

Introduction to Helminthology

The term helminths means...

- Worm
 - Multicellular
 - Bilaterally symmetrical
 - Three germ layers
 - The kingdom – Metazoa
 - Nematelminths
 - Nematode
 - Platyhelminths
 - Cestode
 - Trematode



General features of helminths

■ Platyhelminth

- Bodies- flattened dorsoventrally, leaf like or tape like
- Segmented or unsegmented
- Hermaphrodite – monoecious
- Alimentary canal – incomplete or lacking
- Body cavity - absent

■ Nematelminths

- Elongated & cylindrical
- Unsegmented
- Diecious –sexes separate
- Alimentary canal complete with anus
- Body cavity present

	Cestode	Trematode	Nematode
Shape	Tape like segmented	Leaf like unsegmented	Cylindrical elongated
Head	Suckers +nt Hook +nt	Suckers + Hooks -nt	Suckers -nt Hooks - nt Buccal capsule
Sex	Not separate		Separate
Alimentary canal	Absent	+nt but incomplete	+nt & complete
Body cavity	Absent	Absent	Present

General features of Cestode

■ Shape-

- Dorso-ventrally flattened, segmented, tape like

■ Size

- Few mm to several meters
- *H.nana* – 3 to 4 cm- smallest
- *D.latum* – 15 meter- largest

■ Habitat

- Adult worm – intestinal canal of man

■ Body structure

- Head or scolex
- Neck
- Strobila or trunk or body



Body structure

■ Scolex

- Organ of attachment
- Cup like suckers - Cyclophyllidean
- sucker like grooves- Pseudophyllidean

■ Neck

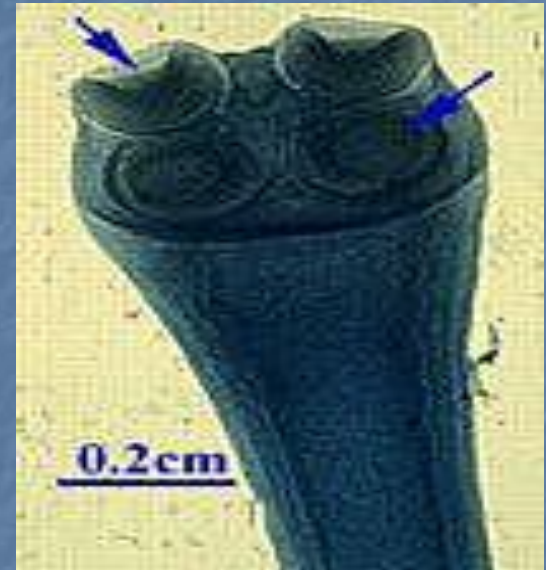
- Immediately below head
- Gives rise to proglottids or segments

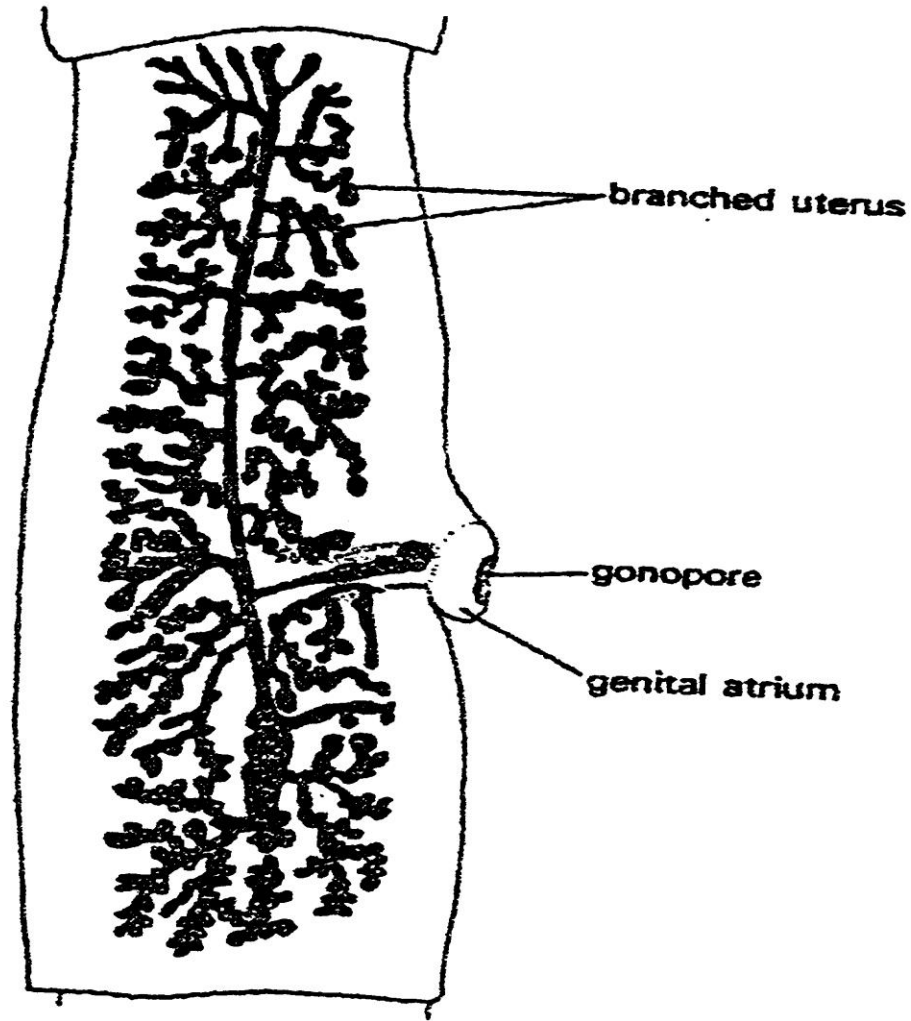
■ Strobila

- Composed of variable number of proglottids
- Echinococcus -3 to 4 & D.latum – 4000
- According to maturity
 - Immature , mature & gravid



Head



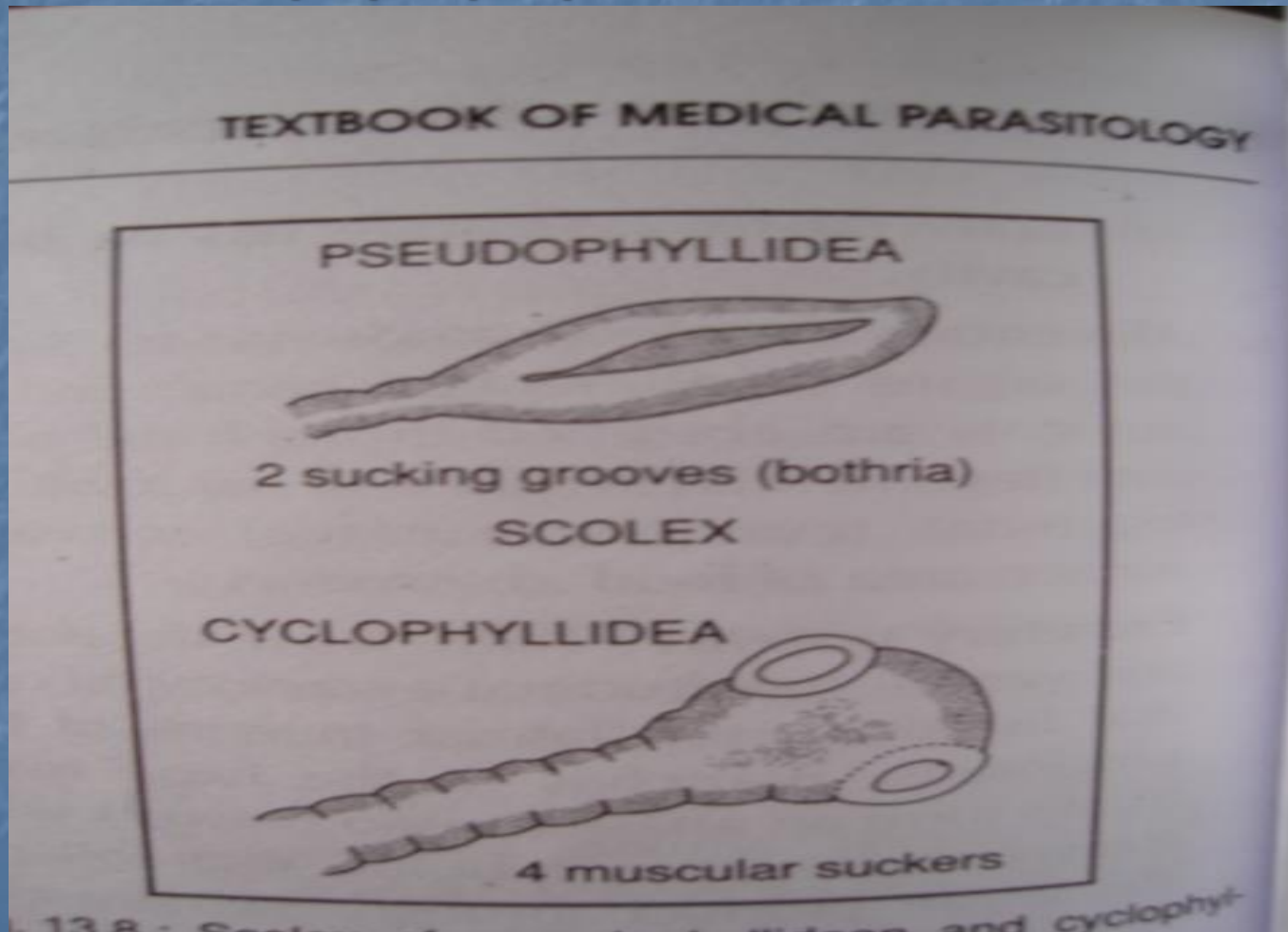


Gravid proglottid of *Taenia* sp.

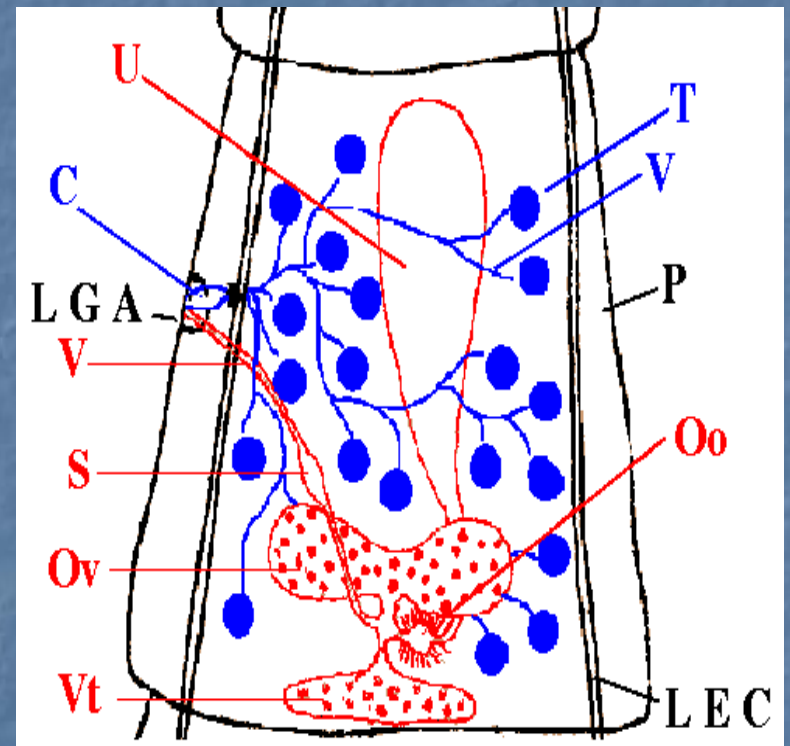
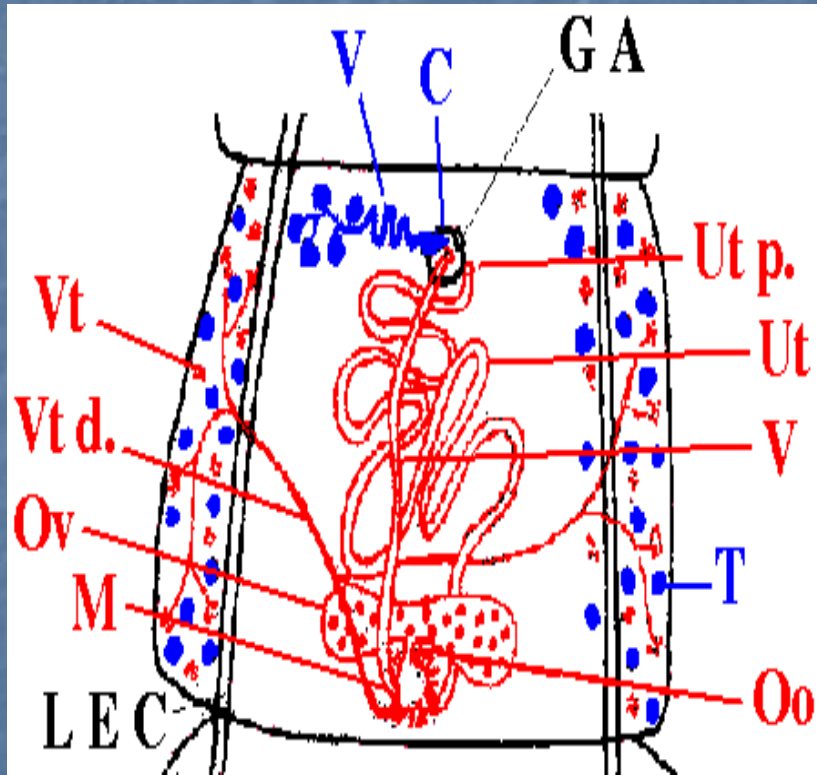
Proglottid or segment of Cestode

- **Body wall**
 - Outer elastic layer - Cuticle
 - Middle muscular layer
 - Inner layer – radially arranged tegumental cell
- **Excretory system**
 - Developed – dorsal & ventral longitudinal excretory tubule
 - Flame cells & transverse excretory tubule
- **Reproductive system**
 - Male – testes, vasa efferentia, vas deferens, seminal vesicle & cirrus
 - Female – ovary, oviduct, ootype, seminal receptacle, uterus & vagina

Difference In Head of Pseudo & Cyclophyllidean cestode



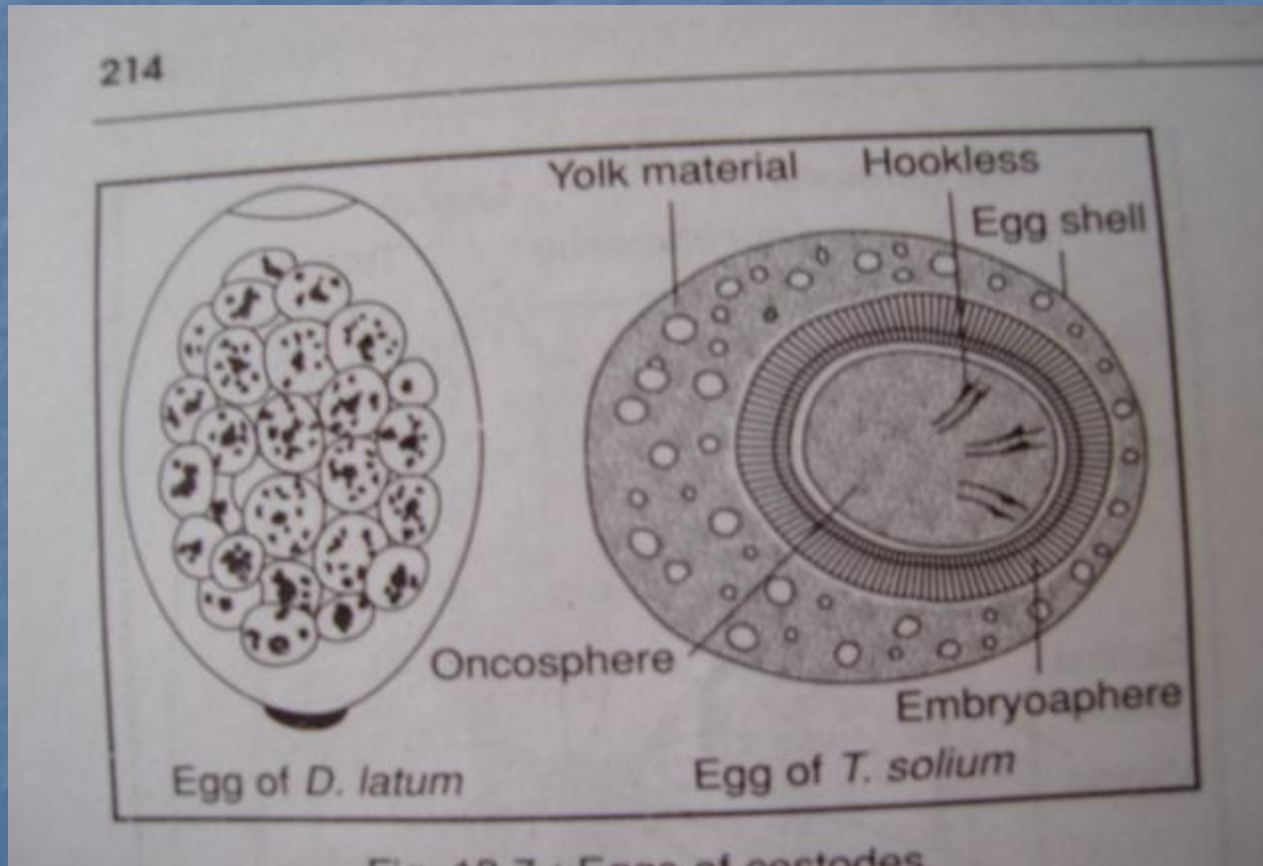
Difference in segment of Pseudophyllidean & Cyclophyllidean



Difference In Eggs of Pseudo & Cyclophyllidean cestode



Difference In Eggs of Pseudo & Cyclophyllidean cestode



Pseudophyllidean cestode

- Diphylobothrium latum – example
- Scolex having two bothria-slit like grooves
- The term
 - Di = two
 - Phylo = groove
 - Bothria = mouth

Diphyllobothrium latum

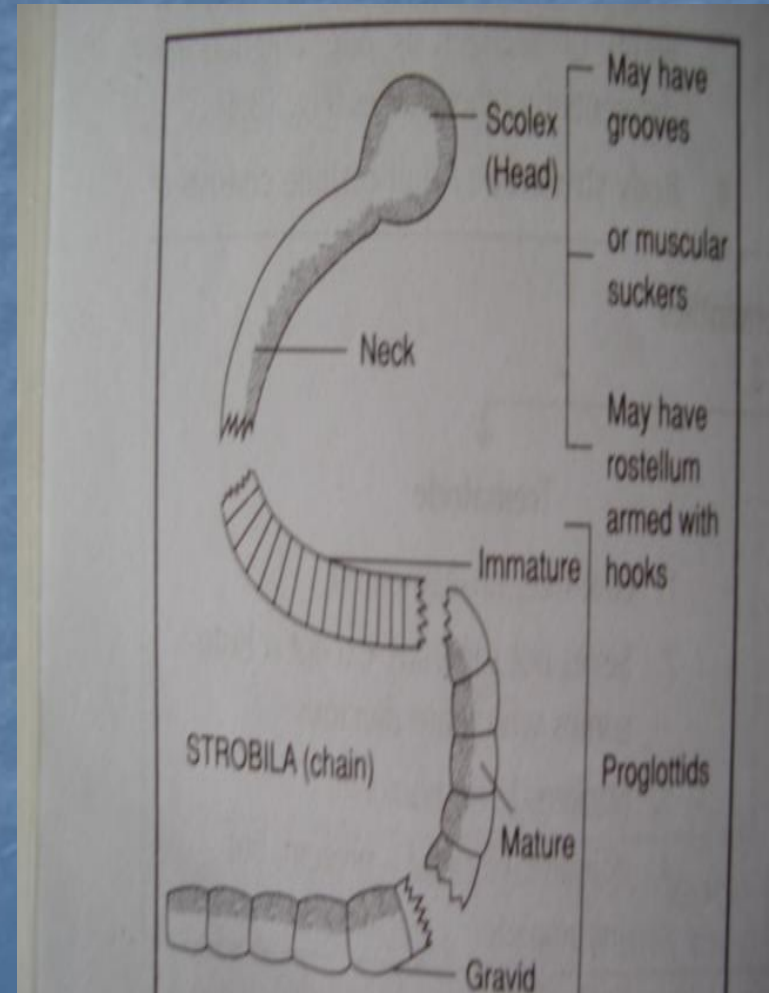
D. latum

■ Habitat

- Adult worm – small intestine of man with scolex embedded in mucosa
- Other animals- cat, dog, Fox

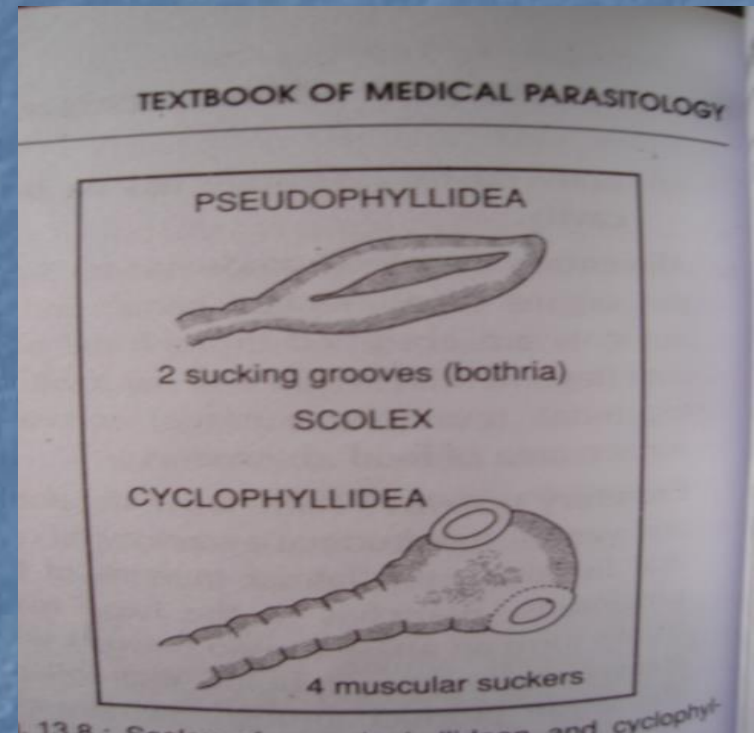
■ Morphology

- Largest of all cestode
- Yellowish gray
- 4-10 meter
- 3000 to 4000 segments



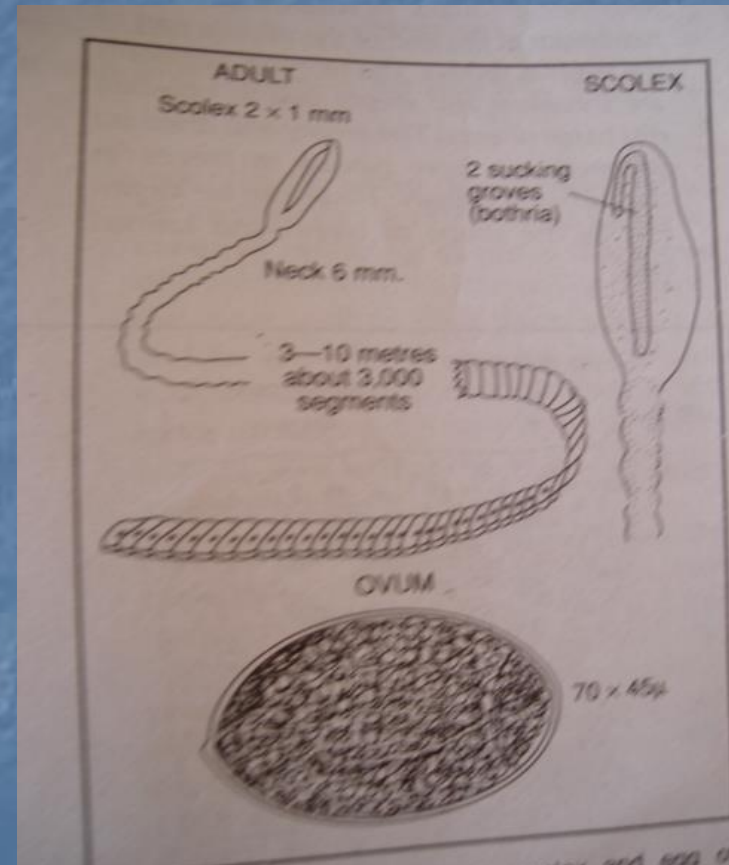
Head

- Elongated & spoon like
- 2-3mm * 1 mm
- Bears 2 slit like grooves
- No rostellum, no hooklets



NECK

- Slender & unsegmented
- Longer than head
- 4-30 mm

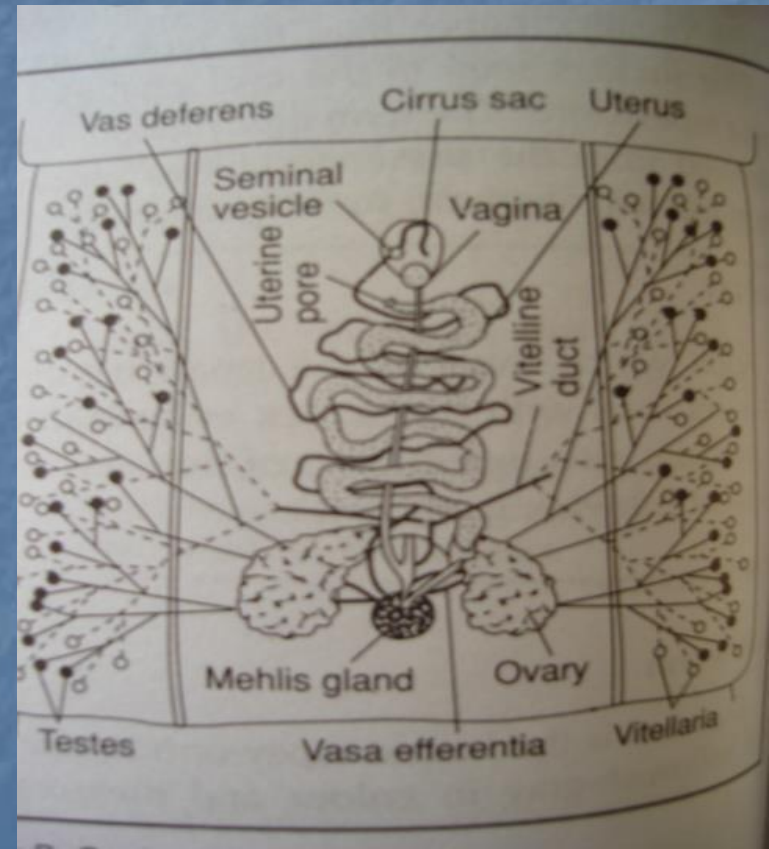


Proglottids

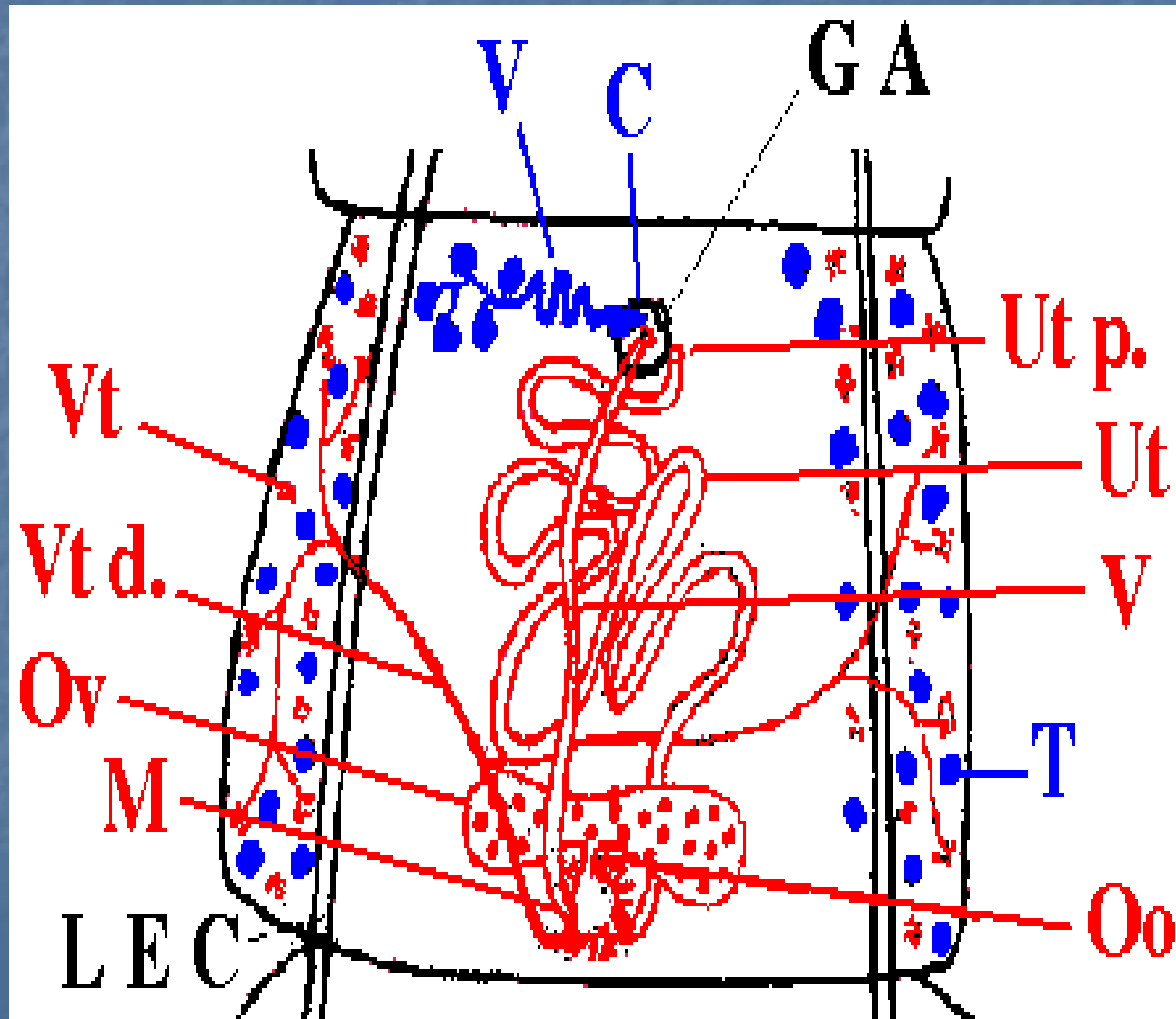
- 3000 – 4000 in number
- Greater in breadth than length = 10-20 mm * 2-4 mm
- Filled with male & female reproductive organs
- Terminal segment are empty & shrunken due to discharge of eggs
- Passed in faeces in chains

Structure of a mature segment

- **Genital pore – on ventral aspect in midline**
 - Opening of vas deferens
 - Opening of vagina
 - Opening of uterus
- **Ovary**
 - bilobed
- **Uterus**
 - coiled structure – like a rosette – in centre
- **Other structures**
 - Testes, ootype, vitellaria & vitelline duct



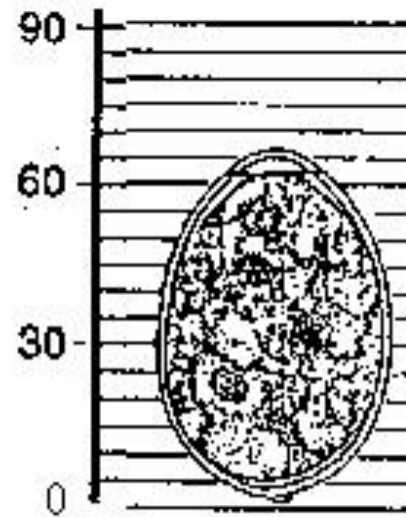
Mature segment of D.latum



Eggs

- Pale yellow, oval to elongated in shape
- $70 \times 45 \mu$ with thick brown shell
- Possess an operculum at one end & knob like thickening at the other
- Contains a mass of yolk sac surrounding an unsegmented ovum
- Does not float in saturated salt solution
- Not infective to man

Eggs of *D. latum*



Diphylobothrium latum

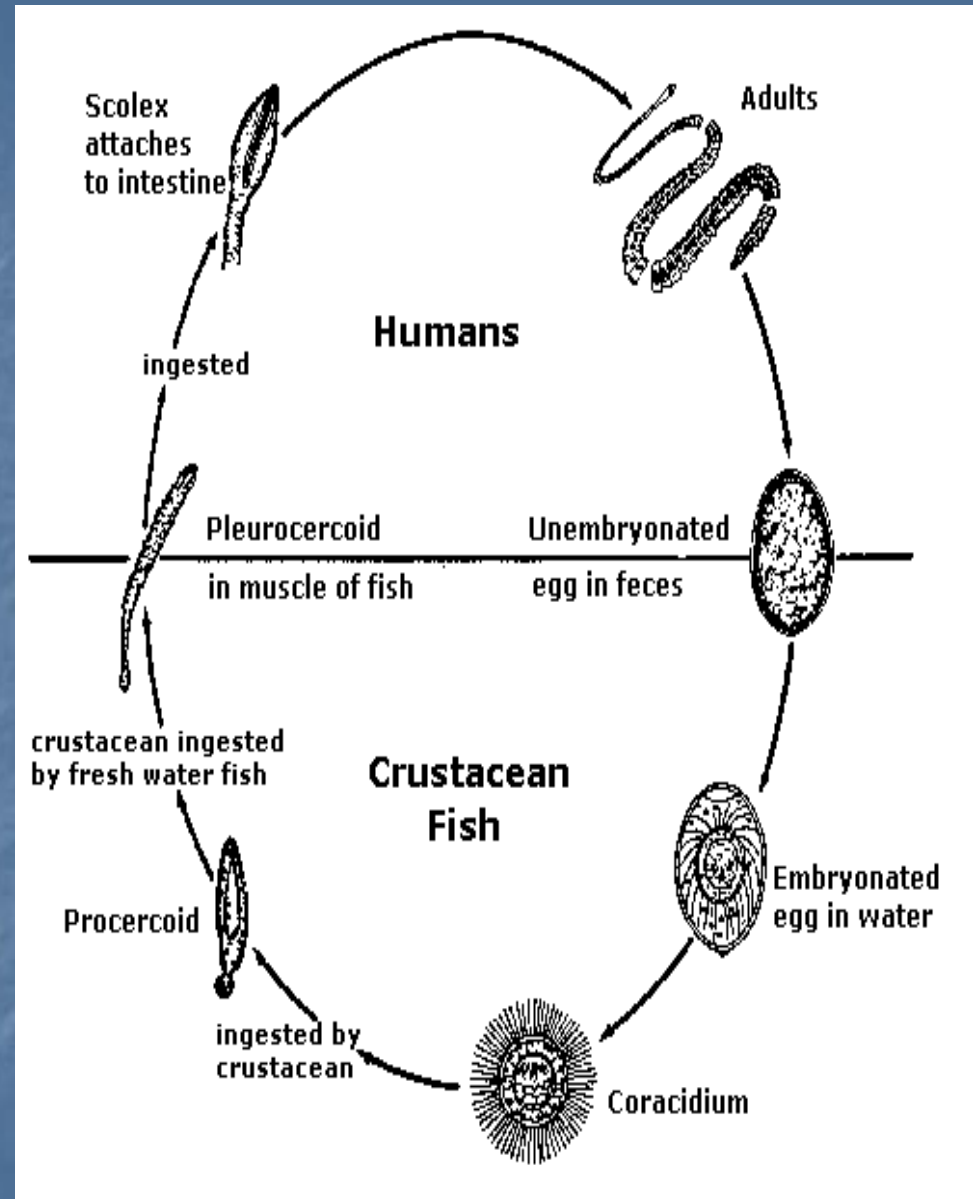
Larval stage

1st stage larvae

- Called as *coracidium*
- Develop from egg in water in 1-2 weeks
- Leaves egg via operculum
- Spherical having diameter of 50 μ
- 2nd stage larvae
 - Coracidium ingested by Cyclops
 - In stomach of Cyclops- outer wall of coracidium lost & larvae penetrate gut wall
 - Develop into *Procercoid larvae* in 2-3 weeks
 - 0.5 mm in length

■ 3rd stage larvae

- Proceroid larvae ingested by fish
- Penetrates intestinal wall & develop into plerocercoid larva in about 4 hours in connective tissue & muscles of fish
- Elongated worm like larvae
- 10-12 mm X 2-3 mm
- In 4 weeks time converted into infective form

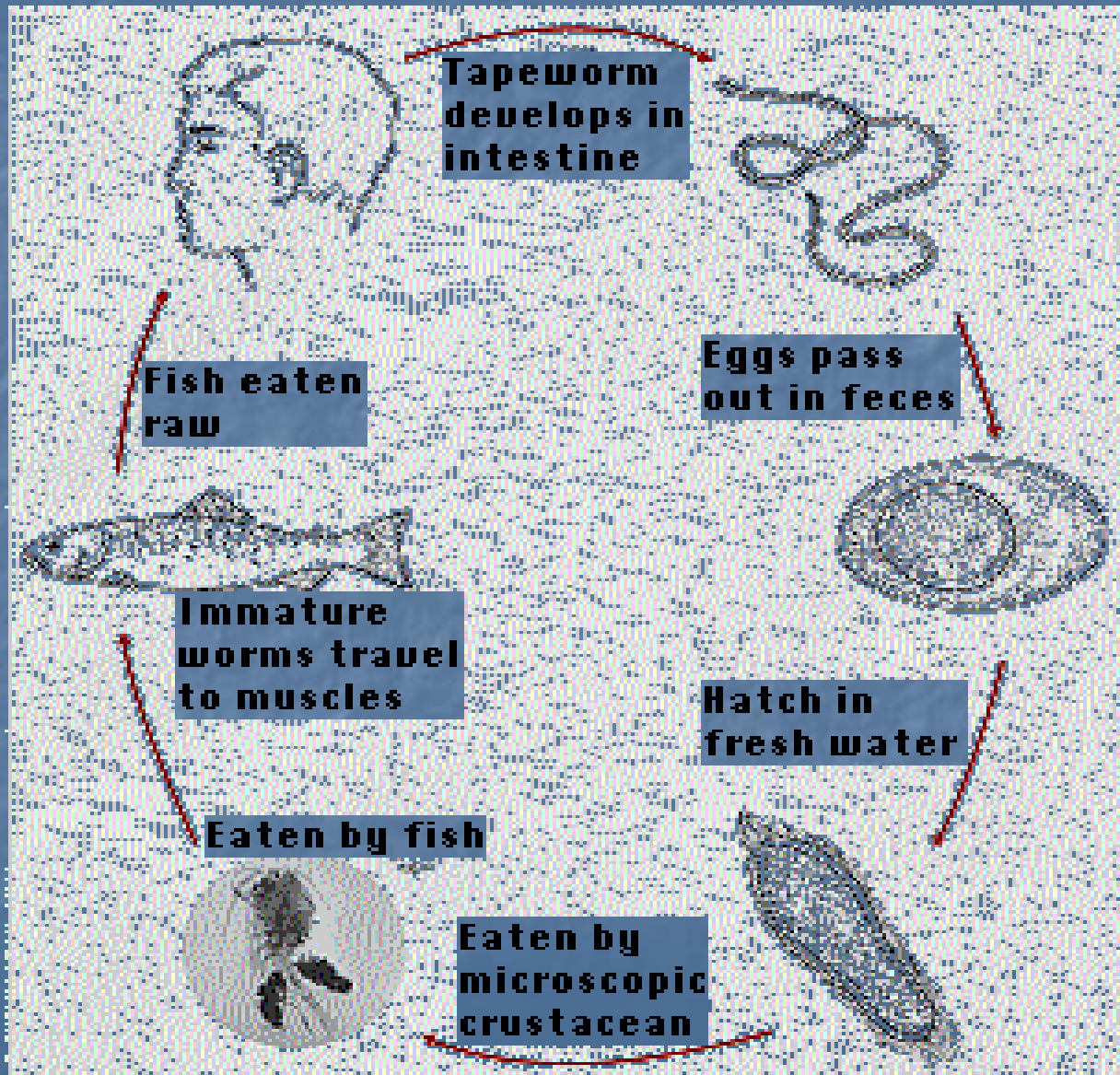


Life cycle

■ Hosts

- Definite host – man
- 2 intermediate host
 - 1st intermediate host – Cyclops
 - 2nd intermediate host – fresh water fish
- Man becomes infected by ingesting undercooked meat of fish containing plerocercoid larvae

Host of D.latum



Development of egg/larva

- Adult worm – egg in faeces

1-2 Weeks

- In fresh water – a spherical ciliated embryo with 3 pairs of hooklets – CORACIDIUM
- Mature coracidium escape from operculum
- Ingested by Cyclops

2-3 weeks

- 2nd stage larva – Proceroid larva

- Infected Cyclops containing Proceroid eaten by fresh water fish
- Larva free in intestine, penetrate gut wall
- Enters liver, muscles or mesenteric fat

↓ 1-3 weeks

- 3rd stage larva – Plerocercoid larva (Fish)
- Ingestion of poorly cooked fish by man – plerocercoid larva develop into adult worm in intestine

↓ 5-6 weeks

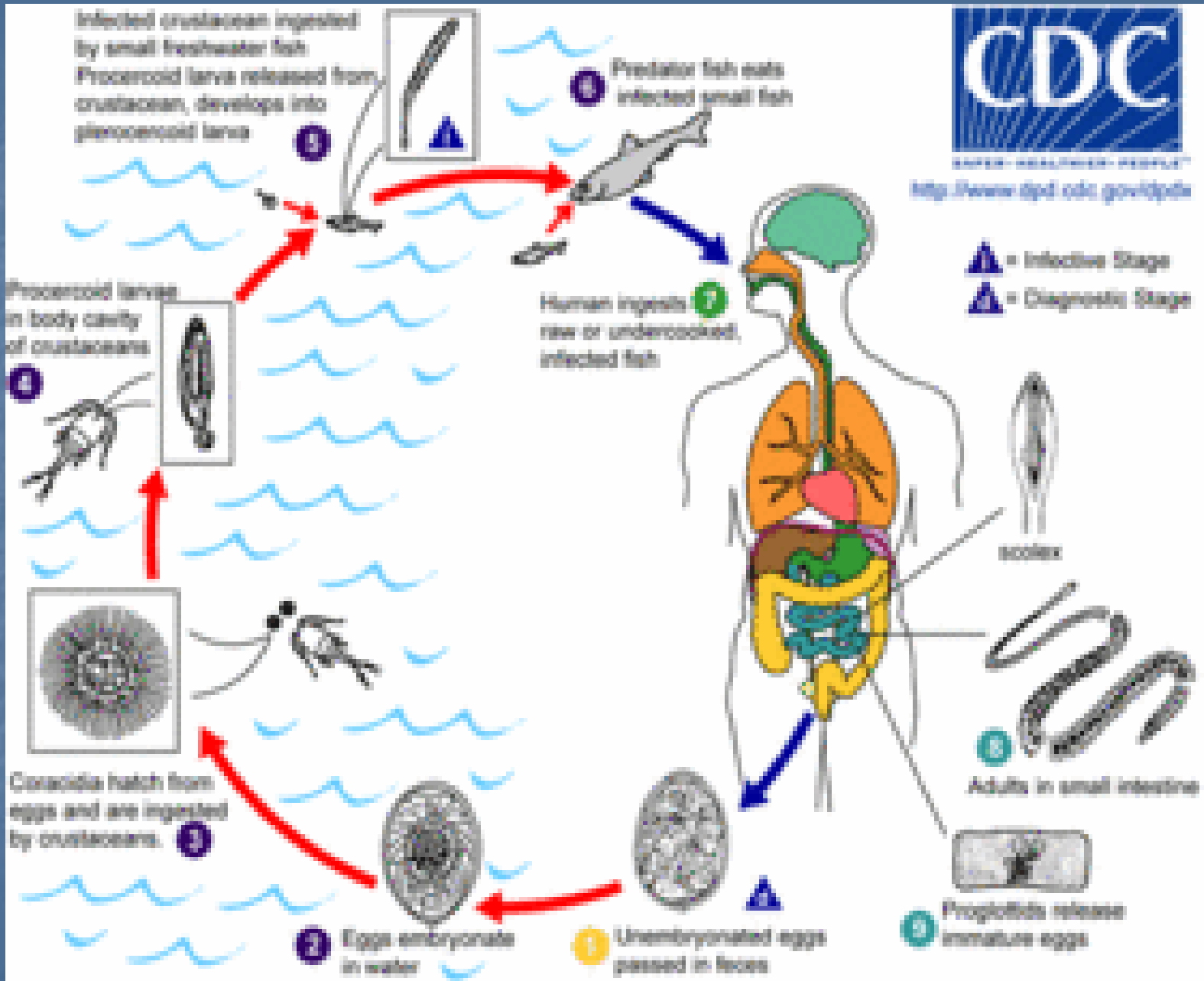
- Becomes sexually mature, lay down eggs which passed in faeces



www.cdc.gov

<http://www.dpd.cdc.gov/dpd>

▲ = Infective Stage
▲ = Diagnostic Stage



Clinical disease

- Disease called as **Diphyllobothriasis**
- Asymptomatic
 - Occasionally –epigastric pain, nausea, vomiting & weight loss
- Megaloblastic anemia
 - Interfere with intrinsic factor because of liberated unsaturated fatty acid
 - Worm itself consume Vit B₁₂ present in food
 - Competition with host for Vit B₁₂ , ultimately depriving host

Laboratory diagnosis

- Microscopy
 - Eggs
 - Proglottids
- Immunodiagnostic
 - ELISA
 - Latex agglutination test