Kingdom

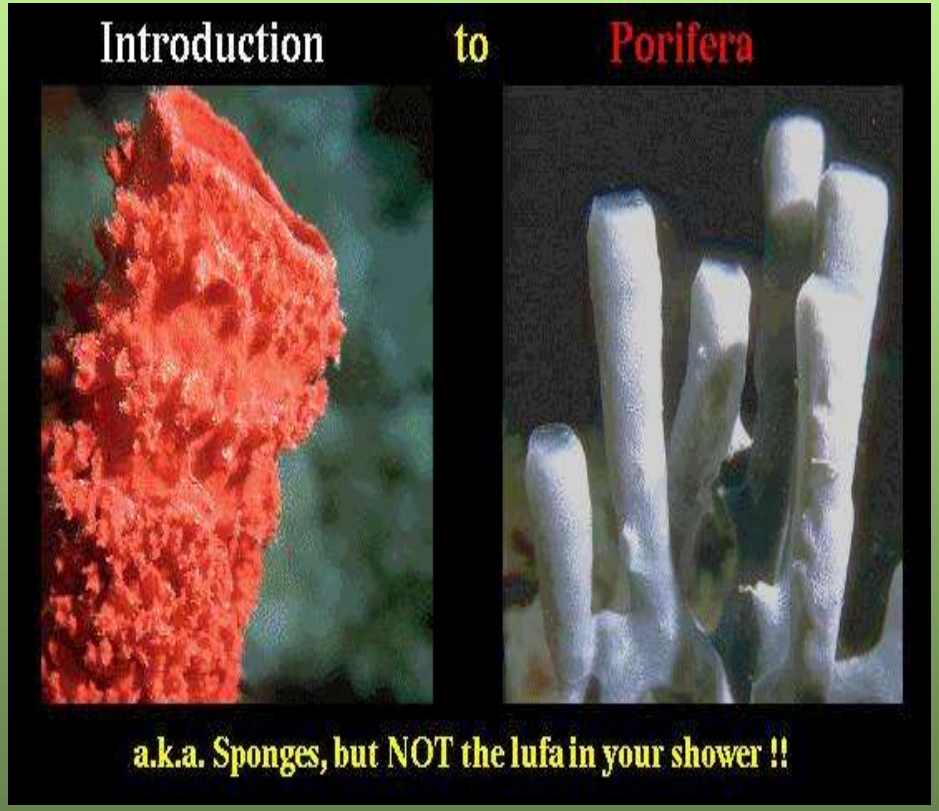
ANIMALIA

PHYLUM PORIFERA
(animals without tissues)

Ivana Jankovská, FAPPZ 49

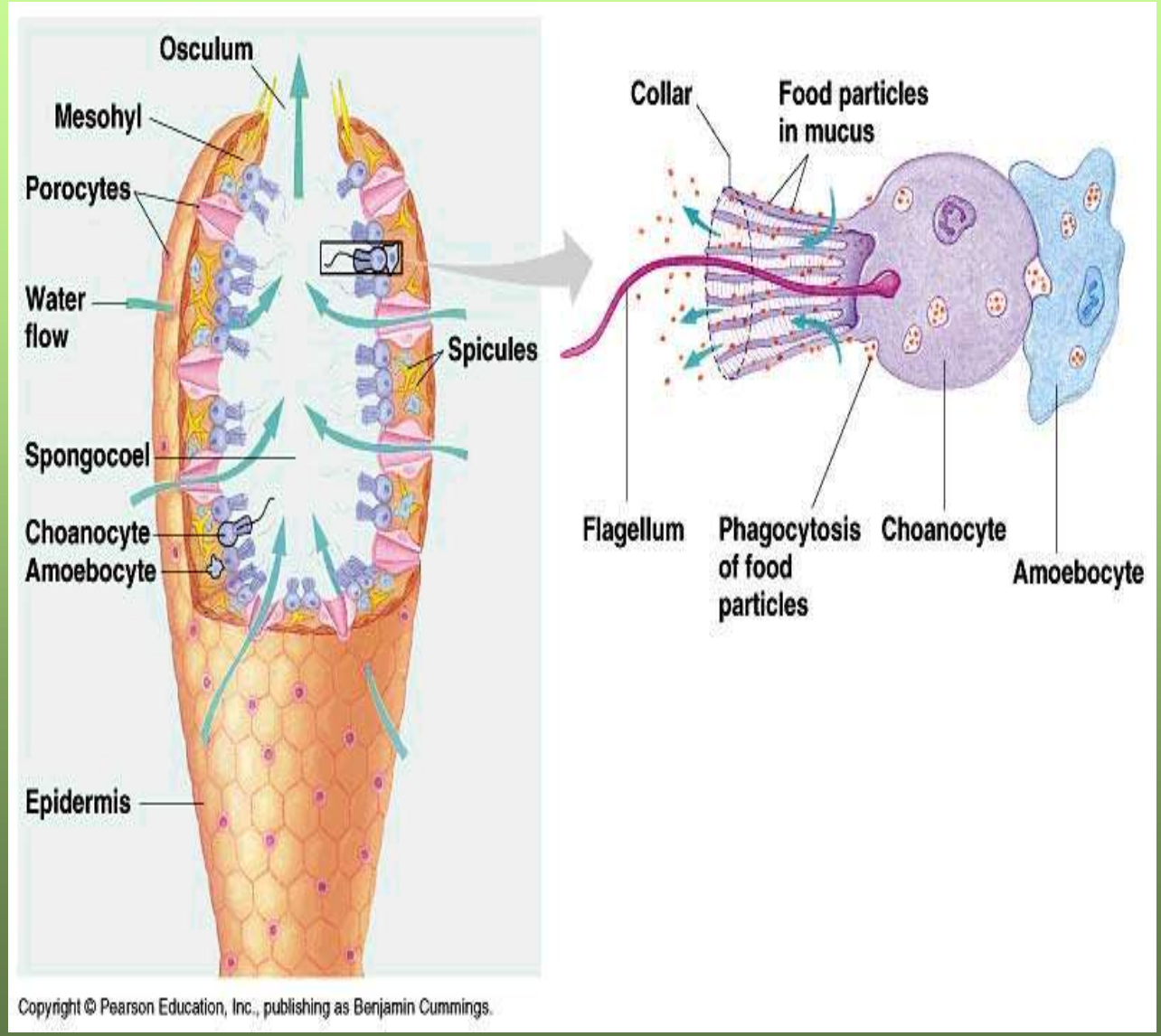
1. Phylum: Porifera

- **sessile aquatic animals**
- the great majority are **marine** (salt water) species
- Hermafrodites
- no nervous, digestive or circulatory systems



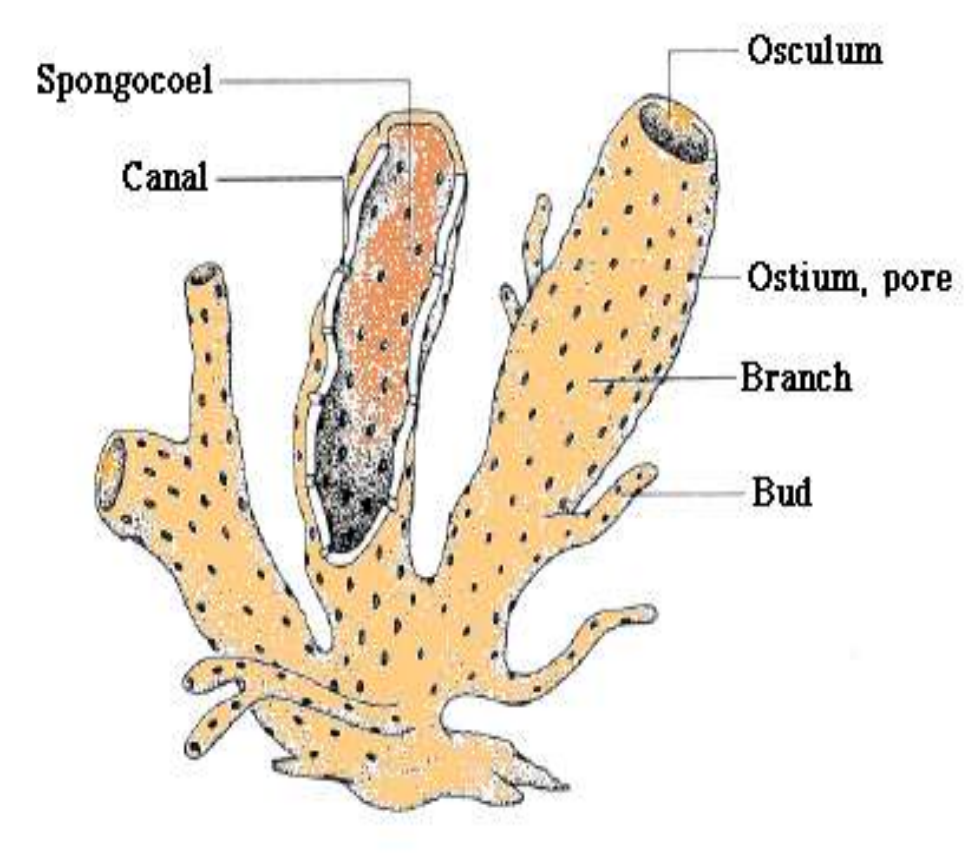
Sponges (Porifera)

- jelly-like mesohyl sandwiched between two thin layers of cells
- constant water flow through their bodies to obtain food and oxygen and to remove wastes
- the shapes of their bodies are adapted to maximize the efficiency of the water flow.
- feed on bacteria and other food particles in the water



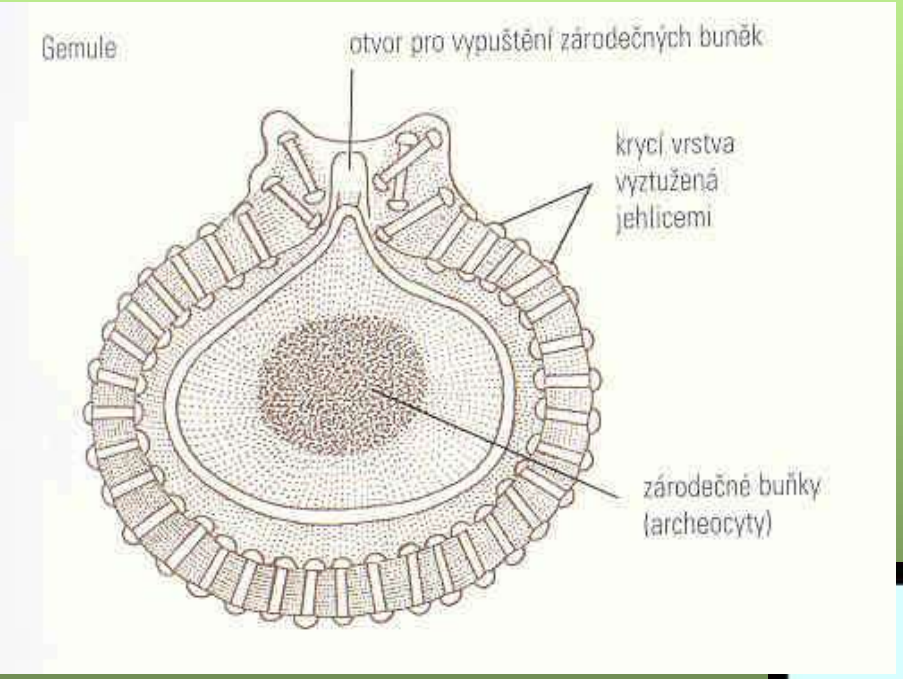
Asexual reproduction

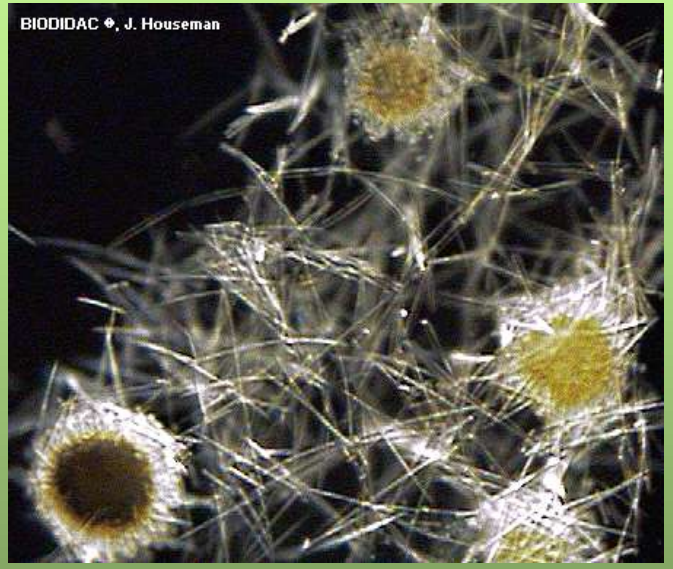
- by fragmentation;
- by budding;
- by producing gemmules.



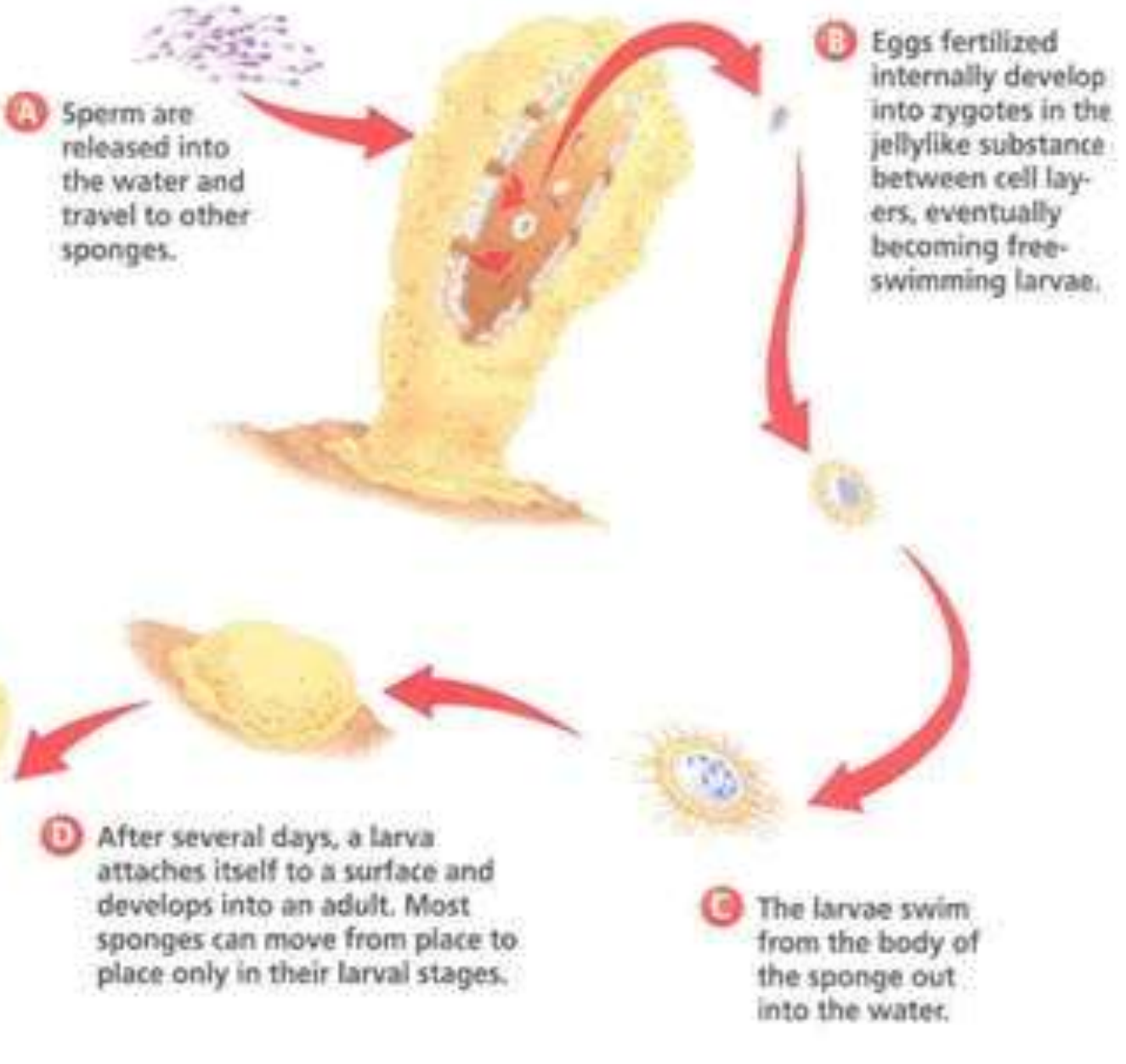
Gemules

"survival pods" which a **few marine** sponges and **many freshwater** species produce by the thousands when dying and which some, mainly freshwater species, regularly produce **in autumn**.

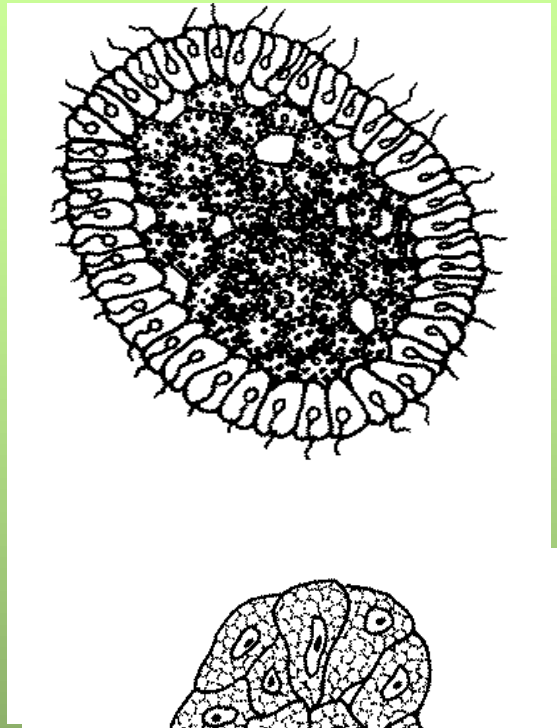




Sexual reproduction

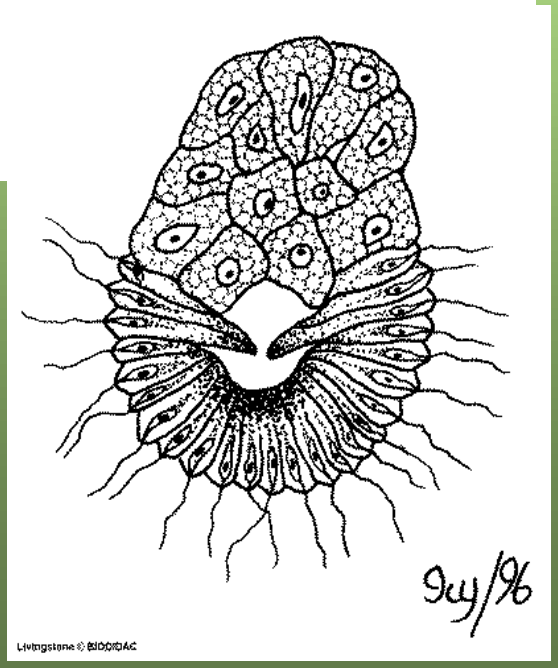


Free swimming larvae



= the balls of cells with an outer layer of cells with flagellae or cilia

- **parenchymela larva**



- **amphiblastula larva**

Classes:

- **Calcarea**

Calcareous sponges produce **spicules** made of **calcium carbonate**.

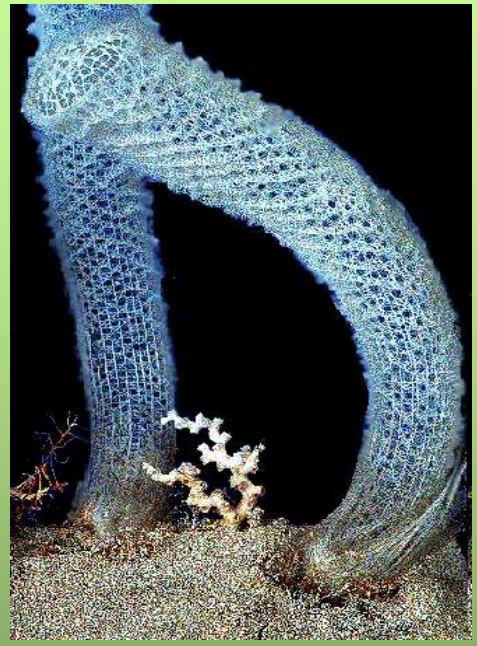
May be individual or large masses

Body form: Asconoid, syconoid or leuconoid

- **Hexactinellida** (glass sponges)

Hexactinellid sponges are sponges with a skeleton made of four- and/or six-pointed silaceous spicules.

leuconoid

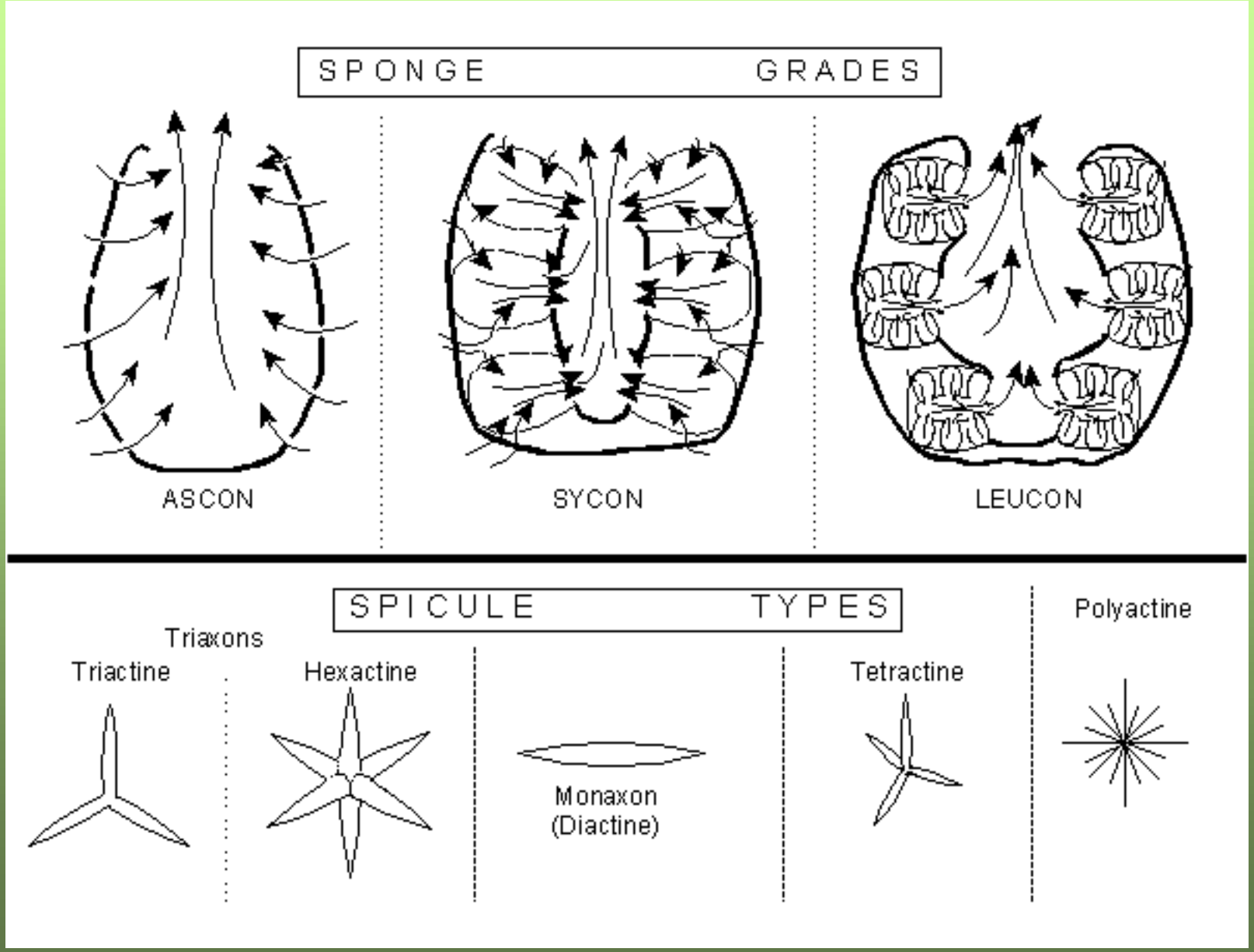


- **Desmospongia**

Demosponges reinforce the mesohyl **with fibers of a special form of collagen called spongin,** most also produce spicules of silica, and a few secrete massive external frameworks of calcium carbonate.

•Leuconoid

Body form:


SPONGE GRADES
ASCON
SYCON
LEUCON
SPICULE TYPES
Triaxons
Triactine
Hexactine
Monaxon
(Diactine)
Tetractine
Polyactine

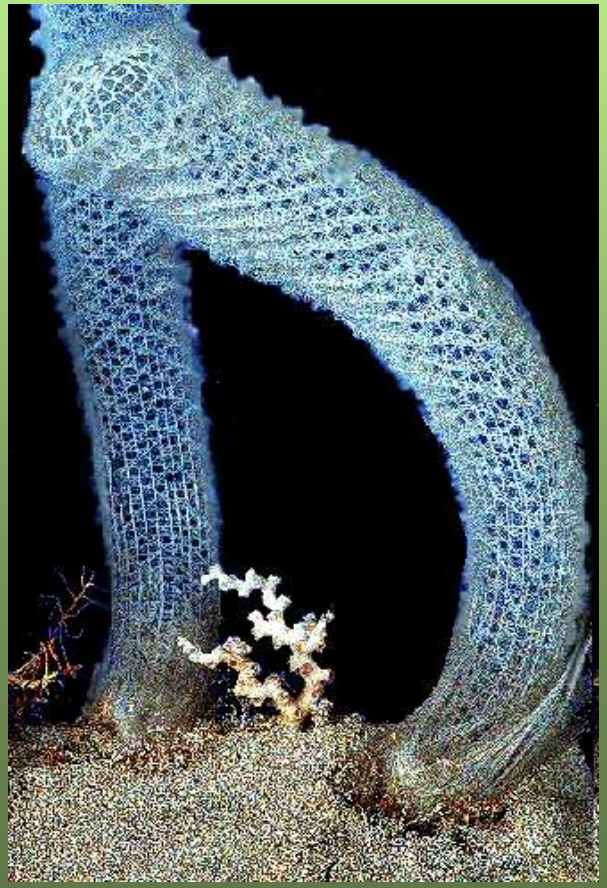
Hexactinellida (**Glass sponges)**

Mostly syncytia in all species silica

May be individual or fused

leuconoid..

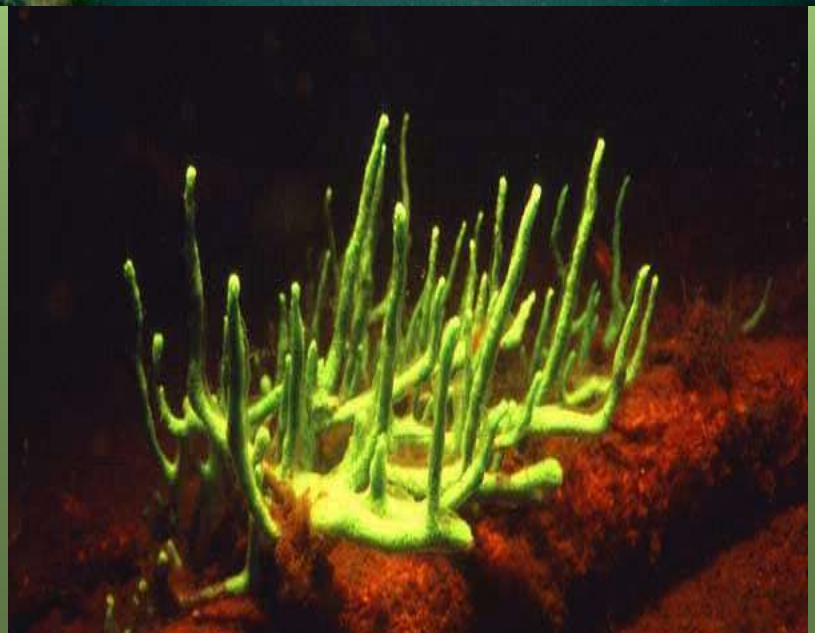
(*Euplectella aspergillum*)



Desmospongia (**Demosponges**)

- *Spongia officinalis*

The freshwater sponges: 1) *Spongilla lacustris*



- *2) Ephydatia fluviatilis*

Phylum Cnidaria

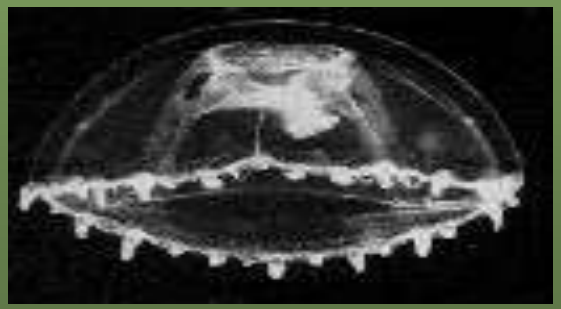
- in aquatic, mostly marine, environments
- **sessile Anthozoa** (sea anemones, corals, sea pens)
- **swimming Scyphozoa (jellyfish); Cubozoa (box jellies);**
- and **Hydrozoa -** a diverse group that includes all the freshwater cnidarians as well as many marine forms, and has **both sessile** members such as ***Hydra*** and colonial **swimmers** as **Freshwater Jelly (*Craspedacusta sowerbyi*)**

(Scyphozoa)

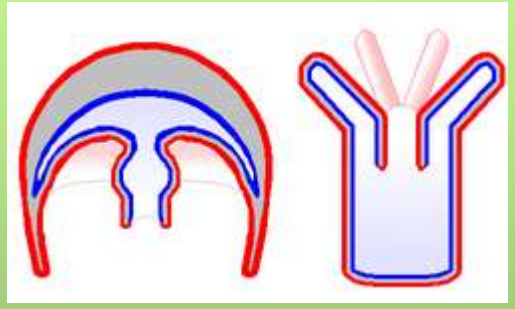
(Cubozoa)

(Anthozoa)

(Hydrozoa)



Fylum Cnidaria

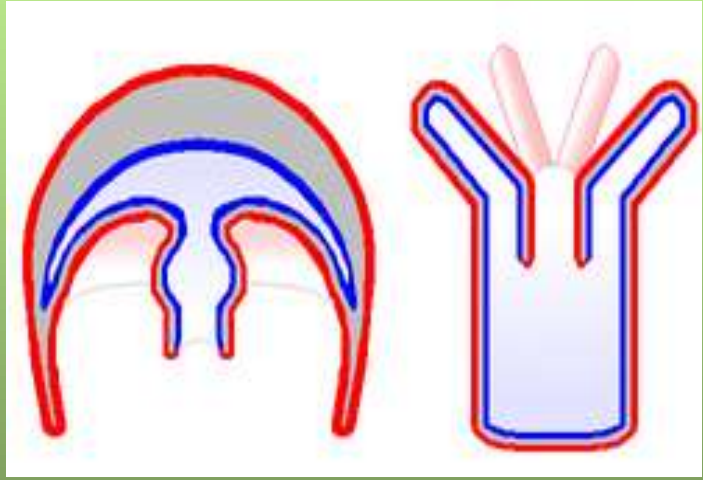


•diploblastic animals
•two main cell layers

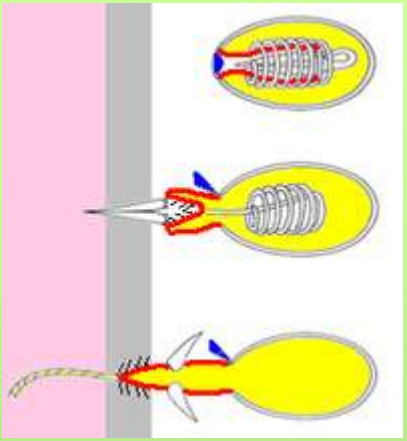
- Both forms (medusa-like or polyp-like zooids) have a single orifice and body cavity that are used for digestion and respiration.
- Cnidarians' activities are coordinated by a **decentralized nerve net and simple receptors**.
- Their bodies consist of mesoglea, a non-living jelly-like substance, sandwiched between two layers of epithelium that are mostly one cell thick.

Basic body forms

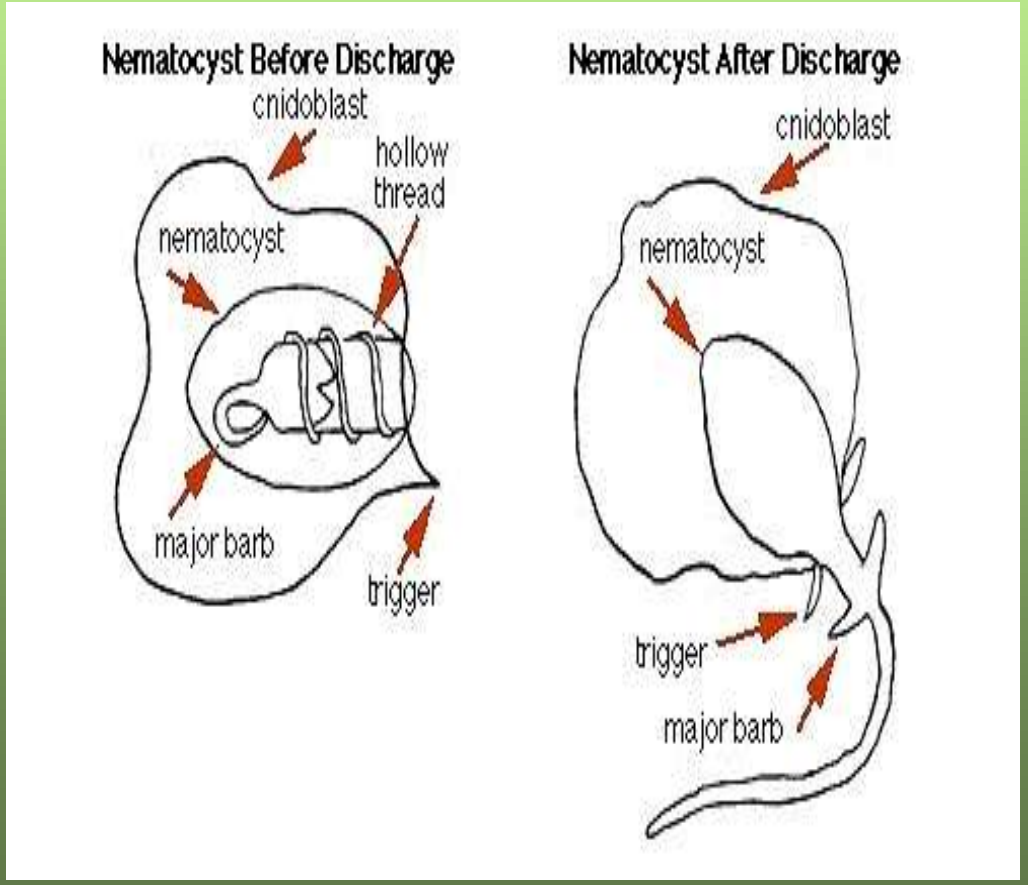
- **radially symmetrical**
- **no heads**
- **"oral„ end**
- **"aboral" end**
- **tentacles with cnidocytes**
- medusae generally have an inner ring of tentacles around the mouth



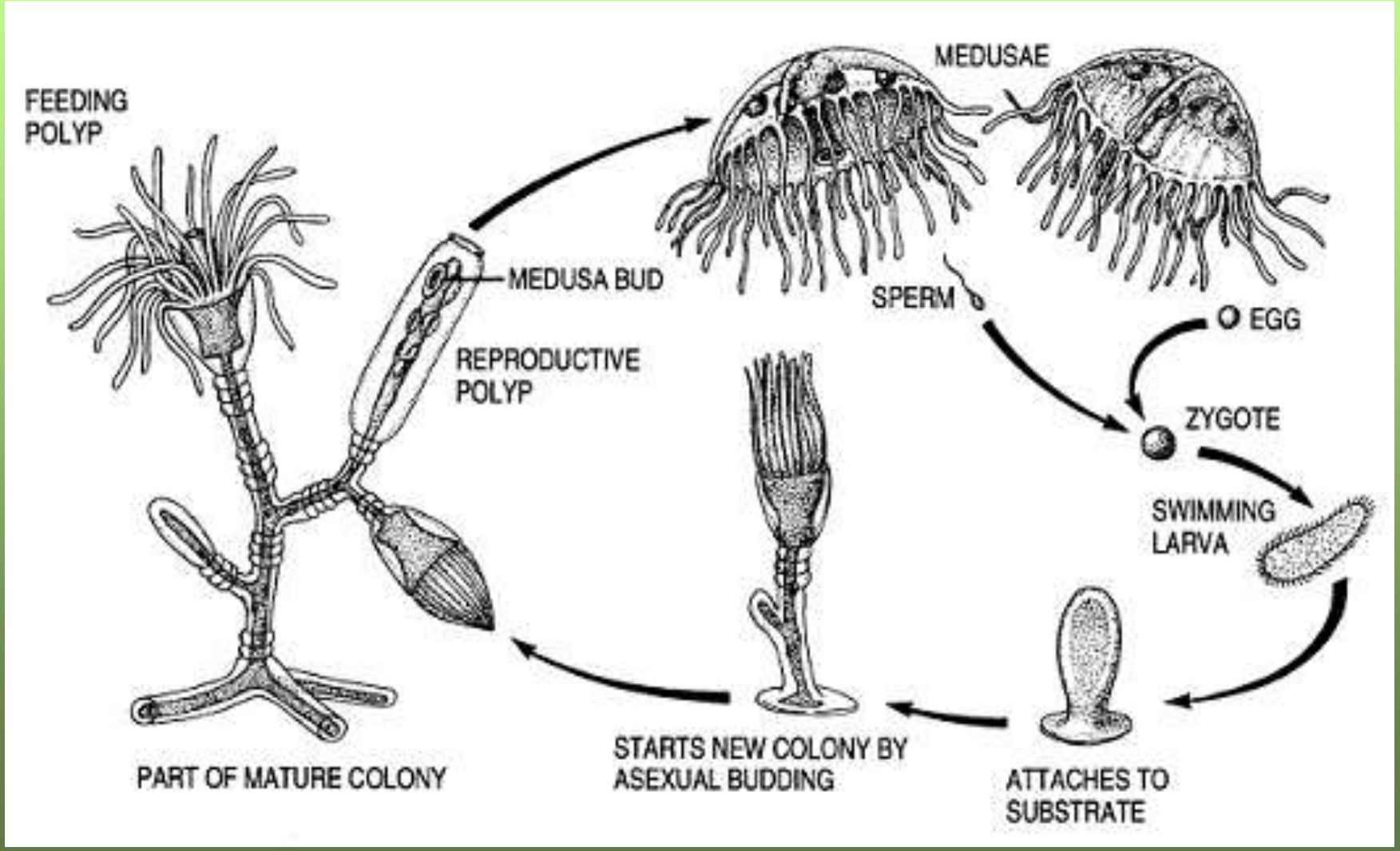
Cnidocytes the harpoon-like "nettle cells"



- specialized cells
  for capturing prey
- **between or on top of the muscle cells**

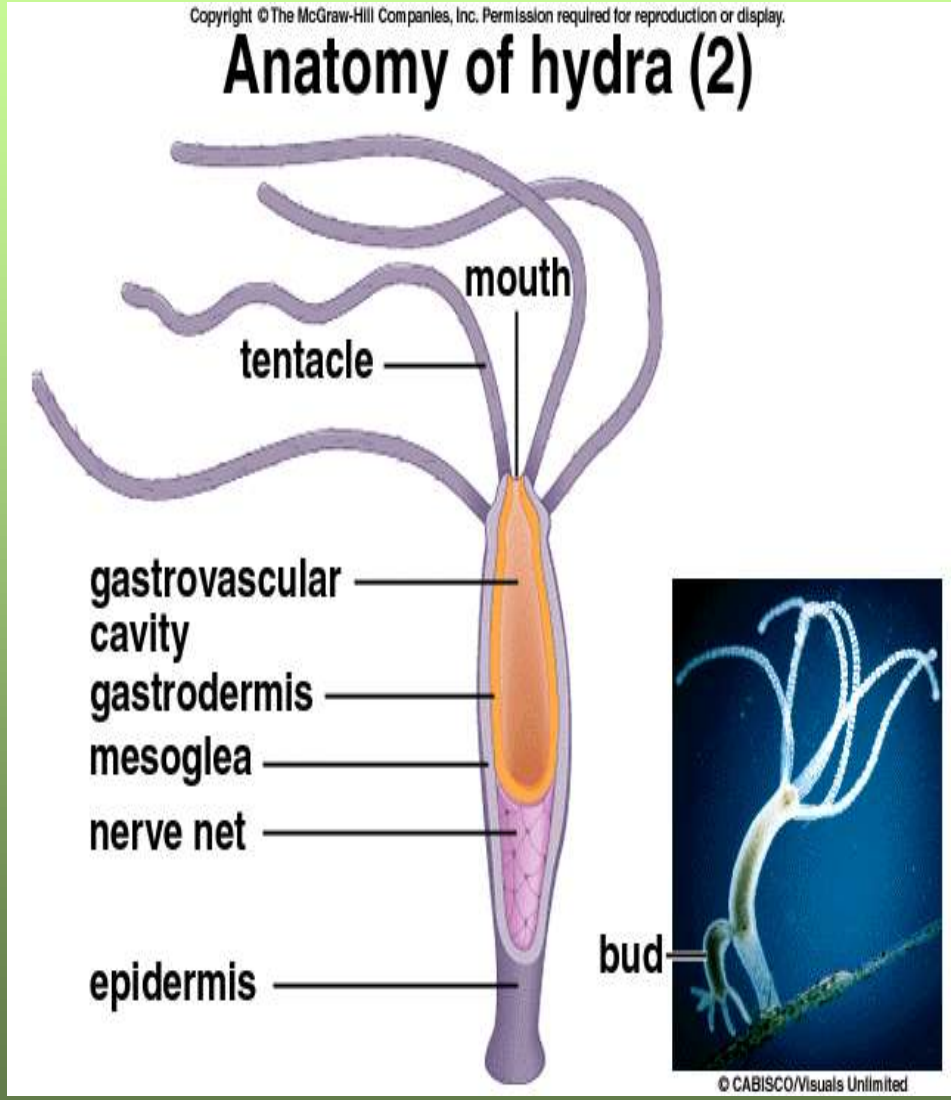


Reproduction



1. Hydrozoa

- **taxonomic class of very small, predatory animals**
- **can be solitary or colonial**
- **mostly live in saltwater**



a few genera within this class live in freshwater
Freshwater Jelly (*Craspedacusta sowerbyi*),
the freshwater polyps (*Hydra*)

(*Chlorohydra viridis*)

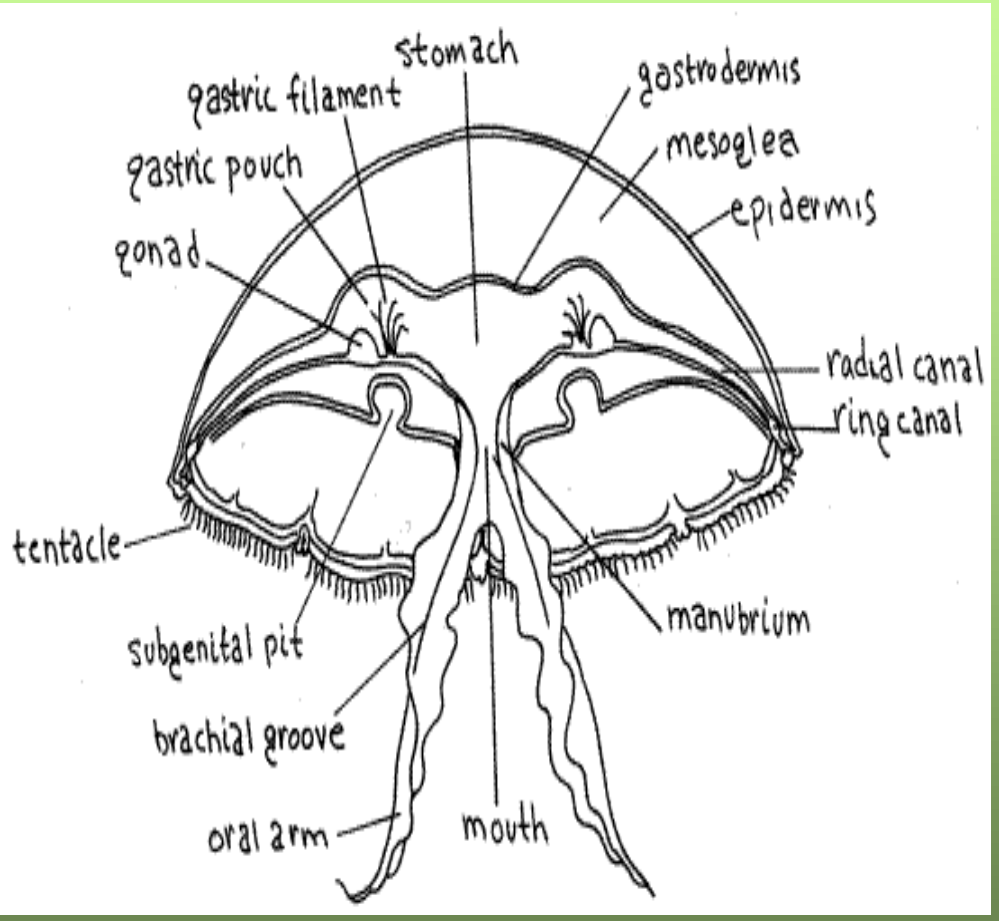
(*Craspedacusta sowerbyi*)

- 1 - 2 cm
- kosmopolit

(*Pelmatohydra oligactis*)

2. Scyphozoa

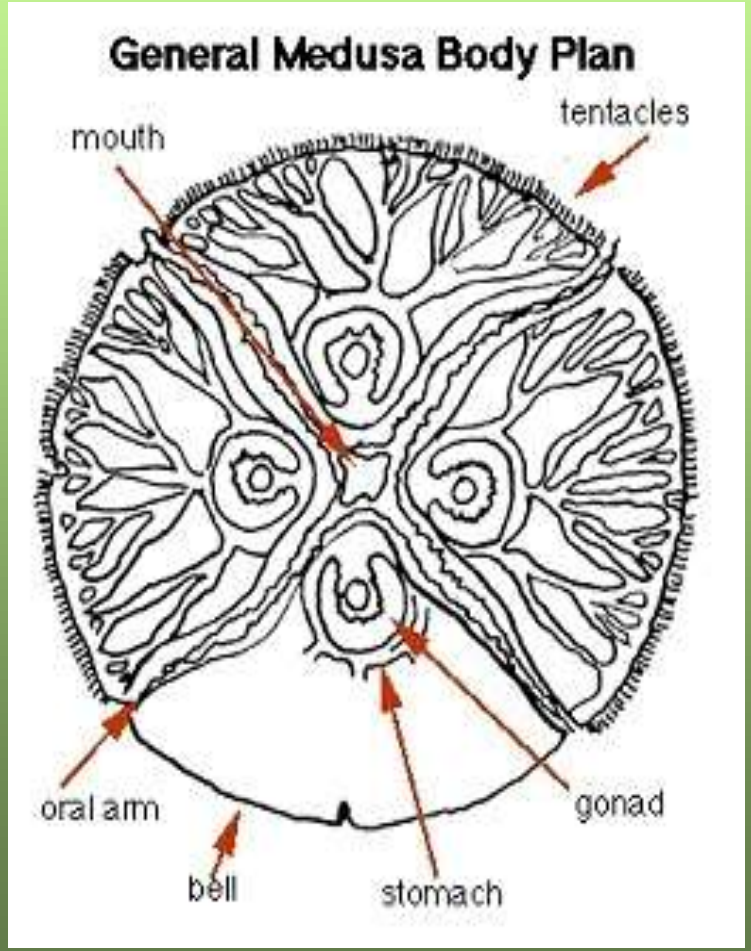
"true jellyfish"



Scyphozoans have no durable hard parts, including **no head, no skeleton and**
no specialized organs for respiration or excretion.

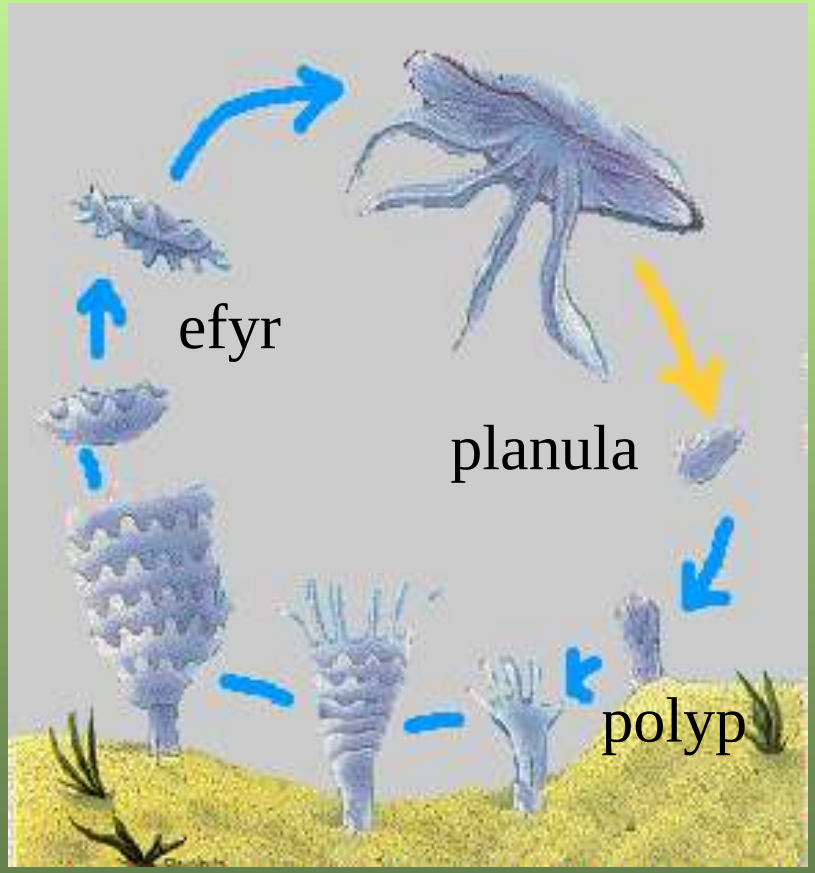
*** four-part symmetry**

- they eat a variety of **crustaceans and fish**, which they capture using stinging cells called **nematocysts**



•The *nematocysts* are attached to the **tentacles** that radiate downward from the edge of the umbrella dome.

Scyphozoa reproduction:

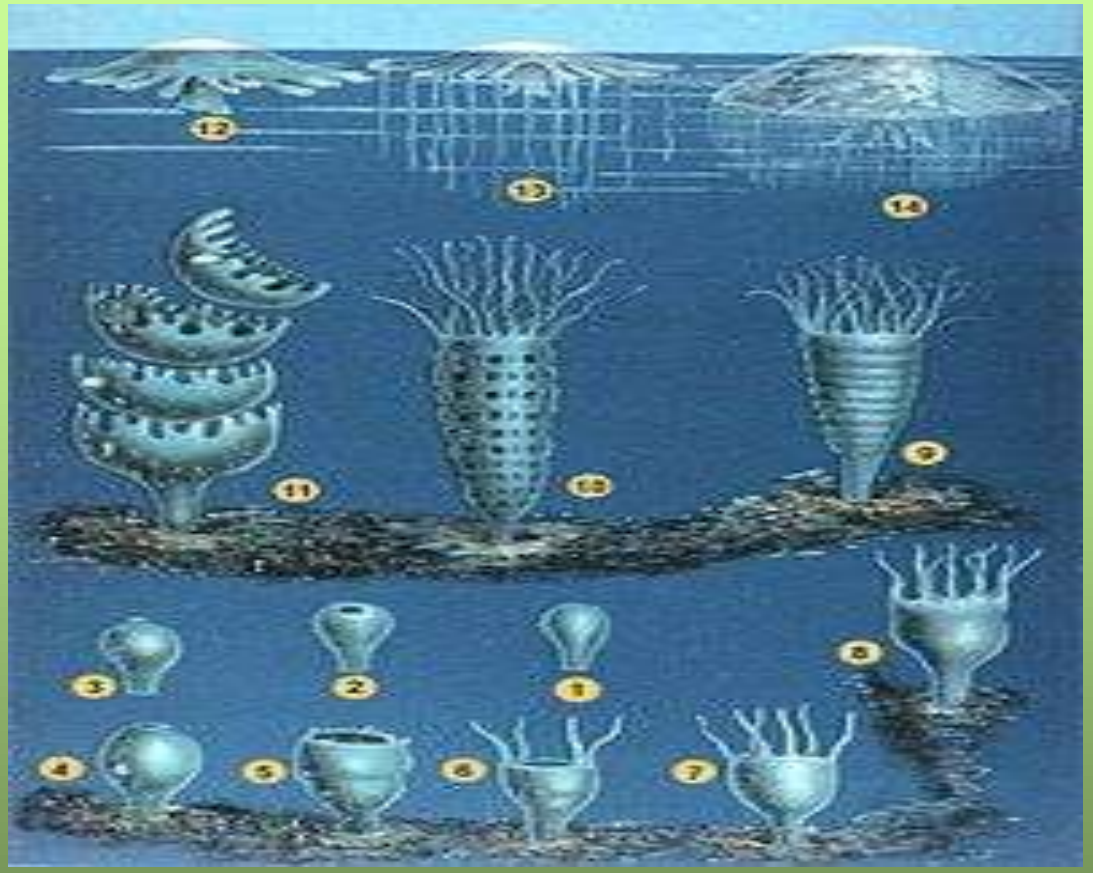


- planula (larva)
- polyp
- polyp releases **efyres**
- From efyres forms new medusae

Life cycle of a jellyfish

two basic body forms:

- **swimming medusae**
- **sessile polyps**



1–3 Larva searches for site
4–8 Polyp grows
9–11 Polyp strobilates
12–14 Medusa grows

Movement

- While scyphozoans lack the specialized locomotive device (velum), they are able to **move through the water by contracting and relaxing the muscles of their umbrella.**


(c) Herb S

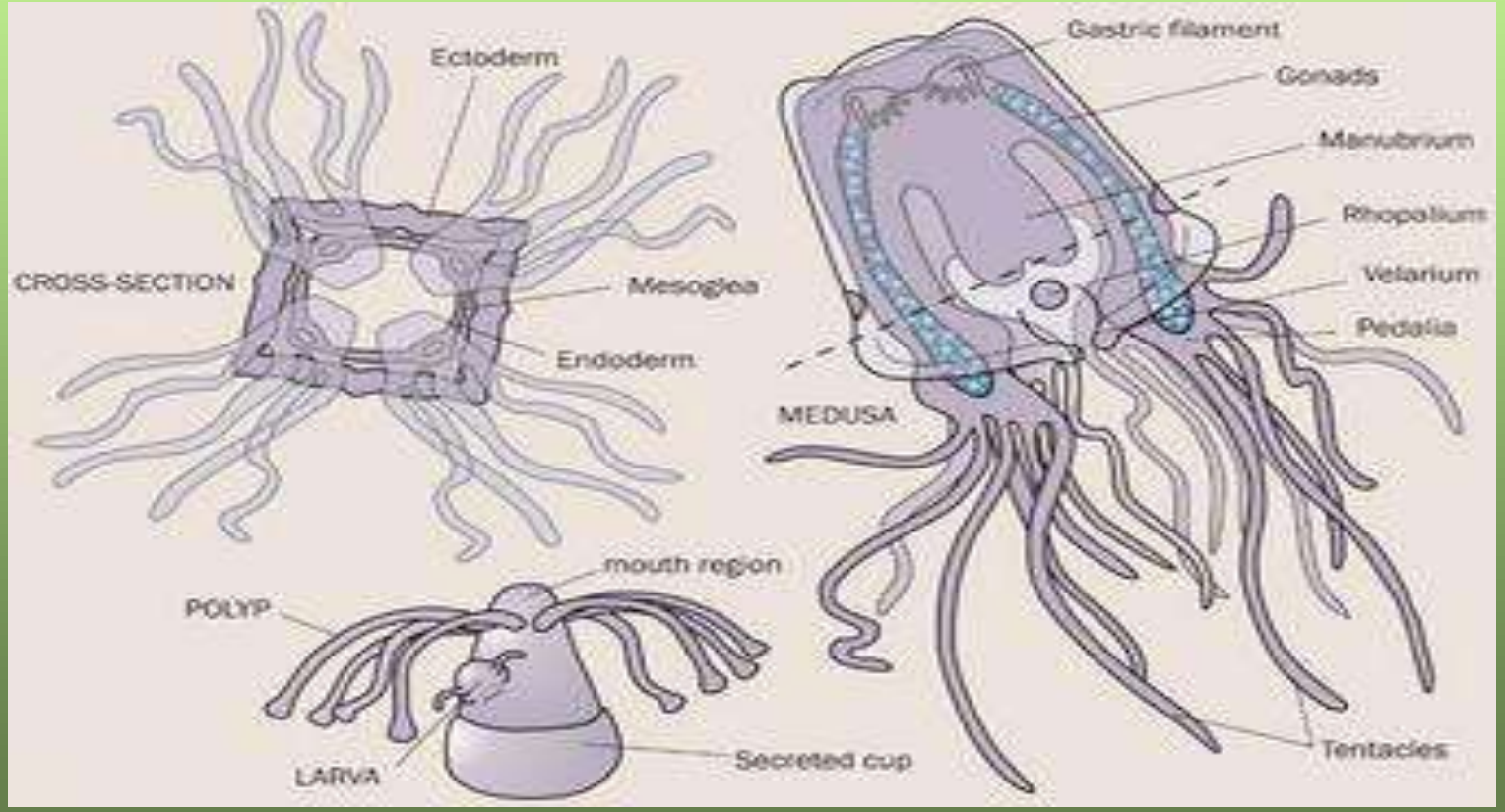

(c) Herb Segars

3. Cubozoa box jellies

- Various types of box jellies, ranging in toxicity, can be found in Australia, the Philippines, Indonesian Coast, Hawaii, Vietnam, the Carribean and other tropical areas.
-
- Box jellyfish are extremely venomous and can kill humans;

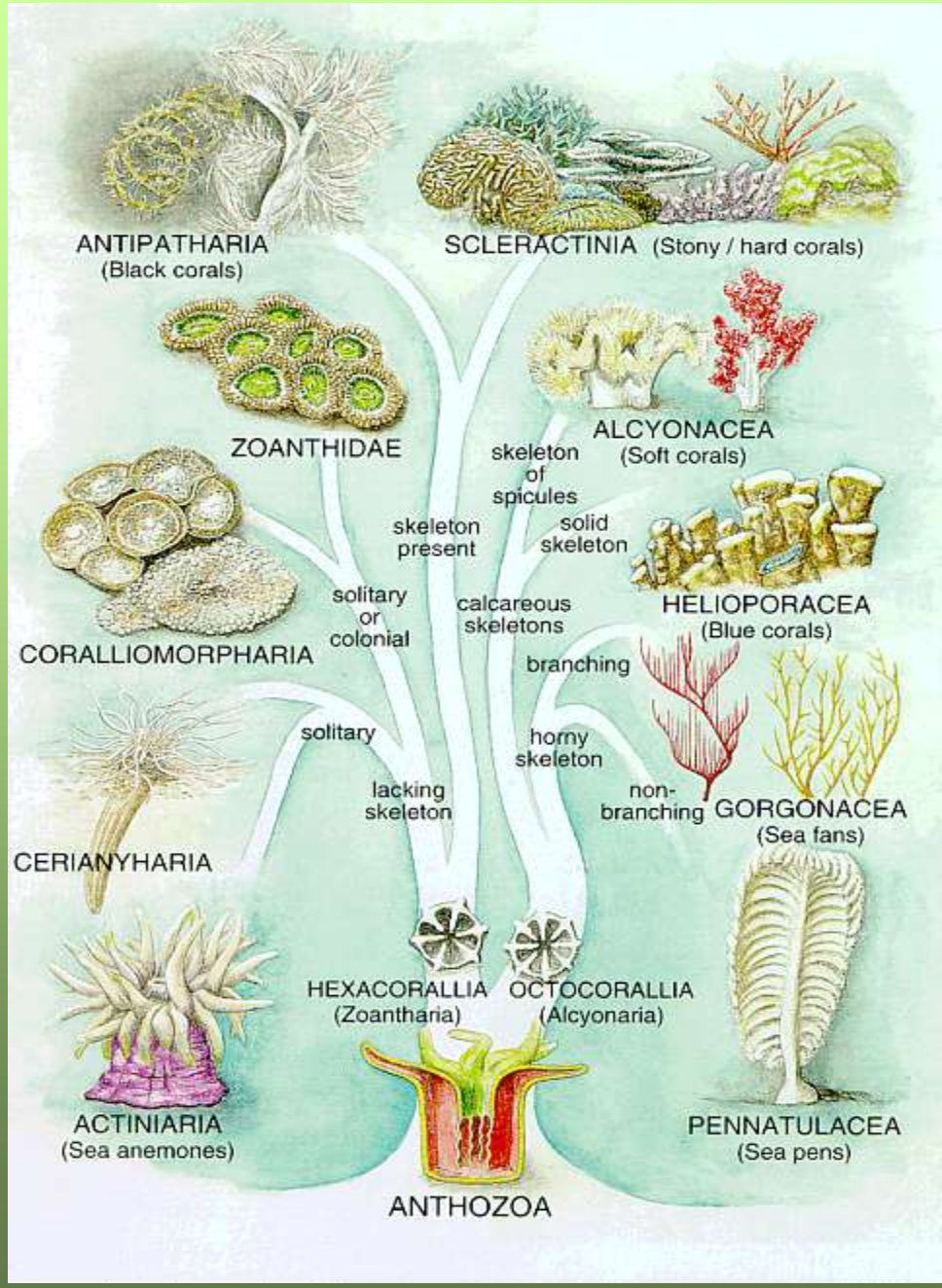
- (*Chironex fleckeri*)

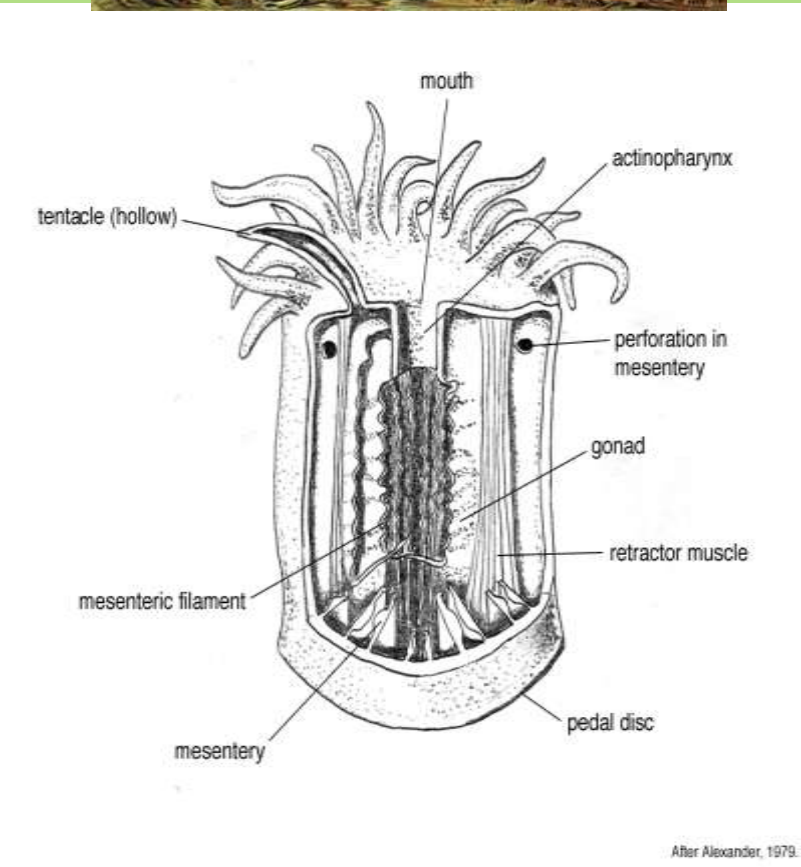
Polyp transforms (into) medusae stage



4. Anthozoa

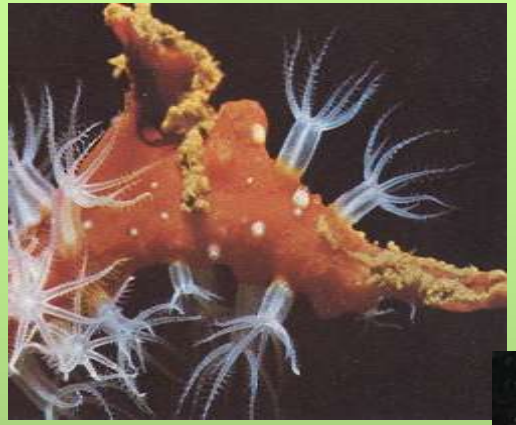
- **„Sea anemones, corals, sea pens“**
- **only sessile**
- Anemones and certain species of coral live in isolation, however most corals **form colonies** of genetically identical polyps; these polyps closely resemble anemonies in structure, although are generally considerably smaller.
- Most kinds of stony coral live in all parts of the underwater world.





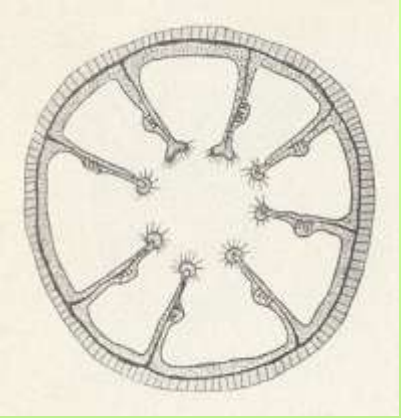
- **anthozoans do not have a medusa stage in their development.**
- they release sperm and eggs that form a planula, which attaches to some substrate on which the cnidarian grows
- Some anthozoans can also reproduce asexually through budding.

Anthozoa



- **Octocorallia**

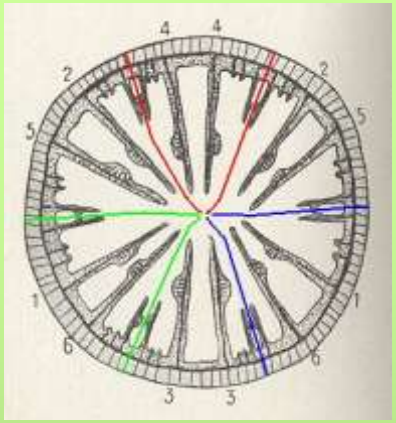
- **Hexacorallia**
  - Actiniarida
  - Madreporarida



Octocorallia

8-way symmetry in polyp structure

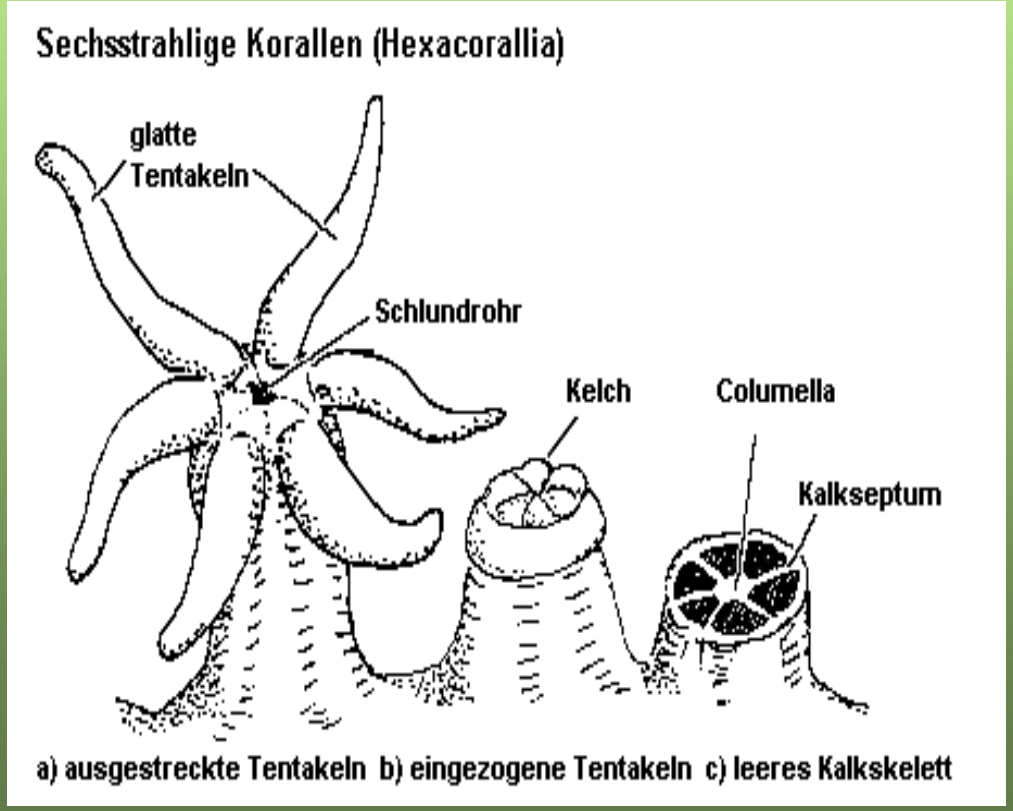
Corallium rubrum



Hexacorallia

- 6 -way symmetry in polyp structure

1. Actiniarida
2. Madreporarida



Actiniarida

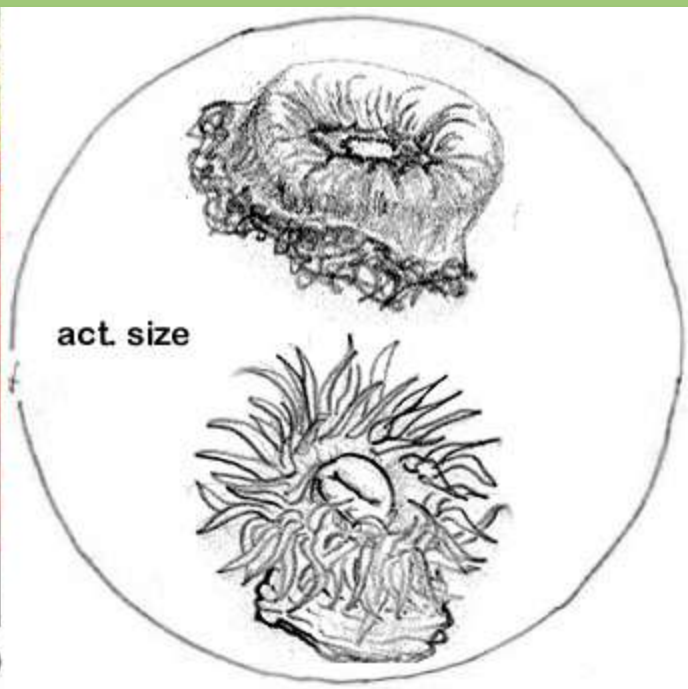
Actinia equina

„ The Beadlet anemone“

- *A.e.* is found primarily in the North Atlantic Ocean and the Mediterannean Sea.
- One of the most abundant concentrations of the species can be found around the British Isles.

- **sessile**
- **no skelet**

Actinia equina (at high tide)



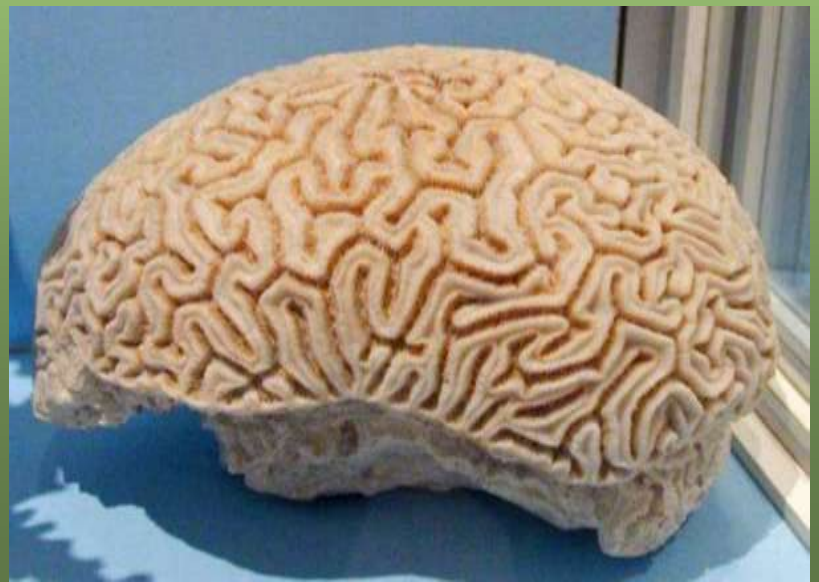
Madreporarida

Acropora

The Great Barrier Reef, Australia

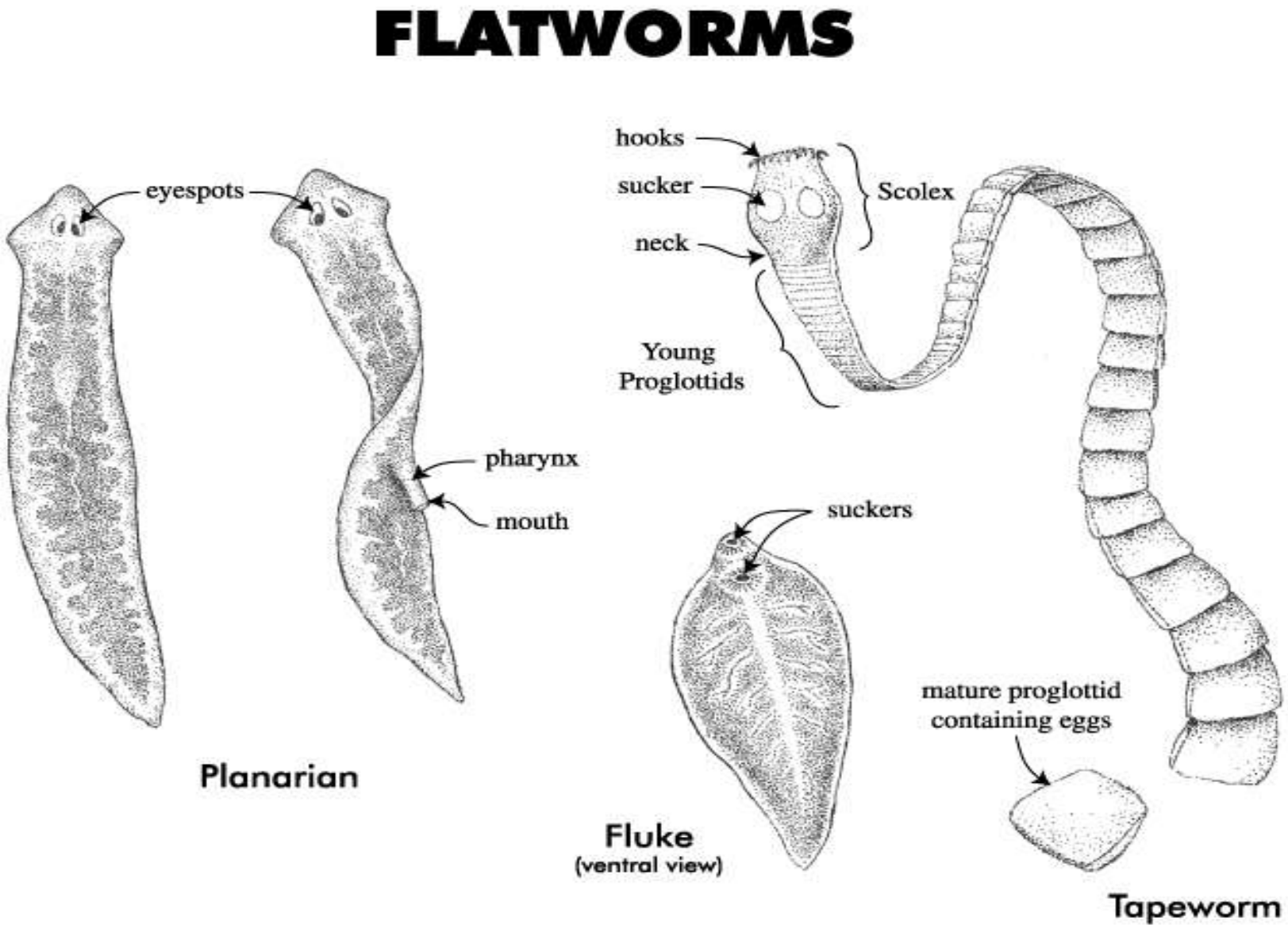
- 2 000 km long

Diploria cerebriformis

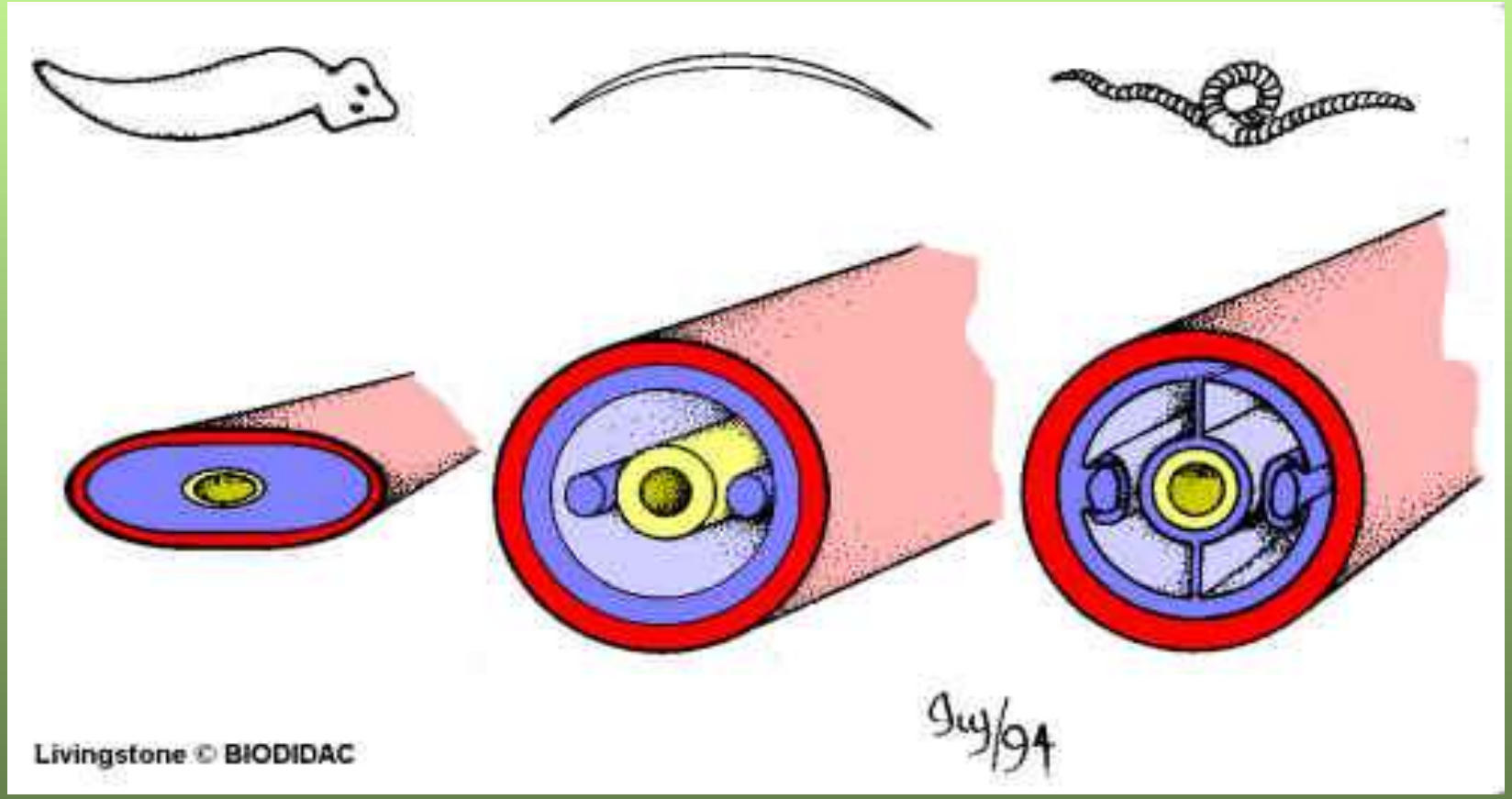


The Great Barrier Reef, Australia

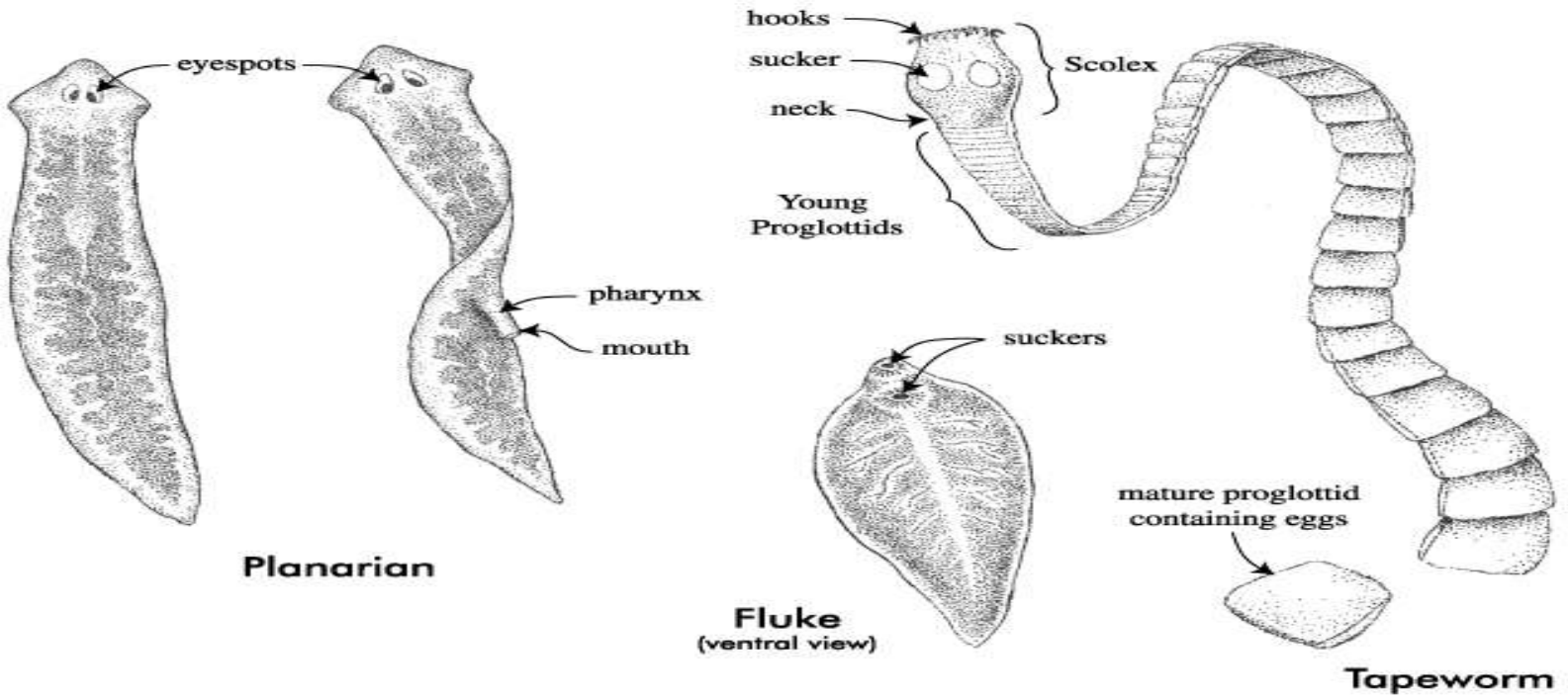
Platyhelminthes



the acoelmates, pseudocoelomates, and coelomates



FLATWORMS

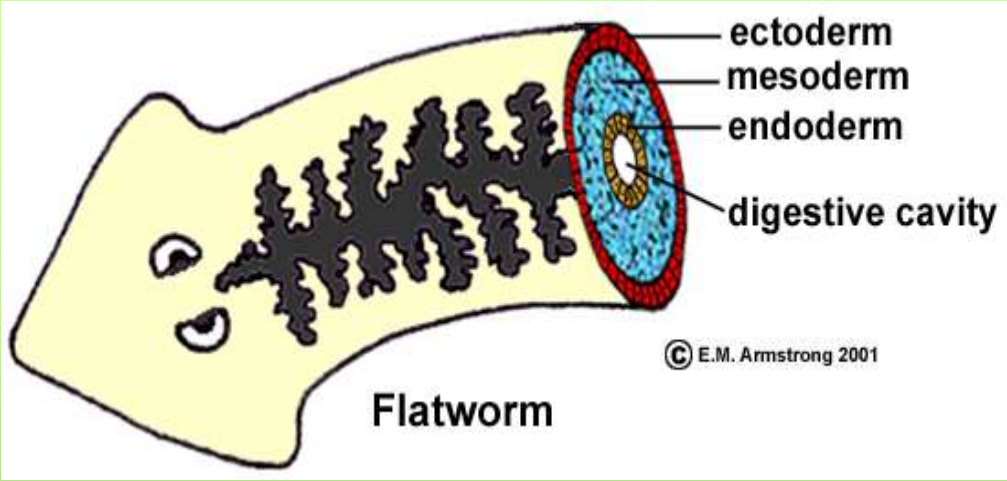


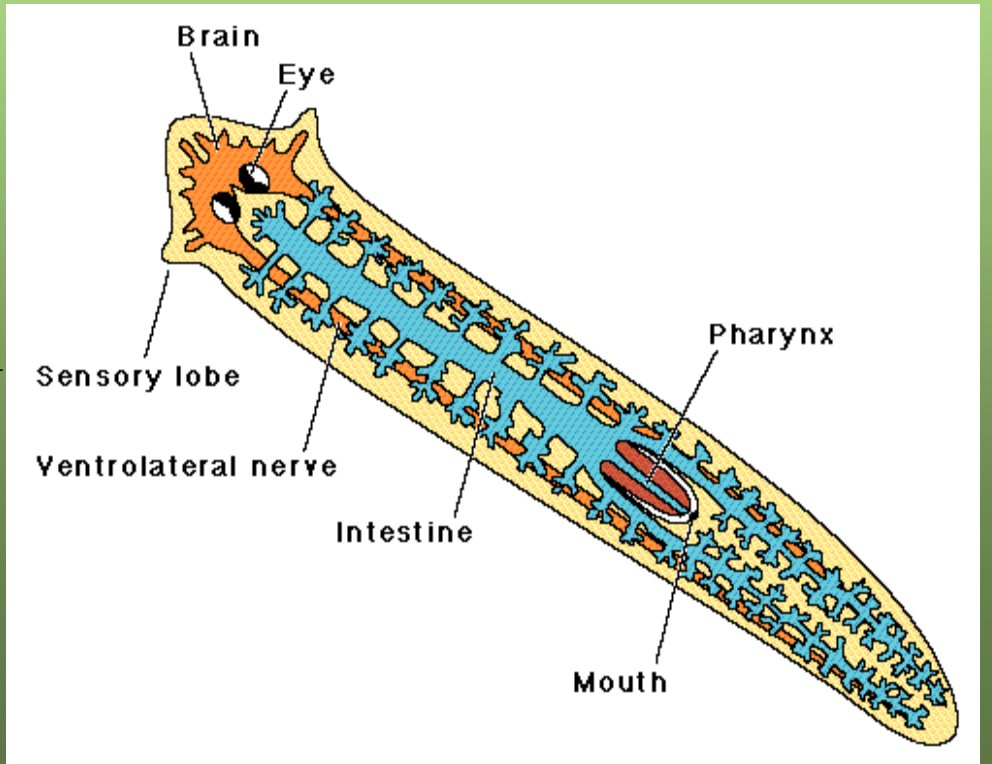
flatworms consist of four classes of

- free-living **turbellaria** (Planarian)
- parasitic **monogeneans**, **digeneans (Flukes)** and **tapeworms**

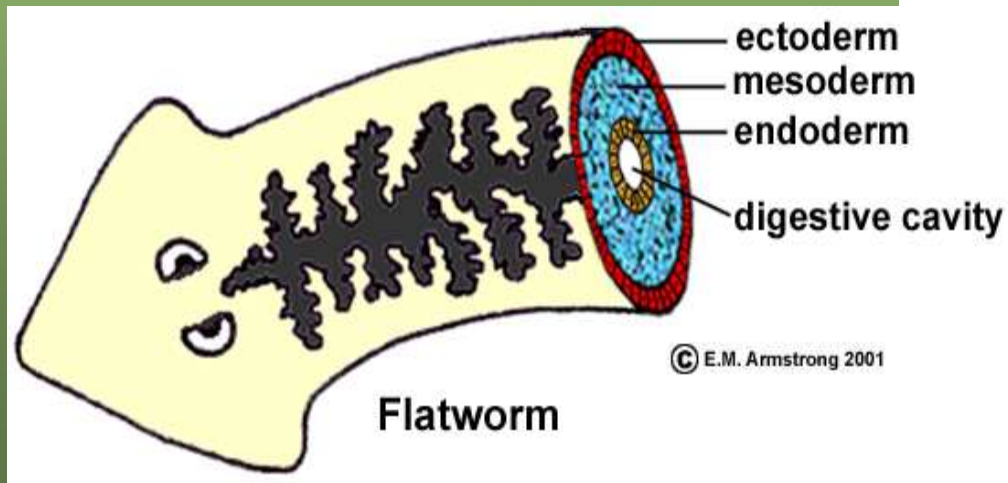
most flat worms are hermaphrodites

- **triploblastic**
- no body cavity (lack a coelom)
- bilaterally symmetrical
- lack an anus
- lack respiratory or circulatory system
- respire by **diffusion**
- pharyngeal opening takes food and excretes waste
- highly branched gut transports food to all parts of the body –
  (this is lacking in many parasitic species)





- cephalized nervous system consisting of a cerebral ganglion
  - usually attached to longitudinal nerve cords that are interconnected across the body by transverse branches



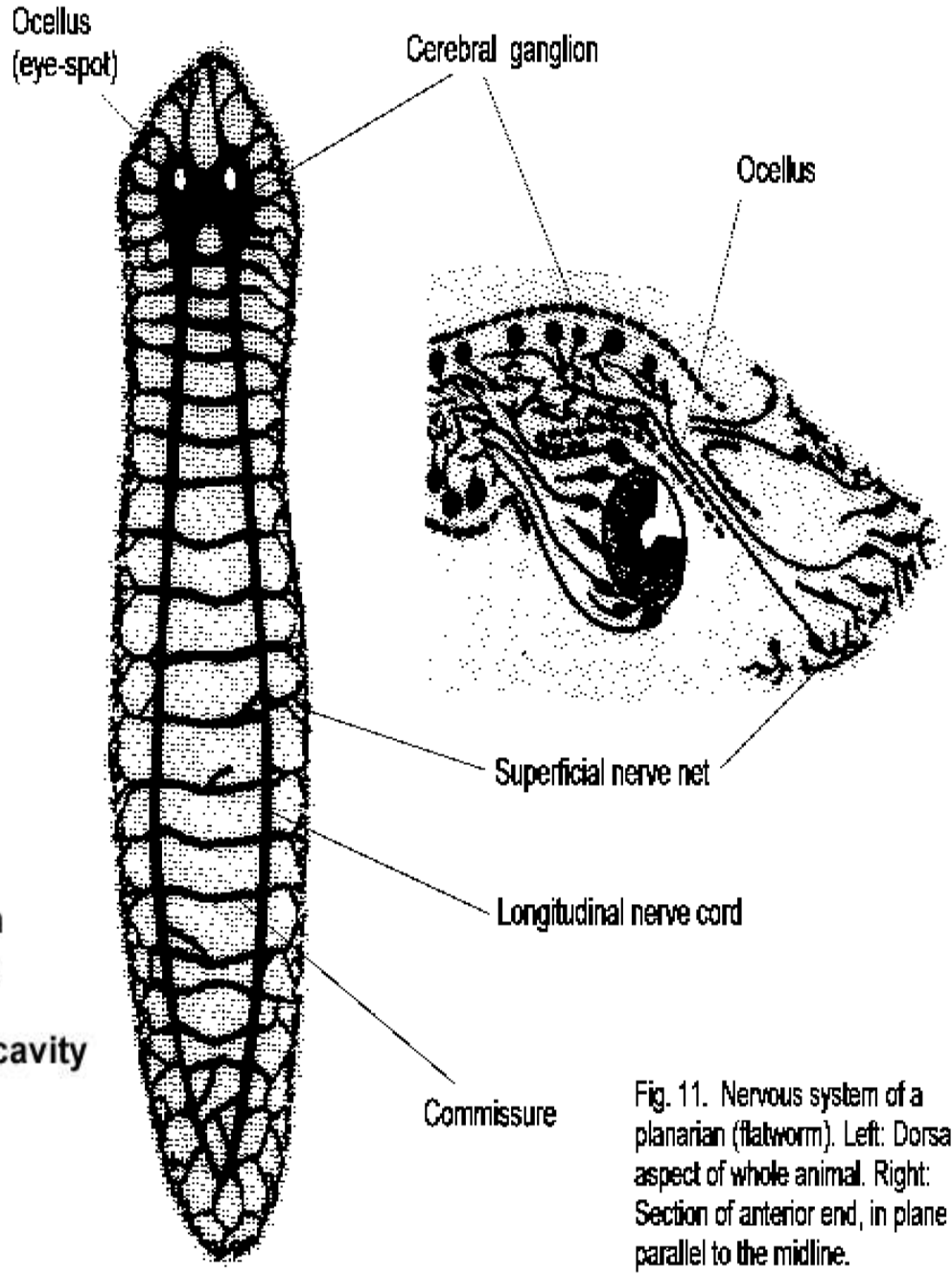
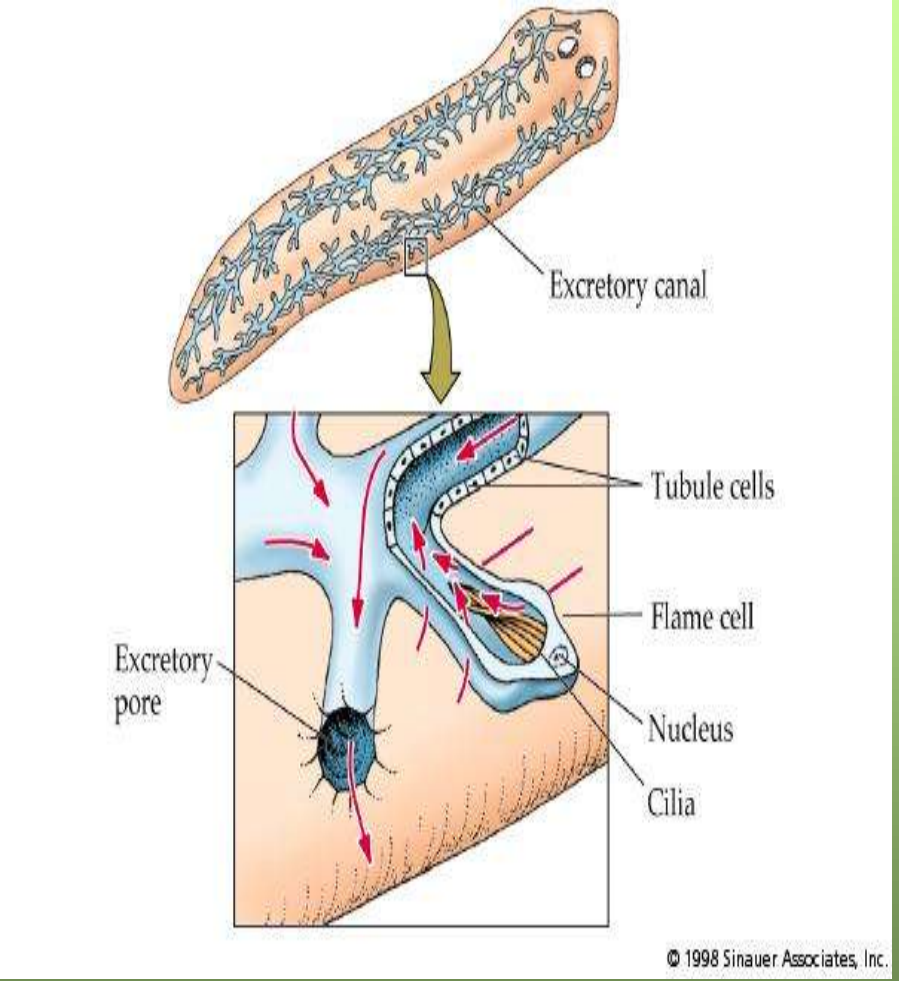


Fig. 11. Nervous system of a planarian (flatworm). Left: Dorsal aspect of whole animal. Right: Section of anterior end, in plane parallel to the midline.

Excretion and osmoregulation

- controlled by "flame cells" located in the protonephridia
  (it is **absent in some forms***)*
- these functions take place by absorption through the body wall



1. class: Turbellaria

- mostly free-living flatworms
- few are parasitic

- inhabitants of fresh or marinewaters and moist terrestrial habitats

<u>The body:</u>

- elongated
- relatively soft
- usually tapered at the ends

Turbellarians

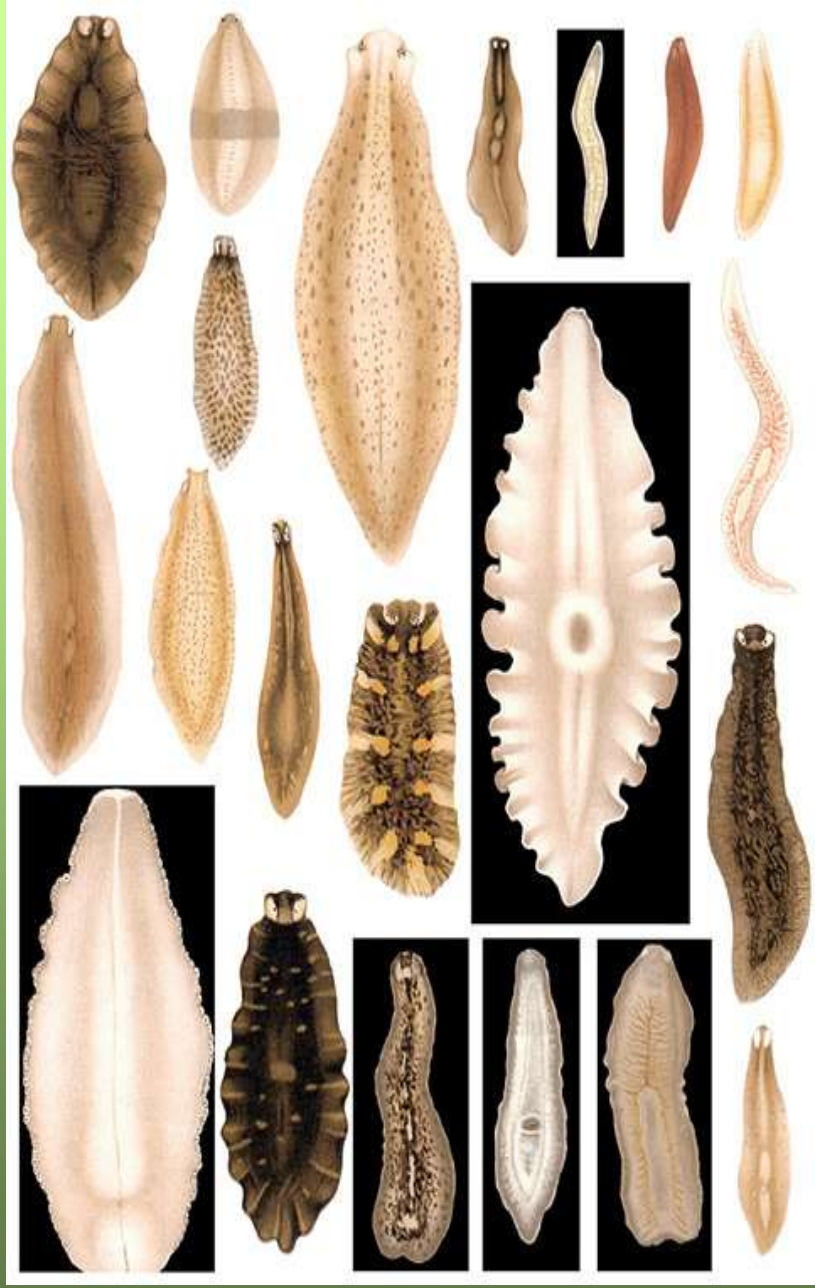
may be:

- Colourless or coloured

(white, red, bluish, green, black, brown, yellowish)

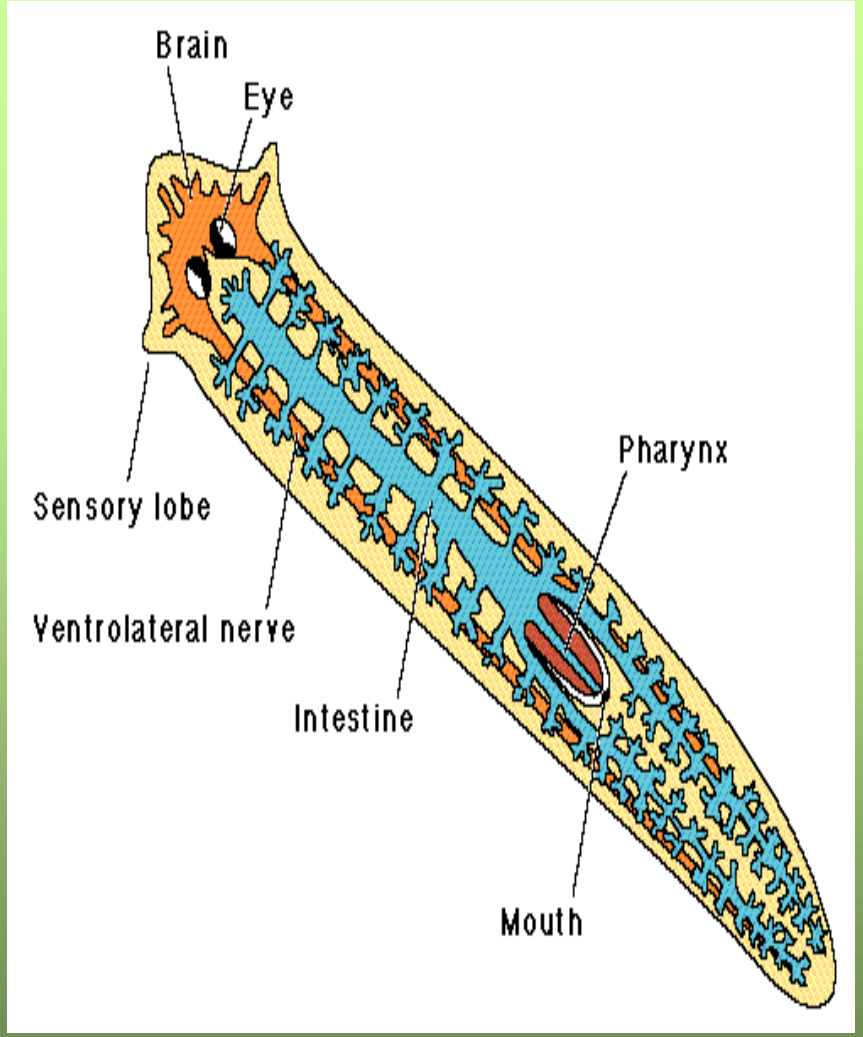
- depending on epidermal and parenchymal pigments, gut content, and symbiotic algae

- Most turbellarians are: Detritivores or zoophagous



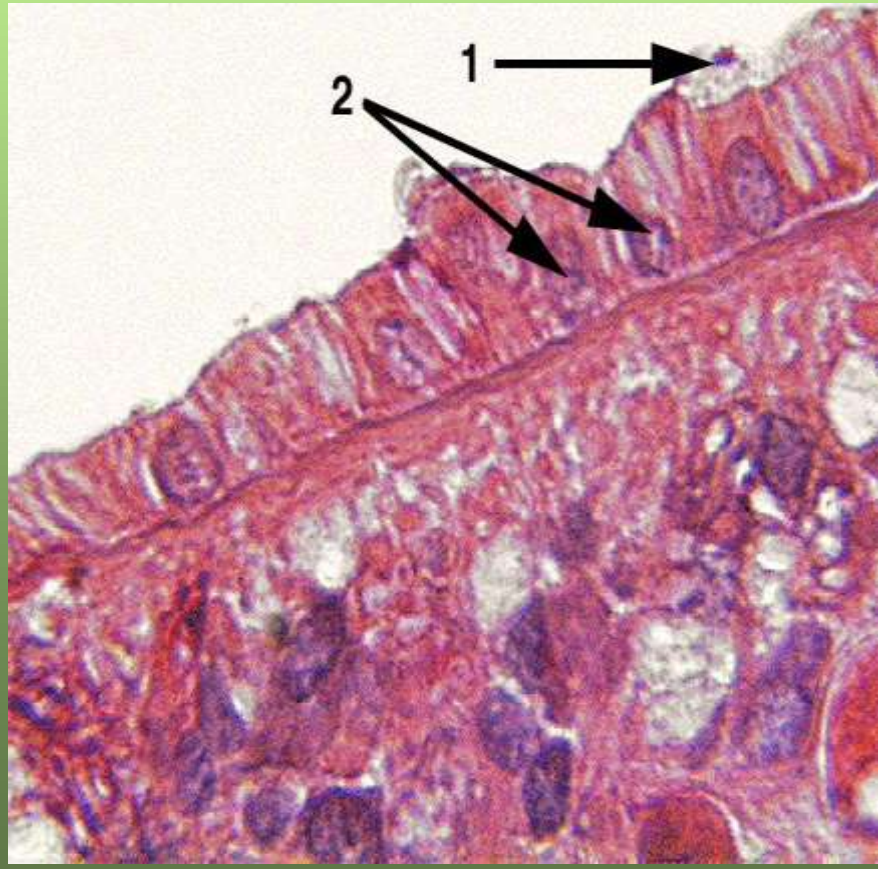
Turbellaria

intestine without anus,
ventral mouth



Movement

- is controlled by longitudinal, circular, and oblique layers of muscle
- Others move along slime trails by the beating of epidermal cilia



Photomicrograph of a longitudinal section through the turbellarian epidermis, showing **cilia (1) and**

Freshwater turbellarians

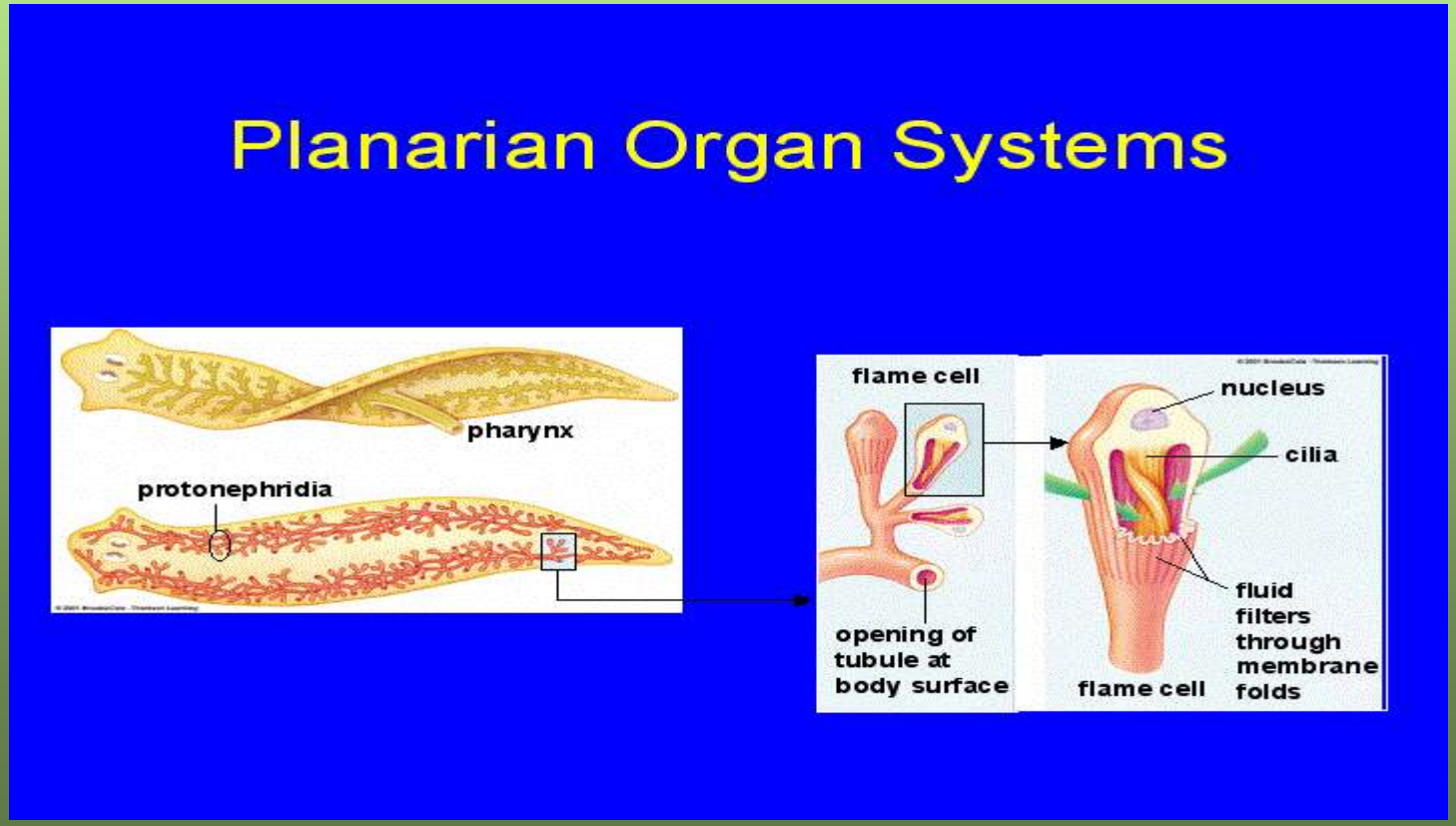
- largely free-living animals

- a few European freshwater species are ectoparasitic on crustaceans

Turbellarians or planarians *(Turbellaria)*

* Possess a pharynx tube that extends to feed on whole small animals or suck tissues from dead or wounded prey

•have protonephridia, with flame cells, to regulate body fluid volume and composition



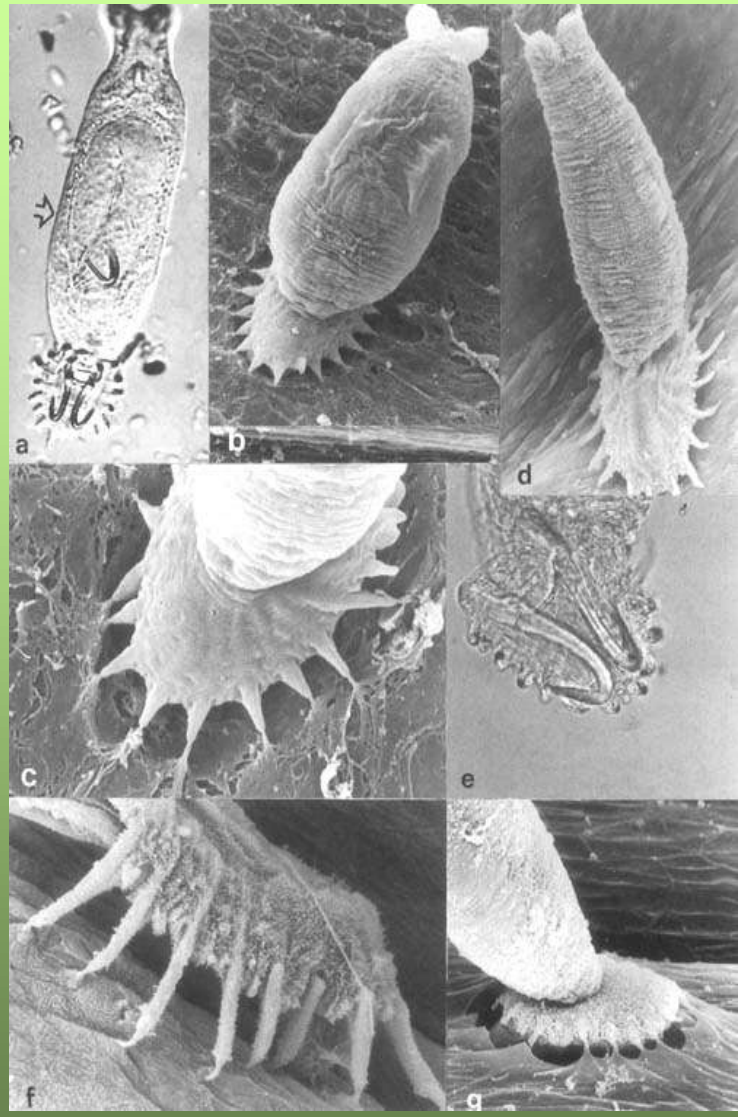
Reproduction

- sexually or asexually (Asexual reproduction is by fission of the body).
- self-fertilization
- **hermaphroditic**
- Miniature replicas of the adult **hatch directly from eggs**
- an absence of a reproductive system in juveniles
- Some freshwater turbellarians may be ovoviviparous (*Mesostoma*) or may have a larval stage distinctly different from the adult (*Rhynchoscolex*).

Development is:

- **direct** (eggs hatch into tiny worms that resemble the adults)
- **indirect** (with a ciliated larval form)

2.class:
Monogeneans

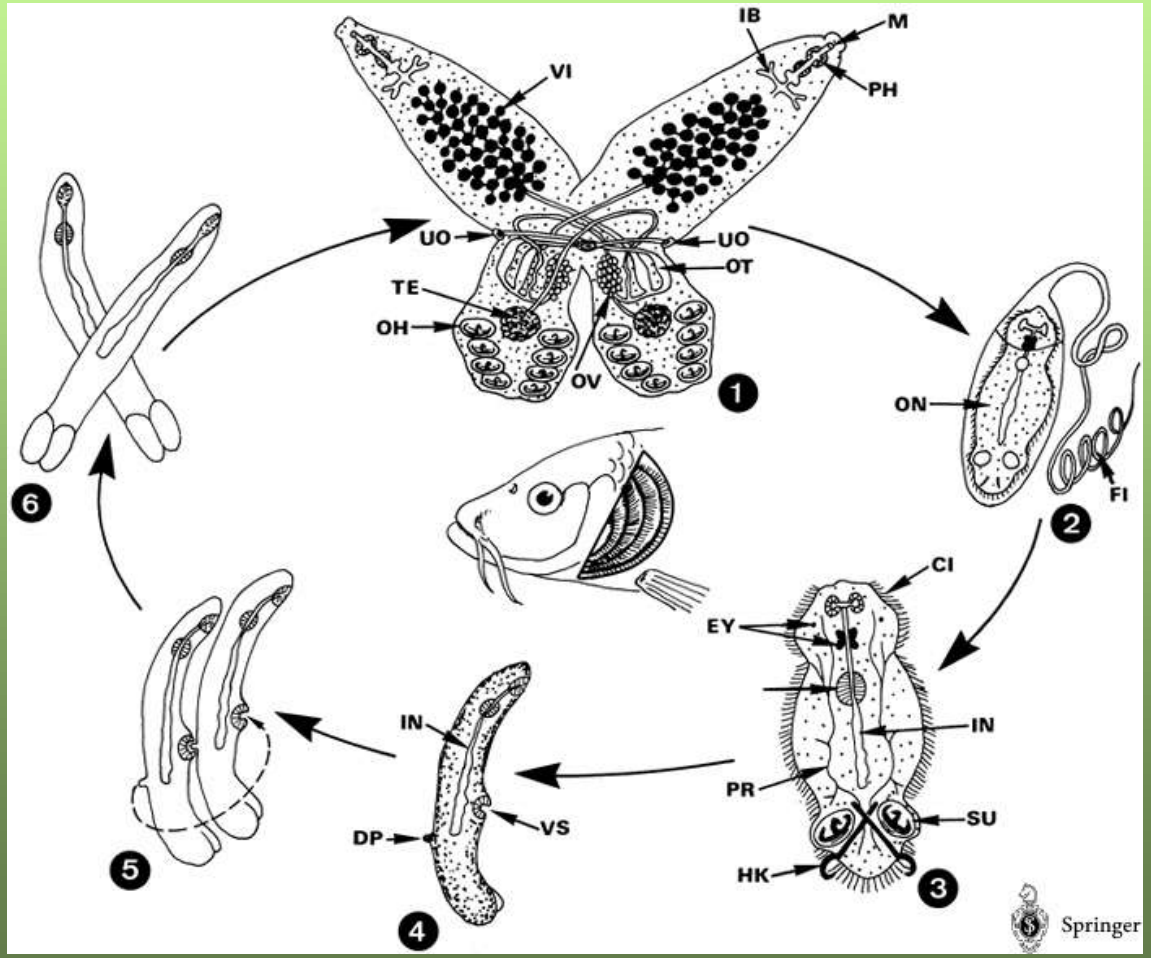


•parasites

•commonly found on the gills, skin or fins of fishes and lower aquatic invertebrates.

•Monogeneans have a **series of hooks** that enable them to attach while feeding

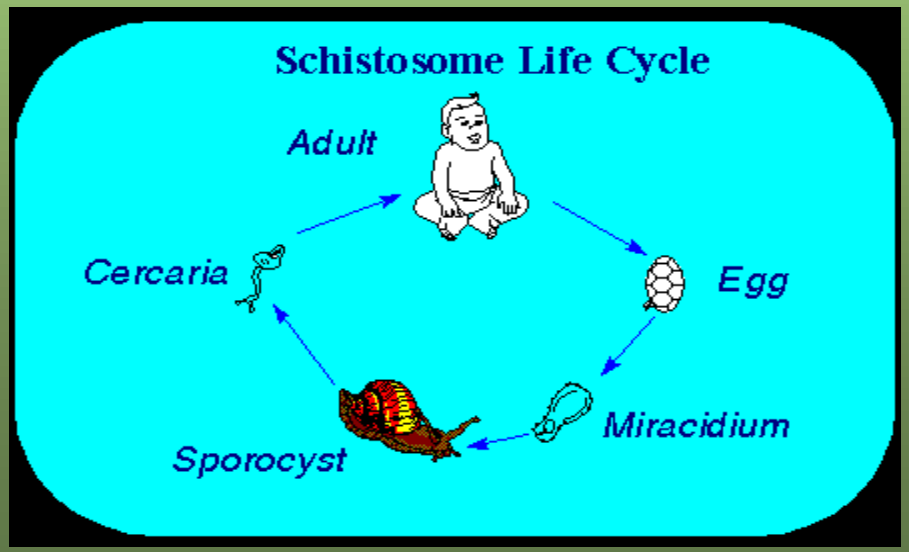
Life cycle of *Diplozoon paradoxum* on the gills of cyprinid fish



1 Adults on the gills of fish. ***2*** Egg with an larva. ***3*** Free oncomiracidium. ***4*** After attachment to the gills of a host the oncomiracidium is transformed into the diporpas larva. ***5, 6*** Fusion of two diporpas on the host; each attaches its sucker (*VS*) to the dorsal papilla (*DP*) of the other. This process stimulates their maturation and cross-fertilization. The blood-sucking adults can live for years in this form of complete copulation. *CI*, *DP*, dorsal papilla; *EY*, eyes; *FI*, filament; *HK*, hook; *IB*, intestinal branch; *IN*, intestine; *M*, mouth; *OH*, with suckers; *ON*, oncomiracidium; *OT*, ootyp, *OV*, ovary; *PH*, pharynx; *PR*, ; *SU*, sucker (clamps); *TE*, *UO*, uterus opening; *VI*, (vitelline gland); *VS*, ventral sucker

3. Trematoda or digenea („flukes“):

- all parasitic
- complex life cycles specialized in parasitism in animal or human tissues
- a number of juvenile stages that are parasitic in one, two, or more **intermediate hosts** before adulthood, at which time they parasitize a **definitive host**

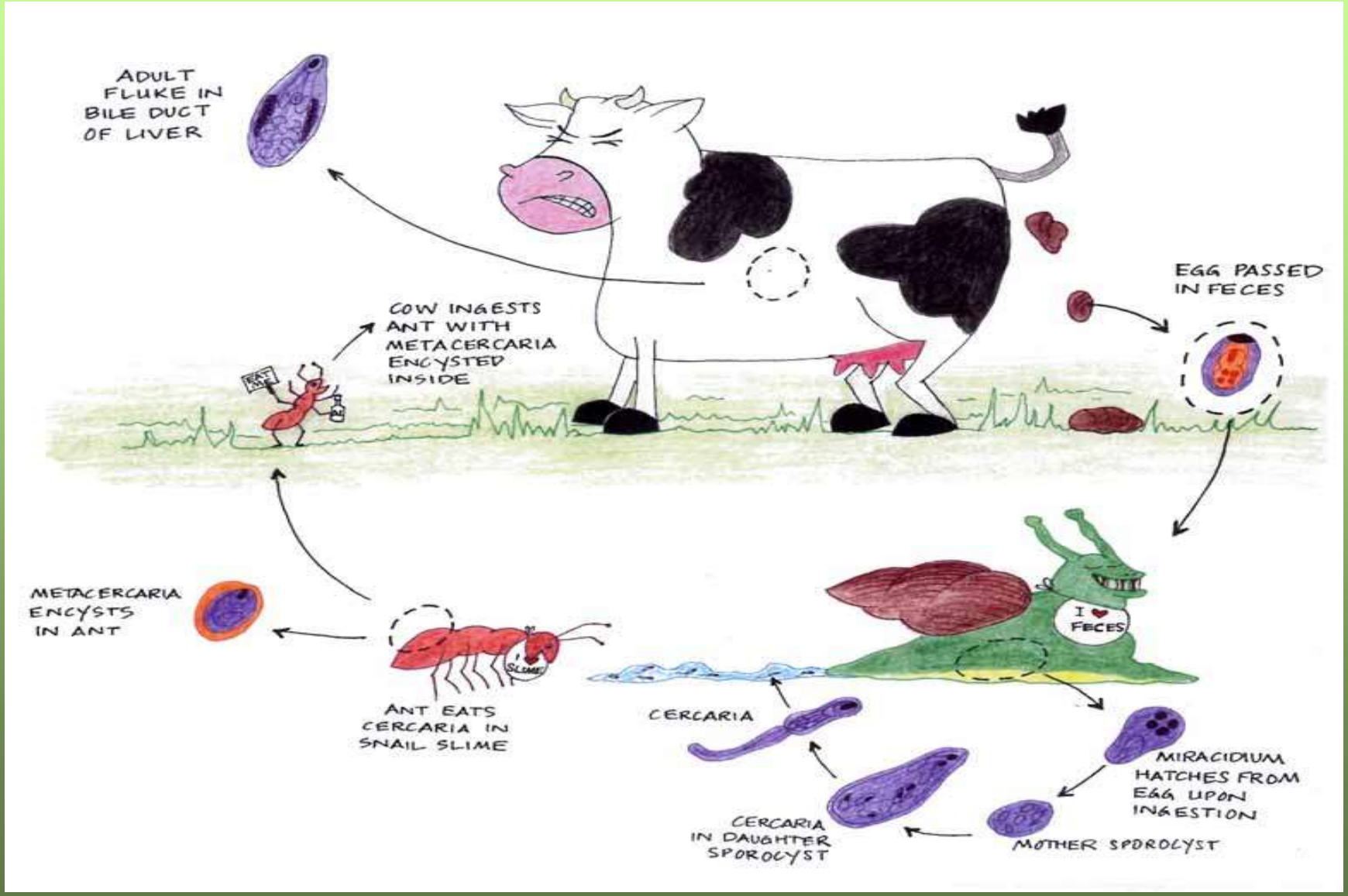


Digeneans as adult flat worms,
have **two suckers**.

Digeneans are endoparasites

- Life cycle involves two to four hosts and a number of developmental stages, including two types of free-living larvae
- The definitive (final) host of adult is always a vertebrate
- Snails are common intermediate hosts

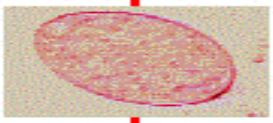
Dicrocoelium dendriticum



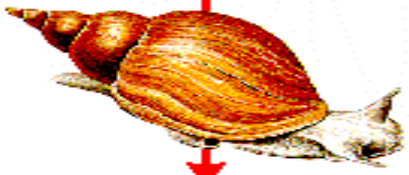
The Life Cycle of *Fasciola hepatica*
(the sheep liver fluke)

The worms reach sexual maturity in the bile ducts.

Eggs are passed in the host's feces.



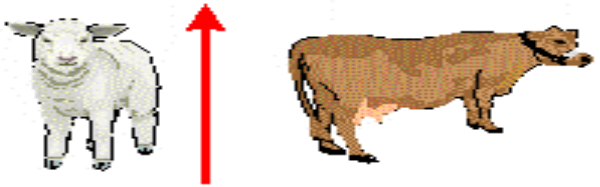
The eggs hatch, and the miracidium penetrates the first intermediate host, a snail.



The parasite reproduces asexually within the snail, and cercariae are produced.

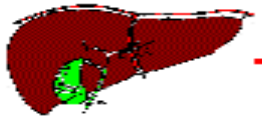
The cercaria "encysts" on vegatation, resulting in a metacercaria.

The definitive host is infected when it ingests metacercariae that are on vegatation.



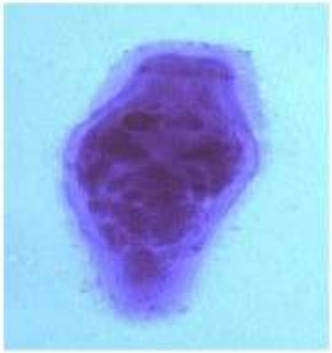
The metacercaria "excysts" in the small intestine, and the immature worm burrows through the intestinal tract.

The worm migrates through the peritoneal cavity, into the liver, and finally into a bile duct.



(Parasites and Parasitological Resources)

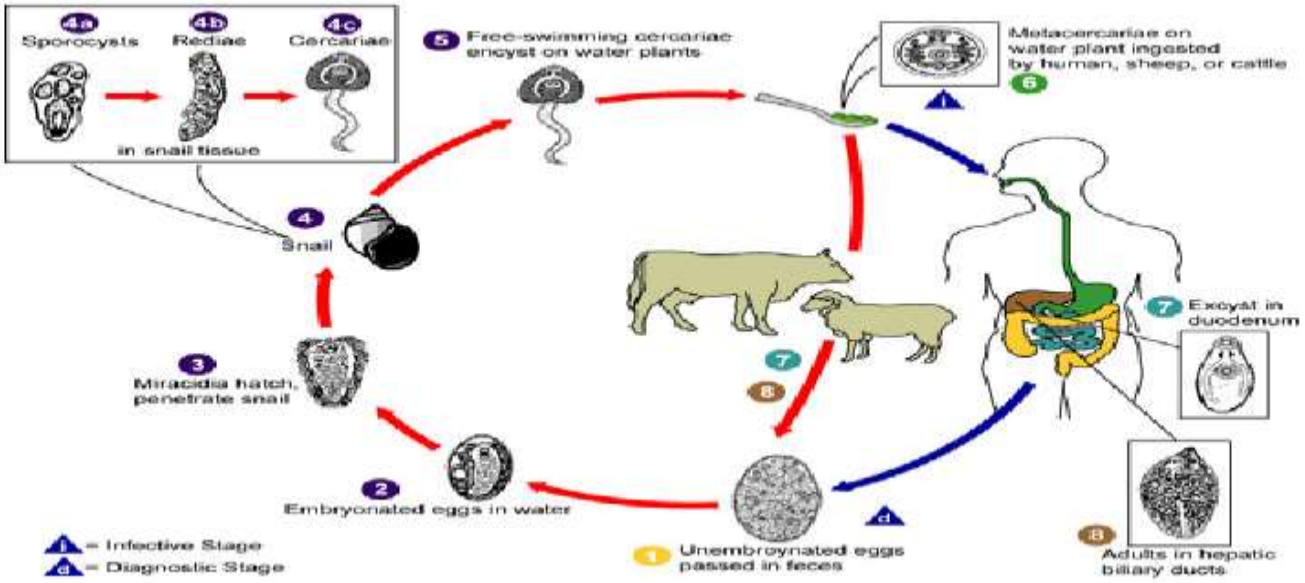
vajícko



miracidium

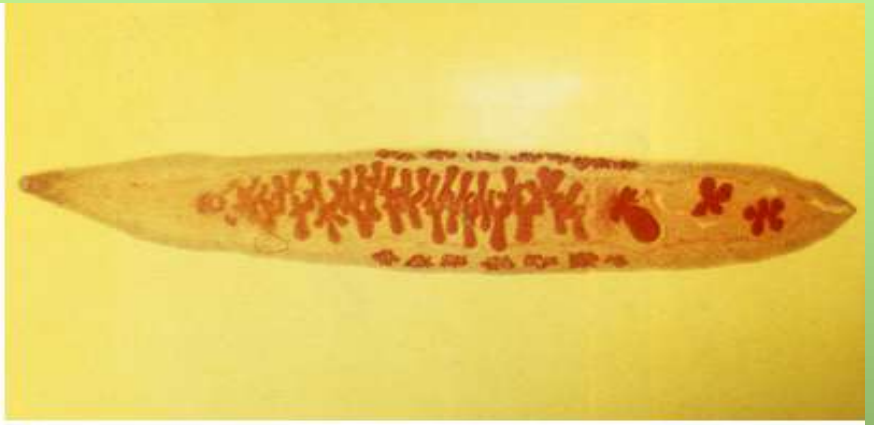
redie

cerkarie



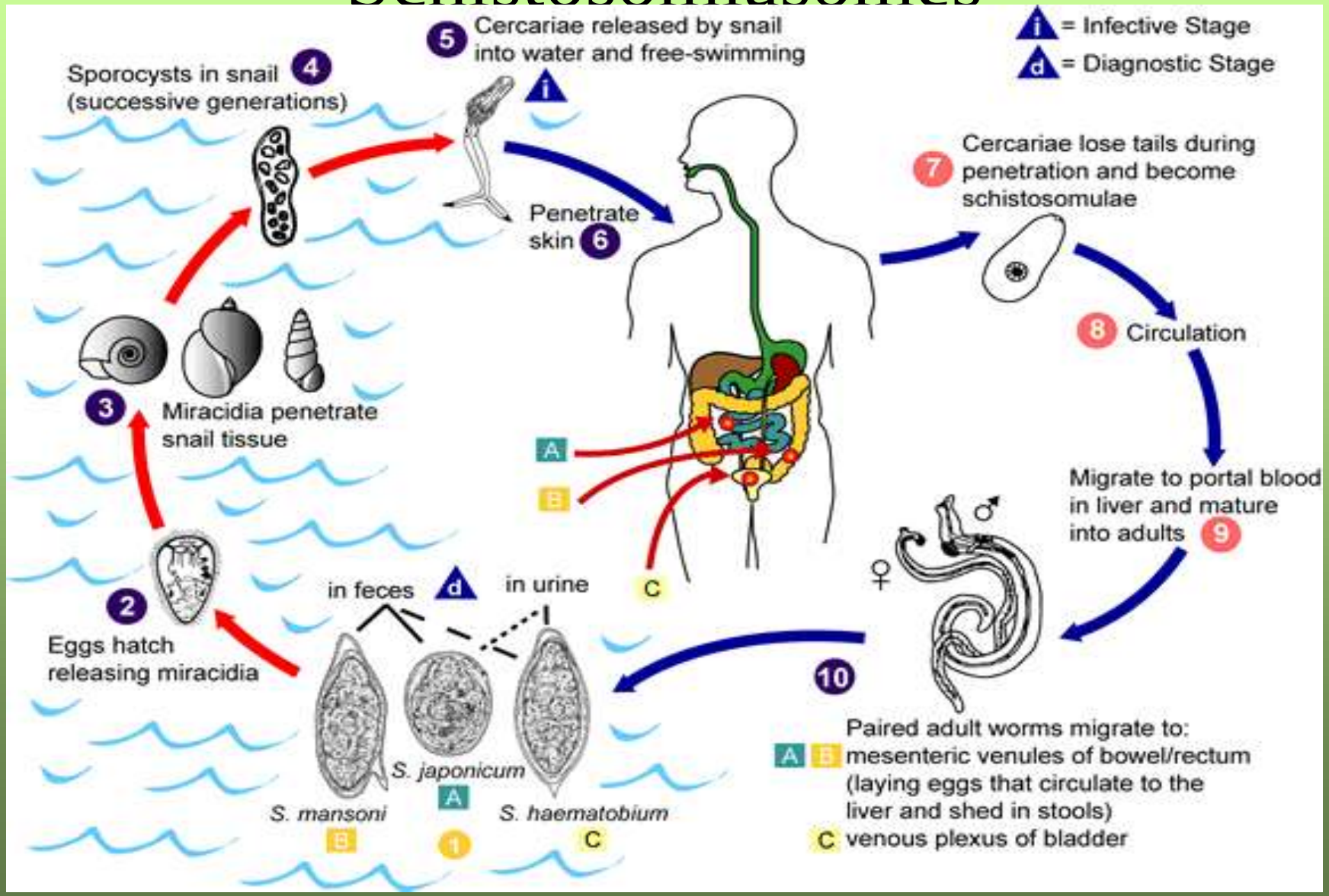
The species that infect humans can be divided into groups: Schistosomiasomes and non-Schistosomiasomes

Dicrocoelium dendriticum and *Opisthorchis* sp. liver flukes of mammals

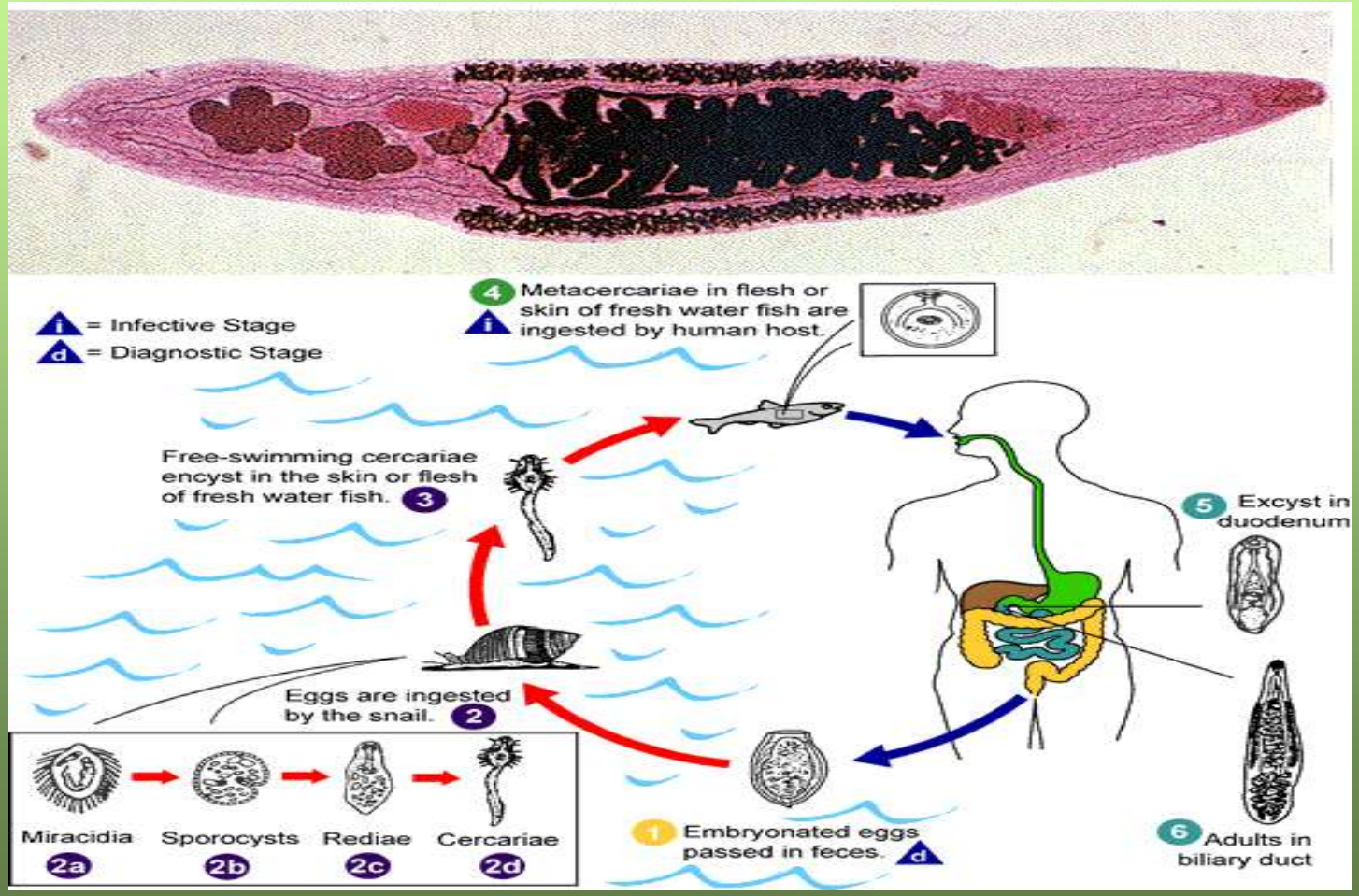


blood flukes, *Schistosoma* spp. are among most widespread and serious parasites of humans

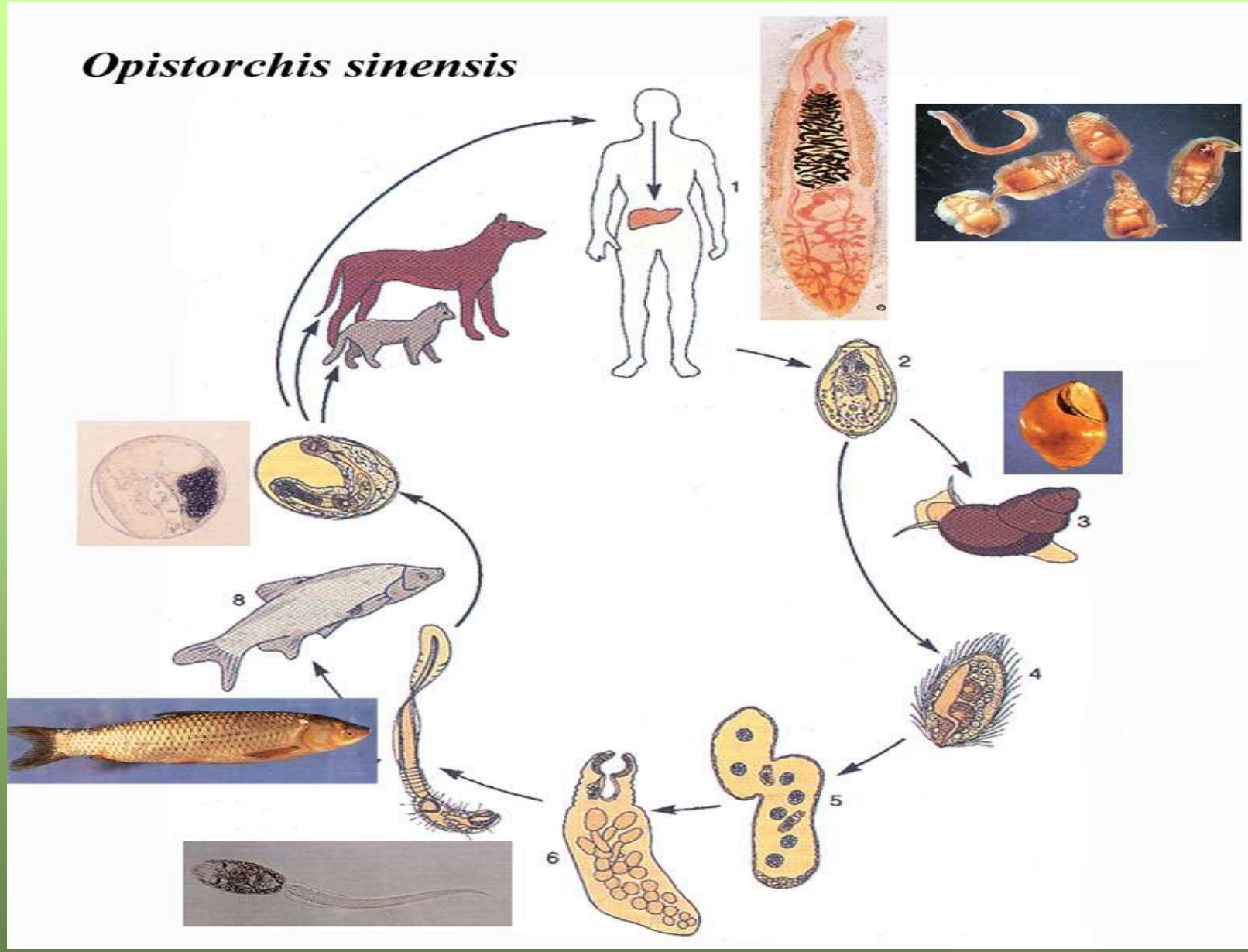
Schistosomiasomes

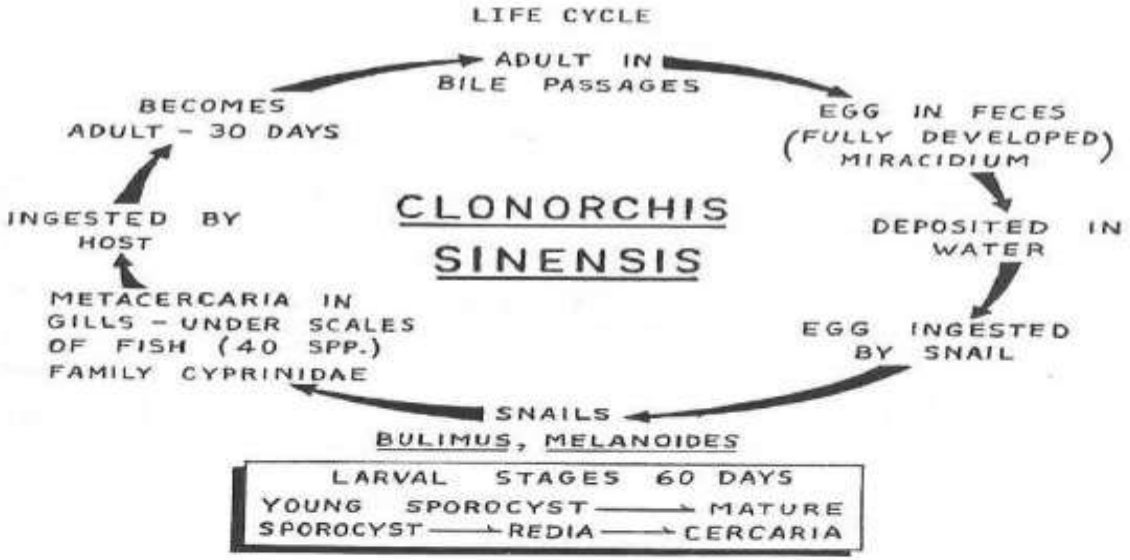


Opistorchis felineus syn. tenuicolis



Opistorchis sinensis



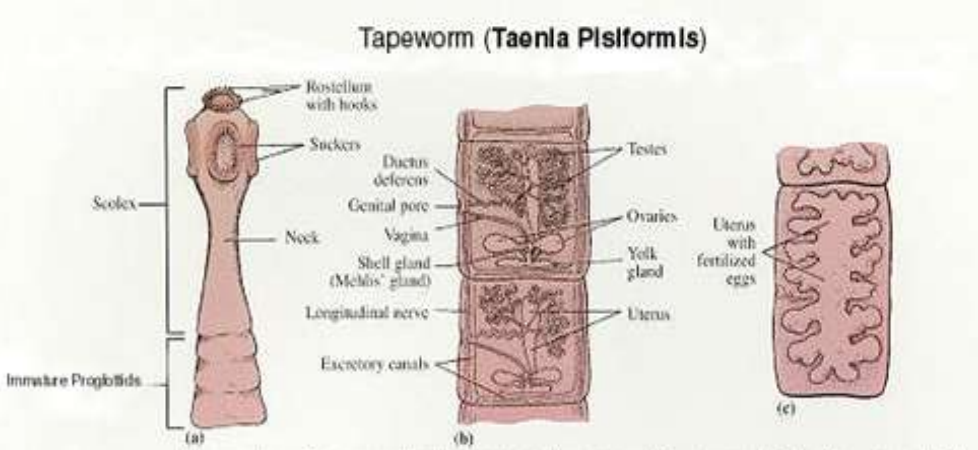

LIFE CYCLE
ADULT IN BILE PASSAGES
EGG IN FECES (FULLY DEVELOPED) MIRACIDIUM
DEPOSITED IN WATER
EGG INGESTED BY SNAIL
SNAILS
BULIMUS, MELANOIDES
LARVAL STAGES 60 DAYS
YOUNG SPOROCYST → MATURE SPOROCYST → REDIA → CERCARIA
METACERCARIA IN GILLS - UNDER SCALES OF FISH (40 SPP.) FAMILY CYPRINIDAE
INGESTED BY HOST
BECOMES ADULT - 30 DAYS
CLONORCHIS SINENSIS

4. Cestoda (tapeworms):

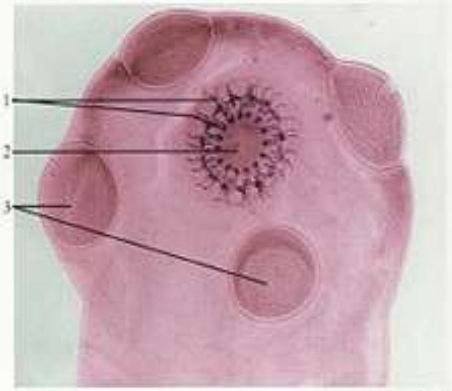
- intestinal parasites of vertebrates
- no digestive tract
- absorbtion predigested nutrients
- The body consists of an anterior **scolex** solely for attachment to the host's gut

and **a string of proglottids**,

each of which possesses both **male and female organs**

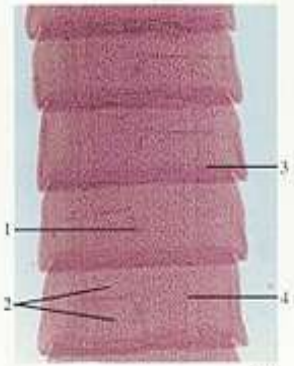


Diagrams of a parasitic tapeworm, *Taenia pisiformis*. (a) the anterior end, (b) mature proglottids, and (c) a ripe proglottid.



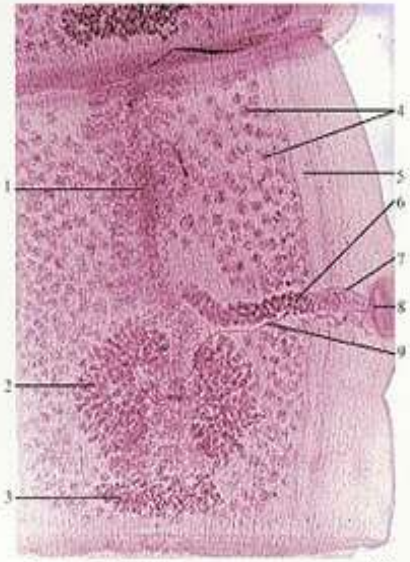
Scolex of *Taenia pisiformis*.
1. Hooks
2. Rostellum
3. Suckers

40X



40X

Immature proglottids of *Taenia pisiformis*.
1. Early ovary
2. Early testes
3. Excretory canal
4. Immature vagina and ductus deferens



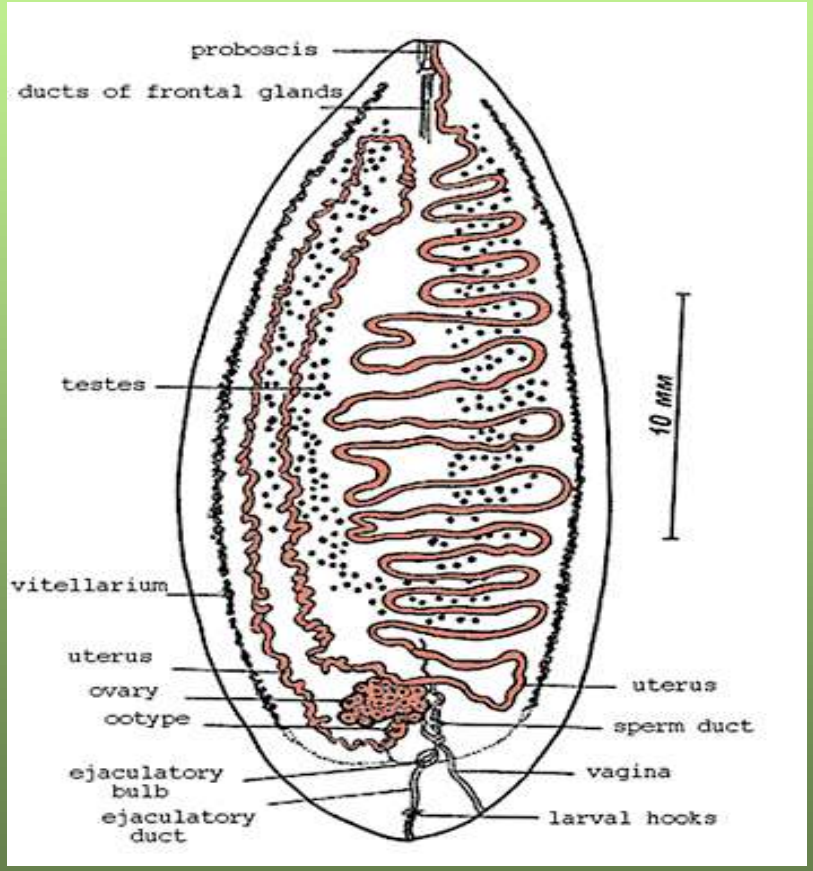
A mature proglottid of *Taenia pisiformis*.

40X

1. Uterus
2. Ovary
3. Yolk gland
4. Testes
5. Excretory canal
6. Ductus deferens
7. Cirrus
8. Genital pore
9. Vagina

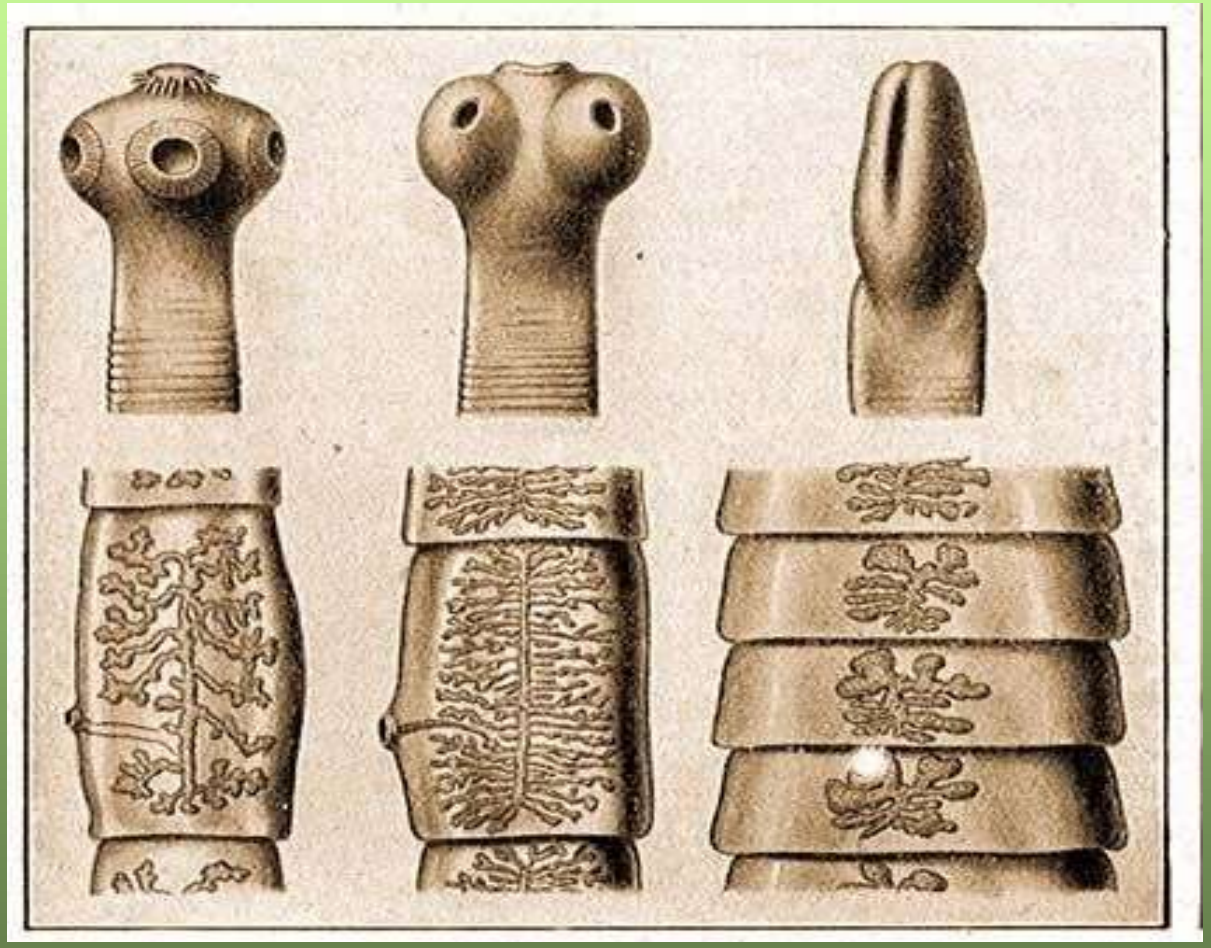
The Cestodaria

contains only a few species of **unusual worms**, their bodies are **unsegmented** and roughly oval in shape, they have only one set of reproductive organs and the larvae have 10 hooks for attachment.

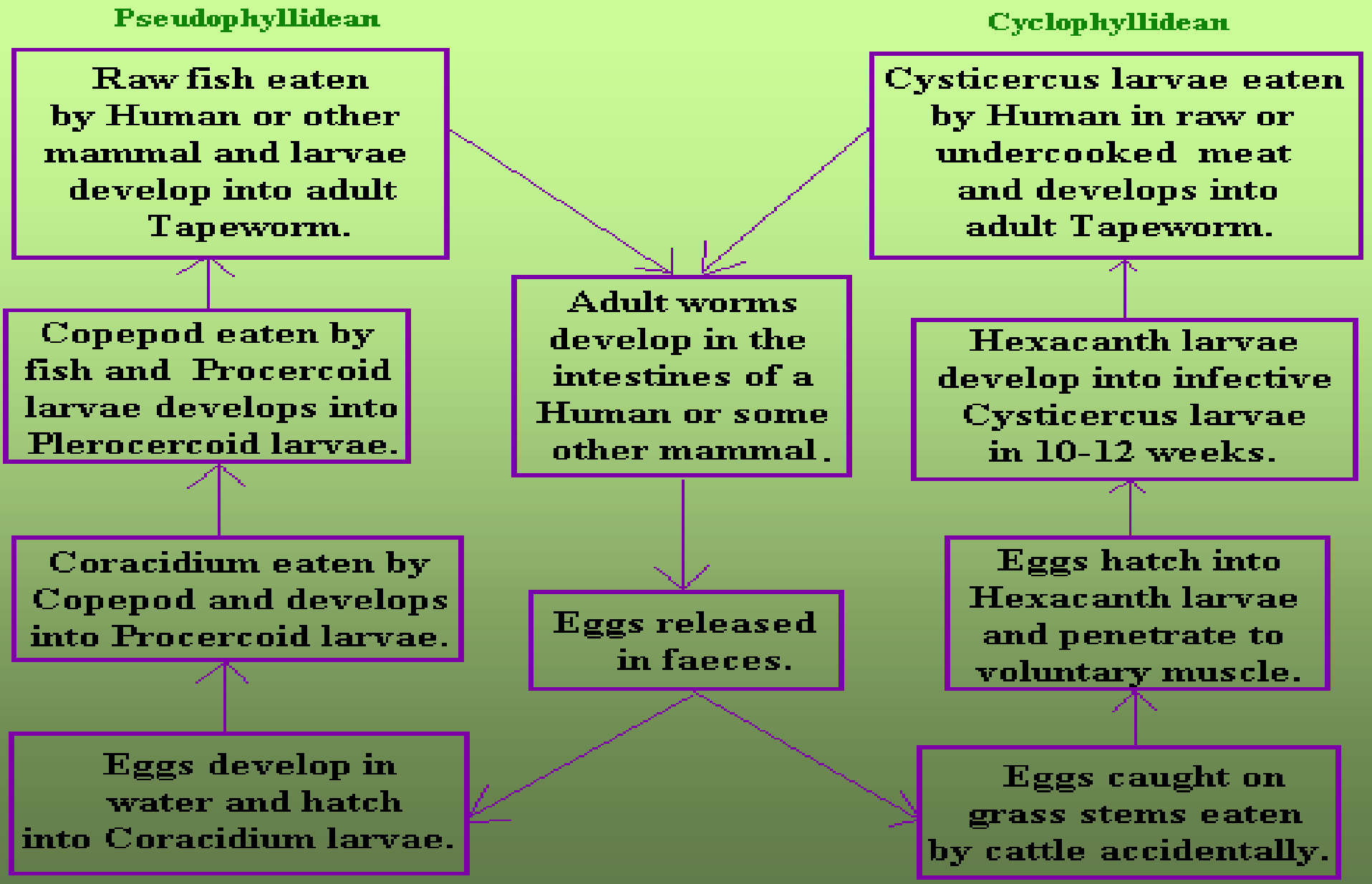


The subclass Eucestoda

The Eucestoda contains all the animals we usually think of as tapeworms.



Two Different Cestode Life Cycles



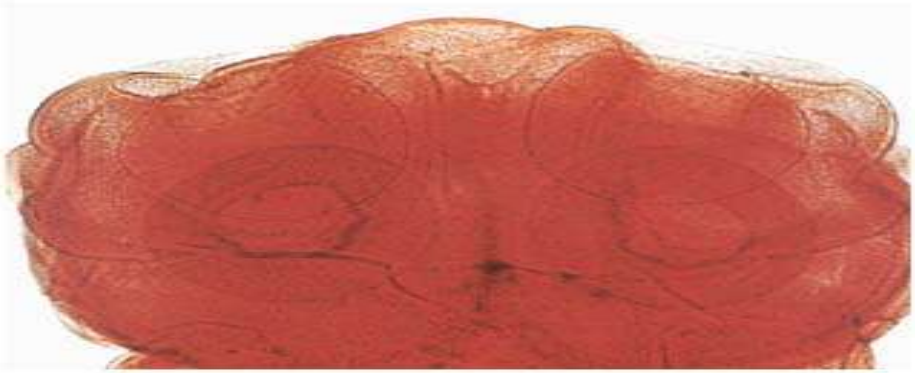
Order: Cyclophyllidea

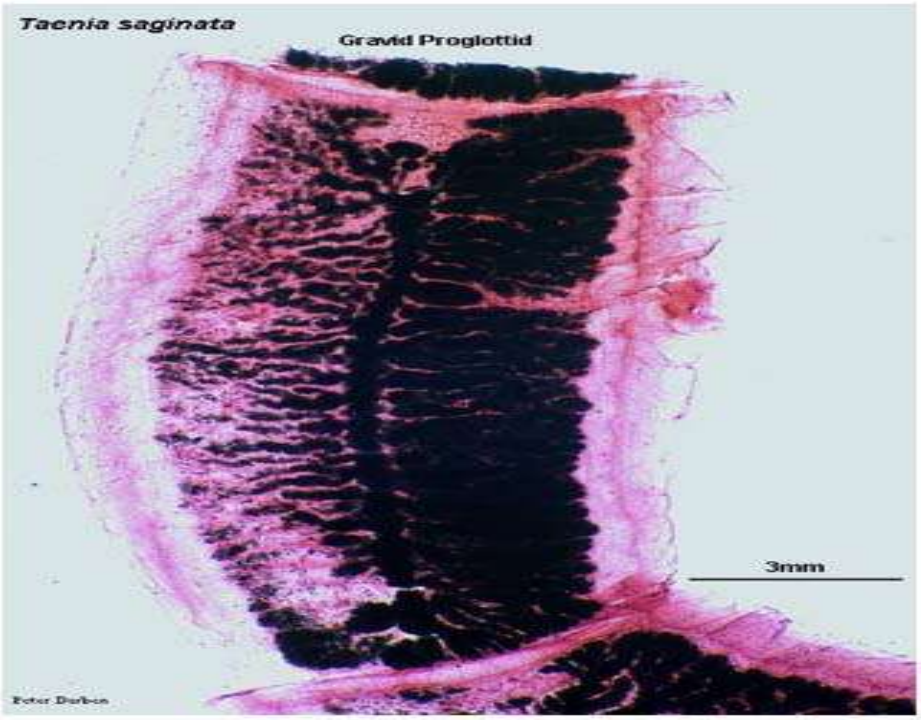
- **four acetabulate suckers**
- often armed with hooklets on an eversible **rostellum**.

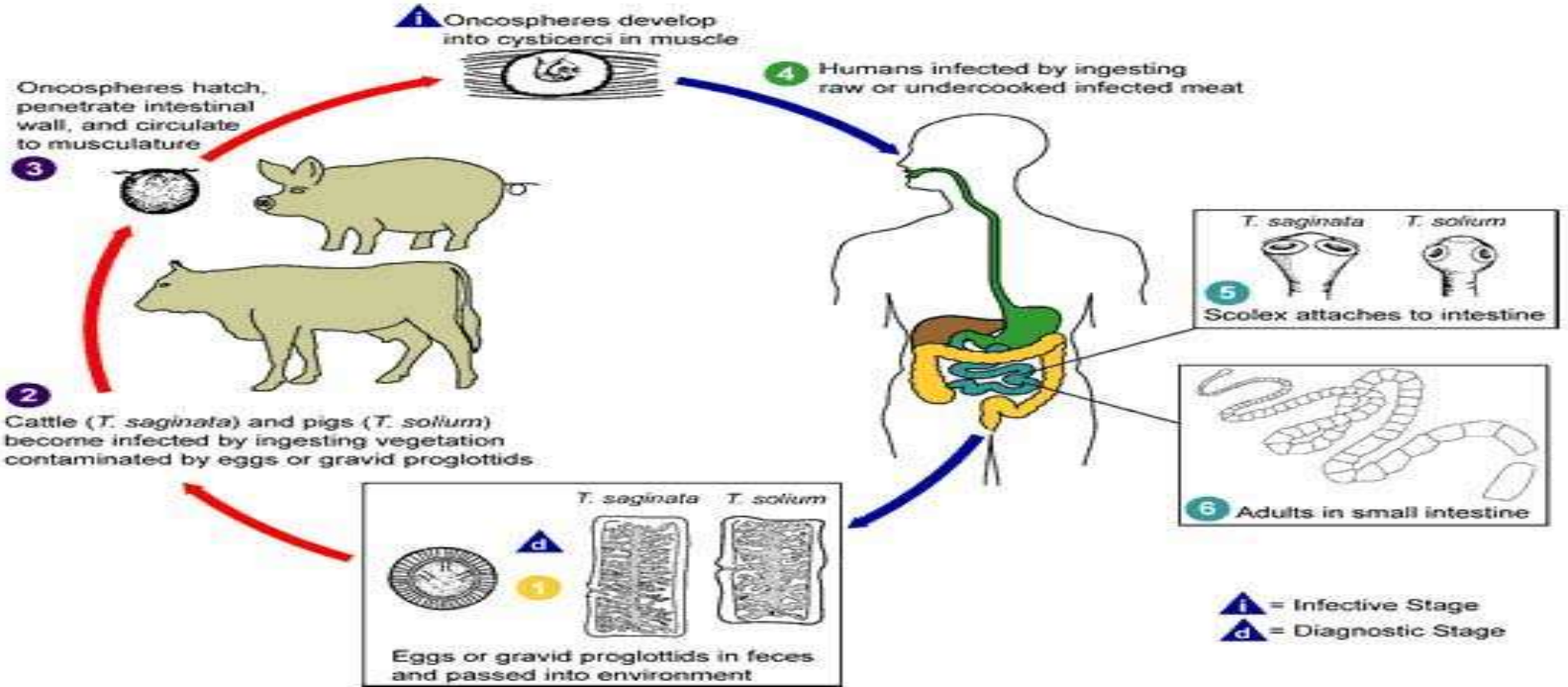
(*Taenia solium*)

(*Taenia saginata*)

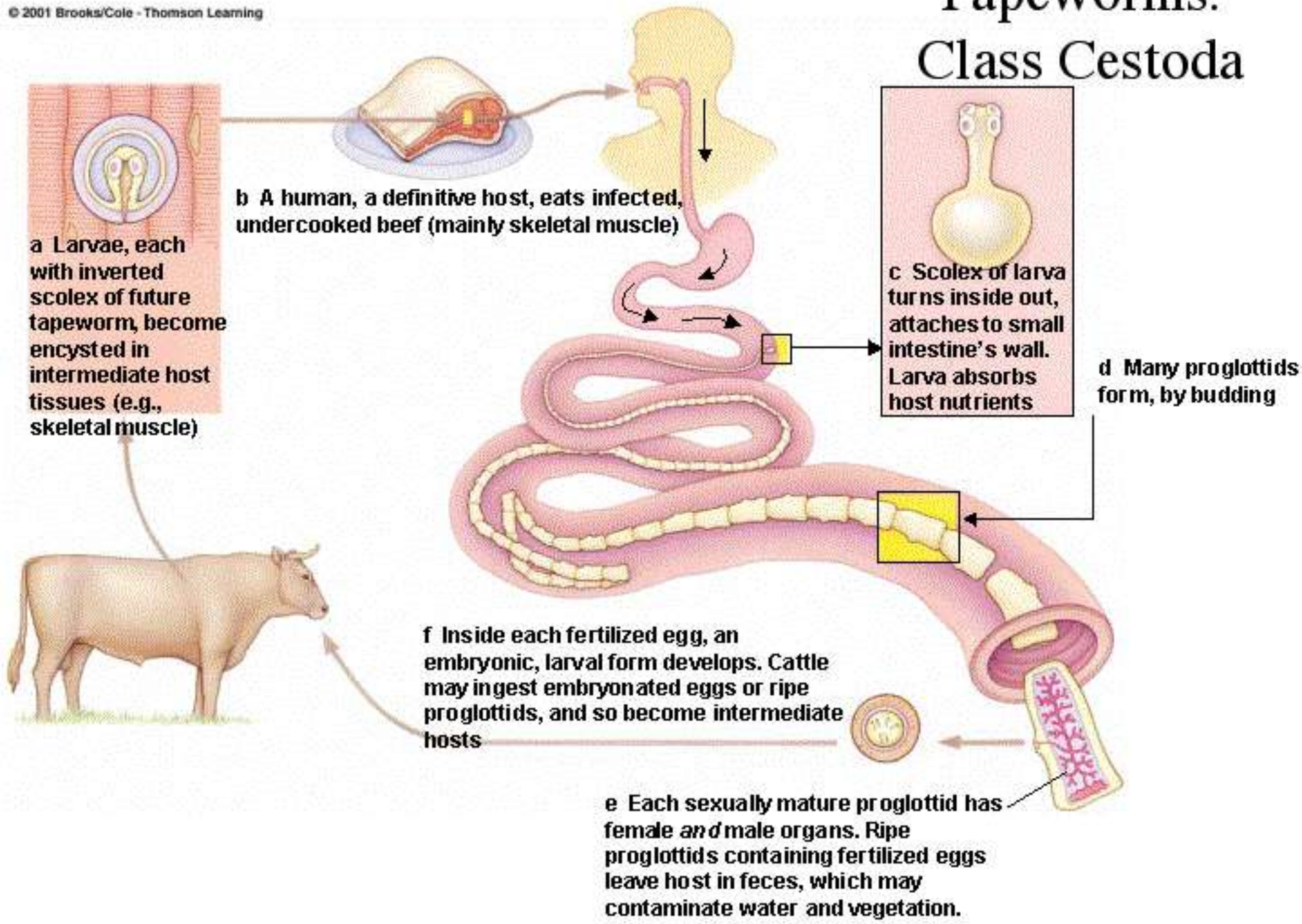
- parasites of warm blooded animals (birds and mammals)



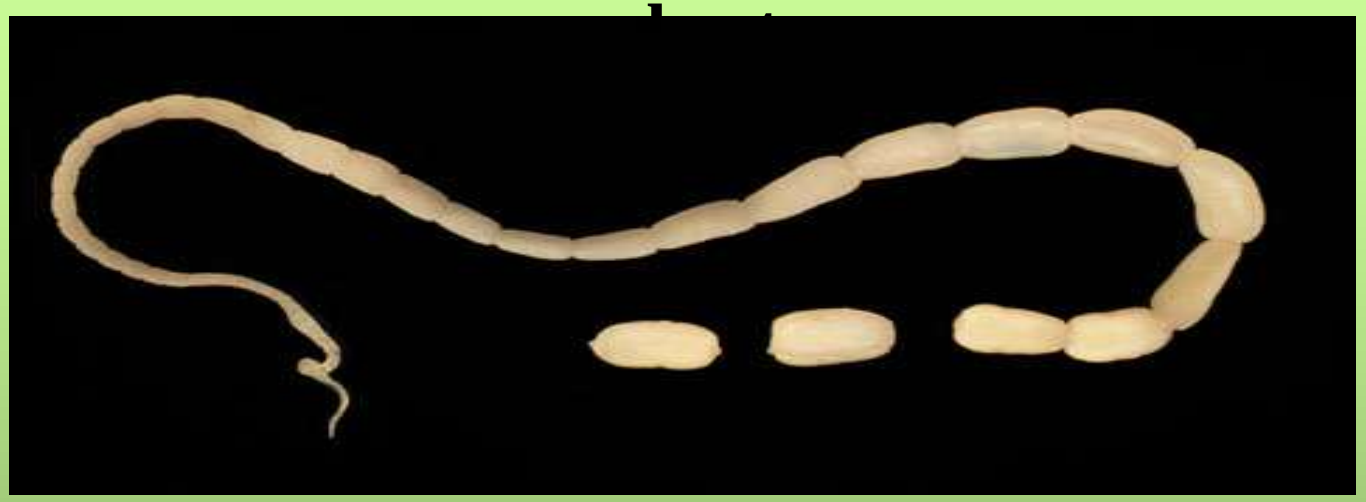

Taenia saginata
Gravid Proglottid
3mm


Oncospheres develop into cysticerci in muscle
Humans infected by ingesting raw or undercooked infected meat
Oncospheres hatch, penetrate intestinal wall, and circulate to musculature
T. saginata
T. solium
Scolex attaches to intestine
Cattle (T. saginata) and pigs (T. solium) become infected by ingesting vegetation contaminated by eggs or gravid proglottids
Adults in small intestine
Eggs or gravid proglottids in feces and passed into environment
= Infective Stage
= Diagnostic Stage

Tapeworms: Class Cestoda

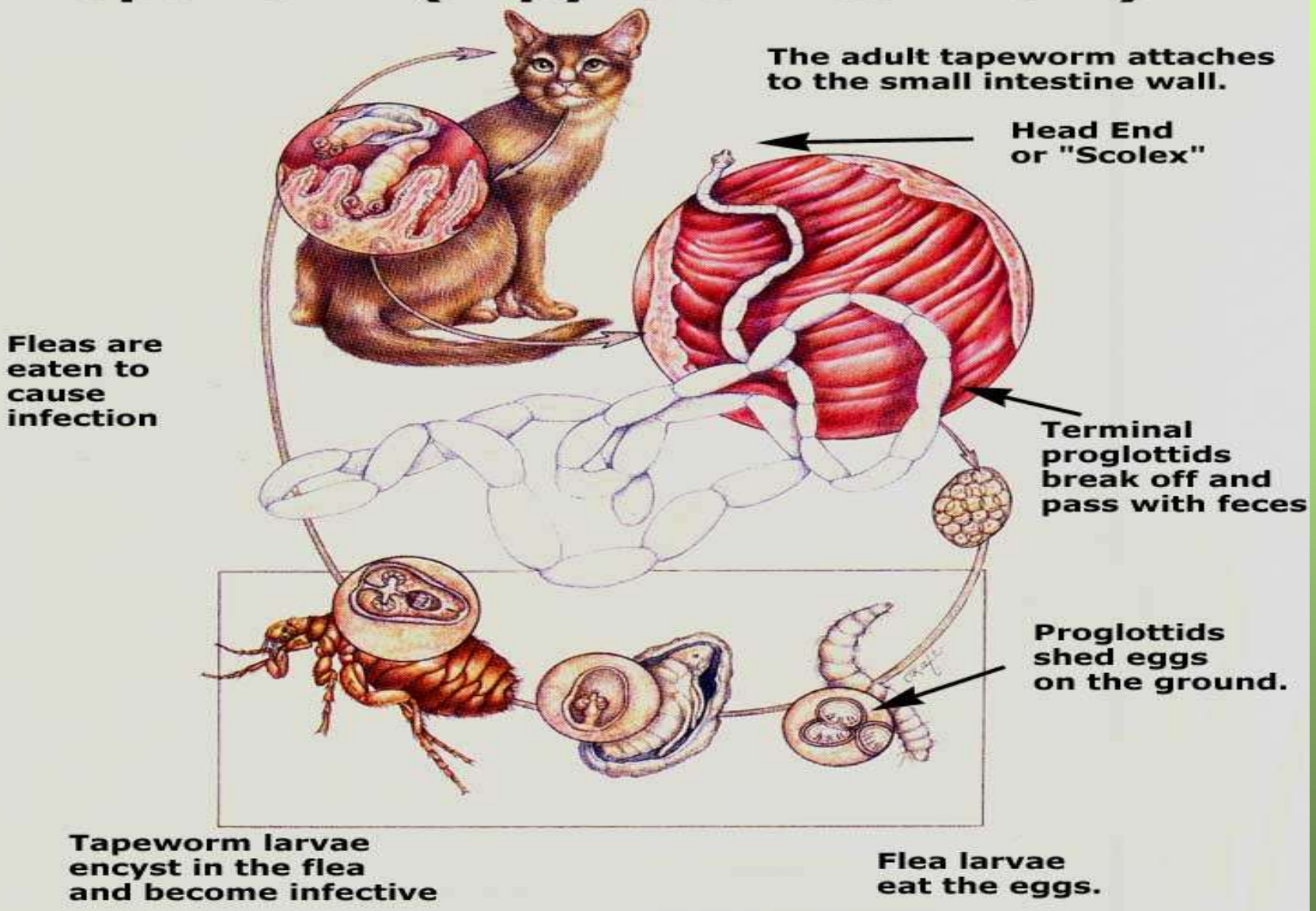


There are three common species affecting dogs



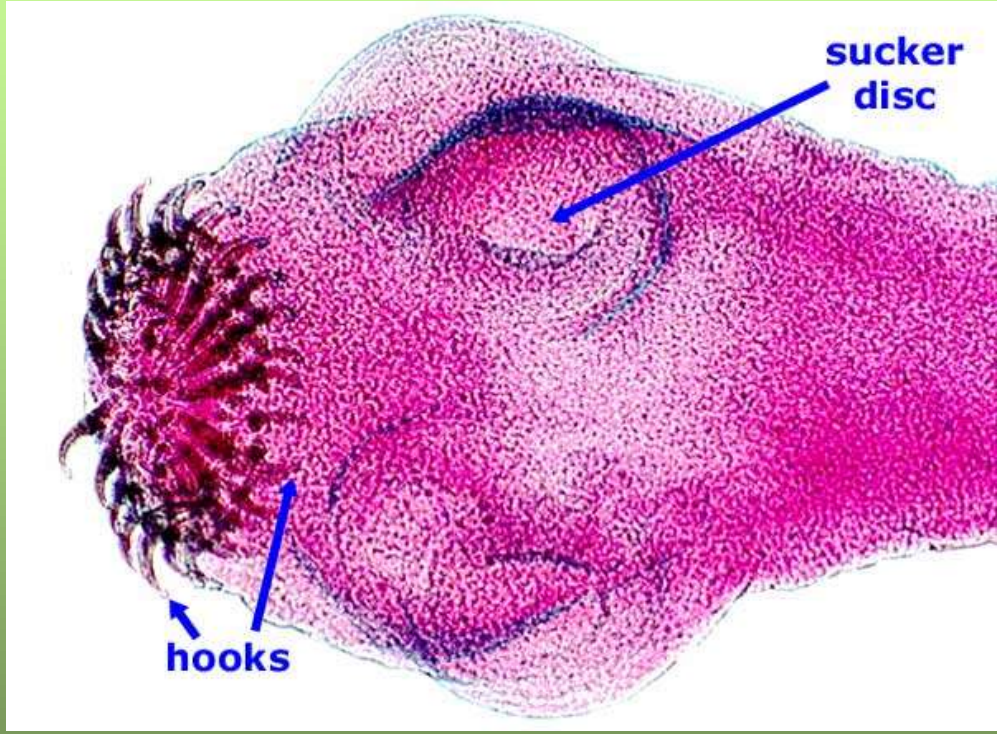
- *Dipylidium caninum* **which can infect dogs, cats and people uses the flea larva as an intermediate host;**
- *Taenia pisiformis* **which infects dogs uses the rabbit;**
- *Taenia taeniaeformis* **which infects cats uses the rat or mouse.**

Tapeworm (Dipylidium caninum)



Taenia pisiformis

infect dogs and cats

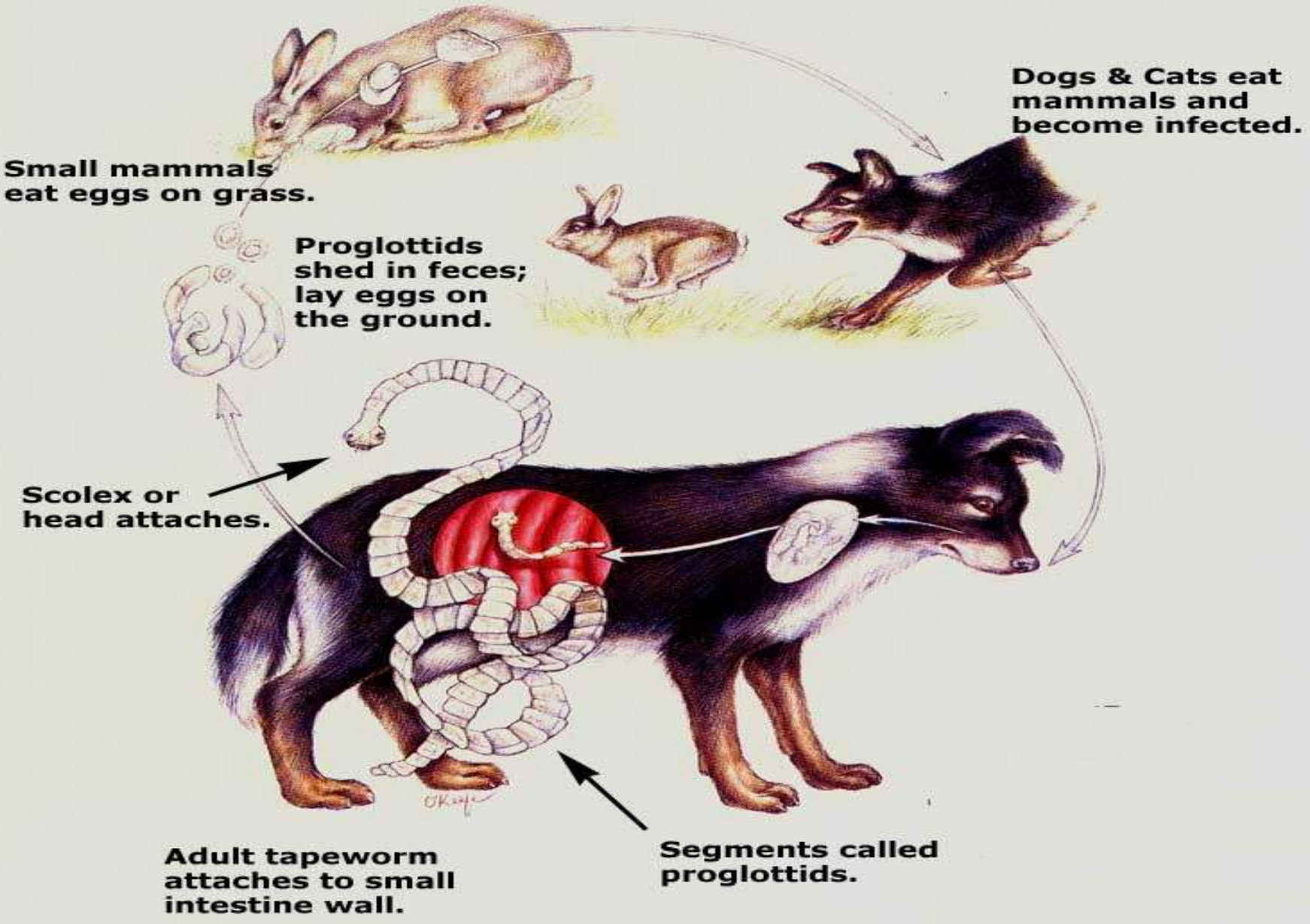


Proglottids containing eggs break off the posterior end of the tapeworm,

these proglottids are either passed intact in the host's feces or they dissolve in the host's intestine and eggs are passed in feces.

hooklets on an eversible **rostellum**

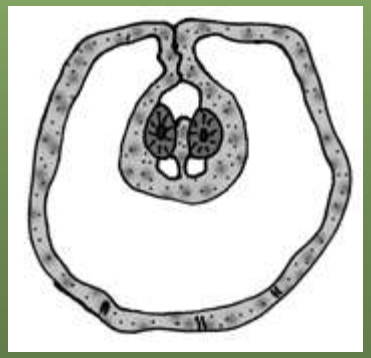
Tapeworm (Taenia)

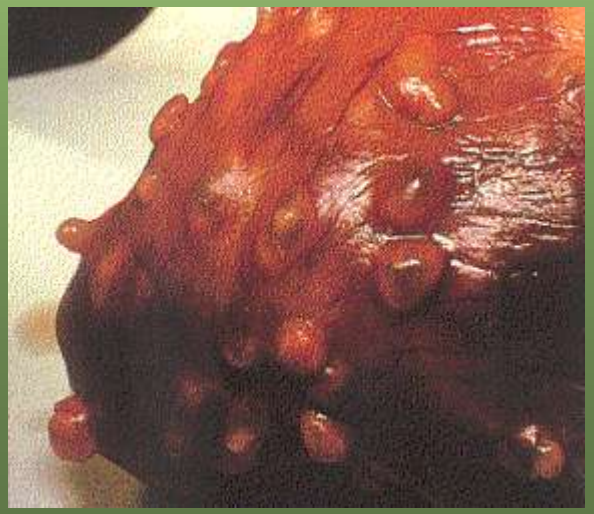


Taenia pisiformis

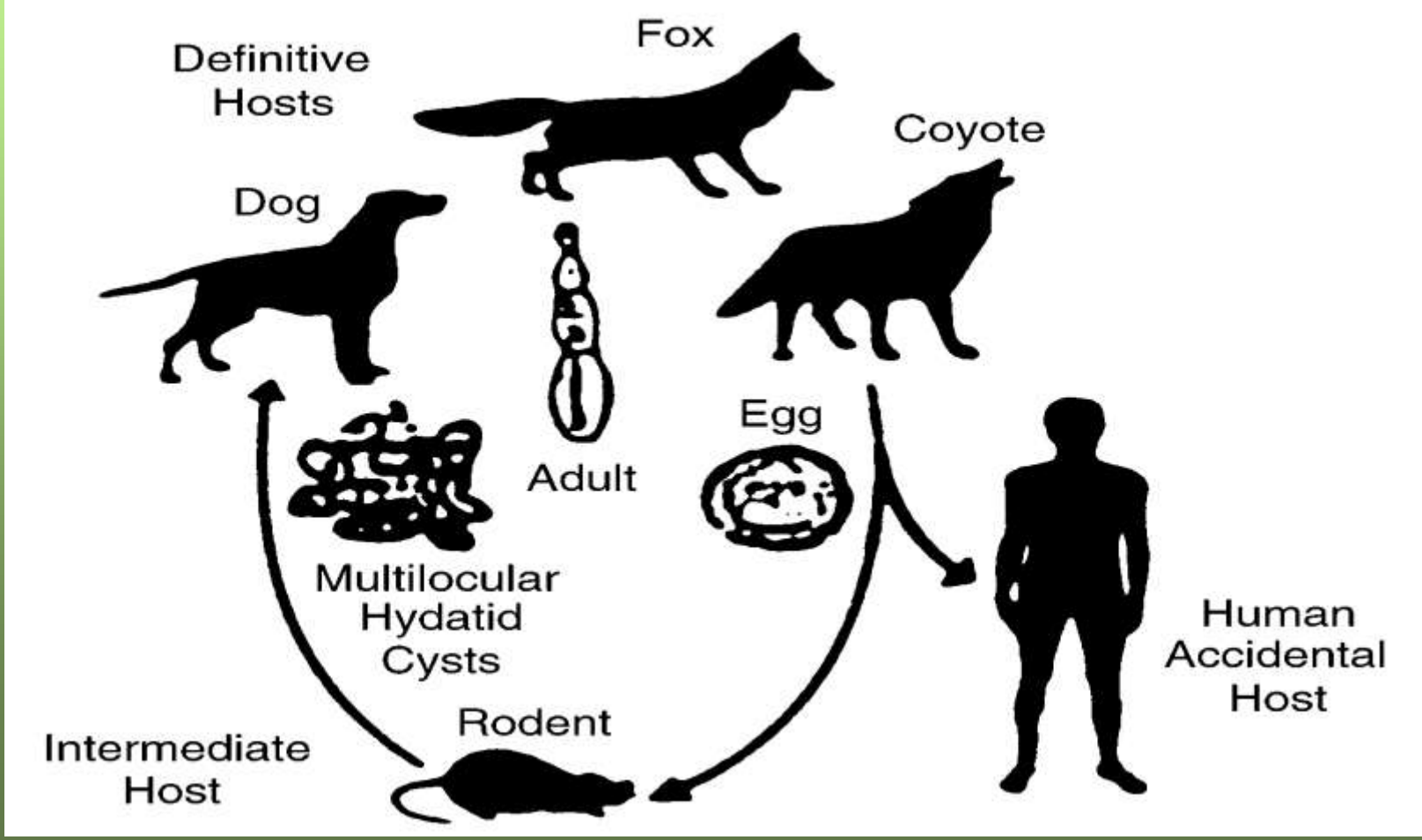
The intermediate host is infected when it ingests the eggs, and a cysticercus develops in the intermediate host (hare, rabbit, rodent).

The definitive host is infected when it eats an intermediate host infected with cysticerci.

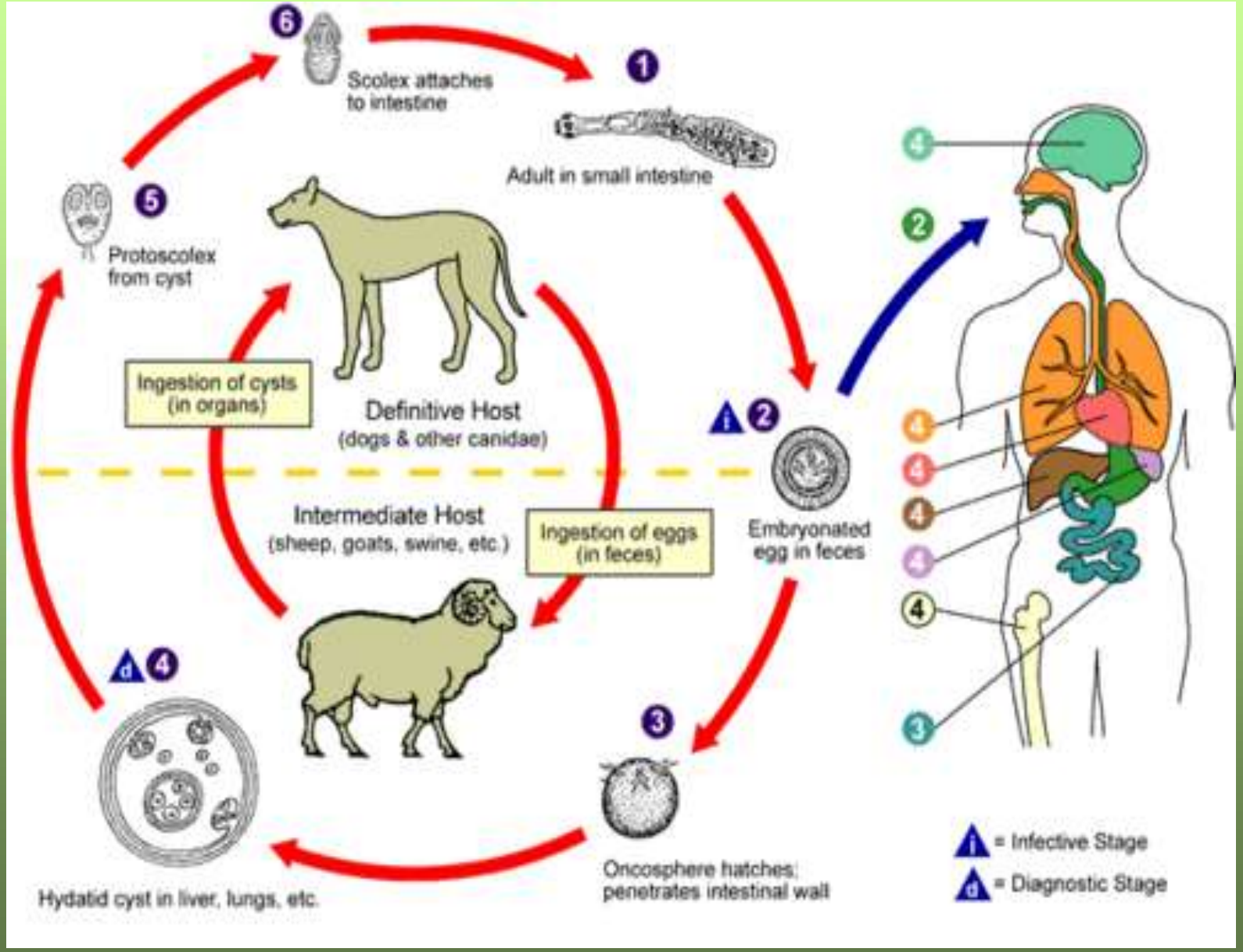




Echinoccocus multilocularis



Echinococcus granulosus



Order: Pseudophyllidea

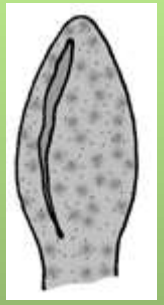
The scolex

-very simple

-often consisting simply of two elongated shallow grooves, or bothria (*Diphyllobothrium latum*)

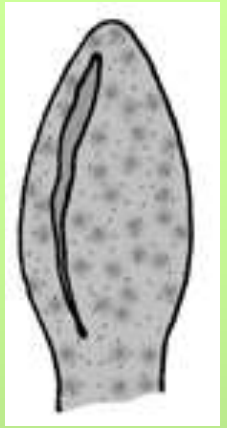
-Or two tubes with narrow slits at the end make up the holdfast (*Bothridium* sp.)

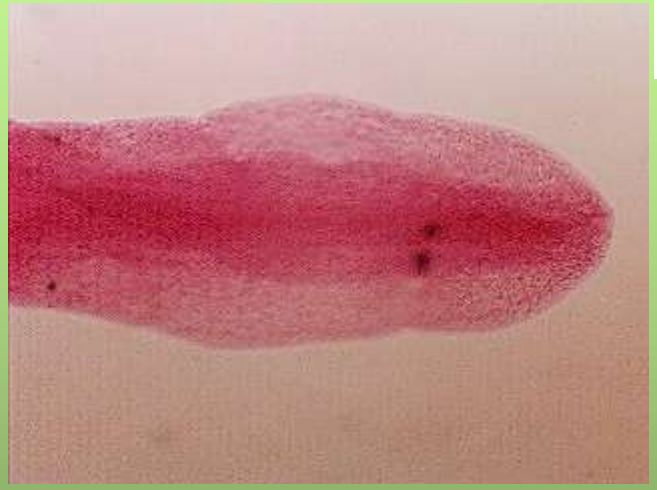
(*Bothridium* sp.)



(*Diphyllobothrium latum*)

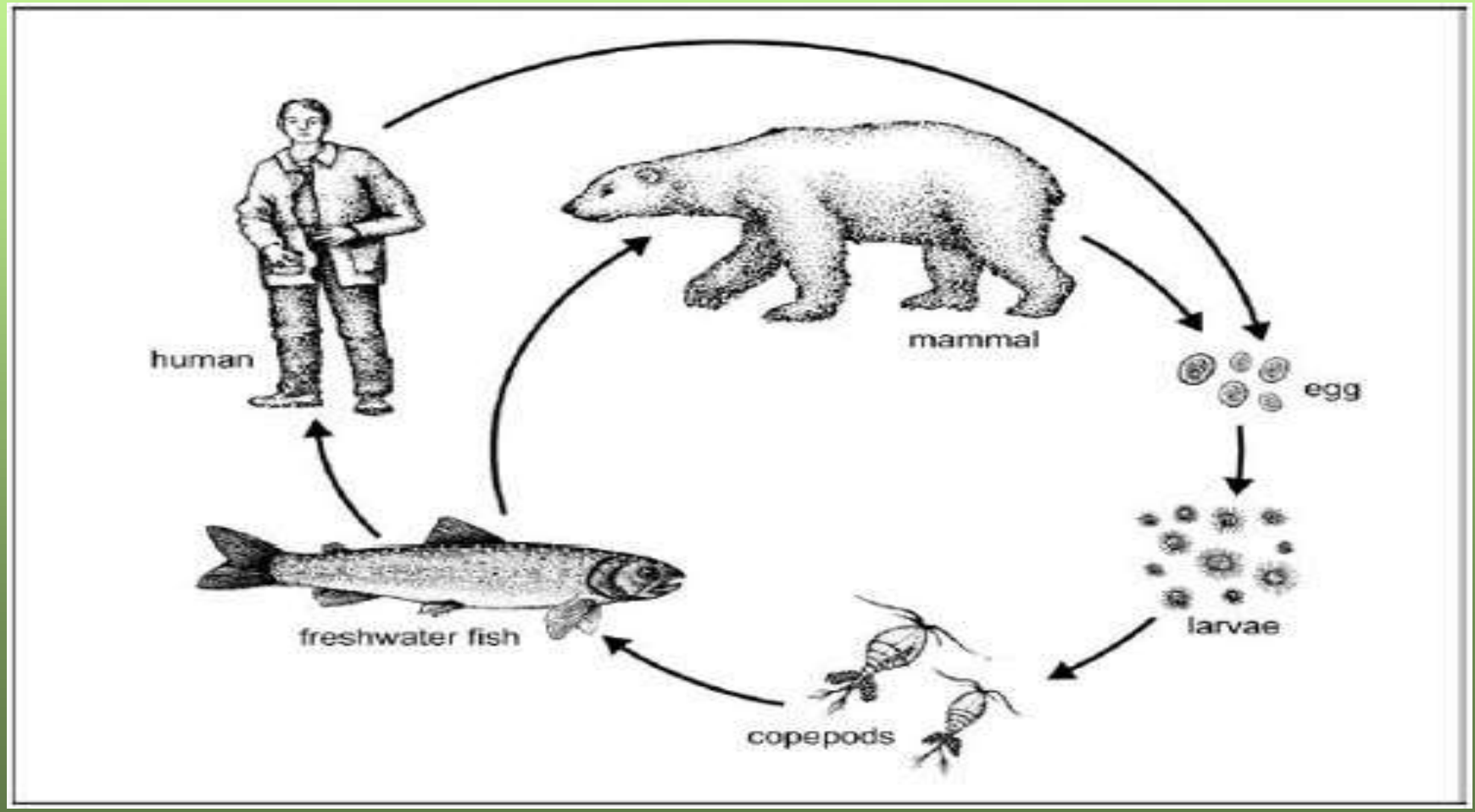
Pseudophyllid cestodes (order **pseudophyllidea**)



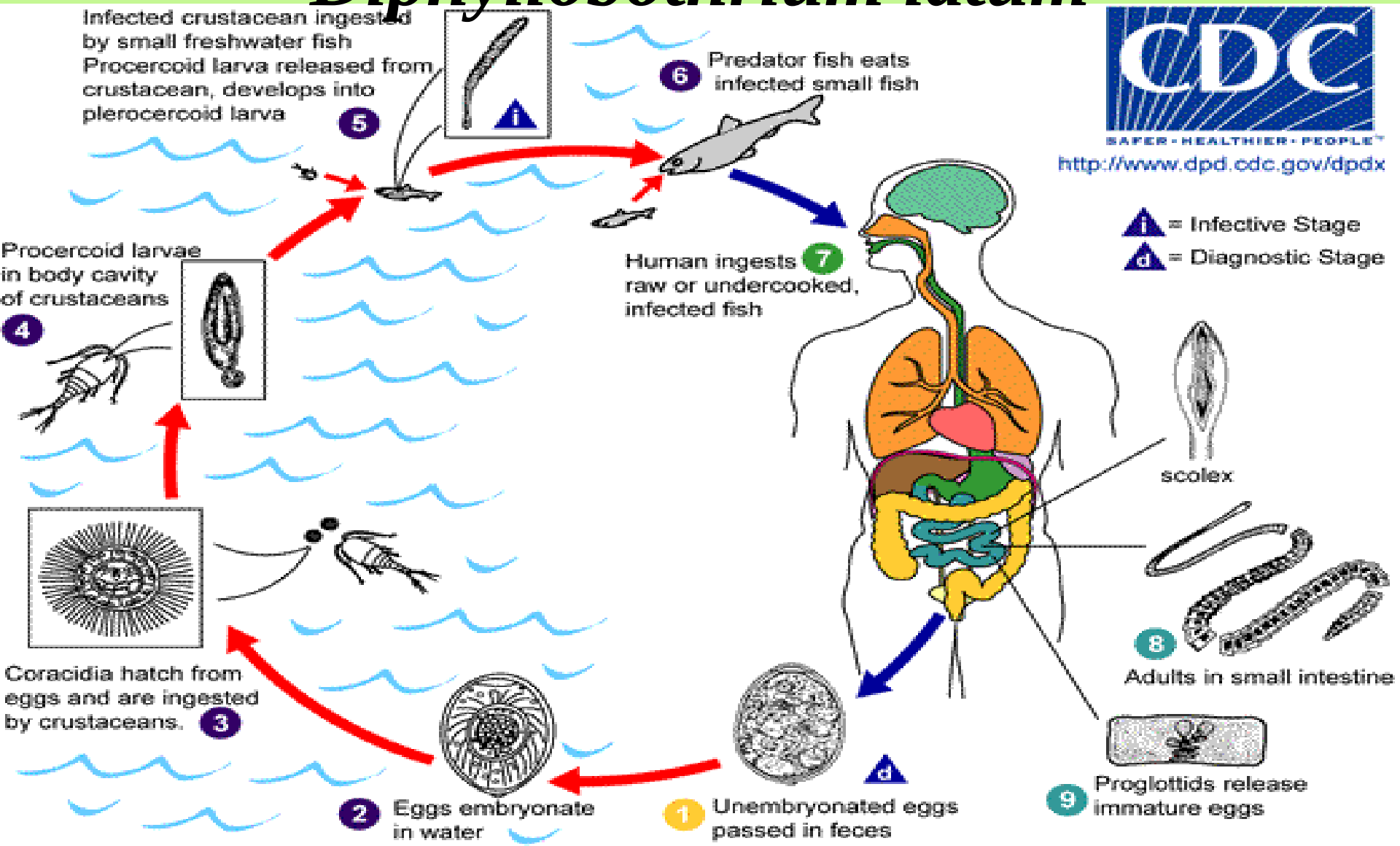


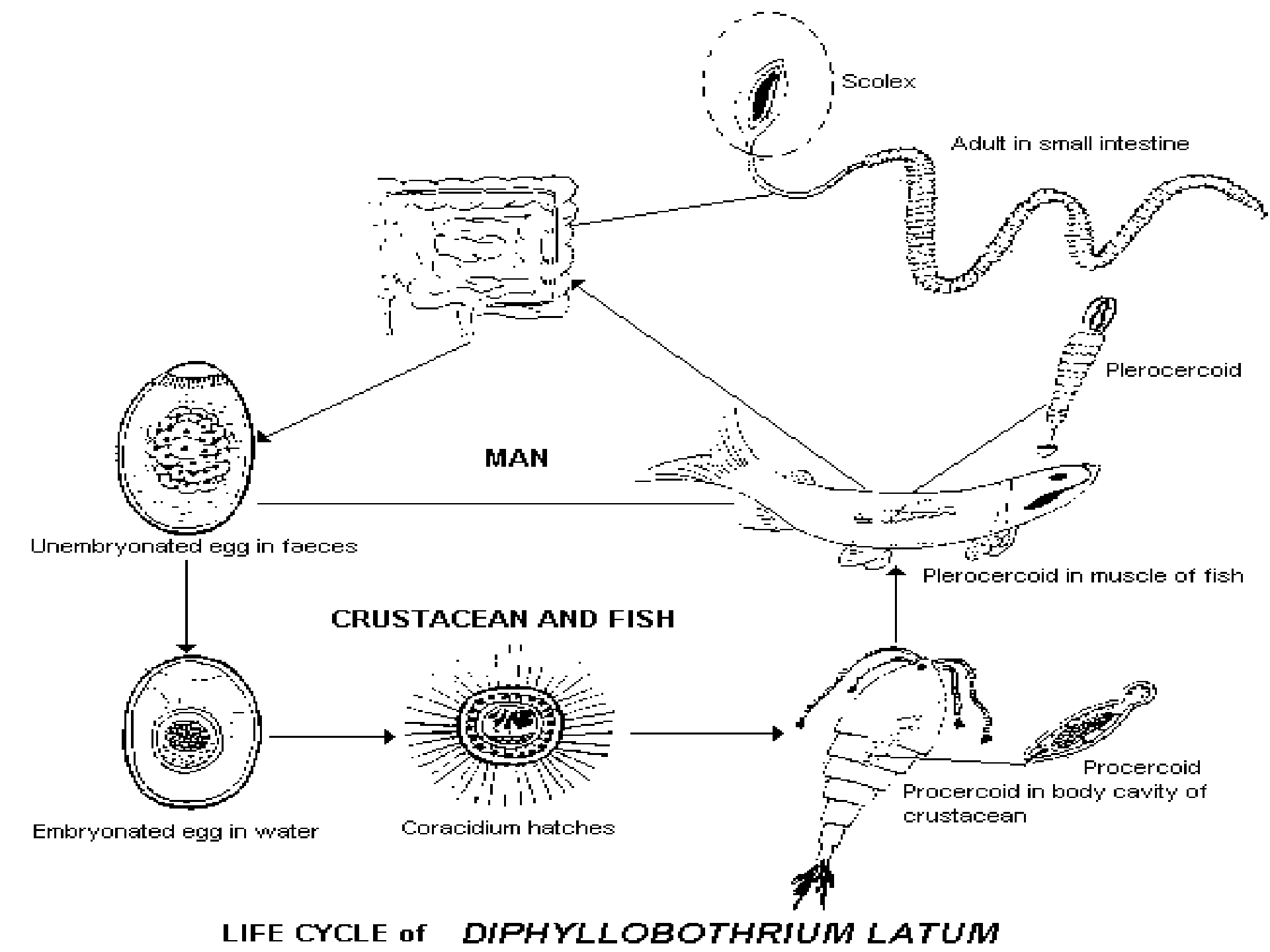
- are a kind of flatworm with multiple "segments" (proglottids) and **two bothria** or "**sucking grooves**" as adults
- Typically have a scolex with 2 longitiudinal bothria
- Bothria may be equipped with hooks

The life cycles of pseudophyllideans usually involves a crustacean as a first intermediate host and fish as second intermediate hosts



Pseudophyllidea:
Diphyllobothrium latum





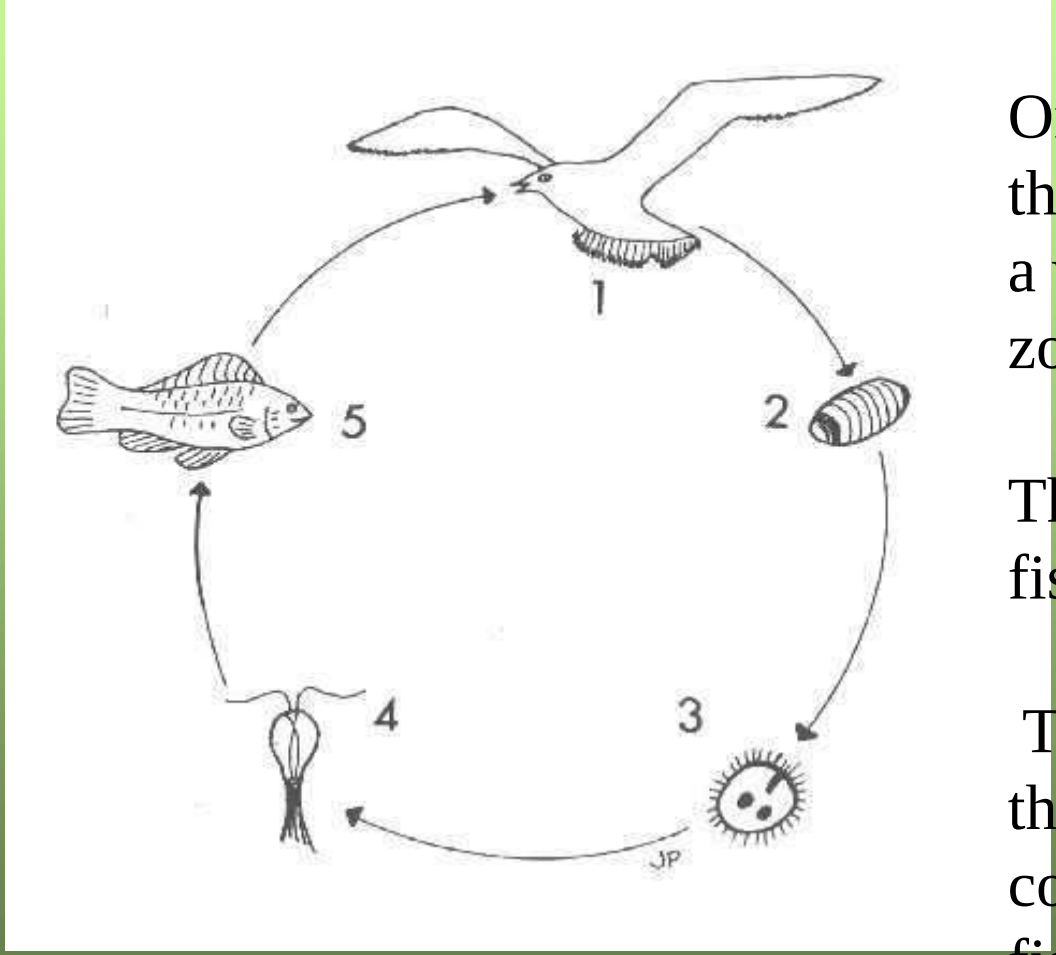
LIFE CYCLE of *DIPHYLLOBOTHRIUM LATUM*

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**
- 2
- 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
- The hexacanth embryo metamorphoses into an elongated **procercoid** larva
- The prominent cercomer, containing the 6 larval hooks, projects posteriorly
- When the infected copepod is ingested by a plankton-feeding FW fish, the procercoid
- 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
- 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

- Immature eggs are passed in feces . Under appropriate conditions, the eggs mature (approximately 18 to 20 days) and yield oncospheres which develop into a coracidia . After ingestion by a suitable freshwater crustacean (the copepod first intermediate host) the coracidia develop into procercoid larvae . Following ingestion of the copepod by a suitable second intermediate host, typically minnows and other small freshwater fish, the procercoid larvae are released from the crustacean and migrate into the fish flesh where they develop into a plerocercoid larvae (sparganum) . The plerocercoid larvae are the infective stage for humans. Because humans do not generally eat undercooked minnows and similar small freshwater fish, these do not represent an important source of infection. Nevertheless, these small second intermediate hosts can be eaten by larger predator species, e.g., trout, perch, walleyed pike . In this case, the sparganum can migrate to the musculature of the larger predator fish and humans can acquire the disease by eating these later intermediate infected host fish raw or undercooked . After ingestion of the infected fish, the plerocercoid develop into immature adults and then into mature adult tapeworms which will reside in the small intestine. The adults of *D. latum* attach to the intestinal mucosa by means of the two bilateral groves (bothria) of their scolex The adults can reach more than 10 m in length, with more than 3,000 proglottids. Immature eggs are discharged from the proglottids (up to 1,000,000 eggs per day per worm) and are passed in the feces . Eggs appear in the feces 5 to 6 weeks after infection. In addition to humans, many other mammals can also serve as definitive hosts for *D. latum*.

Ligula intestinalis



These eggs are passed into water via the faeces of the bird (2)

Once in the aquatic medium they hatch (3) and are eaten by a wide range of copepod zooplankton (4)

The cycle continues when the fish ingests the copepod (4-5)

The worm then burrows through the gut wall and continues to develop in the fish's body cavity (5)

The cycle is then complete

Ligula intestinalis

pseudosegmented **plerocercoid** larva in fish