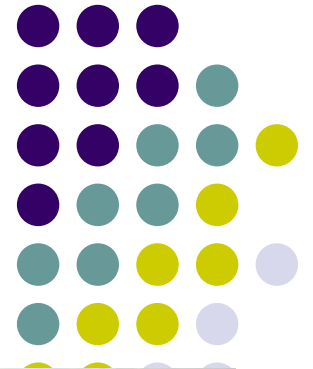
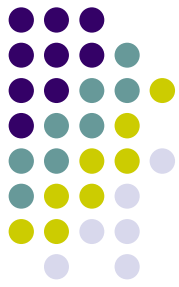


Tapeworms

George A. Lozano
UNBC





Cestode Characteristics

- **Platyhelminth ,...plus**
- **Endoparasitic**
- **NDS**
- **Segmentation**
- **Vert int. (usually) or derivatives (2 gen in inverts)**
- **Int. hosts required (usually), vert or invert**
- ***Polygonoporus* , whales, 40 m**

Cestode structure: 2 main parts

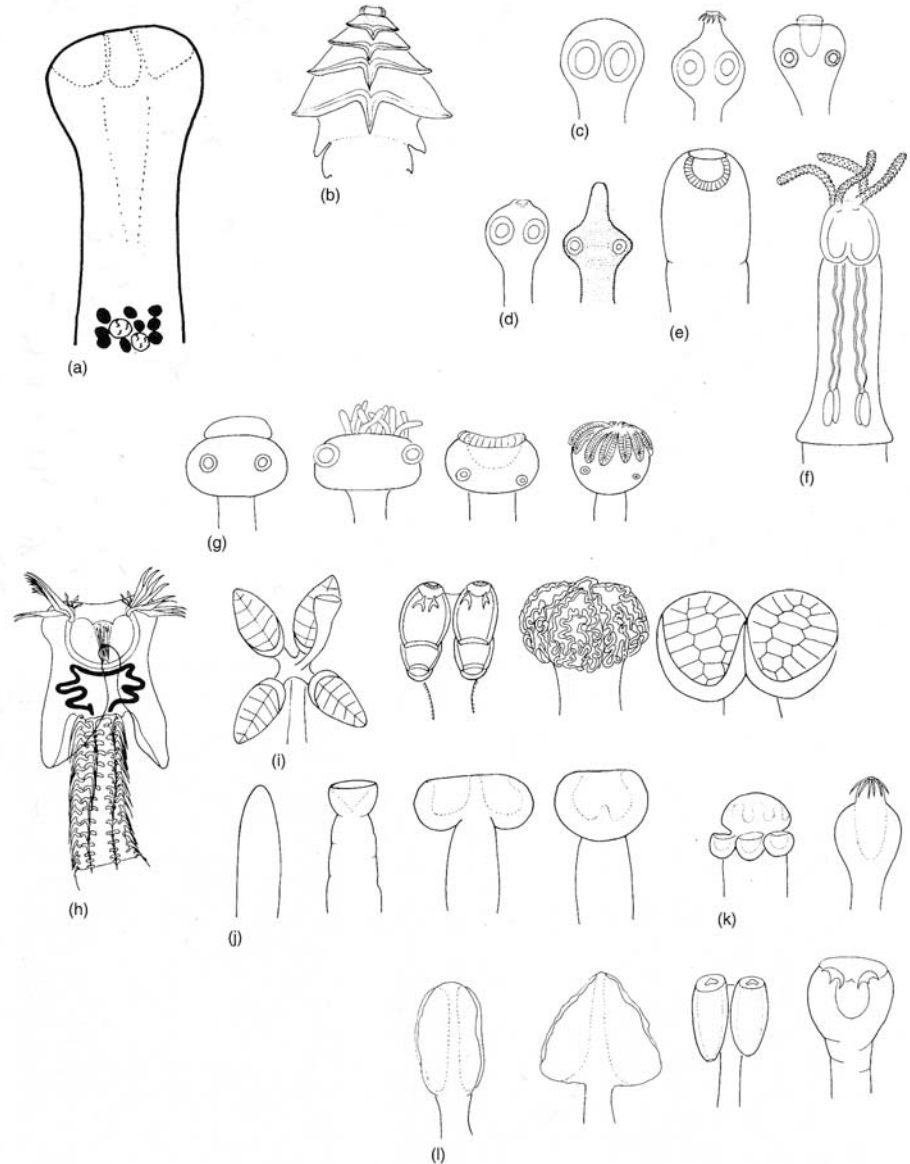


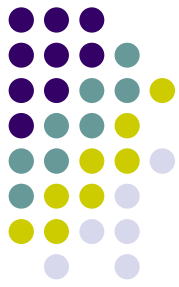
- **Scolex and strobilum**
- **Scolex (Scolices)**
 - **Suckers, hooks, tentacles, glands, spines.**
 - **Sensory ganglia**
 - **Neck (stem cells)**
- **Strobilum (strobila)**
 - **Immature, mature and gravid**

A few scolices



- **Acetabulate - Suckers.**
 - non-penetrative.- Suckers enclose a group of villi, but the scolex does not penetrate into the mucosa.
 - Penetrative.- the scolex penetrates into the crypts of Lieberkuhn.
- **Bothriate.-** A pair of shallow sucking grooves (*bothria*)
- **Bothridiate.-** has four leaf-like outgrowths called *bothridia*, adapted to the hosts' intestine.

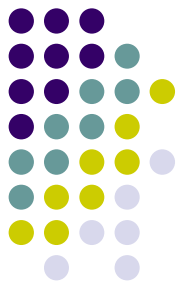




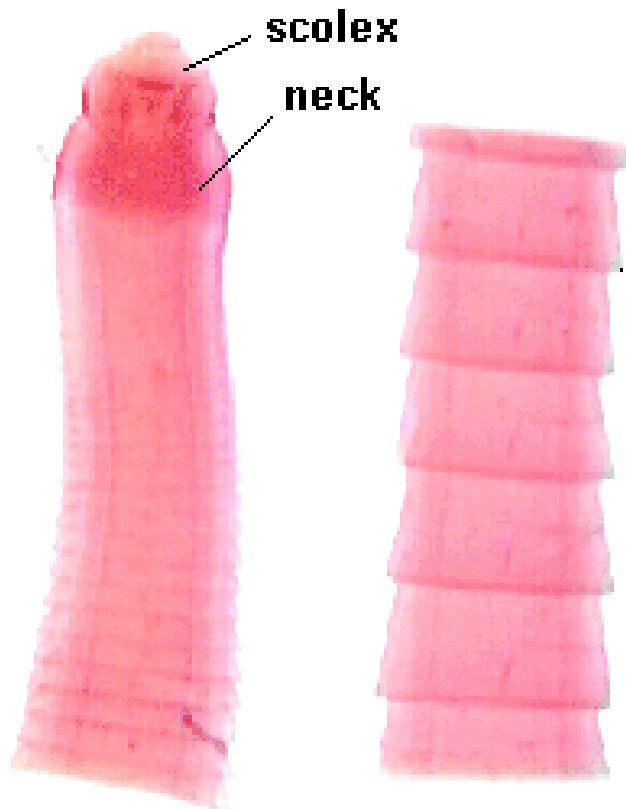
Cestode structure

- **Tegument...**
 - **Microtrichs**
 - **Glycocalix**
 - **Diffusion, active and passive transport**
 - **No digestive enzymes**
 - **Glucose required – starve your worm**
- **Reproduction**
 - **Monecious (usually)**
 - **♂ and ♀ in each p**
 - **Protandry or protogyny – self-fert.**

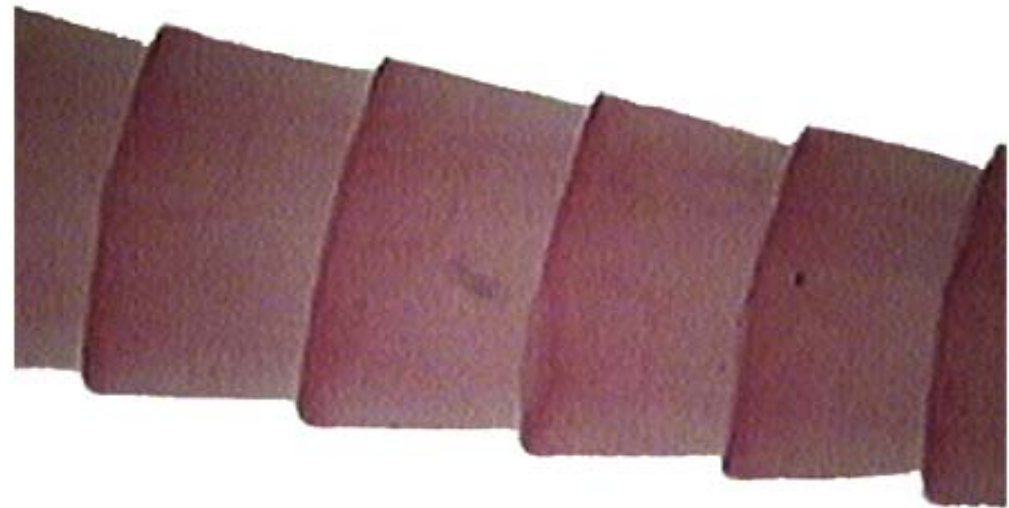
Proglottids



Taenia solium

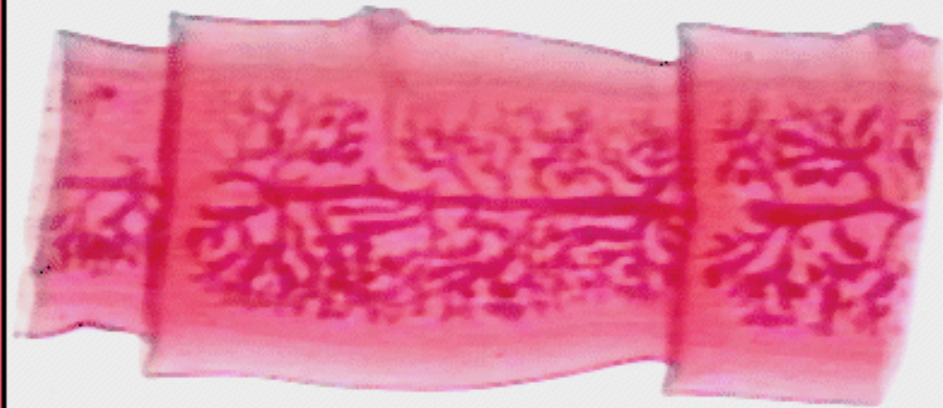


Tapeworm Immature Proglottids



(by P.W. Pappas and S.M. Wardrop)

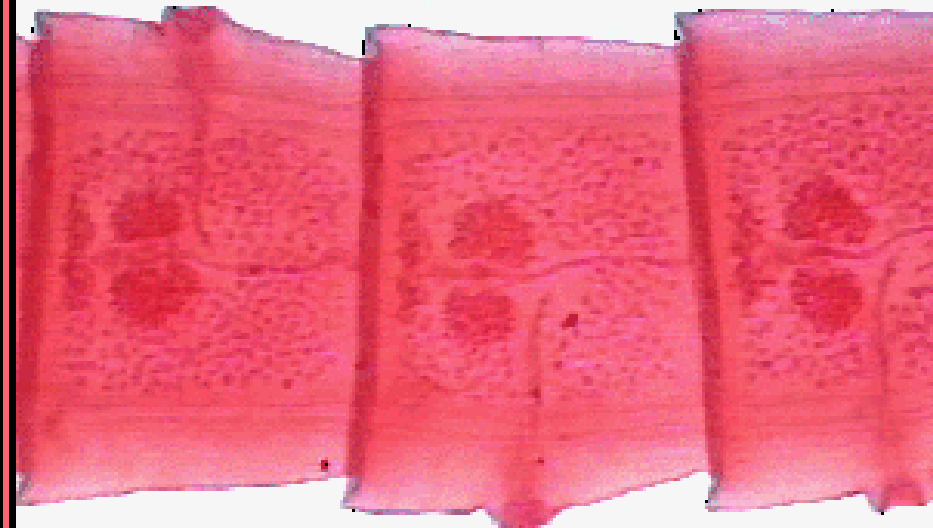
Taenia solium



gravid proglottid

(by P.W. Pappas and S.M. Wardrop)

Taenia
mature proglottids

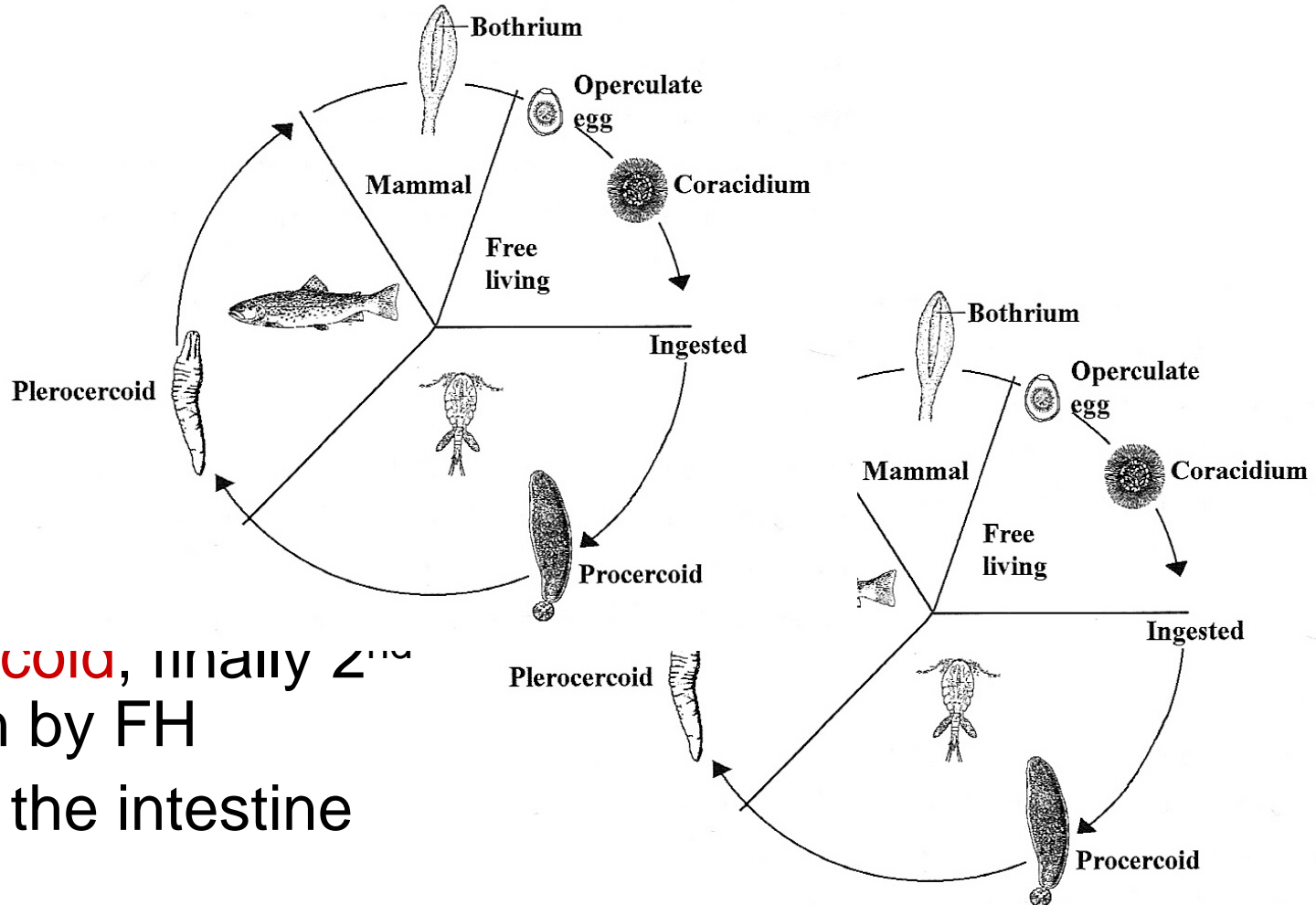


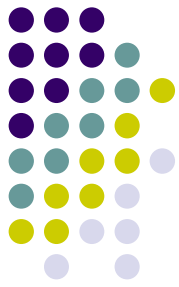
(by P.W. Pappas and S.M. Wardrop)



“Typical” life cycles: aquatic

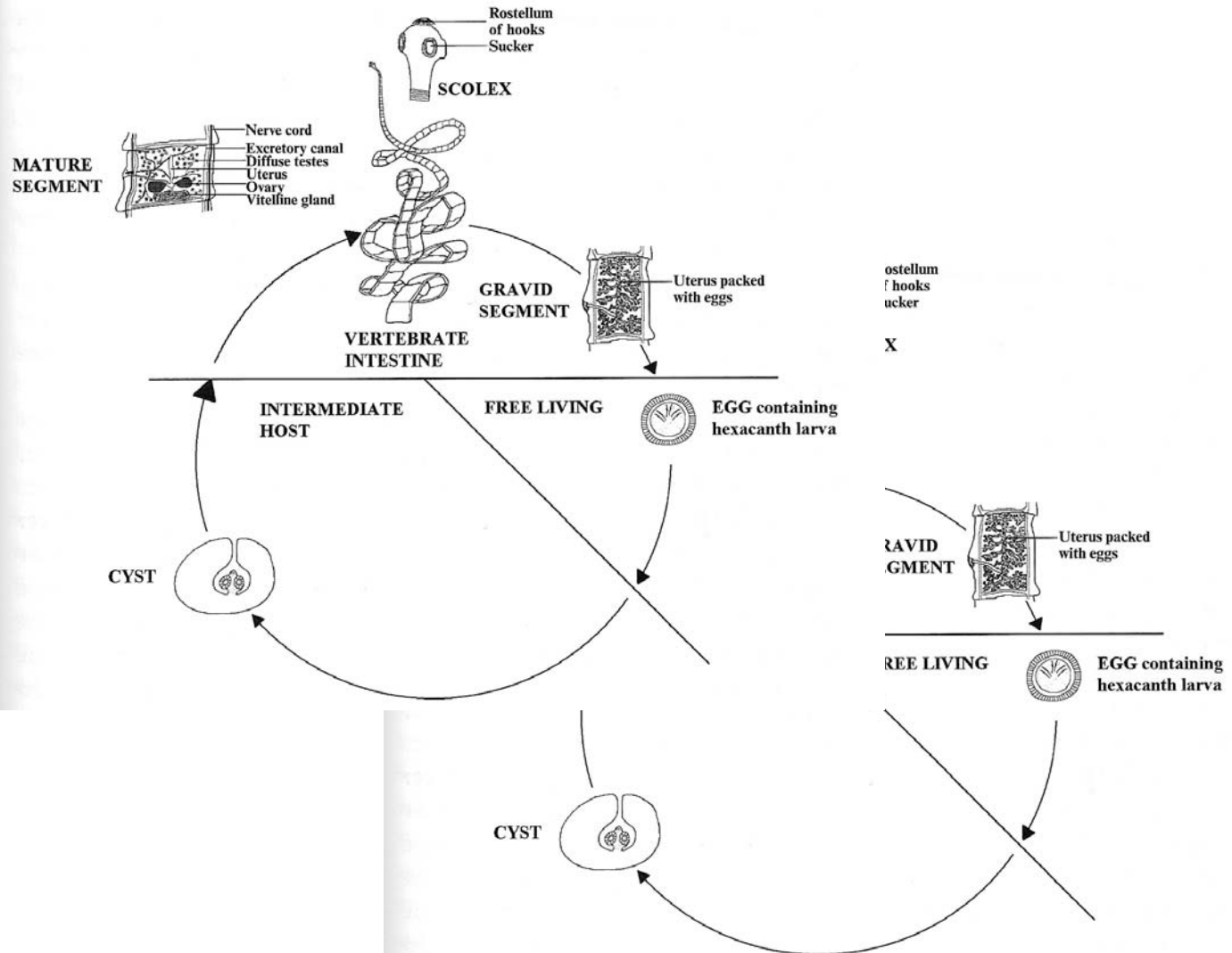
- egg
- coracidium
arthropod
gut wall
hemocoel
by 2nd IH
- procercoid
fish gut
to muscle
- plerocercoid, usually 2nd IH eaten by FH
- adult, in the intestine



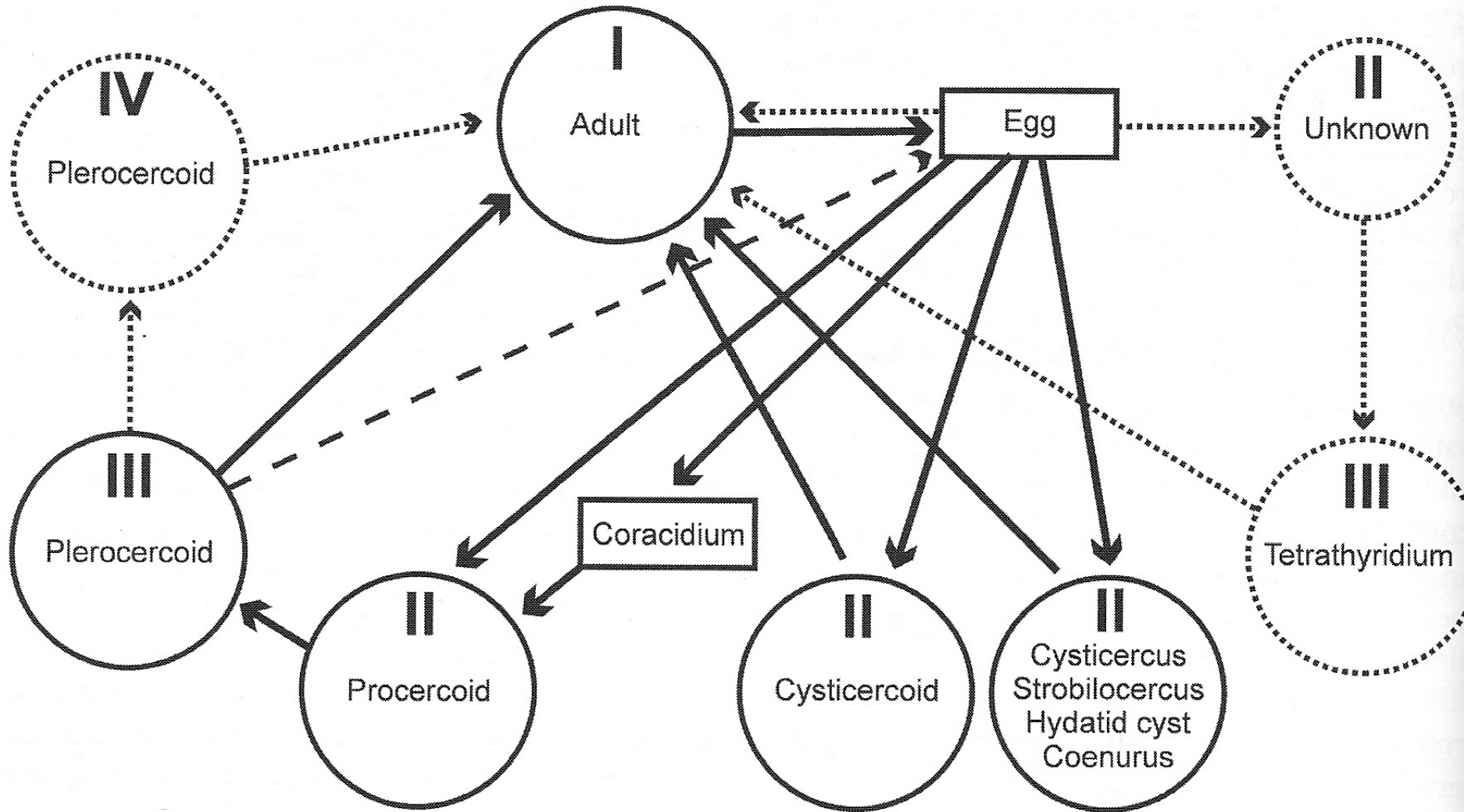


“Typical” life cycles: terrestrial

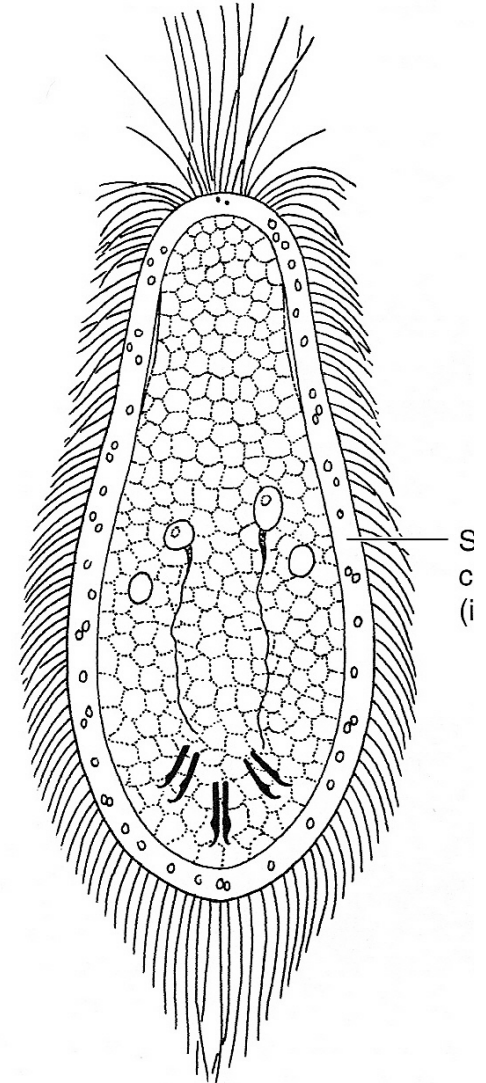
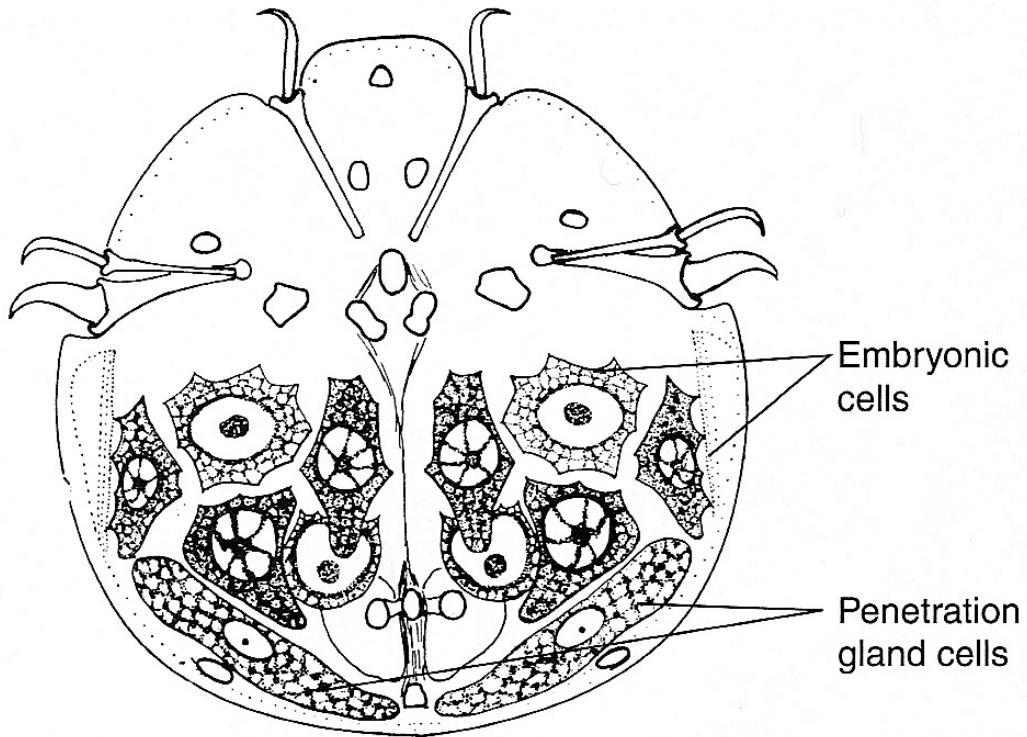
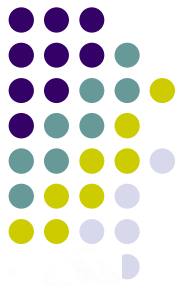
- **Egg** hatch usually a
- **Oncosphere** gut wall and tissues
- **Cysticercoid** stage. IH
- **Adult** in the intestine



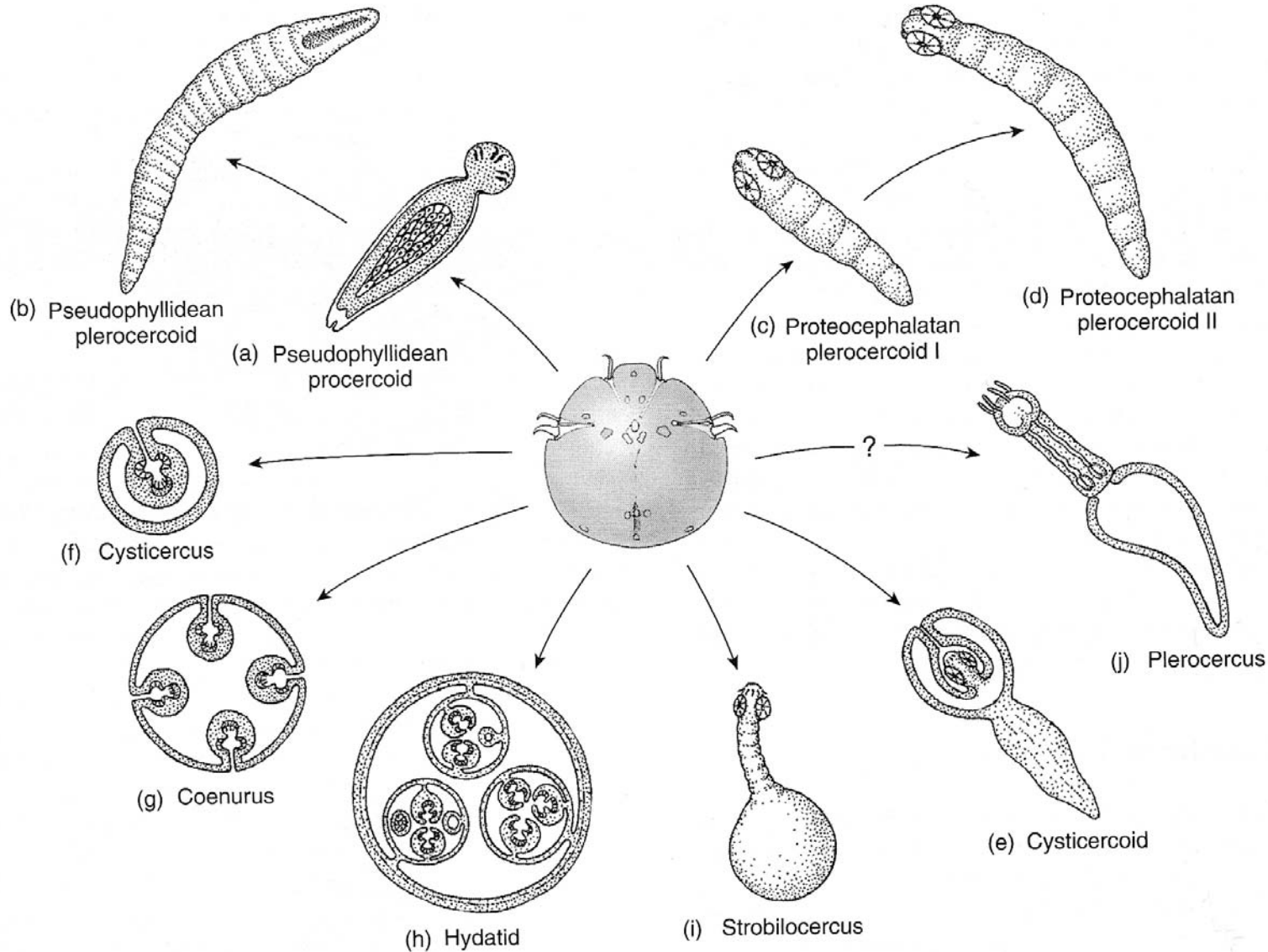
But of course, it can get complicated



Oncosphere and coracidium



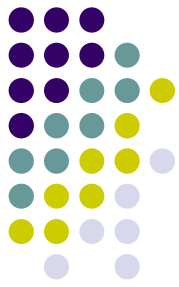
Metacercoids





Other cool aspects: PITT

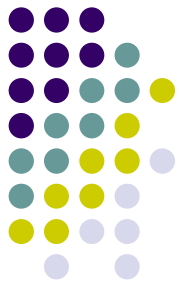
- Parasite induced trophic transmission
- Int host copepods swim near the water surface (*Triaenophorus sp.*)
- Muscles affected in fish → easy prey
- Hormonal manipulation → subordinate mice (*Taenia sp.*)
- *Tenebrio* → longer lives but lower rs.-prey
- *Tenebrio* preferentially feeds on feces of infected mice (*Hymenolepis diminuta*)
- More later...



Final host manipulation

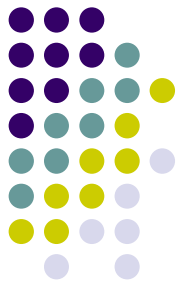
- **Castration of fish with *Ligula intestinalis***
- **Growth hormone produced by *Diphyllobothrium mansonioides***
- **More later**

A few Cestode examples



1. ***Diphyllobothrium dendriticum (D. latum)***
2. ***Ligula intestinalis***
3. ***Taenia solium***
4. ***Echinococcus granulosum***
5. ***Hymenolepis sp. (H. nana, H. diminuta)***
6. ***Dipylidium caninum***

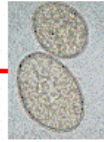
Diphyllobothrium dendriticum (*D. latum*)



- IH fish – little host specificity
- FH: canines, felines, mustelids, bears, pinnipeds and humans.
- Typical aquatic cestode life cycle
- Plerocercoids in fish muscle (lab) - cook it
- Discomfort, diarrhea, nausea, etc (Finnish)
- Anemia B₁₂
- Plerocercoids in the usual “final” hosts*

THE LIFE CYCLE OF *DIPHYLLOBOOTHRIUM LATUM* (THE BROAD FISH TAPEWORM)

In water, the eggs hatch releasing a free-swimming larva (coracidium).



Eggs are passed in the host's feces.

First intermediate host (a copepod) eats the coracidium.



The plerocercoid attaches to the lining of the small intestine and grows into an adult (sexually mature) tapeworm.

The coracidium develops into a proceroid.



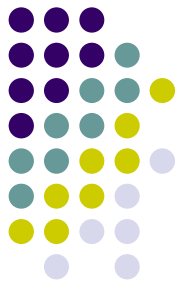
The copepod is eaten by a fish, and the proceroid develops into a plerocercoid in the fish's muscle.



The definitive host is infected when it ingests a plerocercoid in raw or undercooked fish.

The plerocercoid can be transferred up the food chain as larger fish (transfer hosts) eat smaller fish.

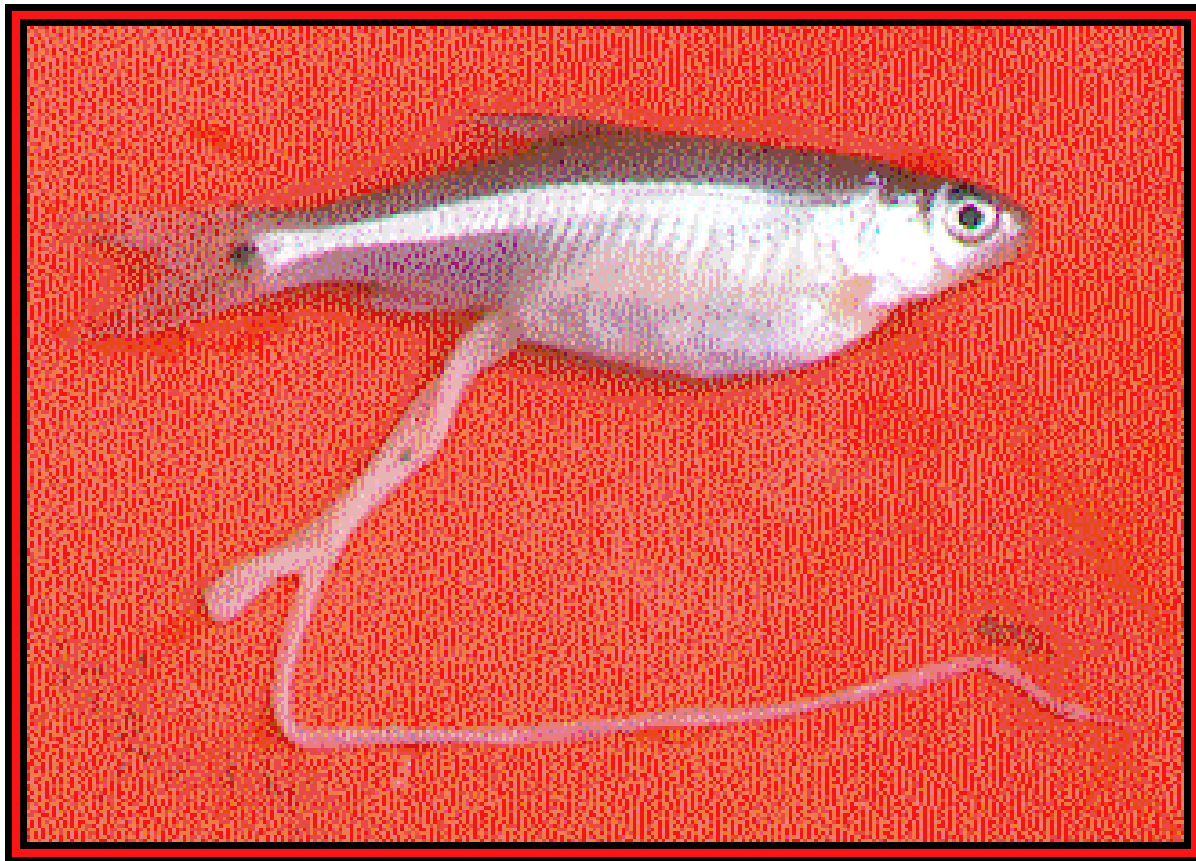
(Parasites and Parasitological Resources)





Ligula intestinalis

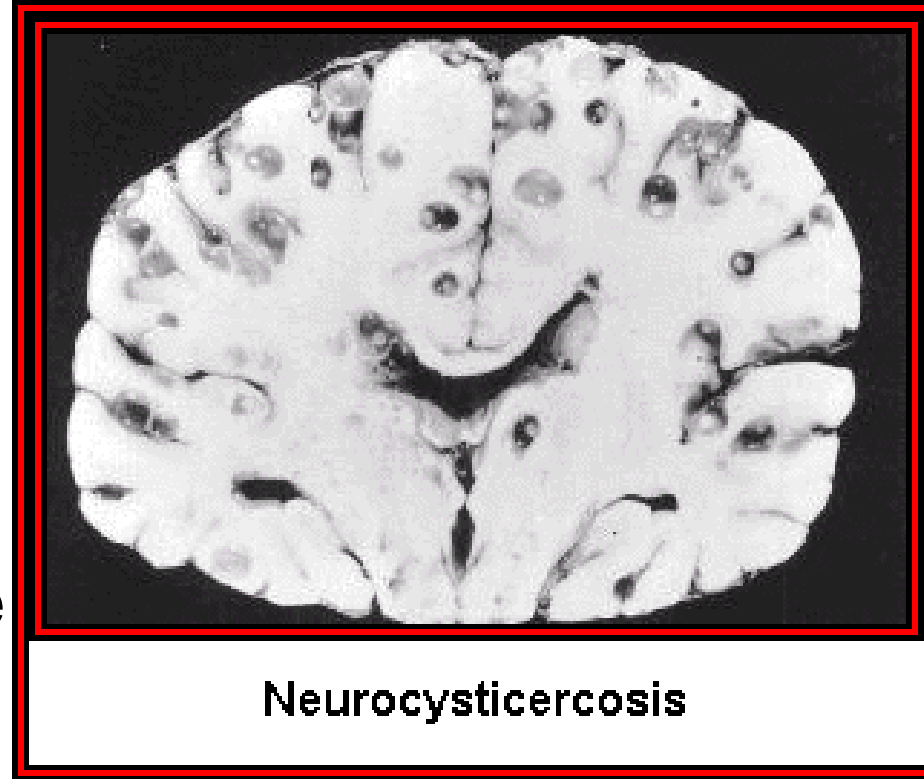
- **Plerocercoid in peritoneal cavity**
- **Affects swimming ability and habitat preference**



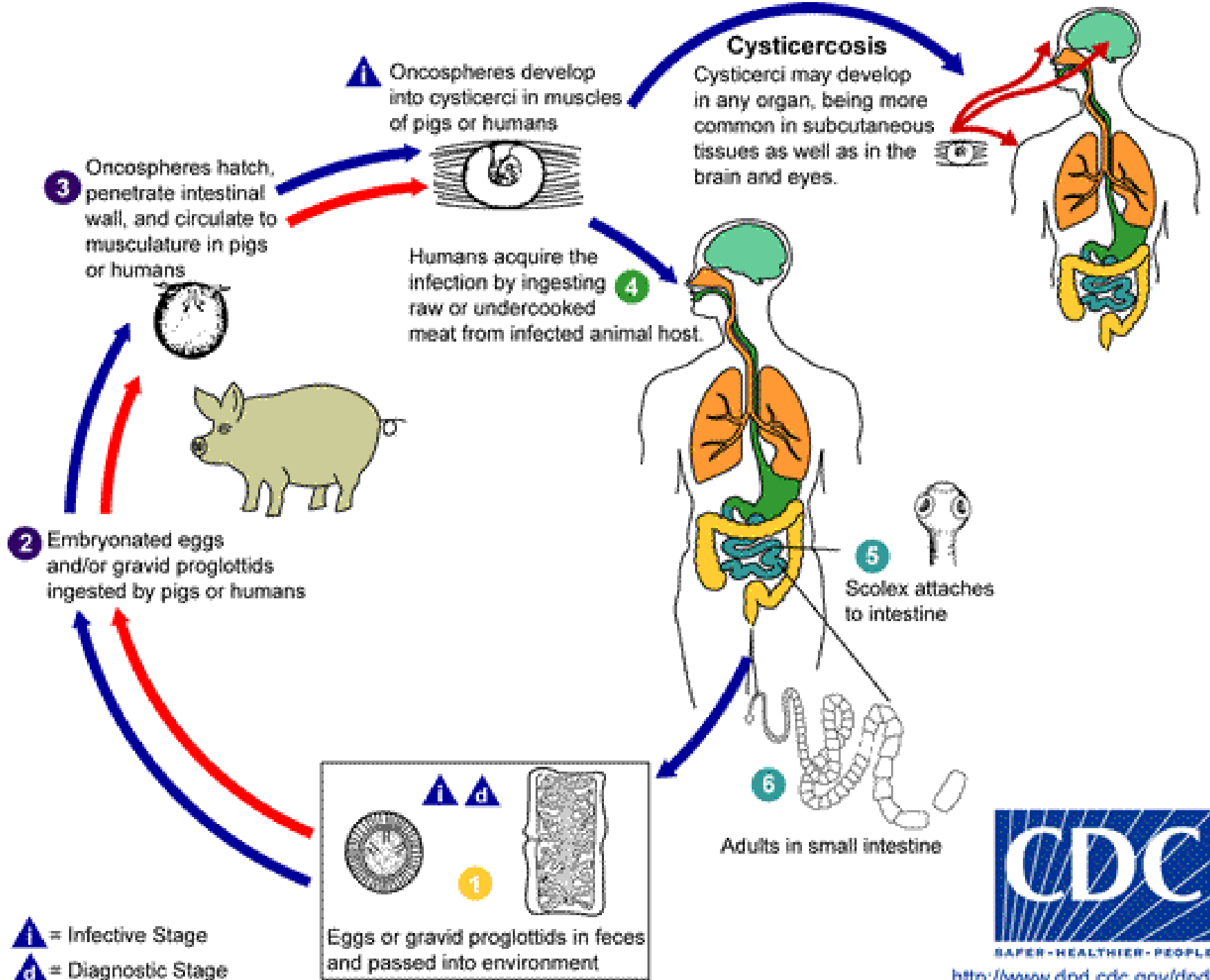


Taenia solium

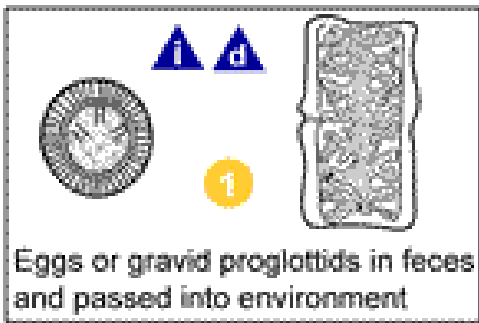
- A human example, why not?
- Humans can be either FH or IH
- If FH, no major problem, a tummy ache, etc
- If IH, plerocercoids migrate to tissues, change into cysticerci and cause damage.
- Cutaneous connective tissue, eye, brain, muscles, liver, lungs coelom



***Taenia pisciformis* –
canid FH – similar cycle**

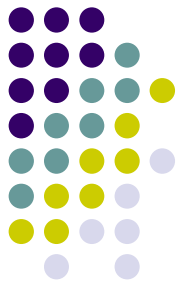


i = Infective Stage
d = Diagnostic Stage



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

Echinococcus granulosus

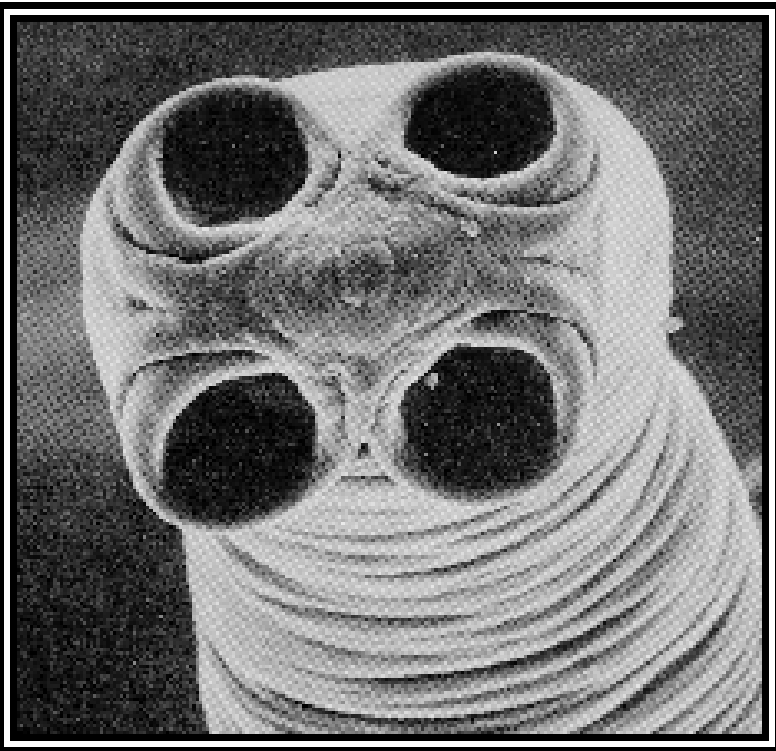


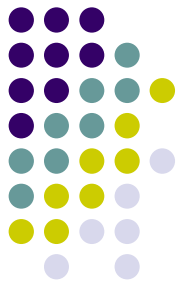
- Tiny by comparison, 5 mm
- Carnivore FH and herbivore IH, normally
- Most harm to IH when cysts develop in tissue.
- Humans occasionally become IH.



Hymenolepis sp.

- FH birds and mammals
- IH : insect larvae
- *H. nana*, children US 9%
 - IH can be bypassed!





Dipylidium caninum

- Just a brief honourable mention, for our offspring, best friends, and enemies.
- Children, **dogs**, and cats
- IH – flea (which itself is a parasite!!)

Next → nematodes

