Nematoda

Lecturer: Omer Sardar

Medical Parasitology Ⅱ

(Summer School)

Lab 2

17/08/2025

Introduction

Nematodes are said to be the most worm-like of all helminths. This is because they generally resemble the common earthworm in appearance, which is considered to be the prototype of "worms''. However, taxonomically earthworms are not nematodes as they are segmented worms of the Phylum ***Annelida.***

- Nematodes are elongated, cylindrical, unsegmented worms with tapering ends. The name "nematode" means "thread-like'; from "nema" meaning **"thread".** Unlike trematodes and cestodes, all of which are parasitic, most nematodes are ***free-living*** forms found in soil and water.
- The largest number of helminthic parasites of humans belong to the class of nematodes. There are an estimated 500,000 species of nematodes.

General Characteristics

They are **cylindrical,** or filariform in shape, bilaterally symmetrical with a secondary *triradiate symmetry al the anterior end.*

- The adults vary greatly in size, from about a millimeter to a meter in length. Male is generally smaller than female and its posterior end is curved or coiled ventrally.
- The digestive system is complete, consisting of an 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.

Enterobius vermicularis

Introduction

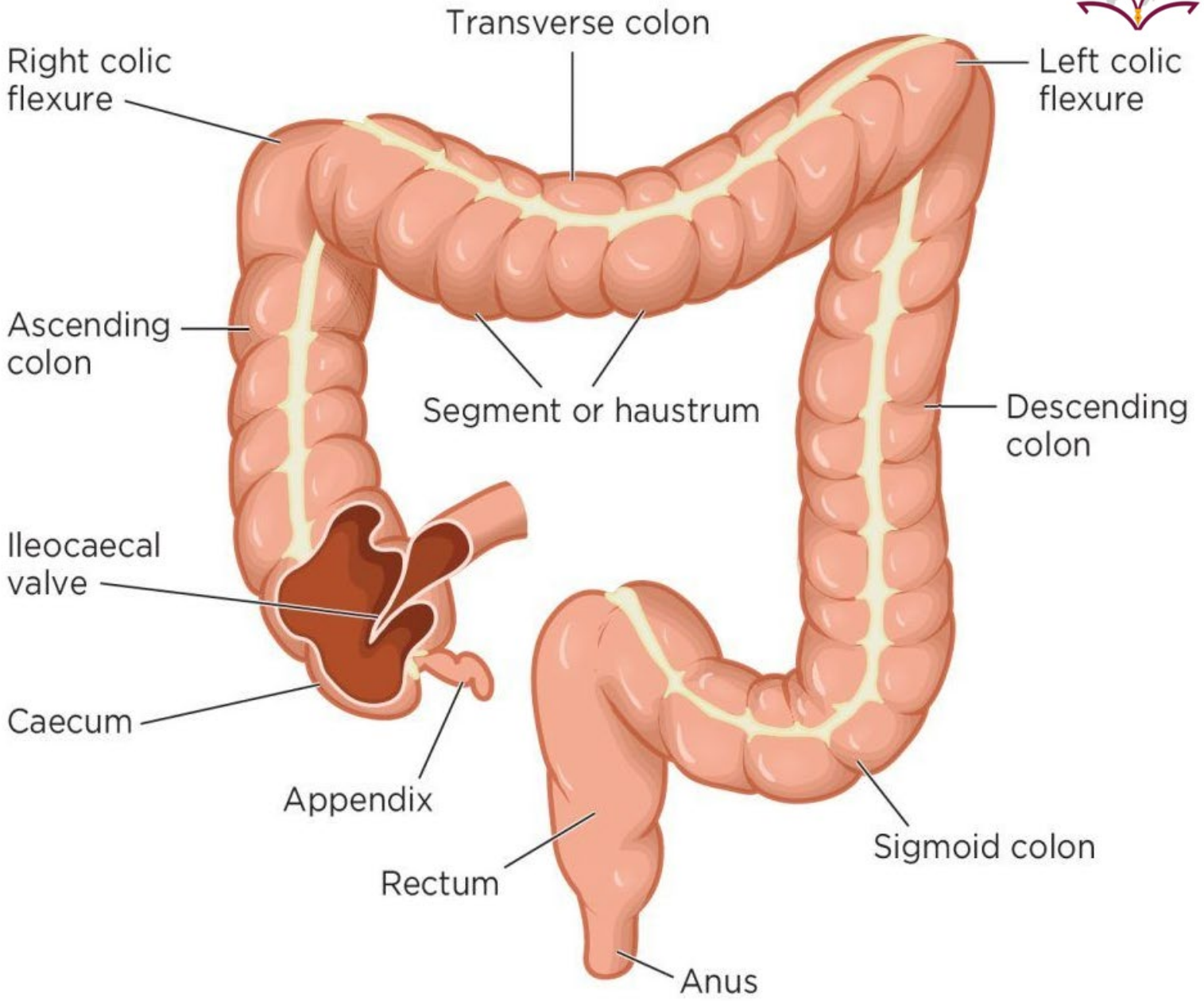
- The name ***Enterobius vermicularis*** means a tiny worm living in the intestine (Greek *enteron-intestine, bias-life* and *vermiculus-small worm).* The term *Oxyuris* means "sharp tail'; a feature of the female worm, from which the name "pinworm" is also derived.

- **Common Name**

Pinworm, threadworm.

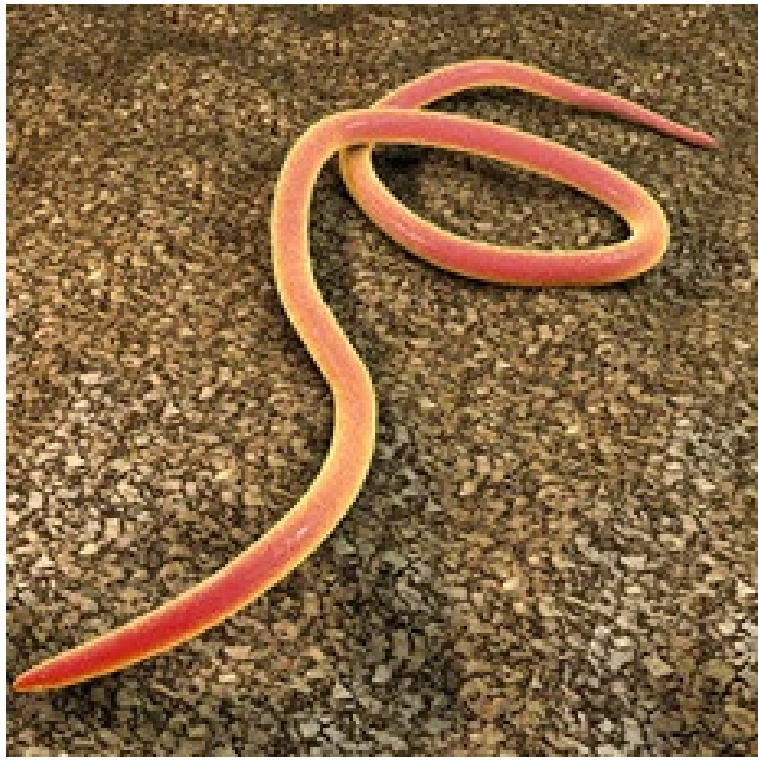
Habitat

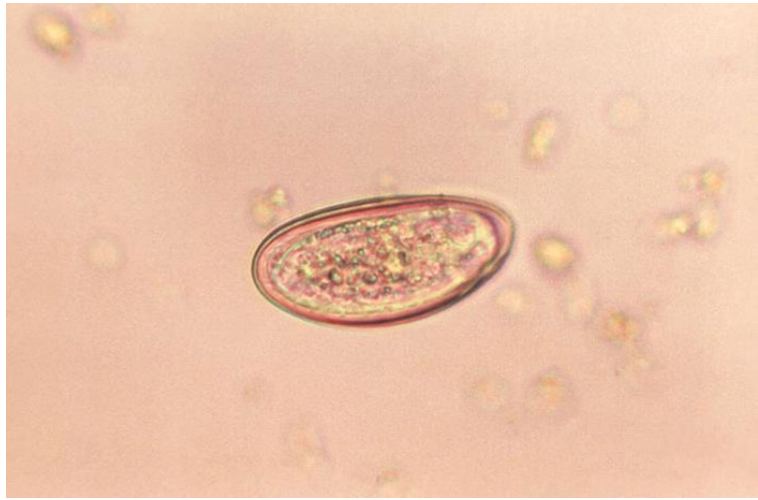
Adult worms are found in the cecum, appendix and adjacent portion of ascending colon.

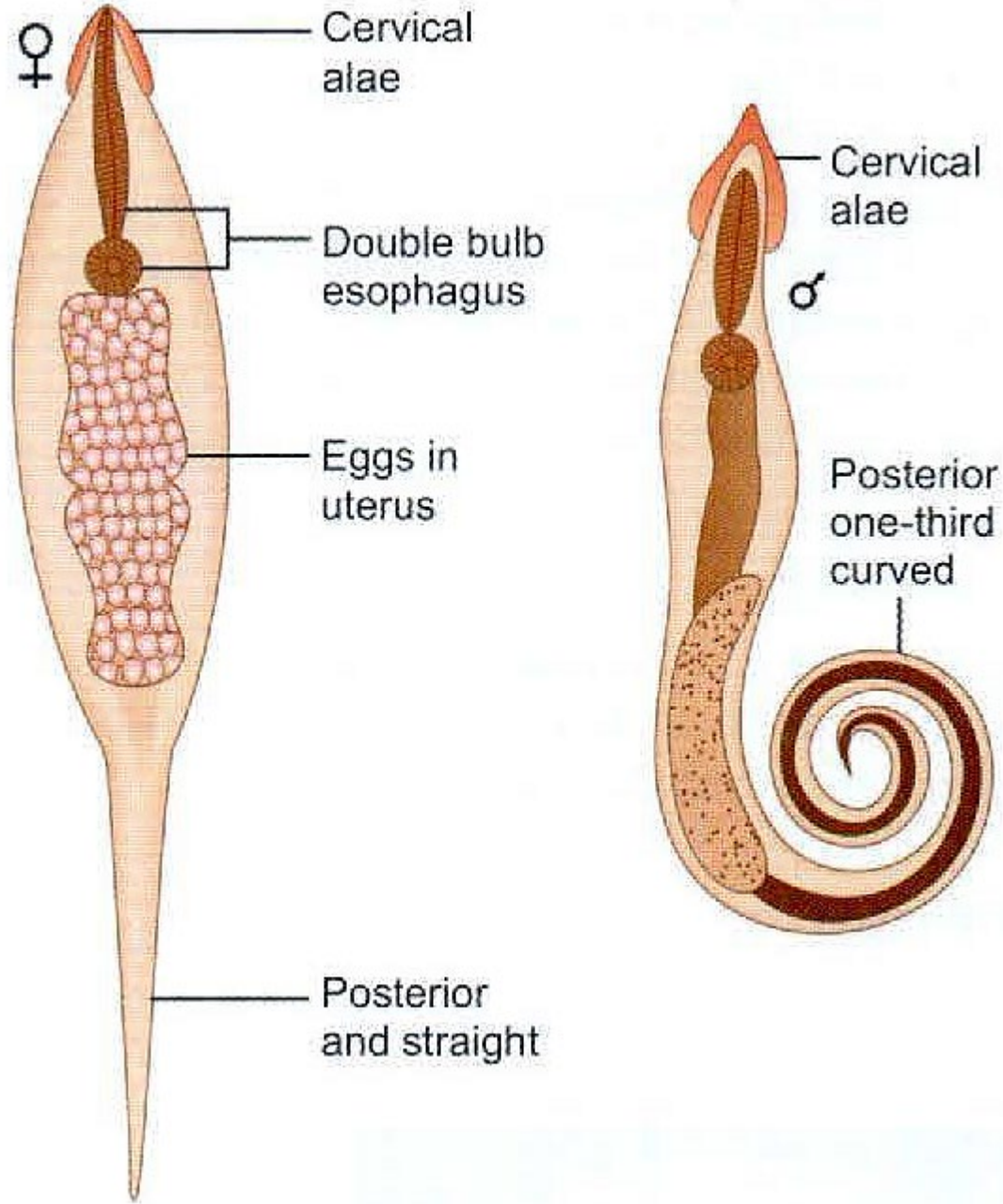


Morphology:

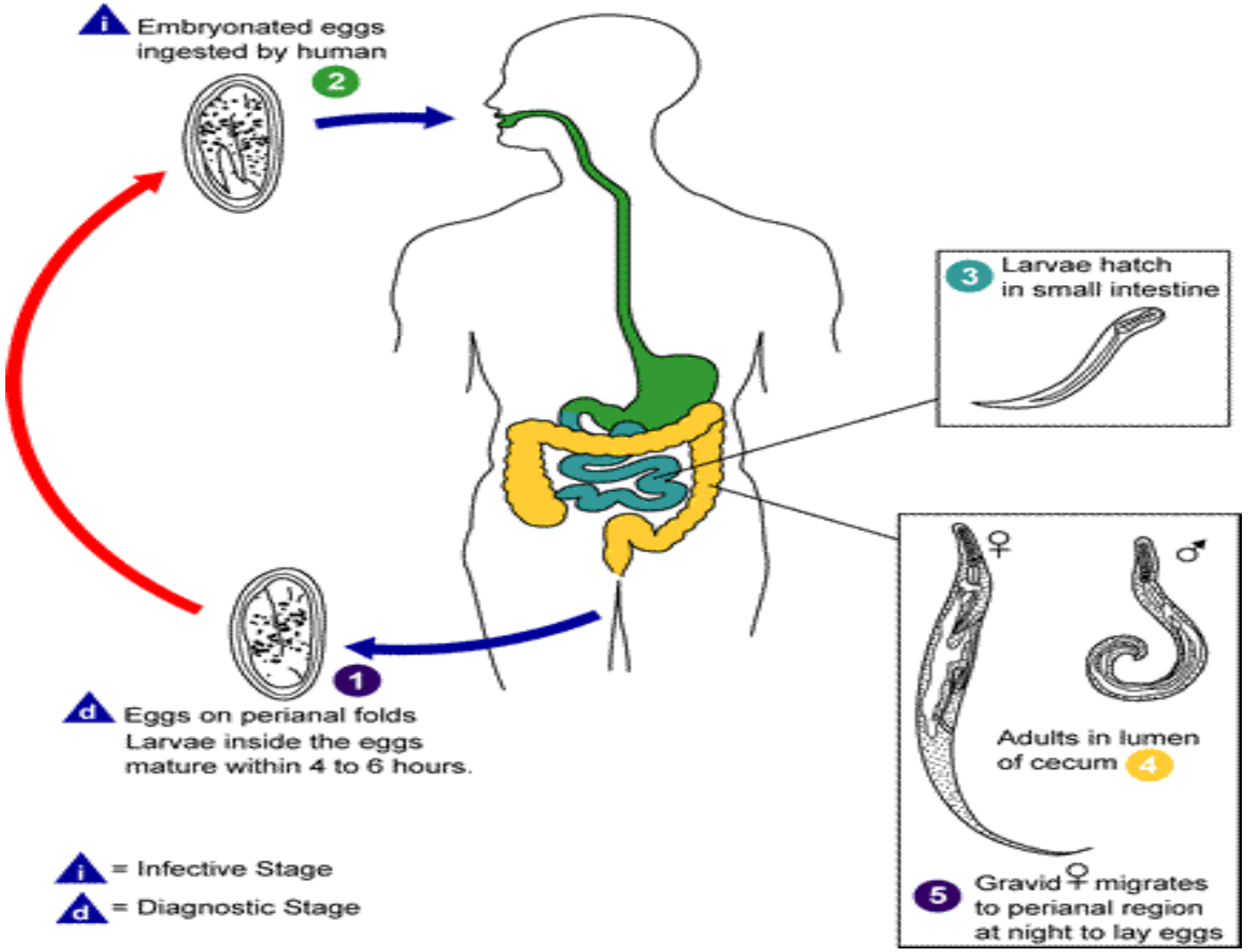
- They are small worms; they live in appendix and cecum
- It causes disease Enterobiassis, Pinworm infection, oxyurasis.
- Method of infection: Oral- fecal or eggs inhaled.
- Males: 2-5mm long, and 0.1-0.3mm in diameter and ventrally curved posterior end provided with one copulatory spicule.
- Female is 8-13mm long and 0.3-0.5mm in diameter with straight sharp posterior end.
- Egg is D shaped





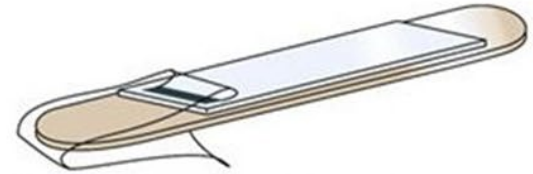

♀
Cervical alae
Double bulb esophagus
Eggs in uterus
Posterior and straight
Cervical alae
♂
Posterior one-third curved

Life Cycle:


i Embryonated eggs ingested by human
2
3 Larvae hatch in small intestine
Adults in lumen of cecum 4
5 Gravid ♀ migrates to perianal region at night to lay eggs
1
d Eggs on perianal folds
Larvae inside the eggs mature within 4 to 6 hours.
i = Infective Stage
d = Diagnostic Stage

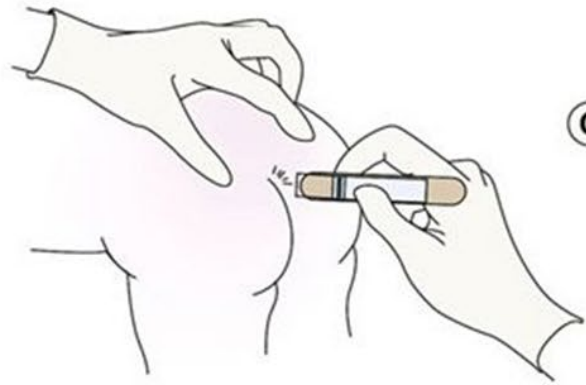
Diagnosis

- Diagnosis depends on the characteristic eggs.
- The eggs and the female adults can be removed from the folds of the skin in the perianal regions using the cellophane tape method (scotch tap method).
- The examination (GSE)should be made before the patient has washed or defecated .
- the major problem is reinfection. Include
- A retroinfection: infective pinworm eggs that migrate back into the host body develop and reproducing again.
- Autoreinfection: if infective pinworm eggs are ingested via hand-to-mouth contamination.



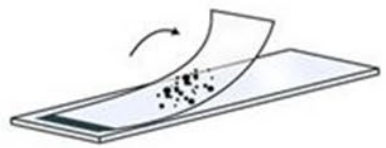
(A) Clear plastic tape is pulled back over the end of the slide to expose the gummed surface.

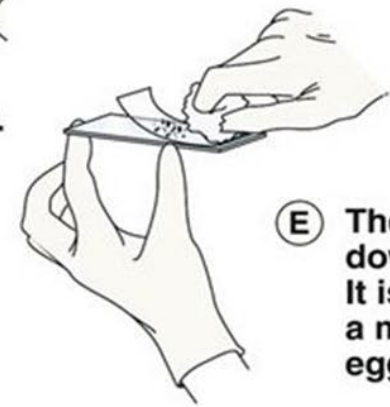
(B) The tape, still attached to the slide, is looped over a wooden stick.



(C) The gummed surface of the tape is touched several times to the anal region.

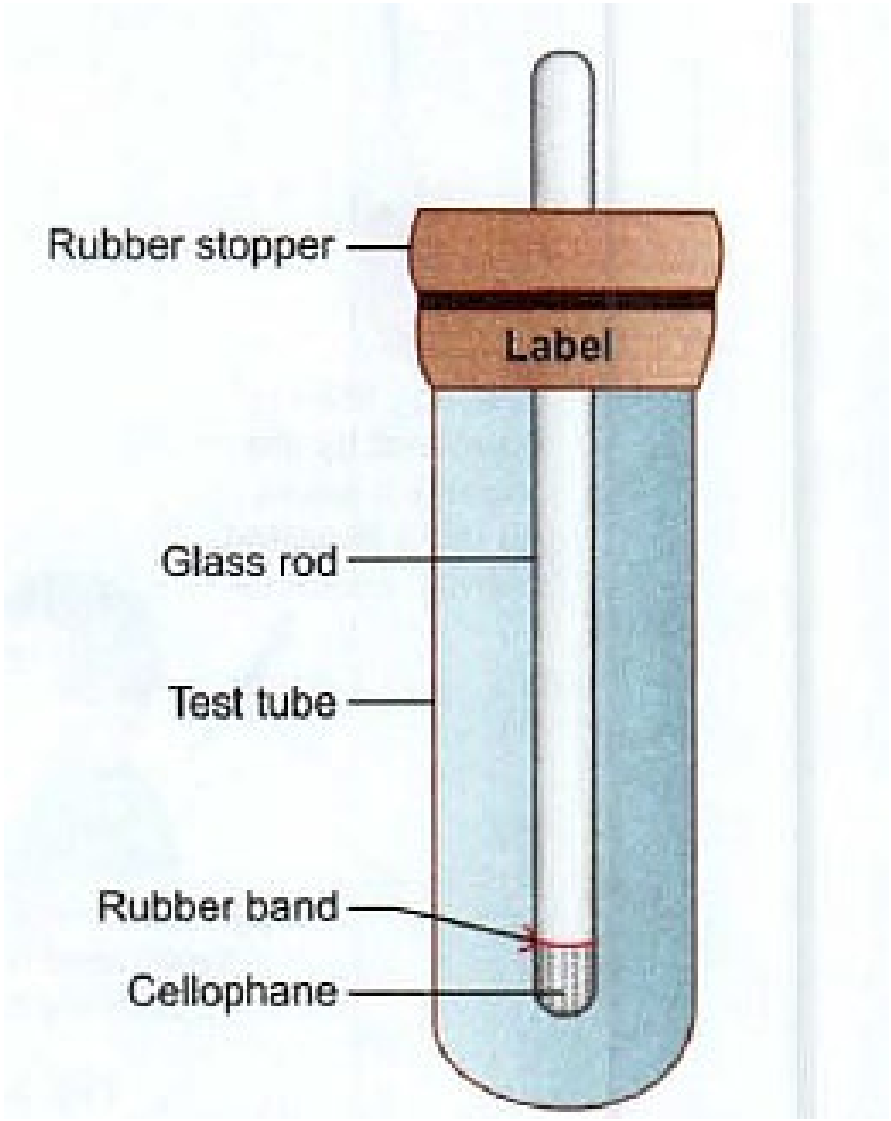
(D) The tape is replaced on the slide.





(E) The slide is smoothed down with cotton or gauze. It is then examined under a microscope for pinworm eggs.

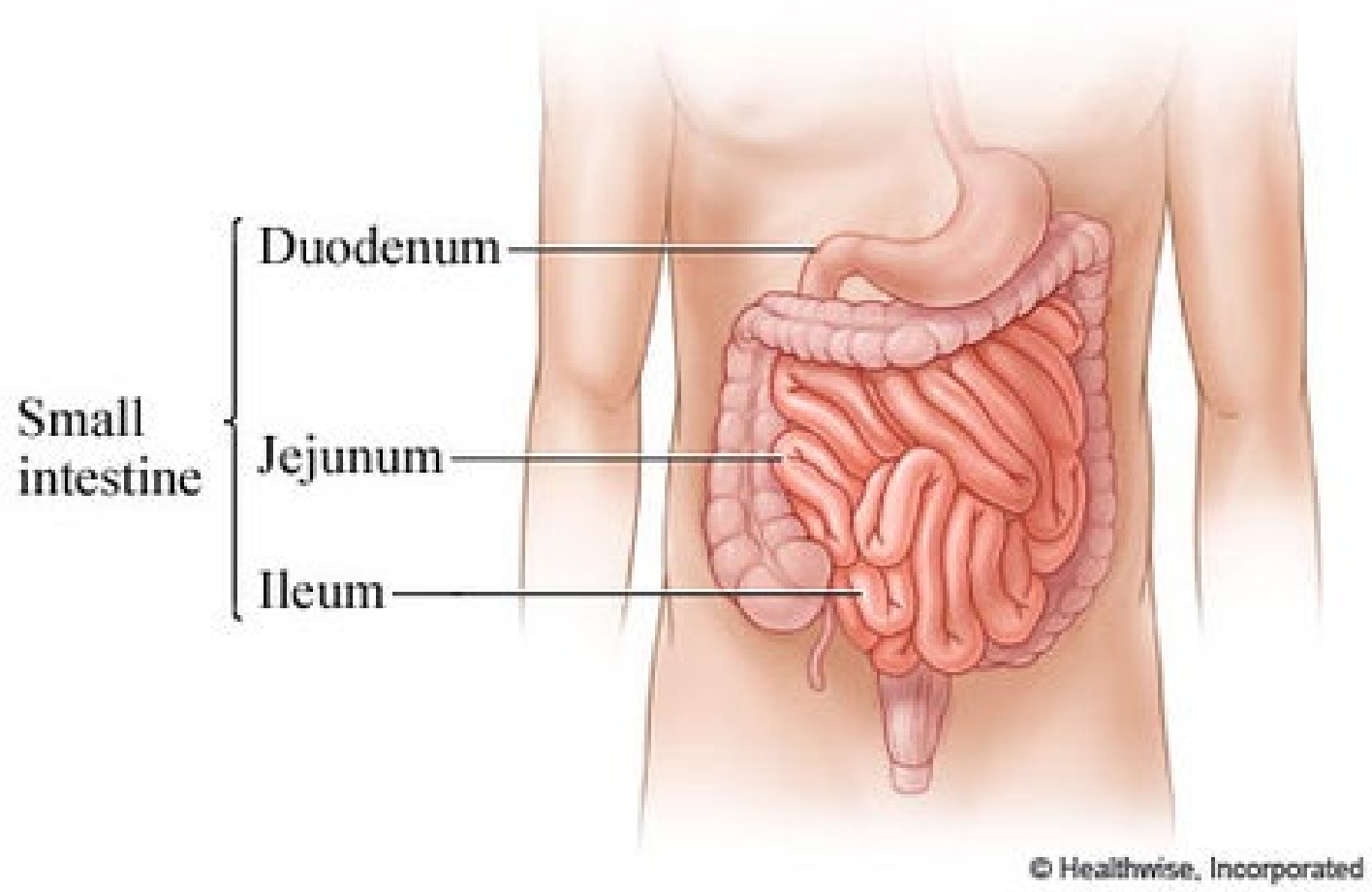
NIH Swab method



Ascaris lumbricoidis

Habitat

- Adult worms live in the small intestine (85% in jejunum and 15% in ileum). The roundworm, *Ascaris lumbricoides* is the largest nematode parasite in the human intestine.



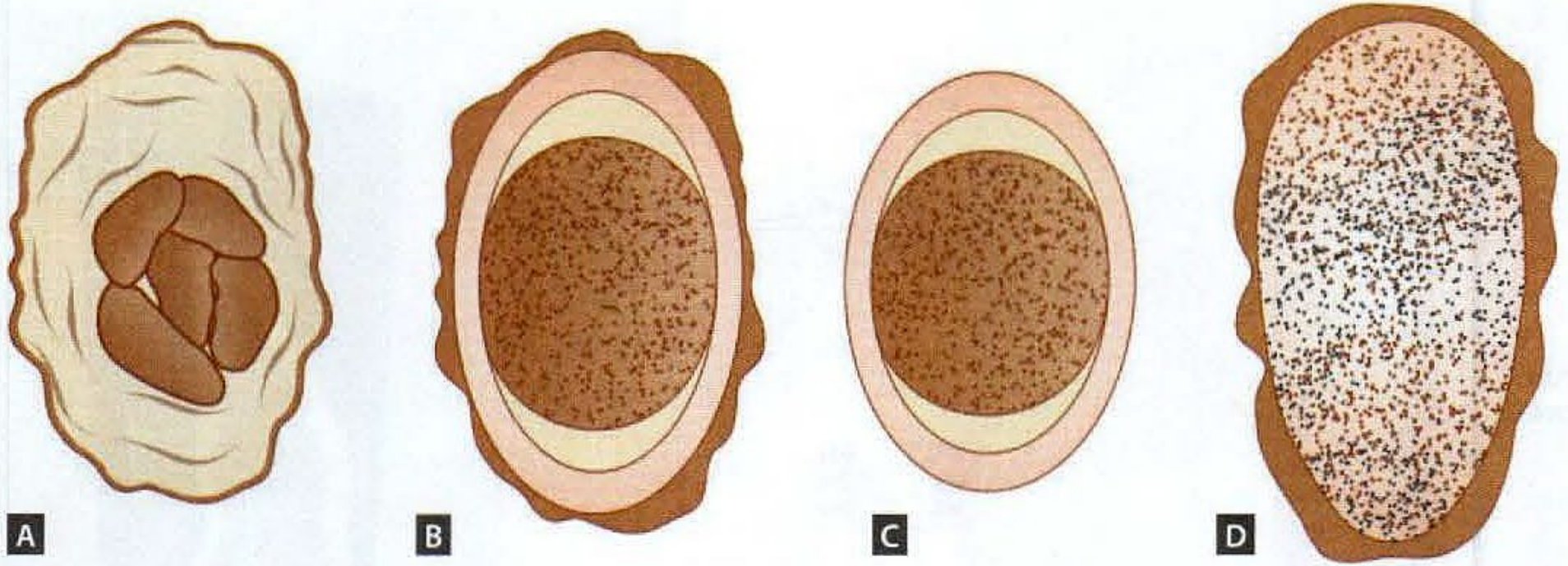
Ascaris lumbricoides

- It is an intestinal parasite, large in size (largest human parasitic nematode).
- It is the most common worm found in human
- The disease which causes is called Ascariasis or roundworm infection
- Common name called Round worm

Morphology

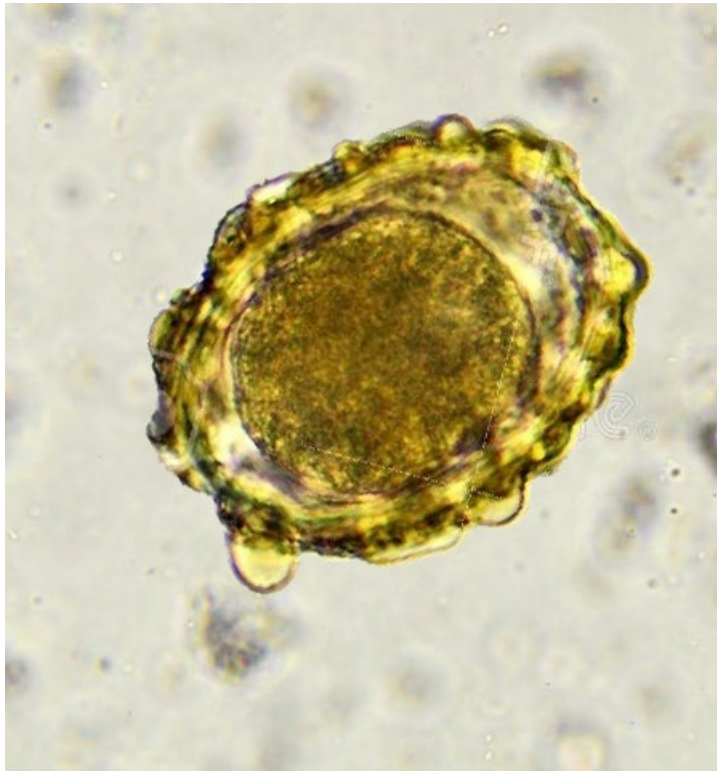
- The white reddish yellow adult worms are elongated nematodes
- The male is 15-31cm in length and its distinguished from the female which is 20-35cm by smaller in size and the ventral curved posterior end provided with two spicules
- The male has one set of genital organ while the female has two sets of genital organs
- On the tip of the head there are three lips. They have a complete digestive tract. Reproductive organs are tubular.

Egg



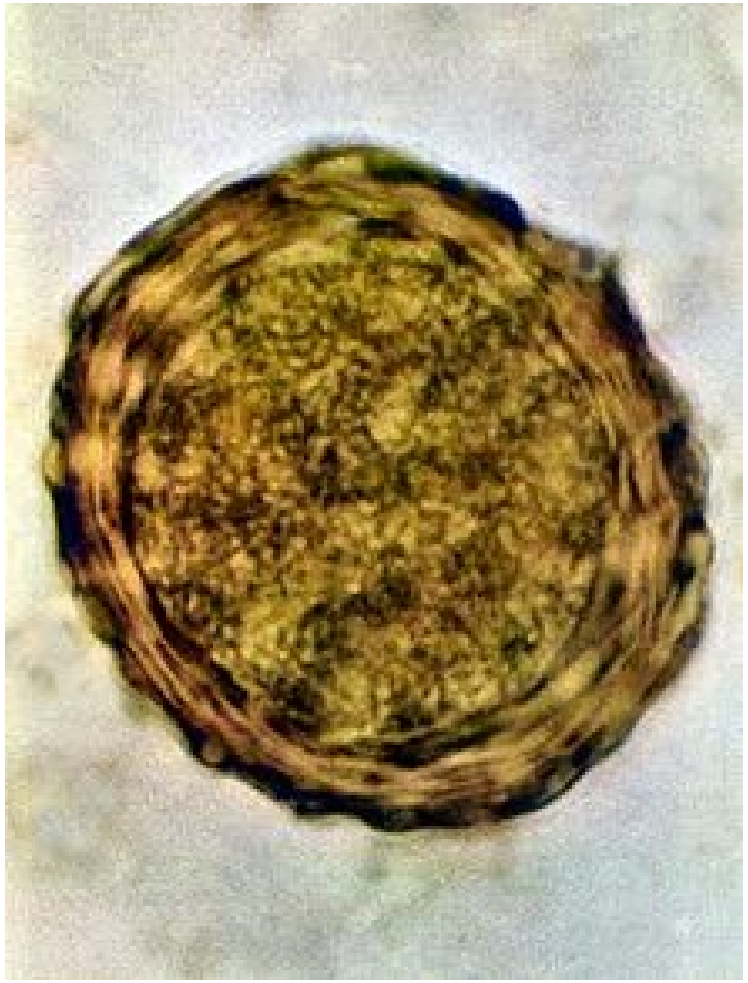
Figs 3A to D: Types of *Ascaris* eggs found in stools. (A) Fertilized egg surface focus, showing outer mamillary coat; (B) Fertilized egg, median focus, showing unsegmented ovum surrounded by three layers of coats; (C) Decorticated fertilized egg, the mamillary coat is absent; and (D) Unfertilized egg, elongated, with atrophic ovum

Fertilized Egg

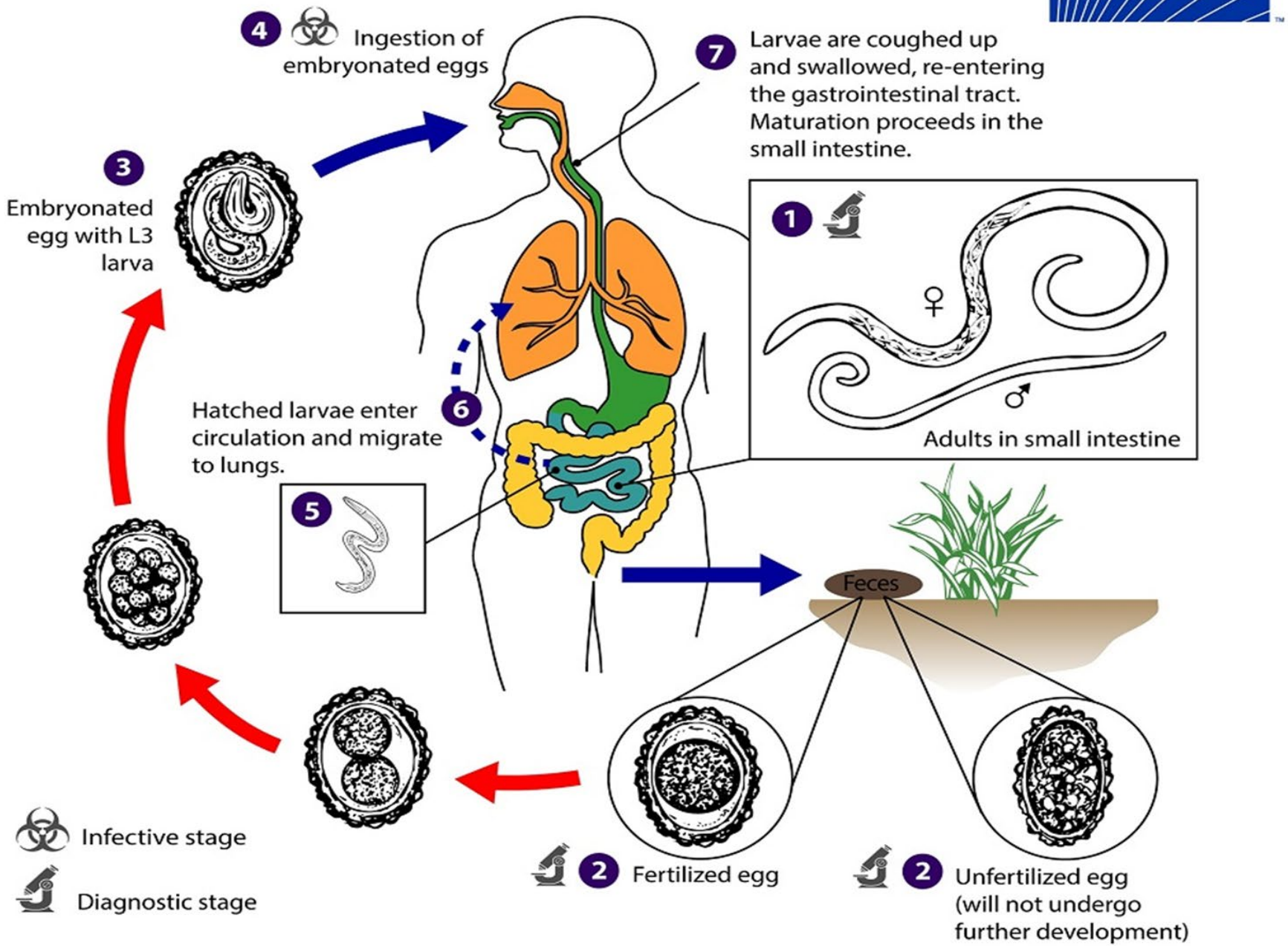


Unfertilized Egg

Ascaris lumbricoides **egg**



Ascaris lumbricoides



Diagnosis

The symptoms and signs are for reference only. The confirmative diagnosis depends on the recovery and identification of the worm or its egg.

1. **Ascaris pneumonitis**: examination of sputum for Ascaris larvae is sometimes
2. **Intestinal ascariasis**: feces are examined

for the ascaris egg.

The intestinal ascariasis diagnosis by:

(A) Direct fecal film: it is simple and effective. The eggs are easily found using this way due to a large number of the female ova position, approximately 240,000 eggs per worm per day. So, **this method is the first choice**.

(B) Indirect method (sedimentation):

Diagnosis

The symptoms and signs are for reference only. The confirmative diagnosis depends on the recovery and identification of the worm or its egg.

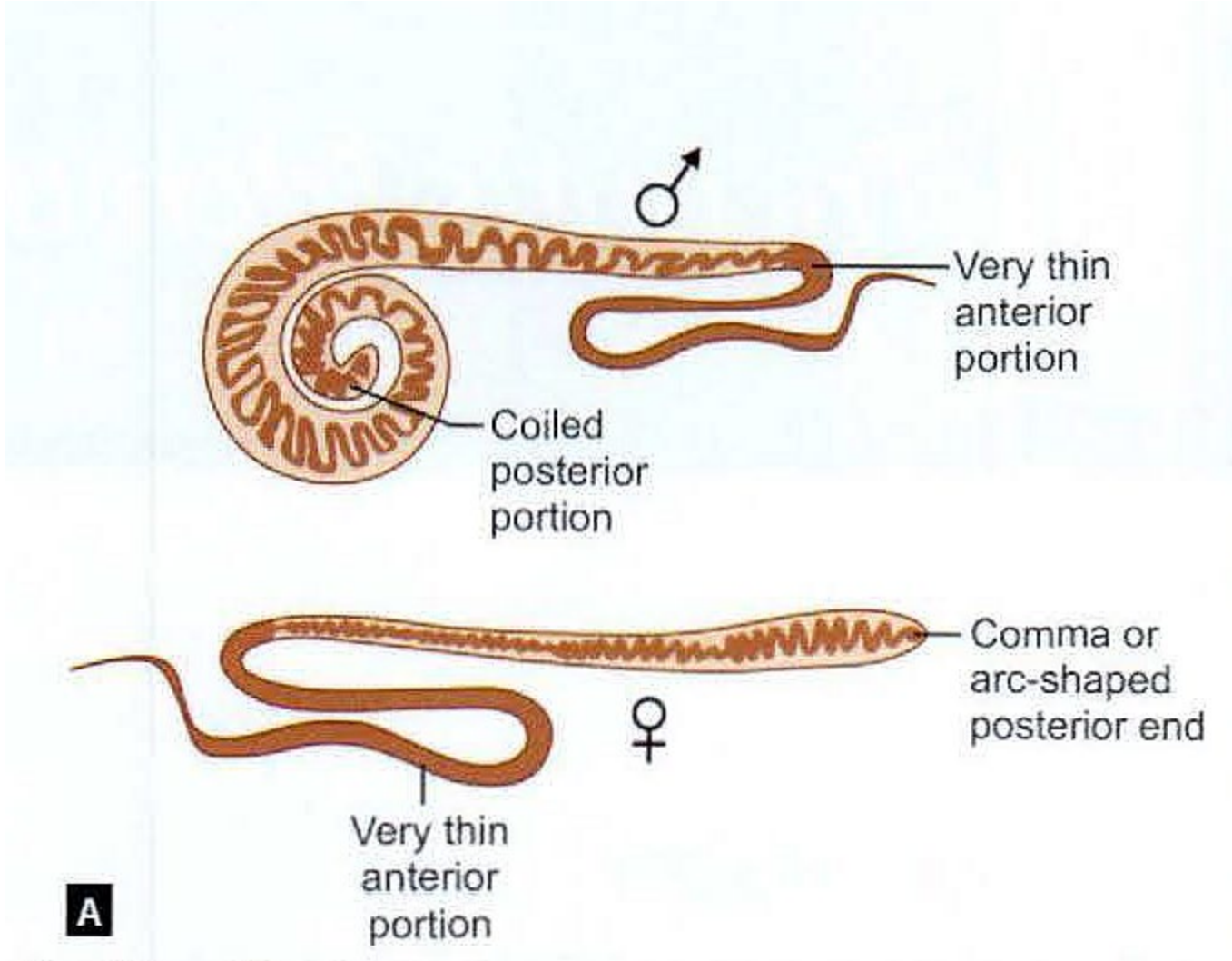
1. **Ascaris pneumonia**: examination of sputum for Ascaris larvae is sometimes
2. **Intestinal ascariasis**: feces are examined

for the ascaris egg.

Trichuris Trichiura

- The name ***Trichuris*** means a "hair- like tail" *(Greek trichos- hair, oura- tail).* This name is not quite correct because it is the anterior end of the worm that is hair-like and not the tail. the name **whipworm** is more apt as the thick posterior part resembles the stock and thin anterior end resembles the lash of a whip.

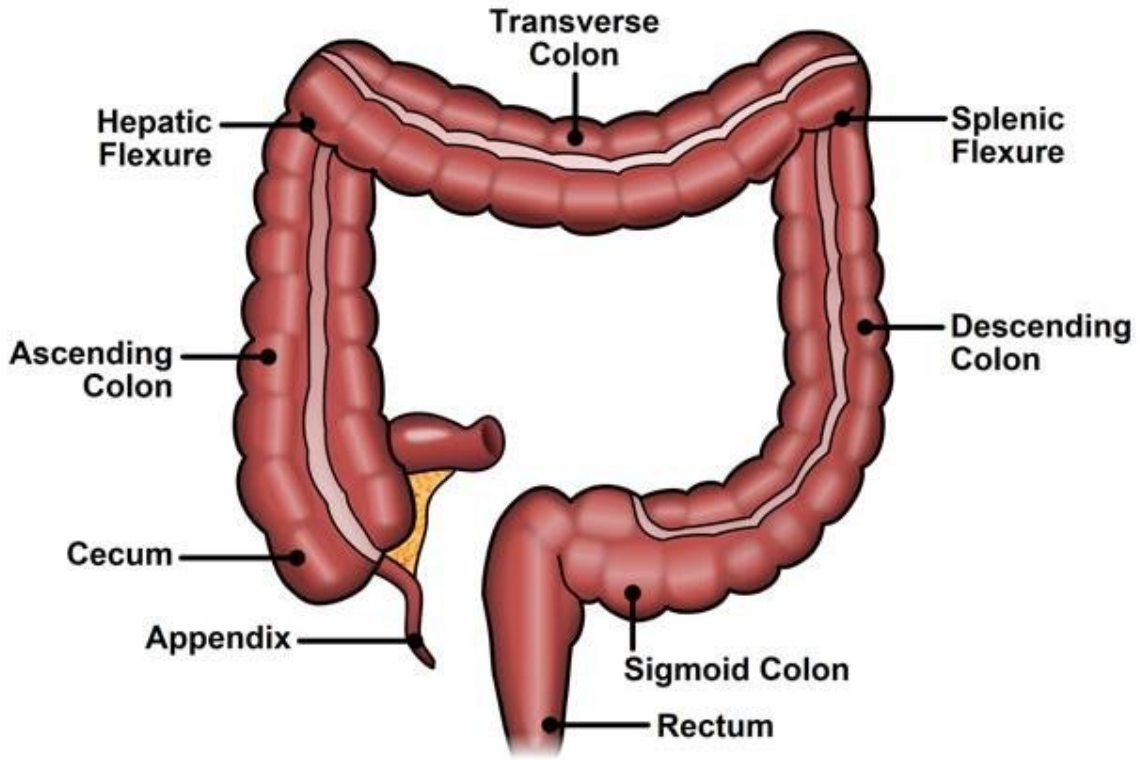
Common Name: Whipworm


♂
Very thin anterior portion
Coiled posterior portion
Comma or arc-shaped posterior end
♀
Very thin anterior portion
A


B

Habitat

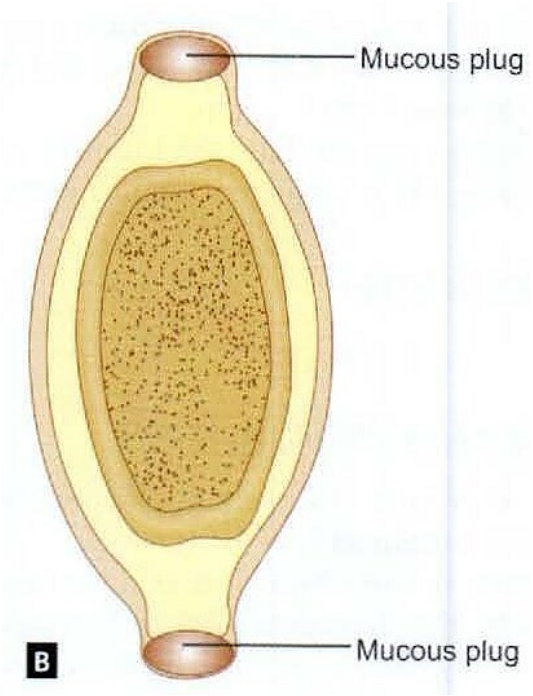
T. trichiura lives in the **large intestine**. The adult worms are found attached to the wall of the *cecum* and less commonly to the vermiform appendix, colon and anal canal.

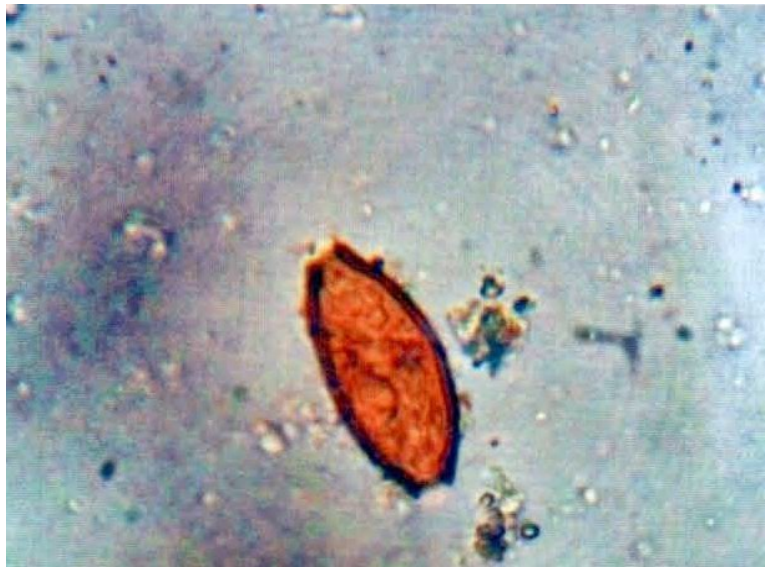


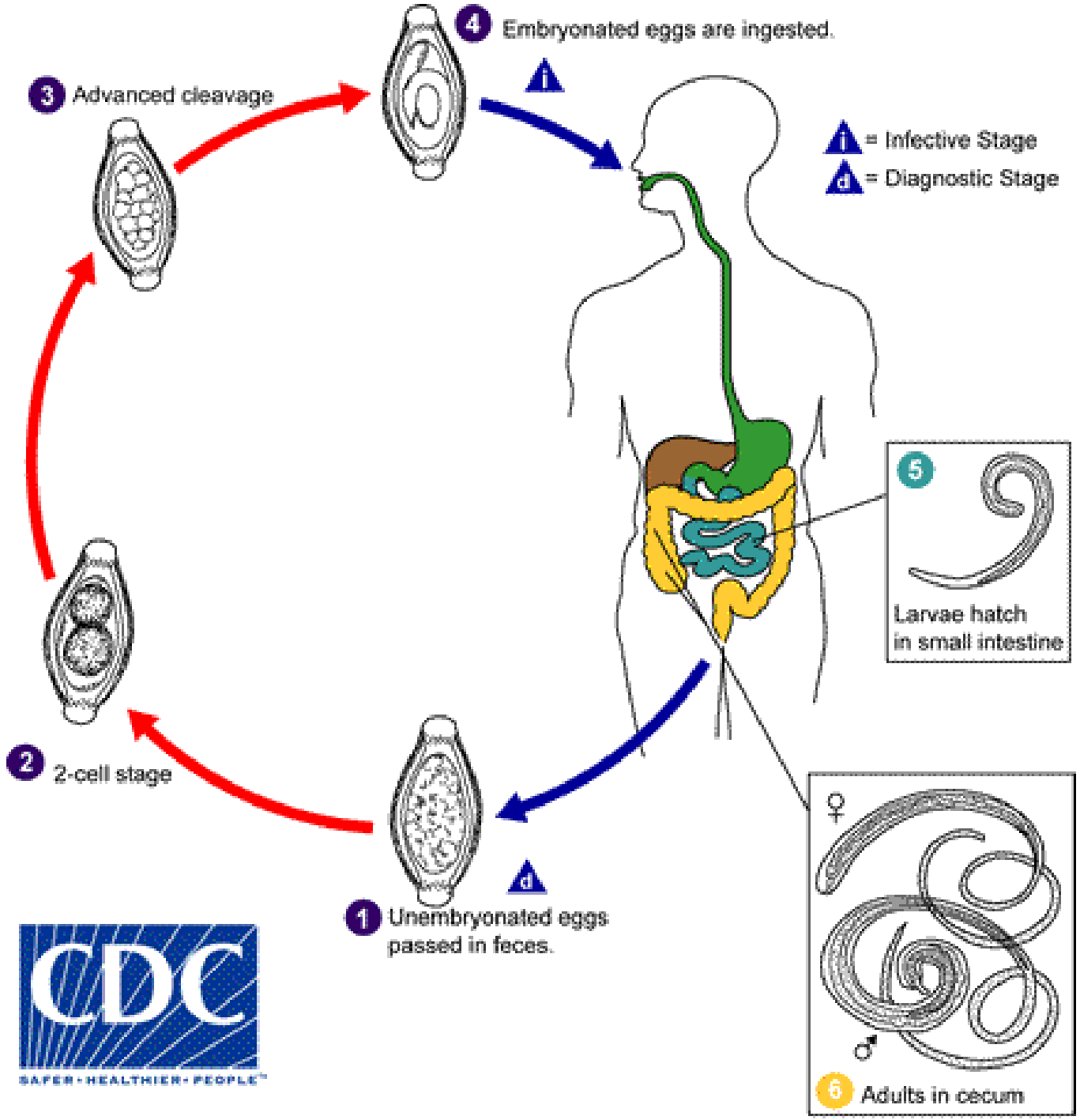
Egg

the egg has a characteristic appearance.

- It is brown in color being
- It has a ***triple shell,*** the outermost layer of which is stained brown.
- It is ***barrel-shaped*** and about 50 µm long and 25 µm wide in the middle






4 Embryonated eggs are ingested.
i
3 Advanced cleavage
i = Infective Stage
d = Diagnostic Stage
5
Larvae hatch
in small intestine
2 2-cell stage
d
1 Unembryonated eggs
passed in feces.
♀
♂
6 Adults in cecum
CDC
SAFER·HEALTHIER·PEOPLE™

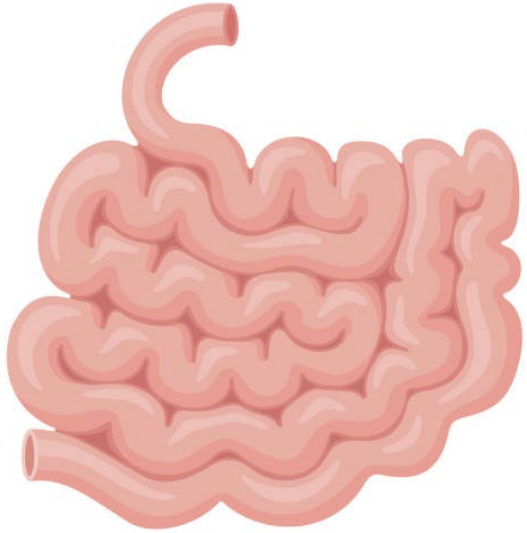
Trichinella spiralis

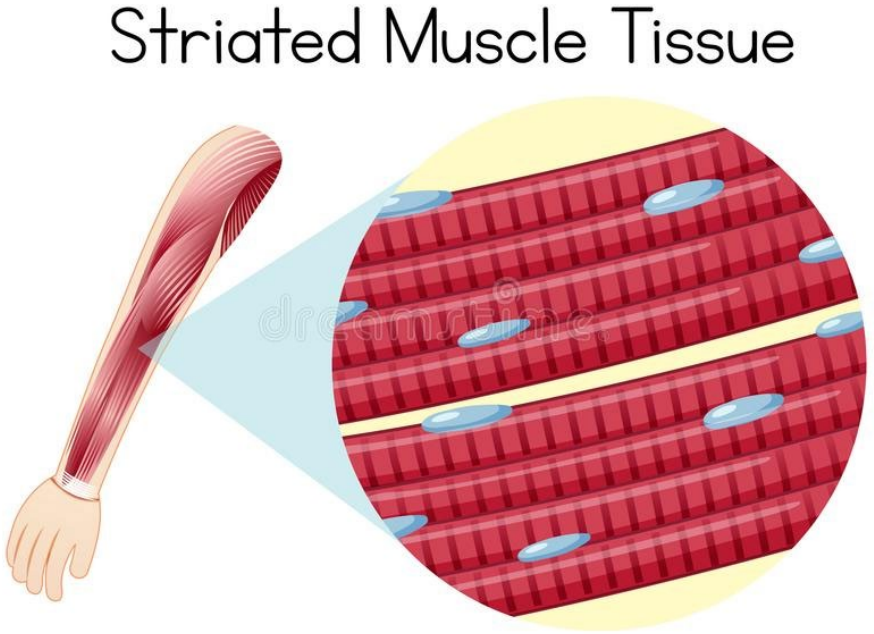
- *Trichinella spiralis,* tissue nematode, is the causative agent of *trichinosis.*
- The name *Trichinella* is derived from the minute size of the adult (Greek *trichos-hair, ella* suffix for diminutive, *spiralis* refers to the **spirally coiled** appearance of larvae in muscles).

Common name: Trichina Worm

Habitat

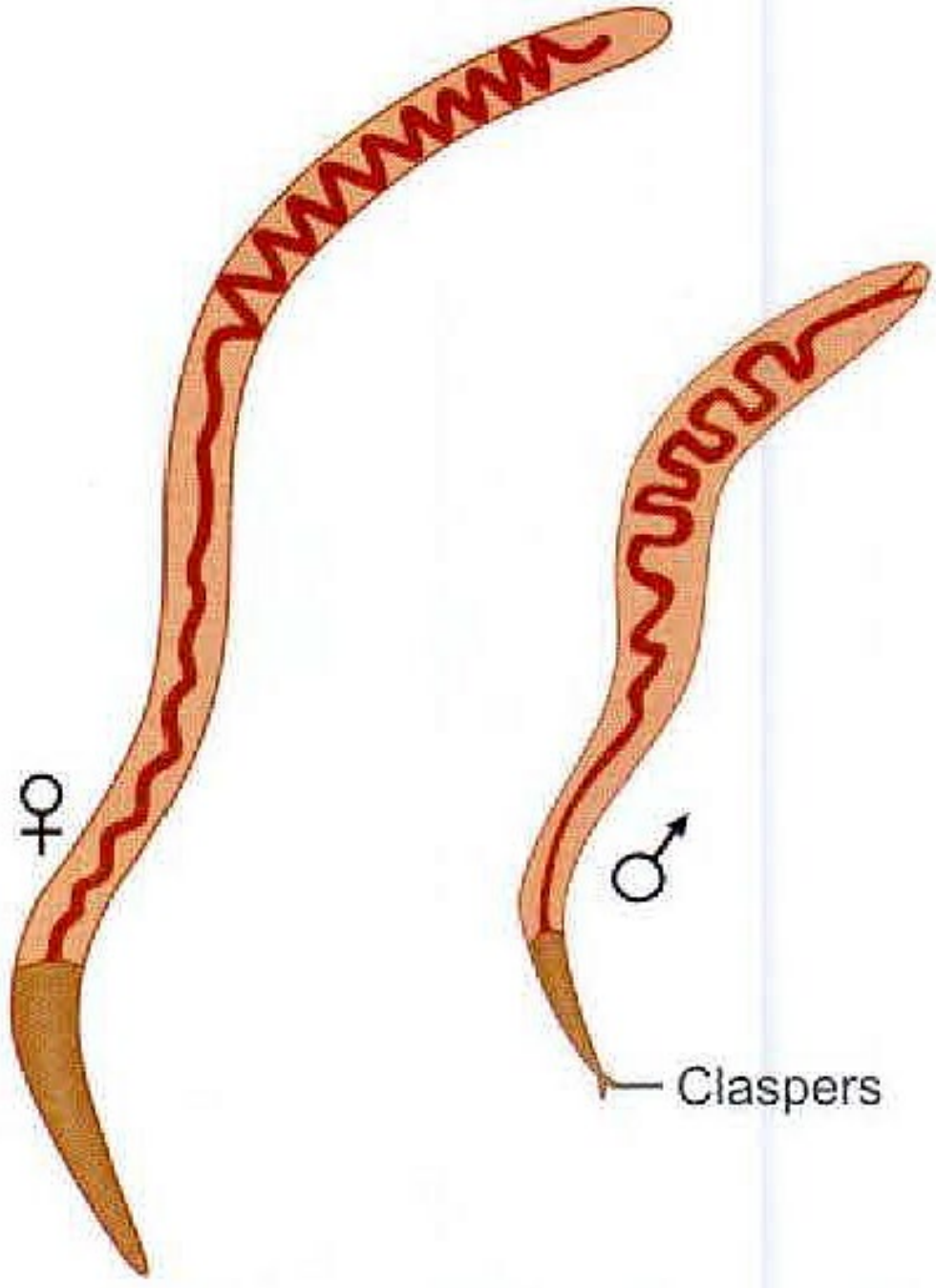
- Adult worms live deeply buried in the *mucosa of small intestine (duodenum or jejunum)* of pig, bear, rat, or man.
- The encysted larvae are present in the ***striated muscles*** of these hosts. There are no free-living stages.





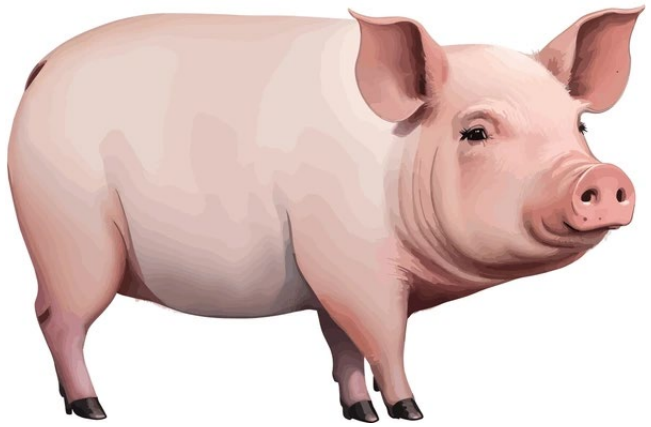
Morphology

- The ***male*** measures about 1.5 mm by 0.04 mm and the ***female*** about 3 mm by0.06 mm (twice the length of male). The *anterior half* of the body is *thin* and *pointed,* well adapted for *burrowing* into the mucosa! Epithelium The *posterior end* of the male has a pair of pear-shaped *clasping papillae* (termed as **claspers),** one on each side of the *cloacae orifice* that it uses to hold the female worm during mating
- The female worm is ***viviparous*** and discharges larva instead of eggs.
- The lifespan of the adult worm is very short. The male worm dies soon after fertilizing the female and the female dies after 4 weeks to 4 months (16 weeks), the time required for discharging the larvae.


♀
♂
Claspers

Hosts

Optimum host: Pig



Alternative host: Human

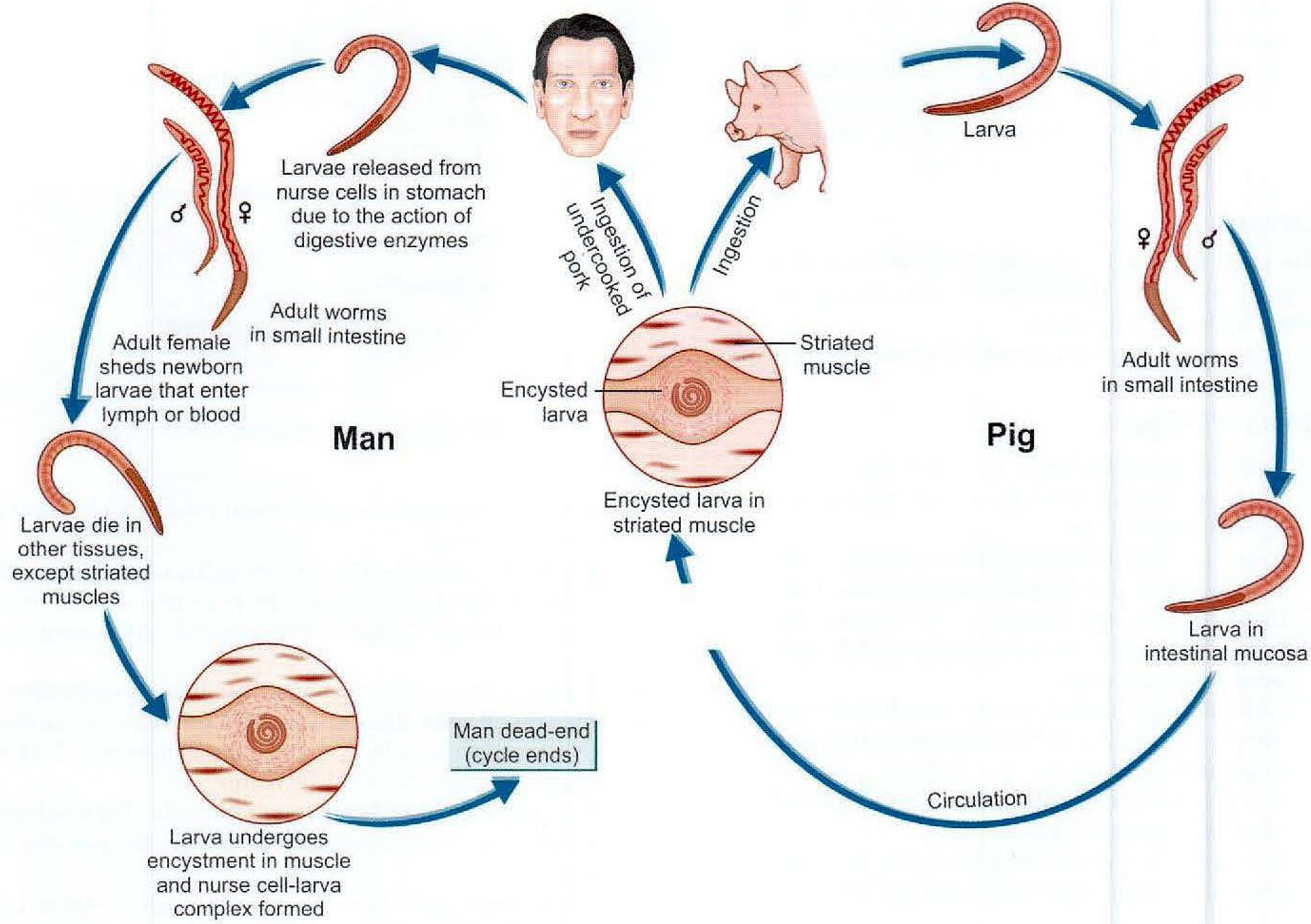
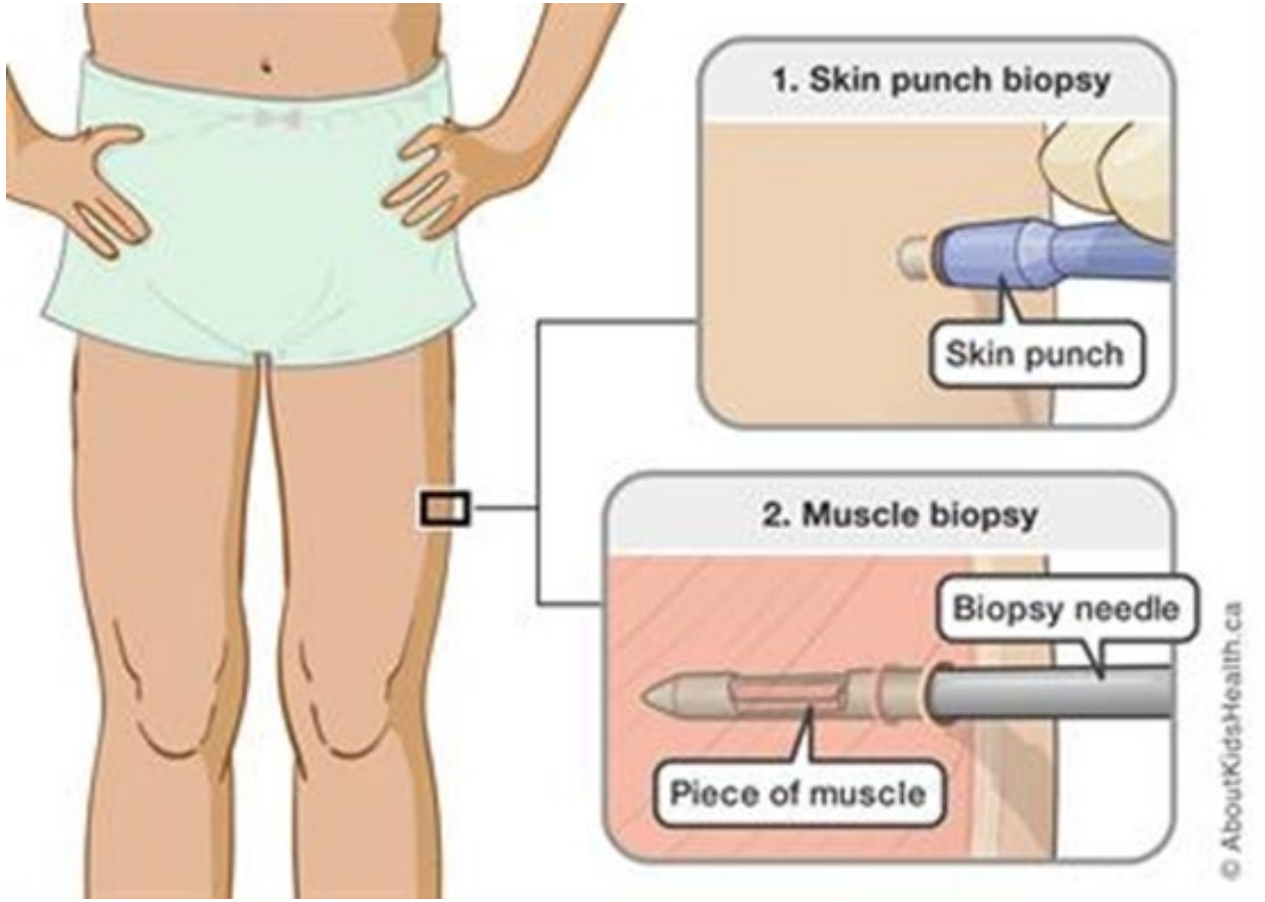


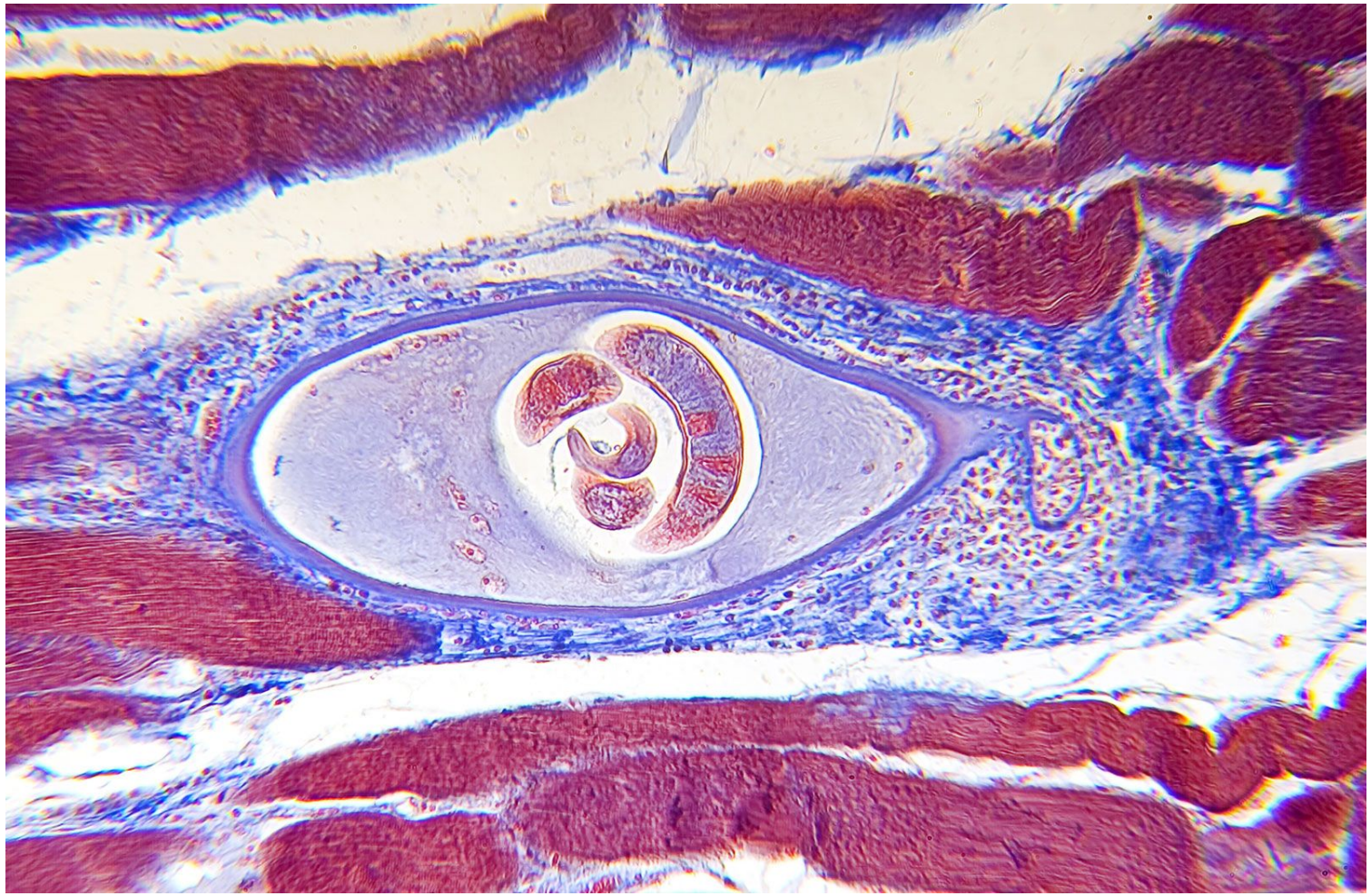
Fig. 3: Life cycle of *Trichinella spiralis*

Diagnosis

Direct methods

- Detection of spiral larvae in muscle tissue by performing **muscle biopsy.** Deltoid, biceps, gastrocnemius, or pectoralis muscles are usually selected for biopsy**.**
- Detection of adult worms and larvae in the stool during the diarrheic stage.
- **Xenodiagnosis:** For xenodiagnosis, biopsy bits are fed to laboratory rats, which are killed in a month or so, later. The larvae can be demonstrated more easily in the muscles of such infected rats.


1. Skin punch biopsy
Skin punch
2. Muscle biopsy
Biopsy needle
Piece of muscle
© AboutKidsHealth.ca

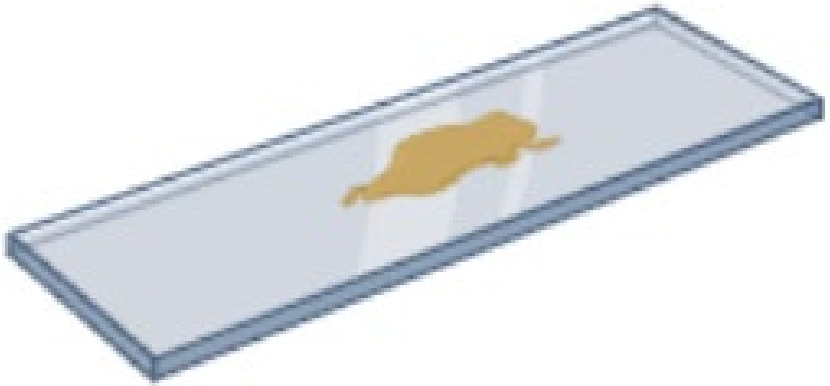


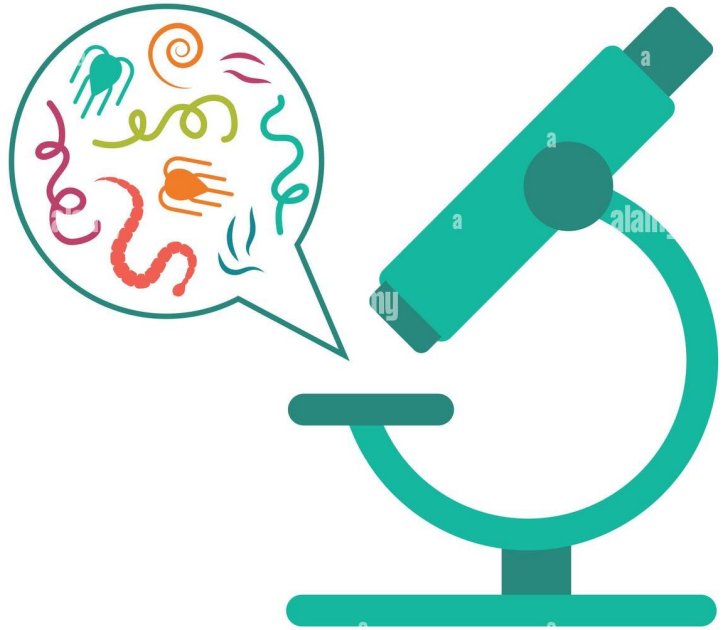
Indirect Methods

- **Blood examination:** It shows eosinophilia (20-95%).
- **Serology:** There is massive hypergammaglobulinemia with elevated serum immunoglobulin E (IgE). *T. spiralis* antibody can be detected by enzyme-linked immunosorbent assay (ELISA) test using TSL-1 secreting antigens obtained from the infective stage Larvae

Techniques of using Microscope during GSE

Preparation of Slide for GSE (Microscopical Examination)





GSE Report

LAB No.	XX002250	Date	20/Feb/2021
Name	Mr. .	Sex	M

GENERAL STOOL EXAMINATION (GSE)

Test Name	Result	Units	Normal Range
MACROSCOPIC EXAMINATION			
COLOURE	.		
APPERANCE	.		
PH	.		
MICROSCOPIC EXAMINATION (Conc			
PUS CELL	.		(H.P.F)
RBC cell	.		(H.P.F)
GIARDIA LAMBLIA	.		
E. HISTOLYTICA	.		
E .COLI	.		
UNDIGESTED FOOD	.		
FATTY DROP	.		
BACTREA	.		
MONELLIA	.		
OTHERS	.		
NO PARASITE	.		
SPECIAL TEST			
OCCULT BLOOD	.		

End of Report