 40 million persons are infected with pinworms,

Pinworm infection is prevalent in large family groups and in schools and mental institution,infections are more prevalent in the poor people

The infection is more common in children than adults

Morphology:

The adult male and female have an anterior expansion from both side (ventral and dorsal) called (cervical alae).

the mouth is surrounded by 3wing-like cuticular expansions ,the oesophagus has a double-bulb structure (oesophagial bulb)

The male measures 2-5 mm long and width of 0.1- 0.2mm .

The posterior end is strongly curved with copulatory spicule

Male live for about 7–8 weeks

Female length 8- 13 mm ,0.3-0.5 mm width. They are light yellowish to white thread like .

The posterior end is sharply pointed

The vulva is located just in front of the middle third of the body and opens into the single vagina, which leads to the paired uteri, oviducts, and ovaries.

In the gravid female the whole body is filled by the distended uteri carrying thousands of eggs.

The gravid female is oviparous.

Females survive for 5–12 weeks

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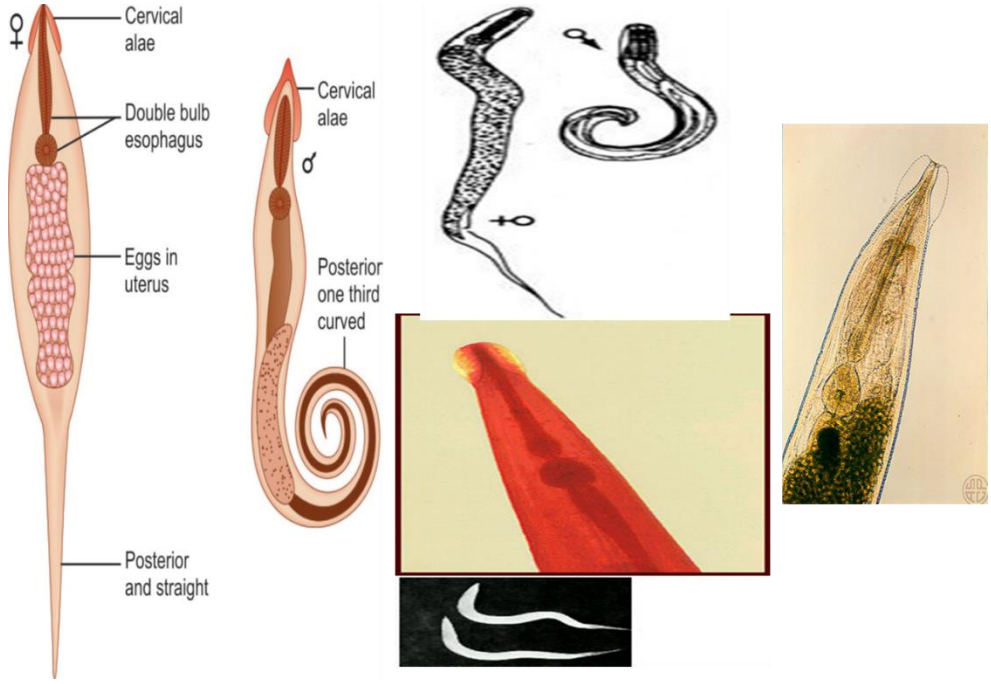


Egg

The egg is colorless (with out bile-stained), floats in saturated salt solution.

It has a characteristic shape, being elongated ovoid, fl attened on one side, and convex on the other (D shape), measuring 50–60 µm by 20–30 µm

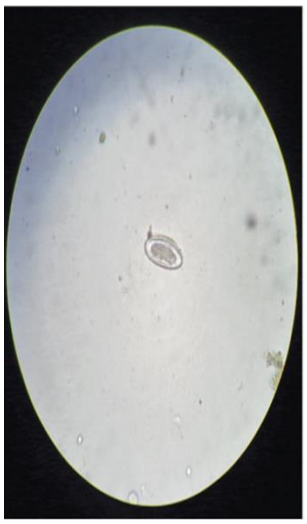
The egg shell is double layered ,colorless transparent inner layer and The outer albuminous layer makes the eggs stick to each other and to clothing and other objects.

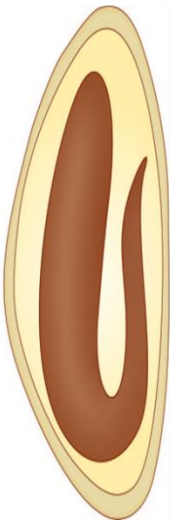
The egg contains a tadpole-shaped coiled embryo, which is fully formed, but becomes infectious only 6 hours after being deposited on the skin.

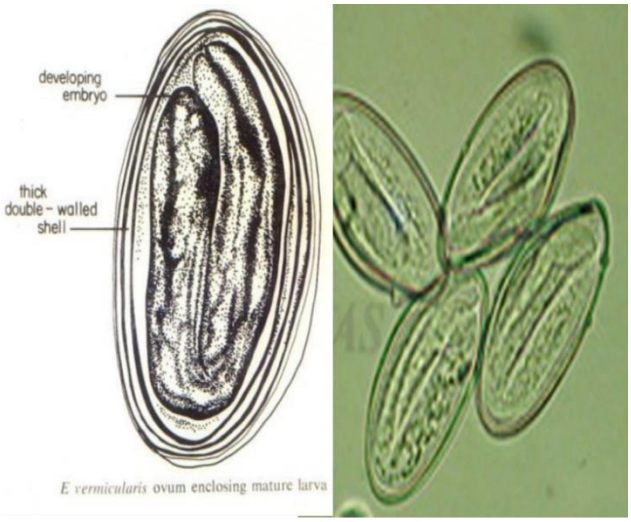
Under cool moist conditions, the egg remains viable for about 2 Weeks.

A single female worm lays 5,000–17,000 eggs.

Notes...







Mode of infection:

1) By swallowing fully developed eggs with food or water.
2) Inhalation of eggs (light infection).
3) Autoinfection
4) Retroinfection

Life Cycle

life cycle only in one host.

No intermediate host and does not undergo any systemic migration

Natural host: Man

Infective form: Embryonated eggs

Mode of infection: Man acquires infection by ingesting embryonated eggs containing larva by means of

1-Contaminated fingers

2-Autoinfection

Eggs laid on perianal skin containing infective larvae are swallowed and hatch out in the intestine.

They moult in the ileum and enter the caecum, where they mature into adults.

It takes from 2 weeks - 2 months from the time the eggs are ingested, to the development of the gravid female, ready to lay eggs

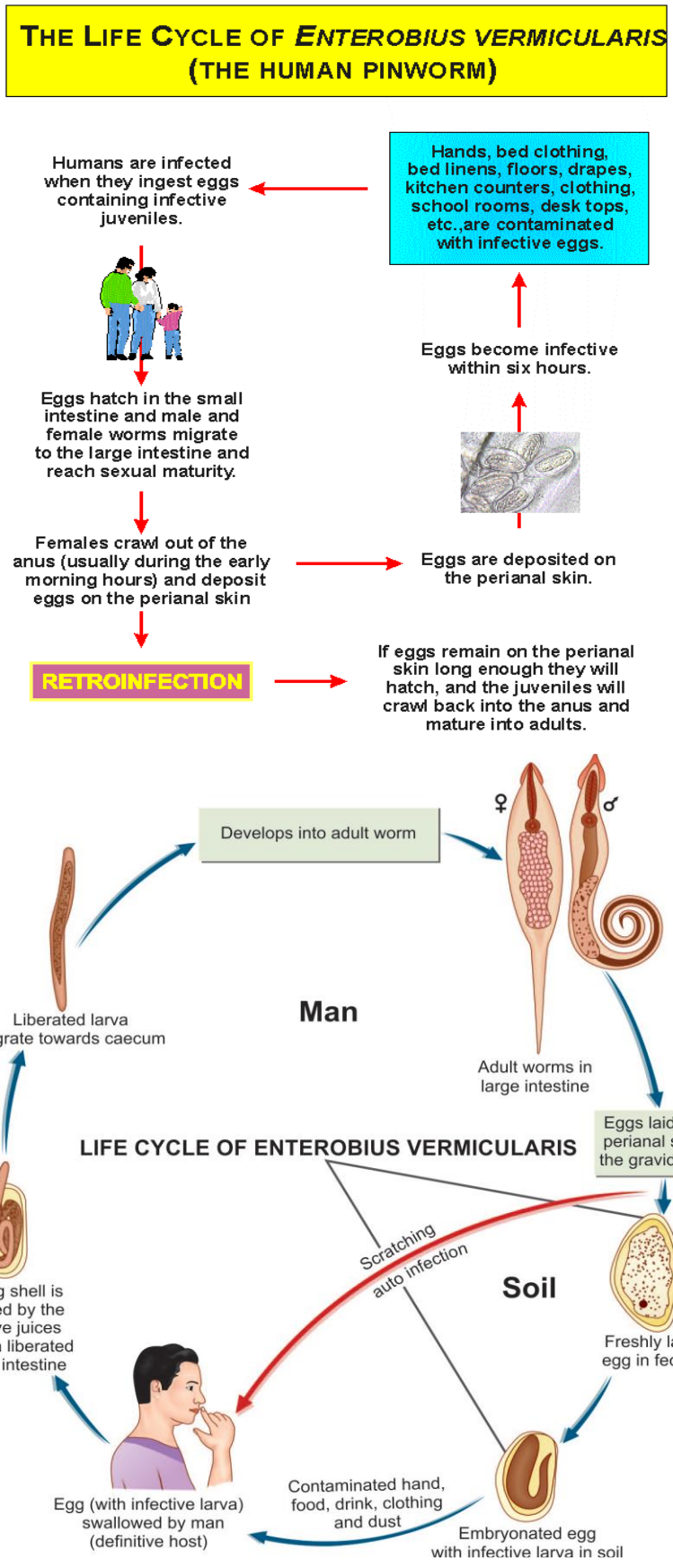
The gravid female migrates down the colon to the rectum.

At night, when the host is in bed, the worm comes out through the anus and crawls about on the perianal skin to lay its sticky eggs.

Notes...

The female worm may wander into the vulva, vagina and even into the uterus and fallopian tubes, sometimes reaching the peritoneum.

The male is seldom seen as it does not migrate,It usually dies after mating and is passed in the feces



Notes...

When all the eggs are laid, the female worm dies or gets crushed by the host during scratching.

The worm may often be seen on the feces, having been passively carried from the rectum.

The eggs rarly found in feces, as the female worm lays eggs in the perianal area .

Crawling of the gravid female worm leads to pruritis and the patient scratches the perianal area.

These patients have eggs of E. vermicularis on fingers and under nails leading to autoinfection

Autoinfection: Ingestion of eggs due to scratching of perianal area with fingers leading to deposition of eggs under the nails. This type of infection is mostly commo in children.

This mode of infection occurs from anus to mouth.

Retroinfection: In this process, the eggs laid on the perianl skin immediately hatch into the infective stage larva and migrate through the anus to develop into worms in the colon.

This mode of infection occurs from anus to colon

Some time pinworm eggs which inhaled and then it reach the pharynx and pass down the oesophagus and migrate to the large intestine.

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