

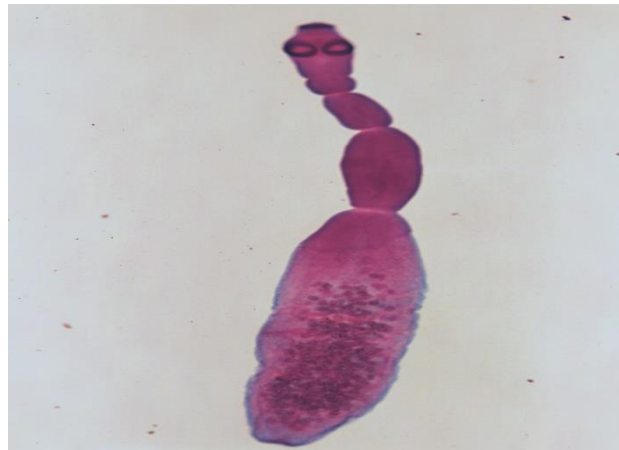
Chapter 8

Phylum Platyhelminthes **“The Flatworms”**

Phylum Platyhelminthes (The Flatworms)

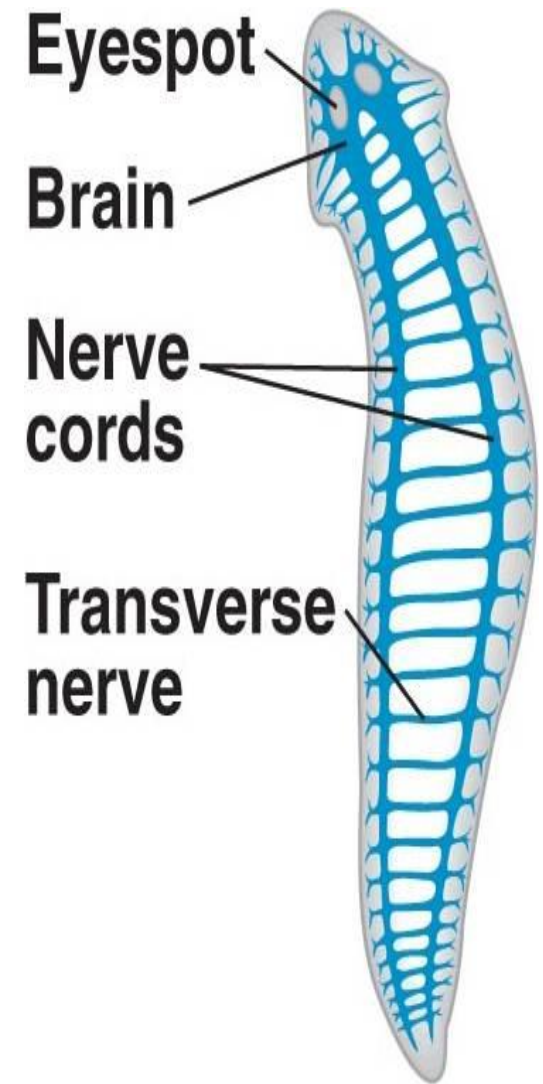
- ▶ **Platy**. helminthes: G. = **Flat**. worms
- ▶ They have a **flat body**.



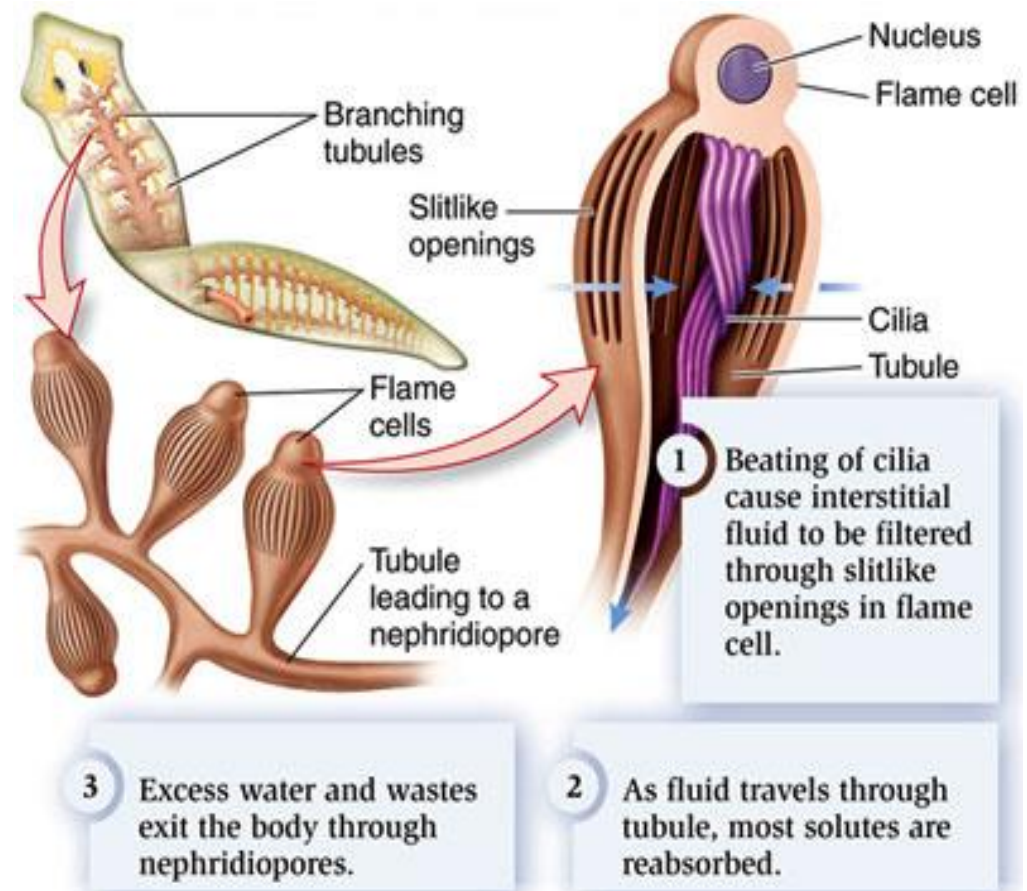


- ▶ Includes about **34,000 species**.
- ▶ Oldest fossil is about 40 Million years old.
- ▶ Includes **1 class of mostly free-living** individuals (the *Turbellarians*) and **three classes of exclusively parasitic** individuals (*Monogeneans*, *Cestodes* and *Trematodes*).
- ▶ > 80% of all flatworms are parasitic.
- ▶ All are **acoelomate**, **triploblastic** and **bilaterally symmetrical**.
- ▶ Mostly, they have an **anterior brain** that is connected to at least **1 pair of longitudinal nerve cords**.

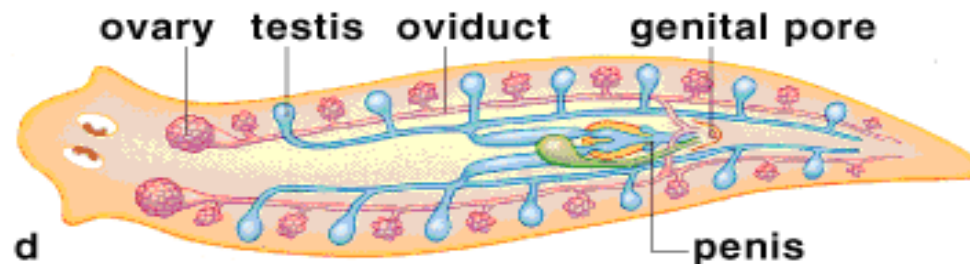
- ▶ The **mesoderm layer** of the embryo develops into a **loose collection of cells** known as **parenchyma tissue**.
- ▶ Most have **no anus**; they take in food and remove wastes through a single opening.
- ▶ They have **no specialized respiratory or circulatory systems** (few species have hemoglobin).
- ▶ **Gas exchange** is through **simple diffusion** across the flat body.



- **Excretion** is **mostly by simple diffusion** across the body surface.
- In addition, most species have **protonephridia** (G: first. Kidney).
- Typical protonephridia
Consists of a group of cilia projecting into a fine-meshed cup
(**Flame cells**).



- ▶ Other protonephridia take the form of **Solenocytes** in which a **single flagellum** is found within the cup.
- ▶ Most species are **simultaneous hermaphrodites**; that is each individual can, at anytime, function as both a male and a female.
- ▶ However, in most species, **fertilization is cross** (non-self).
- ▶ The parasitic forms have **nonciliated syncytial tegument**.



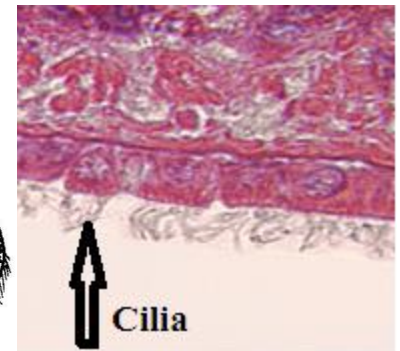
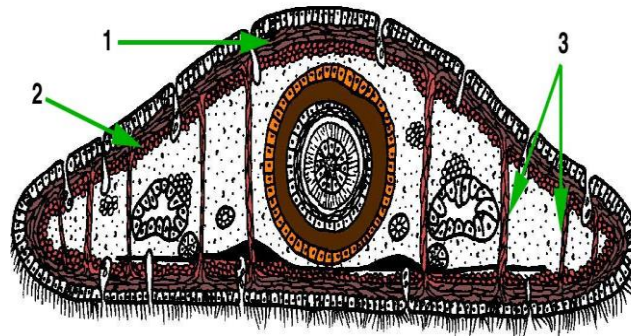
Class Turbellaria

- ▶ Forms about **16% of all flatworms** that are **mostly aquatic**.
- ▶ **Most** of the 3000 Turbellarians are **free living** (*About 150 species are commensal or parasitic*)
- ▶ **Most species are marine**, few freshwater or even terrestrial (in humid areas).
- ▶ Mostly **less than 1 cm long**.



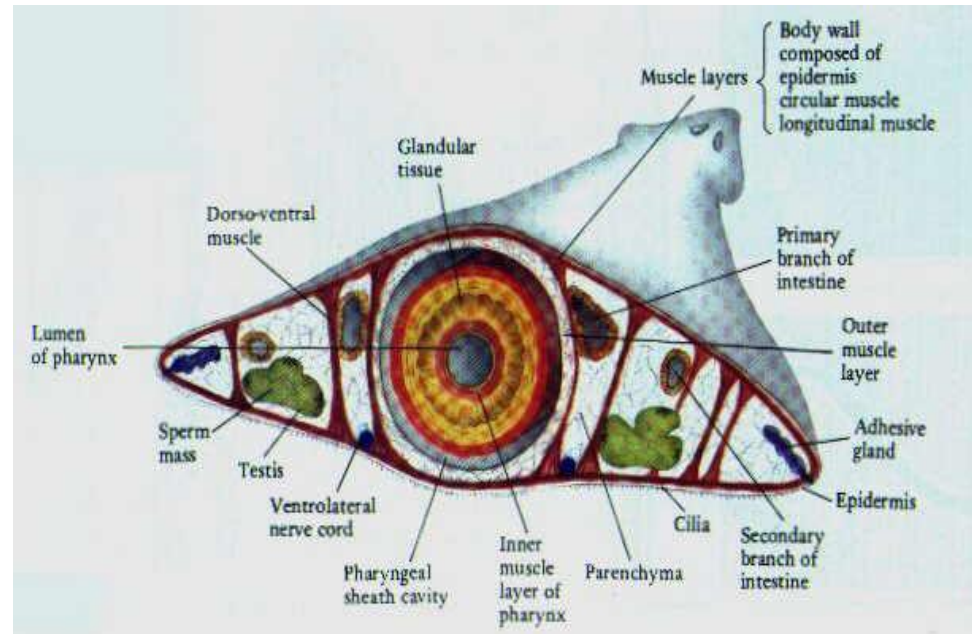
▶ Nervous system:

- Consists of a **primitive brain** (cerebral ganglion) plus **1–3 longitudinal nerve cords** (rarely 4).
- Typically, they bear **1 pair of eyes anteriorly**. In addition, they have **chemical, pressure** and **mechanical receptors**.
- 10% have **Statocysts** (balance receptors).
- ▶ Most aquatic species are **benthic** (live in or on the bottom).
- ▶ **Ventral surface is ciliated**.



► Movement: by many ways:

- Most species move by **cilia and mucus secretion** on the ventral surface.
- Others move by **A) pedal waves of muscle contraction**: these are unidirectional moving from anterior to posterior.
- They have: **longitudinal, circular, dorsoventral and diagonal muscles.**

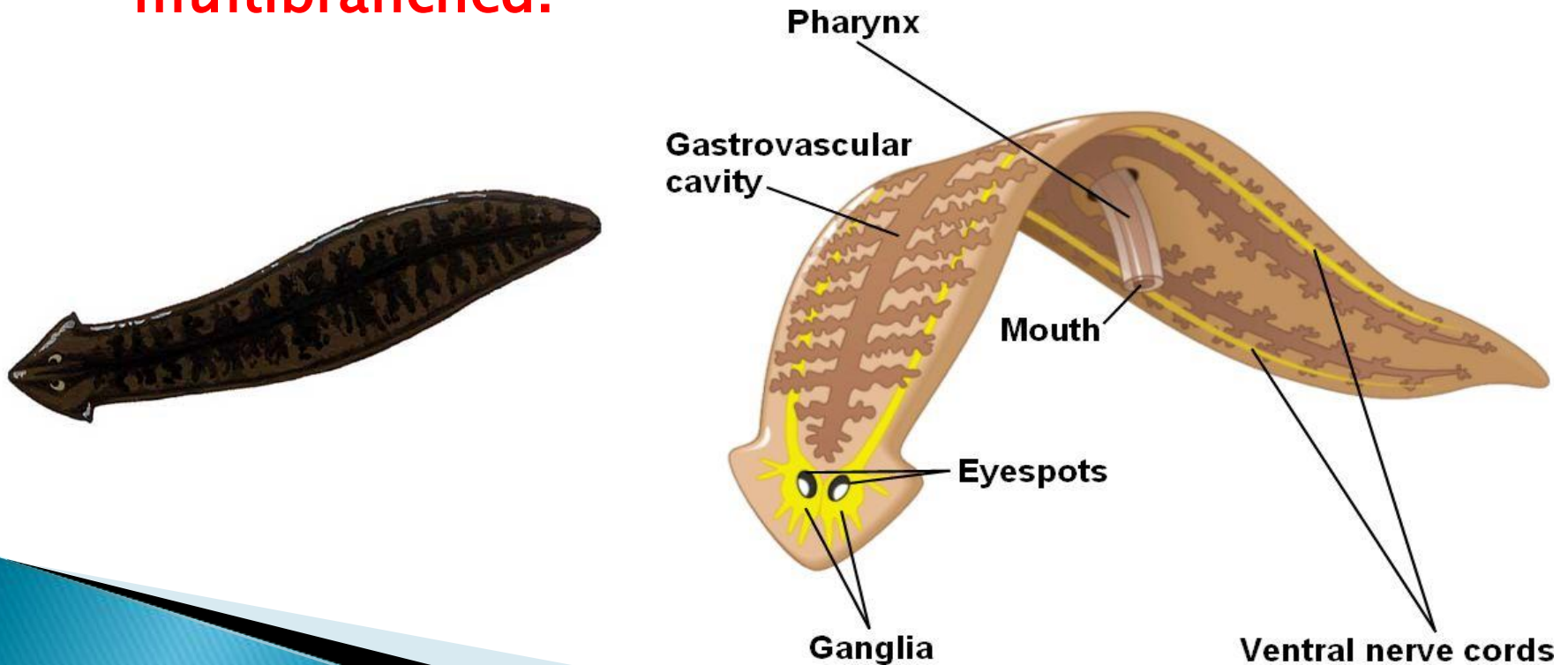


- **B) Looping movement:** in order to be effective, flatworms must be able to adhere to the substrate. This is done by the **duo-glands** that secrete glue to adhere to surfaces.
- **C) Some can swim** by ciliary action or muscular contractions.



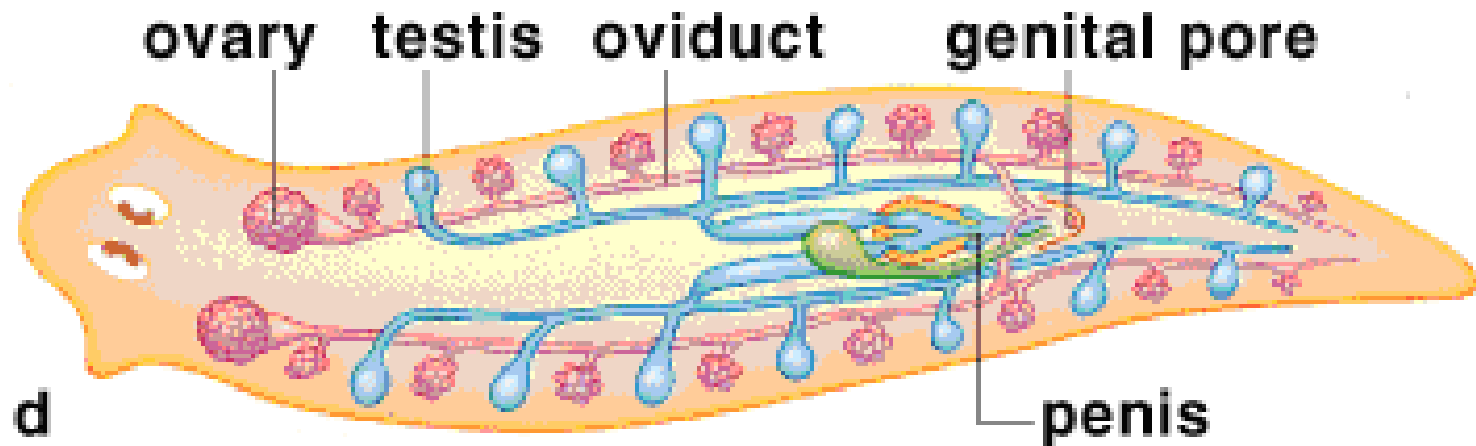
► Digestive System:

- Digestive system is simple and variable according to species.
- Mouth is usually at the end of a **protrusible pharynx**.
- Gut may be **straight, three-branched, or multibranched**.

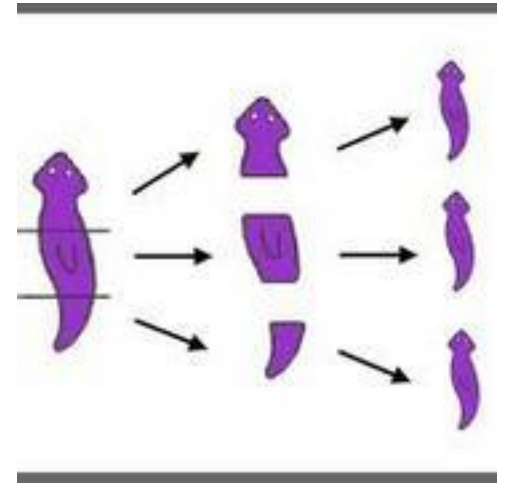


- Most species are **active carnivorous**. However, some **ingest algae and detritus**. Some have **endosymbiotic algae**.
- **Initially, digestion is extracellular**. Thereafter, it is completed intracellularly.
- ▶ **Reproductive System:**
 - **Sexual reproduction**
 - Turbellarians are **hermaphrodites**.
 - Two organisms exchange gametes (**cross-fertilization**).
 - Eggs are released after fertilization.

- ▶ Mostly, eggs develop into **miniature worms** without a free-living larval stage.
- ▶ However, several marine species have a free-swimming **larval stage called Müller's larva**.



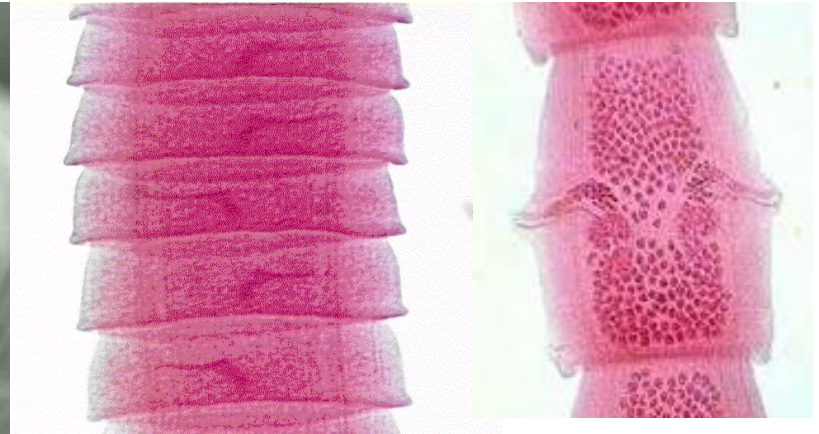
- **Asexual reproduction:**
 - **Regeneration.**
 - **Asexual fission.**
- **Examples: *Planaria (Dugesia)***



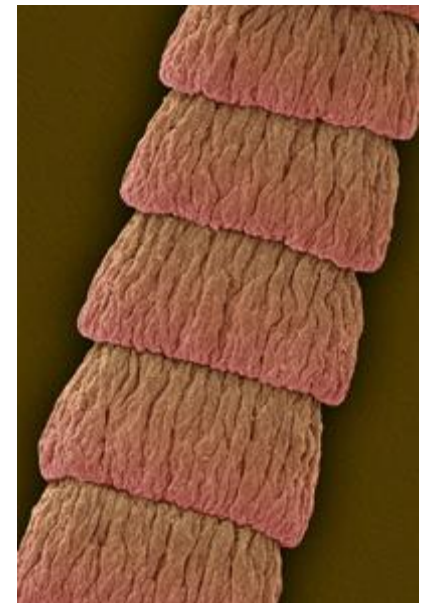
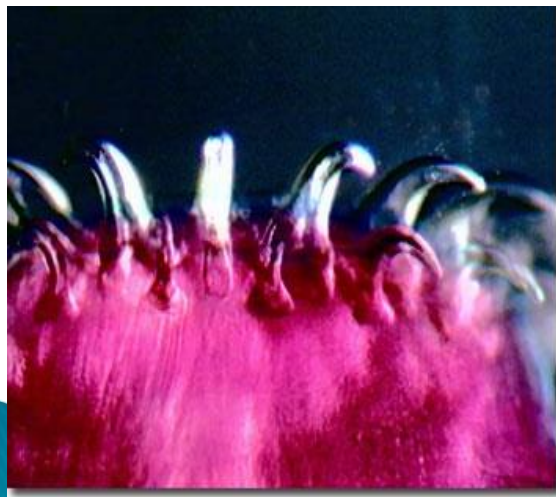
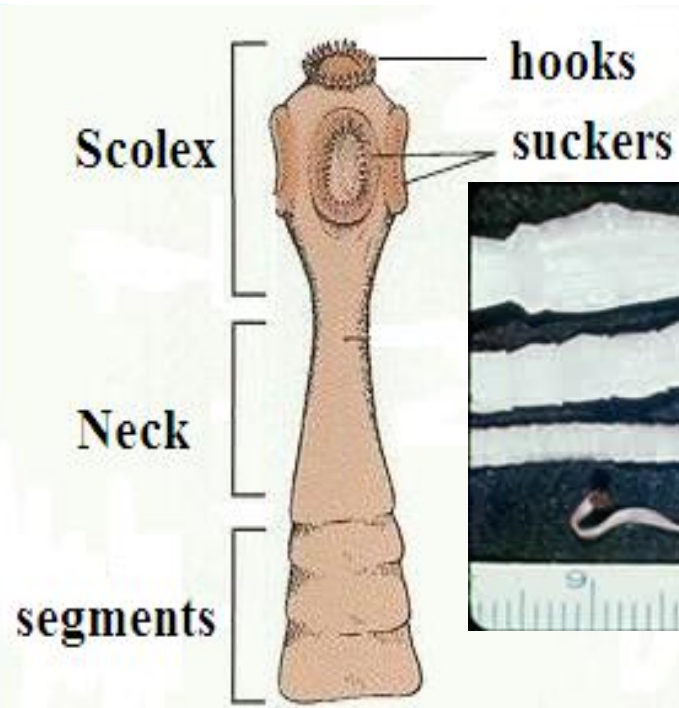
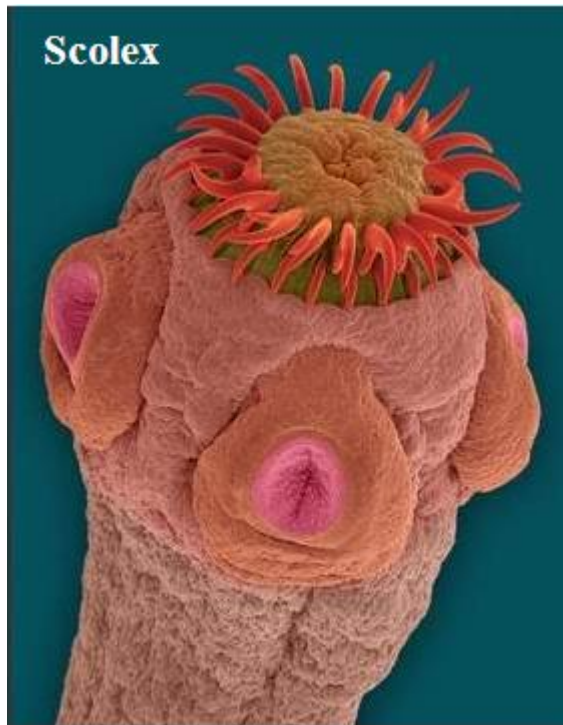
Class Cestoda

► Defining characteristics:

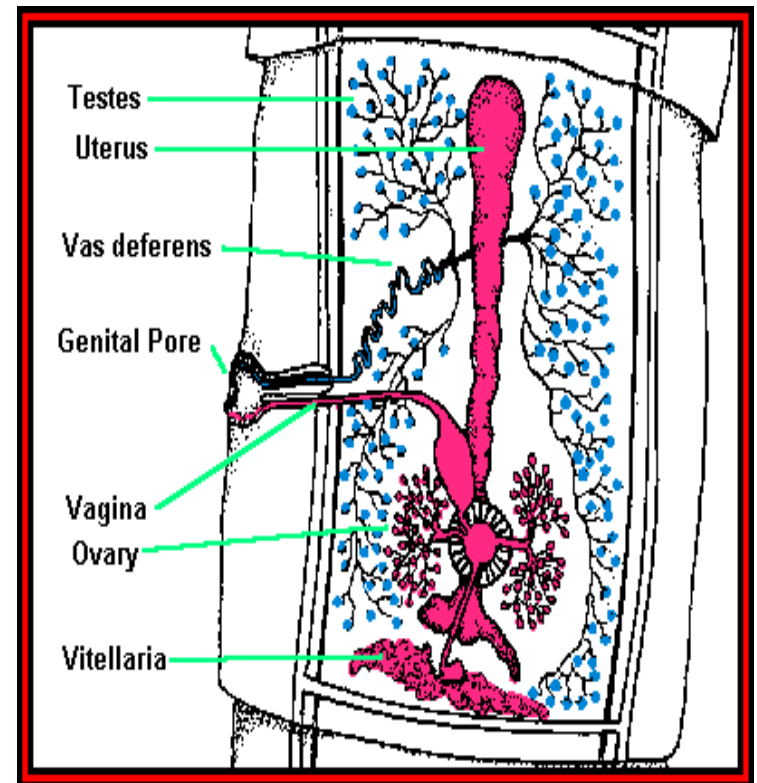
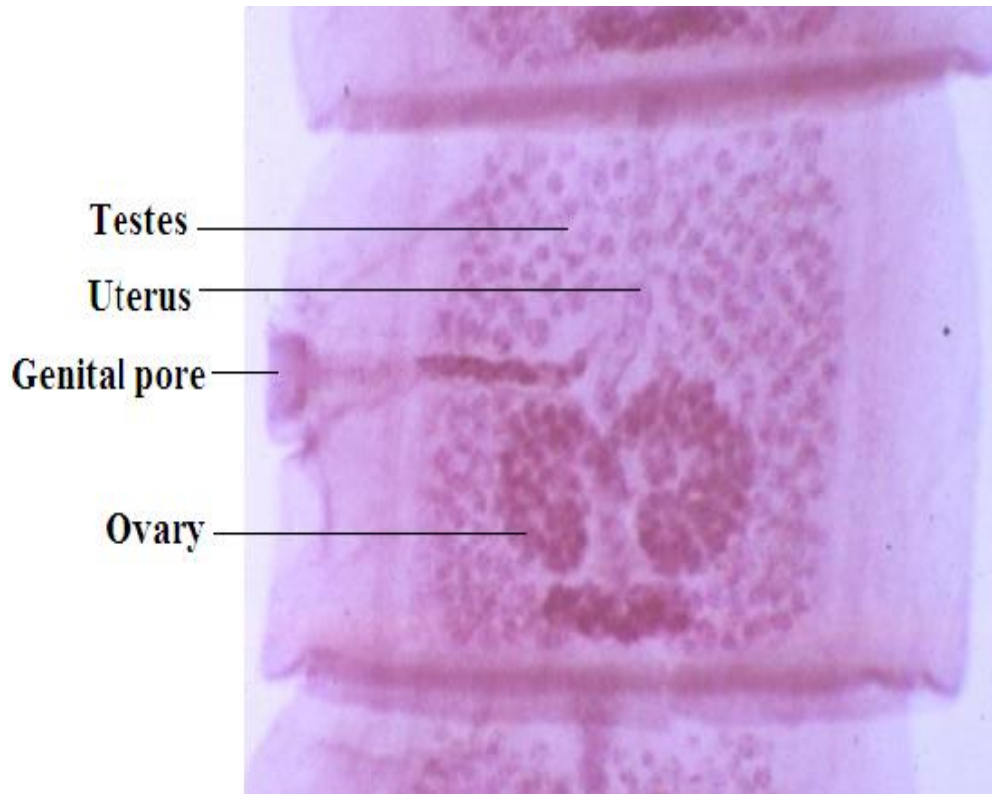
- *Small hooked anterior attachment organ (scolex).*
- *Division of body into segments (proglottids) arising from anterior end, behind the scolex.*
- *Absence (loss) of digestive tract.*



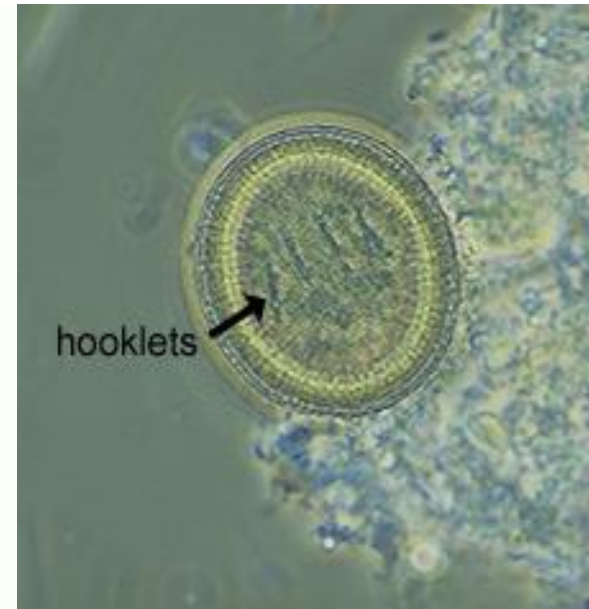
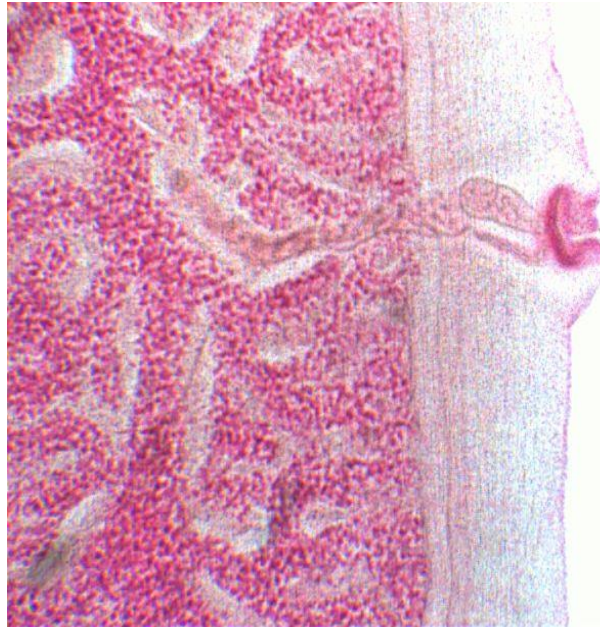
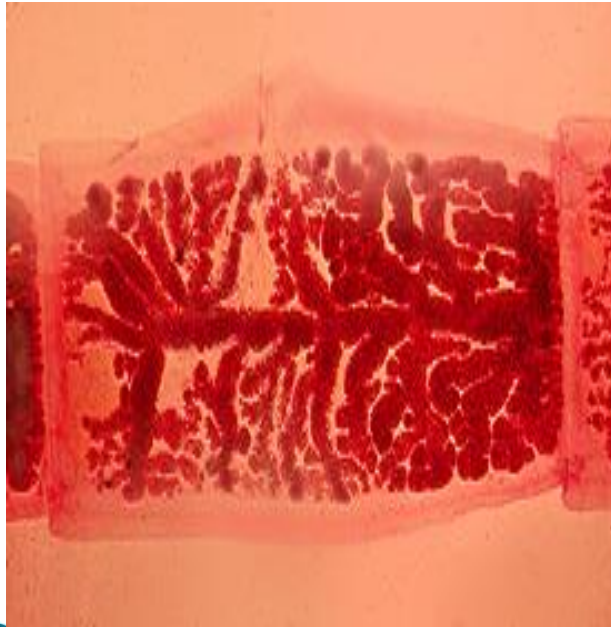
- ▶ Most species belong to **Subclass Eucestoda** which includes the **Tapeworms** (about 5000 sp).
- ▶ All are **endoparasites** of vertebrates (live in the digestive tract).
- ▶ The number of infected persons **worldwide** is about **135 million**.
- ▶ Body is covered by a **nonciliated, syncytial tegument**.
- ▶ Nutrients are taken **across the body surface**. They have **no mouth or gut**.
- ▶ **Body is composed** of: **scolex**, **neck** and **proglottids**.
- ▶ The anterior end takes the form of a **scolex** which is provided with **hooks and/or suckers**.
- ▶ Hooks and suckers are **used to maintain position within the host's gut**.



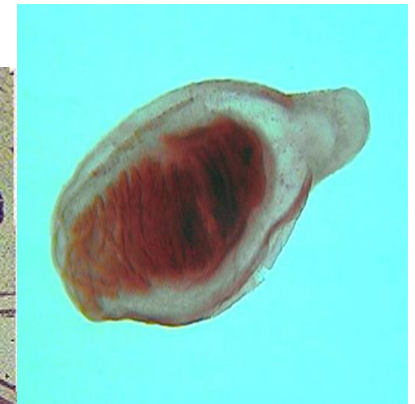
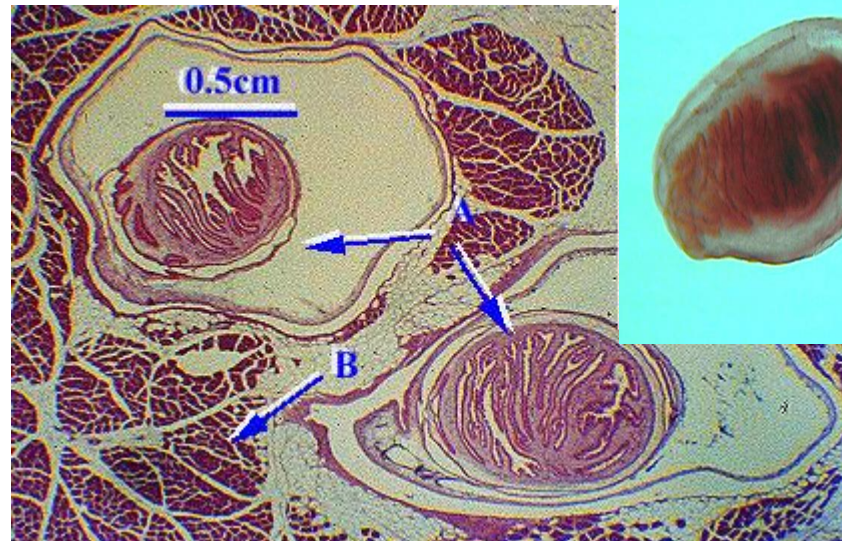
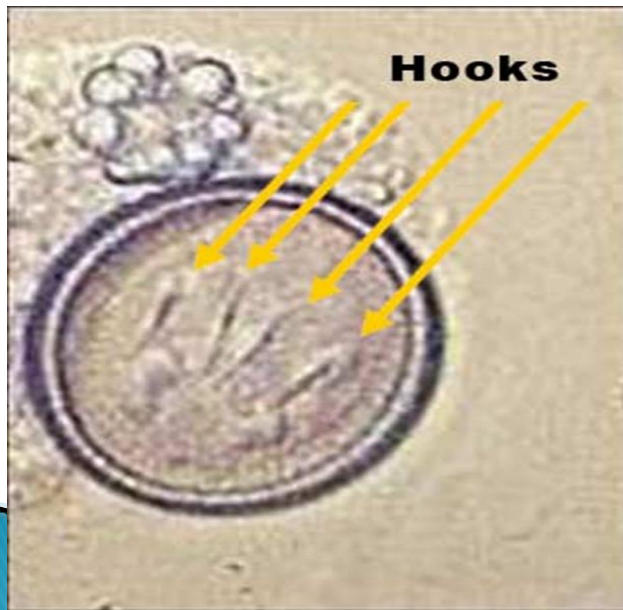
- Neck divides several times/day to give the **proglottids**.
- Each proglottid is **simultaneous hermaphrodite**.
- Each proglottid contains **numerous ovaries** and about **100 testes**.

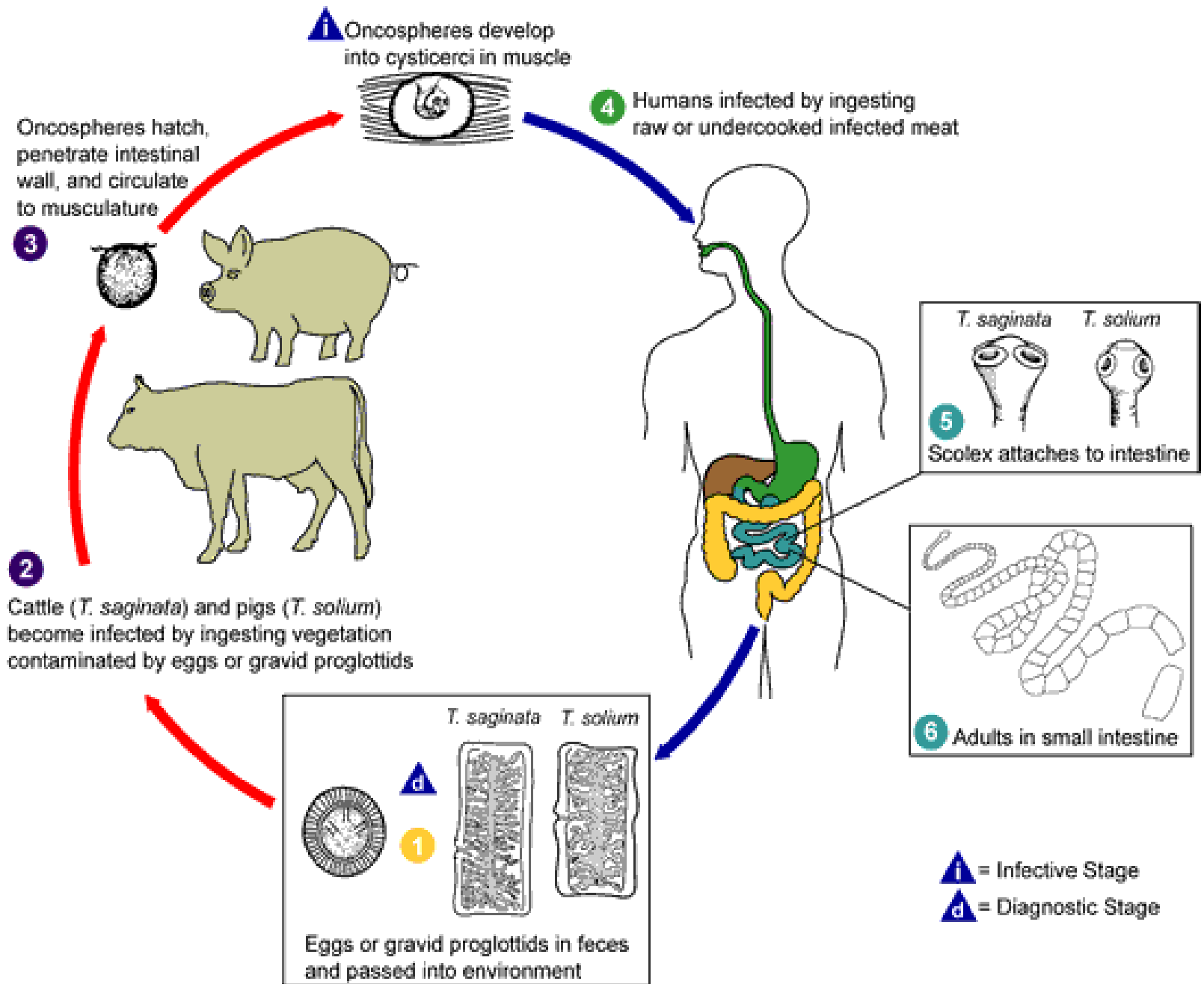


- Each proglottid **might contain 50,000 eggs** that are fertilized by sperms from neighboring individuals or from the same one.
- The length of a worm is usually **10–12 m** and the length of **each proglottid is 3–5 mm**.
- Eggs leave the digestive system of the host **with feces**.

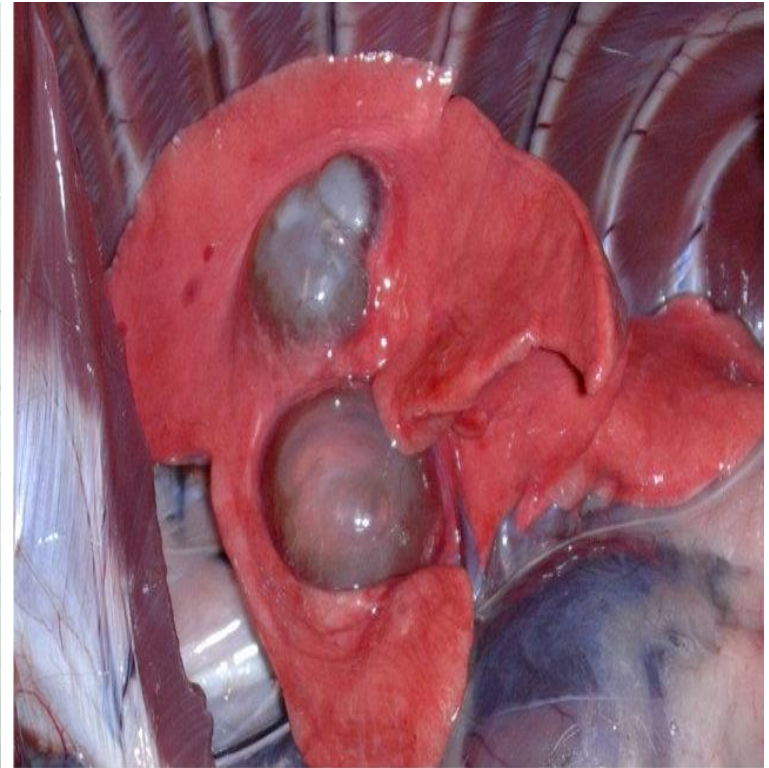
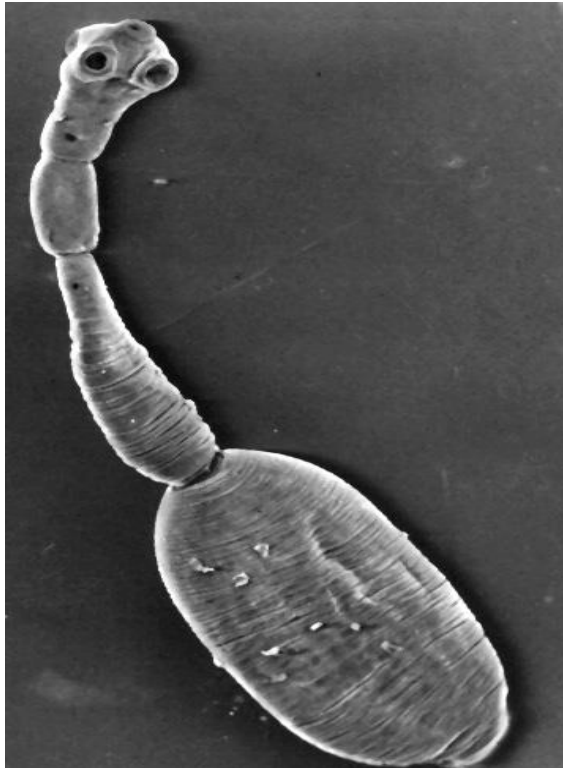


- Eggs cannot infect the **definitive (final) host** immediately; they must enter an **intermediate host** first.
- When eggs are ingested by an intermediate host→ an **onchosphere larva** hatches out. This larva is provided with **3 pairs of hooks**.
- Onchosphere lyses the intestinal wall→ encysts in the muscles or internal organs in the form of a **cysticercus (bladder worm)**.

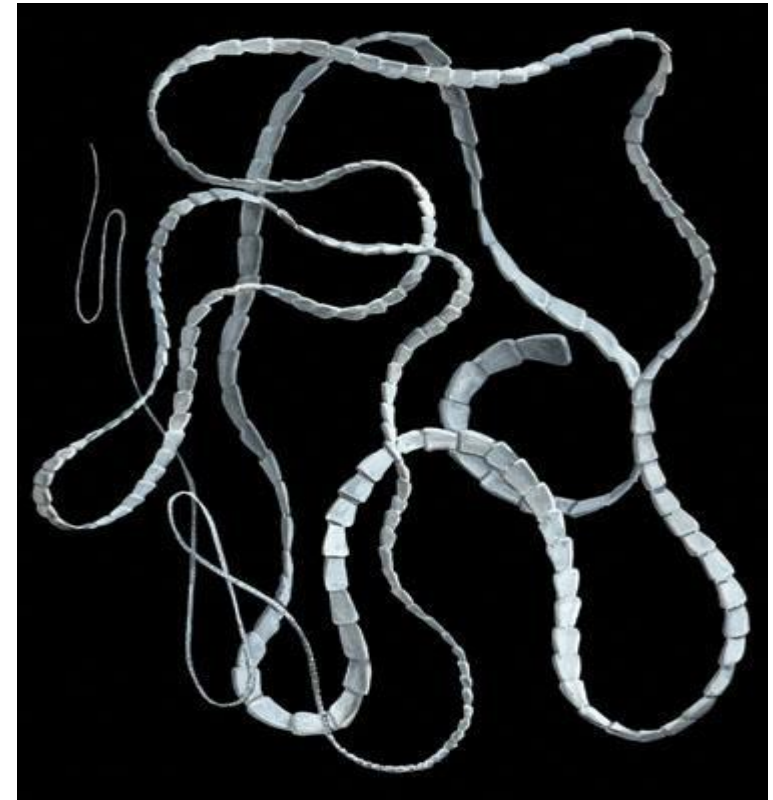




- ▶ The cysticercus of some species divides **asexually** forming a large **hydatid cyst** as in **the Dog Tapeworm (*Echinococcus*)**.



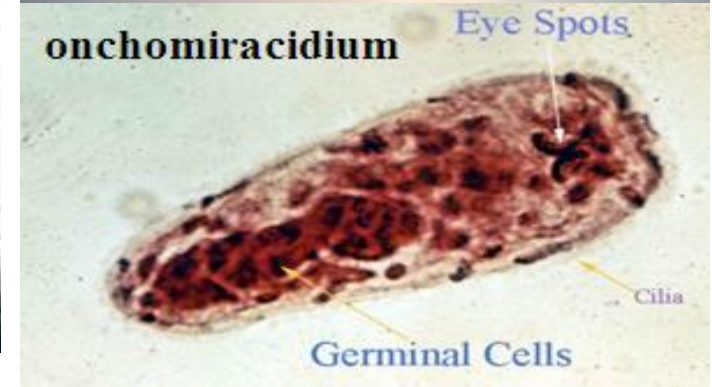
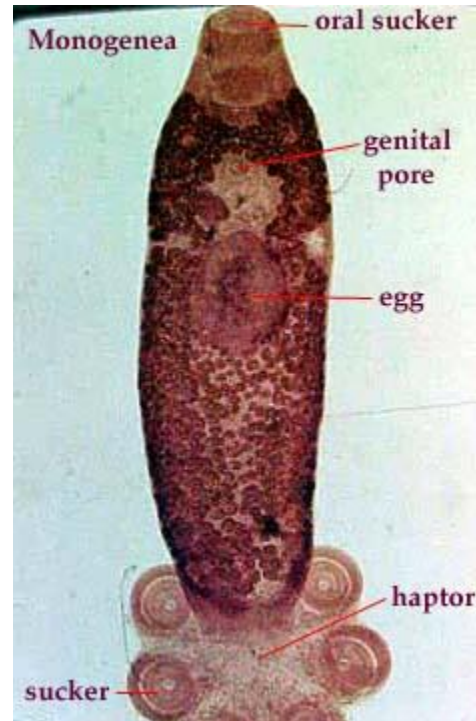
- If the infected meat containing the cysticercus is ingested by another intermediate host or a definitive host→ cysticercus develops into an adult worm.
- **Intermediate hosts** include: **Fishes cows, pigs, dogs & birds, man and arthropods.**
- **Definitive hosts** include: **man.**
- Examples: *Taenia saginata*,
Taenia solium.
Echinococcus granulosus,



Class Monogenea:

- Defining characteristics:

- Posterior attachment organ (haptor=opisthohaptor) including suckers and complex hooks and sclerites.*
- Larva (onchomiracidium) bears 3 bands of cilia and usually 1 or 2 pairs of eyes.*

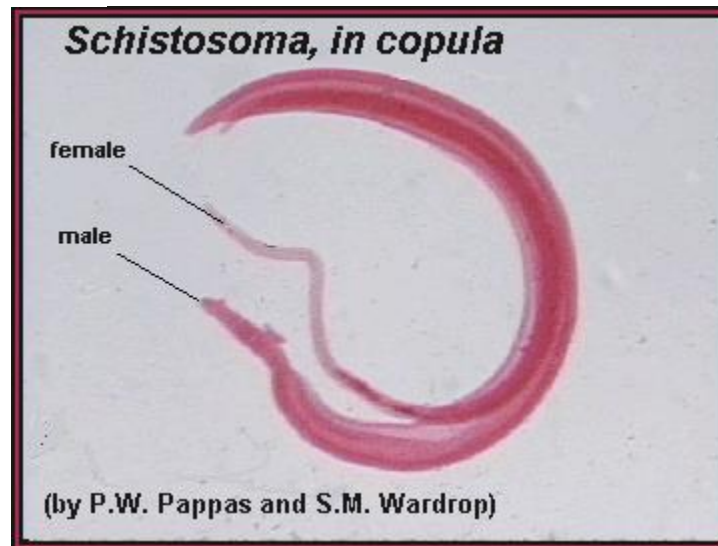
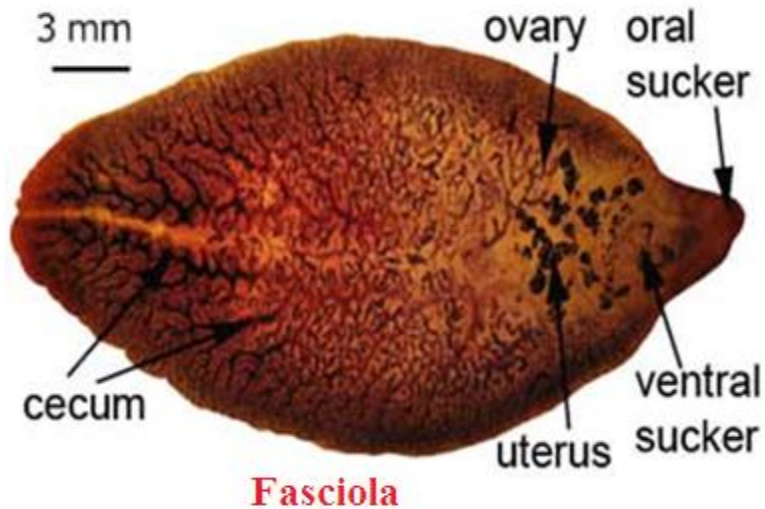


- **Ectoparasites** on skin or gills **of fish** (8000 sp).
- **An anterior adhesive organ (prohaptor)**, consisting of suckers and adhesive glands, aids the opisthohaptor in attachment.
- **No intermediate hosts** in the life cycle.
- **Life cycle:** Adults on fish → egg production → larval stage (onchomiracidium) → attachment to fish.
- About **1100 species** have been described.
- They have a high level of **host specificity**.

Class Trematoda:

- ▶ All members (8000 sp) are **parasitic species** (endo- and ectoparasites).
- ▶ Members of this class are considered **successful parasites that must:**
 - 1) Reproduce within definitive host
 - 2) Get the fertilized eggs or embryos out of the host.
 - 3) **Contact and recognize a new, appropriate host.**
 - 4) **Obtain entrance into the host**
 - 5) Locate the appropriate environment within the host.
 - 6) Maintain position within the host.
 - 7) Withstand anaerobic environment.
 - 8) Avoid the digestive or the immune system of the host.
 - 9) Avoid killing the host, at least until reproduction has been achieved.

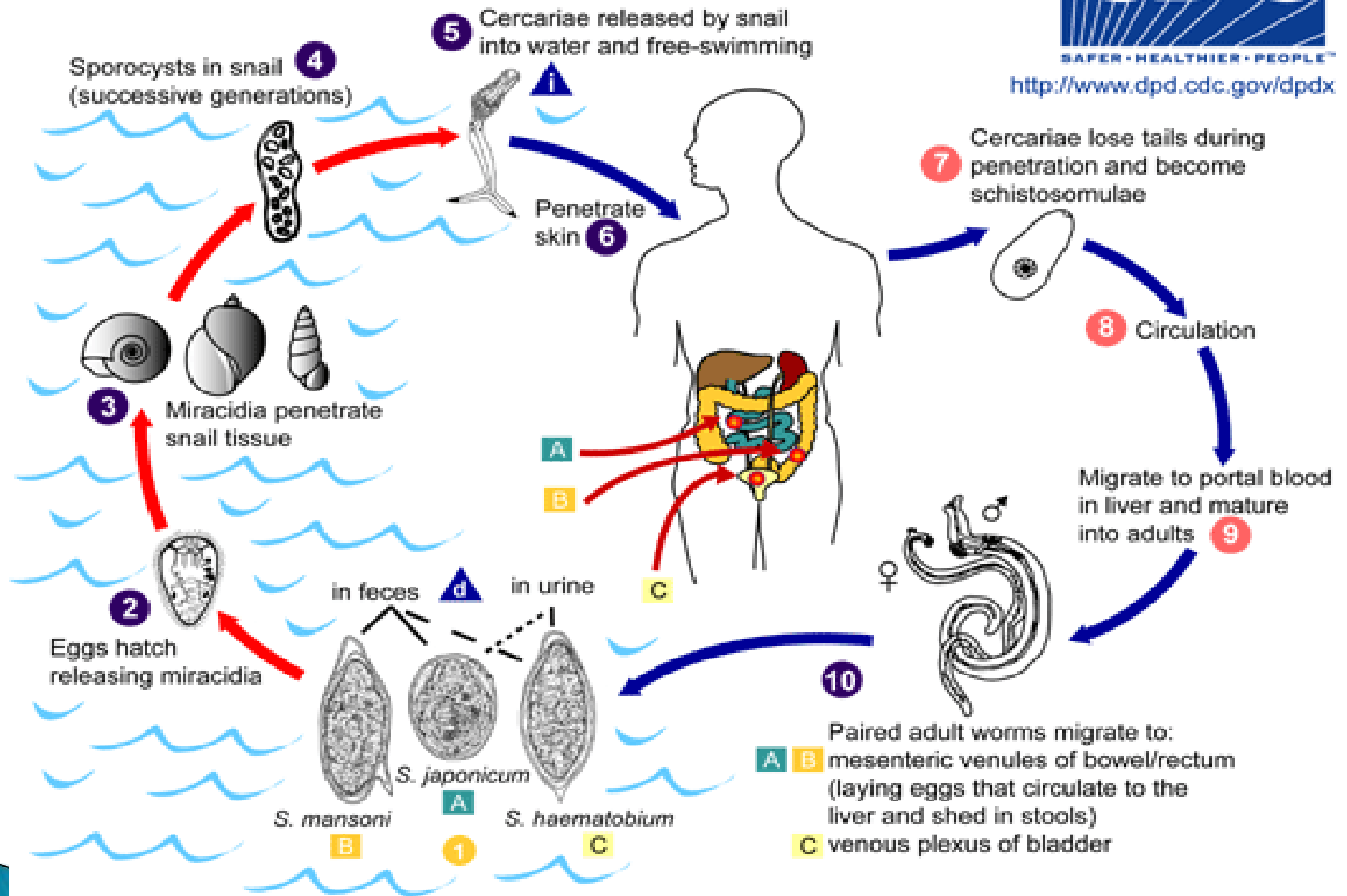
- ▶ **Trematodes (called Flukes)** have remarkable ability to # 3 and 4 above.



- Outer layer is a non-ciliated **syncytial tegument**.
- They have a **mouth opening** and a **blind ended digestive tract**.
- Body is **not segmented** (like Turbellarians).
- They **feed on the tissue and blood of the host**.
- Some Trematodes (**Blood flukes**) cause serious, often deadly diseases like ***schistosomiasis***.
 - Infects more than **200 Millions in 77 countries** (second after malaria).
 - Kills more than **800,000 people/year**.

- ▶ Trematodes are classified in **two subclasses**:
 - **Subclass Digenea** (main group)
 - **Subclass Aspidogastrea** (much smaller group)
- ▶ **The Digeneans:**
 - Members require at least one intermediate before reaching the final one (Digeneans: G. : ***Di*: two, gena: birth**).
 - **Host finding is an active process** (Their larvae search for the appropriate host actively. This is a passive process in other Cestodes).

i = Infective Stage
d = Diagnostic Stage



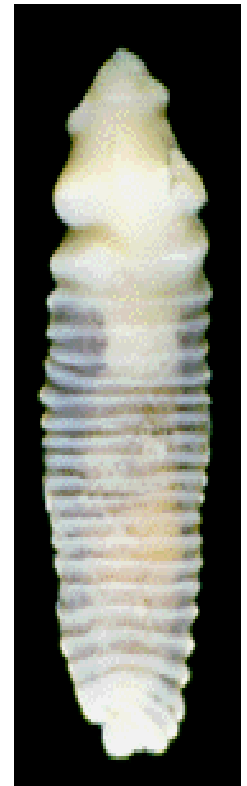
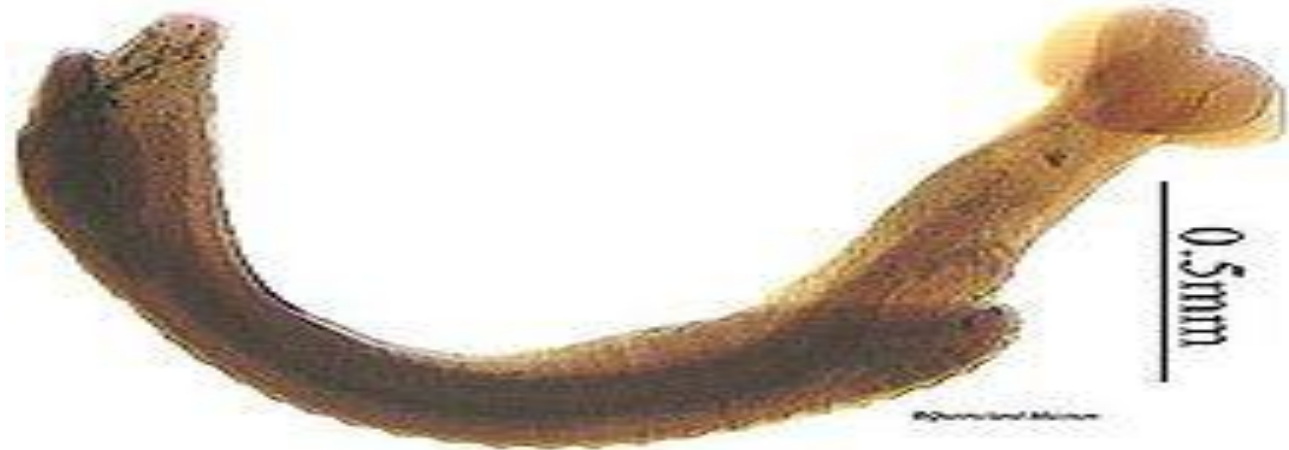
- ▶ Schistosomes can produce **>3000 fertilized eggs/day**.
- ▶ The digeneans are **exclusively endoparasites**.
- ▶ They are **mostly hermaphrodites** (some are dioecious).
- ▶ A **single miracidium** gives rise to **> 10_s of thousands of cercariae**.



The Aspidogastrea (aspidobothrea):

- ▶ **Defining characteristic:**

- ▶ *Large ventral sucker divided by septa, generally forming a row of suckers.*



- A **small group** (80 species).
- Have **similarities to both mono- and digeneans**, but they do not fit in any one of them.
- Most have a **simple life cycle** with a single host (as monogeneans), mostly a mollusk.
- Have **no haptor** (like the one found in monogeneans).
- They have a **large ventral adhesive sucker**.
- **Some need an intermediate host** (usually a mollusk) to reach the final host (fish, turtle). (Like digeneans).
- However, **life cycle has no asexual replication** within the intermediate molluscan host. (unlike digeneans).