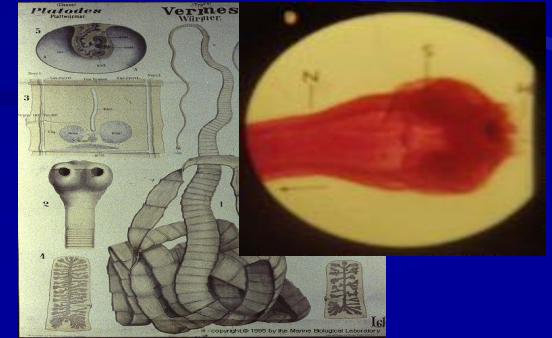
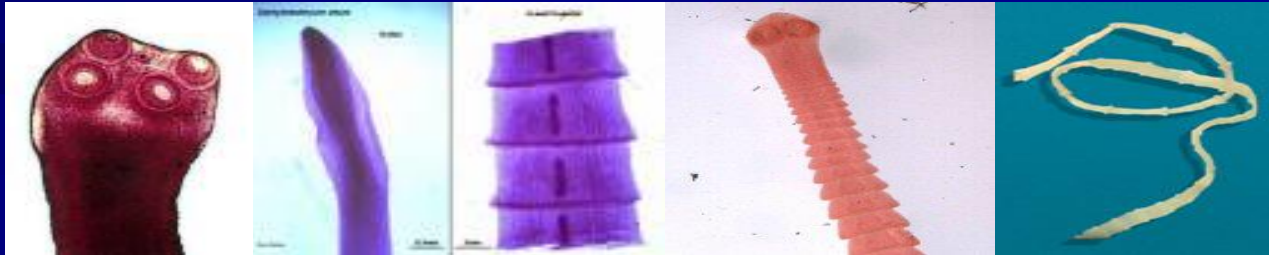


CESTODES



General Characteristics

- Majority are long, segmented, tape-like and are called tapeworms
- Dorso-ventrally flattened
- Size varies from a few mm to several meters
- Adult worms are found in the intestinal canal of man and animals
- “Head” or scolex is provided with suckers and sometimes with hooks that serve as organs of attachment
- There are 3 regions in an adult worm:
 - Head: scolex
 - Neck
 - Strobila (body or trunk)
 - Consist of a series of segment called proglottids

General Characteristics

- Sexes are not separate
- Body cavity is absent
- Alimentary canal is entirely absent
- Excretory and nervous systems are present
- Reproductive system is present and complete in each segment
 - According to maturity of reproductive organs, three types of segments of the strobila can be recognized from the front backwards
 - Immature: male and female organs are not differentiated
 - Mature: male and female organs have become differentiated (male organs appear first)
 - Gravid: uteri are filled with eggs (other organs are atrophied or have disappeared)

Classification of Cestodes Infecting Man

- I. Pseudophyllidean cestodes
 - Possess false or slit-like grooves called bothria
 - Adult worms in Intestine
 - *Diphyllobothrium latum*: Fish Tapeworm
 - Larval stages: Plerocercoid in Man
 - *Sparganum mansoni*
 - *Sparganum proliferum*

Classification of Cestodes Infecting Man

■ II. Cyclophyllidean cestodes

- Possess cup-like and round suckers called acetabula
- Adult Worms in the Intestine
 - *Taenia saginata*
 - *Taenia solium*
 - *Hymenolepis nana*
 - *Hymenolepis diminuta*
 - *Dipylidium caninum*

Classification of Cestodes Infecting Man

- According to Habitat
- II. Cyclophyllidean cestodes
 - Possess cup-like and round suckers called acetabula
 - Larval Stages in Man
 - Hydatid cyst of *Echinococcus granulosus* and *Echinococcus multilocularis*
 - *Cysticercus cellulosa* of *Taenia solium*
 - *Coenurus cerebralis* of *Multiceps multiceps*
 - *Coenurus glomeratus* of *Multiceps glomeratus*

Differences Between a Pseudophyllidean and a Cyclophyllidean Cestode

	Pseudophyllidean	Cyclophyllidean
Head or scolex	Bears 2 slit-like grooves	Bears 4 cup-like suckers
uterus	No branching Convoluting uterine tubes assume the form of rosettes	Branching May or may not be present
Uterine pore	present	absent
Common genital pore	Ventral; in the midline	lateral
eggs	Operculated; gives rise to ciliated larvae	Not operculated; do not give rise to ciliated larvae

Order Pseudophyllidea

Characteristics

- Large worms consisting of a long chain of segments
- “head” has two slit-like sucking grooves called bothria instead of suckers
- Uterine glands are widely scattered in the parenchyma and is composed of many acini
- Genital pores are on the ventral surface of the segment and are not marginal
- Uterus opens to the exterior through which eggs come out
- Eggs are operculated and can develop only in water; immature when oviposited and oncosphere gives rise to ciliated embryo
- Larval development proceeds in two intermediate hosts:
 - First larval stage is called proceroid
 - Second larval stage is called plerocercoid

Diphyllobothrium latum

- Parasitizes several species of fish eating mammals (including humans)
- Common Name:
 - Fish Tapeworm
 - Broad Tapeworm
- Morphology
 - Adult worm is yellowish grey in color
 - Dark central markings in the strobila are due to the egg-filled uterus
 - Measures 3 to 10 meters in length
 - Life-span is for a period of 5 to 15 years



Diphyllobothrium latum

- Scolex is spoon-shaped or spatulate
- Scolex bears 2 slit-like grooves called bothria (1 on the dorsal surface and 1 on the ventral surface)
- Scolex has no rostellum and no hooklets
- Neck is thin and unsegmented and is much longer than the head



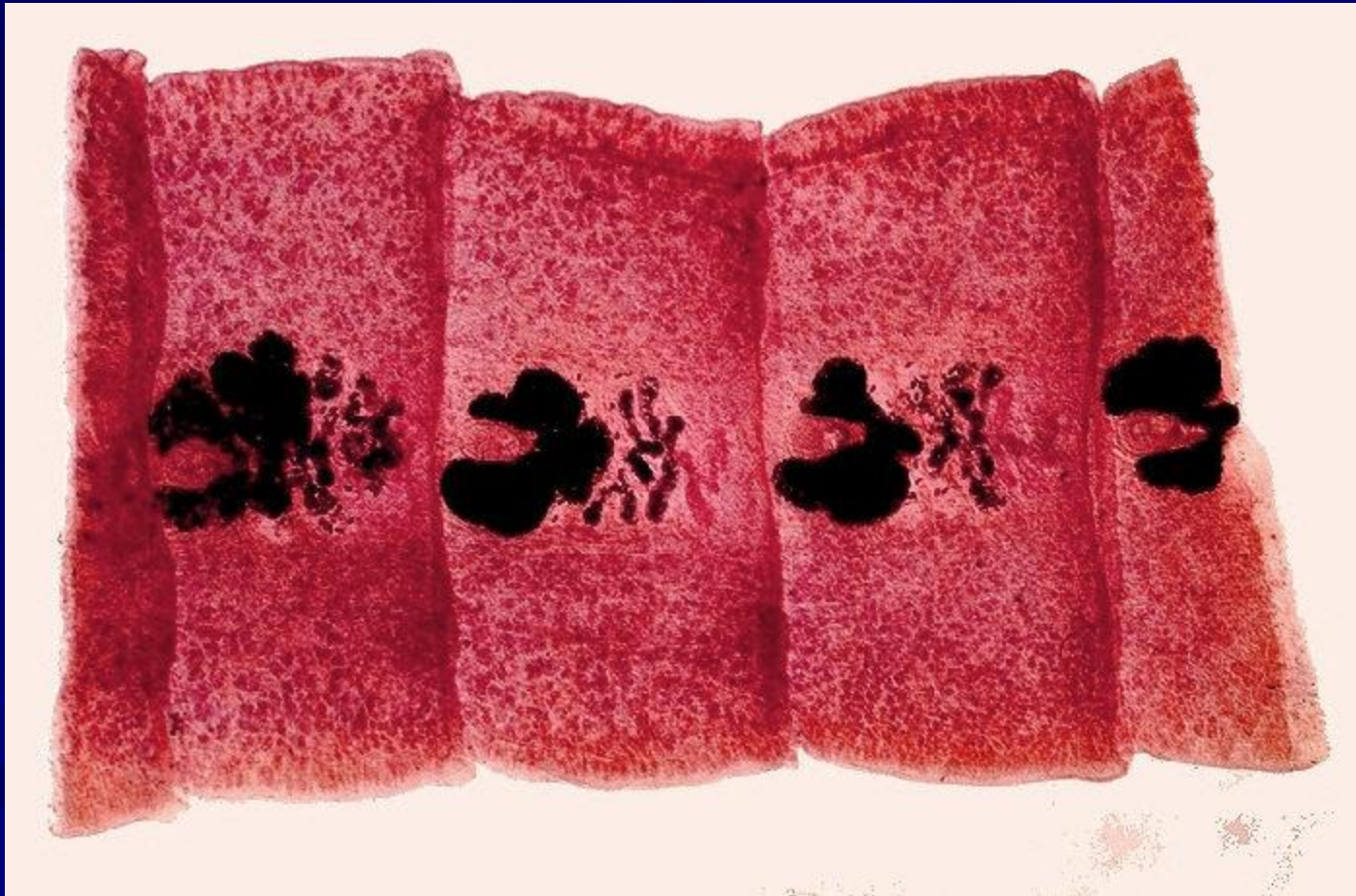
Diphyllobothrium latum

■ Morphology

- 3,000 to 4,000
- A mature segment is filled with male and female reproductive organs
- Terminal segments shrink and becomes empty as eggs are constantly discharged
- Dried up segments break off from the body in chains and are passed out in the host's feces
- Uterus at the center of the segment appears in the form of a rosette



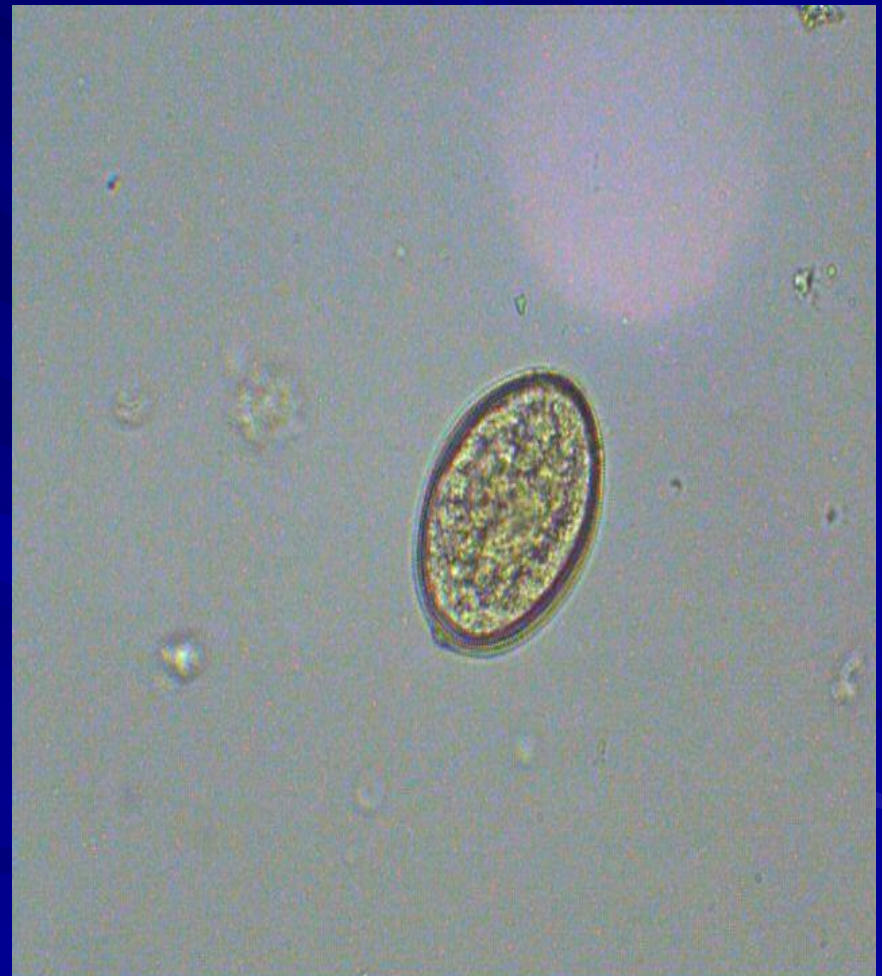
Diphyllobothrium latum



Diphyllobothrium latum

■ Ova

- Passed out in the host's feces in large numbers
- Oval
- Bile stained
- Contains abundant granules and unsegmented ovum
- Inconspicuous operculum at one end and a small knob at the other end
- Does not float in saturated solutions of common salt
- A single egg gives rise to a single larva
- Not infective to man



Diphyllobothrium latum

■ larva

- Passed first in water and then in the respective intermediate hosts
- 3 stage
 - First stage larva
 - Coracidium
 - Ciliated oncosphere that develops from egg in water
 - Second stage larva
 - Proceroid
 - Spindle-like solid body with cephalic invagination
 - Found inside the cyclops (the first intermediate host)
 - Third stage larva
 - Plerocercoid
 - Head is invaginated in the neck
 - Found in the fresh water fish, the second intermediate host

Diphyllobothrium latum

Life Cycle

- The adult worm is attached to the mucosal lining of the small intestine
- Eggs are released from the uterine pore on the ventral surface of the proglottid
- The eggs must lie dormant in the water for approximately 8-12 days or longer to complete embryonic development
- The hexacanth embryo is covered by a ciliated embryophore and is called a **coracidium**
- Soon after hatching, the motile coracidium must be ingested by a FW copepod
- In the digestive tract of the copepod, the ciliated embryophore is shed and the naked hexacanth larva bores through the intestinal wall into the hemocoel

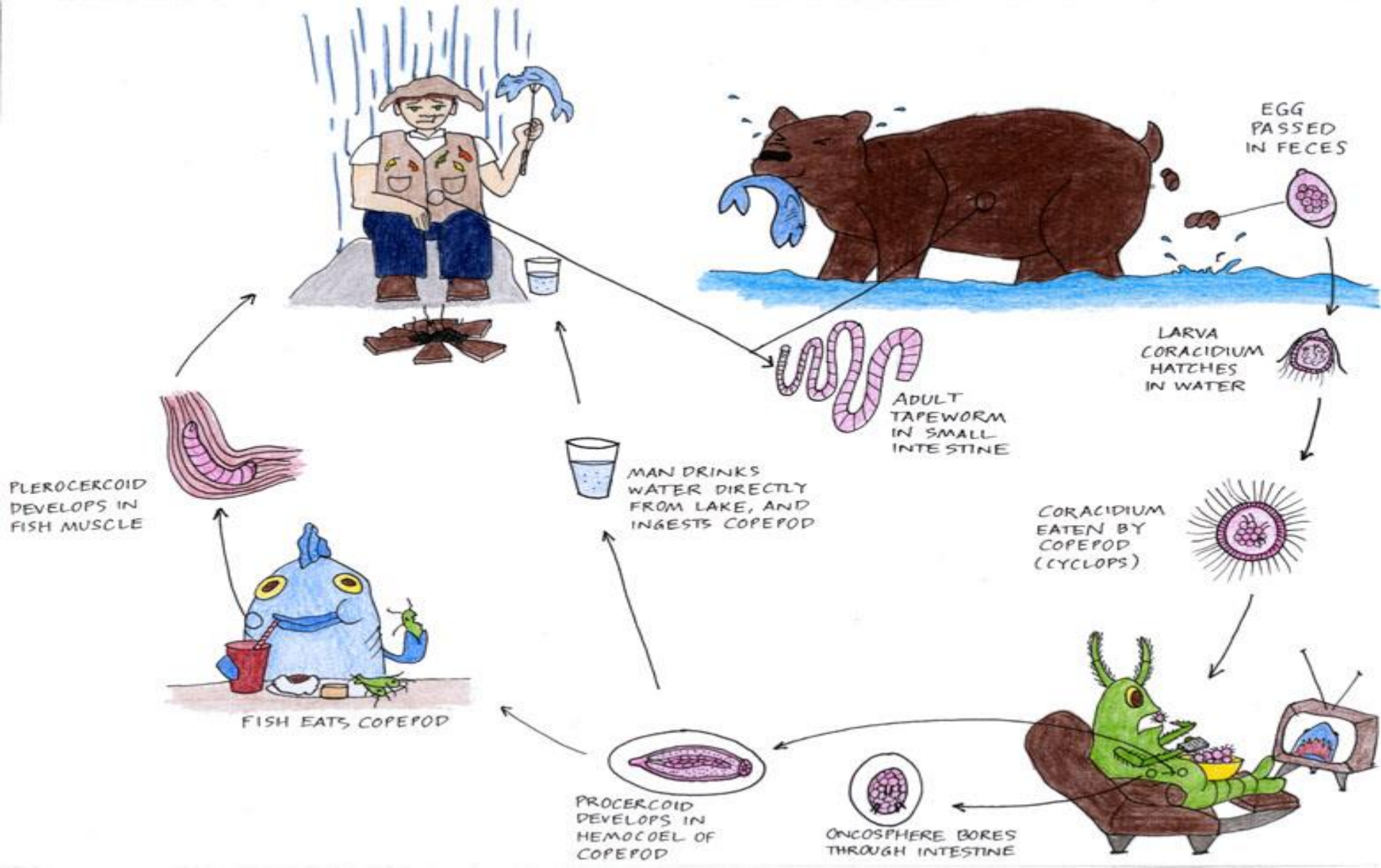
Diphyllobothrium latum

- The hexacanth embryo metamorphoses into an elongated **proceroid** larva.
- The prominent cercomer, containing the 6 larval hooks, projects posteriorly.
- When the infected copepod is ingested by a plankton-feeding FW fish, the proceroid penetrates the intestinal wall and migrates to the body muscles.
- Here it develops into a long, solid, pseudosegmented **plerocercoid** larva with an adult scolex at one end.
- The plerocercoid of *D. latum* is coiled and at times encapsulated, or more commonly, lying free in muscle tissue.
- When it invades the muscles of the body wall, encapsulation rarely occurs.

Diphyllobothrium latum

- However, when it settles in or on the viscera, encapsulation is common.
- Infection of the definitive host results from the ingestion of plerocercoids in poorly cooked, steamed, smoked, pickled, or raw fish.
- Upon entering the small intestine of the definitive host, it attaches to the mucosa and begins to grow

Diphyllobothrium latum

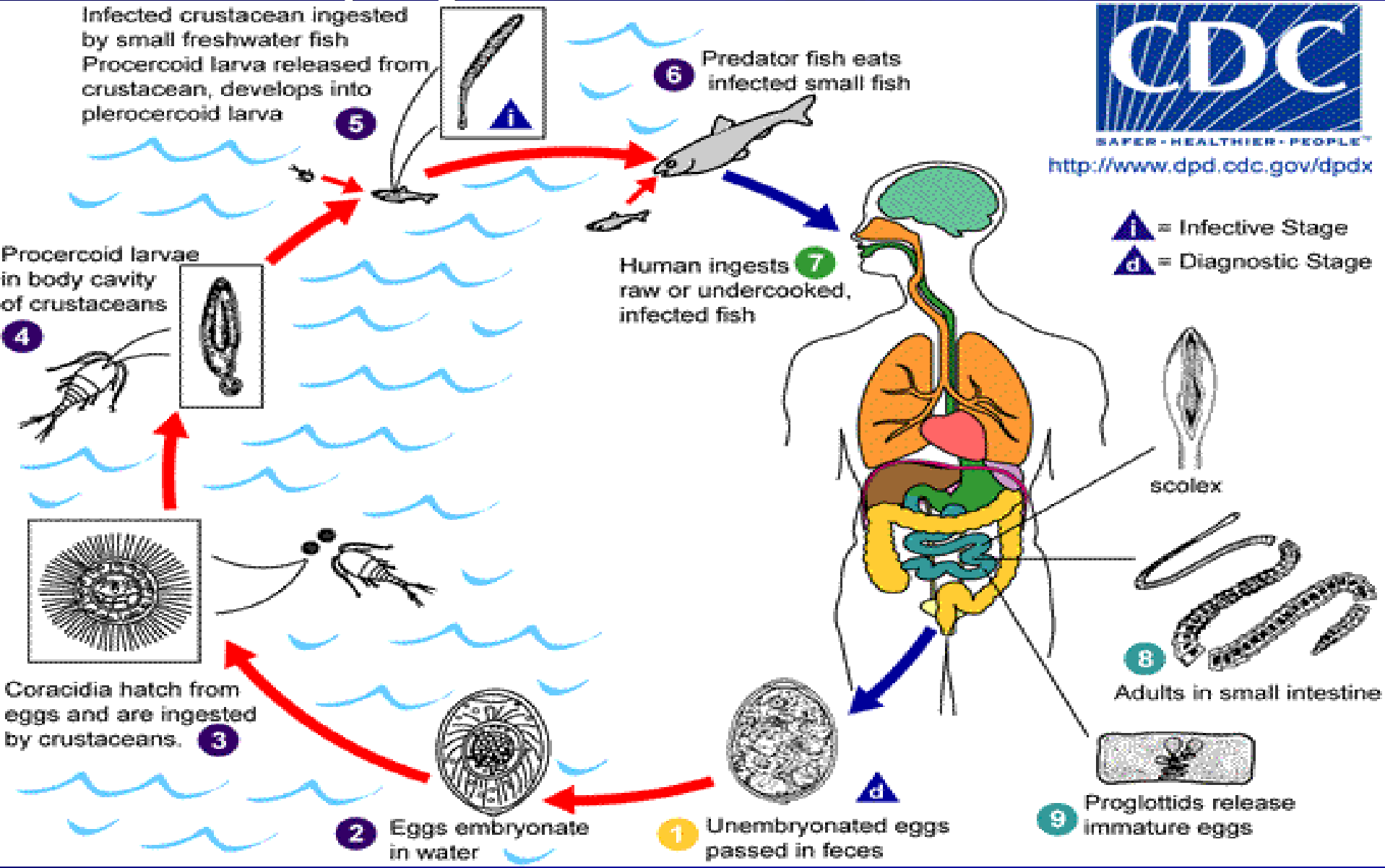


Diphyllobothrium latum



SAFER • HEALTHIER • PEOPLE™

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



Diphyllobothrium latum

Epidemiology

- Human infection with *D. latum* is primarily, although not exclusively, limited to areas where fresh fishes are commonly eaten or where cleaning and handling of fishes is done.
- A number of cold water, FW fishes (including pike, salmon, trout) can serve as second intermediate hosts
- In addition to being ingested with raw or improperly cooked fish, plerocercoids may be accidentally ingested when they cling to the hands of fish cleaners.
- Particularly common in Scandinavia, the USSR and parts of temperate SA

Diphyllobothrium latum

Symptoms

- Rarely is more than a single worm found in an infected human, and many victims display few if any symptoms.
- There may be abdominal pain, weight loss, weakness, and nervous disorders.
- Many of these symptoms are attributable to the patient's reaction to the parasite's metabolic wastes, to degenerating proglottids or to irritation of the intestinal mucosa.
- Occasionally, the worm is found in the upper portions of the jejunum, in which case it can compete successfully with the host for ingested vitamin B12.
- Since this vitamin is important in the synthesis of hemoglobin, deprivation causes anemia in the human host similar to pernicious anemia.

Diphyllobothrium latum

- Final Host
 - Man, dog, cat
 - Small intestine
- 1st I.H.
 - Cyclops or Diaptomus
- 2nd I.H.
 - Fresh water fish, pike, trout, salmon, perch
- Mode of Infection
 - Ingestion of imperfectly cooked infected fish or roe containing plerocercoid larvae
- Infection
 - Diphylllobothriasis
 - G.I. disturbances and anemia
- Diagnosis
 - Microscopic examination of feces for the characteristic operculated eggs

Other Pseudophyllideans Found in Humans

Sparganosis

- When procercoids of some species are accidentally ingested (e.g. swallowing copepods while drinking water) they can migrate from the gut and develop into plerocercoids
- This infection is called **sparganosis**.
- It can cause some rather severe pathology.
- Another pseudophyllidean is *Ligula intestinalis*, found in the body cavity of carp, suckers, and shiners – causes substantial changes in host behavior.
- Adult worms often occur with mergansers (fish eating ducks)