Parasitology Lab.

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Parasitology *Lab.*

Entamoeba histolytica* and *Entamoeba coli

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Parasitology

Parasitology:
Is a branch of science that dials with parasites, their hosts and the relationship between them.

Parasite:
Is an eukaryotic organism that lives in or on an organism from another species (usually called a host). The parasites may cause severe diseases in their hosts such as dysentery, toxoplasmosis, malaria…ets or they may live as non-pathogenic organisms such as Entamoeba coli and Trichomonas hominess. In general, the parasites are divided to the three main groups including; protozoa, helminths and arthropods.

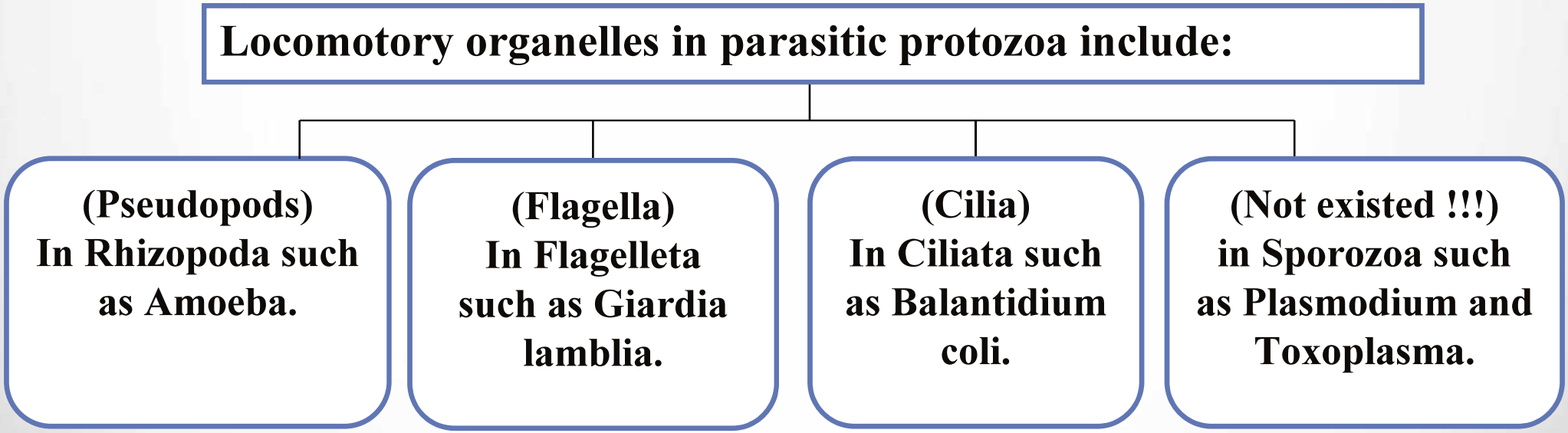
- **Protozoa : is a group of either parasitic or free-living unicellular organisms which feed on organic materials such as organic debris and live tissues or other microorganisms such as bacteria.**

- **Protozoan parasites are microorganisms that consist of a single cell but it can do all the biological activities such as feeding, growth, reproduction... ets.**

Locomotion in parasitic protozoa

Locomotory organelles in parasitic protozoa are originated from ectoplasm and used for:

- Classification of protozoa
- Help parasites to move from one place to another.
- Pseudopods in Sarcodina members are used for food ingestion by phagocytosis process.



Classification of Protozoa

Protozoa is belong to the Kingdom of Protista and this includes:

1. Phylum: Sarcomastigophora
2. Phylum: Ciliophora
3. Phylum: Apicomplexa

Phylum: Sarcomastigophora

Sarcomastigophora phylum contains 3 subphylums include:

1. Subphylum: Sarcodina
2. Subphylum: Mastigophora
3. Subphylum: Opalinata

Subphylum: Sarcodina

Subphylum: Sarcodina
Super class: Rhizopoda
Class: Lobosea
Order: Amoebida
Family: Entamoebidae
Genus: *Entamoeba* : we will focus on the two genera include:

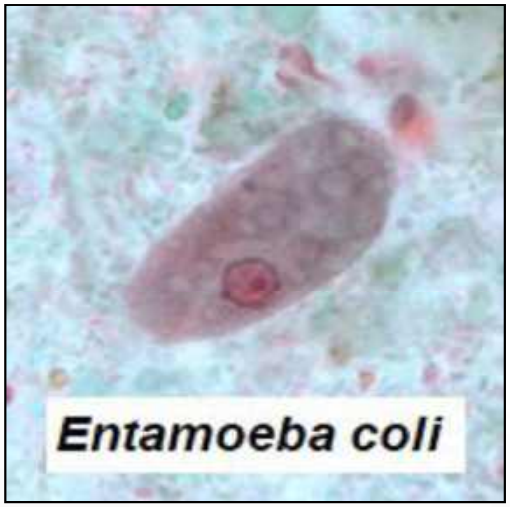
1. *Entamoeba histolytica*
2. *Entamoeba coli*

Order: Amoebida

- **Amoebida order includes group of parasitic protozoa belongs to Rhizopoda super class, where they use pseudopods as Locomotory organelles.**

- **There are 7 species of Amoeba belong to the Amoebida order can infect human, just one of them is pathogenic to the human which is *E. histolytica*.**

- **Additionally, one of these 7 species live in mouth (E. gingivalis), other species live in the intestines. In this lab we will just focus on 2 species of Entamoebidae family including; *Entamoeba histolytica* and *Entamoeba coli*.**

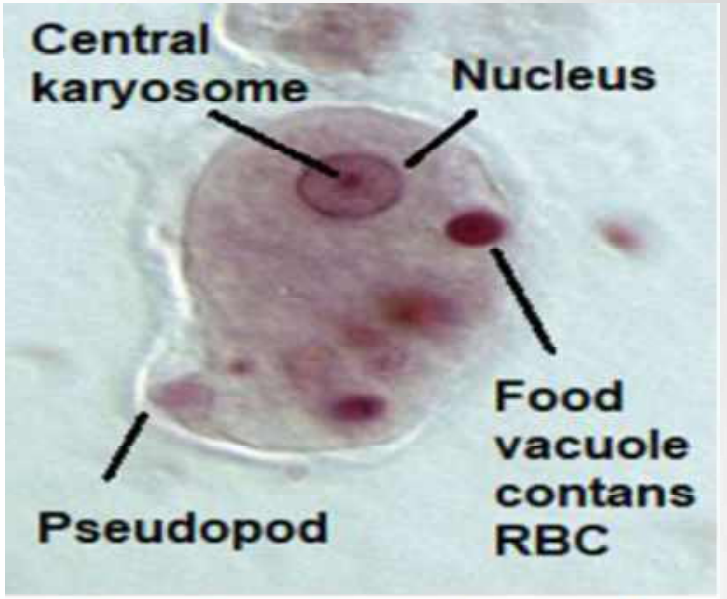


Entamoeba histolytica

E. Histolytica **has two life stages including; trophozoite and cyst stage.**
Trophozoite stage is characterized by:

1.Has a single nucleus with central karyosome.

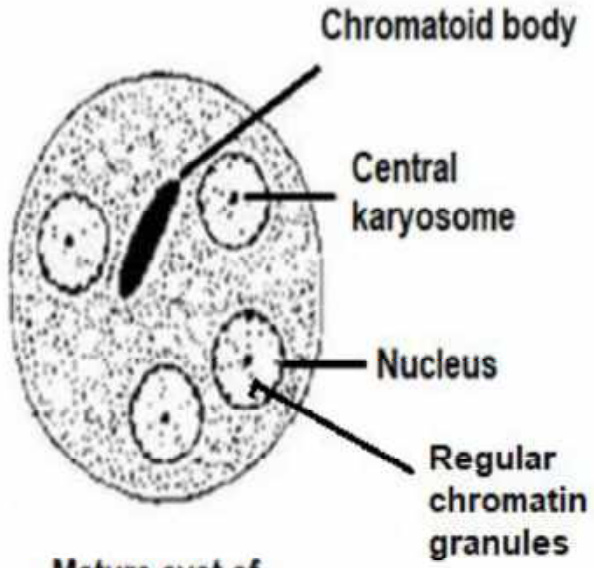
2.Chromatin granules are distributed regularly on the internal surface of nuclear membrane and they have similar size and shape.
3.Has food vacuoles which usually contain RBCs
4.Has obvious pseudopods.



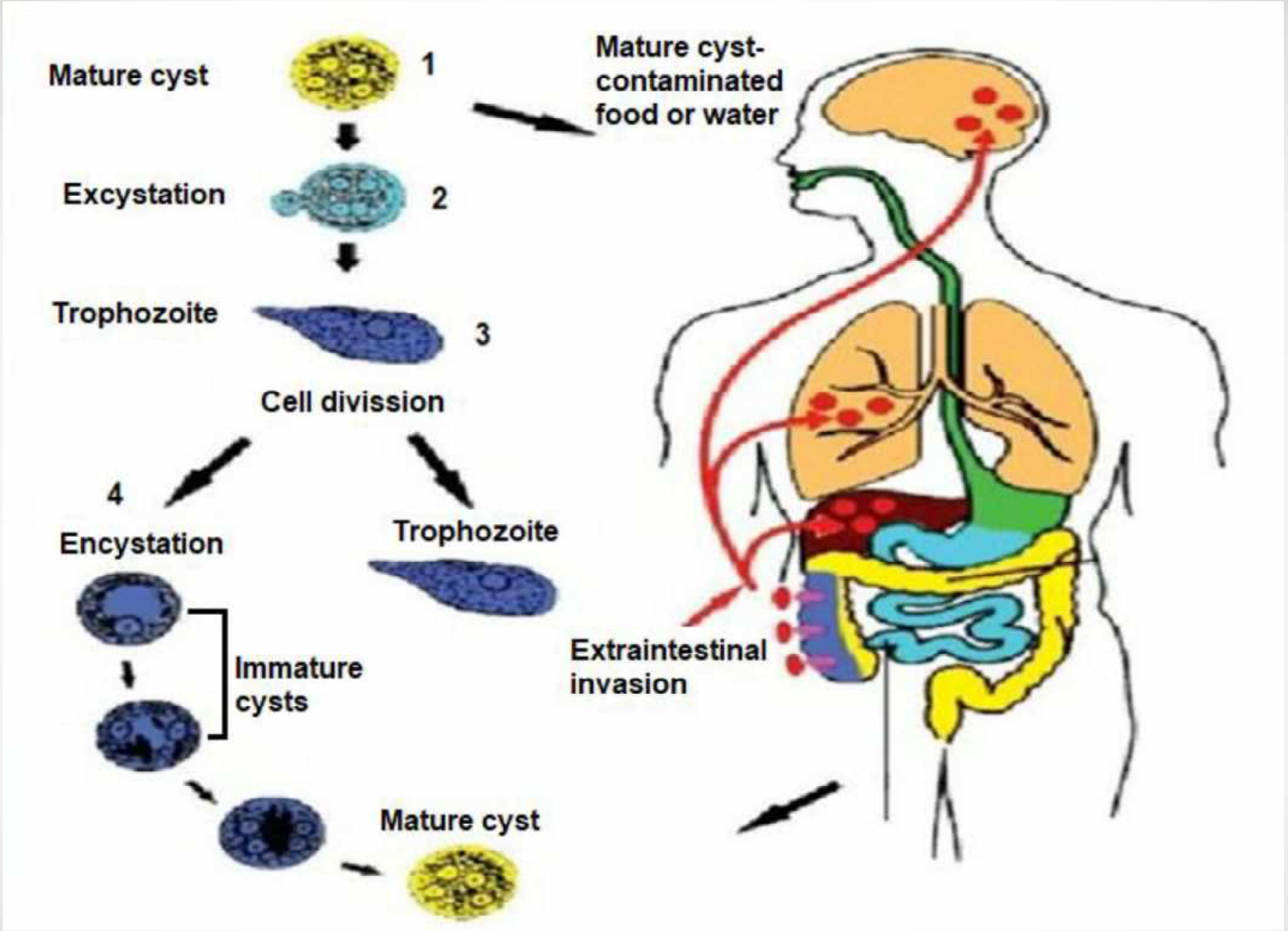
Trophozoite stage of *E. histolytica*

Cyst stage is characterized by:
1.Mature cyst contains 4 nuclei with central karyosome.

2. Each mature cyst contains 2 chromatoid bodies with rounded ends.
3. Chromatin granules are similar to trophozoite stage.



Mature cyst of Entamoeba histolytica



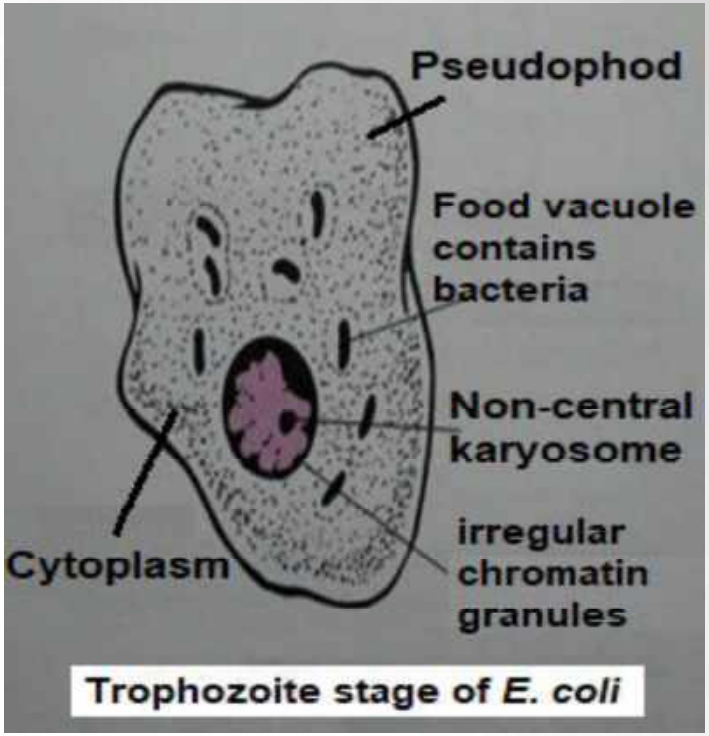
Life cycle of *E. histolytica*
(Obtained with permission from Ximenez et al, 2011)

Entamoeba coli

There are two stages in *E. coli* life cycle including trophozoite and cyst stage.
Trophozoite is characterized by:

1.Has a single nucleus with non-central karyosome.
2.Chromatin granules are distributed irregularly on internal surface of nuclear membrane and have different sizes and shapes.
3.Has food vacuoles usually contain bacteria.

4.Has short pseudopods.

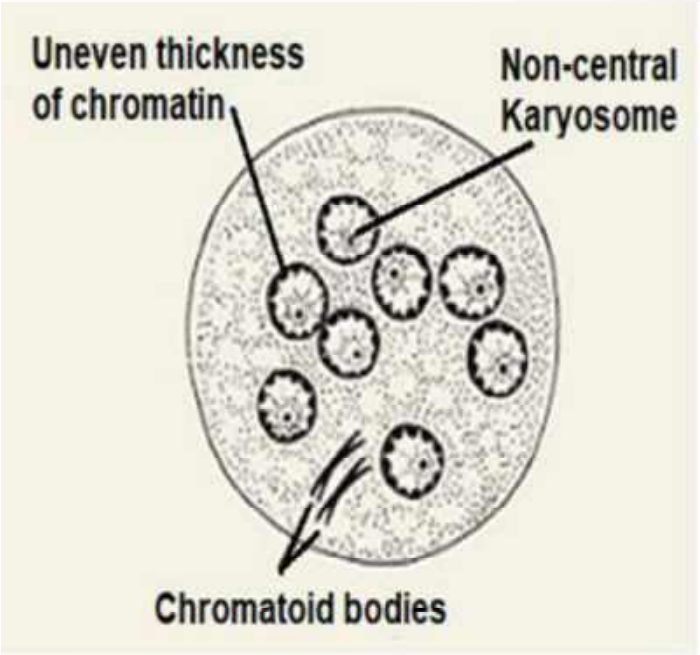


Trophozoite stage of *E. coli*

Cyst stage is characterized by:
1.Mature cyst contains 8 nuclei with non-central karyosome.

2. Each mature cyst usually contains two chromatoid bodies with splinter-like with pointed ends.

3. Cyst nucleus is similar to trophozoite.



Mature cyst of *E. coli*

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Parasitic flagellates

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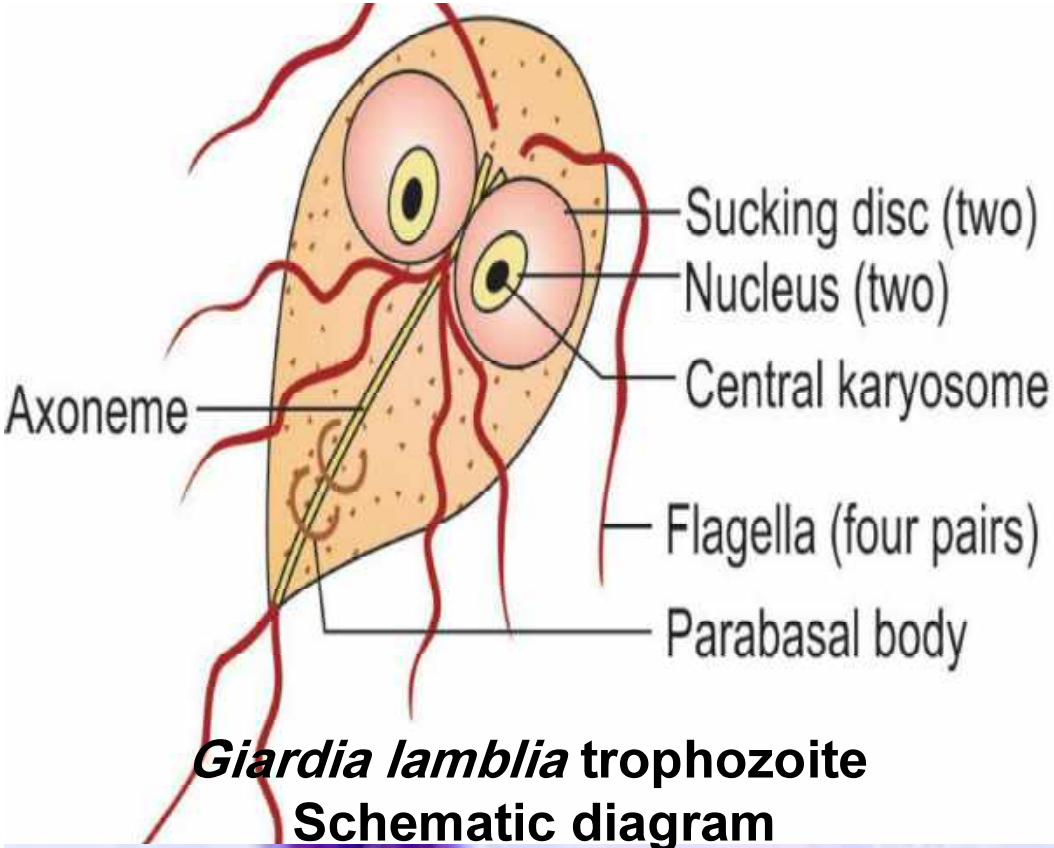
parasitic flagellates of man

This group of parasites bear flagella as the organ of locomotion
Flagellates are classified according to their location in the body
1.Intestinal flagellates (*Giardia lamblia*)
2.atrial flagellates (*Trichomonas vaginalia*)
3.blood and tissues flagellates (*Trypanosoma* , *Leishmania*)

Giardia lamblia

Classificaton of *Giardia lamblia*
Kingdom : protista
Phylum : Sarcomastigophora
Class : zoomastigiphora
Order : Diplomonadida
Family : Hexamitidae
Genus : *Giardia*
Species : *Giardia lamblia*
Habitat:
Duodenum and upper part of jejunum.
Morphology:
It occurs in two forms
(1) trophozoite
(2) cyst

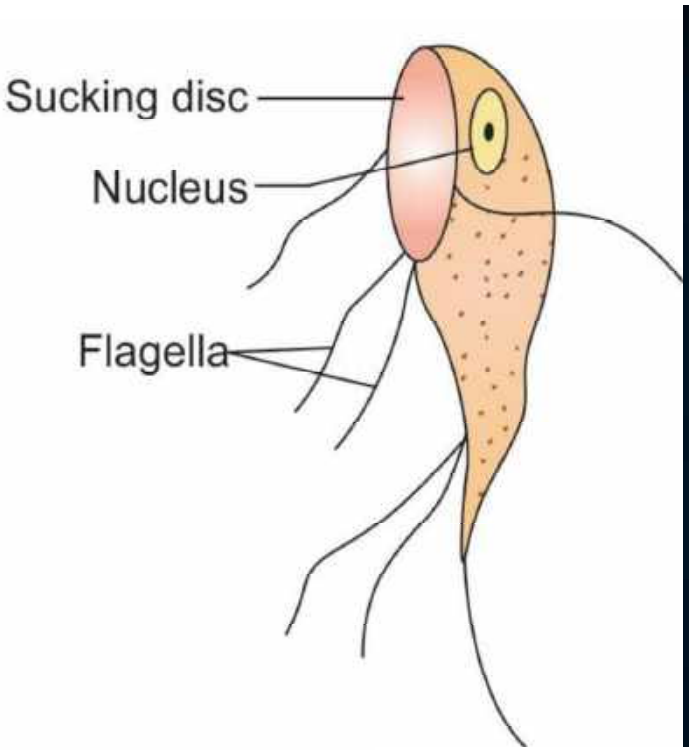


Giardia lamblia **trophozoite**
Schematic diagram

Giardia lamblia **trophozoite**
Microscopic image

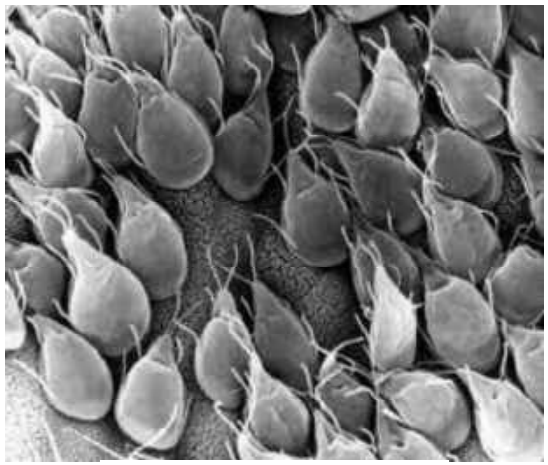
Diagnostic features :

- **In front view, it has pear shaped (or teardrop or tennis racket shaped) with rounded anterior end and pointed posterior end**
- **It is convex dorsally while the ventral surface has a concavity bearing tow sucking disc.**
- **One pair of nuclei**
- **Four pairs of flagella one anterior , one lateral, one ventral and one caudal pair of flagella.**
- **Pair of axoneme or axostyle**

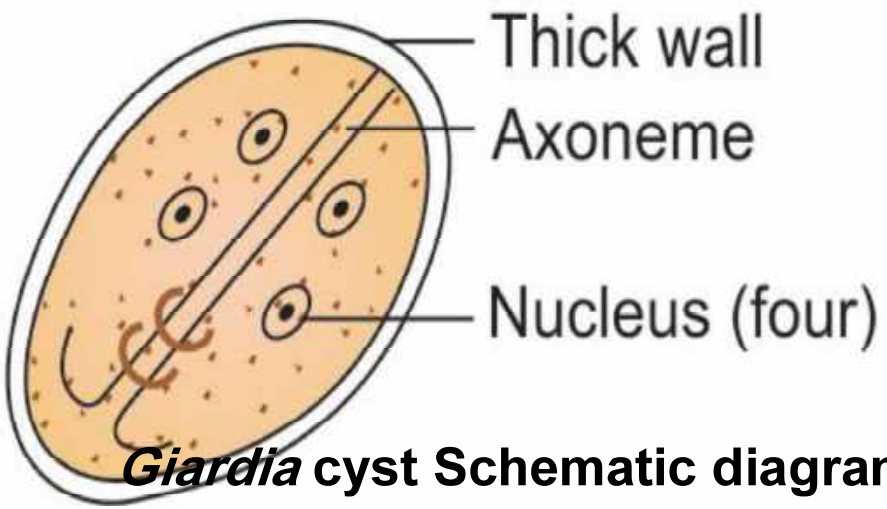


Laterally , it appears as a curved portion of a spoon (sickle shaped)

***Giardia lamblia* trophozoite lateral view**



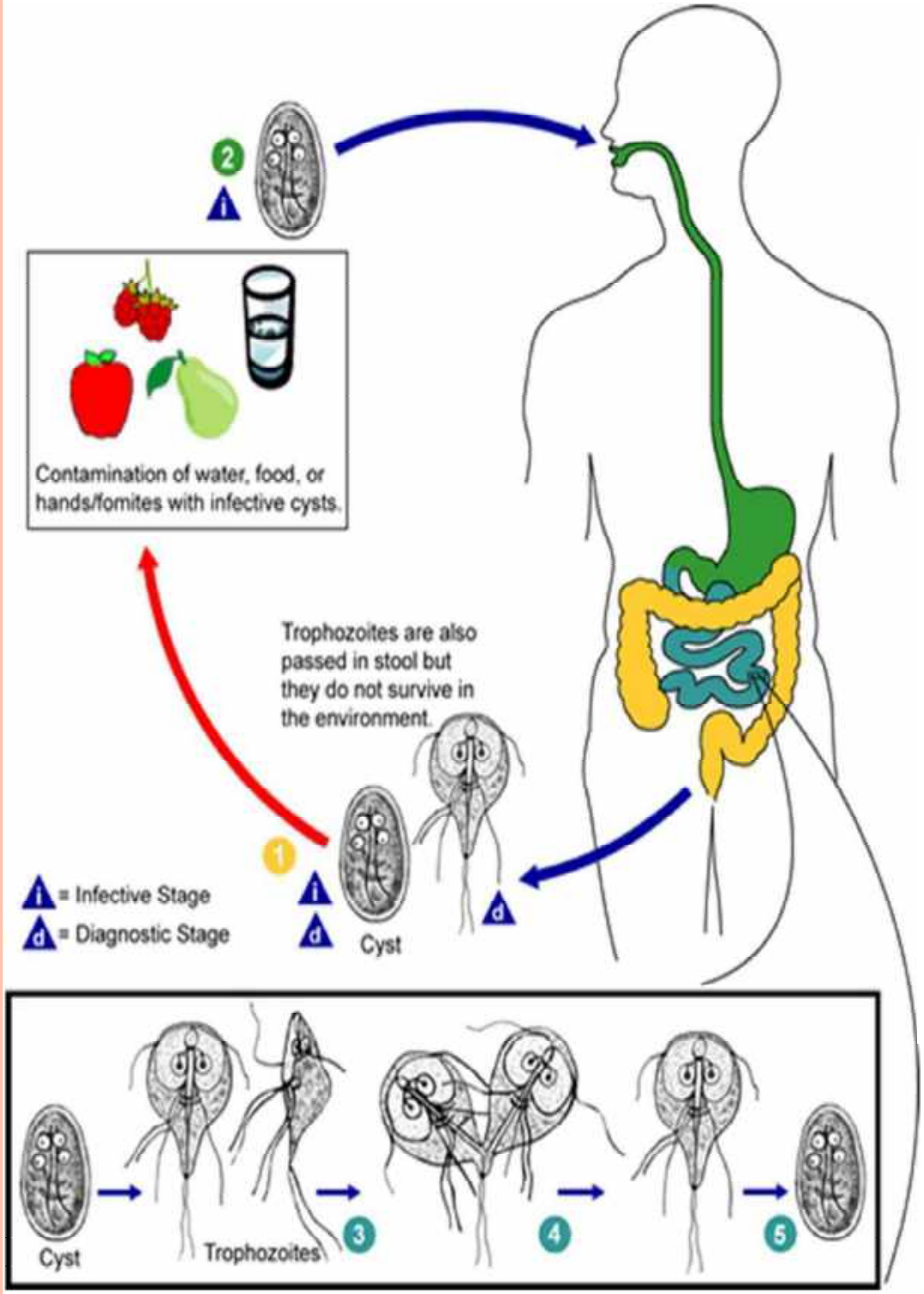
Giardiasis



Giardia **cyst Schematic diagram**

- ***Giardia*** **cyst is oval shaped It contains four nuclei and remnants of axonemes, basal bodies and parabasal bodies**
- **It is the infective form as well as the diagnostic form of the parasite.**

Giardia **cyst Microscopic image**

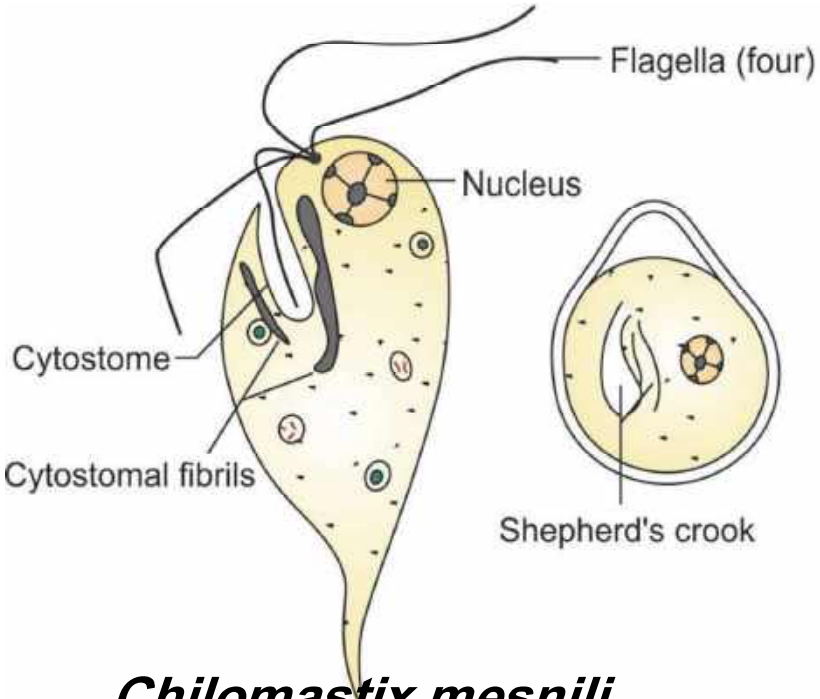


Life cycle of *giaria lamblia*

1. Infection occurs by the ingestion of cysts in contaminated water, food.
2. In the small intestine, excystation releases trophozoites.
3. Trophozoites multiply by longitudinal binary fission.
4. Encystation occurs as the parasites transit toward the colon

Chilomastix mesnili

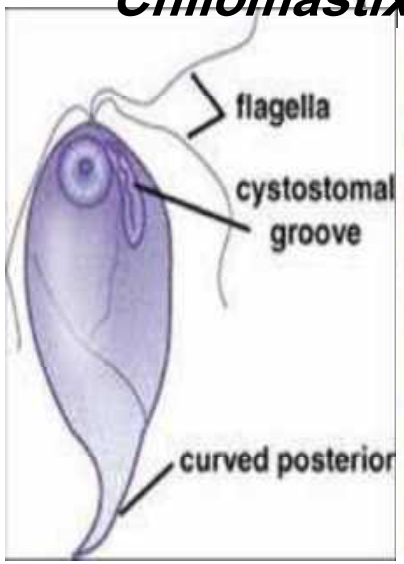
***Chilomastix mesnil*i is a harmless commensal of cecum and colon in man.**



Diagnostic features (trophozoite)

- **It has two stages—trophozoites and cyst stages**
- **it has pear-shaped At the anterior end, there is a single nucleus and cytostome**
- **It has four flagella—three anterior and one in cytostome one in cytostome**

Chilomastix mesnili



Cyst

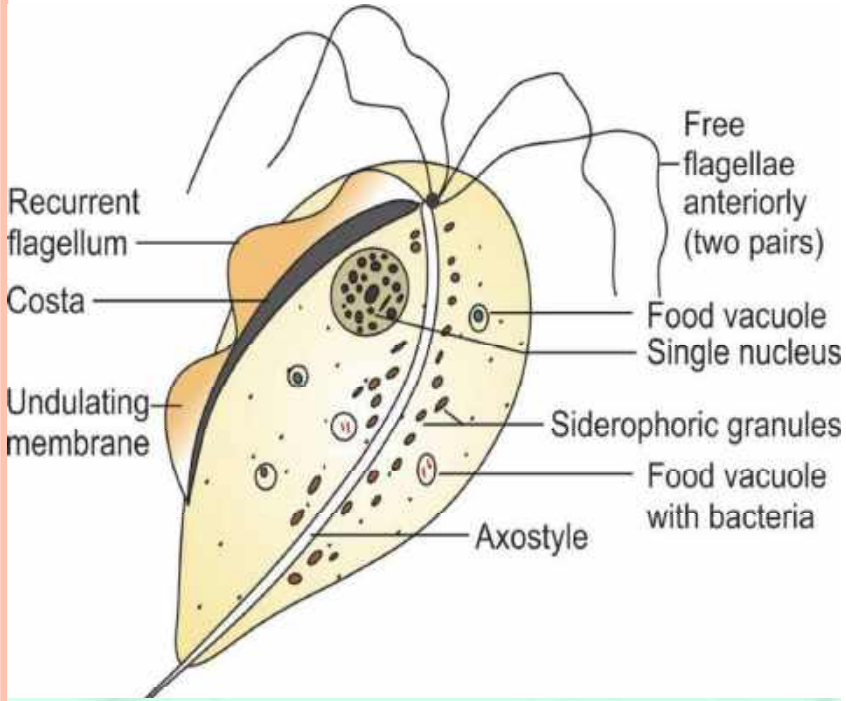
- **It is the infective stage**
- **It has lemon shaped with a narrow anterior end, surrounded by a cyst wall**
- **Bears a single nucleus , cytoplasm is densely granular, separated from the cyst wall at the anterior end**

TRICHOMONAS VAGINALIS

Trichomonas vaginalis **differ from other flagellates as they lack the cyst stage. They exist as only trophozoites.**

Classification

Phylum : sarcomastigophora
Class: Trichomonadea
Order: Trichomonadida
Family: Trichomonadidae



TRICHOMONAS VAGINALIS

Diagnostic features :

- **It has pyriform shaped**
- **It bears five flagella—four anterior flagella and one lateral flagellum called as recurrent flagellum**
- **The undulating membrane is supported by structure called as costa**
- **The axostyle extends the length of the body and supports it**
- **It has a single nucleus containing central karyosome**

Life Cycle

Trophozoites are the infective stage as well as the diagnostic stage.

- **Asymptomatic females are the reservoir ifinfection and transmit the disease by sexual route.**
- **Trophozoites divide by longitudinal binary fission giving rise to a number of daughter trophozoites in the urogenital tract which can infect other individuals.**

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Liver and Pulmonary Trematoda

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Liver and Pulmonary Trematoda

Trematoda is a group of helminthes (worms) includes:

1. **Liver trematodes**
2. **Pulmonary trematodes**
3. **Intestinal trematodes**
4. **Blood trematodes**

Liver Trematodes (Liver flukes)

- **The adult worm lives in liver, bile sac and bile ducts of definitive hosts including; many mammals and human.**

- **The larval stages of liver trematodes include eggs (in the feces of definitive hosts), Miracidium (in the water), while sporocysts, rediae and cercariae live inside freshwater snails), as well as metacercariae lives on water plants.**

Liver trematodes include four genera such as:

1. ***Fasciola hepatica***
2. ***Dicrocoelium dendriticum***
3. ***Clonorchis sinensis***
4. ***Opisthorchis felineus***

Fasciola hepatica

*** Fasciola hepatica is one of the largest flukes in the world and the head of worm has a cone. The adult worms live in liver, bile sac and bile ducts. The general characterization of worm include;**

1. The oral and ventral suckers have approximately same size.

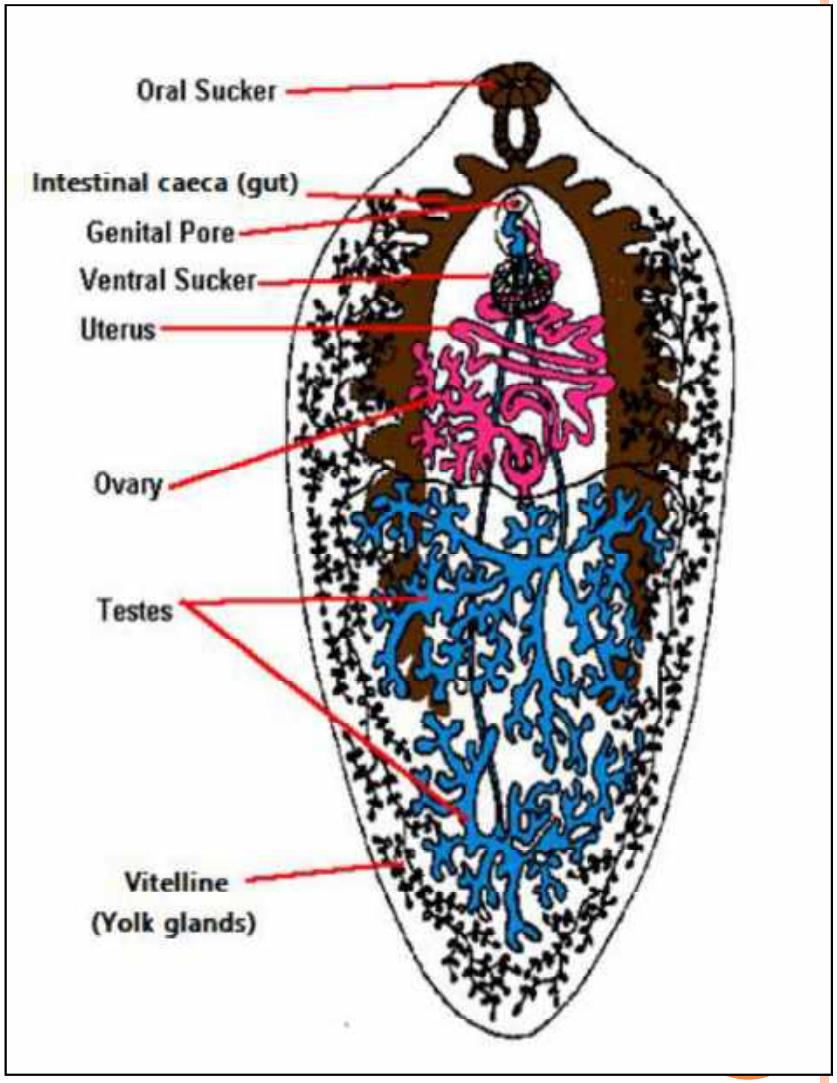
2. Intestinal caeca (gut) are branched.

3. The worm has lateral yolk glands.

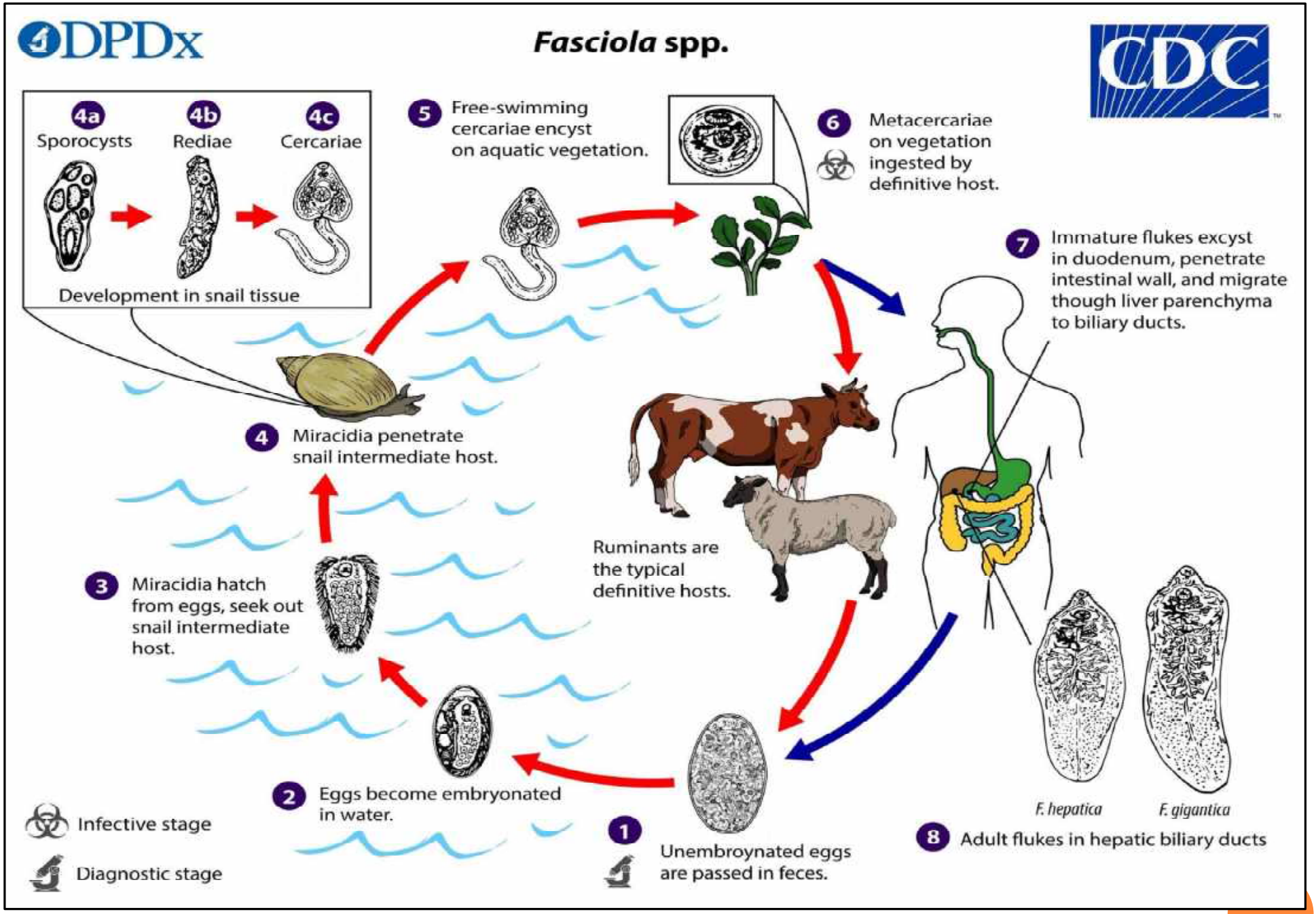
4. The worm has a pair of highly branched testes, where they are located behind each other in the posterior half of the body.

5. The ovary is branched and located in the first third of the body.

6. The uterus is twisted and located in the first third of the body.



Fasciola hepatica



Life cycle of Fasciola hepatica

Dicrocoelium dendriticum

* The adult worm lives in the bile ducts of cattle, deer, and human.
* The general characterization of worm include;

1. The adult worm is elongated with both pointed ends.

2. The ventral sucker is larger than oral sucker.

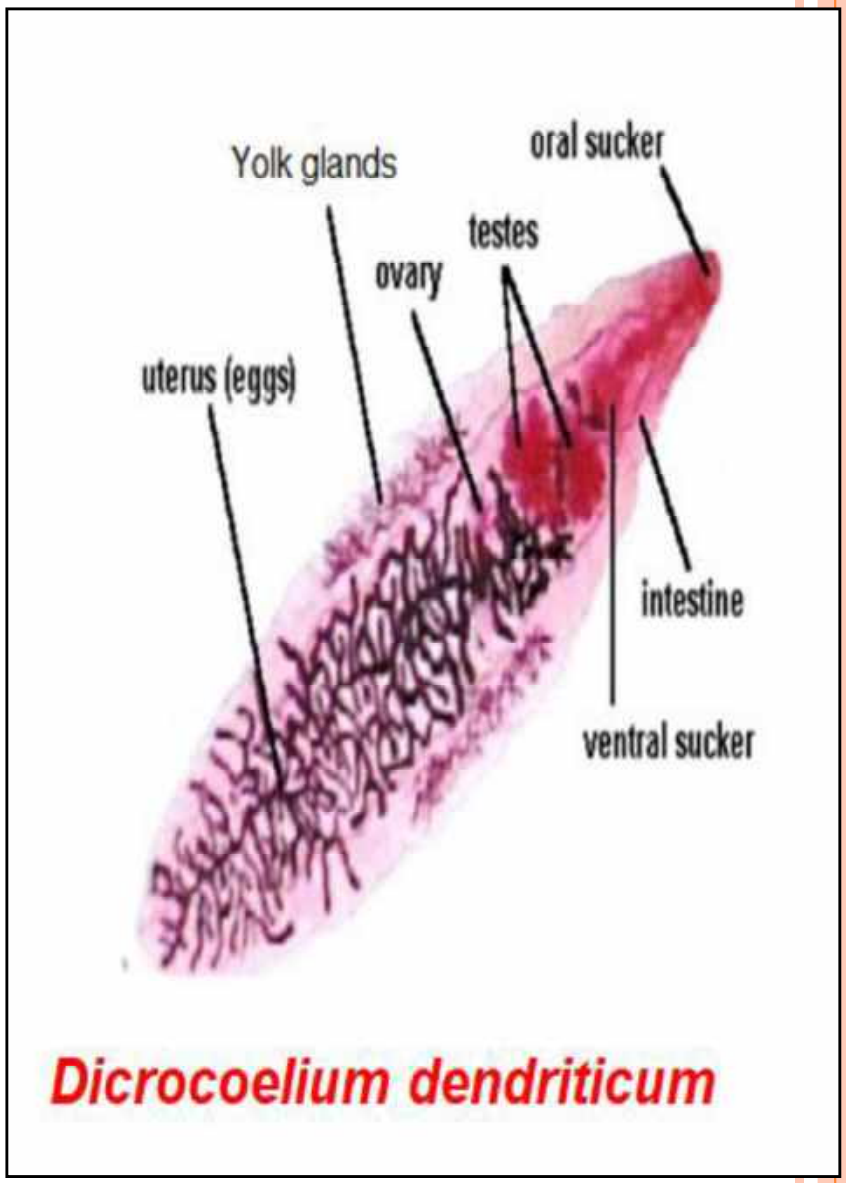
3. The worm has unbranched intestinal caeca.

4. The worm has lateral yolk glands .

5. The lobed testes are next to each other and located directly behind the ventral sucker (in the first third of the body).

6. The ovary is spherical, small and located directly behind the lobed testes.

7. The uterus is coiled and located in the middle and posterior end of the body.



Clonorchis sinensis

* The adult worm lives in bile ducts of definitive host such as human.
The general characterization of worm include;

1. The adult worm is elongated with both pointed ends.

2. The oral sucker is larger than the ventral sucker.

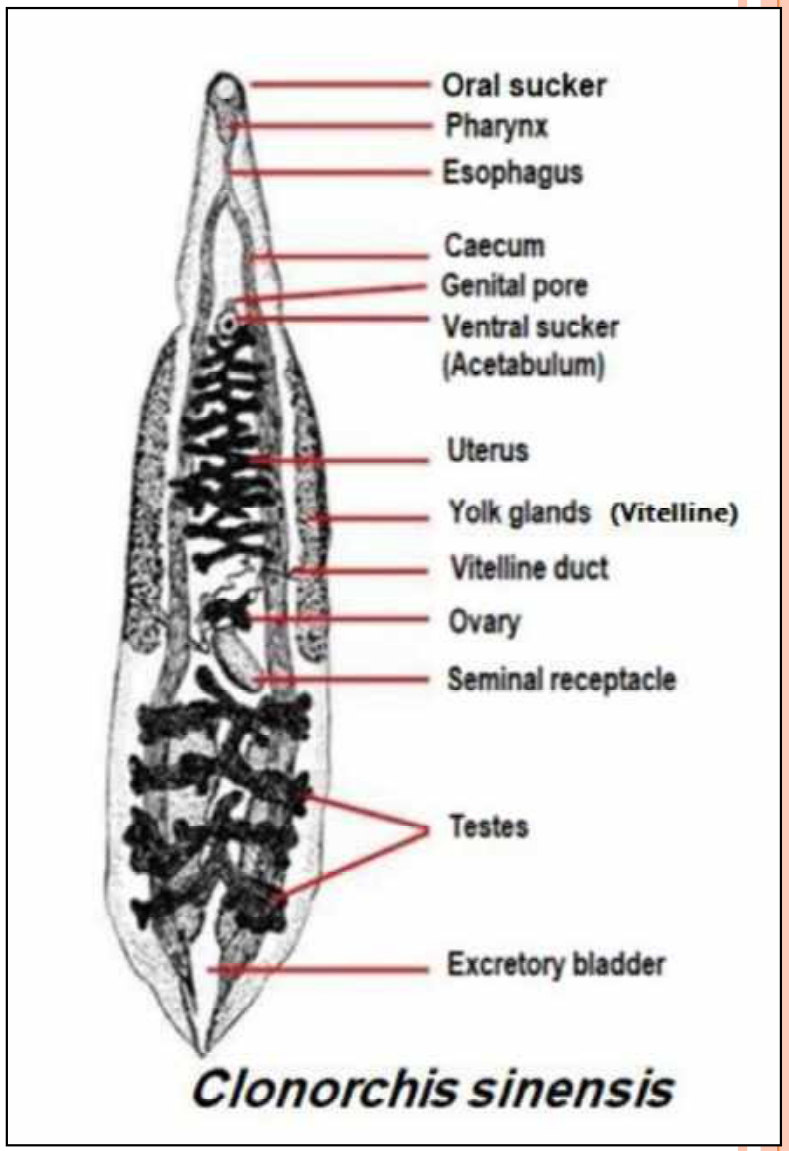
3. Intestinal caeca are simple (unbranched).

4. The worm has lateral yolk (vitelline) glands.

5. Has branched testes at the end of the body and they are located behind each other.

6. The ovary is lobed, small and located in front of the testes.

7. The uterus is twisted and located in the Middle of parasite body.



Clonorchis sinensis

Opisthorchis felineus

* The general characterization include;

1. The oral and the ventral suckers have approximately same size.

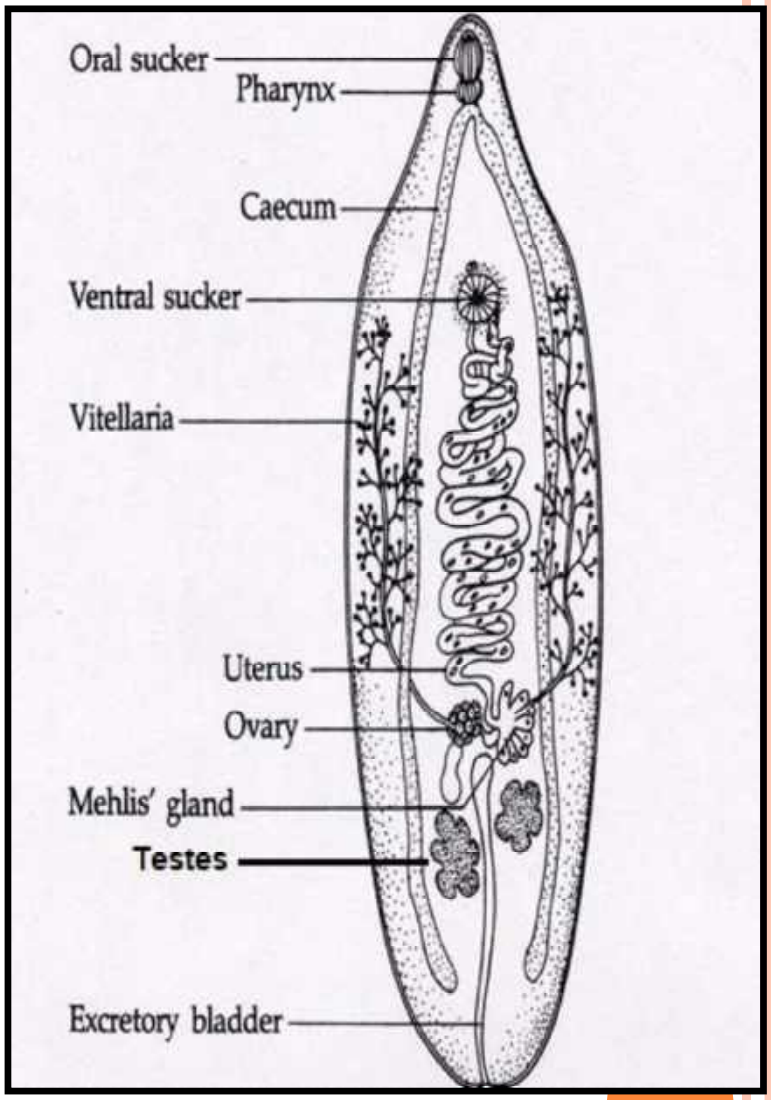
2. Intestinal caeca are simple (unbranched).

3. The worm has lateral yolk glands .

4. The lobed testes are located at the end of the body and they are located next to each others.

5. The ovary is lobular and located in front of the testes.

6. The uterus is twisted and located in the middle of parasite body



Opisthorchis felineus

Pulmonary Trematoda (lung flukes)

Paragonimus westermani

***The adult worm lives in the lung of animals and human is an accidental host.**
.The general characterization of worm include;

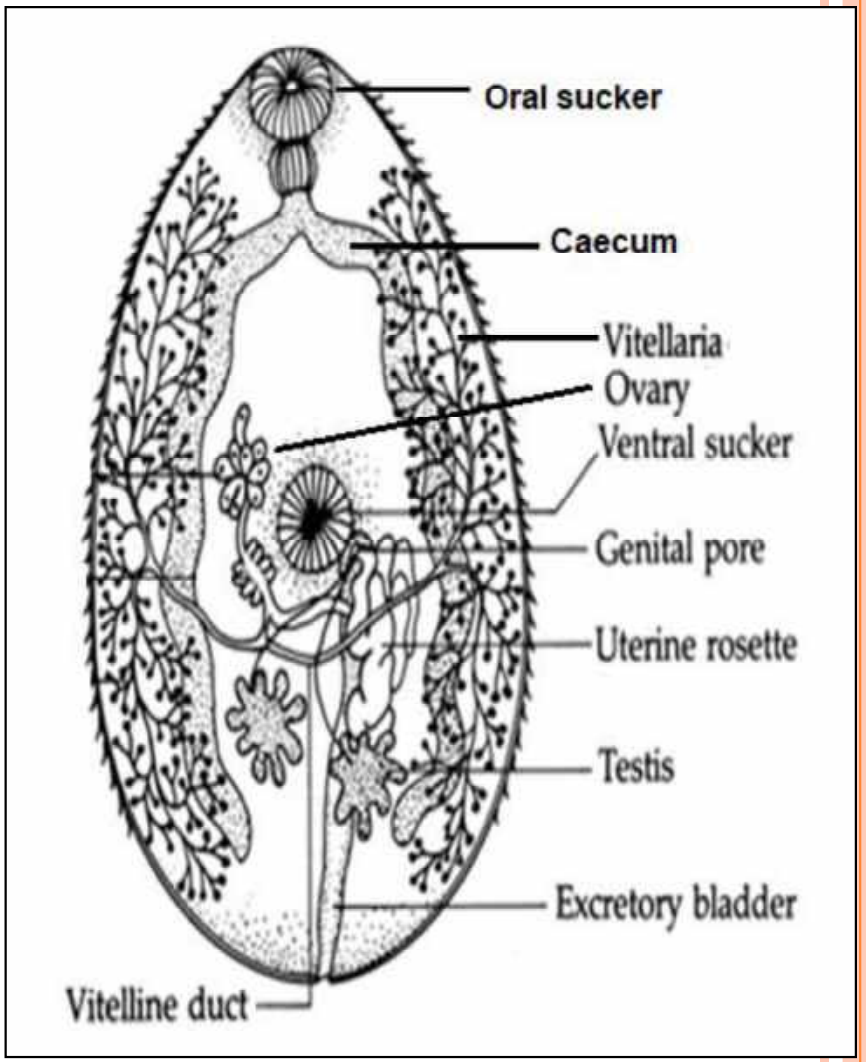
1. The oral and the ventral suckers have approximately same size.

2. Intestinal caeca are unbranched.

3. The worm has lateral yolk glands that are widespread in the lateral field of the body from the pharynx to the posterior end.

4. The testes are lobular, located at the end of the body and they are next to each others.

5. The ovary is lobular and the uterus is twisted.



Paragonimus westermani

DIPYLIDIUM CANINUM

DISEASE: *DIPYLID*IASIS

OR

DOG TAPEWORM INFECTION

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COLLEGE OF EDUCATION FOR PURE SCIENCE
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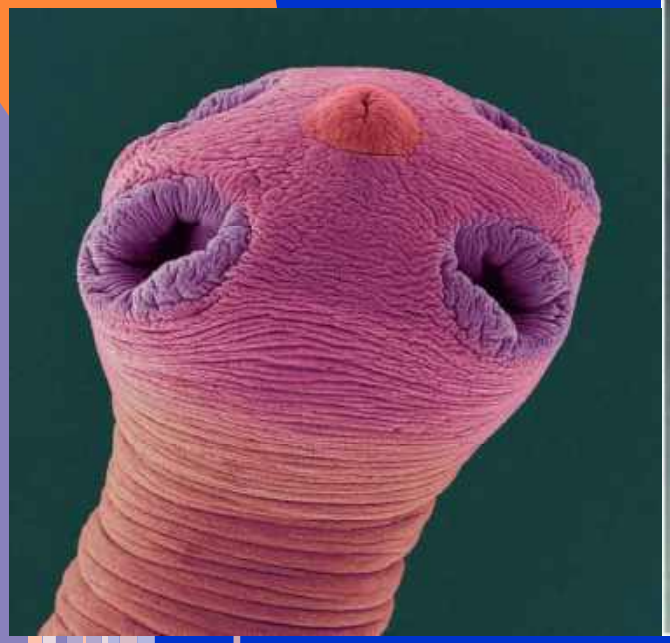
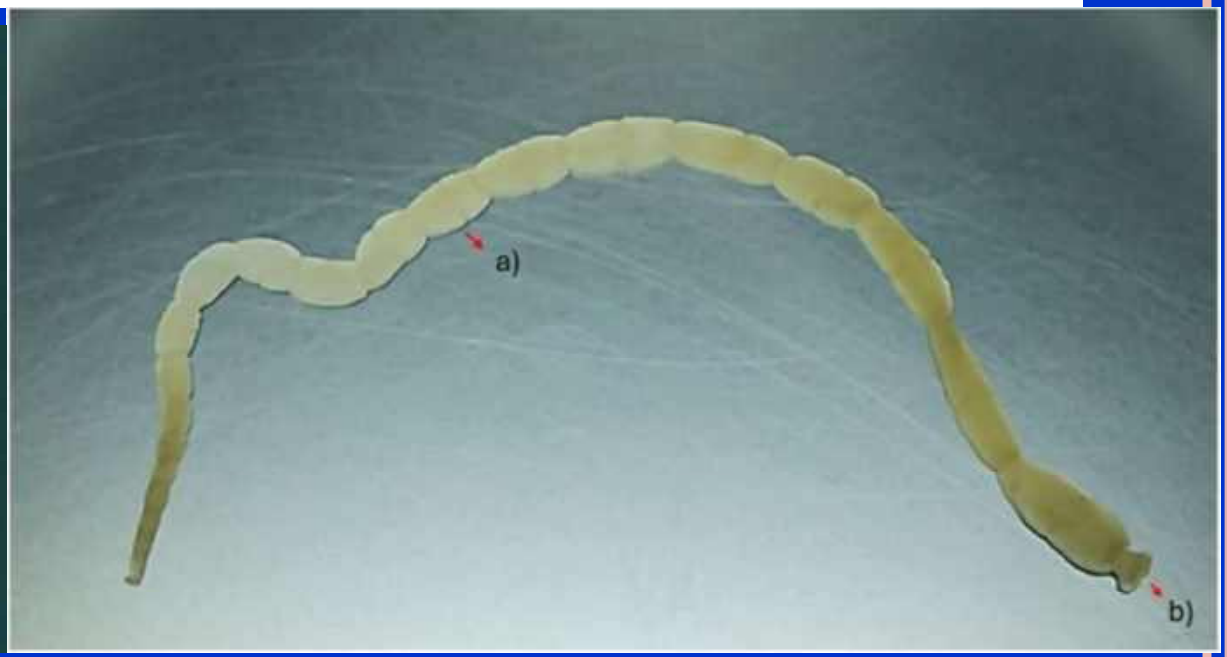




Dipylidium caninum
Adult worm

Dipylidium caninum

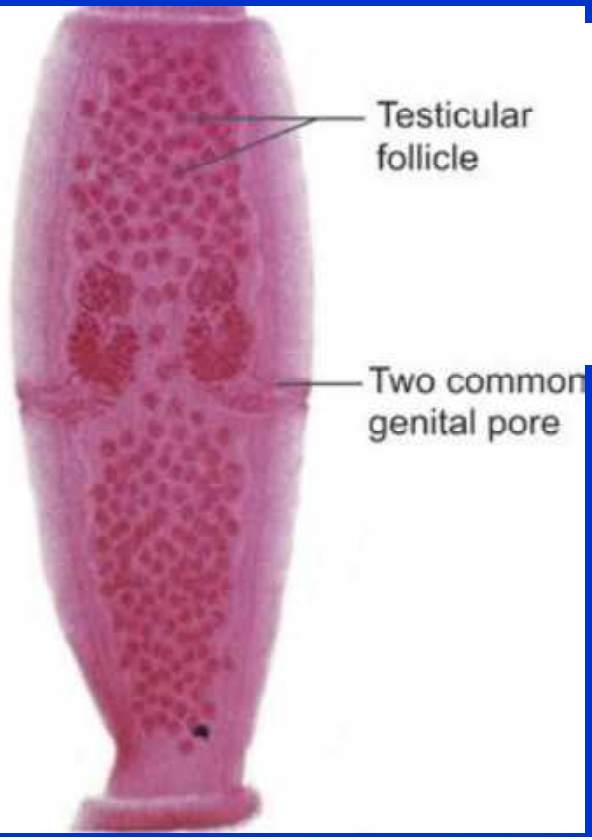
It is a common tapeworm of dogs , cats and sometimes humans .

Morphology

Adult worm is medium size, measuring 10 - 70 cm.

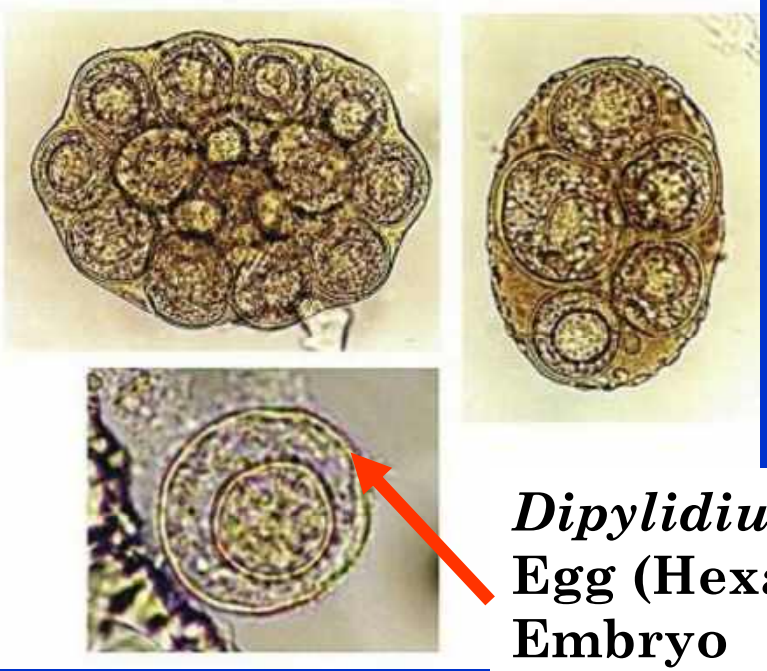
scolex contains four oval suckers and is armed with rostellum and 1–7 rows of hooklets.

Scolex of *Dipylidium caninum*



Proglottids :

are typically barrel-shaped , It contains two sets of reproductive organs with two genital pores, hence named the double-pored tapeworm.



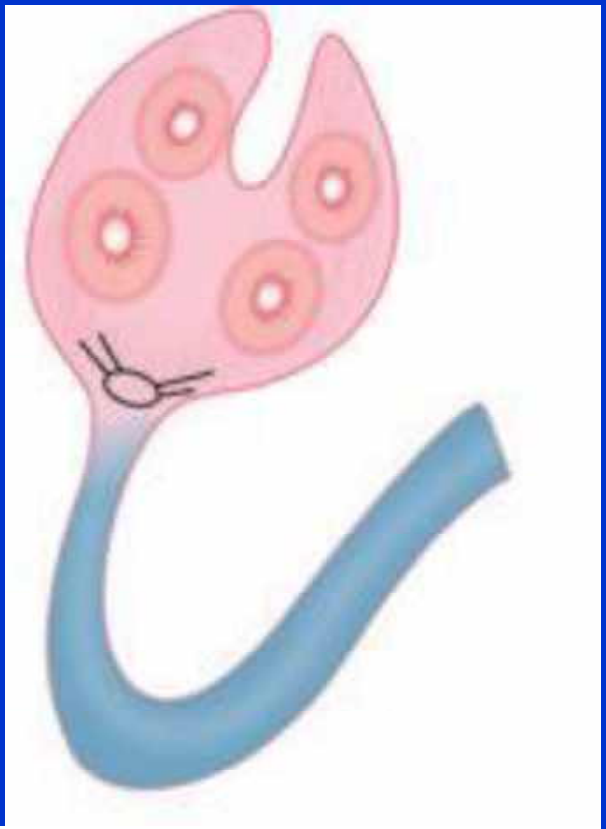
Dipylidium caninum
Egg (Hexacanth)
Embryo

Eggs:

Eggs are present in groups of 15 (egg packets)

Life cycle of *Dipylidium caninum*

Host: There are two types of hosts:
1. **Definitive host:** Dogs and cats (rarely men)
2. Intermediate hst: Insects (fleas) Man acquires infection by ingestion of flea containing cysticercoid larva.



cysticercoid larva of
Dipylidium caninum
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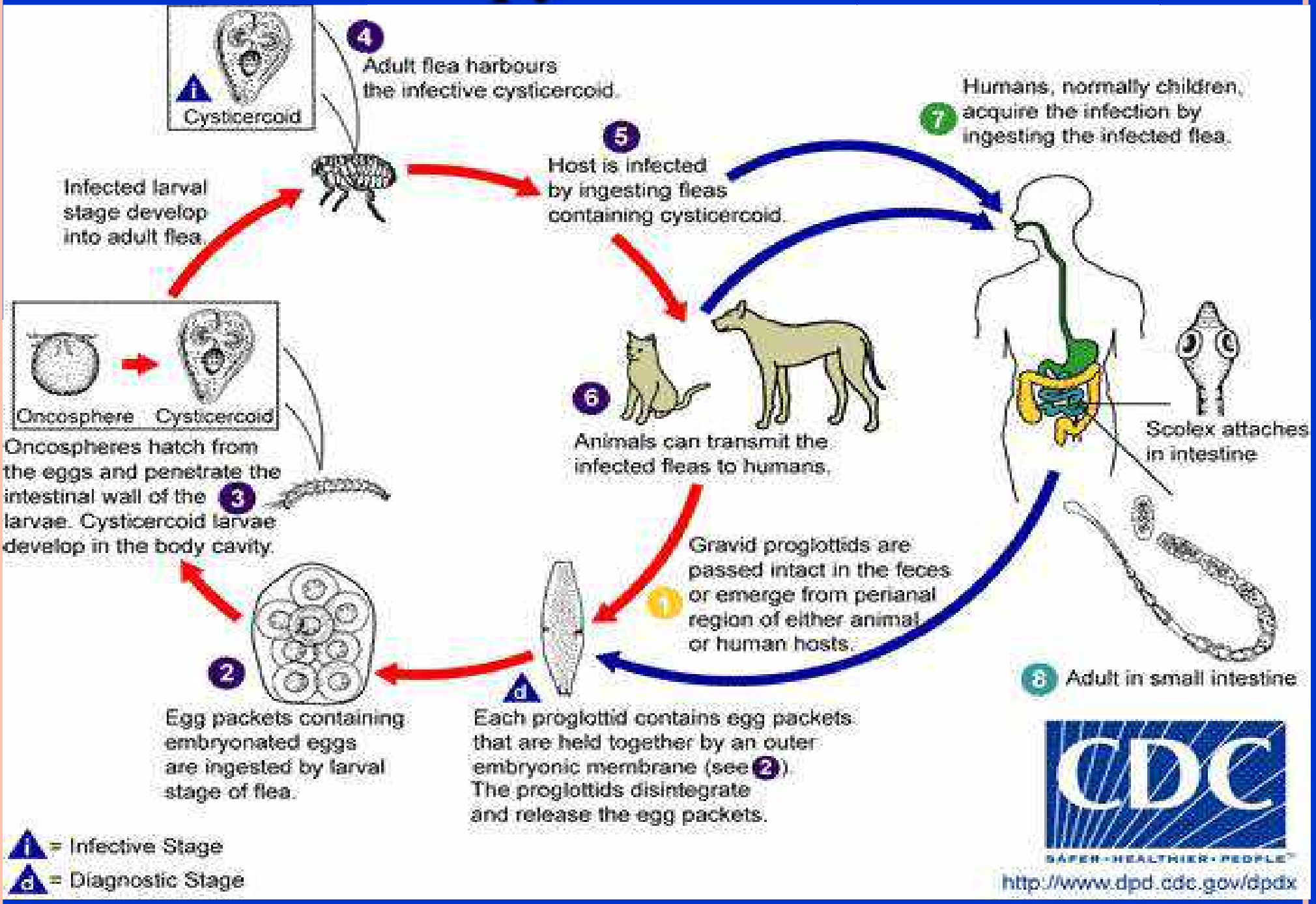
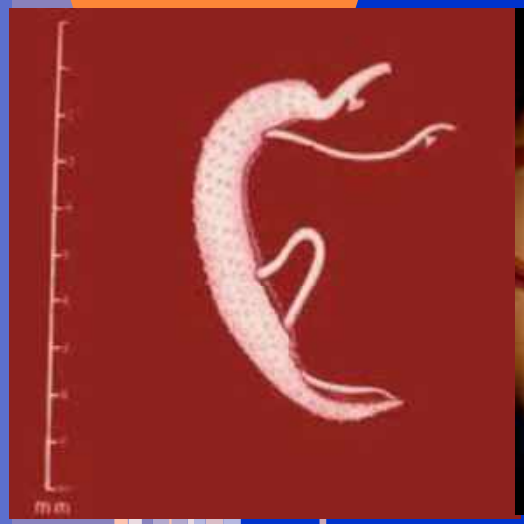
Life cycle of *Dipylidium caninum*



Parasitology

Blood Trematodes (flukes)

Schistosoma spp





Blood Trematodes (flukes) Schistosomes

Schistosoma Spp.: The schistosomes are known as **blood flukes** as they live in the vascular systems of humans and other vertebrate hosts.

Schistosoma species belong to:

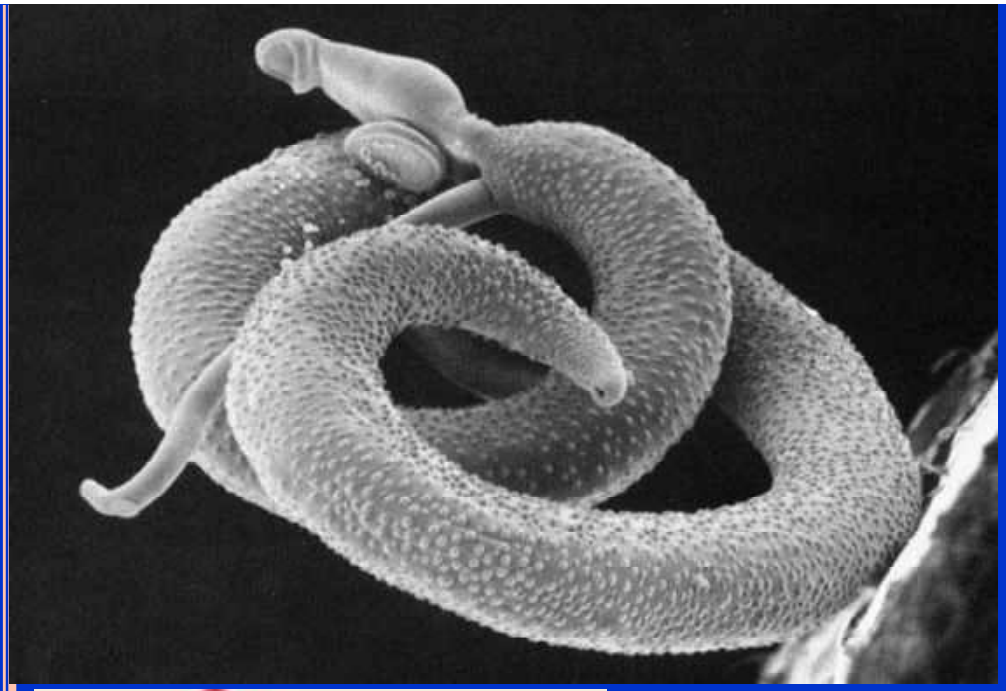
Order: Strigeida

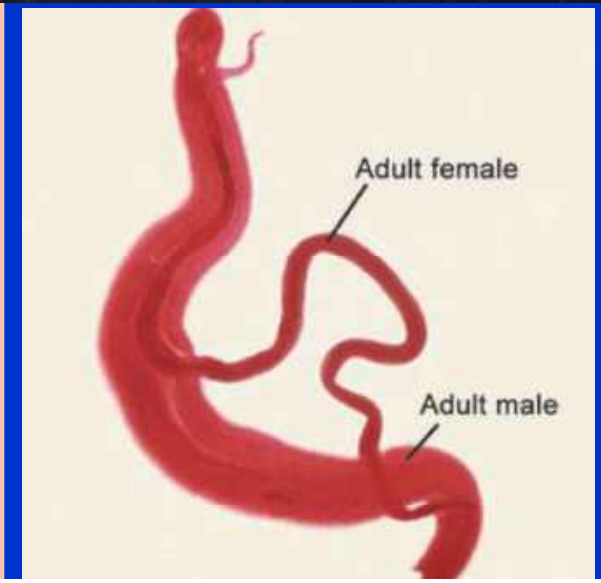
Family: Schistosomatidae

There are three medically important species:

1. ***Schistosoma mansoni*:** lives in the mesenteric venules of the large intestine and causes intestinal bilhariziasis.
2. ***Schistosoma japonicum***: lives in the mesenteric venules of the small intestine.
3. ***Schistosoma haematobium:*** lives in the venous plexus of the urinary bladder and causes schistosomal hematuria or urinary bilhariziasis.

S. mansoni and *S. japonicum* produce their eggs in stool, but *S. haematobium* produces eggs in urine.





Adult worms of schistosomes The thin female resides in the gynecophoric canal of the thicker male

General characteristics of *Schistosoma spp.*

The body is cylindrical and covered by a thick tuberculated tegument (except in *S. japonicum,* which possesses a smooth tegument).

1. Schistosoma *spp. has five* stages.

Egge, miracidia, sporocyst , cercaria, and adult stage

2. There is no muscular pharynx, and the intestinal caeca reunites behind the ventral sucker to form a single canal.

3. Suckers are armed with delicate spines.

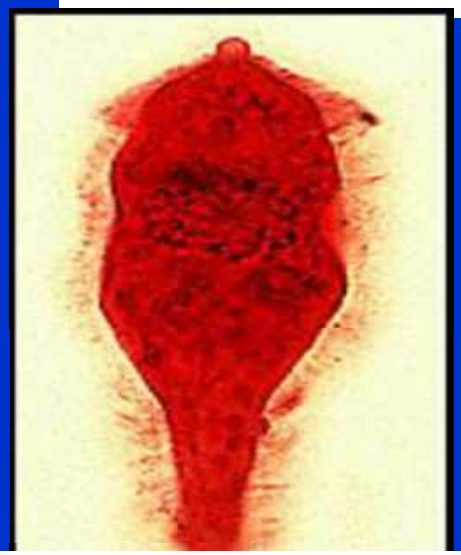
4. The sexes are separate (dioecious), with female worms slightly longer than male worms.

5. The male worm possesses a sex canal (gynecophoric canal) on the ventral side in which the female worm reposes.

6. The number of testes in male worms varies from four to nine.

Humans (or animals) are the definitive hosts; snails are the intermediate hosts. There is no second intermediate host.

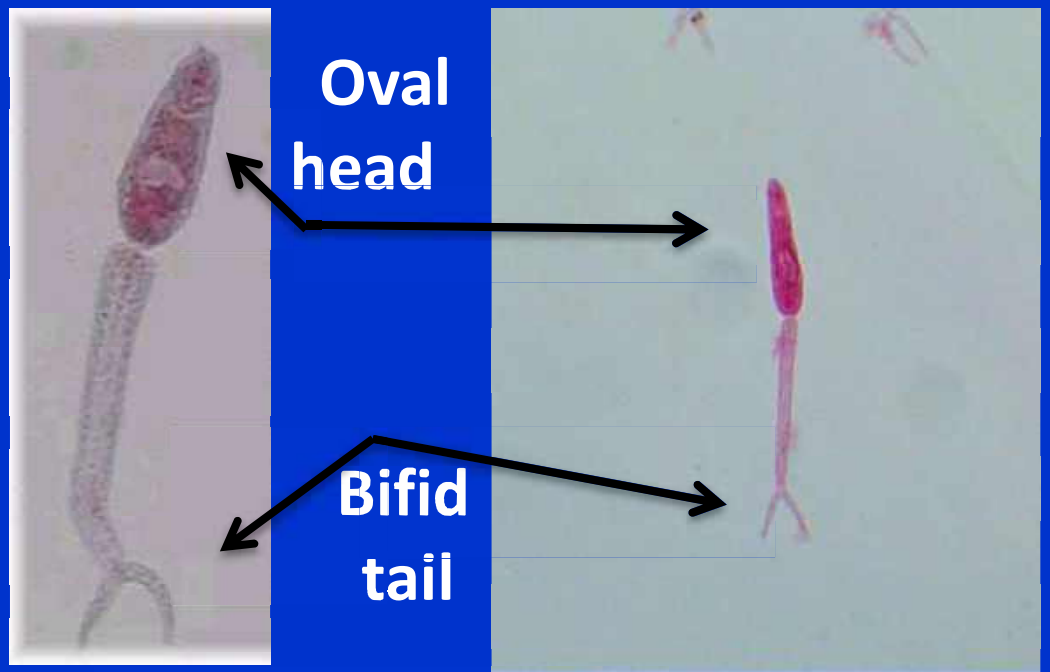
Larva : Various larval forms are miracidium, sporocyst and cercaria



***Schistosoma* miracidium**

1.ciliated, swimming larva
2.The germinal cells will become sporocysts

***Schistosoma* miracidium**



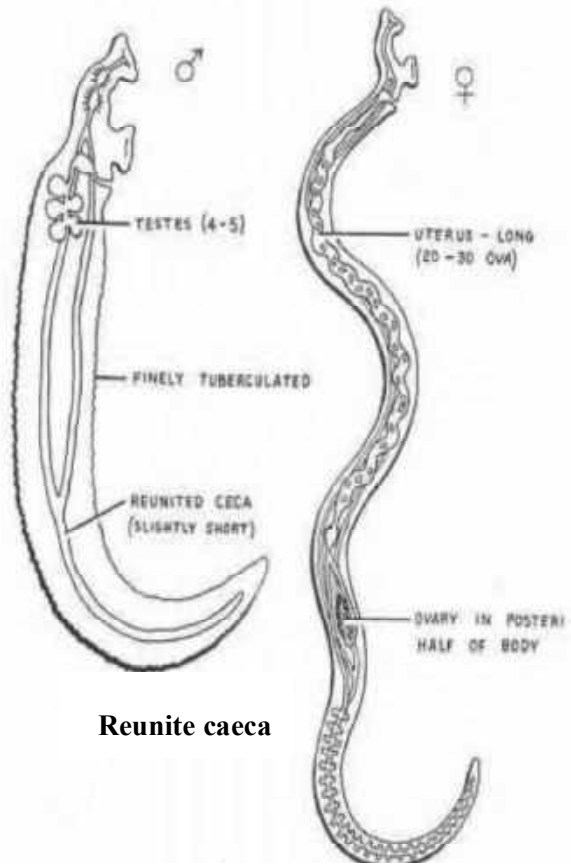
Schistosoma cercaria

1.Free- swimming
2.The cercariae have forked tail
3. Infective form to man (by penetration of skin

The sporocyst forms inside the snail

1. Schistosoma haematobium is the causative agent of **urinary schistosomiasis or bilharziasis**.

Habitat:venous plexus of urinary bladder



Reunite caeca

Schistosoma haematobium

male

-The male is shorter and thicker than the female.

- male has 4–5 testes.

-The intestinal caeca reunites behind the middle of the body.

female

-The body is cylindrical, and the female is thinner and taller than the male.

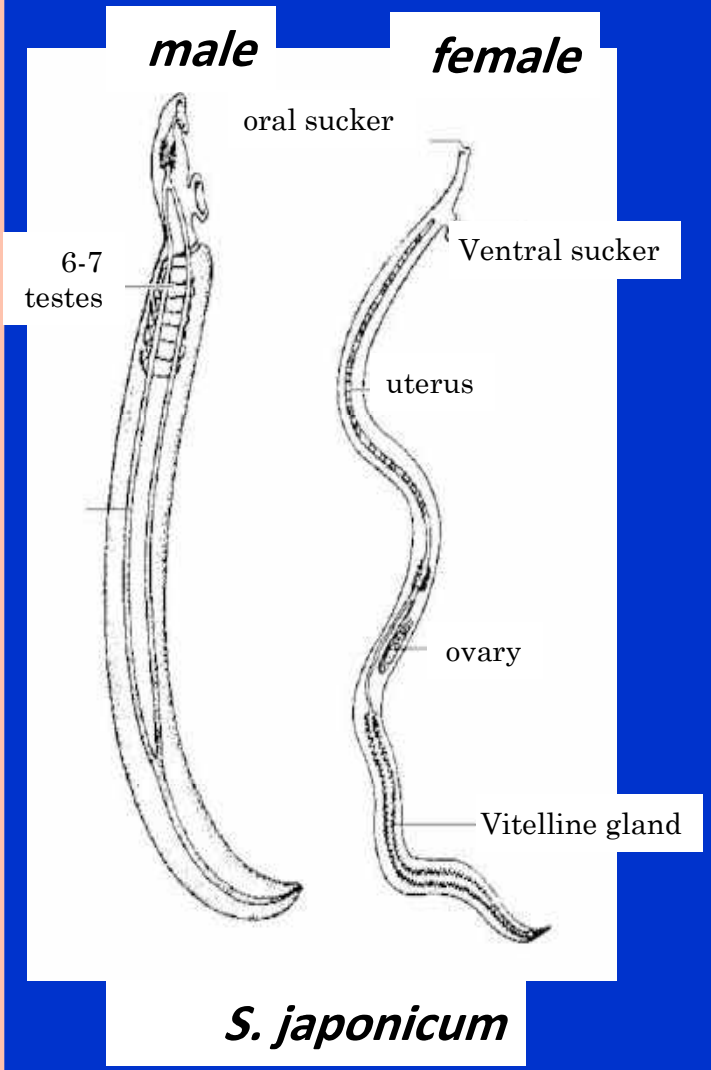
-The ovary is located behind the middle of the body.

-The vitelline glands are located on either side of the intestine in the back of the body.

eggs

***S. haematobium* eggs have a terminal spine.**

S. Haematobium
egg



S. japonicum

***Schtosoma Japonicum*:**

Adult worms are similar to other schistosomes with some minor differences.

Male:

-the intestinal caeca reunite behind the middle of the body near the posterior end.

-male has 6–7 testes

Female:

- **The ovary is located in the center of the body. The uterus is long and contains 50-100 eggs.**
- **Egg: More spherical than those of other schistosomes and have a rudimentary lateral spine.**

Rounded spine

S. Japonicum egg

Schistosoma mansoni

Adult worms are similar to other schistosomes with some minor differences:

male

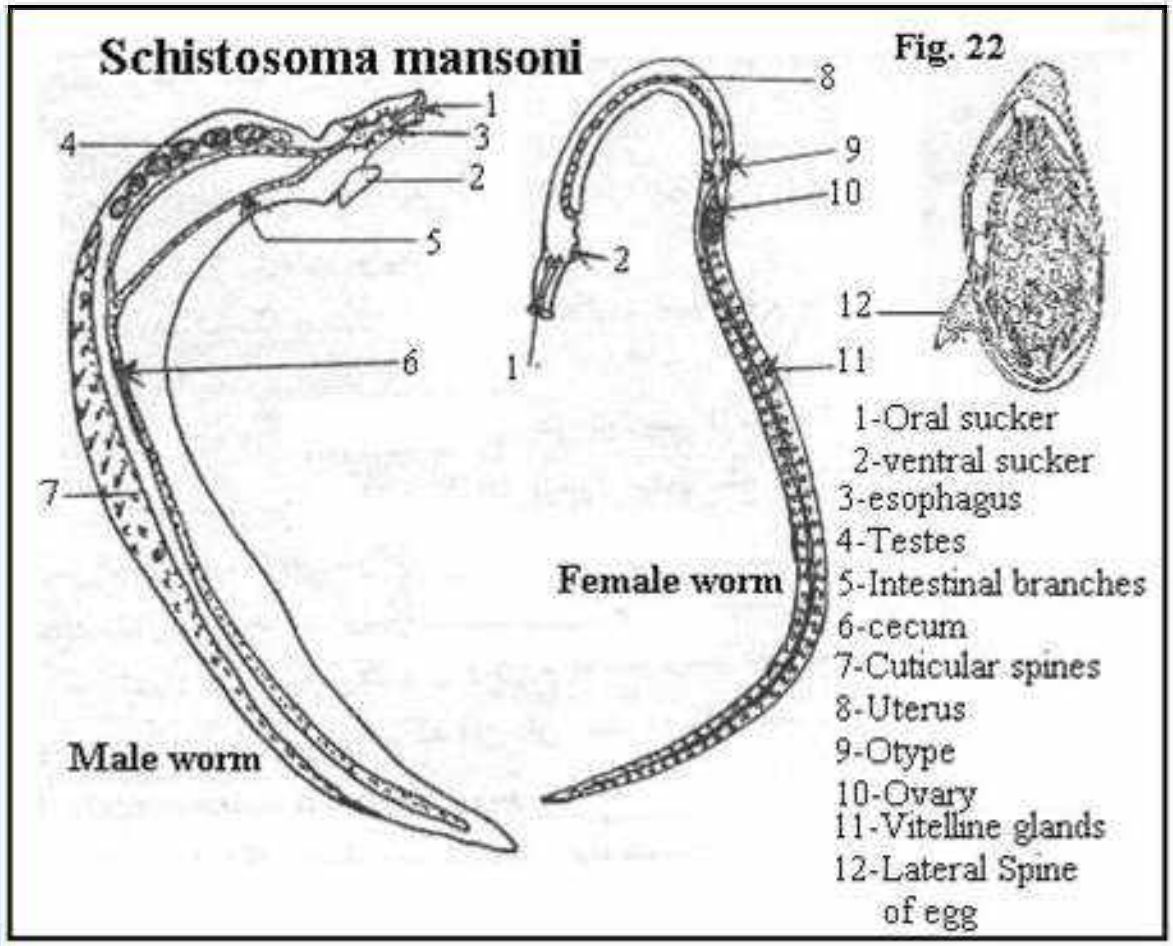
-intestinal caeca reunite before the middle of the body

Female

The ovary is located before the middle of the body

eggs

-Schistosoma mansoni eggs have lateral spine.



***Schistosoma mansoni* egg**

Schistosoma spp.

Intermediate host: snail.

Definitive host: human.

infective stage: Cercaria

diagnostic stage: eggs

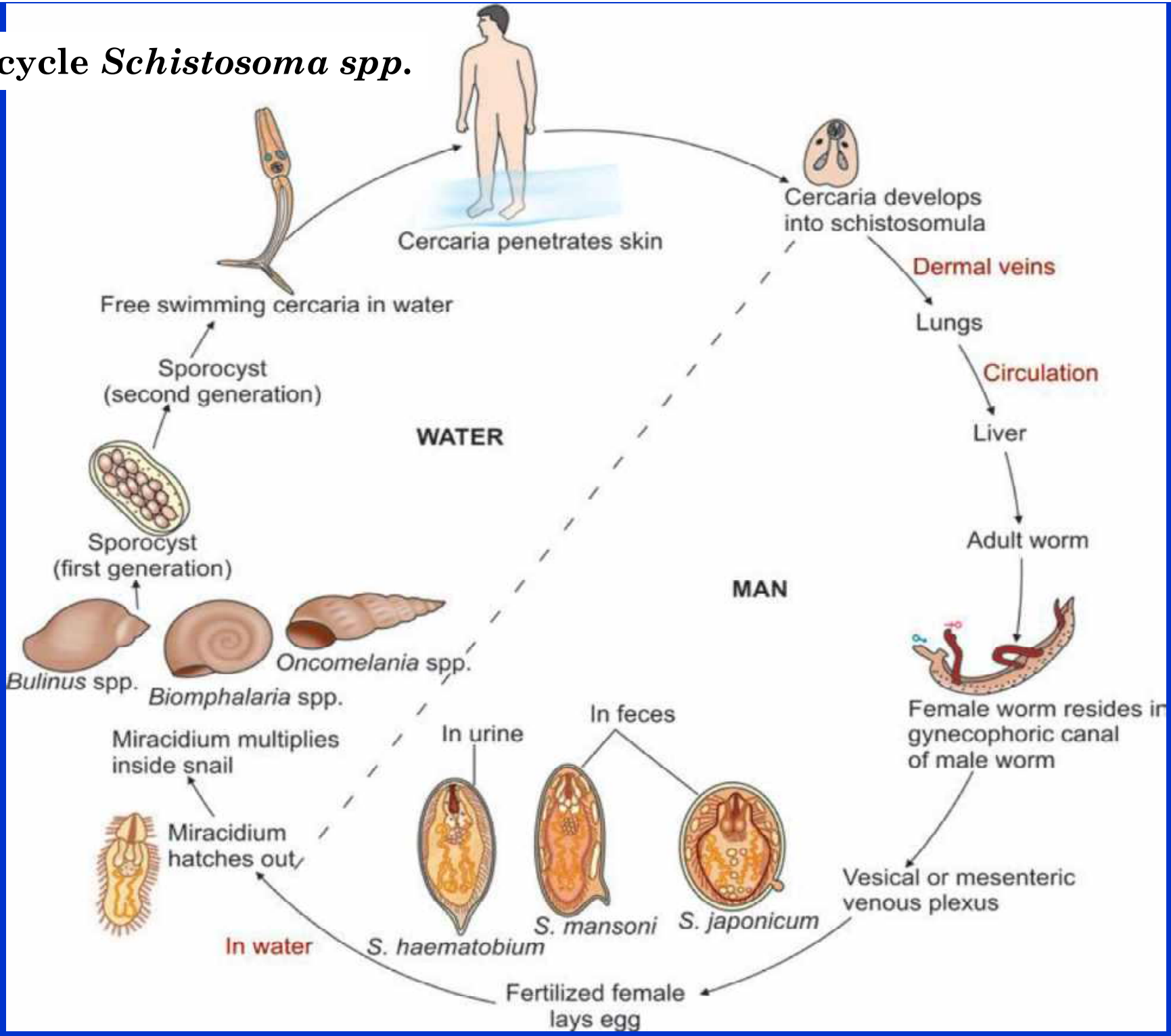
Bulinus spp.
S.chaematobium

Boimphalaria SPP.
S.Mansoni

OncomelaniaSPP.
S.Japonicum

INTERMEDIATE HOST (SNAIL)

life cycle *Schistosoma spp.*



Parasitology Lab.

Hookworms
Ancylostoma duodenale
And
Necator americanus

College of Education for Pure Science
University of Mosul

Hookworms الديدان الشصية

1. Hookworms include *Ancylostoma duodenale and Necator americanus*.

2. Adult worm of *Ancylostoma duodenale* is bigger than *Necator americanus*.

3. Millions of people are infected around the world, mainly in tropical regions.

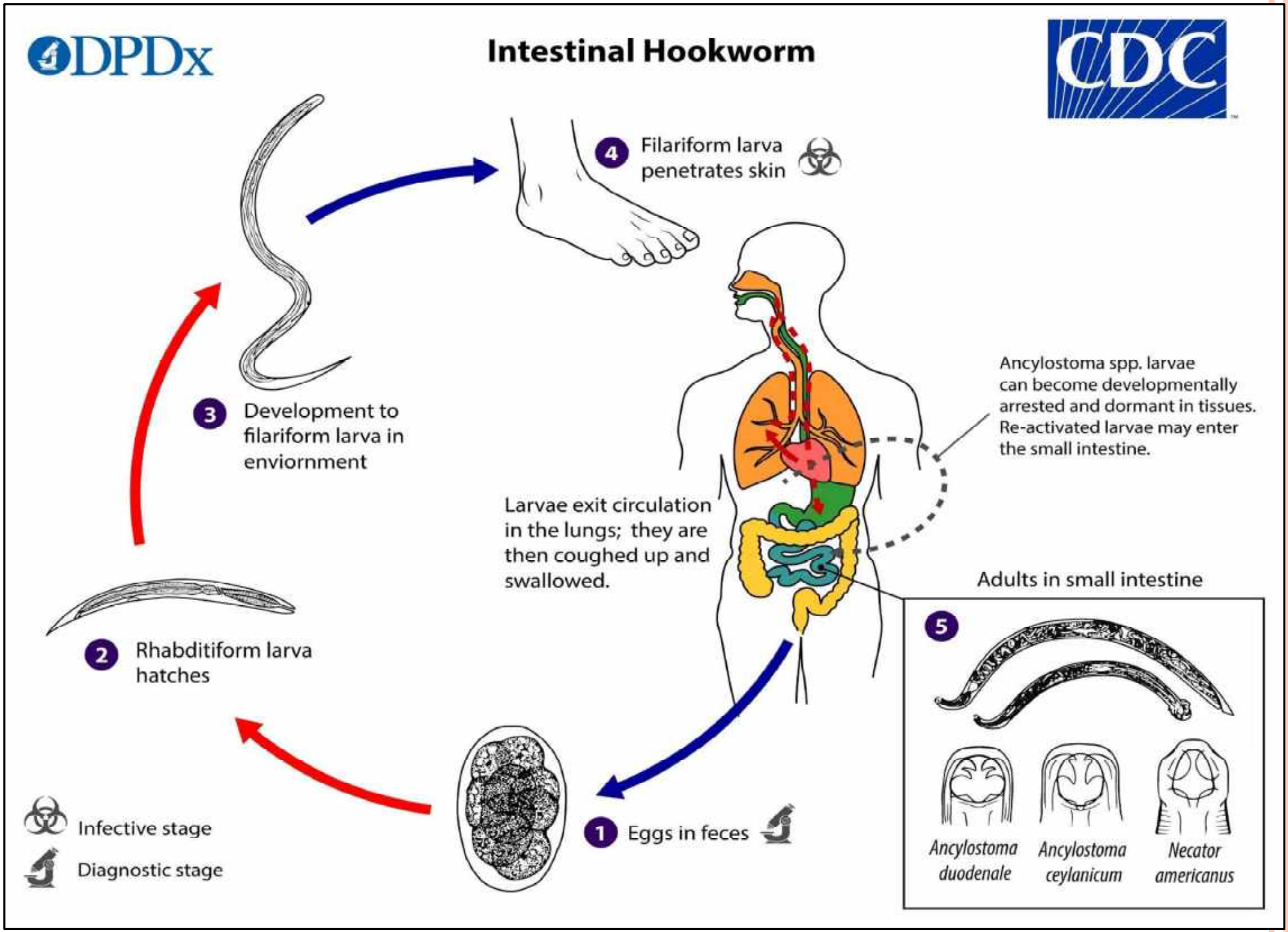
4. They are soil transmitted parasites.

5. Transmission is via dermal penetration by filariform larvae اليرقات الفلارية.

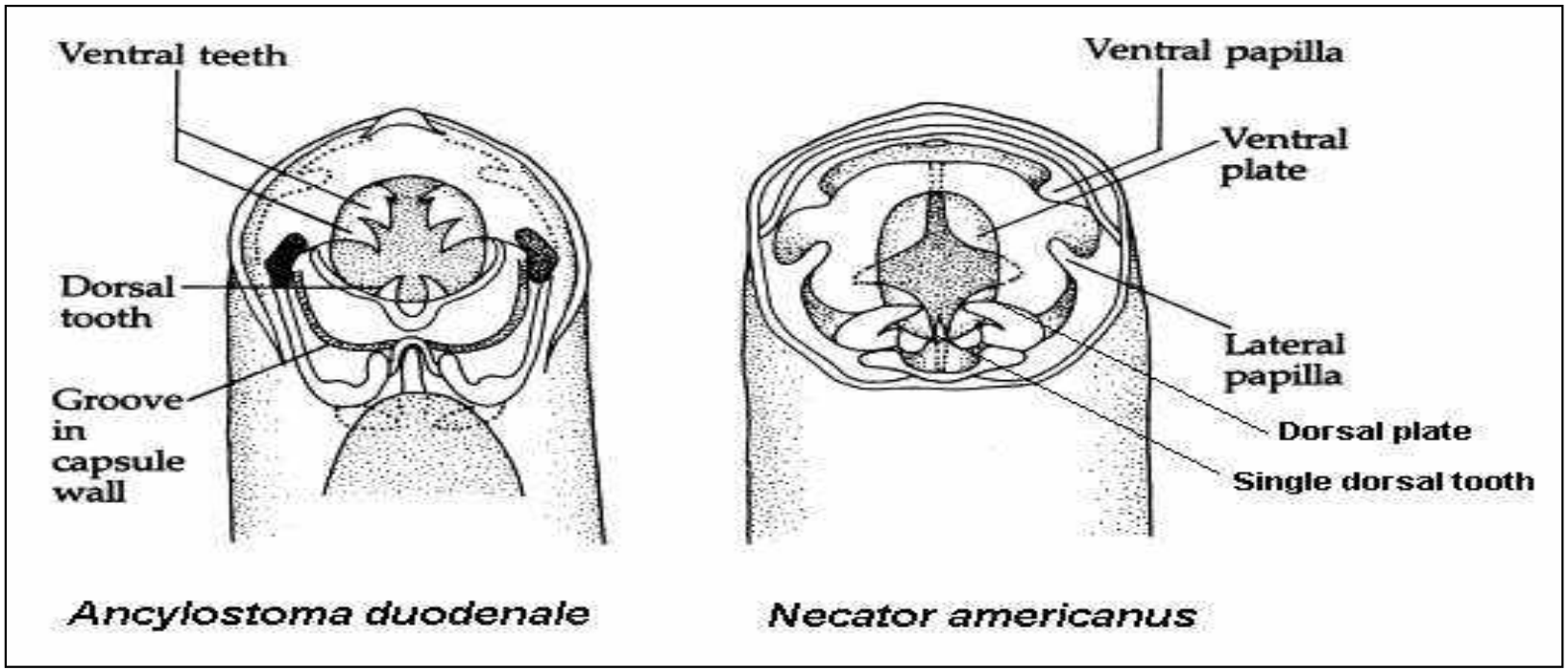
6. After dermal penetration, filariform larvae undergo to transpulmonary passage الانتقال الرئوي, reaching the trachea and pharynx, where they are swallowed.

7. In the small intestine, the larvae develop to mature worms, then they attach to the duodenum.

8. Diagnosis is occurred by finding hookworm eggs in stool of infected people using light microscopy.


DPDx
Intestinal Hookworm
CDC
4 Filariform larva penetrates skin
3 Development to filariform larva in enviornment
2 Rhabditiform larva hatches
1 Eggs in feces
Larvae exit circulation in the lungs; they are then coughed up and swallowed.
Ancylostoma spp. larvae can become developmentally arrested and dormant in tissues. Re-activated larvae may enter the small intestine.
Adults in small intestine
5
Ancylostoma duodenale
Ancylostoma ceylanicum
Necator americanus
Infective stage
Diagnostic stage

Differences between buccal capsules المحفظة الفمية of Hookworms



1. Buccal capsule of *Ancylostoma duodenale* is smaller.

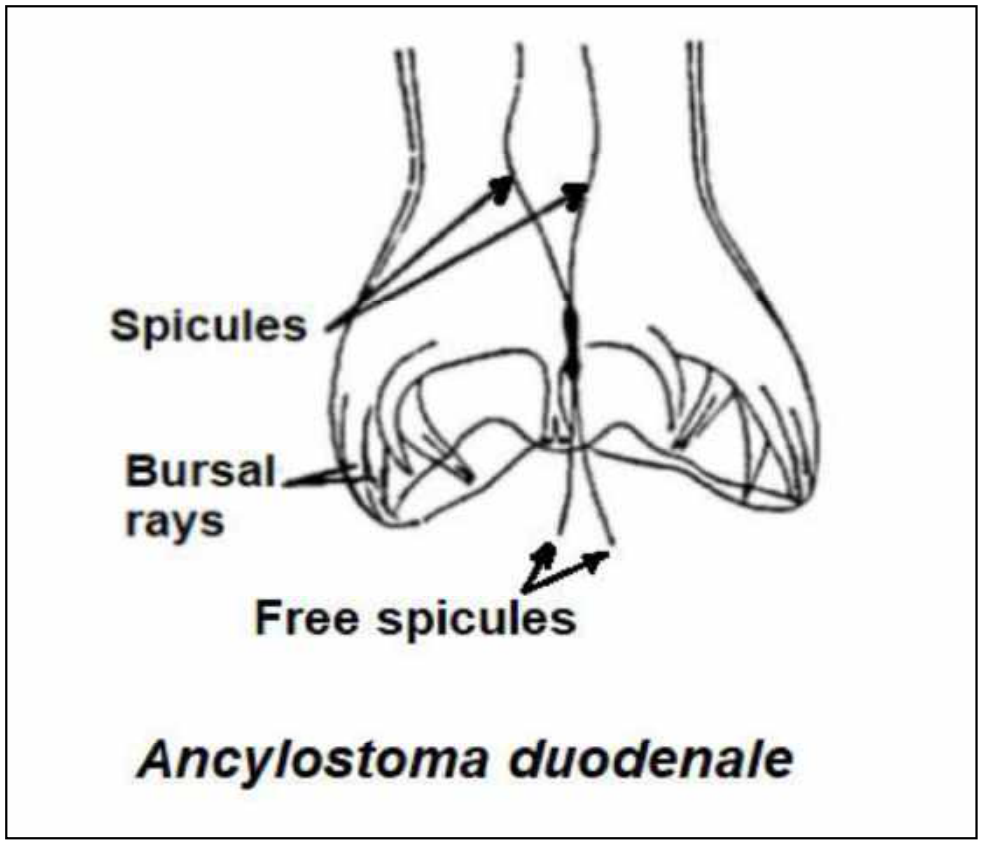
2. Buccal capsule of Ancylostoma duodenale has a pair of ventral teeth and a pair of dorsal teeth.

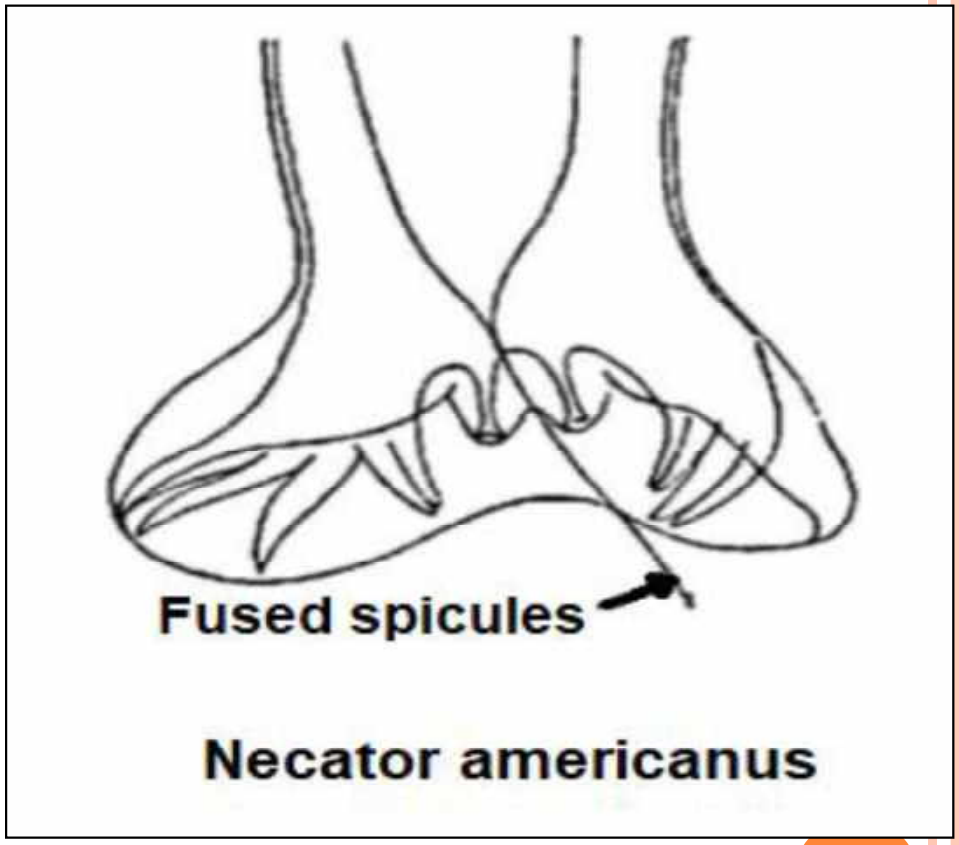
3. Ancylostoma duodenale does not have cutting plates.

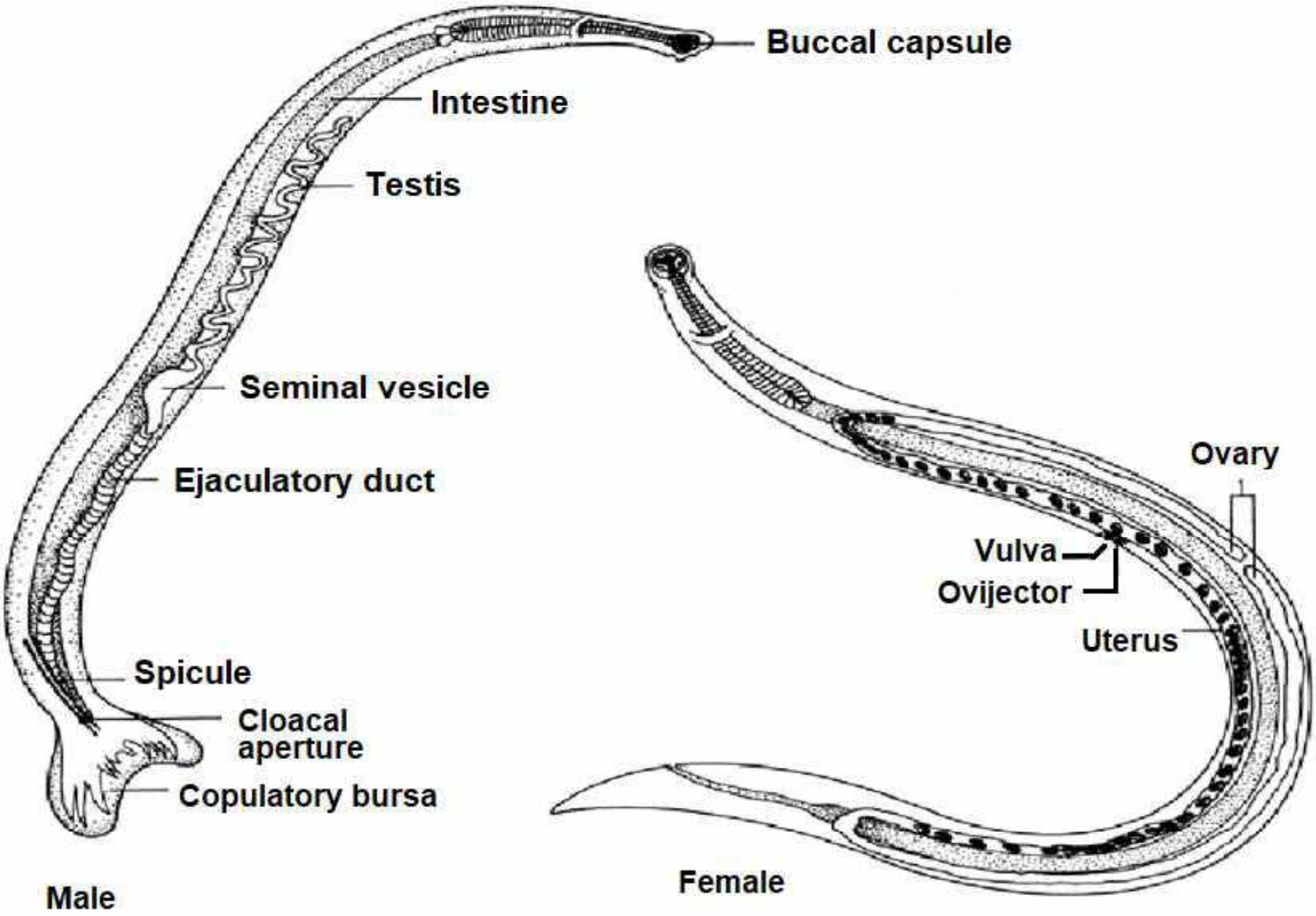
1. Buccal capsule of *Necator americanus* is bigger.
2. Buccal capsule of *Necator americanus* has a pair of ventral cutting plate الصفائح القاطعة and a pair of dorsal cutting plate, with single dorsal tooth.
3. Buccal capsule of *Necator americanus* has a pair of ventral papilla زوج من الحليمات البطنية and a pair of lateral papilla.

Differences between spicules شوكتي الجماع of *Ancylostoma duodenale* and *Necator* americanus

1.The two spicules are free at the distal end in *Ancylostoma duodenale.*	1.The two spicules are fused at the distal end in *Necator americanus*







Adults of Hookworm