Helminthology

LAB 1

م.م. رشا ابجد سلمان

Phylum : Platyhelminthes

General characteristic

1- dorso – ventrally flattened worms
2- bilaterally symmetrical
3- possess an incomplete digestive tract
4- lack body cavity (Acoelomate)
5- without special skeletal , circulatory
6- the excretory system is based on the flame cells
7- they are mostly hermaphroditic (both sexes are contains in one individual) with few exceptions

Platyhelminthes divided into three chief classes:-

1- Class : Trematoda
2- Class : Turbellaria
3- Class : Cestoidea

Class : **Trematoda**
Order : **Digenea**

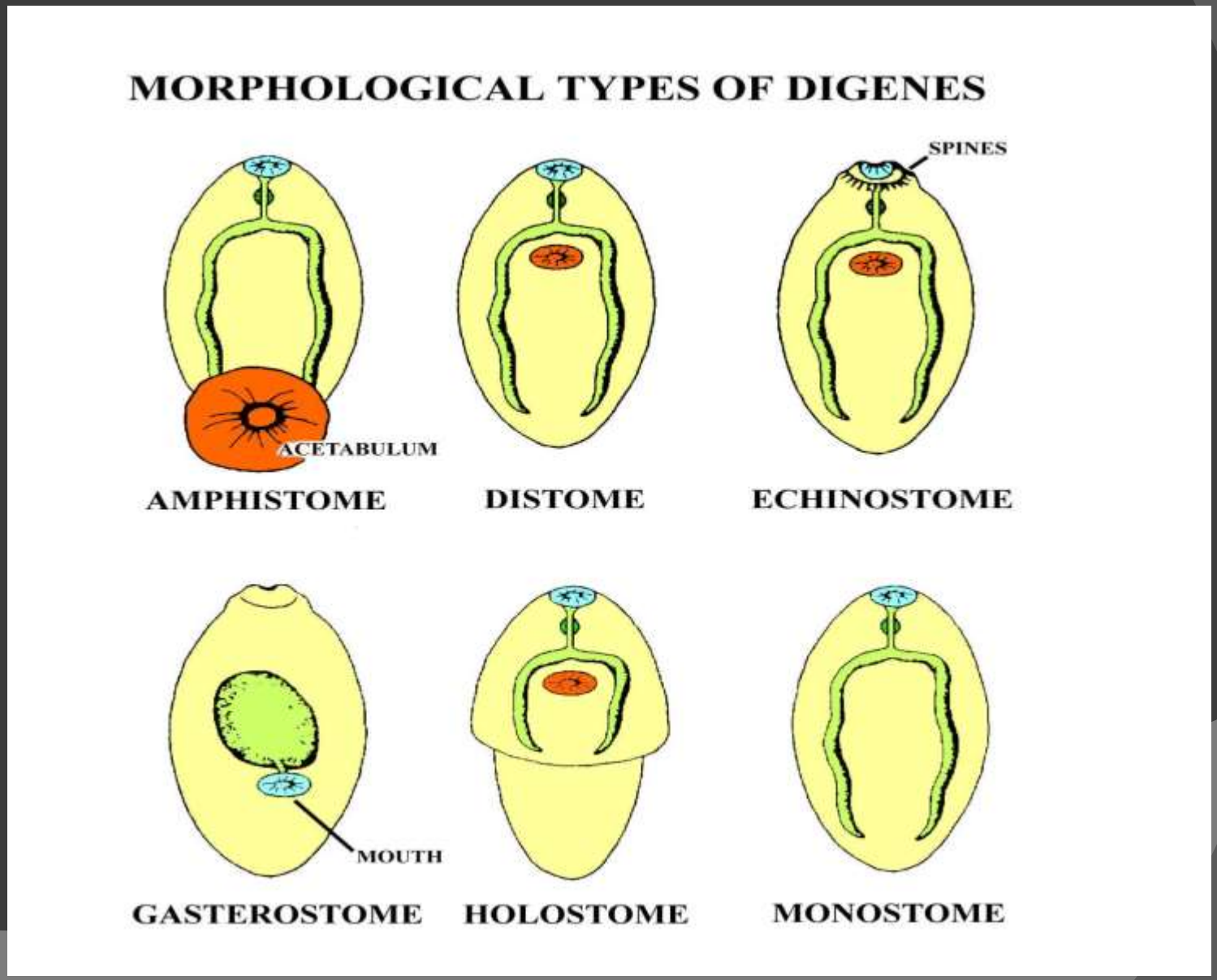
1- All are parasitic
2- Adults usually parasitize vertebrates
3- Body flat; oval to elongate in shape
4- Range in size from <1 mm to -60 mm
5- Efficient at absorbing nutrients
6- Have two suckers : oral sucker acetabulum
7- Anterior mouth
8- Digestive system divides into two blind pouches called cecae

Order : **Digenea**

Divided into four groups according to the site where worm presence :

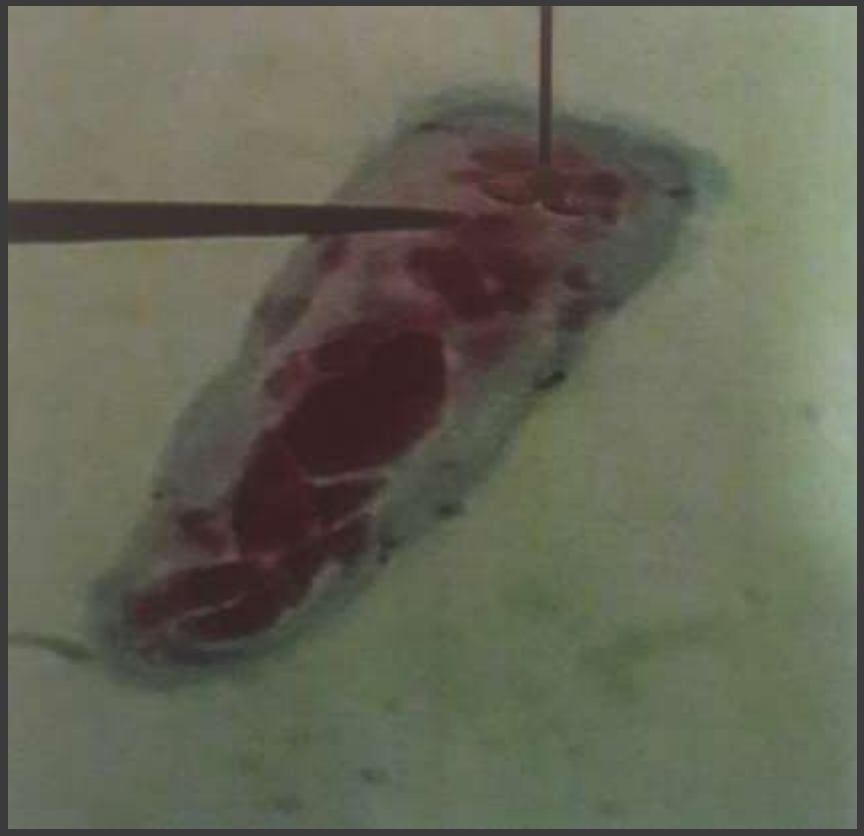
1- Liver Fluke
2- intestinal Fluke
3- Lung Fluke
4- Blood Fluke

Digenic trematode is also can be divided according to number and position of suckers :



Fasciola hepatice

1- Scientific name : **Fasciola hepatice**
2- Common name : **Sheep liver fluke**
3- Disease : **Liver rot**
4- Infective stage : **Metacercaria**
5- 1st intermediate host : **Lymnea**
6- 2nd intermediate host : **aquatic vegetation (water cress)**
7- Diagnosis : **ova are found in faeces**
8- Presence in the host : the adults live in the Bile ducts of sheep, goats, caws and sometimes could infect human.



Fasciola hepatica (miracedium)

Fasciola hepatica
(unembryonate ova)

Cross section in snail tissue showing sporocyst of fasciola hepatica

fasciola hepatica mother redia

Fasciola hepatica
(daughter redia)

Fasciola hepatica (cercaria)

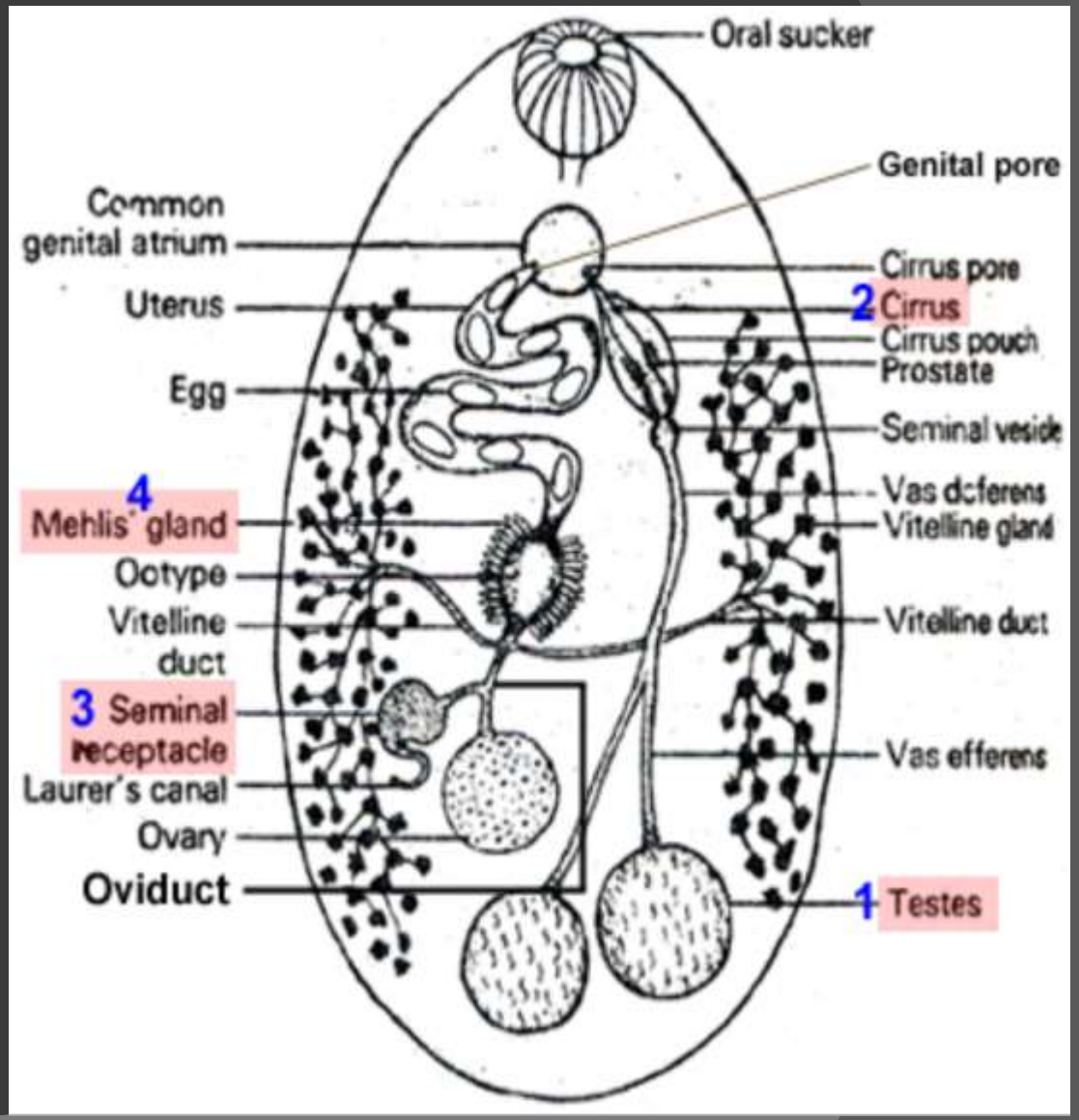
Male and female reproductive system

Male

1- 2testes
2- Vas efferens
3- Vas deferens
4- Cirrus pouch
5- Genital pore

Female

1- single ovary
2- Oviduct
3- Ootype Uterus
4- vagina
5- Vitelline duct



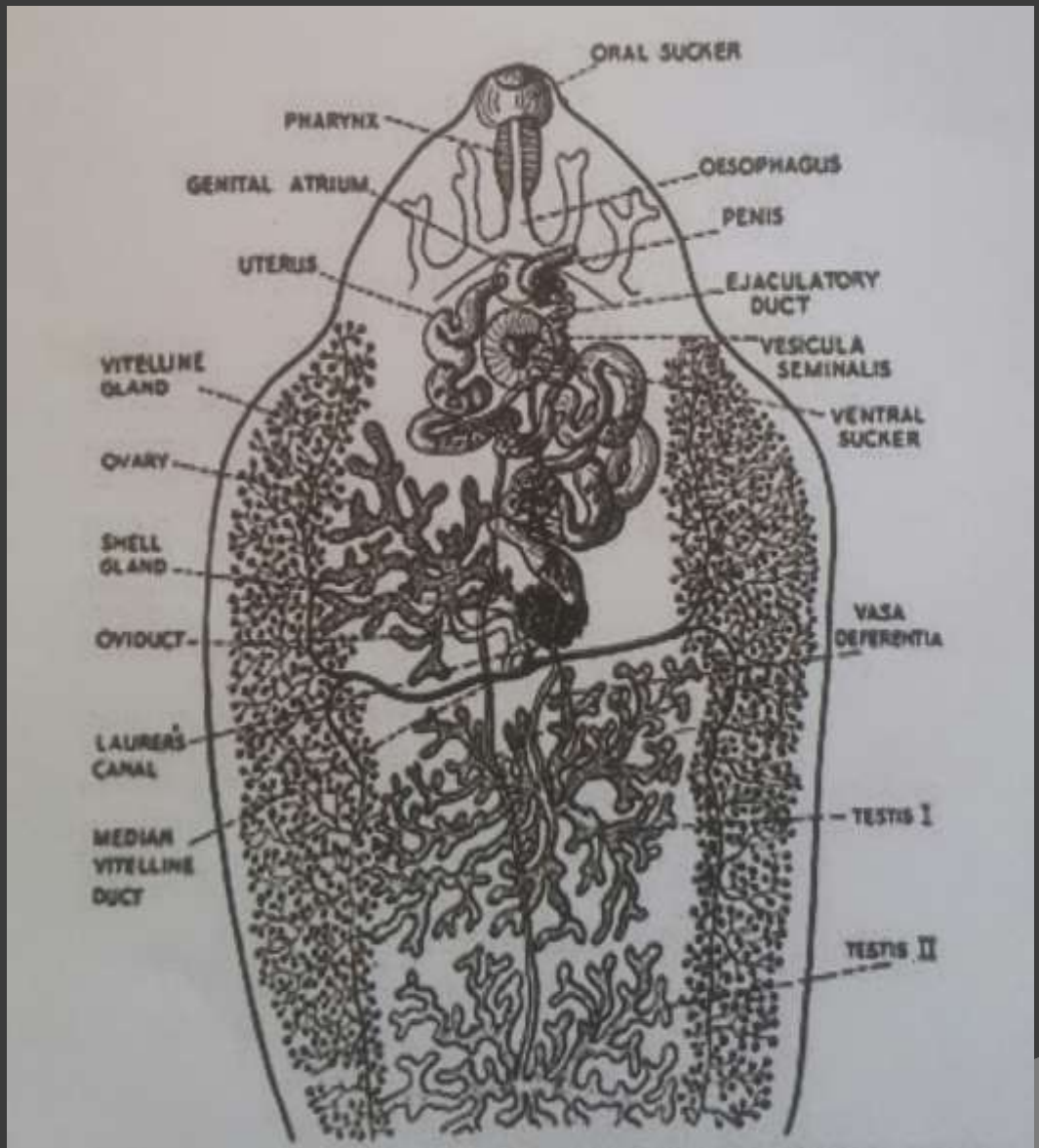
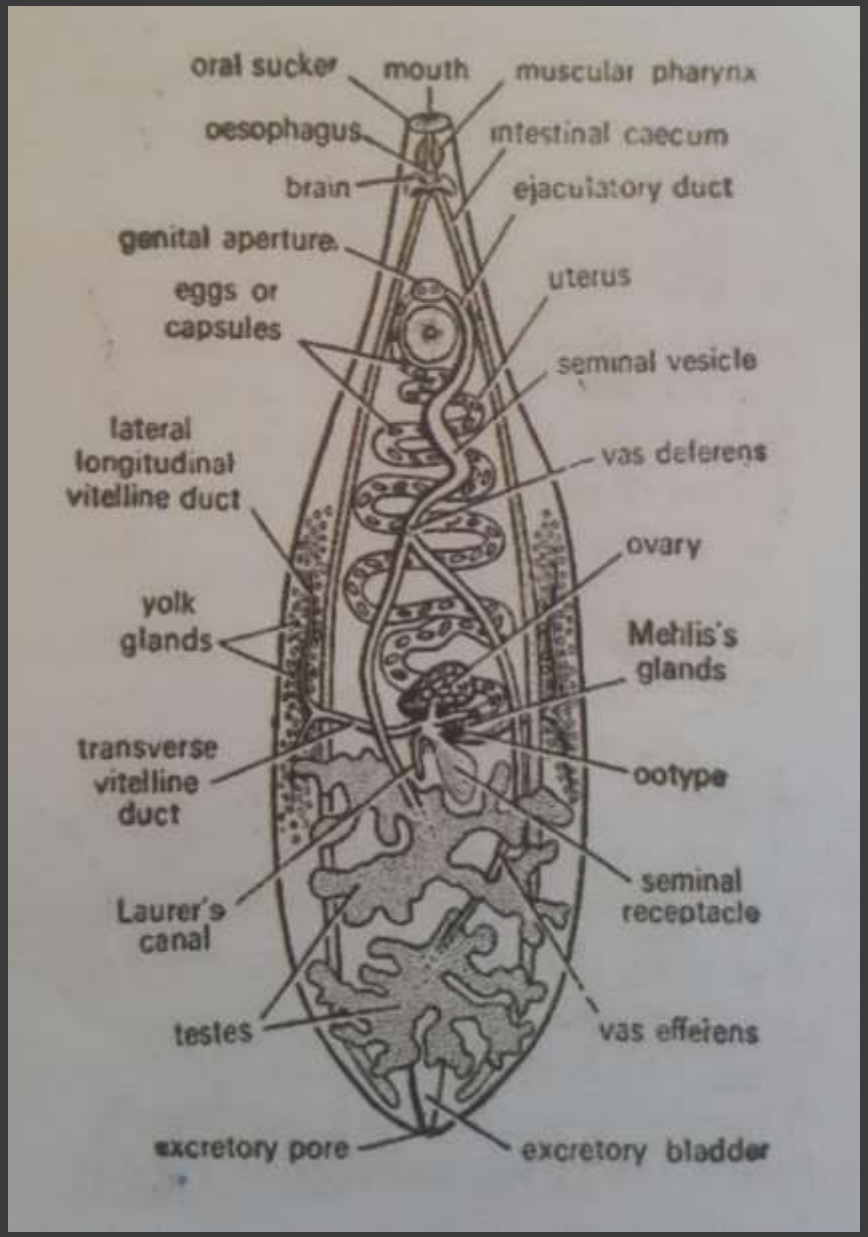


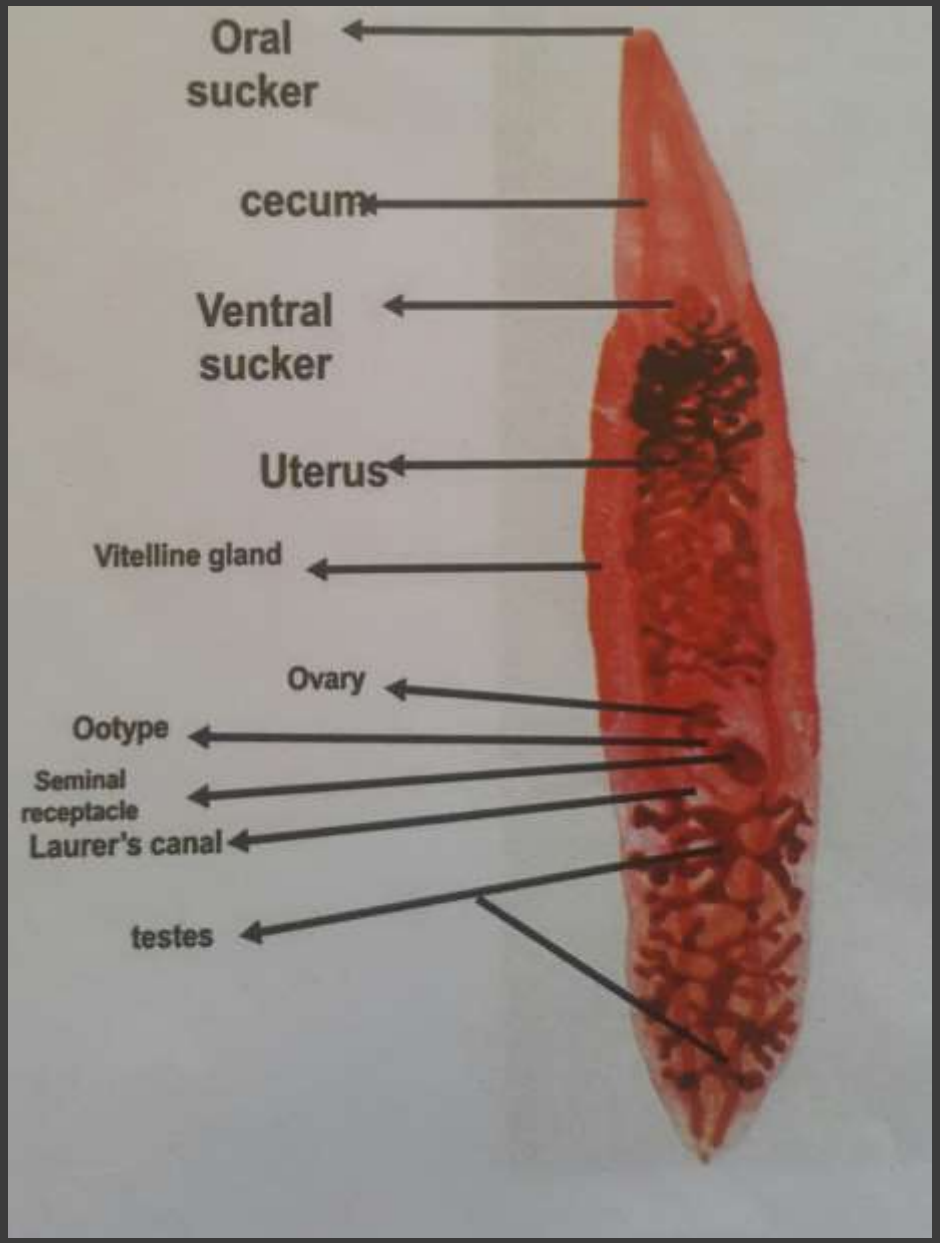
Fig. 65. FASCIOLA HEPATICA.—Diagram of the reproductive system.

Clonorchis sinensis

- Scientific name : **Clonorchis sinensis**
- Common name : **Chinese or Oriental Liver Fluke**
- Disease : **Clonorchiasis**
- Infective stage : **Metacercaria**
- 1st intermediate host : **Thiara or Bithynia**
- 2nd intermediate host : **Fresh water fish (Cyprinoid fish)**
- Diagnosis : **Ova are found in feces**

Presence in the host : Adults lives in bile ducts of human and mammals eat fish (Cats, Dogs)


oral sucker
mouth
muscular pharynx
oesophagus
intestinal caecum
brain
ejaculatory duct
genital aperture
uterus
eggs or capsules
seminal vesicle
lateral longitudinal vitelline duct
vas deferens
ovary
yolk glands
Mehlis's glands
transverse vitelline duct
ootype
seminal receptacle
Laurer's canal
testes
vas effeiens
excretory pore
excretory bladder

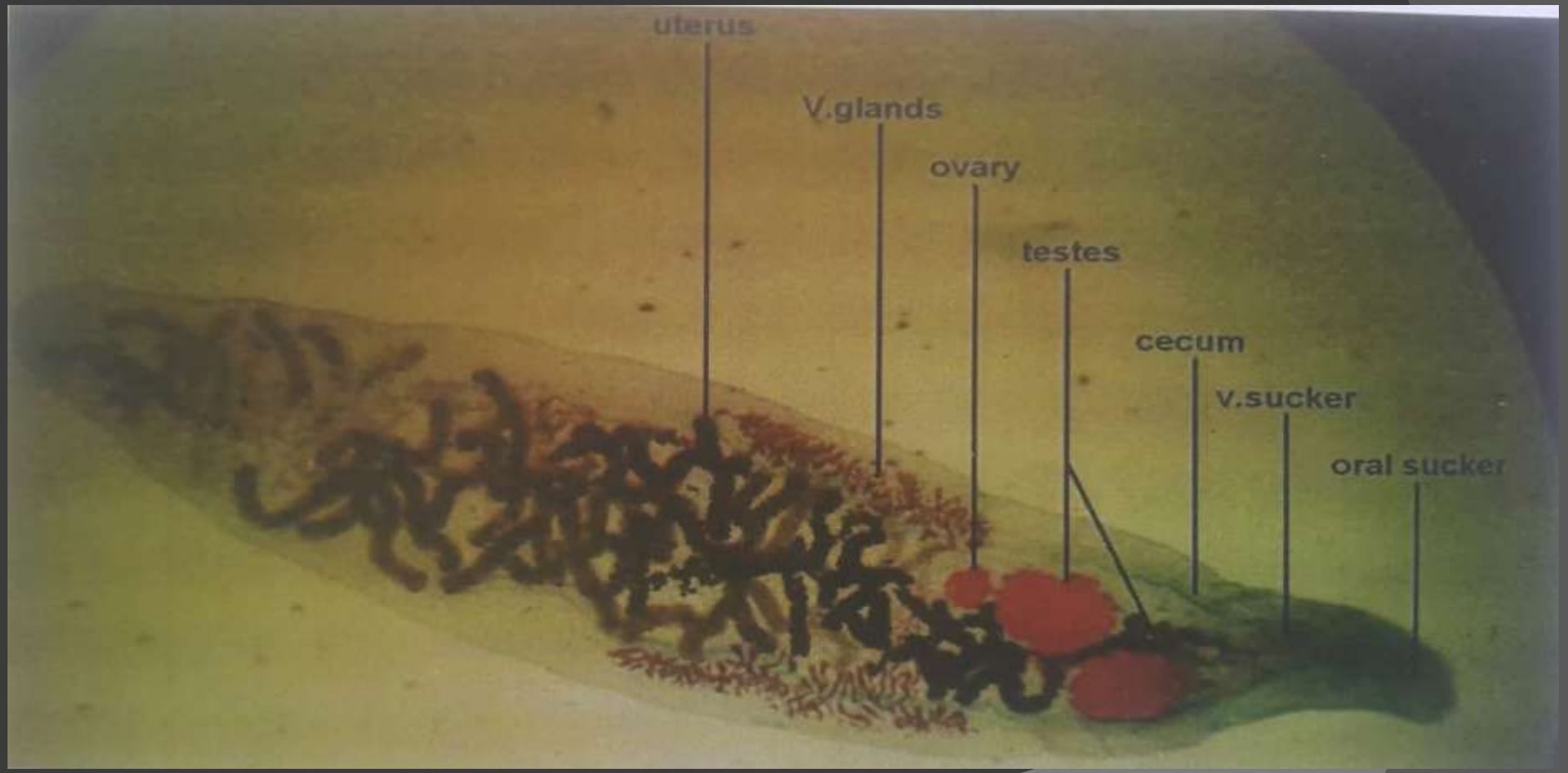

Oral sucker
cecum
Ventral sucker
Uterus
Vitelline gland
Ovary
Ootype
Seminal receptacle
Laurer's canal
testes

Dicrocoelium dendriticum

- Scientific name : **Dicrocoelium dendriticum**
- Common name : **Lancet liver fluke**
- Infective stage : **Metacercaria**
- 1st intermediate host : **Citronella iubrica**
- 2nd intermediate host : **Formica fusca**
- Diagnose : **Ova in feces**

Presence in the host : Adults lives in bile ducts of sheep, goats, pigs, deer, rabbits.

Dicrocoelium dendriticum



Lab 2

HELMINTHOLOGY

Fasciolopsis buski

Common name /Location : giant intestinal fluke / human small intestine, found in pigs

length : 25-75 mm

Disease : fasciolopsiasis

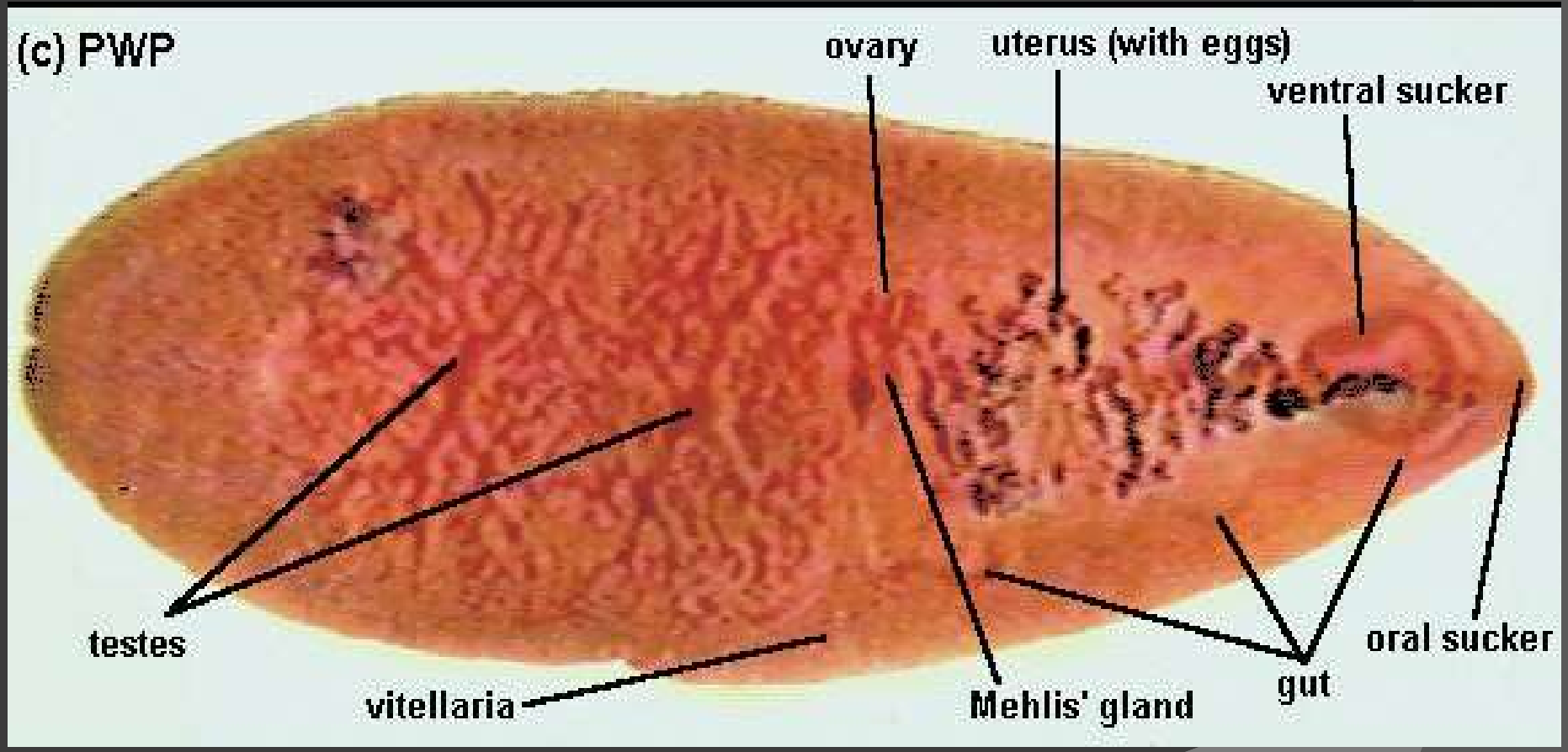
Infective stage : metacercaria

Intermediate host : 1- snail segmentina

2- water chestnut

Diagnosis : ova in feces (unemberyonated ova)

Fasciolopsis buski



Heterophyes heterophyes

Common name / Location : small intestine fluke / live in small intestine between the villi of human / other mammals that eating fish

Length : 0.1 – 1.7 mm

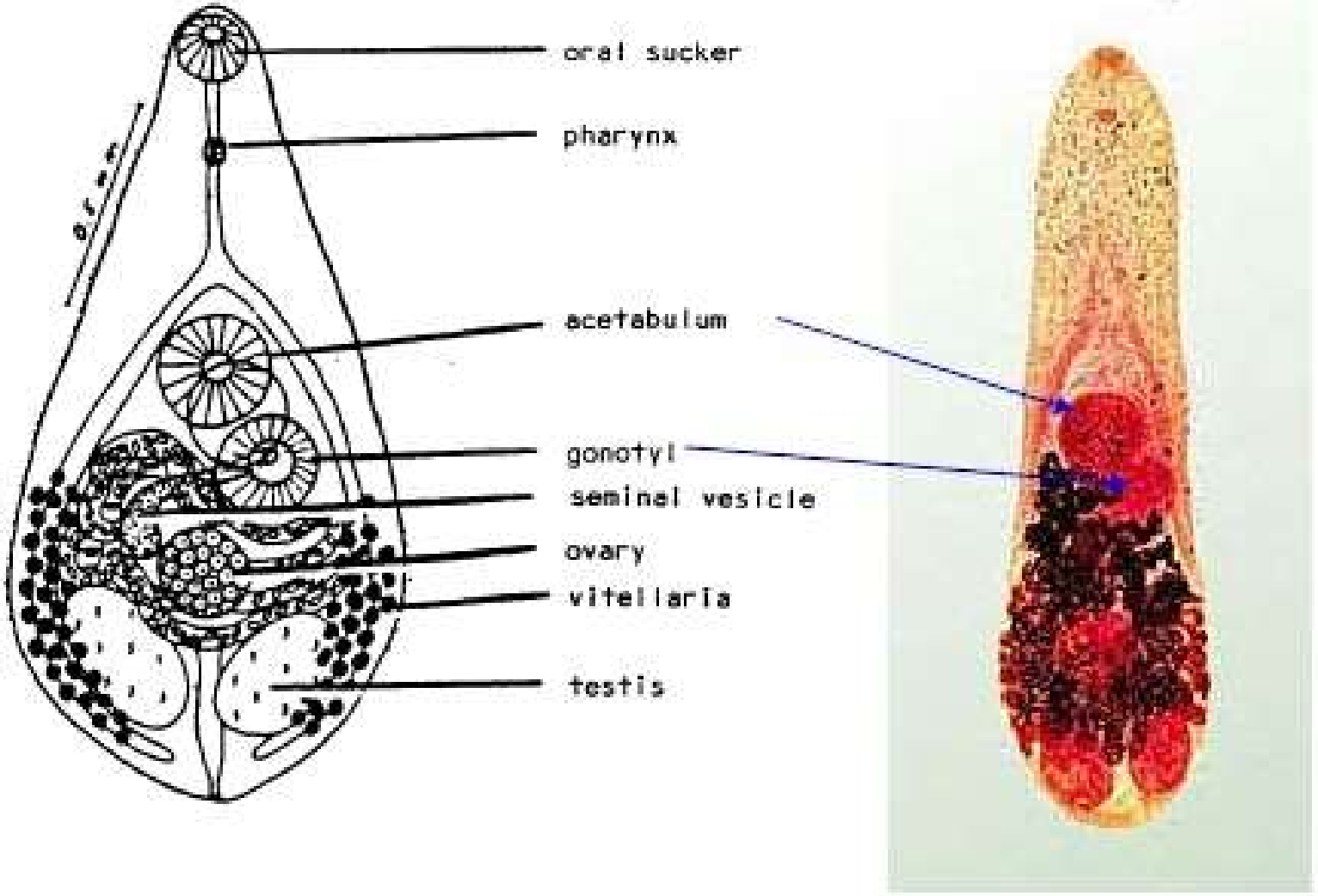
Disease : heterophyiasis

Infective stage : metacercaria

Intermediate host : 1-pirenella conica
2-mugil

Diagnosis : ova in feces (emberyonated)

Heterophyes heterophyes



Trematoda flukes of animal

Paramphistomum cervi

Common name/ Location : Ruminal flukes, found in the rumen of ruminants cattles

Length : 5-13 mm

Disease : amphistomiasis

Infective stage : metacercaria

Intermediate host : 1-fresh water snail bulinus
2-aquatic plant

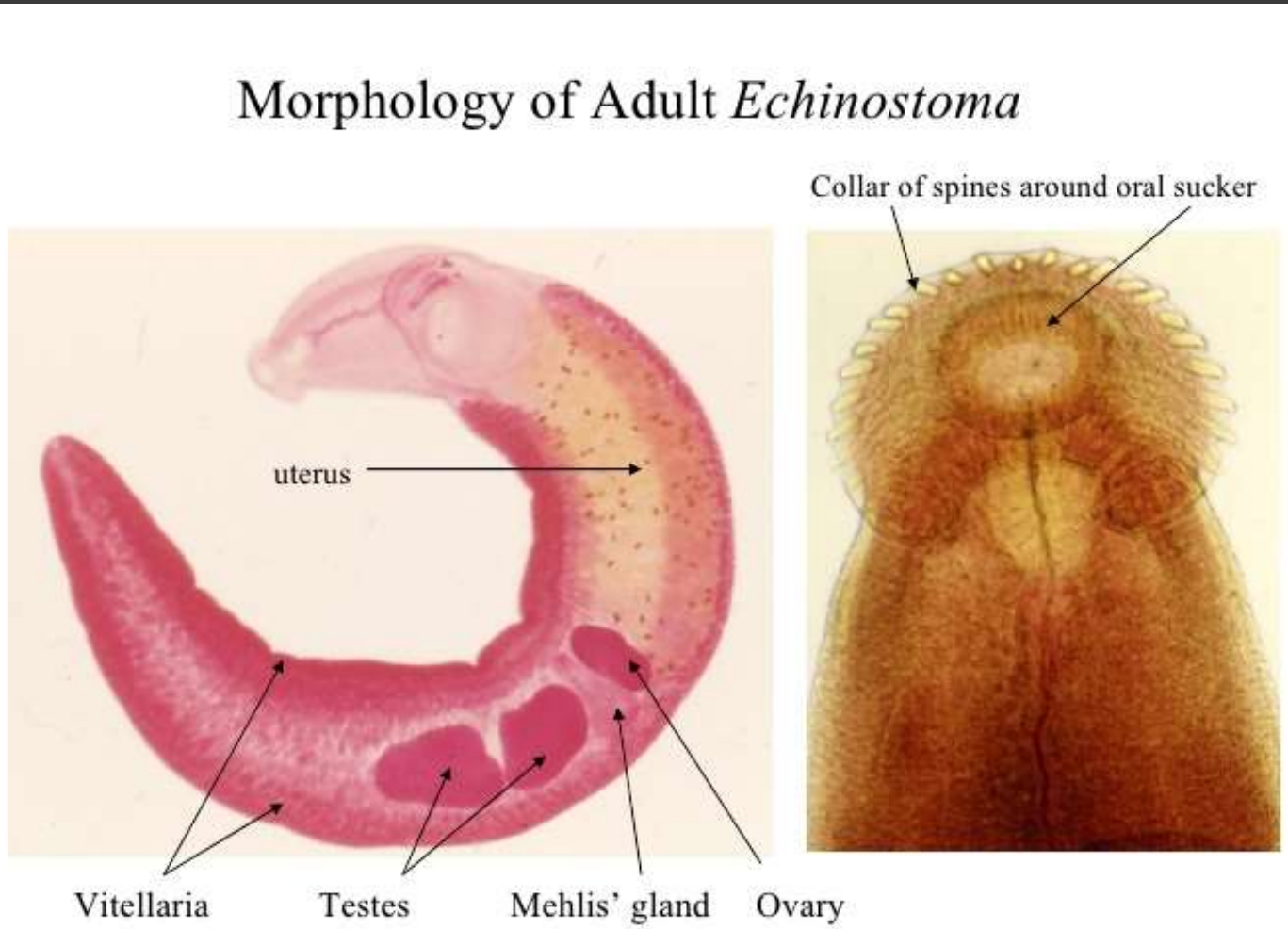
Diagnosis : ova in feces

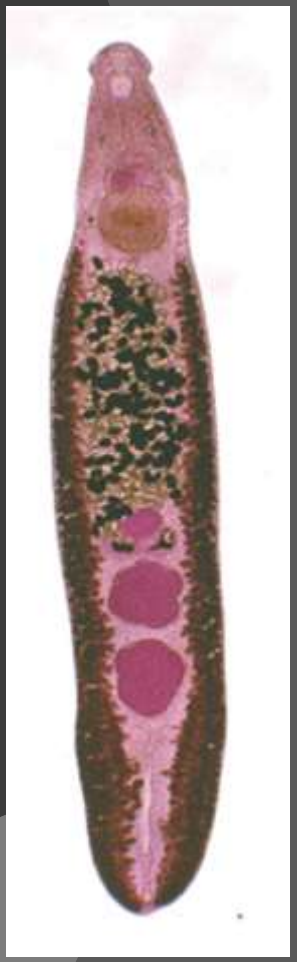
Paramphistomum cervi

Echinostoma revolutum

Common name / Location: trematoda flukes
Found : usually in the ileum of ducks, geese, pigeons, chicken and rarely humans
Length : 8.8 - 9.5 mm
Infective stage : metacercaria
Intermediate stage : snail (physa)
Snail or frogs
Diagnosis : ova in feces
Echinostoma revolutum , oral sucker surrounded by circumoral disk with three rows of spines (37 spines)

Echinostoma revolutum





Lung flukes

Paragonimus westermani

Common name / Location : oriental lung fluke, found in lungs of human

Length : 7.5- 12 mm

Body: covered with scal-like spines

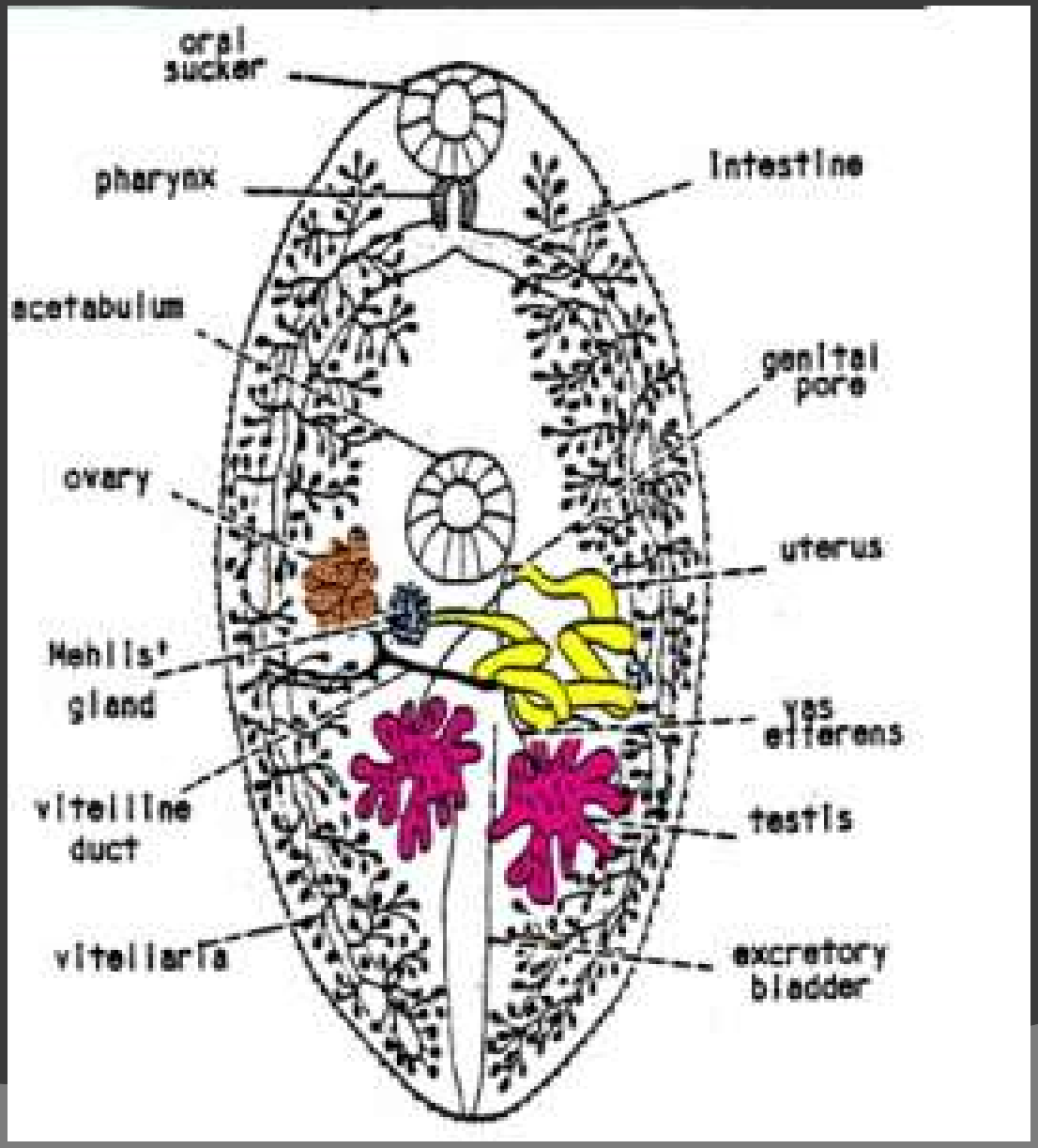
Disease : paragonimiasis or pulmonary distomiasis

Invective stage : metacercaria

Intermediate host : 1-fresh water snail thiara
2-crayfish

Diagnosis : ova in sputum (sometimes in feces)

Paragonimus westermani



Lab3

HELMINTHOLOGY

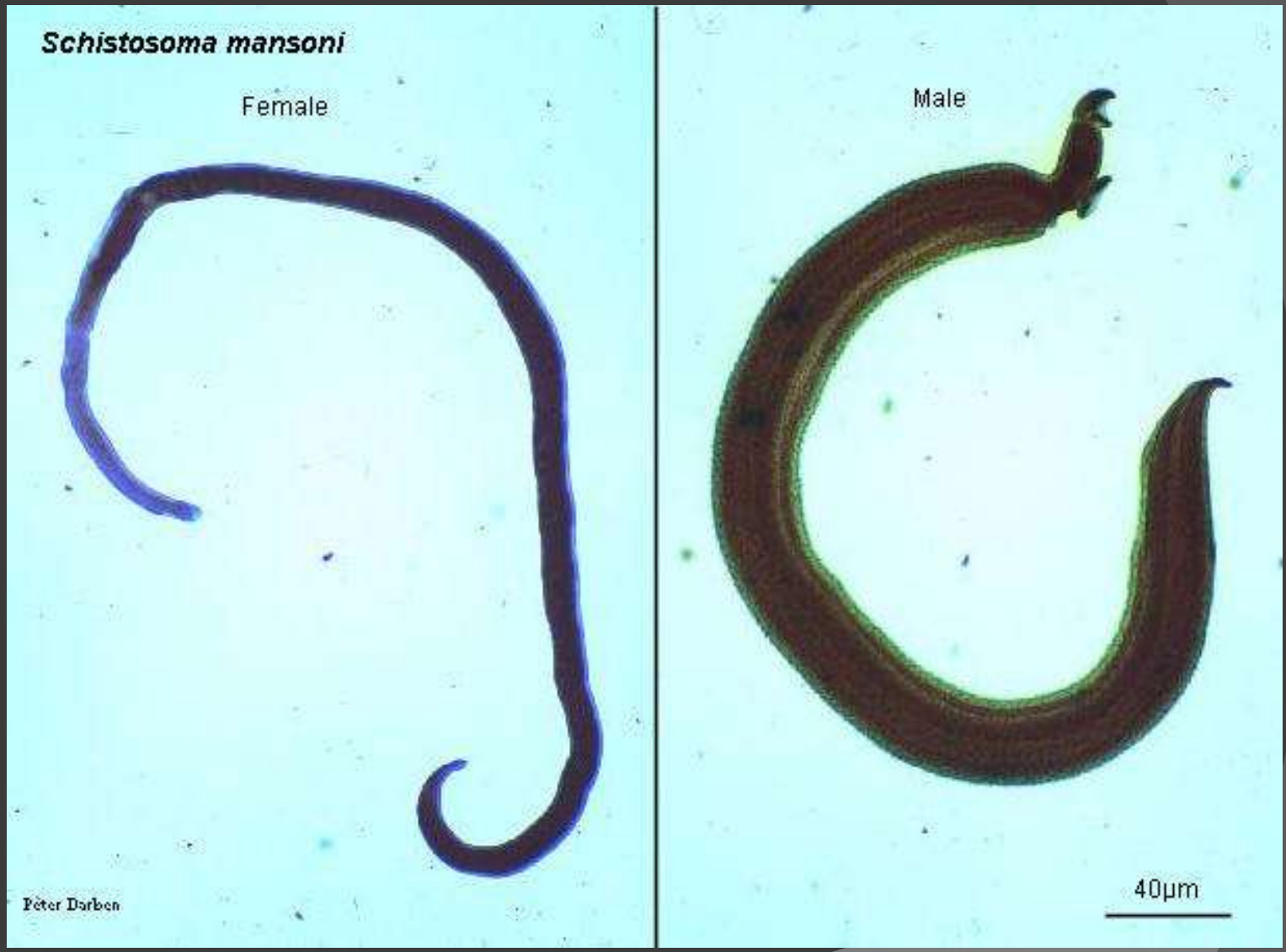
Class : trematoda

Blood flukes (schistosomiasis)

- The german pathologist theodor bilharz was the first who described the adult schistosoma worm in Egypt.
- Schistosomiasis is one of the most important health problem, 200 million peoples in 74 countries were infected with bilharziasis, at least 600 million at risk.

Blood flukes :-

- S . haematobium – Africa and middle east.
- S . mansoni – Africa and latin America.
- S . japonicum – pacific region.
- Dioecious (male and female).
- Oral sucker : includes mouth.
- Ventral sucker : usually bigger than oral sucker and located near genital pore.


Schistosoma mansoni
Female
Male
Peter Darben
40µm

- The body has a groove along match of its length and, it was this groove that inspired the name schistosoma or split body.
- The female lies within the groove, which is called gynaecophoric groove.
- There is no muscular pharynx, and the intestinal ceca unite posteriorly single ceca.
- 4-8 testes are found in males (depending on species).
- Only single ovary in female.
- Cercaria of schistosoma spp is [illegible] cercaria.
- No redia in their life cycle stage

Site of infection

S . haematobium	Urinary veins Vesicle veins Pelvic plexus
S . mansoni	Inferior mesenteric veins Hemorrhoidal plexus
S . japonicum	Superior mesenteric vein Gastric mesenteric veins

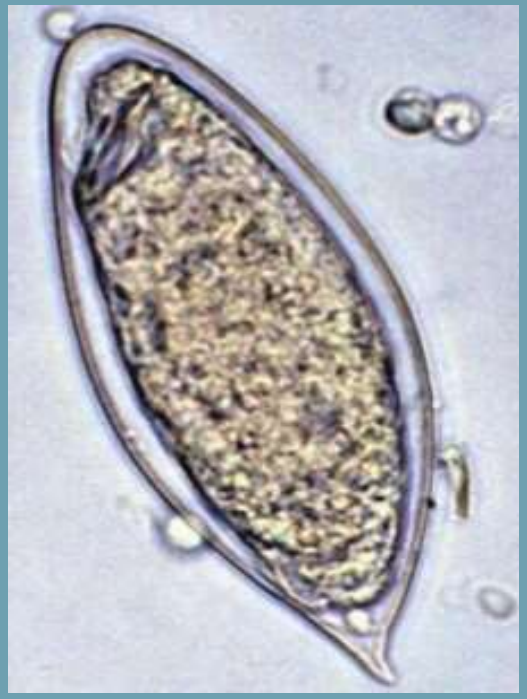
Disease

S . haematobium	Urinary bilharziasis
S . mansoni	Intestinal schistosomiasis
S . japonicum	Oriental schistosomiasis

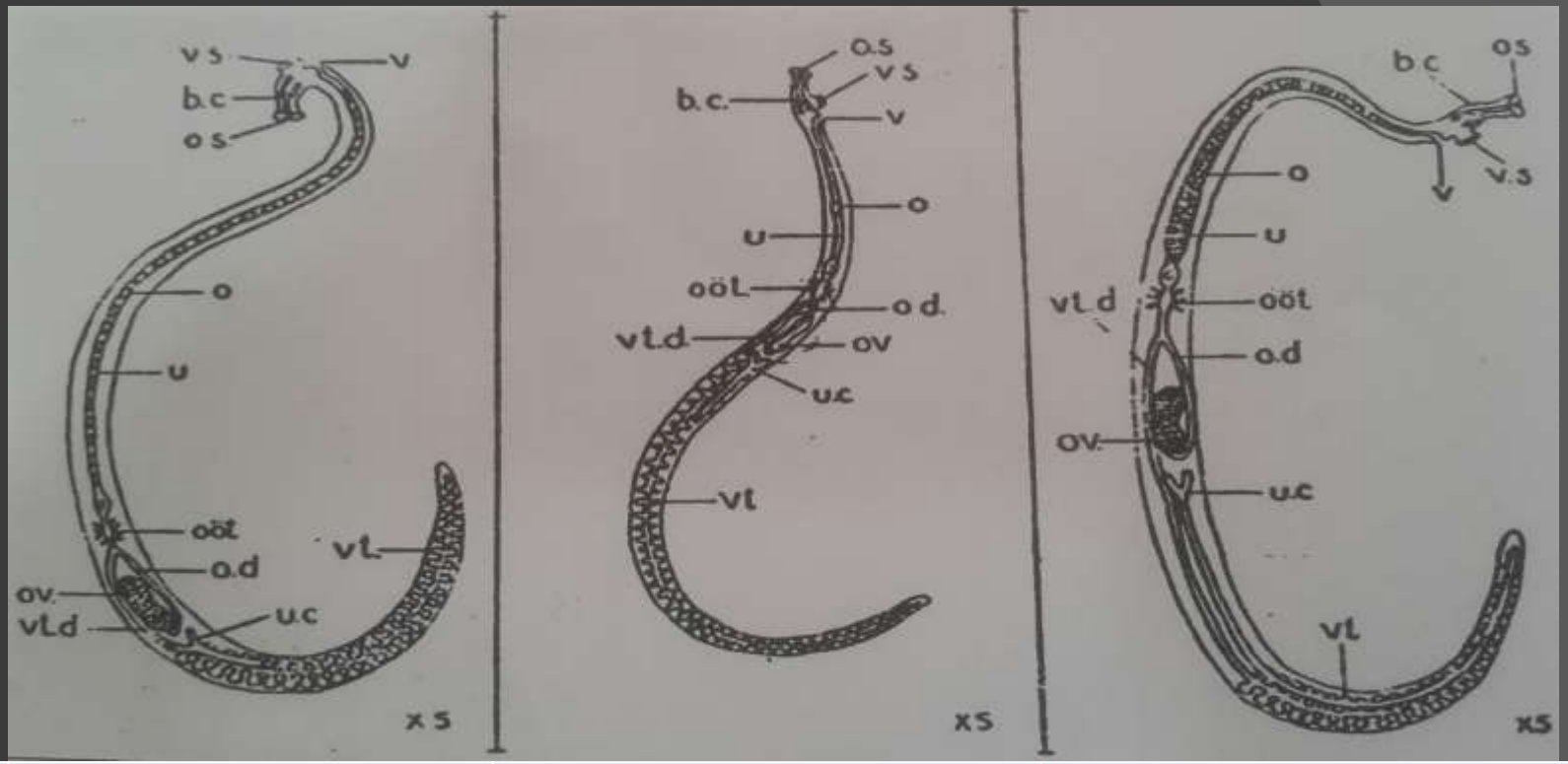
Intermediate host

S . haematobium	**bulinus**
S . mansoni	**biomphalaria**
S . japonicum	**oncomelania**

Blood flukes eggs (ova)

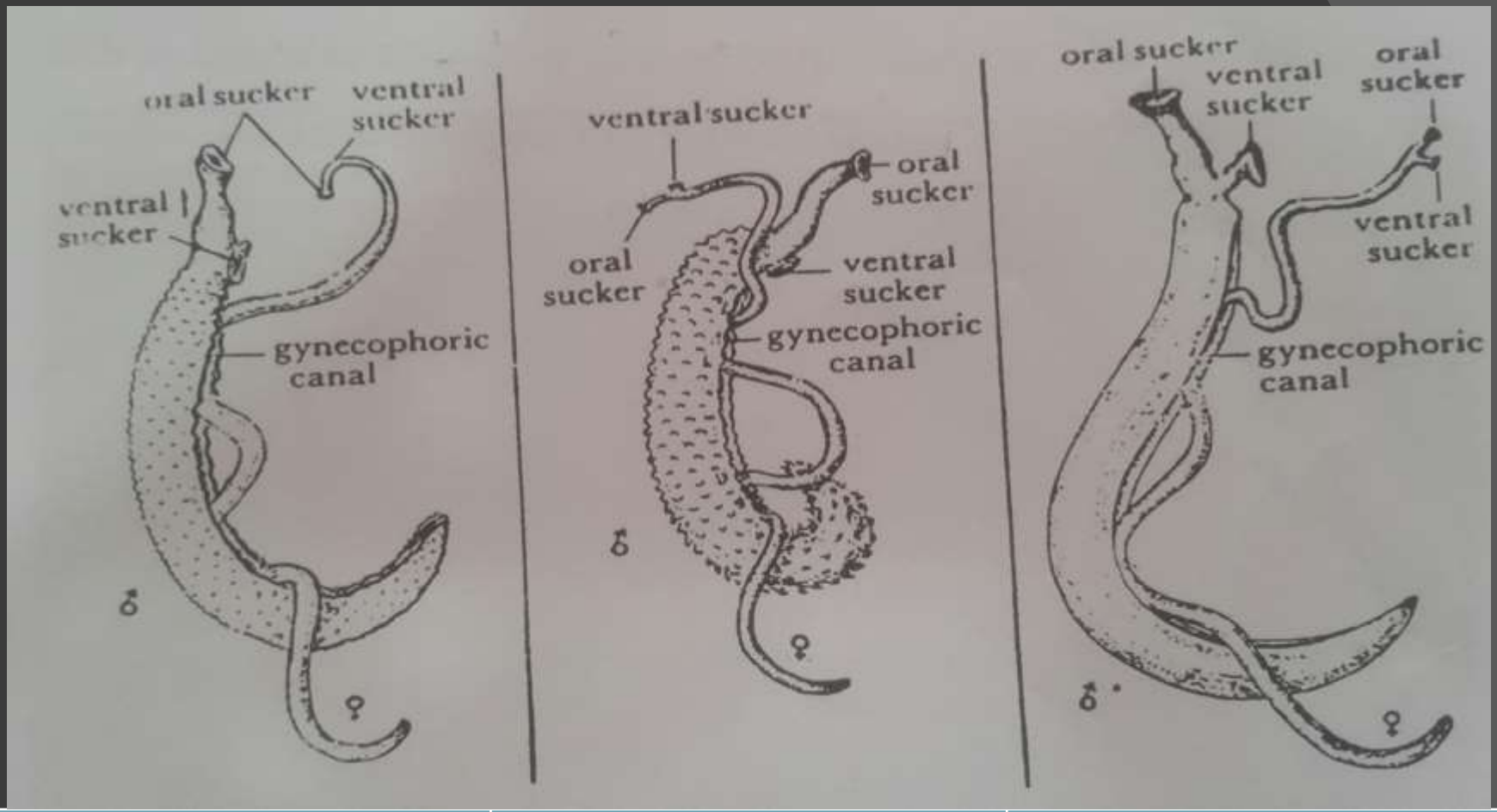
		
S . haematobium egg big with terminal spine secreted with	S . mansoni egg bigger with lateral spine secreted with stool	S . japonicum egg small with reduce lateral spine (knob) secreted with stool

Female ovary and uterus location



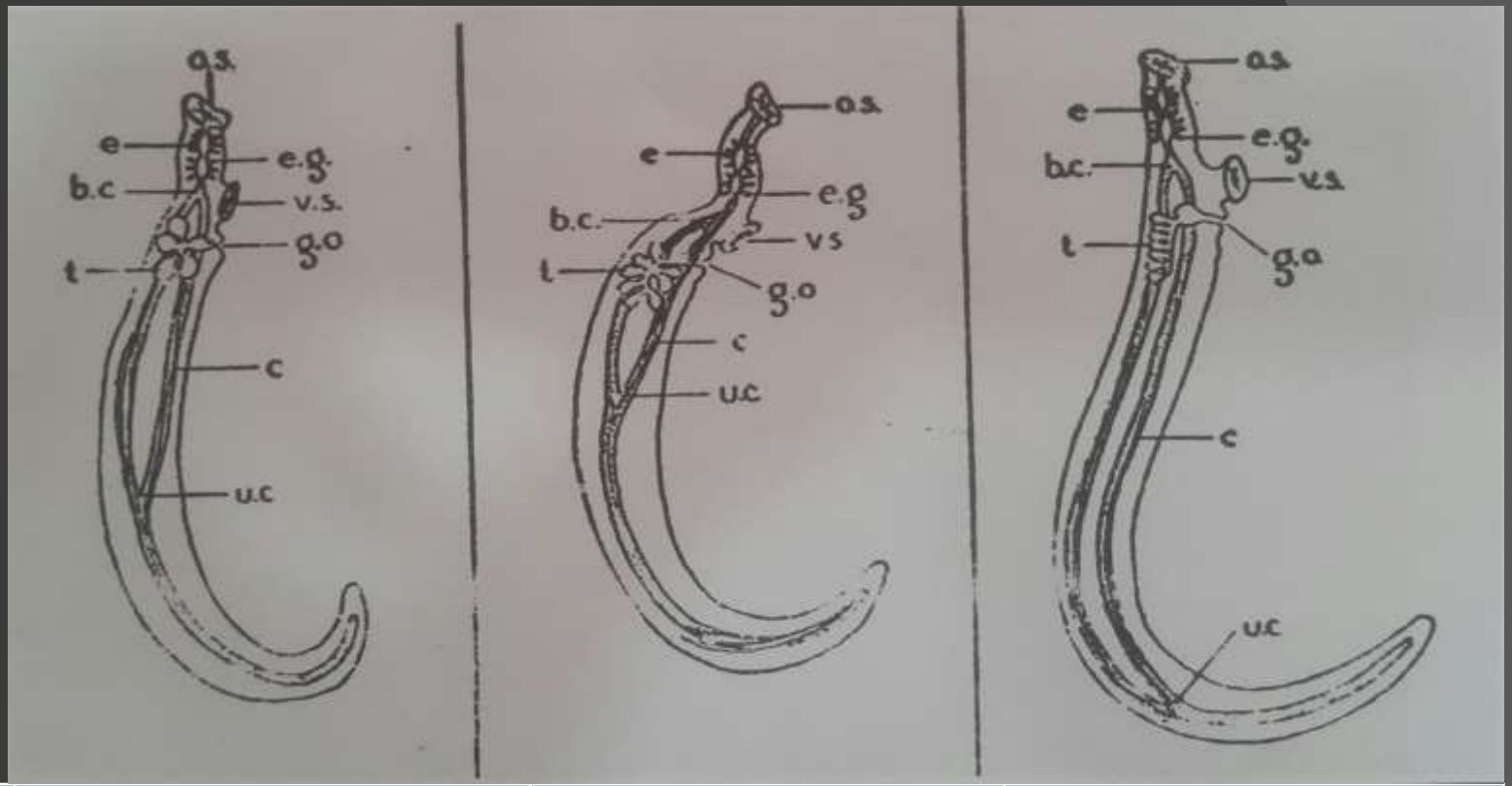
	S . haematobium	S . mansoni	S . japonicum
ovary	2nd half of the body	1st of the body	**Middle of the body**
uterus	Long with 20-30 ova	Short with 1-4 ova	**Long with 50-100 ova**

Male cuticula type and length



S . haematobium	S . mansoni	S . japonicum
Smooth cuticula	Cuticula with coarse tegument	**Cuticula with fine tegument**
10-15 mm	6.5-9.9 mm	**12-20 mm**

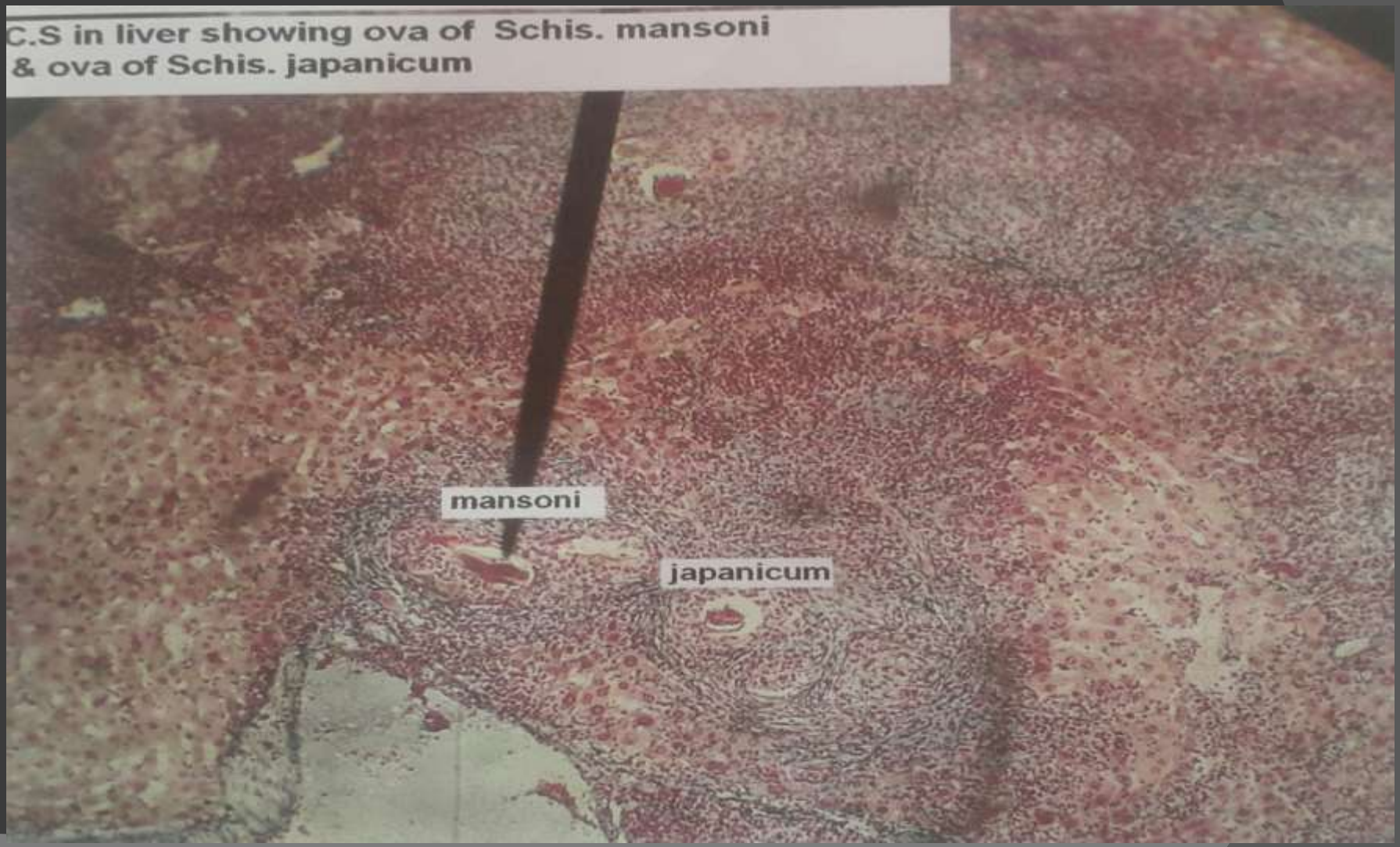
Male testes and intestine (ceca) junction



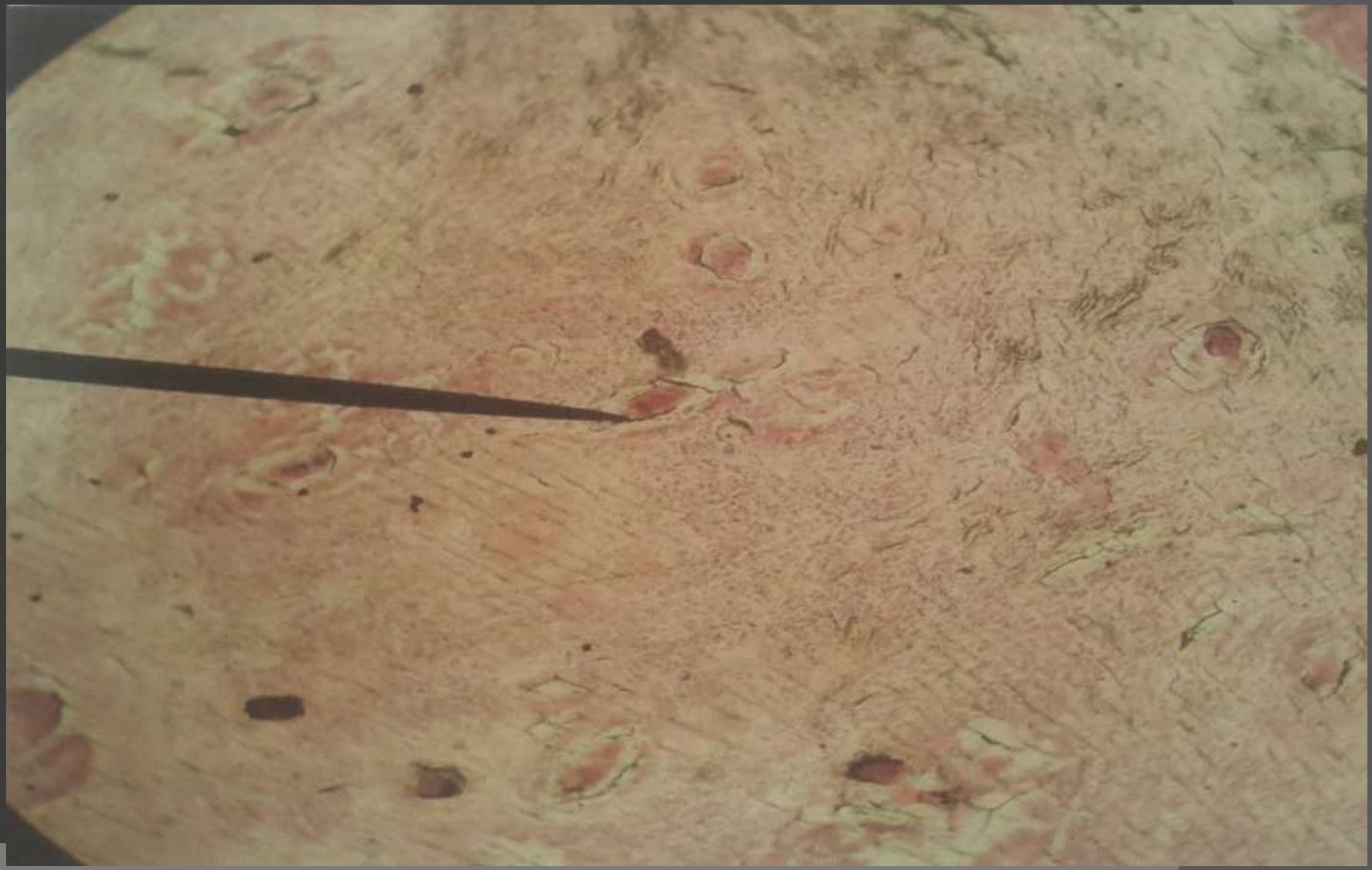
	S . haematobium	S . mansoni	S . japonicum
junction	2nd part of body	1st part of body	**3rd part of body**
testes	Big in cluster (4-5)	Small in cluster (6-9)	**Lined (6-8)**

C.S in bladder showing ova of schistosoma haematobium

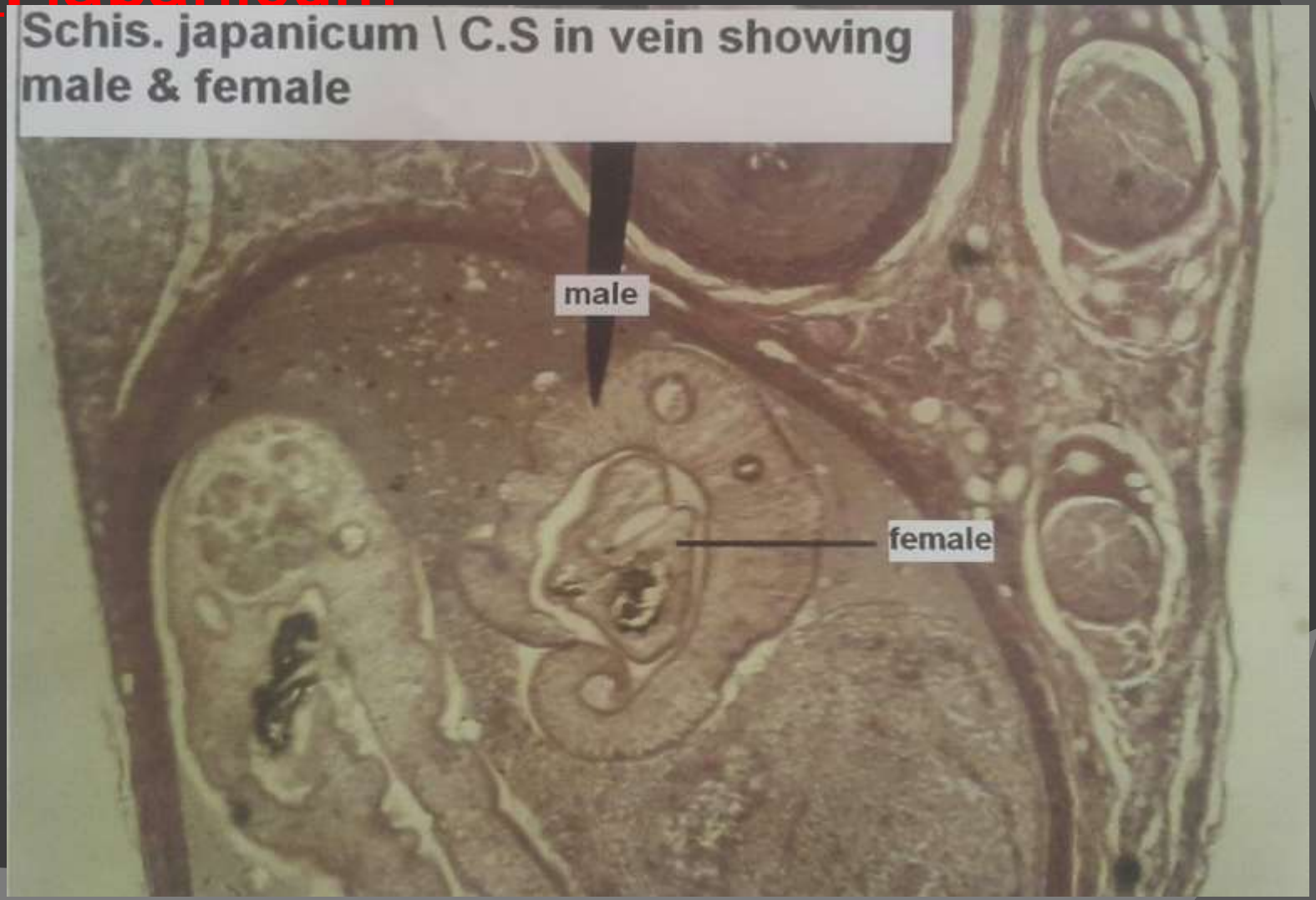
C.S in liver showing ova S. mansoni and japanocium



C.S in intestine showing ova of S. mansoni



C.S in veins showing male and female of S. japanicum



Lab4

HELMINTHOLOGY

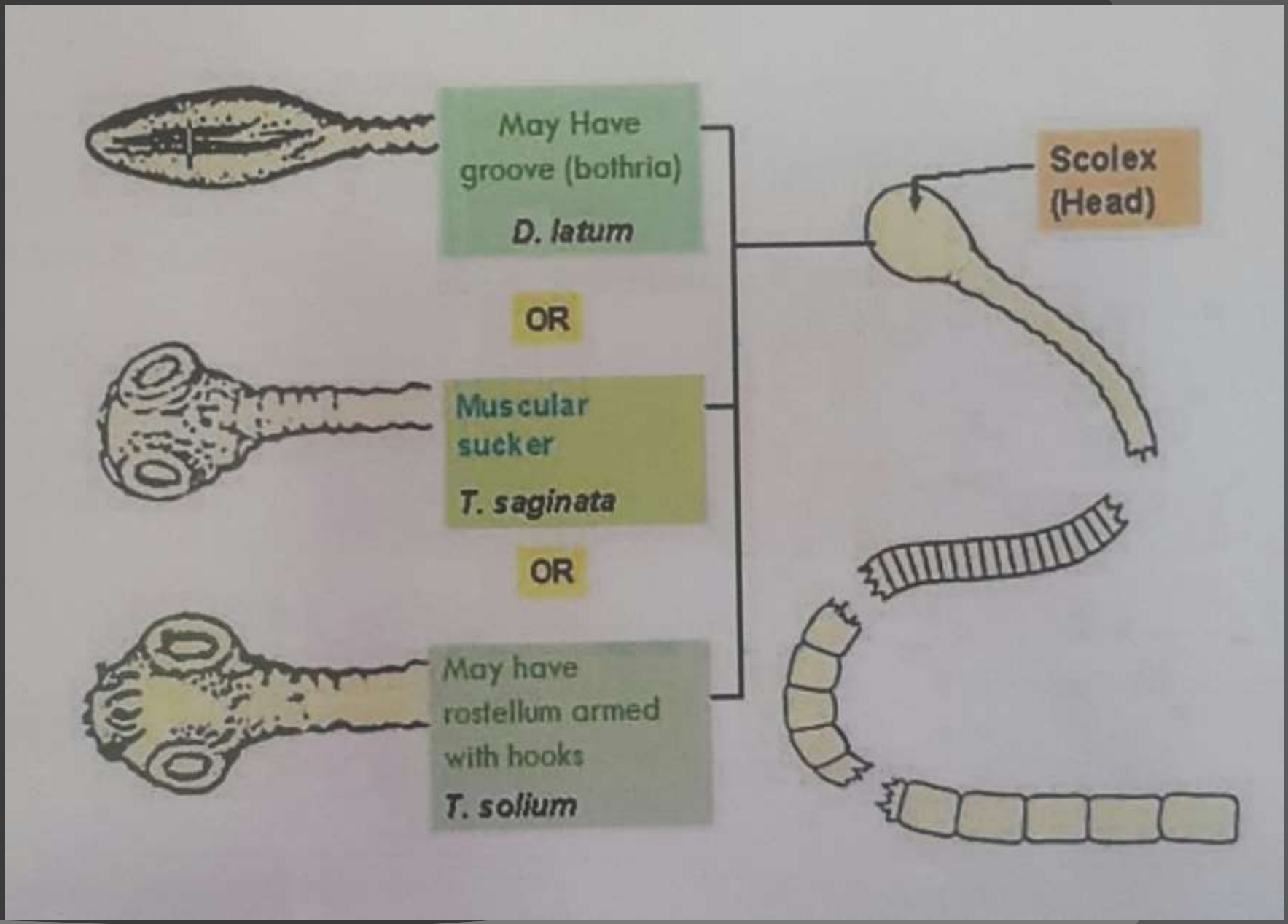
Cestoda

General characteristic

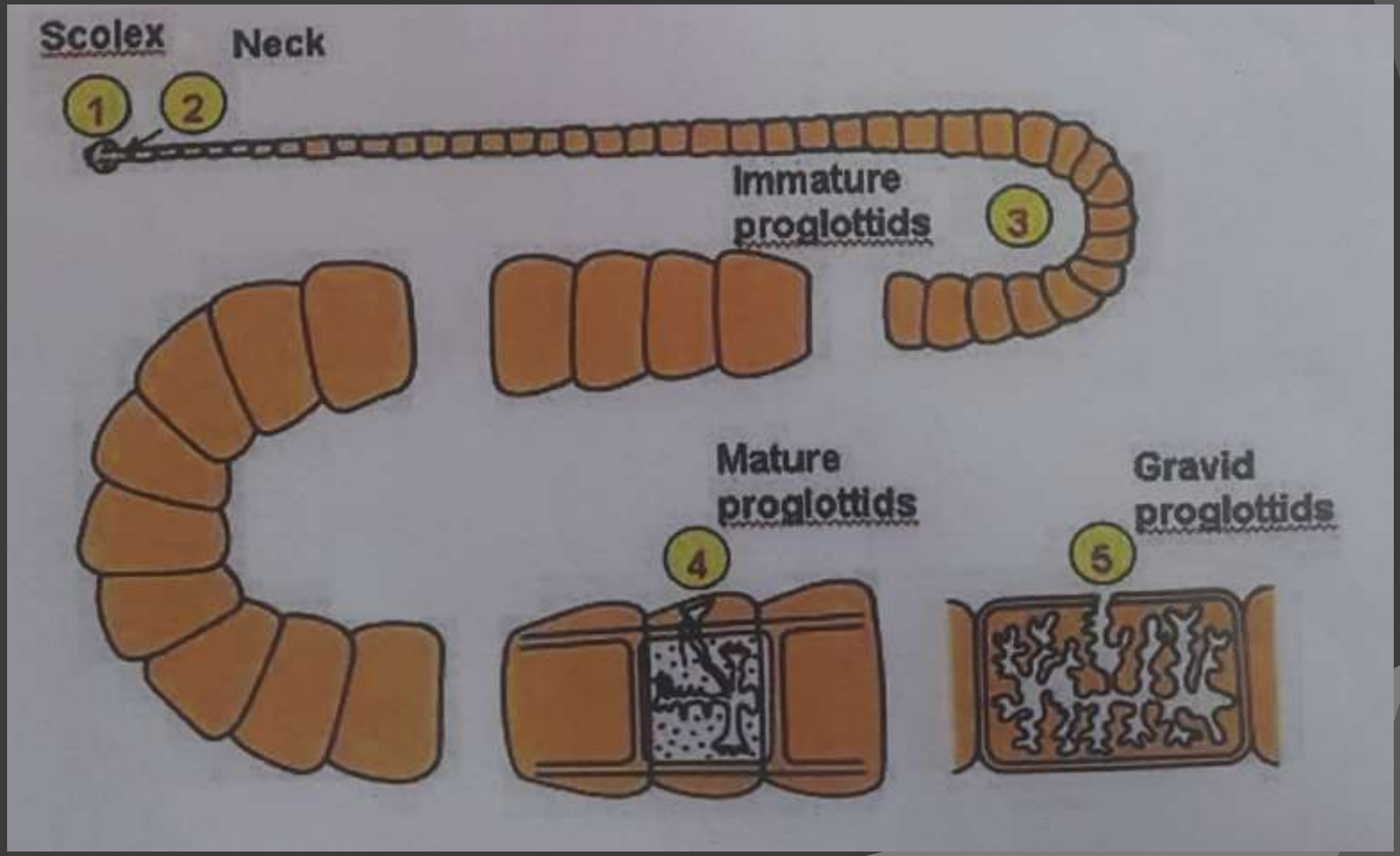
1- flat-segmented body with various length (few mm to several meters)

2- body consist of 3 regions:

- Scolex : suckers either bothria (grooves), muscular suckers (acetabula, cup shape) or hooks (armed).


May Have groove (bothria)
D. latum
OR
Muscular sucker
T. saginata
OR
May have rostellum armed with hooks
T. solium
Scolex (Head)

- Neck: germinal portion.
- Strobila: immature, mature, gravid proglottid

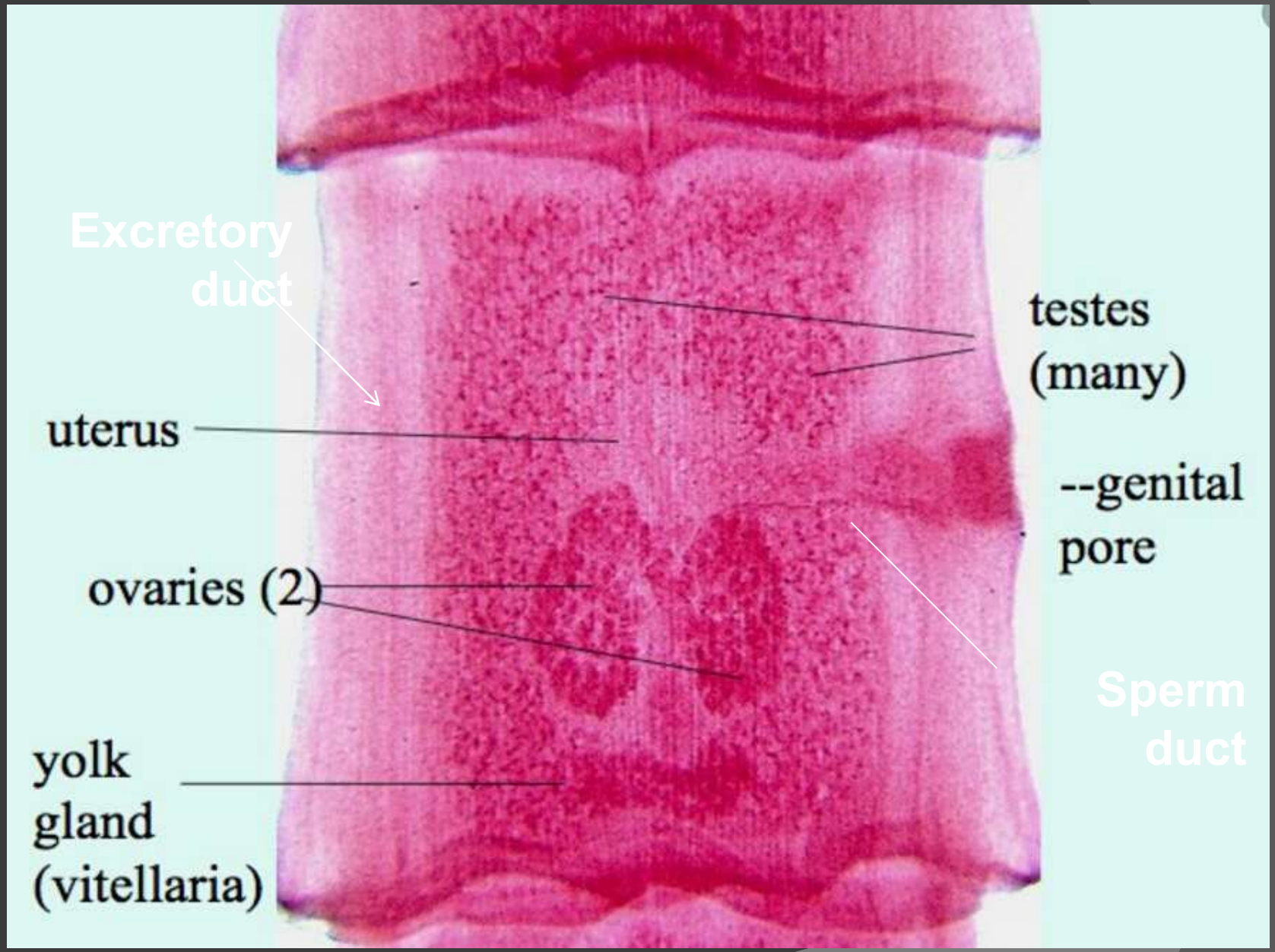


3- No digestive system, cuticle of the body has pores in which nutrients absorbed.

4- Excretory and nervous systems are present.

5- All are hermaphrodite, each segment has developed reproductive system (male and female)

6- All species are parasitic.



Mature proglottid

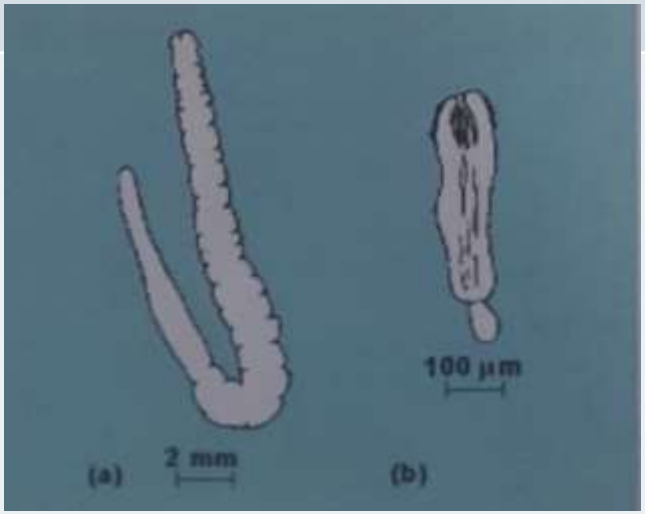
Orders of human parasitic cestoda

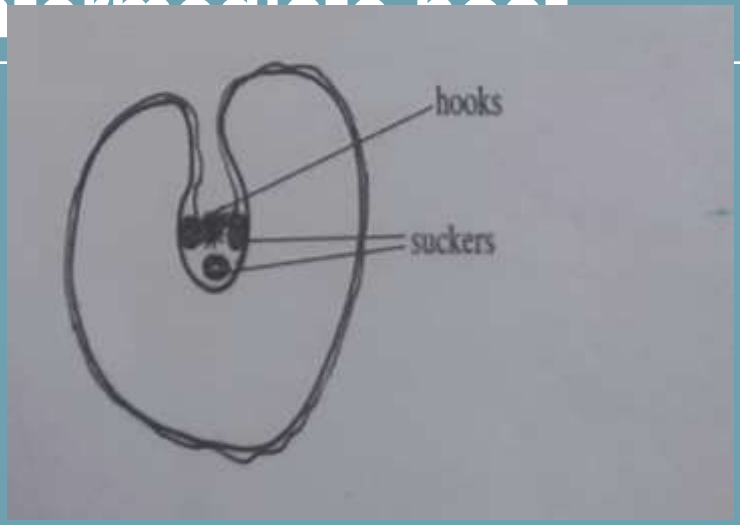
Order: Pseudophyllidae	Order: Cyclophyllidea
Operculated eva	Non-operculated eva

Order: Pseudophyllidae	Order: Cyclophyllidea
S	Sc ac

Order: Pseudophyllidae	Order: Cyclophyllidea
Uterus with ventral pore so ova discharged regularly	**Uterus with no pore so ova discharged with gravid proglottid**
Most proglottid are of same maturity	**Proglottids are of different maturity**
Common genital opening on ventral side	**Lateral common genital opening**
Yolk gland distribution all over the proglottid	**Single yolk gland or2 lobed**

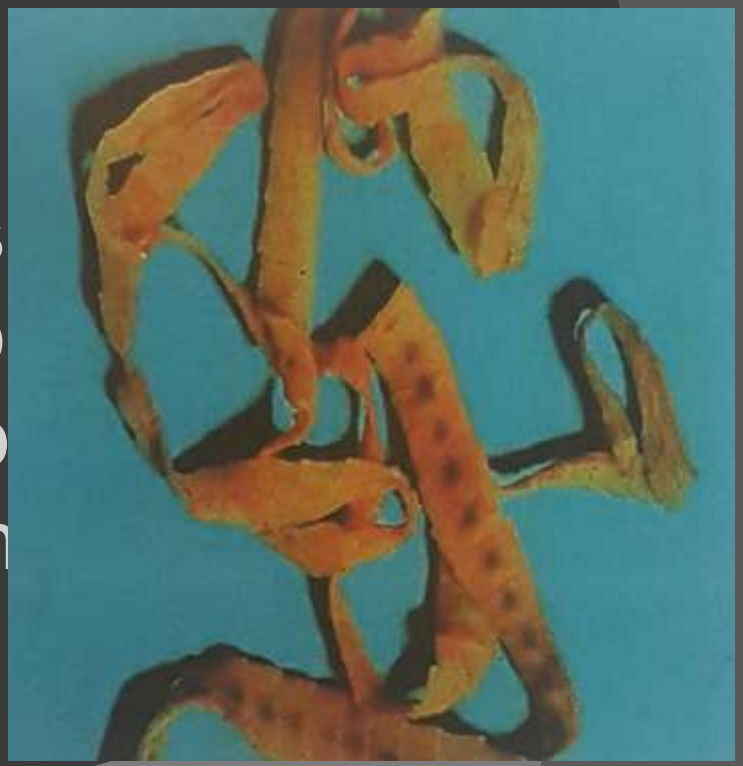
Order: Pseudophyllidae	Order: Cyclophyllidea
Two larval stages, a- procercoid in Cyclops, b- plerocercoid in fish	**One larval stage called cysticercus (bladder worm) live in voluntary muscles of in**





Diphyllobothrium latum

- Common name / location : broad or fish tapeworm/intestine of human and other mammals feed on fish
- Length : 3-10 meters
- Proglottids no. 3000-4000.
- Disease : diphyllobotherias
- Infective stage : plerocerco
- Intermediate host: 1-cyclop
  2-fish
- Diagnosis: ova in stool



Diphyllobothrium latum scolex

Diphyllobothrium latum ova

Diphyllobothrium latum mature proglottid

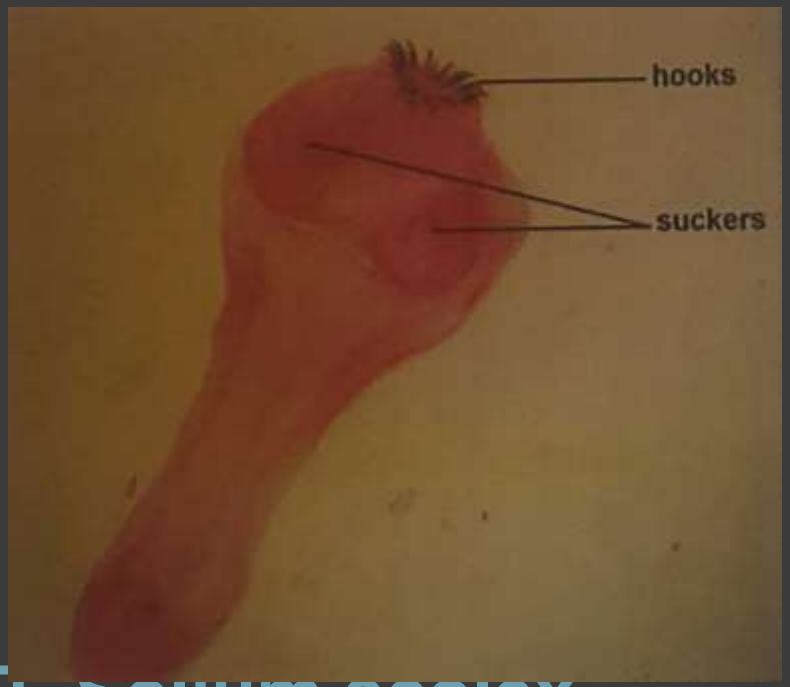
Taenia solium

- Common name / location : pork or armed tapeworm/ small intestine of human
- Length: 2-7 meters
- Proglottids no. 800-900
- Disease : taeniasis
- Infective stage: cysticercus
- Intermediate host: muscle of pigs
- Diagnosis : ova in stool

Taenia saginata

- Common name/ location : beef or un-armed tapeworm/ small intestine of human
- Length: up to 25 meters
- Proglottids no. 1000-2000
- Disease : taeniasis
- Infective stage: *cysticercus bovis*
- Intermediate host: muscle of caws
- diagnosis: ova in stool

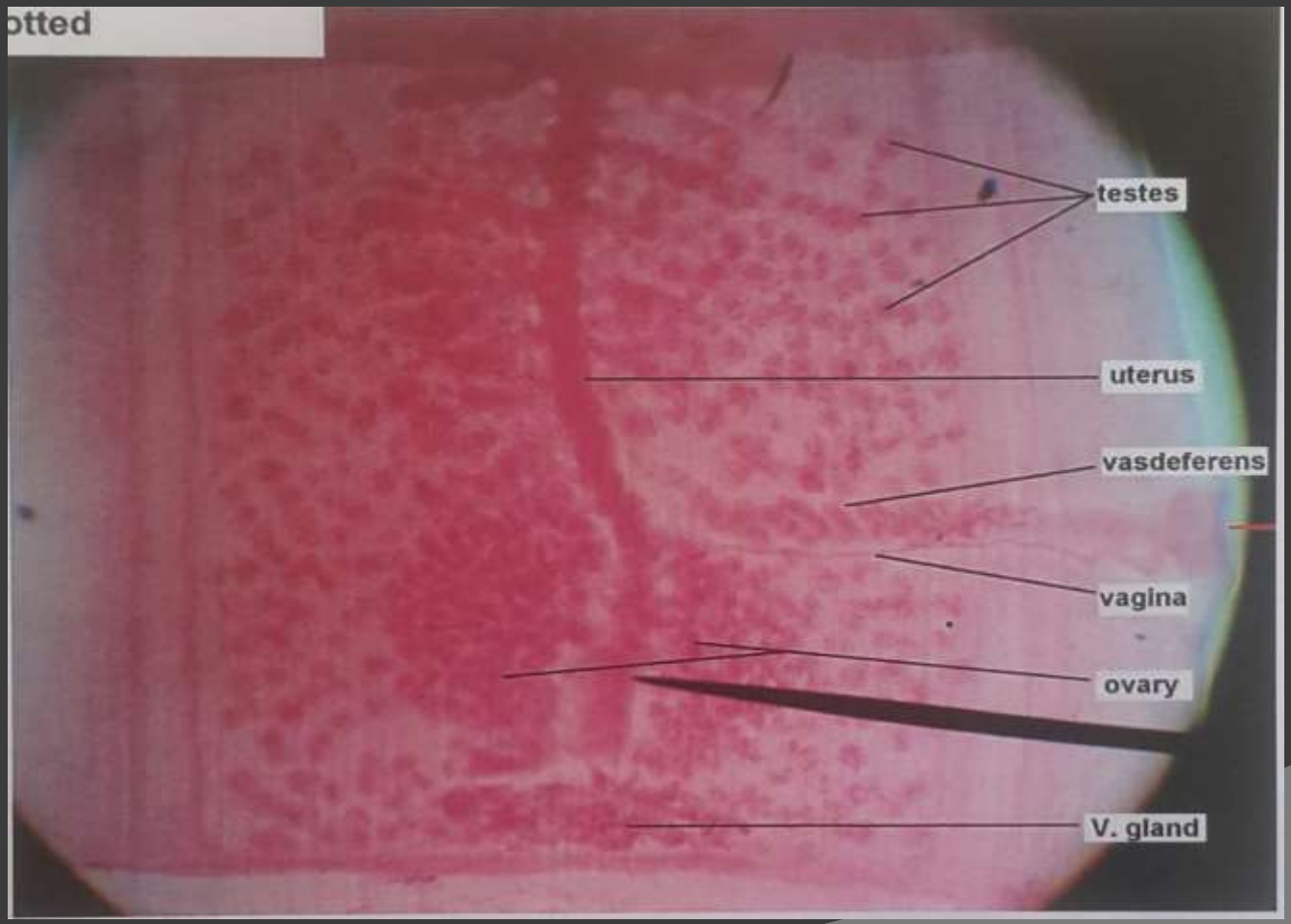
Scloex of taenia spp



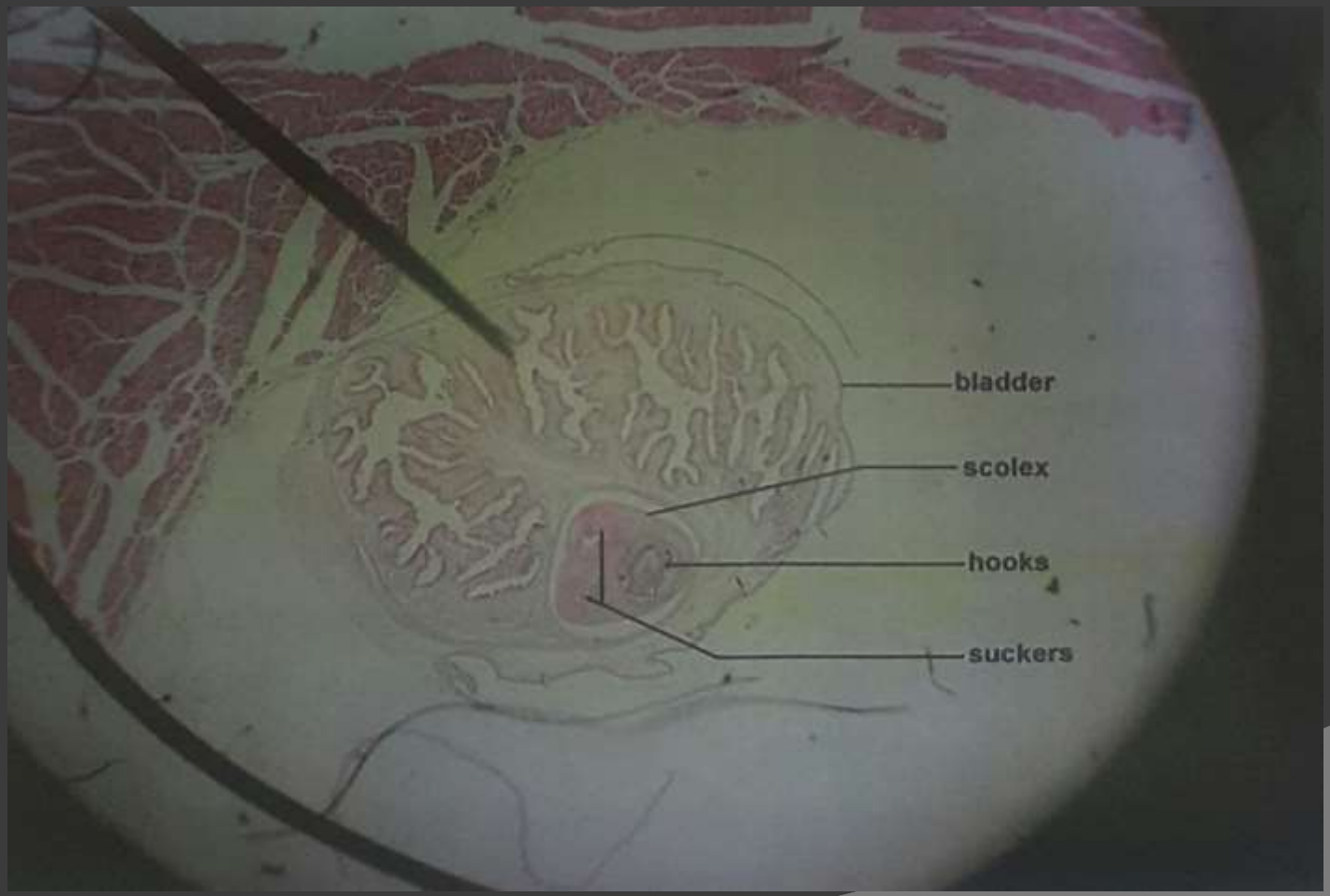
T. Solium scolex

T. Saginata scolex

Taenia spp. Mature proglottid



c.s. in muscle of pig showing *cysticercus celluloae*



gravid proglottid of taenia spp.

t. saginata	t. solium
	
Taller proglottid- branches of uterus are thin and more (15-20)	**Shorter proglottid branches of uterus are thick and less (7-10 or 13)**

Lab 5,6

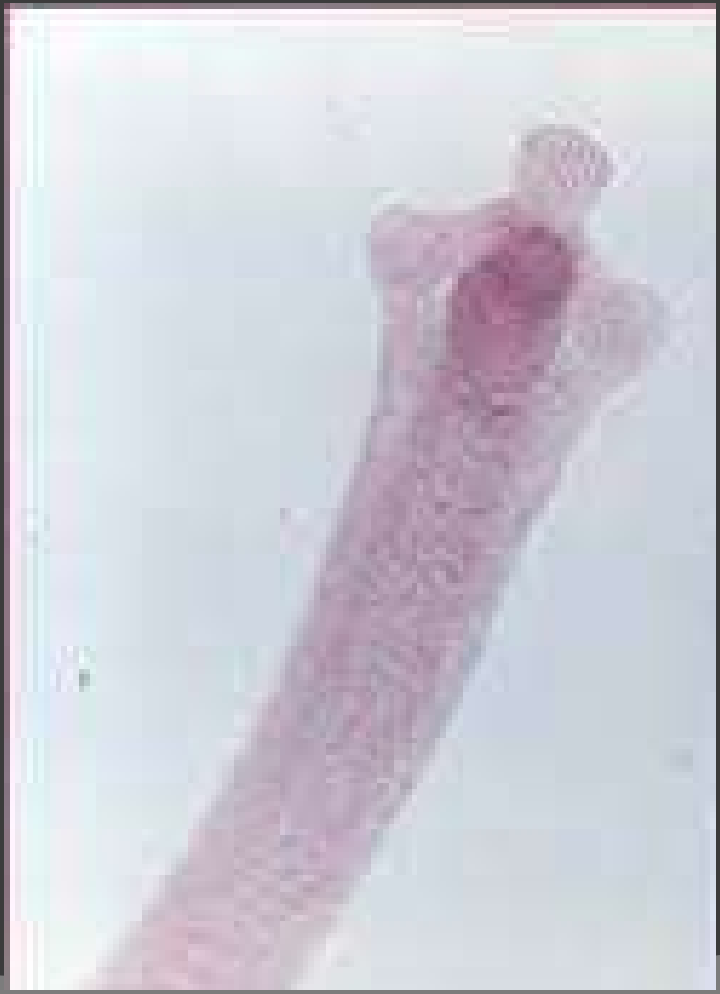
HELMINTHOLOGY

Hymenolepis nana

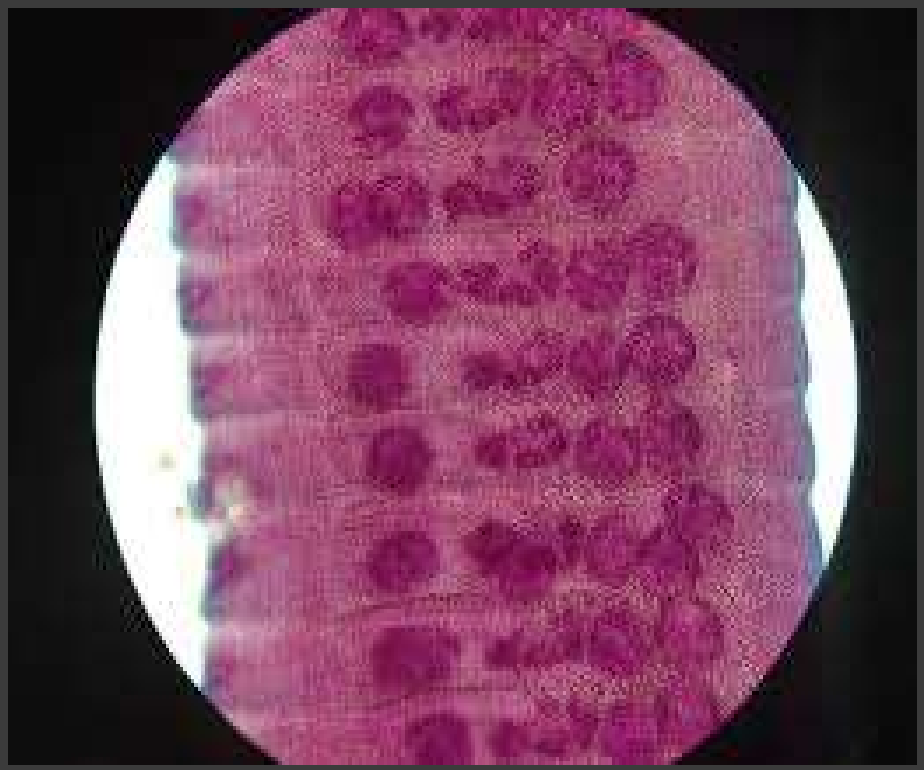
Common name / location : Dwarf tapeworm,
small intestine of
human and rats.
Length : up to 40 mm.
Proglottids no. 150-200.
Disease: Hymenilepiasis.
Infective stage: cysticercoid
Intermediate host: it is needed only for transmission between humans, fleas and grain beetles.
Diagnosis: ova in stool.

Scolex:

Has four suckers bears a retractable rostellum armed with a single circle of 20 to 30 hooks.



Mature proglottids: each has 3 testes



Hymenolepis diminuta

Common name / location: rat tapeworm,small intestine of rats.

Scolex is unarmed.

Length: up to 60mm.

Proglottids no. 800-1000.

Disease: Hymenilepiasis.

Infective stage: cysticercoid

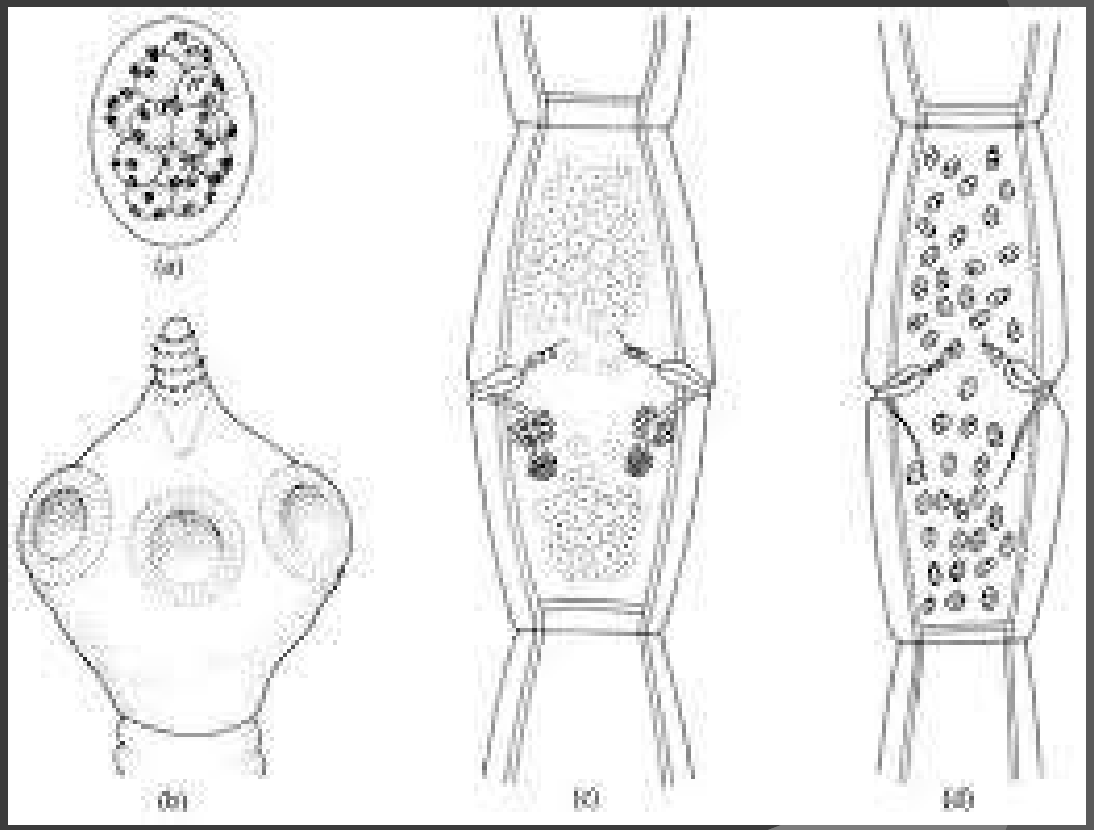
Intermediate host: Tribolium spp.

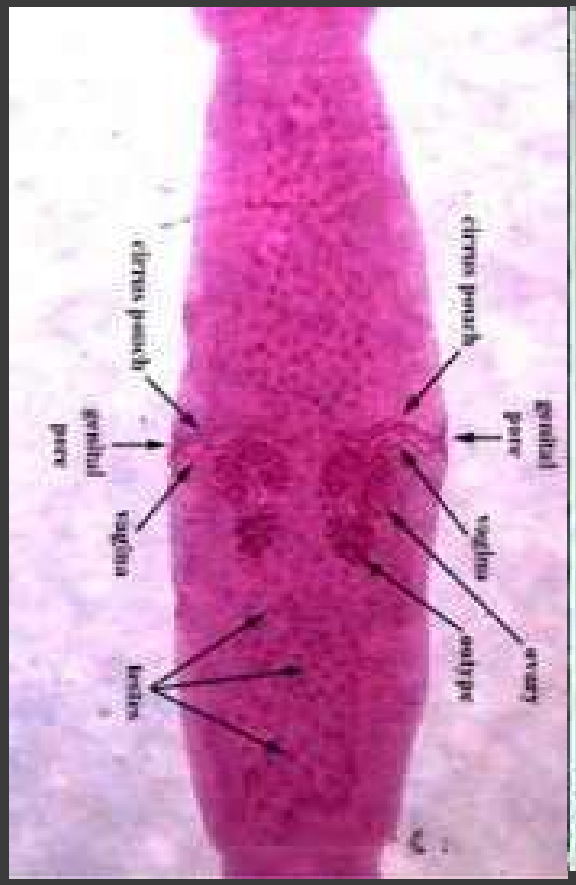
H. Nana	H. diminuta
-Smaller than H.diminuta -Oncosphere covered with thin outer membrane and thick inner membrane with polar thickenings that bear	**-Bigger than H.nana** **-Oncosphere covered with two thin membranes with thickenings but no filaments**

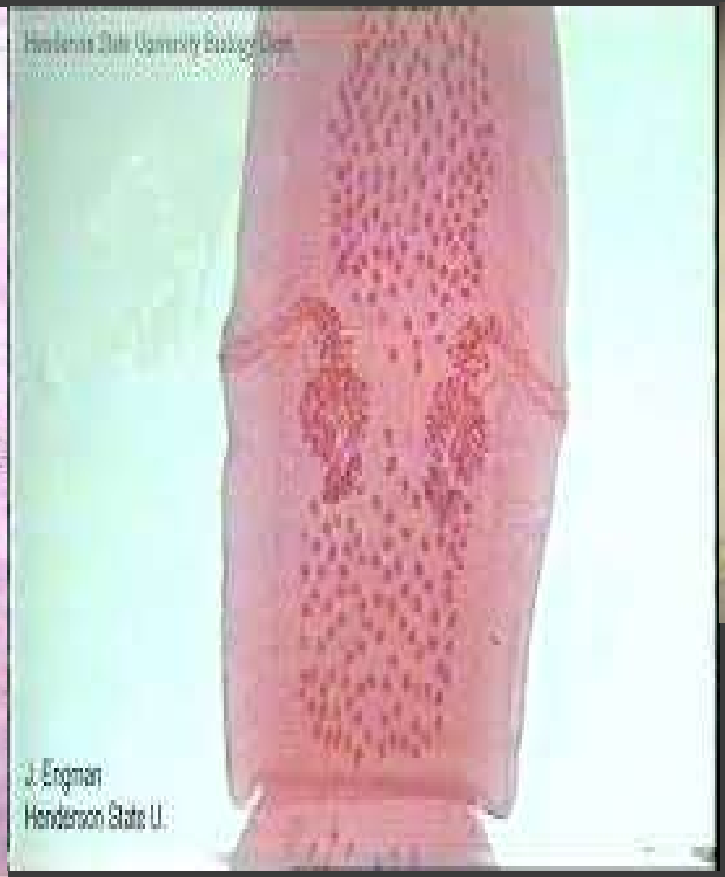
Dipylidium caninum

Common name/location : double pored dog tapeworm or cucumber tapeworm, small intestine of dogs and cats , rarely humans (children).
Length : 10-40 mm.
Proglottids no. 60-175.
Infective stage: cysticercoid
Intermediate host: fleas of dogs and cats, dog's lice.
Diagnosis : ova packets or gravid proglottids in stool.

Scolex has rostellum with four rows of hooks.





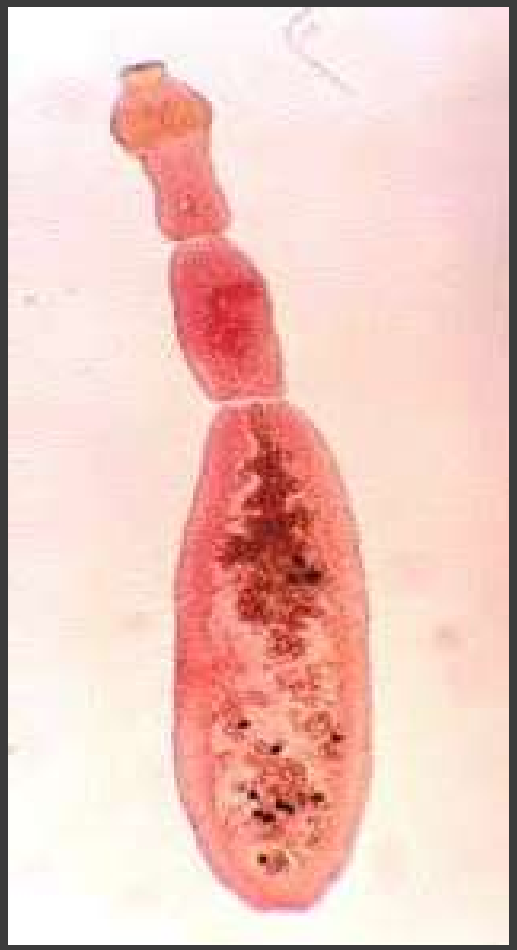


Mature proglottid

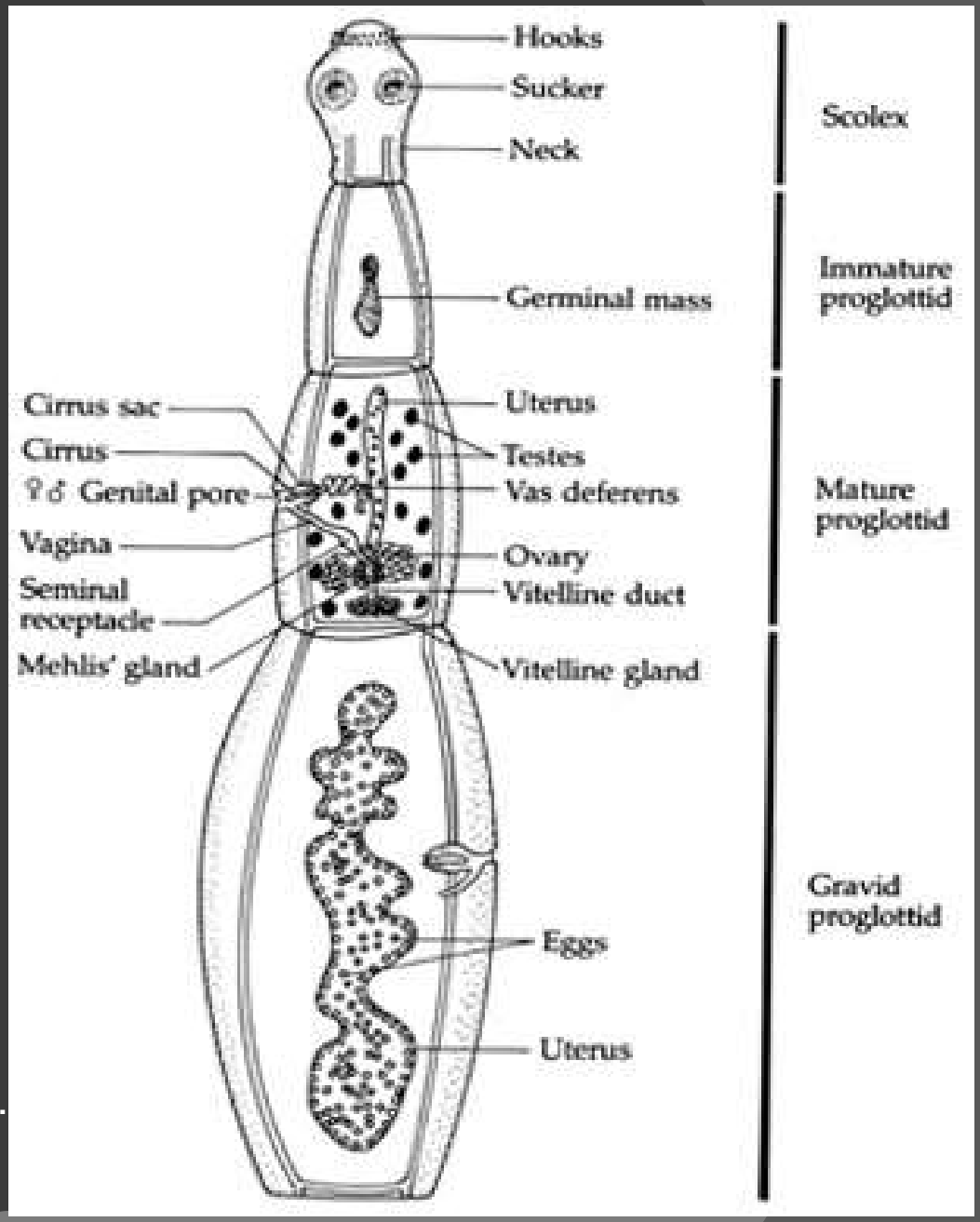
Egg packet/ capsule

Echinococcus granulosus

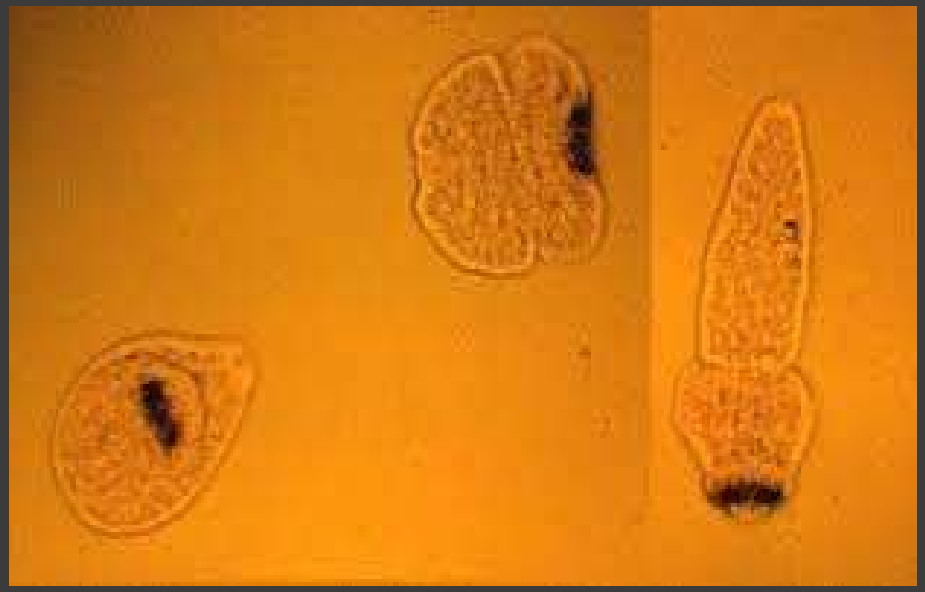
Common name/Location : Hydatid tapeworm /small intestine of carnivorous mammals.
No.of proglottids: 3
Intermediate host : livestock and human.
Final host : carnivorous (dogs , fox etc.)
Infective stage of intermediate host : egg
Infective stage of final host: hydatid cyst
Disease : Hydatidcyst (Echinococcosis)
Diagnosis : X-ray, Ultrasound, MRI or serology.



Echinococcus granulosus w.



Echinococcus granulosus egg

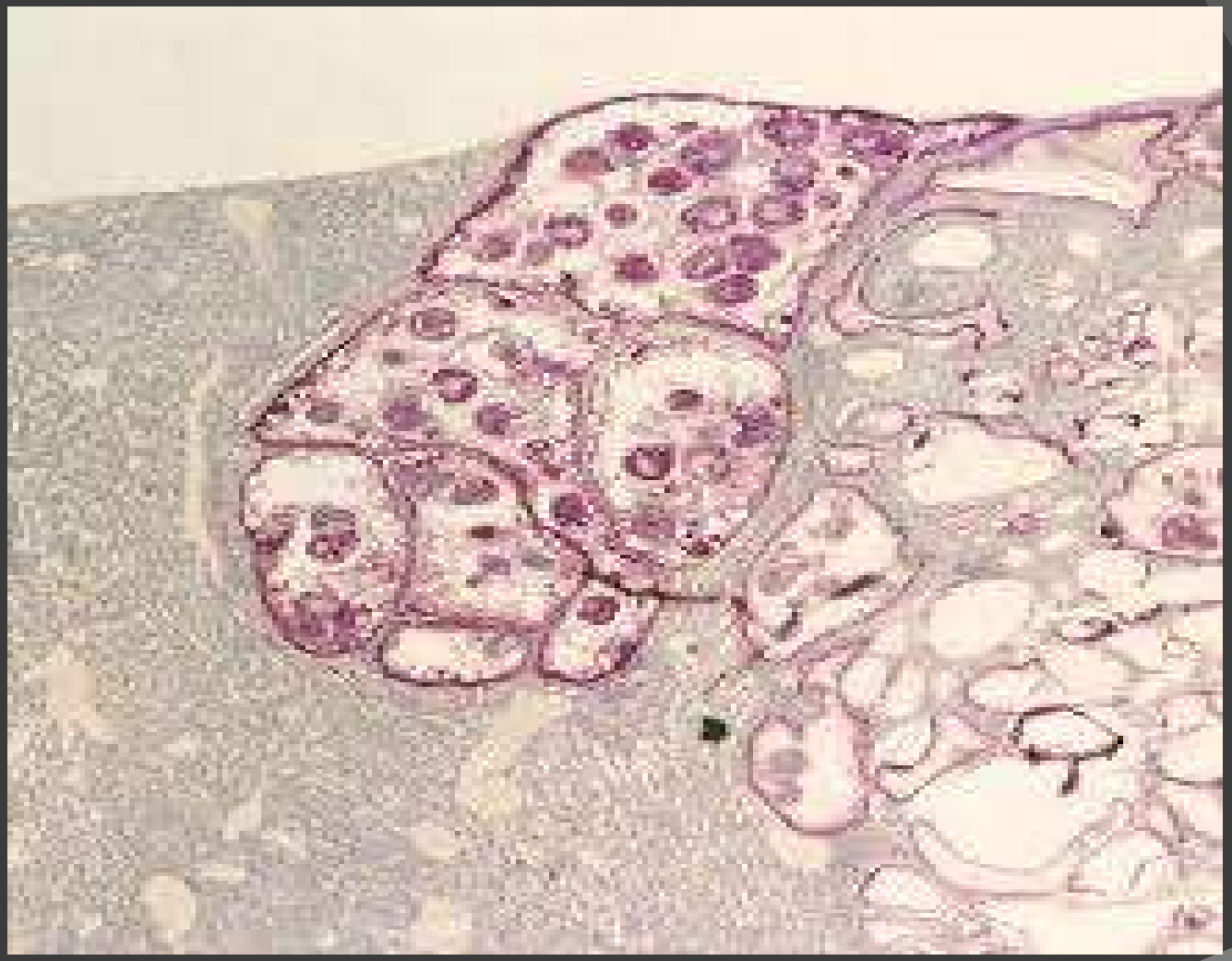


Echinococcus granulosus **hydatidsand/protoscolices**

Echinococcus granulosus c.s in hydatid cyst

Echinococcus multilocularis

Common name/location : Alveolar hydatid tapeworm/small intestine of carnivorous mammals.
Intermediate host : small rodents and rarely human.
Final host : carnivorous (dogs,fox) sometimes dogs and cats.
Infective stage of intermediate host :egg.
Infective stage of final host : hydatid cyst.
Disease : Alveolar echinococcosis.
Diagnosis : X-ray, Ultrasound, MRI or serology.



C.S in alveolar cyst showing Echinococcus multiloculais

Lab7

HELMINTHOLOGY

Nematoda (subclass : phasmidia)

General characteristic :-

Hook worms include some of worms known as Ancylostomac distributed in most of the world.

- Adults lives in intestine and feed on blood and body fluids.
- Hook worms have developed Buccal capsule have either teeth or cutting plates.
- it has Copulatory bursa in the posterior end of males.

Hook worms which infect the human are:-

- Ancylostoma duodenale
- Necator americanus

Hook worms which infect animal are :-

- Ancylostoma caninum
- Ancylostoma briziliensis

Ancylostoma duodenale

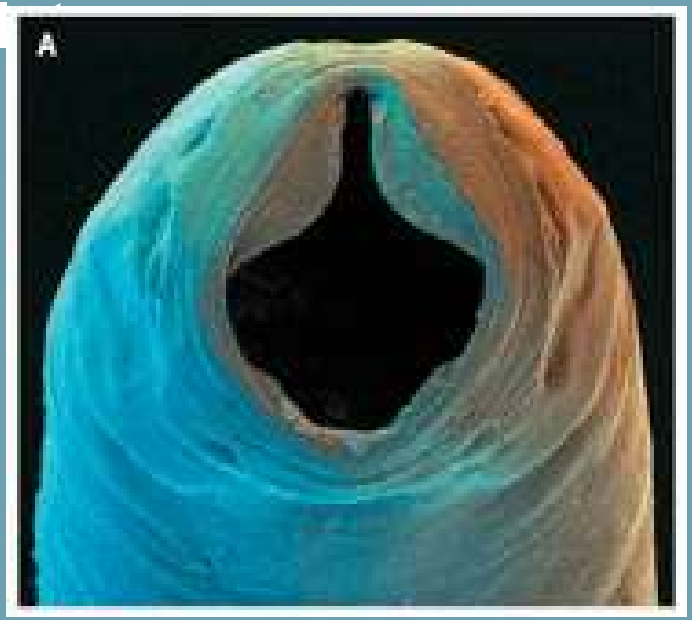
Scientific name: Ancylostoma duodenale
Common name: the Old world hook worm
Location : the worm lives in small intestine of
human
Disease : Ancylostomiasis
Infective stage: Filariform larva
Diagnosis : ova in feces

Necator americanus

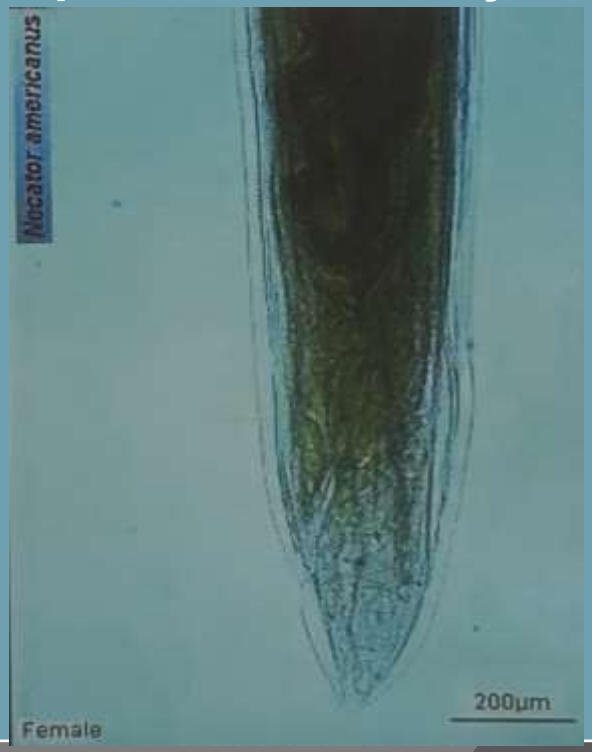
Scientific name : Necator americanus
Common name : the new world hook worm
Location : the worm lives in small intestine of human
Disease: Ancylostomiasis
Infective stage: Filariform larve
Diagnosis : Ova in feces

The difference between Ancylostoma duodenale and Necator americanus are shown in the following points:

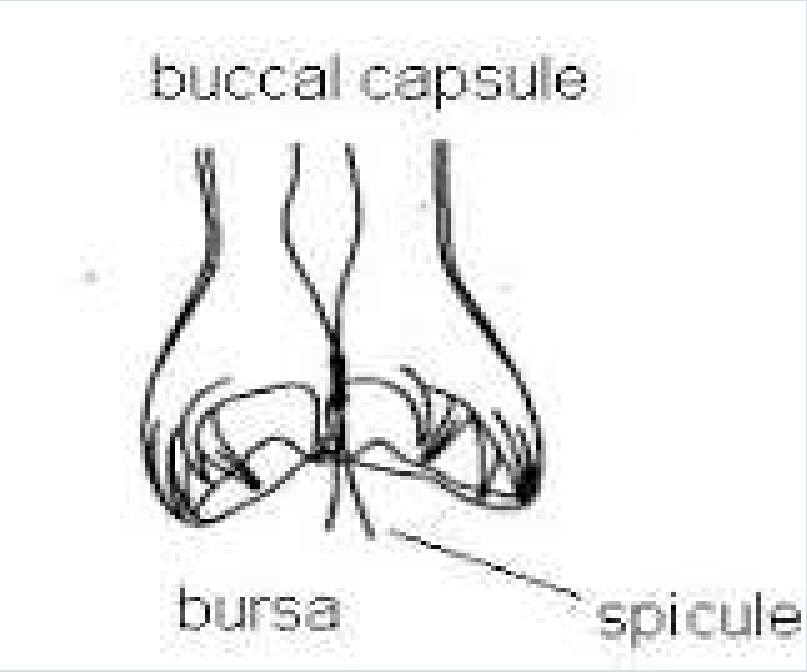
Ancylostoma duodenale	Necator americanus
• Anterior end turned toward dorsal side. • Buccal cavity has two pairs of teeth in the ventral side.	• **Anterior end more turned toward dorsal side.** • **Buccal cavity has one pair of semilunar cutting pl**

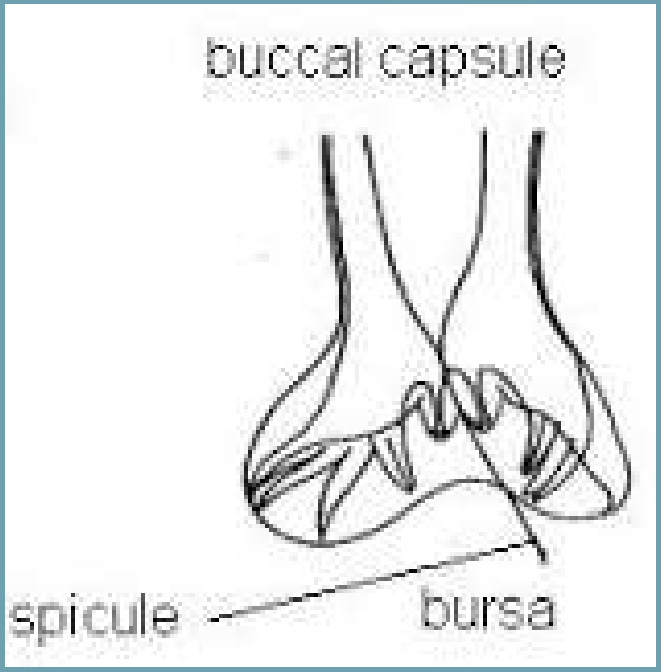


Ancylostoma duodenale	Necator americanus
• The female pore in the second part of the body worm on the ventral surface. • The female put 25.000 eggs. • The female has a posterior end with mucron. • Life span between 6-8 years.	• **The female pore in the first part of the body worm on the ventral surface.** • **The female put 10.000 eggs.** • **The female has a posterior without mucron.** • **Life span between 4-6 years.**



Ancylostoma duodenale	Necator americanus
• Copulatory bursa is short and wide. • The two copulatory spicules don't fused.	• **Copulatory bursa is long and narrow.** • **The two copulatory spicules fused to formed one spicule.**





Copulatory bursa vs Copulatory Spicules

Ancylostoma duodenalae copulatory spicules

Necator americanus copulatory spicules

Scientific name : Ancylostoma caninum

The adults of this worm live in the small intestine of dogs and foxes.

Disease : when the larva of this worm infected human cause a medical case called creeping eruption.