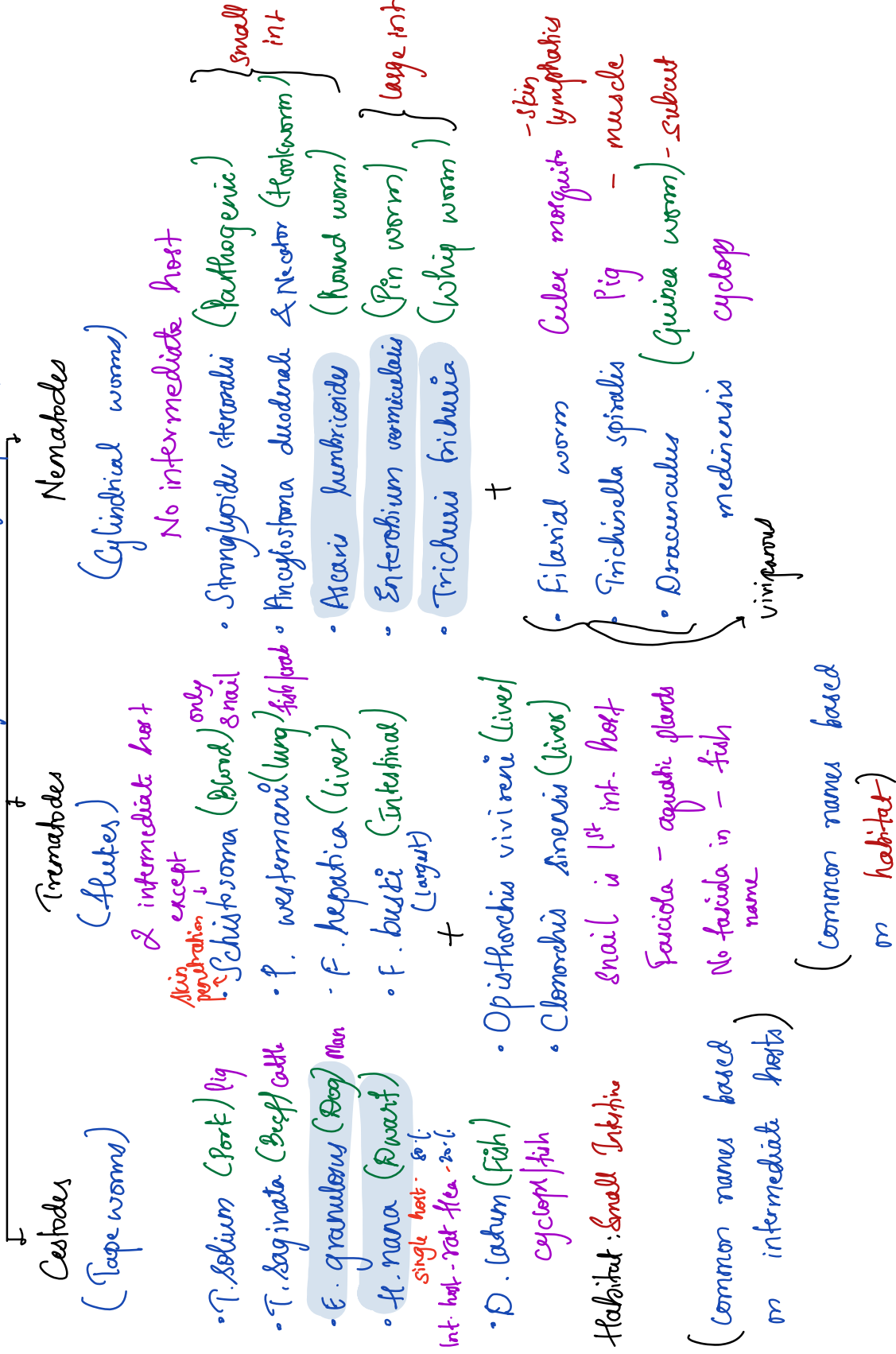


HELMINTHS

Eggs → Larvae

ingestion / skin penetration



* Most helminths 2 hosts $\begin{cases} \text{Intermediate host} \\ \text{Definitive host} \end{cases} \rightarrow \text{sexual cycle takes place}$

Among helminths $\rightarrow$ man is definitive host
except $\rightarrow$ Echinococcus granulosus

man - intermediate host
dog - definitive host

* If 2 intermediate hosts $\oplus \rightarrow$ 2nd intermediate host is infective to man

* Infective form is larvae except 5 in which egg is infective form

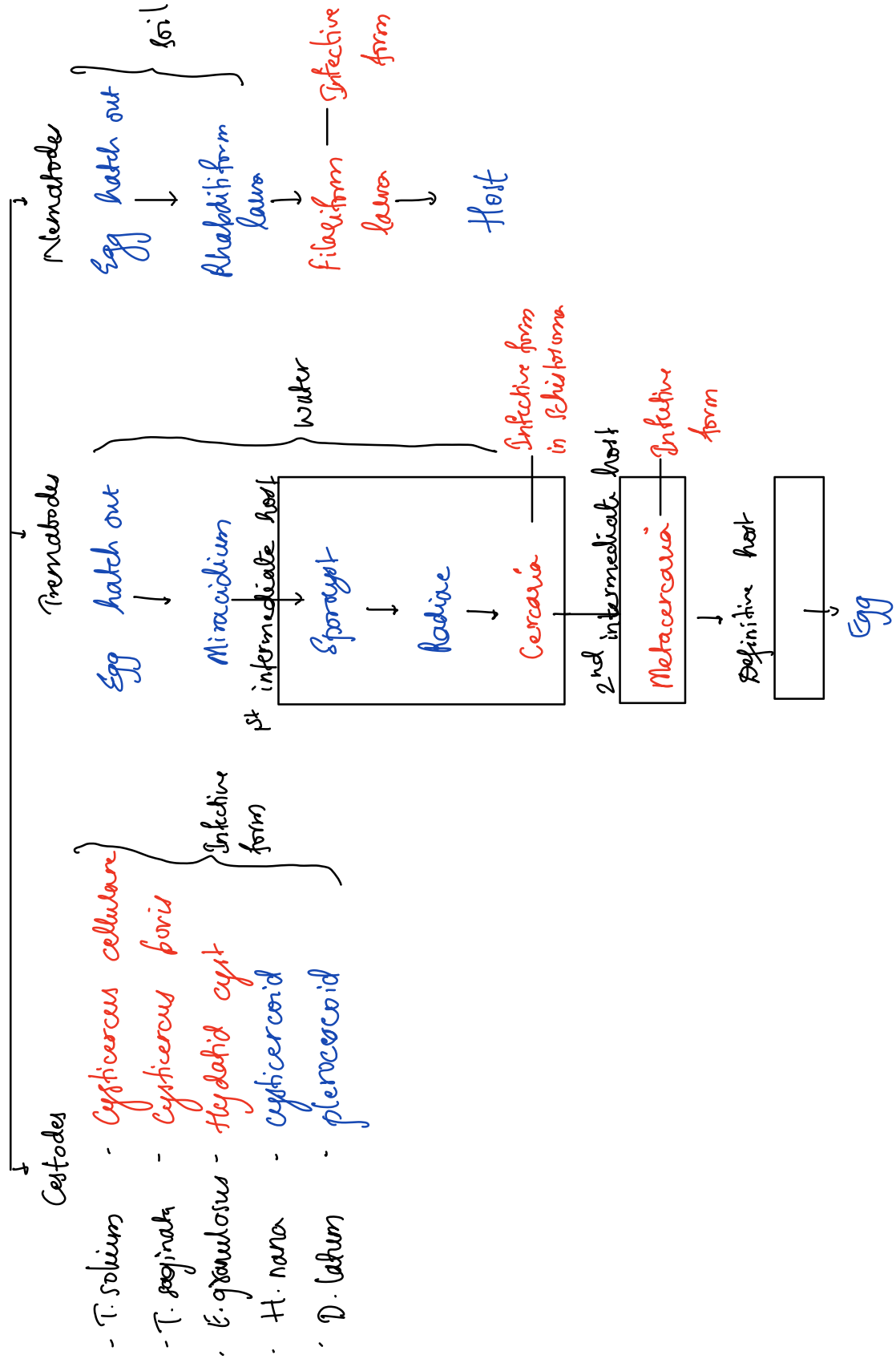
- D - Dog worm
- Dwarf worm
- A - Ascaris
- T - Tricuris
- E - Enterobium

* Egg -



has opening - operculated egg
helminths $\hat{=}$ 2 intermediate hosts

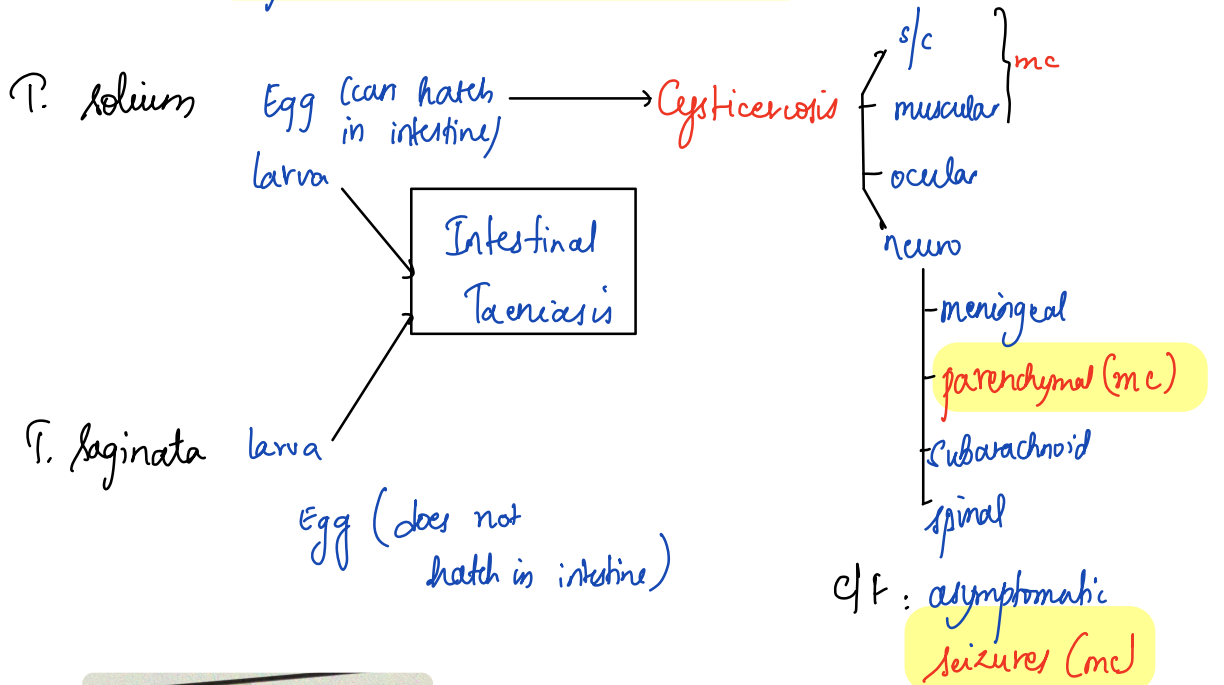
LARVAL FORMS



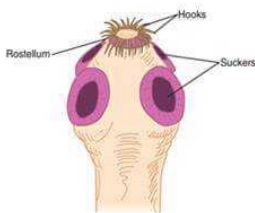
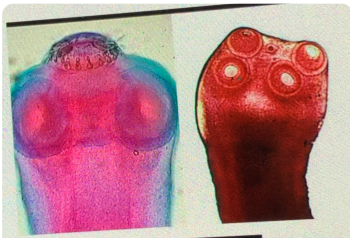
Cestodes

autoinfection $\left\{ \begin{array}{l} - T. solium \\ - H. nana \end{array} \right.$

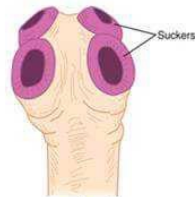
megaloblastic anemia - *D. latum*



Rx: Albendazole + corticosteroids
($\because$ when they die there is inflammation)

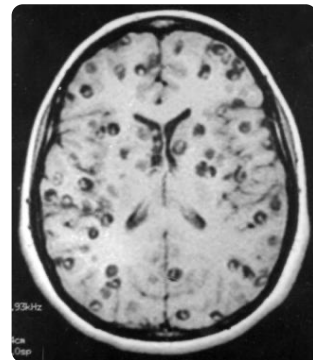


Taenia solium scolex



Taenia saginata scolex

Neurocysticercosis
Black cyst = white scolex



Echinococcus granulosus (Dog - definitive host)

Infective form : Egg

↳ human - intestine → larva → Blood → Liver

Hydatid cyst
(can get calcified)

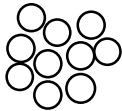
Site: Liver
(mc)

> lung > brain
↓

least chance
of calcification

Types: Unilocular  → E. granulosus

Multilocular  → E. multilocularis

Polycystic  → S. vogeli

Dx : Canon's skin test : Type I hypersensitivity
Water lily sign

Rx: PAIR - Percutaneous Aspiration Injection & Reaspiration
↓

Sx: Exploratory laparotomy

H. nana

Intermediate host: Rat flea (in 20% cases)

Habitat : Small Intestine

Int. form : Egg non operculated

causes : autoinfection

Rx : Praziquintel

D. latum

Intermediate host: cyclops & fish

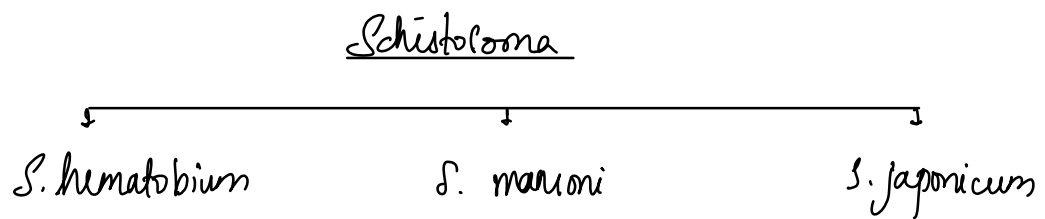
Habitat : small intestine

Int. form : larva

Egg : operculated egg

causes : megaloblastic anemia (vit B₁₂ def)

<u>Trematodes</u>	
<u>Schistosoma</u>	<u>Other trematodes</u>
- 1 intermediate host - non operculated egg - cercaria - skin penetration	2 intermediate host - operculated egg - metacercaria - Ingestion



Habitat: Bladder plexus Inf. mesenteric vein Sup. mesenteric vein

Egg:  terminal spine  lateral spine  lateral knob

c/f: Urinary schistomiasis Katayama fever > Katayama fever
 Bilharziasis (more common)

- painless terminal hematuria
 - Bladder Ca

Note: O. viverrini C. sinensis	}	→ - HCC - cholangio Ca - pancreatic Ca
-----------------------------------	---	--

Nematodes

Strongyloides stercoralis

(pathogenic)

lay egg without fertilization

Oroviviparous

Egg laying → larva → stool
(egg hatches immediately)

unfertilized egg can
develop into embryo &
adult worm

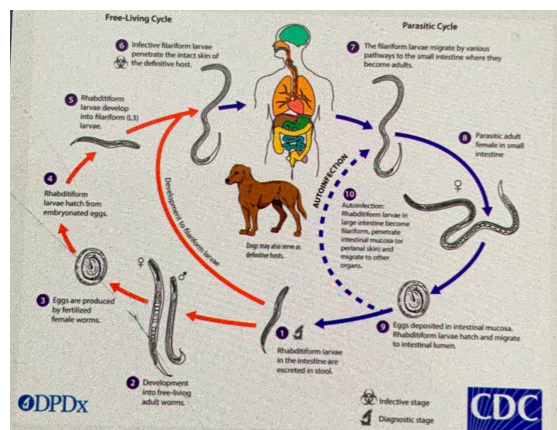
In ovoparous stool examination - egg seen

In oroviviparous stool examination - egg not seen
only larva seen

1) larva → skin penetration → Cutaneous → Loeffler's pulmonary
larva migrans eosinophilia

2) can cause autoinfection
(internal re-infection)

Rx: Ivermectin



hookworms

- *Ancylostoma duodenale* - 0.2 ml/day - old world
- *Necator americanus* - 0.03 ml/day - new world

Iron deficiency anemia

Infective from → larva → skin penetration → Cutaneous larva migrans → Loeffler's pulmonary eosinophilia

Chandler's index - counting eggs / gram of stool

(public health)

< 200 - non significant

> 200 - significant

> 300 - severe public health problem

Ascaris lumbricoides

Egg → ingestion → visceral larva → Loeffler's pulmonary
migrans eosinophilia

mechanical obstruction ———> Intestinal
Respiratory tract
biliary tract

Enterobium vermicularis (Pin worm)

- Habitat - large intestine
- Egg - infective form
- Autoinfection

APPENDICITIS

come out of anal canal & lay egg in perianal area
⇒ perianal pruritis

Di: NIH swab from perianal area
(Cellophane acetate swab)

Trichuris trichiura

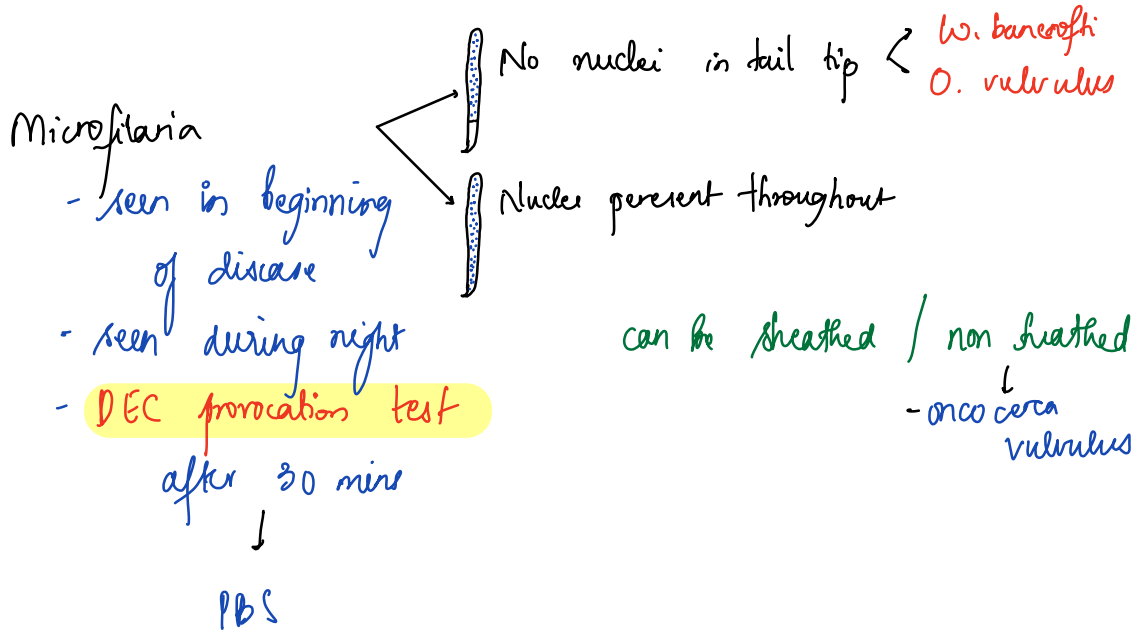
- Habitat - large intestine
 - (barrel shaped) Egg - infective form
 - causes chronic dysentery
- Rx: Mebendazole / Albendazole

RECTAL PROLAPSE

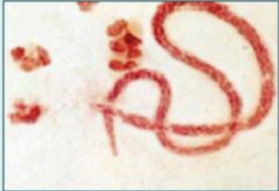
→ Iron deficiency
anemia

Filarial worms

larval forms < *microfilaria*
filariiform larva



No nuclei in tail tip	Nuclei in entire body	Diseases
<i>W. bancrofti</i>	<i>Brugia malayi</i>	lymphatic filariasis
<i>Oncoerca</i> (also causes river blindness) <i>vulvulus</i> Rx: Ivermectin (only non sheathed)	Loa loa 1c nodule called Calabar swelling	subcutaneous filariasis

Parasite	Microfilaria morphology
 Wuchereria bancrofti	• Sheathed with tail tip free of nuclei • Nocturnal periodicity
 Brugia malayi	• Sheathed with 2 nuclei at the tail tip • Nocturnal periodicity
 Loa loa	• Sheathed with multiple nuclei at the tail tip • Diurnal periodicity
 Onchocerca volvulus and Mansonella ozzardi	• Unsheathed with tail tip free of nuclei • Non-periodic
 Mansonella perstans and Mansonella streptocerca	• Unsheathed with nuclei up to the tail tip • Non-periodic

* Occult/filaria : microfilaria destroyed ($\therefore$ not released
hidden in viscera in blood)

also

MAYER'S KUWINAR'S SYNDROME

* Tropical pulmonary eosinophilia
(type of occult
filaria) - microfilaria destroyed
in lung

WEINGARTAN SYNDROME

Note: Transmission assessment survey done for filaria
to determine when infection have been
reduced below target threshold &
Map Drug Administration can be stopped

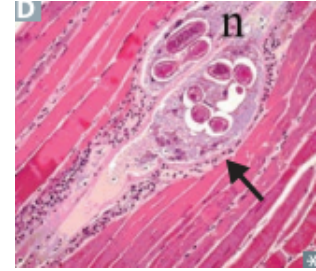
MAZZOTTI REACTION - DEC treatment causes intense
reaction

Rx: Ivermectin

Note: most sensitive test for microfilariae - membrane filter
concentration technique

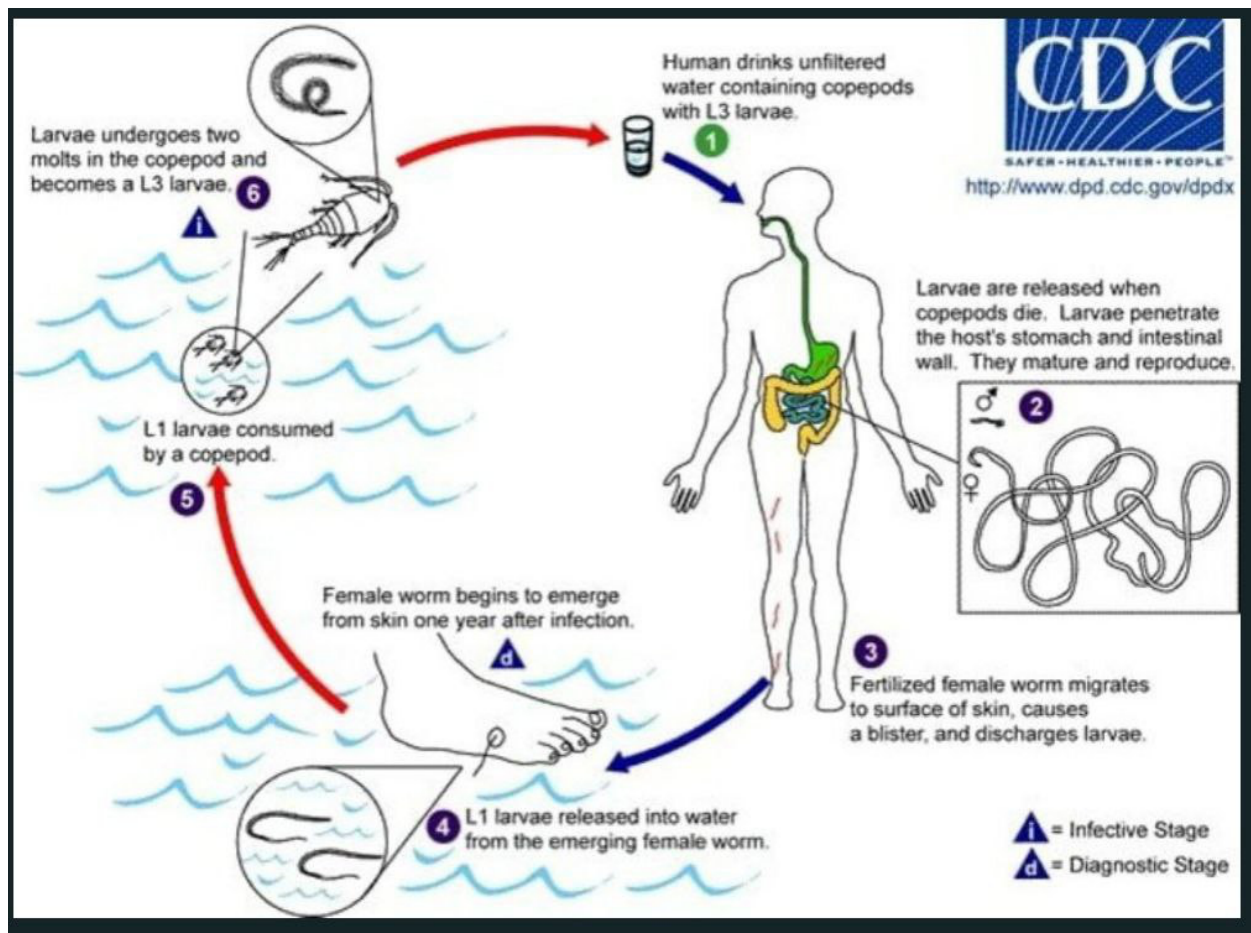
Trichinella spiralis

- pig
- muscle
- mc inv - ocular muscles
- can also inv cardiac - myocarditis



Dracunculus medinensis

cyclops
s/c tissue



Note:

1) <u>Intermediate host</u>	C	T	N
* No of intermediate hosts	1	2	0
* No of hosts	2	3	1

- * Fish act as intermediate host -
D. latum
P. westermani
O. viverrini
C. sinensis.

- * Cyclops act as intermediate host -
D. latum
D. medinensis

- * Crab act as intermediate host - **P. westermani** (oriental lung fluke)

2) Habitat

- * large intestine as habitat -
Enterobius vermicularis
Trichuris trichiura

- * liver flukes - Fasciola hepatica
 { Opisthorchis viverrini
 { Clonorchis sinensis (Chinese liver fluke)
 ↓
 can cause fcc

3) Infective form:

Egg {
 D - Dog worm
 - Dwarf worm
 A - Ascaris
 T - Tricuris
 E - Enterobium

Remaining - larva.

4) Operculated Egg
(c 2 int hosts)

- 1) D. latum
- 2) P. westermani
- 3) F. hepatica
- 4) F. buski
- 5) O. viverrini
- 6) C. sinensis

Viviparous

- Filaria
- Trichinella
- Dracunculus

5) Autoinfection

- T. solium
- H. nana
- Strongyloides
- Enterobium vermicularis

6) Anemia causing helminths

Megaloblastic anemia: *D. latum*

IDA : 1) *Ancylostoma duodenale*
2) *Necator americanus*
3) *Trichuris trichiura*

• Hemolytic anemia → Leishmania
by protozoa Trypanosoma
Plasmodium
Babesia

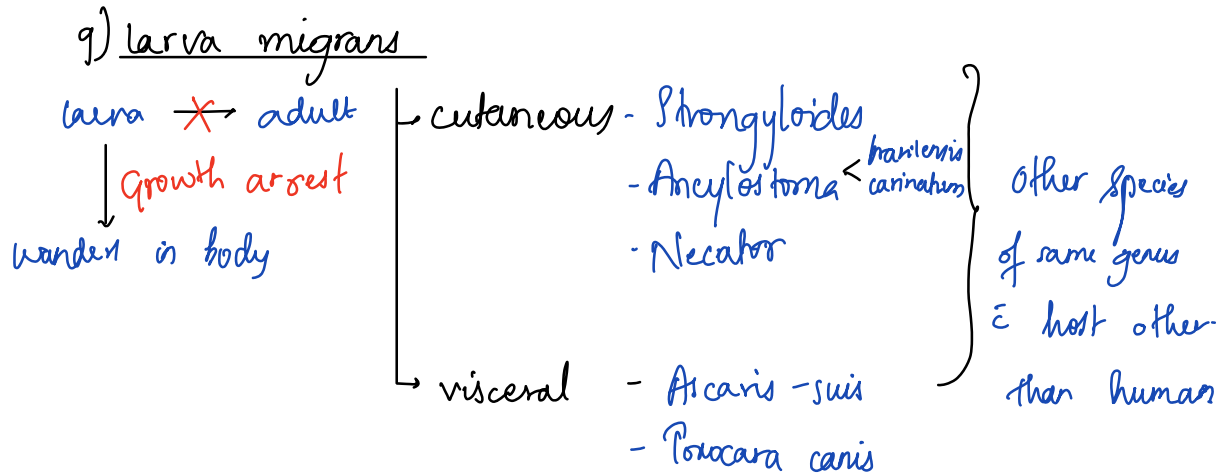
7) Carcinoma - *Schistosoma haematobium* - Bladder Ca
O. viverrini } → - HCC
C. sinensis } - cholangio Ca
- pancreatic Ca

8) Skin penetration : - *Schistosoma*
- *Strongyloides stercoralis*
- *Ancylostoma duodenale*
- *Necator americanus*

Ingested—*Enterobius*, *Ascaris*, *Toxocara*,
Trichinella, *Trichuris*

Cutaneous—*Strongyloides*, *Ancylostoma*,
Necator

Bites—*Loa loa*, *Onchocerca volvulus*,
Wuchereria bancrofti



usually occur in nematodes which infect animals
 if they accidentally infect human → larva migrans

Usually human species develop into adult & complete cycle.

* the helminth causing visceral larva migrans - *Toxocara canis*

Risk factor : *kernel worker*

cutaneous larva migrans are due to - *Ancylostoma brasilense*

10) loeffler's pulmonary eosinophilia - Strongyloides
 Ancylostoma
 Necator
 Ascaris

11) Non bile stained eggs

N	- Necator americanus
E	- Enterobius vermicularis
H	- Hymenolepis Nana
A	- Ancylostoma duodenale

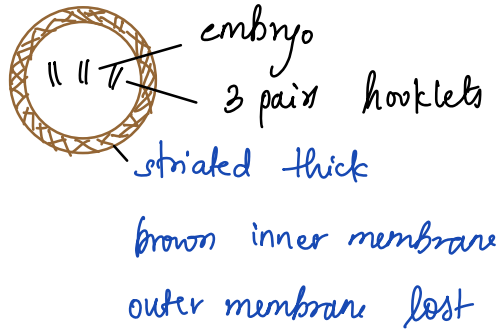
12) Eggs which float in saturated salt solution

Non bile stained	N	- Necator americanus
	E	- Enterobius vermicularis
	H	- Hymenolepis Nana
	A	- Ancylostoma duodenale
bile stained	A	- Ascaris lumbricoides * fertilized egg
	T	- Trichuris trichiura

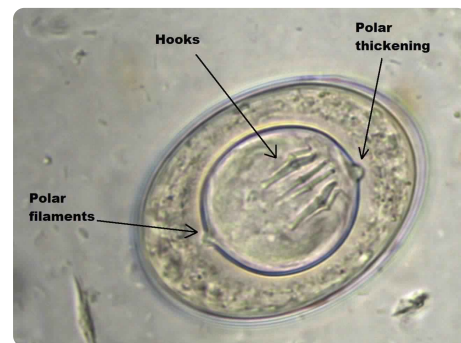
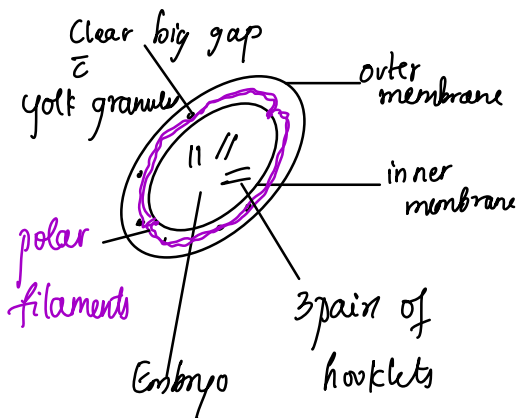
(Unfertilized egg - heavier)

Cestodes

1) *T. solium* / *T. saginata* / *E. granulosus*



2) *H. Nana*



3) *D. latum*



Trematodes

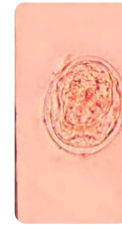
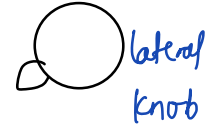
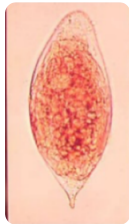
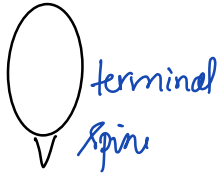
1)

Schistosoma

S. hematobium

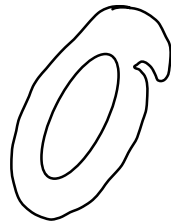
S. mansoni

S. japonicum



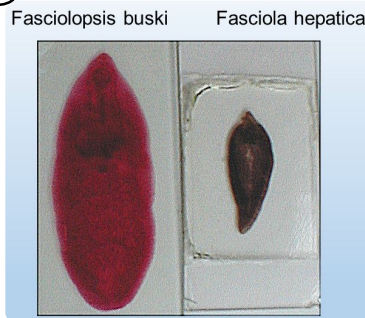
round shape

All other trematodes



operculated egg

2) *Fasciola hepatica*



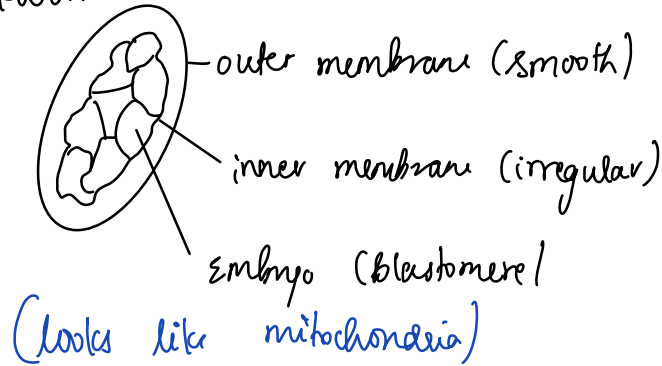
Fasciola buski

No protrusion



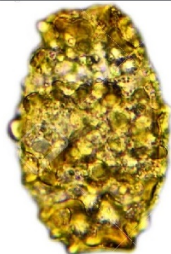
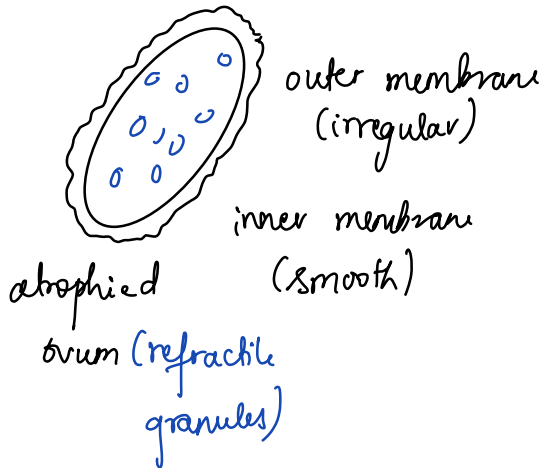
Nematodes

Hookworm



Ascaris

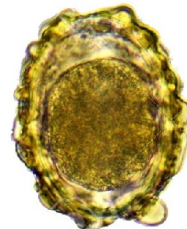
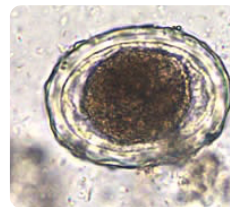
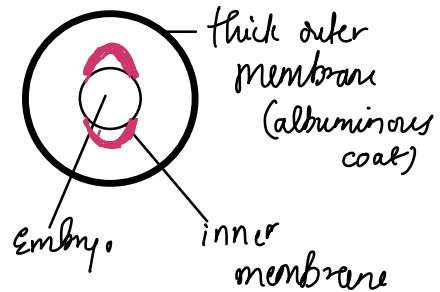
unfertilized



UNFERTILIZED

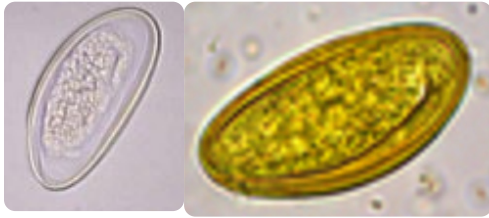
fertilized

semilunar chitin sheath (glistening)
at pole of embryo

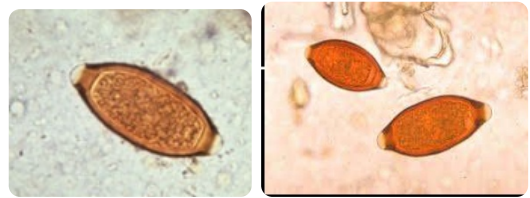
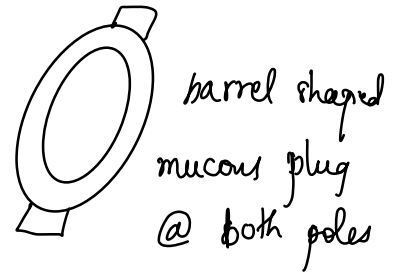


FERTILIZED

Enterobium vermicularis



Trichuris trichura

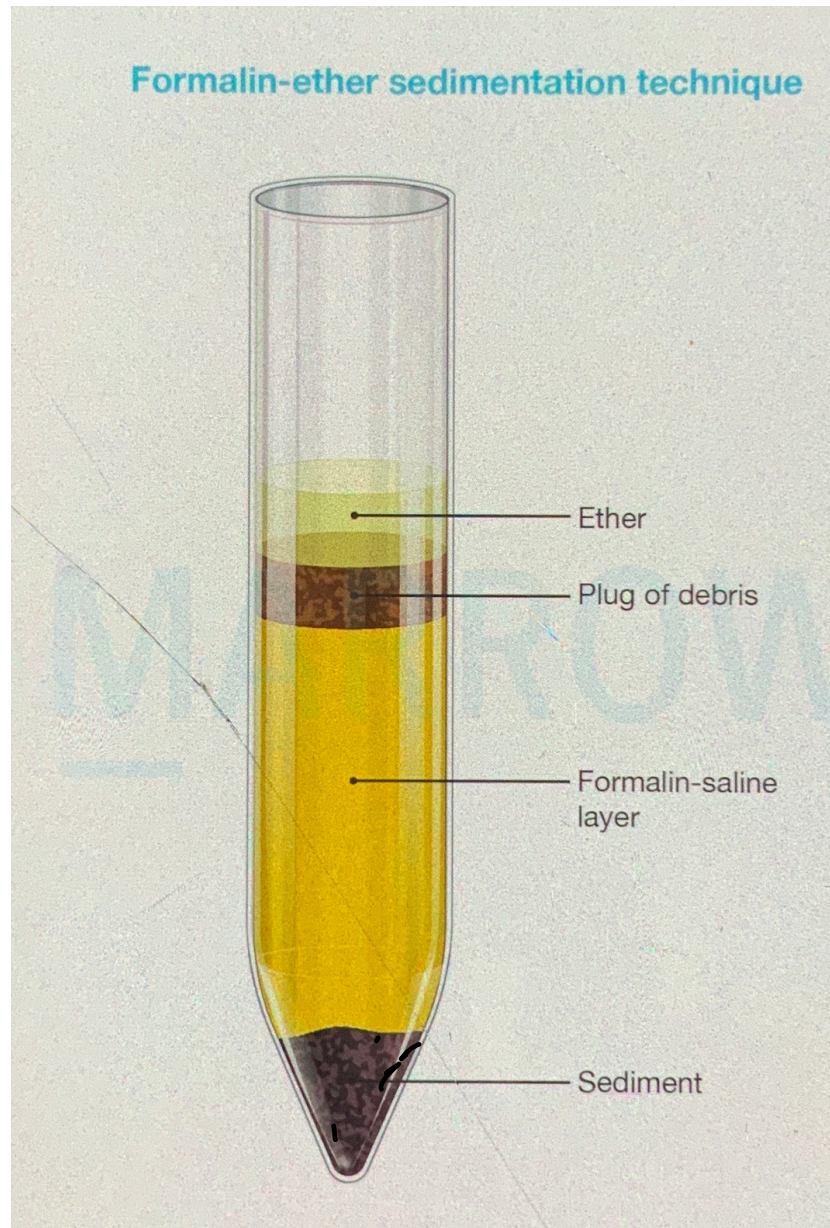


Strongyloides

oval egg = shabditiform
larva



Note: Formal ether sedimentation test
concentrate ova in the bottom part of tube
used when scanty ova



Myocarditis

- *T. brucei rhodiense*
- *T. cruzi*
- *T. gondii*
- *E. granulosus*
- *Trichinella spiralis*