مقرر "تصنيف الحيوان" كود 203 عل ط

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الرموز المستخدمة

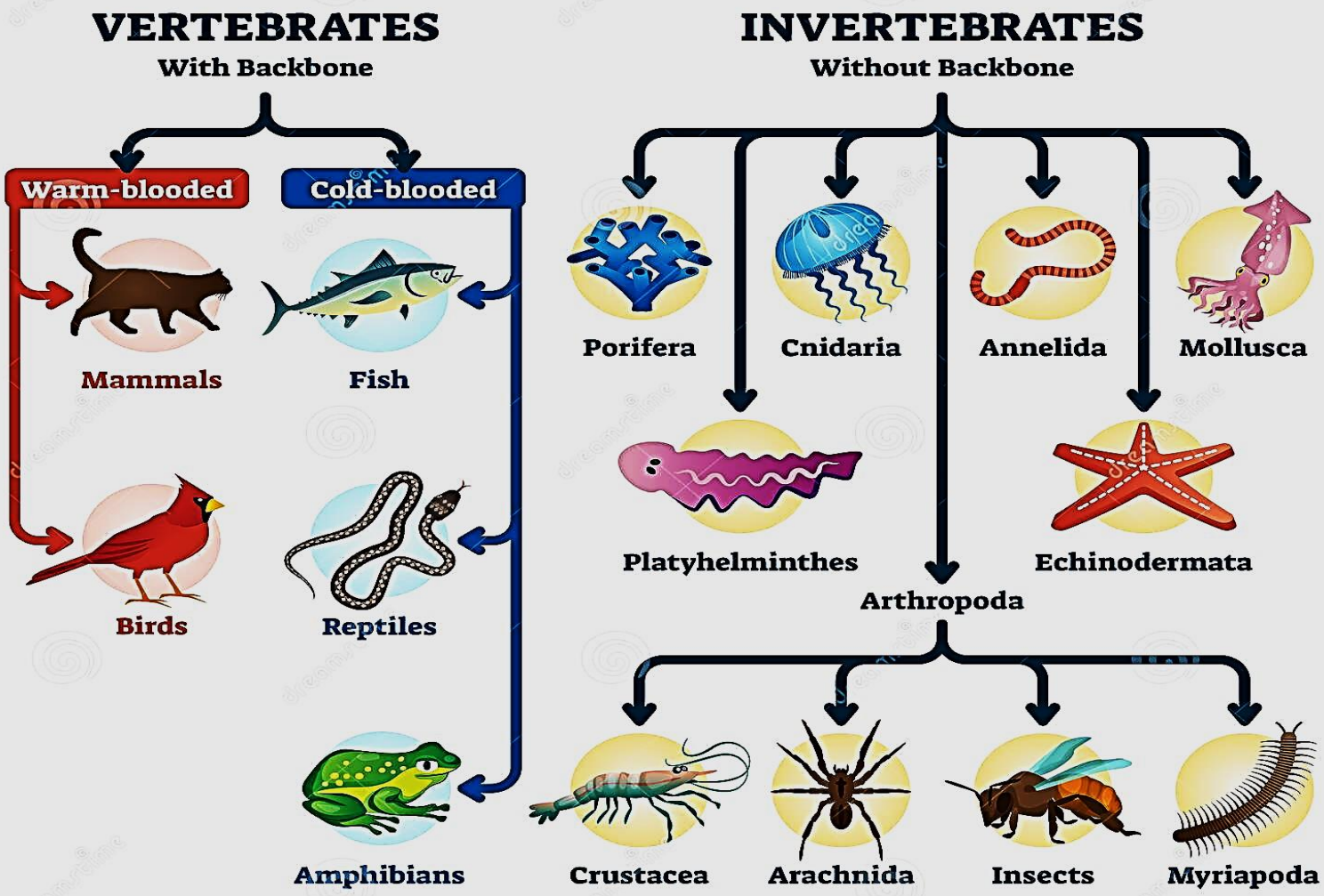

نص للقراءة والدراسة


أنشطة ومهام


أسئلة للتفكير والتقييم الذاتي


فيديو للمشاهدة

CLASSIFICATION OF ANIMALS



Introduction

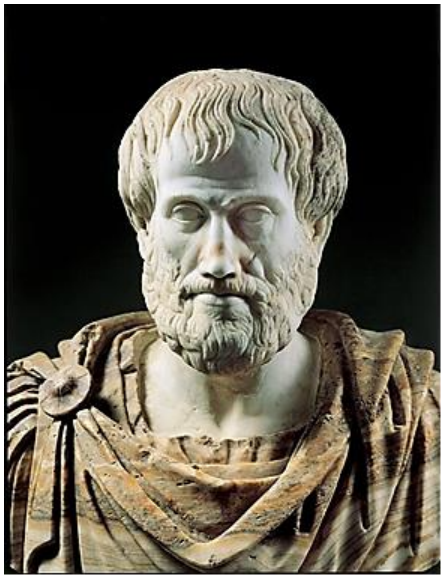
- **Animal taxonomy is one of zoology branches that is concerned with identifying different types of animals, describing them, naming them and placing them in the appropriate classification position.**

- **More than million animal species are currently known to facilitate their study and to understand various relationships between their groups.**

Aristotle

The Greek philosopher Aristotle (384-322 BC) was among the first scientists who were interested in classifying living organisms from animals and plants.

He suggested that animals could be classified according to the presence or absence of red blood into two groups: Enaima and Anaima.



- **Other attempts were performed to classify animals on other bases, such as:**

1. **Environment: accordingly, animals have been classified into terrestrial, aquatic and aerial.**

2. **Food type: consequently, animals were divided into two groups: carnivores and herbivores.**

John Ray

Gradually, however, emerged the idea of classifying animals according to the morphological similarities between them.

This idea was formulated clearly by the English naturalist John Ray (1627-1705).

- **Ray's idea was taken up by the scientific community throughout the seventeenth century and considered the first attempt to classify animals on an accurate scientific basis.**

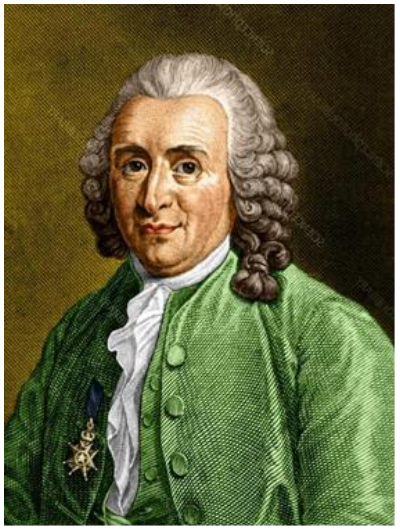
- **The scientist Ray was also the first to develop an accurate definition of species, which is the basic unit of classification for living organisms in general.**

- **The species was defined as:**

"A group of individuals with similar morphological characteristics, that can mate with each other, but do not mate with members of another species, and if this happens, sterile hybrids will result.“

Linnaeus

Later came the Swedish naturalist Linnaeus (1707-1778) who laid down the basis of the system of classification we use nowadays.



- He classified living organisms **according to the morphological and anatomical similarities between them.**

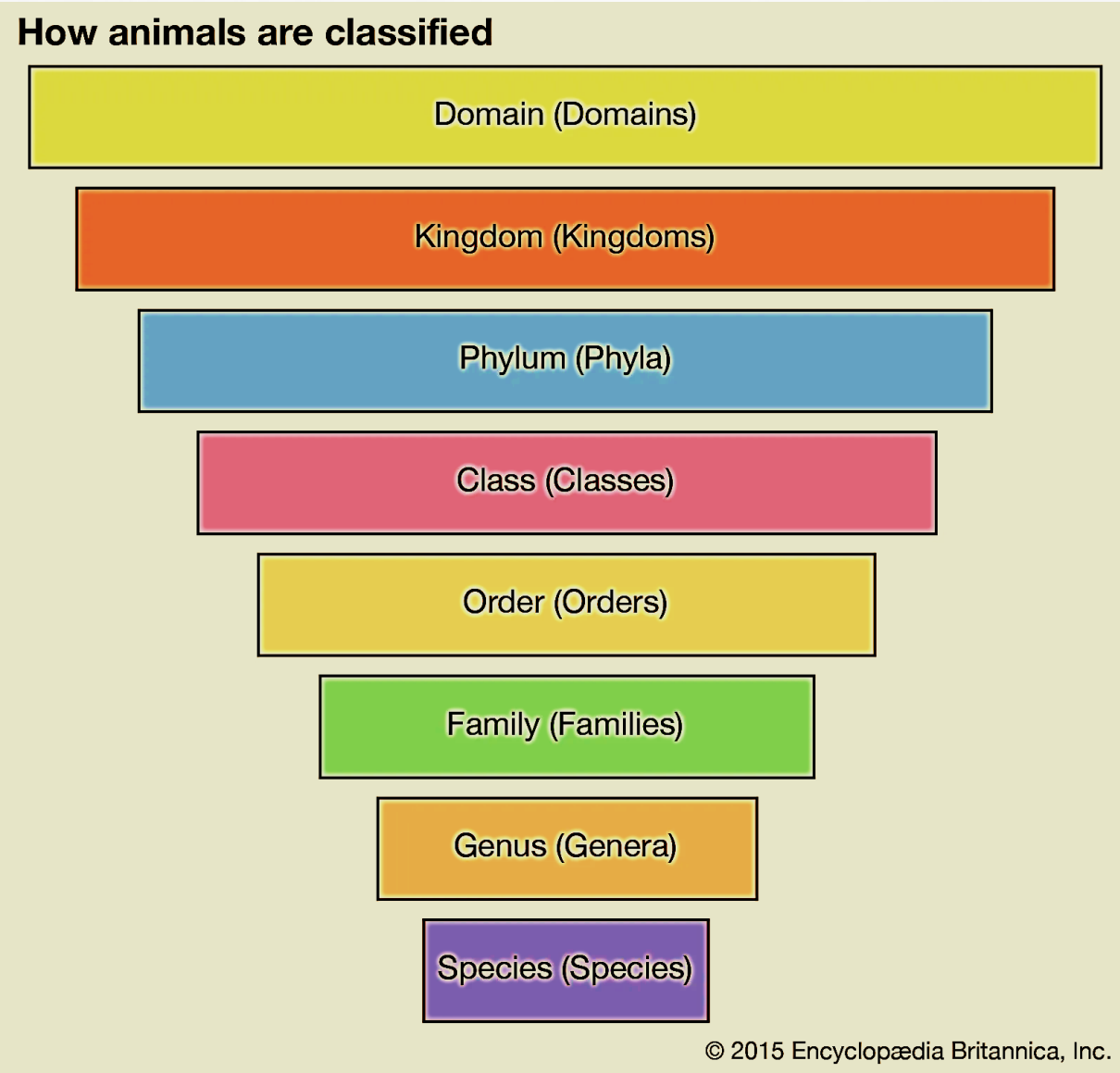
- He also devised the system of "**Binomial nomenclature**" by which each type of organism is given a name composed of two words, the first is the name of the **genus**, and the second is the name of the **species**.

- Both are **Latin** and are **written underlined** or **typed in italics**. The name of the **genus starts with a capital letter** and that of **the species with a small letter**.

- Nowadays, the classification of animals is not only based upon morphological and anatomical characteristics but also on
  - **Biochemical.**
  - **Genetical.**
  - **Embryological.**
  - **Physiological features.**

 Species having many features in common are placed in the same genus.
Similarly, related genera are grouped in a family, and families with certain common characteristics constitute an order, and orders in turn are grouped into classes. From these classes, the higher taxonomic groupings known as phyla are formed.

 Although the relationships between the different phyla may not
be obvious, it is always possible to arrange them according to the degree of complexity of structure and function into larger groups known as subkingdoms or branches.


How animals are classified
Domain (Domains)
Kingdom (Kingdoms)
Phylum (Phyla)
Class (Classes)
Order (Orders)
Family (Families)
Genus (Genera)
Species (Species)
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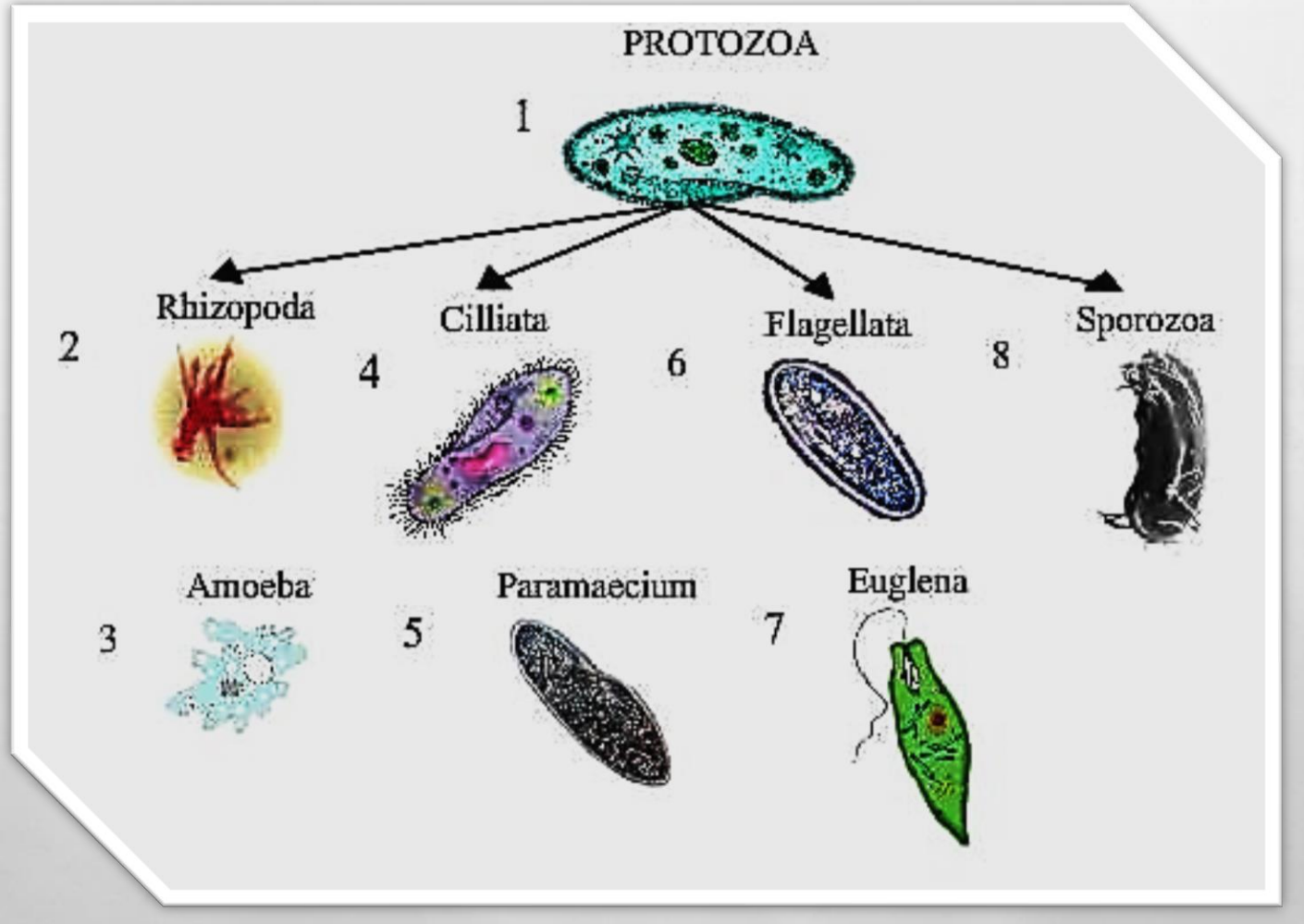
Kingdom: Protozoa



General characteristics of Protozoa

- **Protozoa are aquatic microscopic organism in general.**

- **They are unicellular, and the animal is made up of only one cell.**

- **Protoplasm is found in two parts ectoplasm (outside) and endoplasm (inside).**

- **They are solitary but sometimes become colonial.**

- **They are either free-living or parasitic.**

General characteristics of Protozoa

- **Locomotion takes place by pseudopodia or flagella.**
- **Excretion takes place through body surface.**
- **Respiration may be aerobic or anaerobic.**
- **Reproduction is mostly asexual.**

Examples of Protozoa
Amoeba

Classification

Kingdom: Protozoa

Phylum : Amoebozoa

Class : Tubulinea

e.g. : ***Amoeba* sp**.

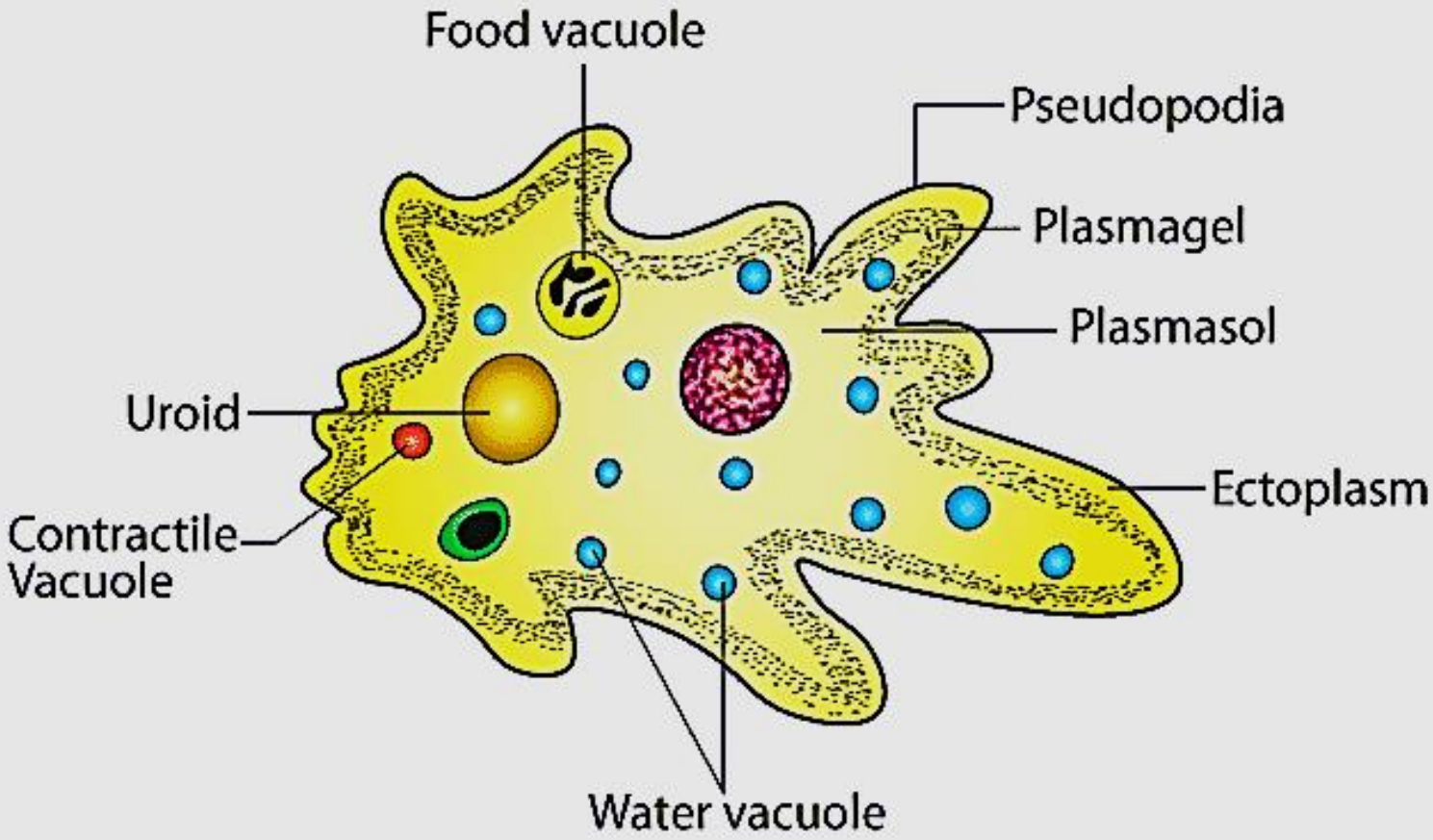
Origin of name:

- **The name is derived from a Greek word meaning “to change”.**

Shape and Size:

- **Amoeboid are microscopic organisms with a jelly-like transparent irregular shape.**
- **Its size ranges from 2 micrometer to 0.5 cm.**

STRUCTURE OF AMOEBA



Habitat:

- **They live in water including lakes, ponds, streams, rivers and puddles.**
- **Some can even live in the bodies of animals.**

Locomotion:

- **Amoeboid move by crawling using pseudopodia.**

- **Pseudopod is a part of the amoeba's body that it can stretch out and pull itself with.**
- **Pseudopod is used to help the amoeba to move, and also to eat.**

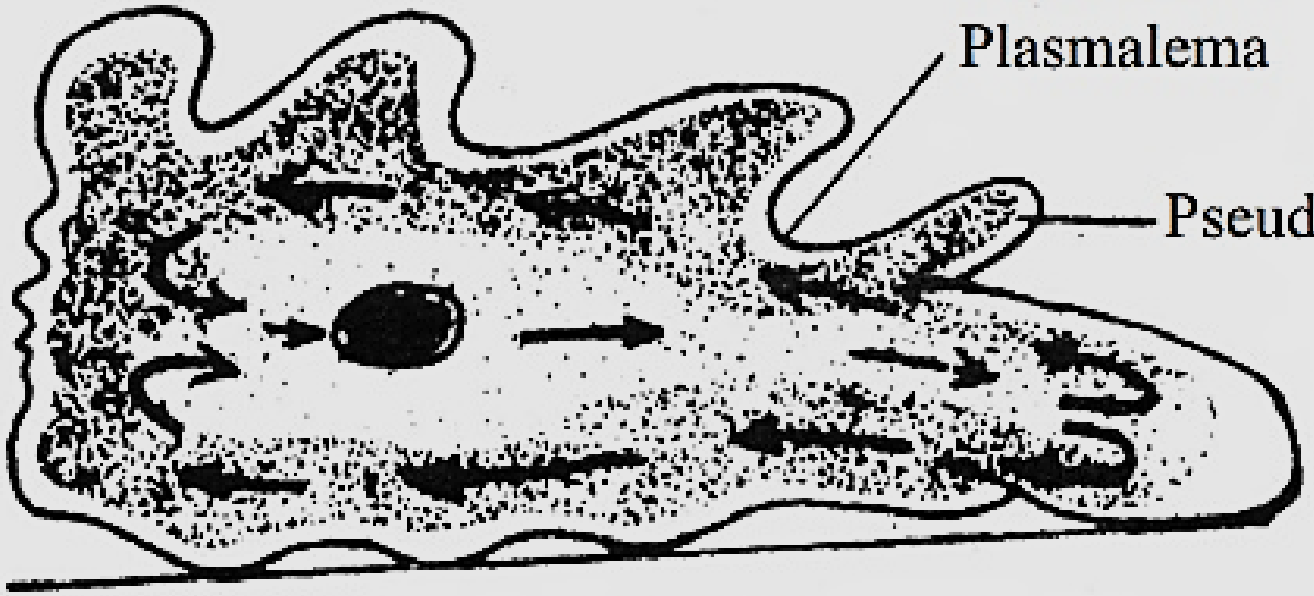


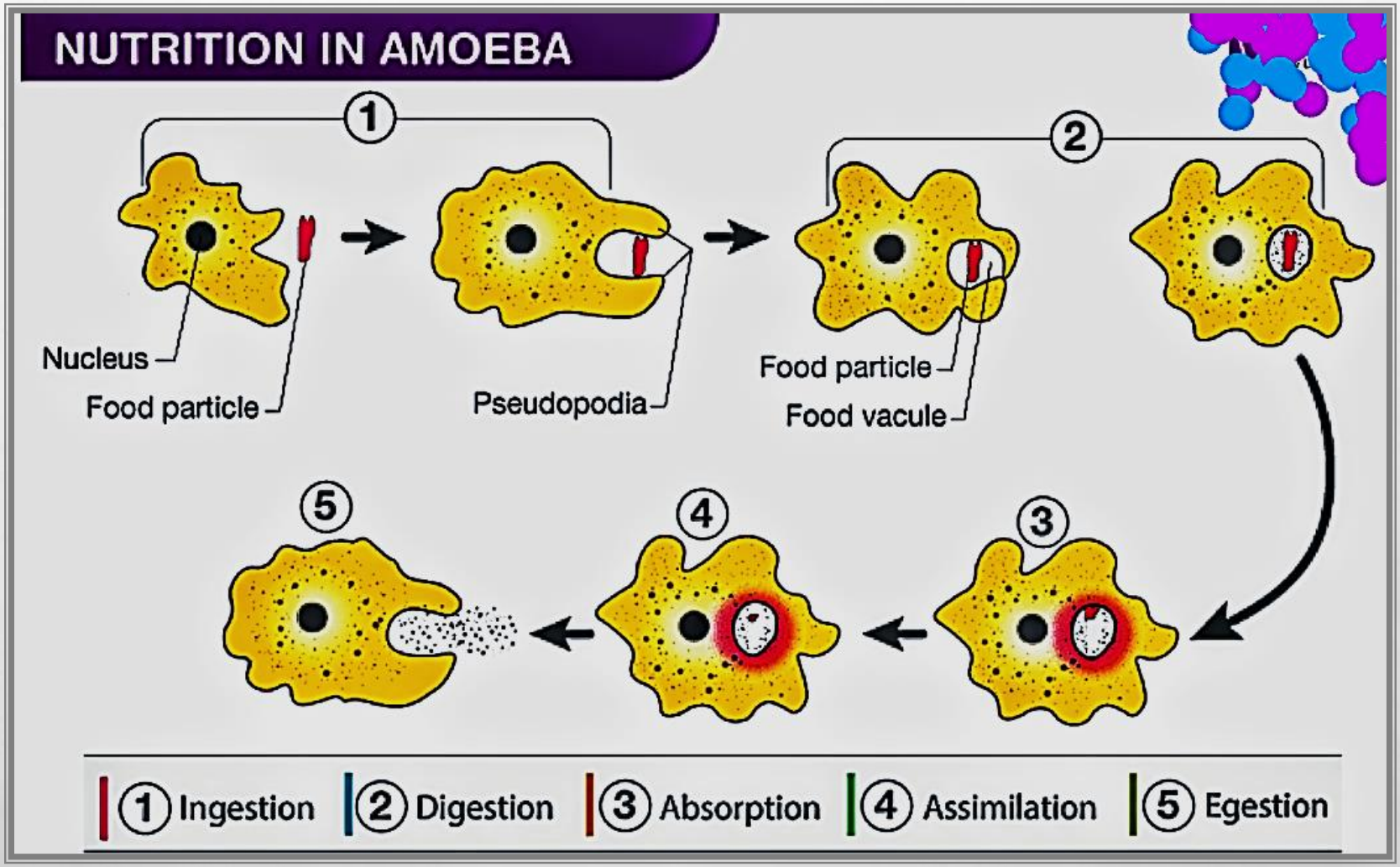
Fig. Movenment of Amoeba

Fig:8.2

Nutrition:

- **The amoeba feed through phagocytosis process.**

- **It stretches out the pseudopod, surrounds a piece of food (mainly bacteria, algae and other protozoa), and pulls it into the rest of the amoeba's body.**
- **An opening in the membrane allows the food particles, along with drops of water, to enter the cell, where they are enclosed in bubble like chambers called food vacuoles where the food is digested by enzymes and absorbed into the cell.**
- **The food vacuoles then disappear.**

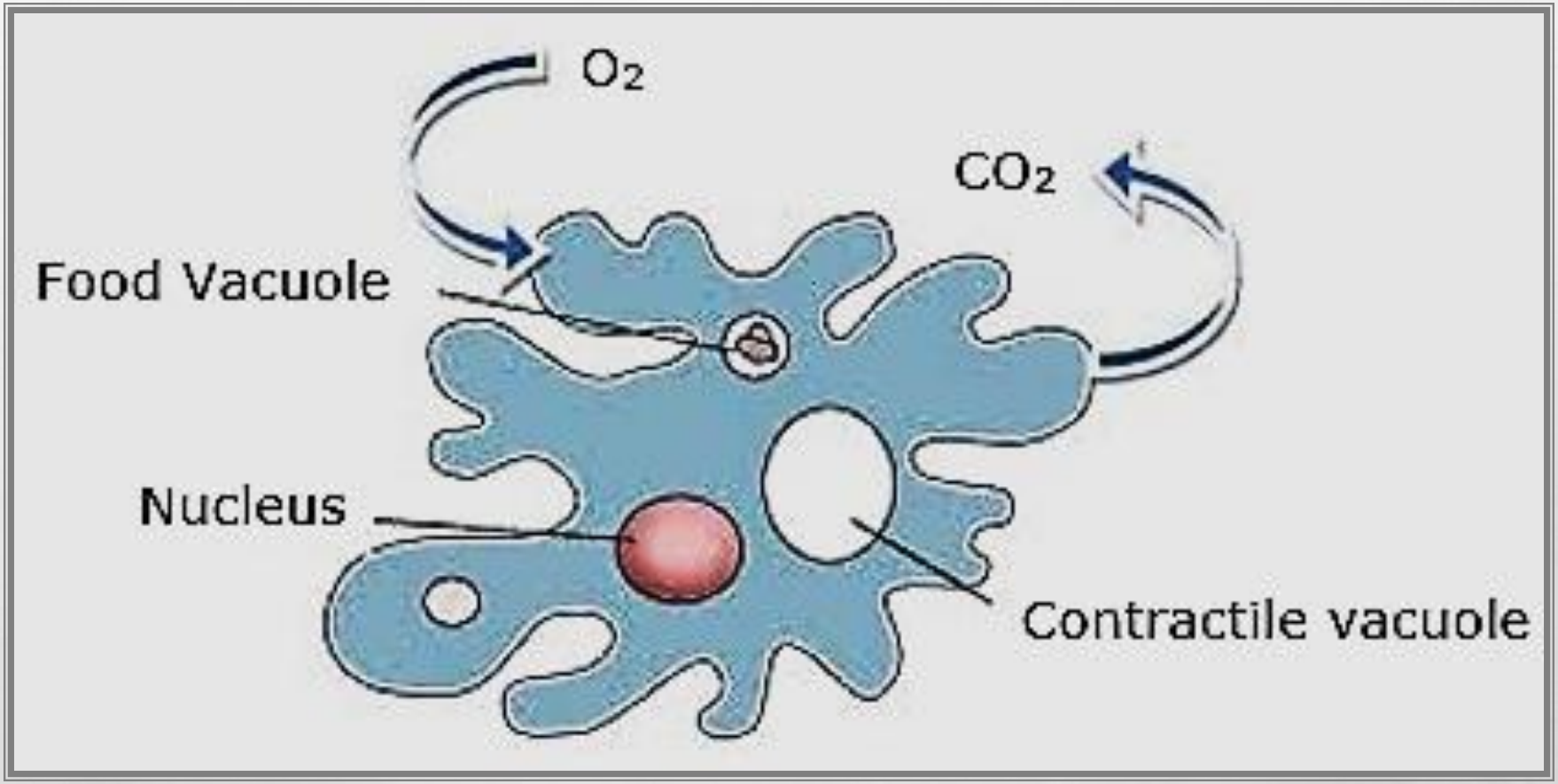

NUTRITION IN AMOEBA
1
2
Nucleus
Food particle
Pseudopodia
Food particle
Food vacule
5
4
3
1 Ingestion
2 Digestion
3 Absorption
4 Assimilation
5 Egestion

Excretion:

- **Liquid wastes are expelled through the membrane by diffusion.**

Osmotic regulation:

- **Water from the surrounding environment flows through the amoeba's ectoplasm by osmosis process.**
- **When too much water accumulates in the cell, the excess is enclosed in a structure called a contractile vacuole and squirted back out through the cell membrane.**

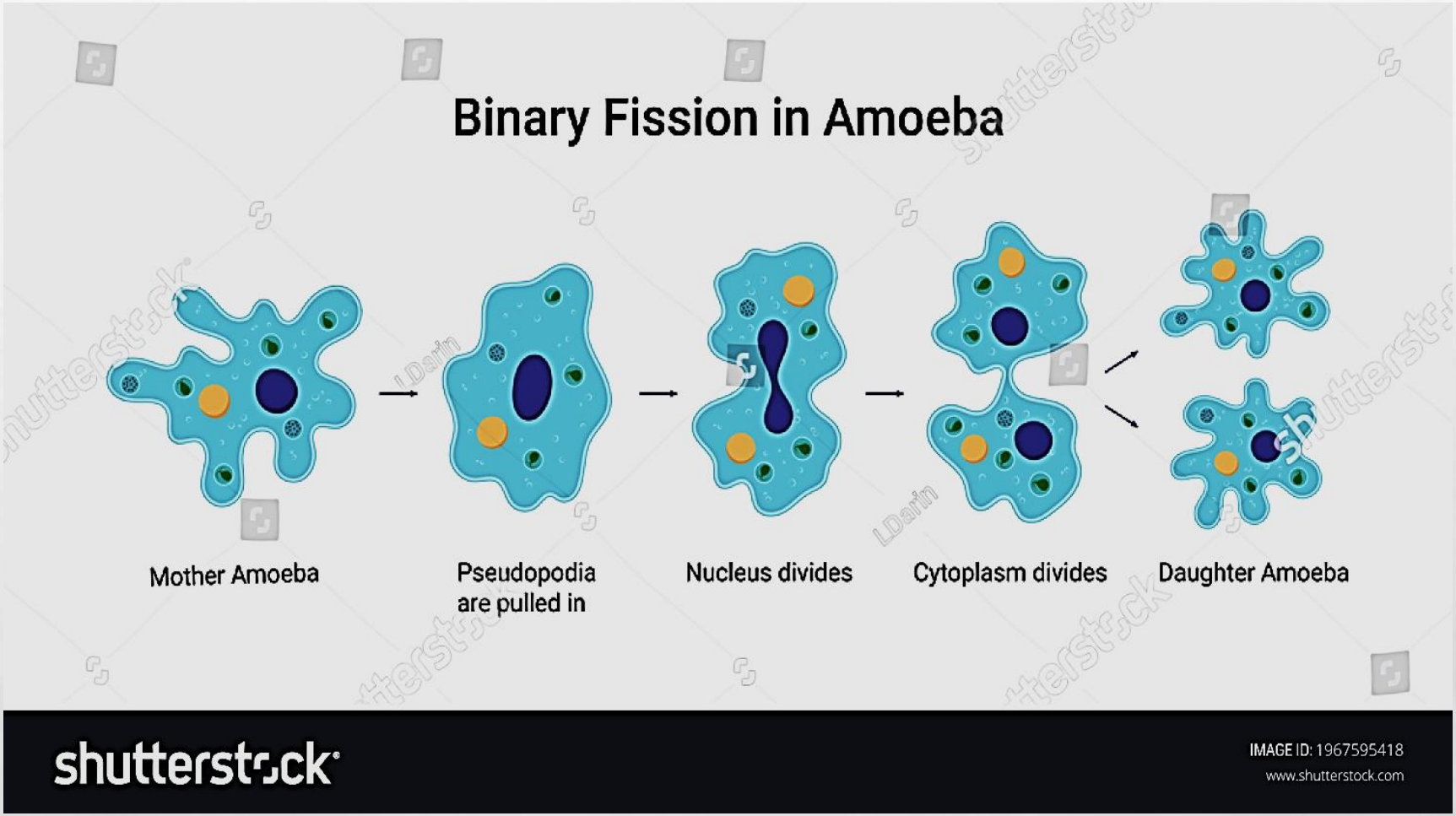

O_2
CO_2
Food Vacuole
Nucleus
Contractile vacuole

Respiration:

- **The membrane allows oxygen to pass into the cell and carbon dioxide to pass out by diffusion.**

Reproduction:

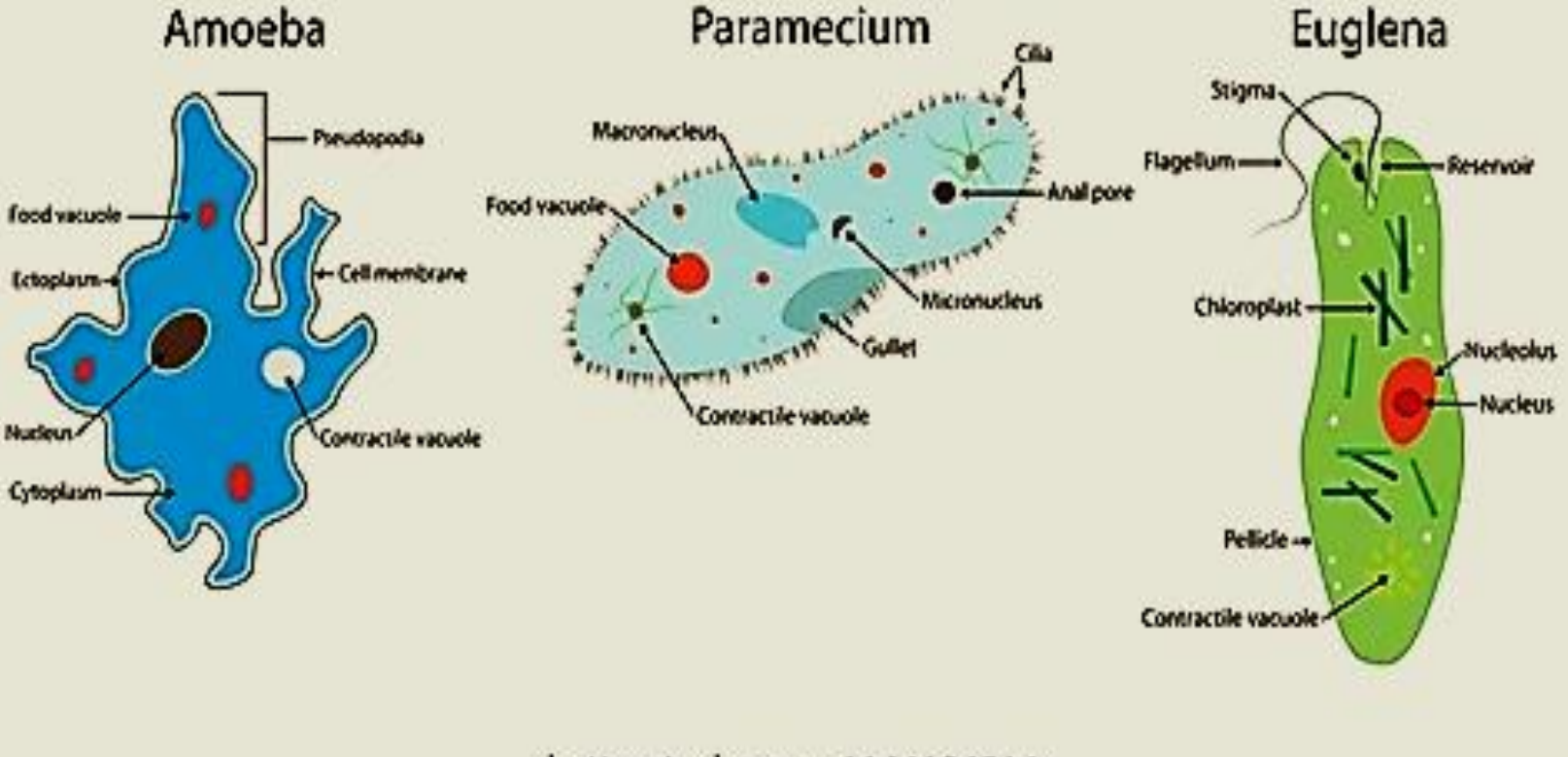
- **Amoebas reproduce by a process called binary fission. This means that one amoeba can split in half and make two new amoebas.**
- **As amoebas get older, they increase in size. When big enough they split in half to create two cells that are identical genetically to each other.**



Watch video

Watch video

Unicellular Organisms



phylum : MASTIGOPHORA

- **Commonly called flagellates.**
- **Locomotion through flagellum.**
- **Body covered with pellicle.**
- **Nutrition may be Holophytic, Saprophytic.**
- **Free living or parasitic.**
- **Asexual reproduction by longitudinal binary fission.**

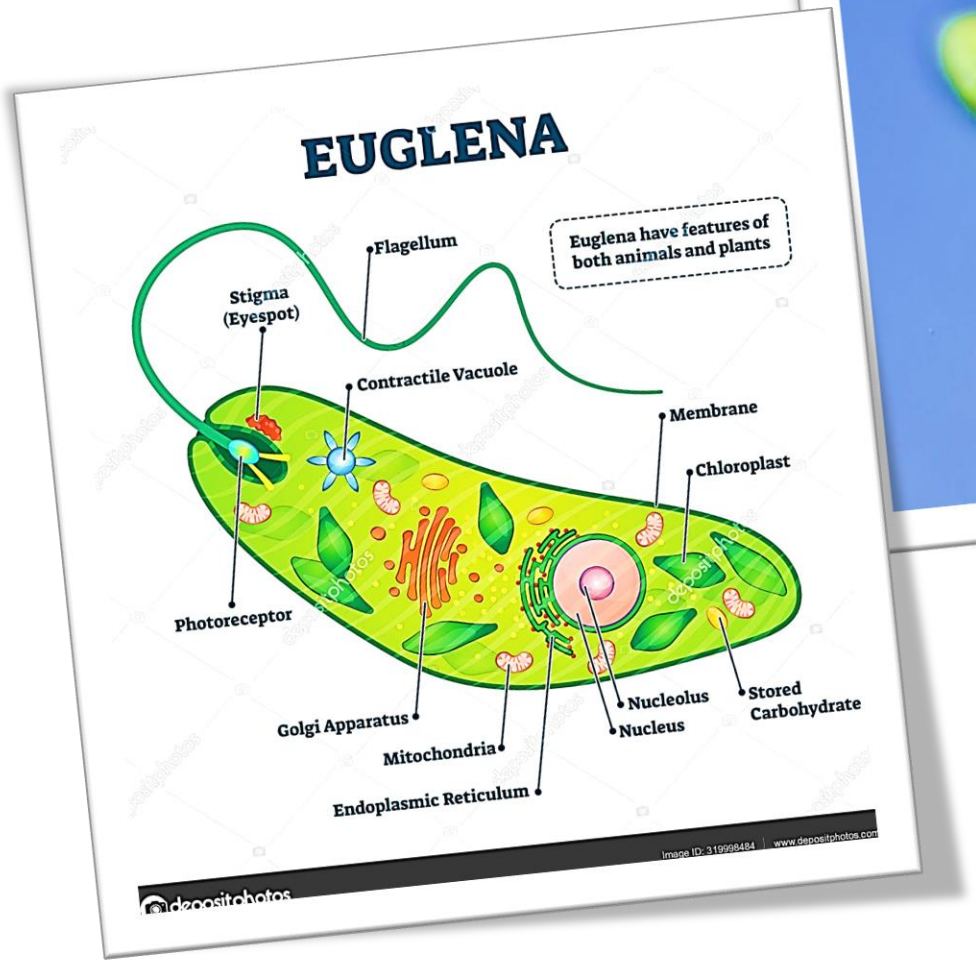
Phylumn : MASTIGOPHORA

- **CLASS: PHYTOMASTIGOPHOREA**
- **CLASS: ZOOMASTIGOPHOREA**

CLASS: PHYTOMASTIGOPHOREA

- **Presence of chromatophores (chloroplasts).**
- **There are one or two flagella.**
- **Nutrition mostly Holophytic (by photosynthesis).**
- **Paramylon is reserve food.**
- **Reproduction take place by longitudinal binary fission.**

e.g.: Euglena


EUGLENA
Euglena have features of both animals and plants
Flagellum
Stigma (Eyespot)
Contractile Vacuole
Membrane
Chloroplast
Photoreceptor
Golgi Apparatus
Mitochondria
Endoplasmic Reticulum
Nucleolus
Nucleus
Stored Carbohydrate
depositphotos
Image ID: 319998484 | www.depositphotos.com

It looks slimy, a lot like algae, You will find them in water such as ponds or marshes.

Euglena are interesting because they are a sort of combination of plant and animal.

Some Euglena are green because they have chlorophyll from eating green algae.
They can make their own food like a plant, but they can also eat other things, like an animal. They can also swim and move.

Movement

Euglena has a long hair-like thing that stretches from its body . This is called a **flagellum**, and the euglena uses it to swim.

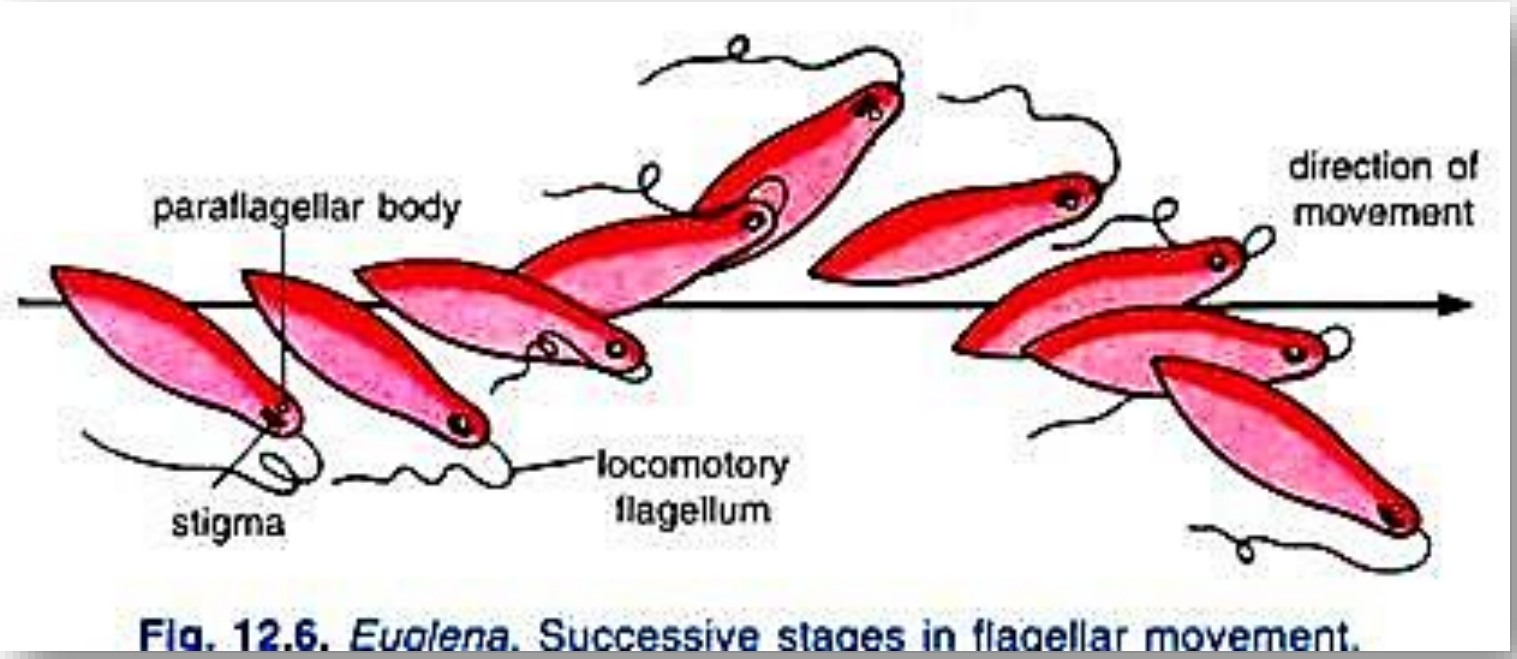


Fig. 12.6. *Euglena*. Successive stages in flagellar movement.

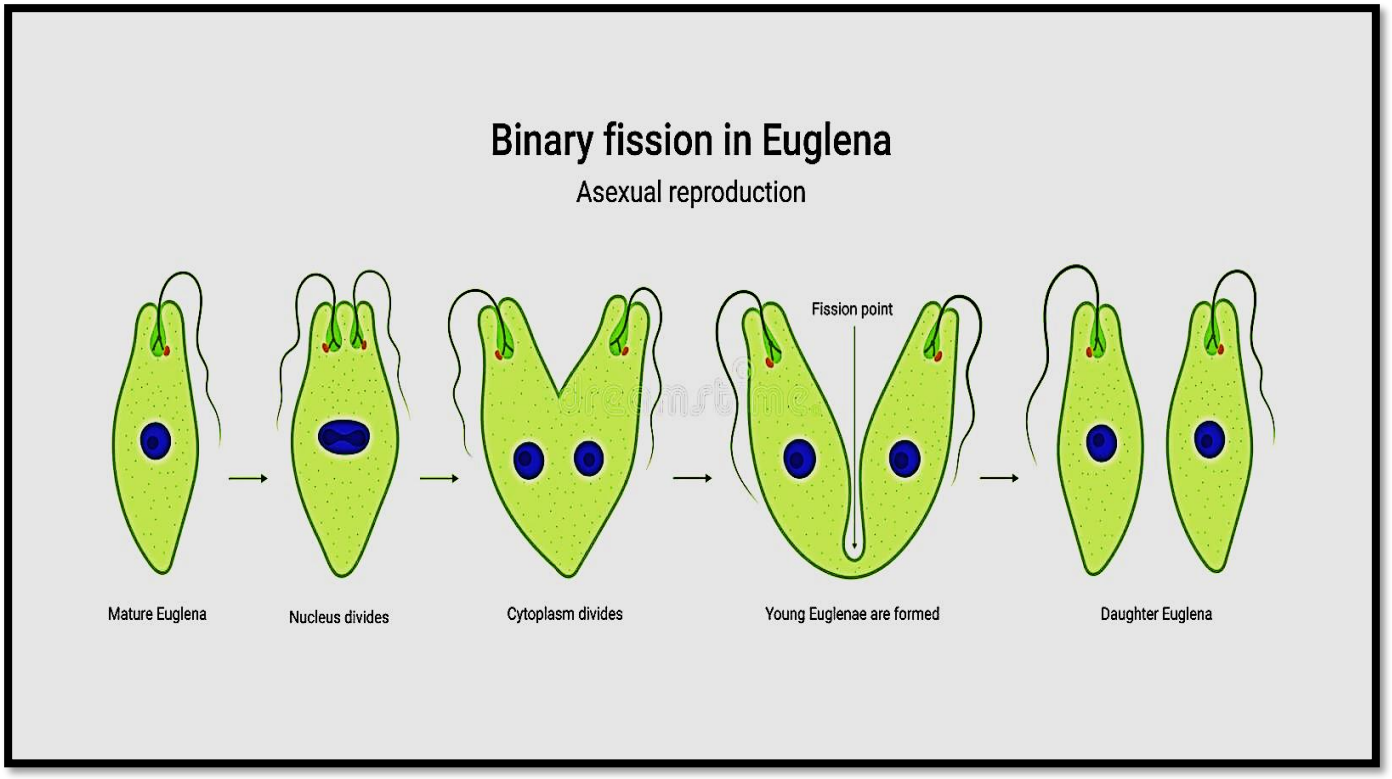
How and what does the Euglena eat?

It has a red eyespot that it uses its to locate light. Without light, it cannot use its chloroplasts (green parts inside the body) to make itself food. Algae is a source of chloroplasts.

When Euglena doesn't have enough light to make its own food, it looks for other things to eat. Swimming around, it preys on other tiny organisms, such as amoeba and paramecium (absorb food directly through the cell surface via phagocytosis)

Reproduction in *Euglena*

a. Longitudinal binary fission



b. Encystment

- **During unfavourable conditions such as drought, extreme cold or extreme hot, scarcity of food and oxygen Euglena undergoes encystment.**
- **First of all, Euglena becomes inactive, loses its flagellum and secretes a cyst around it.**
- **The cyst is secreted by the muciferous bodies lying below the pellicle.**

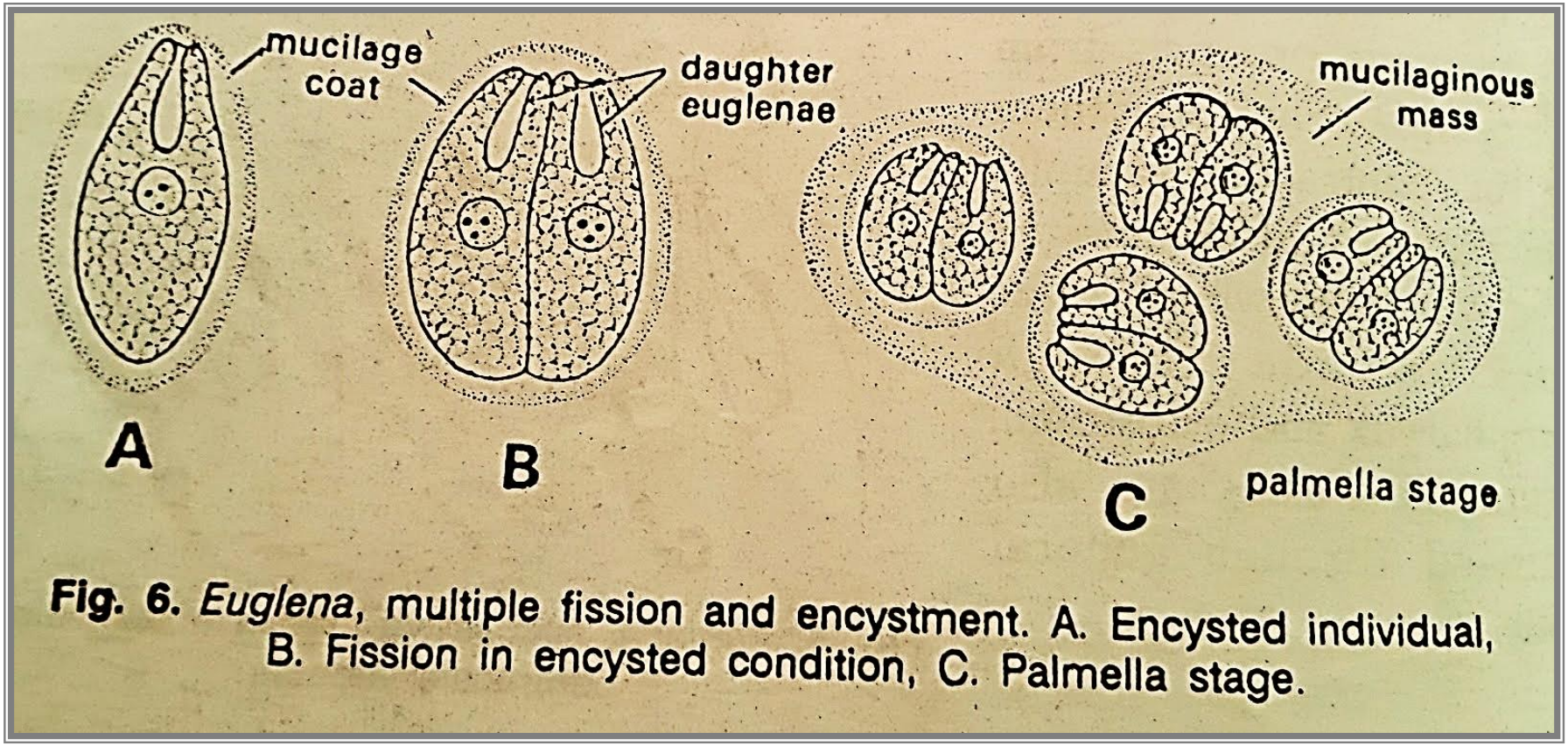


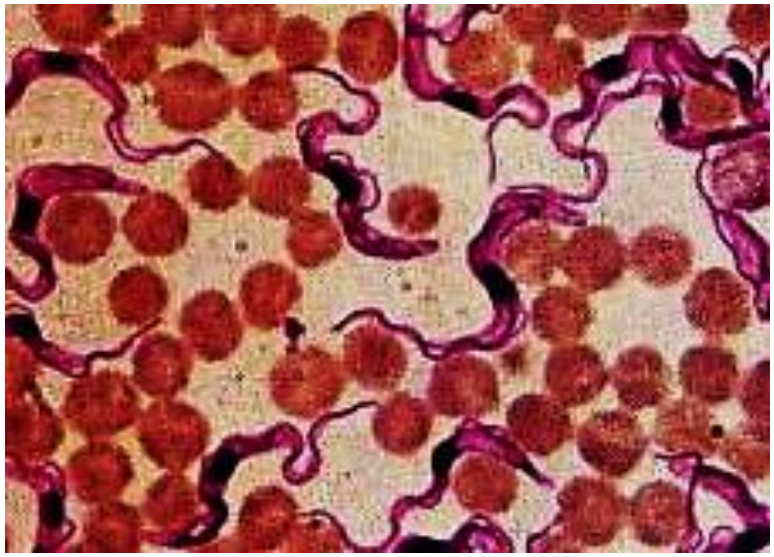
Fig. 6. *Euglena*, multiple fission and encystment. A. Encysted individual, B. Fission in encysted condition, C. Palmella stage.

CLASS: ZOOMASTIGOPHOREA

- **Absence of chromatophores (chloroplasts).**
- **There are one to many flagella, often undulating membrane is present.**
- **Holozoic or saprozoic nutrition.**
- **Parasitic.**
- **Reproduction through binary fission.**

Shape and size:

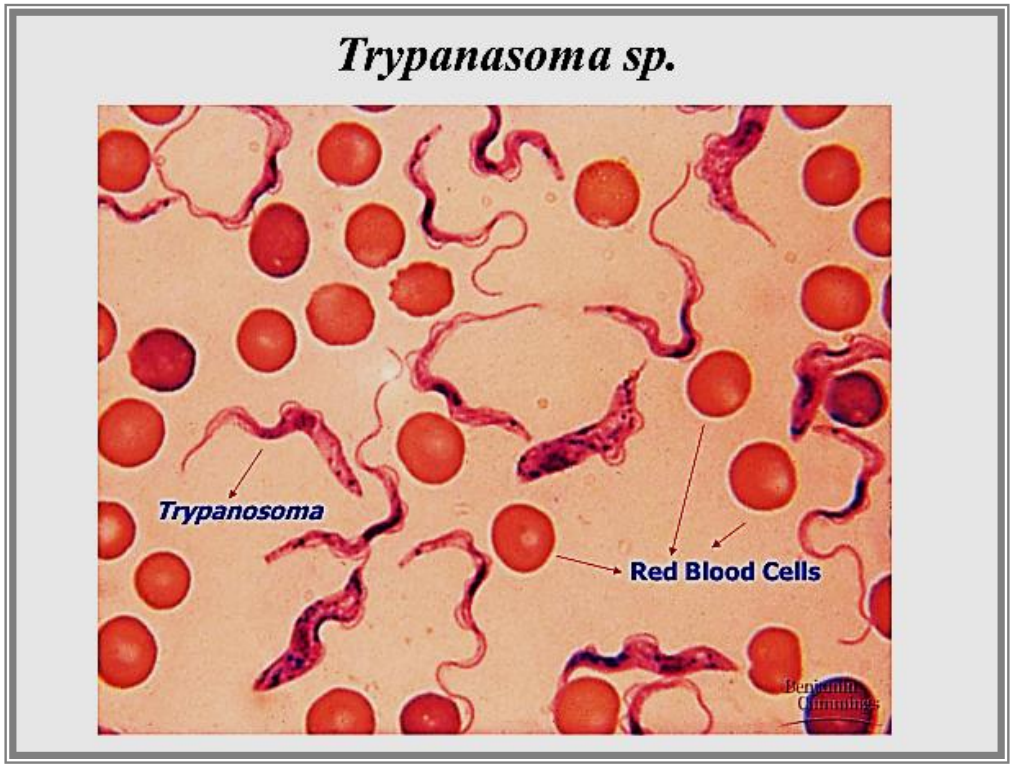
- They are unicellular flagellate protozoa with an elongated cell body shaped like a spindle.
- Its size ranges from 14 to 33 micrometer.
- The general shape of the body is maintained by a surrounding thin pellicle.



E.G. : *TRYPANOSOMA*

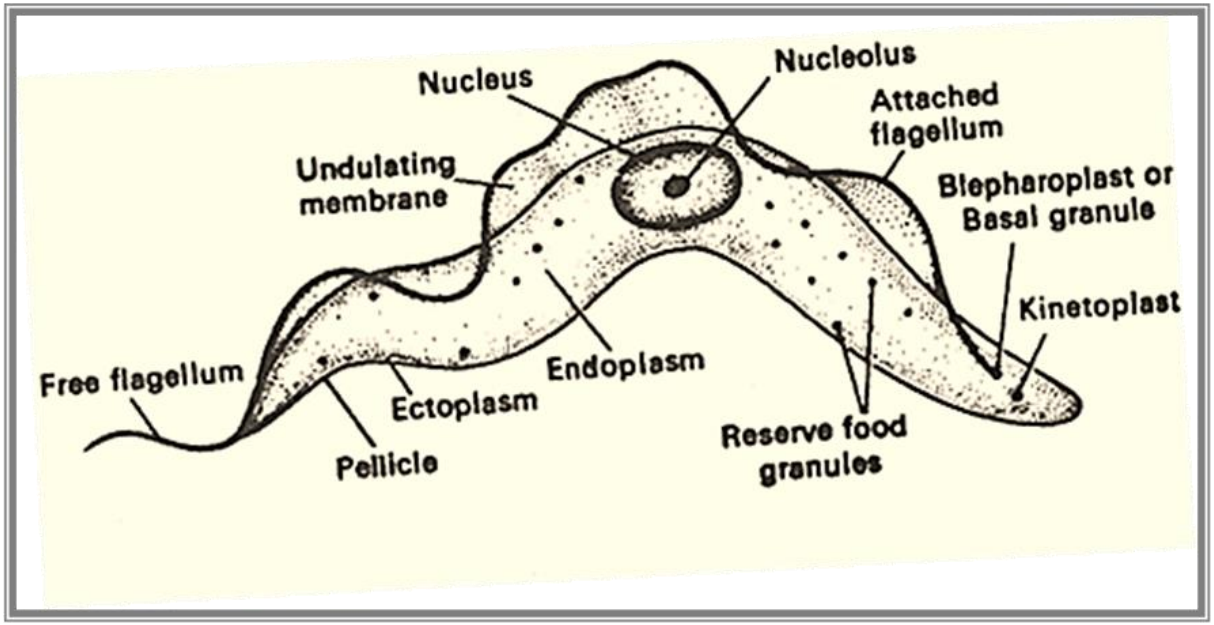
Habitat:

- Live as parasites.
- Need more than one host to complete its life cycle.



Locomotion:

- Trypanosomes have a corkscrew like motion and move actively in its host (as human blood) by movement of the undulating membrane and the free flagellum.



Nutrition:

- Trypanosomes feed by absorbing nutrients, through their outer membrane, from the body fluids of the host.
- The proteins, carbohydrates and fats are digested by enzyme systems within their protoplasm.

Excretion:

- The metabolic waste products are directly diffused out through its pellicle or general body surface into its external host environment (human blood for example).

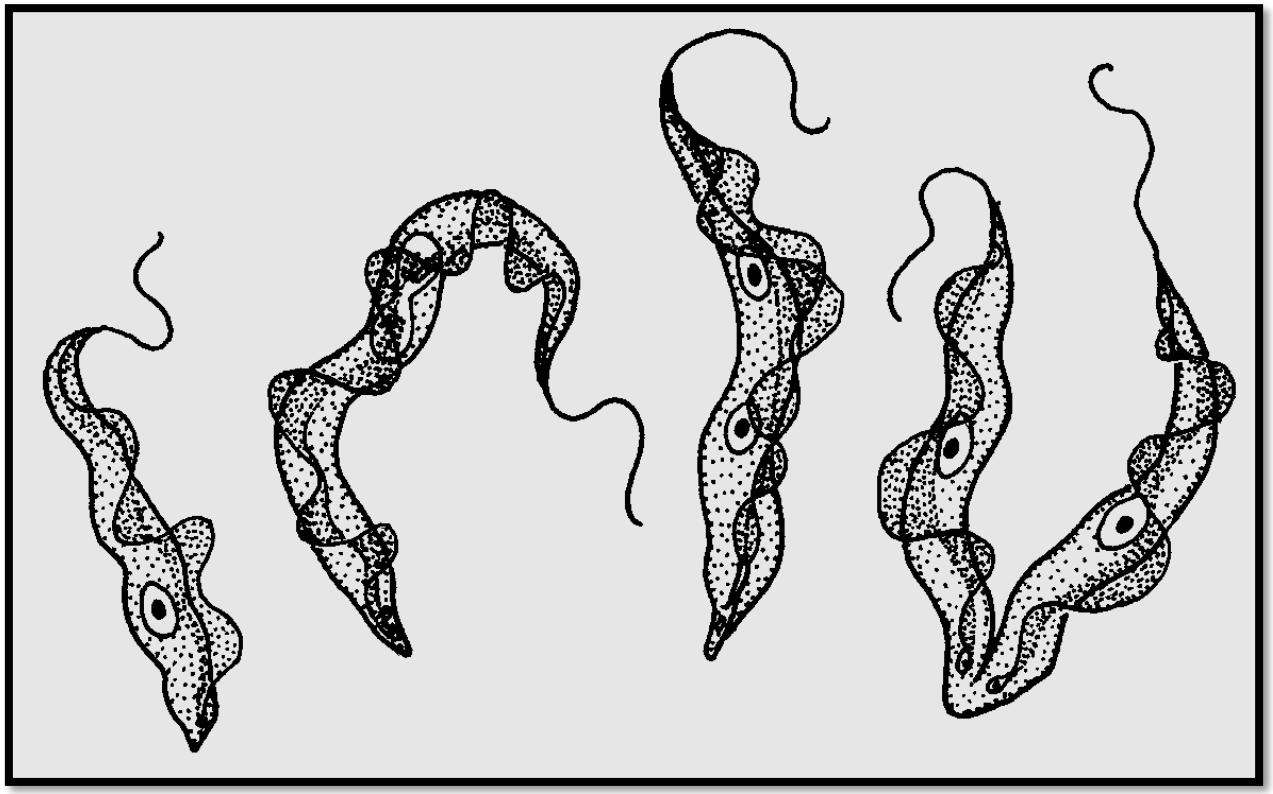
Respiration:

- Respiration is anaerobic. The absorbed glucose undergoes glycolysis to release energy necessary for metabolic activities.

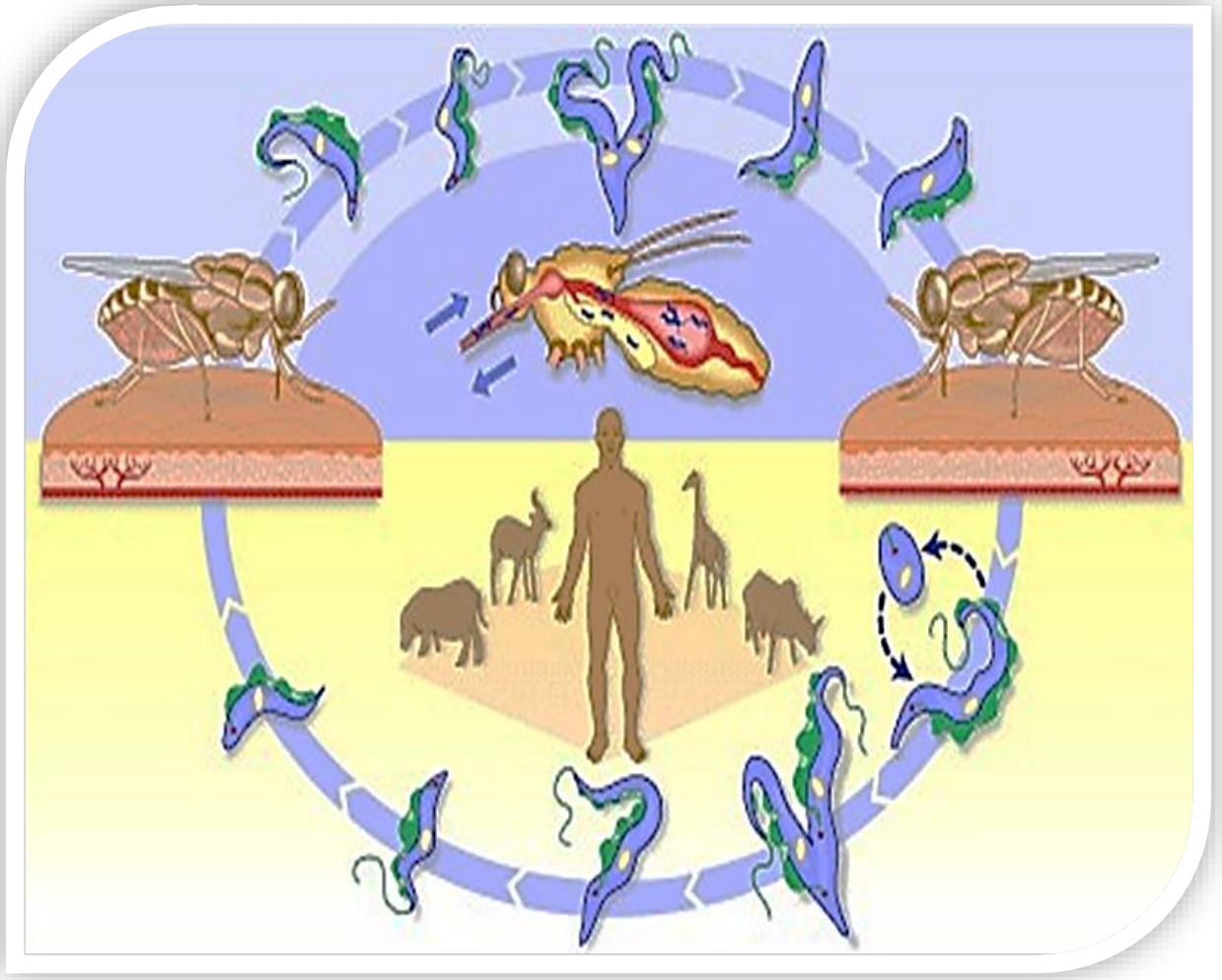
Reproduction:

- Reproduction is mostly asexual and takes place by longitudinal binary fission.

Longitudinal binary fission

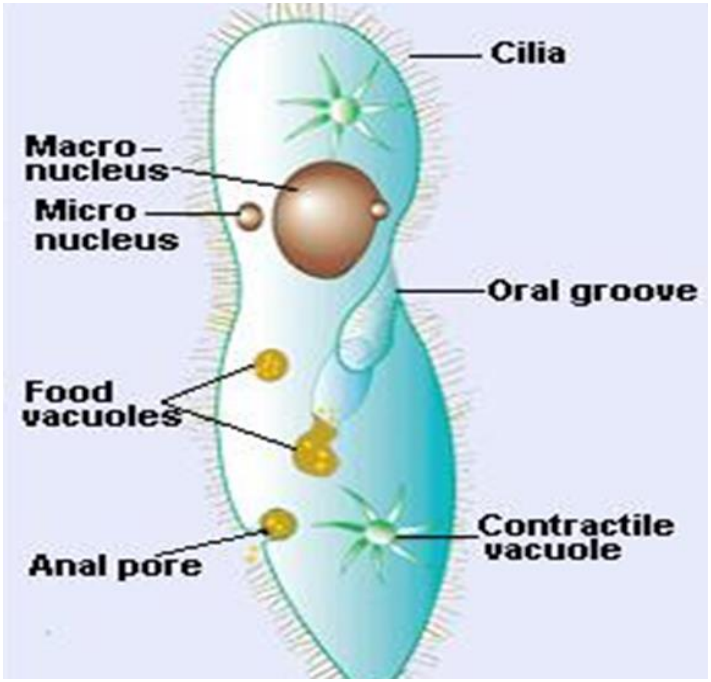


LIFE CYCLE OF *TRYPANOSOMA*



- Transmitted by insects – **Africa** (tsetse flies, African Sleeping Sickness); **South America** (bugs – Chagas' disease)

- **Move by the cilia covering their bodies.**
- **They can be found almost anywhere, in freshwater or marine environments.**
- **Probably the best-known ciliate is the organism *Paramecium*.**



- **Paramecia have many well-developed organelles.**
- **Paramecia have two nuclei, a macronucleus and a micronucleus.**
- **The larger macronucleus controls most of the metabolic functions of the cell.**
- **The smaller micronucleus controls much of the pathways involved in sexual reproduction.**

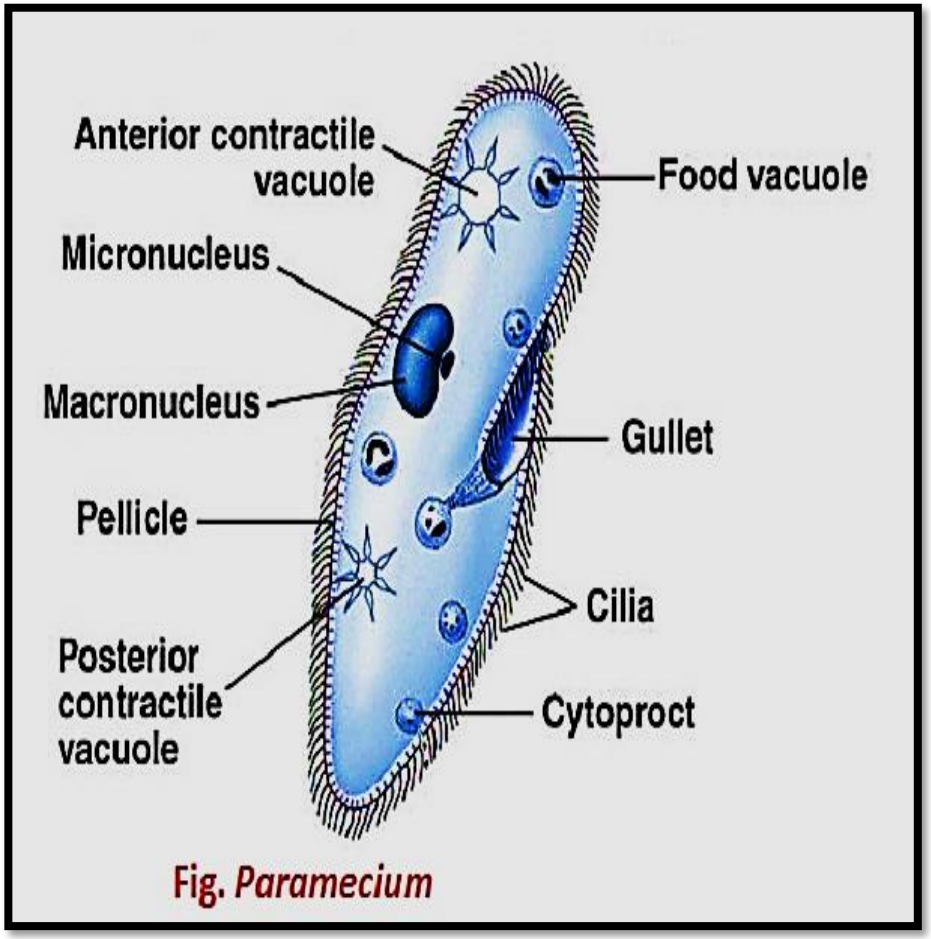


Fig. *Paramecium*

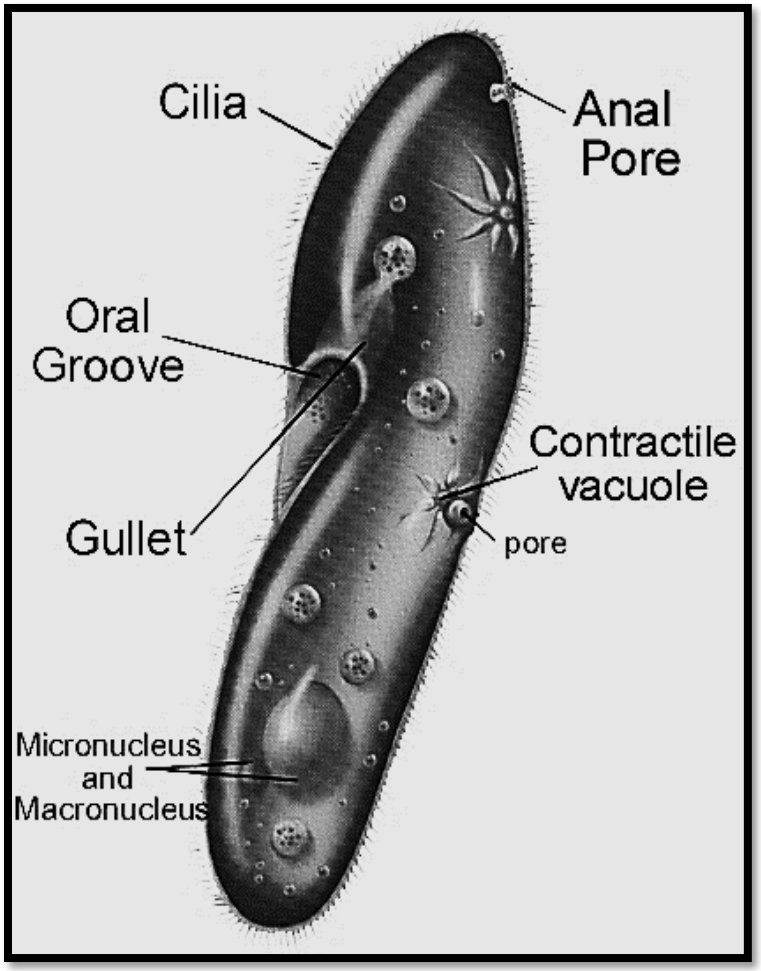
Feeding:

•Food enters the cell through the oral groove (lined with cilia, to "sweep" the food into the cell), where it moves to the gullet, which packages the meal into a food vacuole.

•Enzymes released into the food vacuole break down the food, and the nutrients are absorbed into the cell.

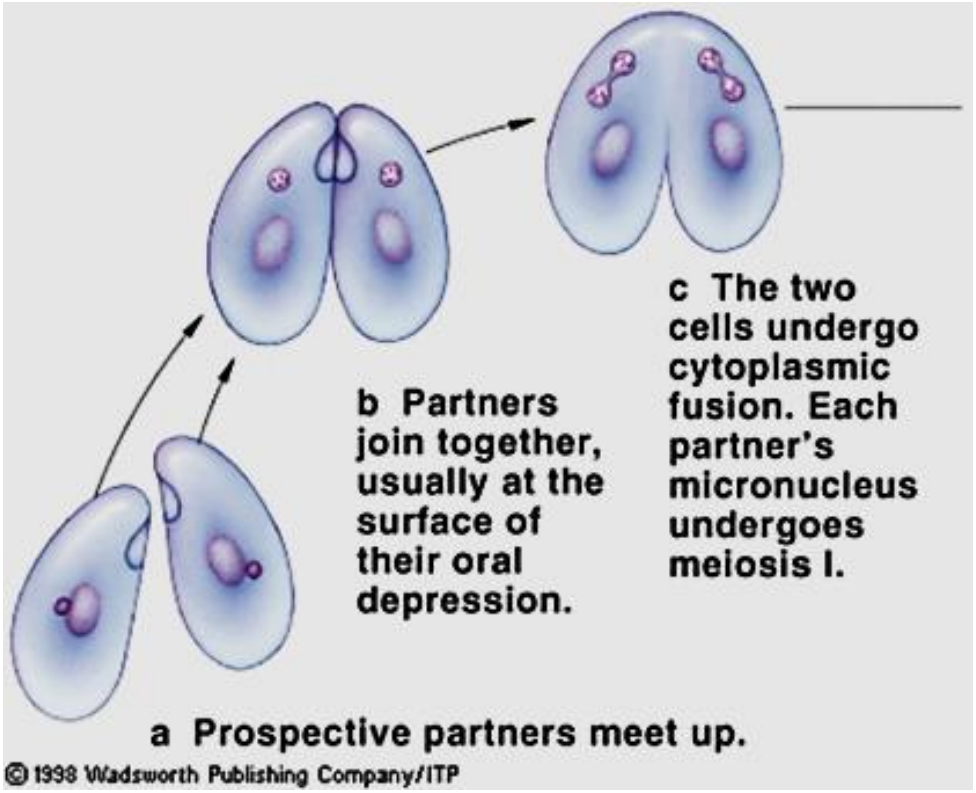
•Wastes are removed from the cell through an anal pore.

•Contractile vacuoles pump out excess water, since paramecia live in freshwater surroundings.



Reproduction:

- Paramecia usually reproduce asexually, by **transverse fission**
- When conditions are unfavorable, however, the organism can reproduce sexually.
- This form of sexual reproduction is called **conjugation.**
- During conjugation, two paramecia join at the oral groove, where they exchange genetic material.
- They then separate and divide asexually

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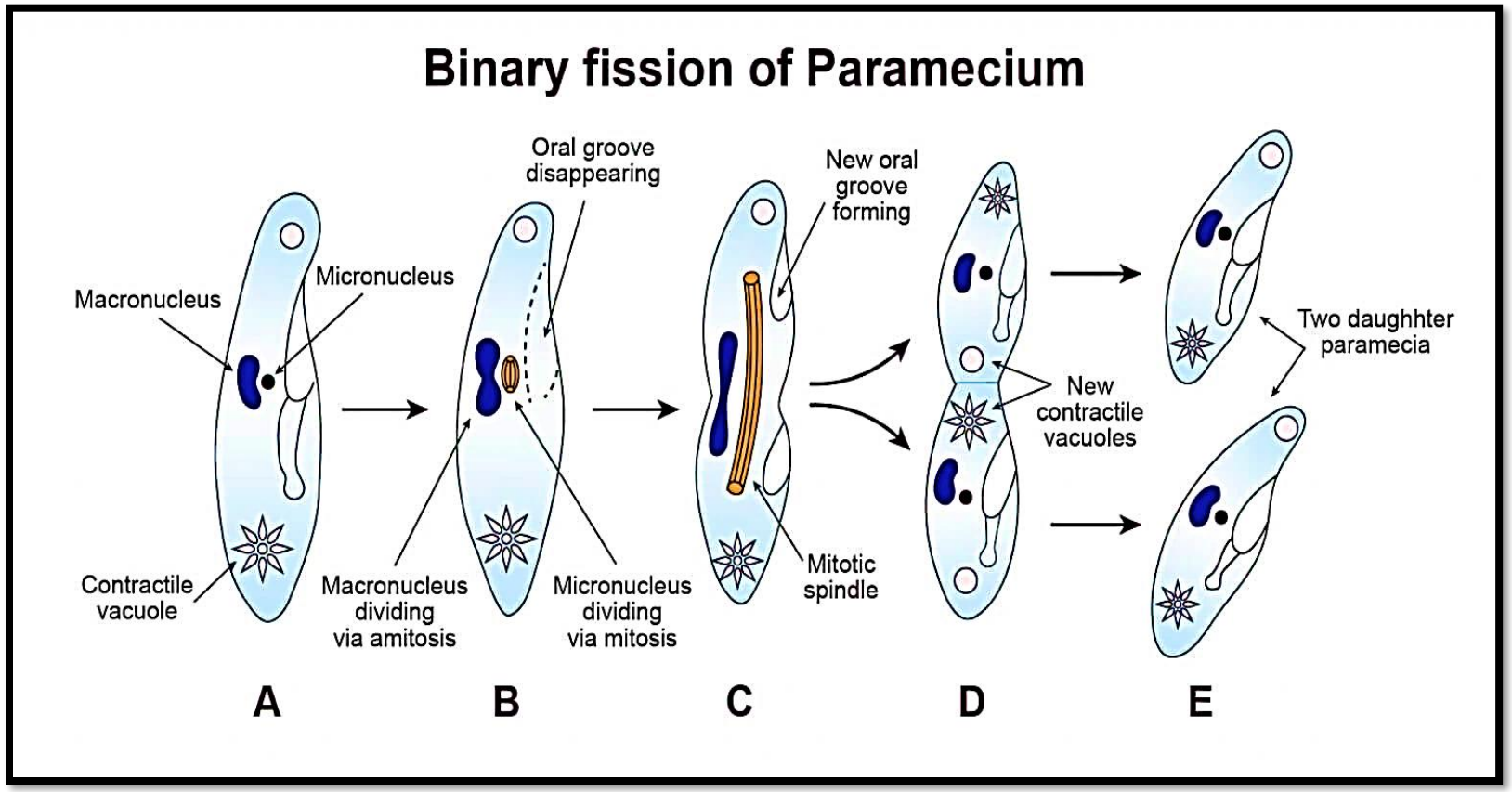
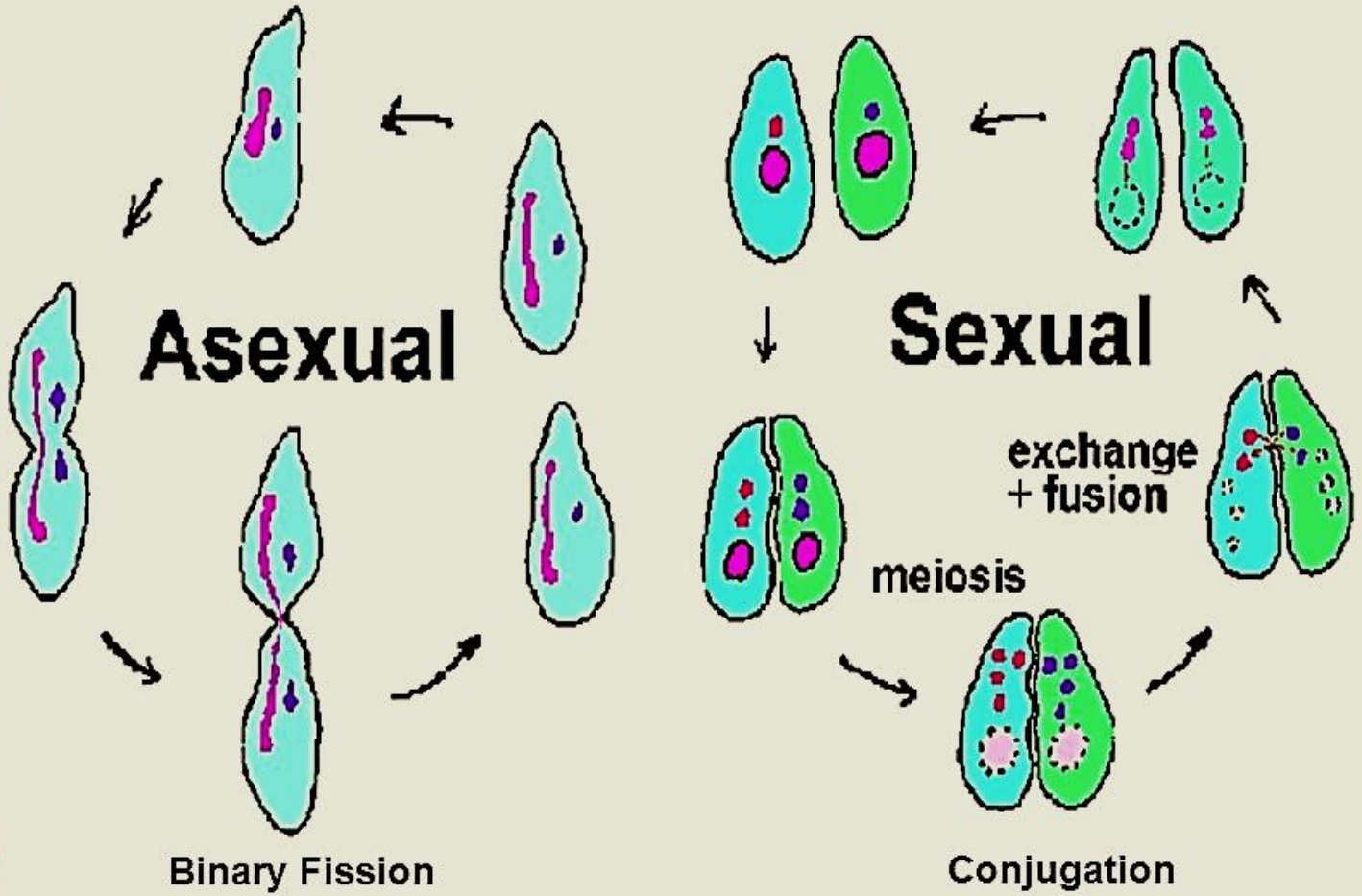
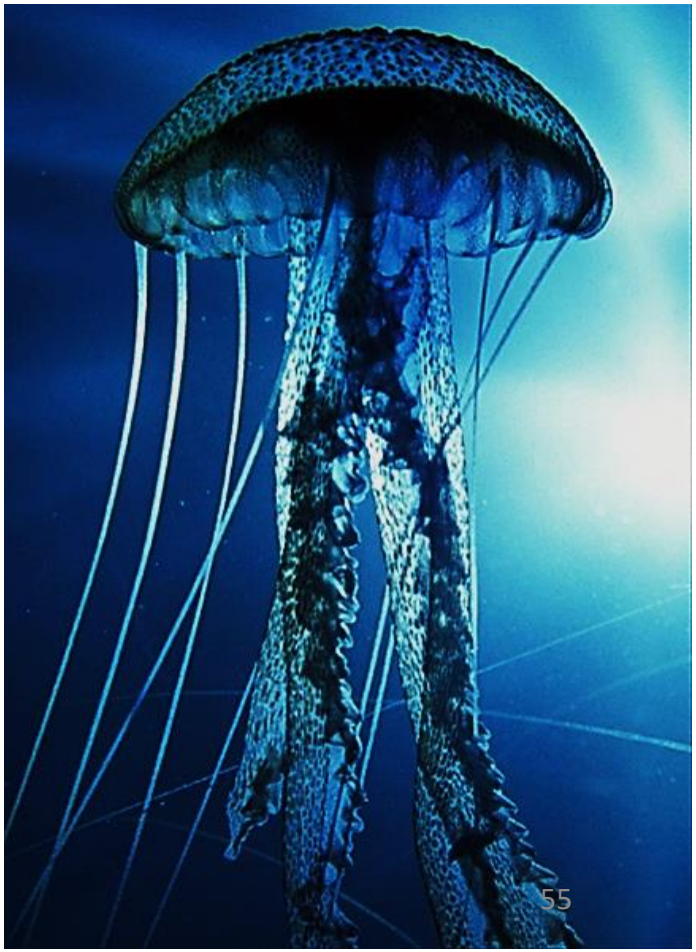
B. TRANSVERSE BINNARY FISSION



Reproduction



Animal Phyla:
Porifera & Cnidaria



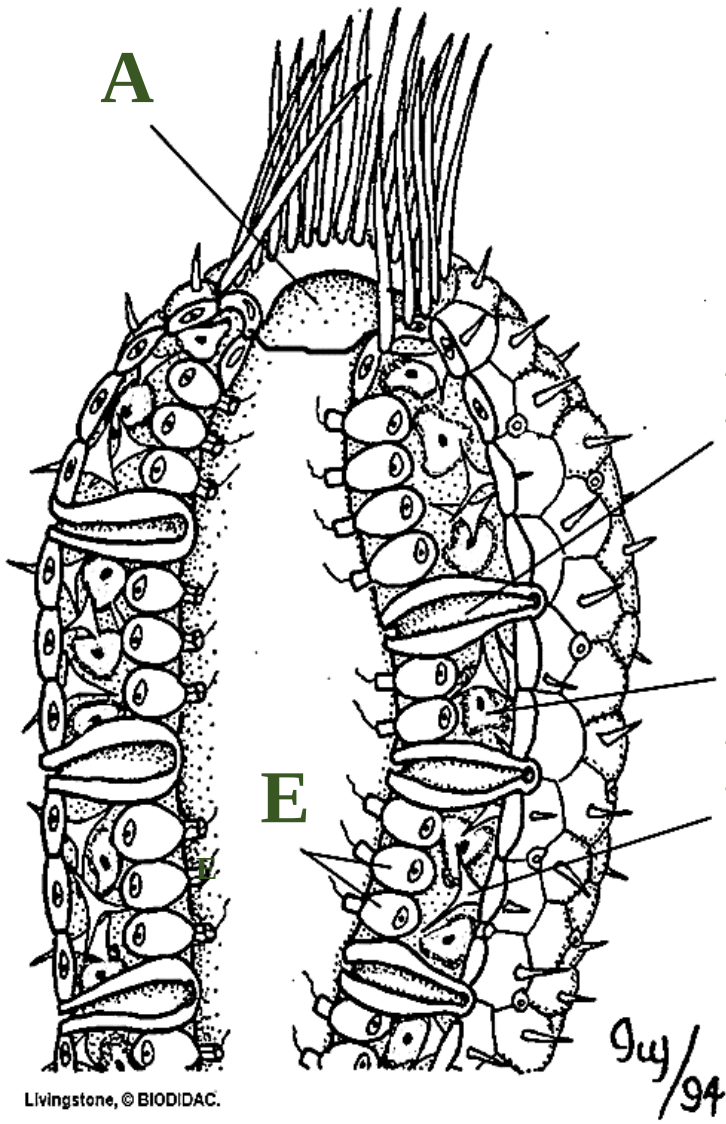
Phylum Porifera (Sponges)

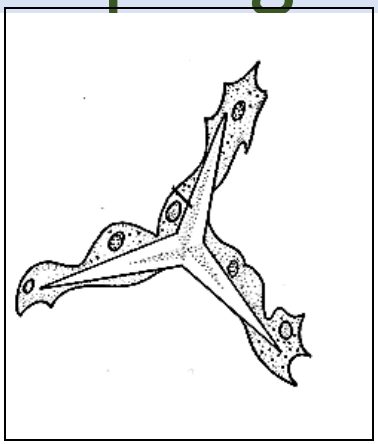
- **Porifera means "pore-bearing"**

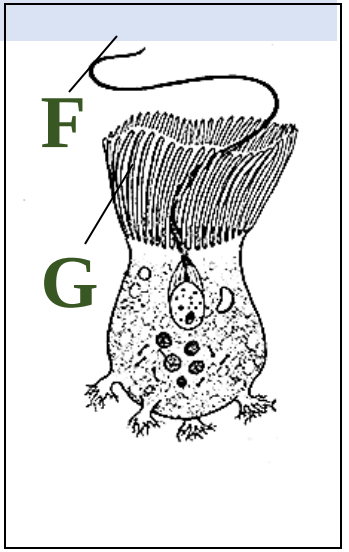
- **Their bodies are perforated with holes that lead to an inner water chamber**

- **They pump water through these pores and expel it though osculum (large opening at top)**

Anatomy of a Sponge







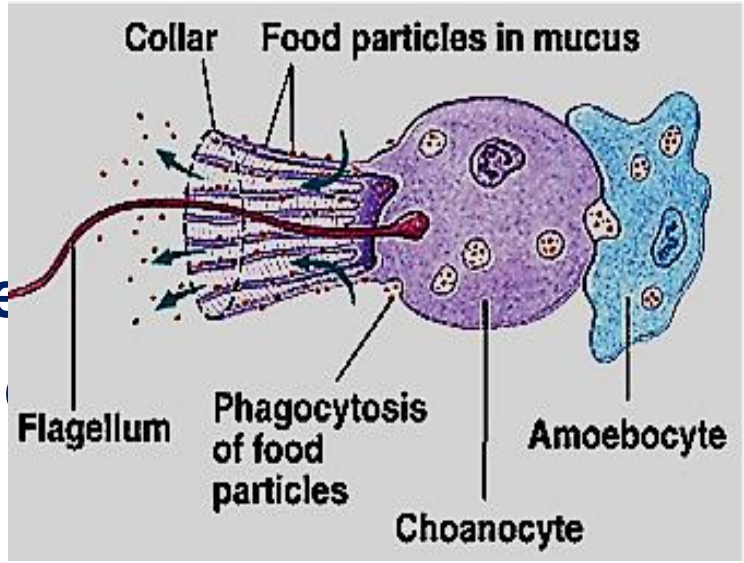
Key

A) Osculum
B) Pore
C) Amoebocyte
D) Spicule
E) Choanocyte
F) Flagella
G) Microfilaments

Image Source: http://www.biologycorner.com/worksheets/sponge_color.html

Anatomy of a Sponge (Cont.)

- **Collar Cells (Choanocytes)**
  - Inner layer of cells
  - Contain flagella and microfilaments
  - Flagella = suck water through pore
  - Microfilaments = trap food particl



- **Amoeboid Cells (Amebocytes)**
  - Middle layer
  - Take up food from choanocytes, digest it, and carry nutrients to other cells, Form spicules
- **Spicules**
  - Scaffolding that give sponge shape
  - Used by scientists to identify different species of sponges

Water Flow in Sponges…

Pores→ Internal Cavity → Osculum

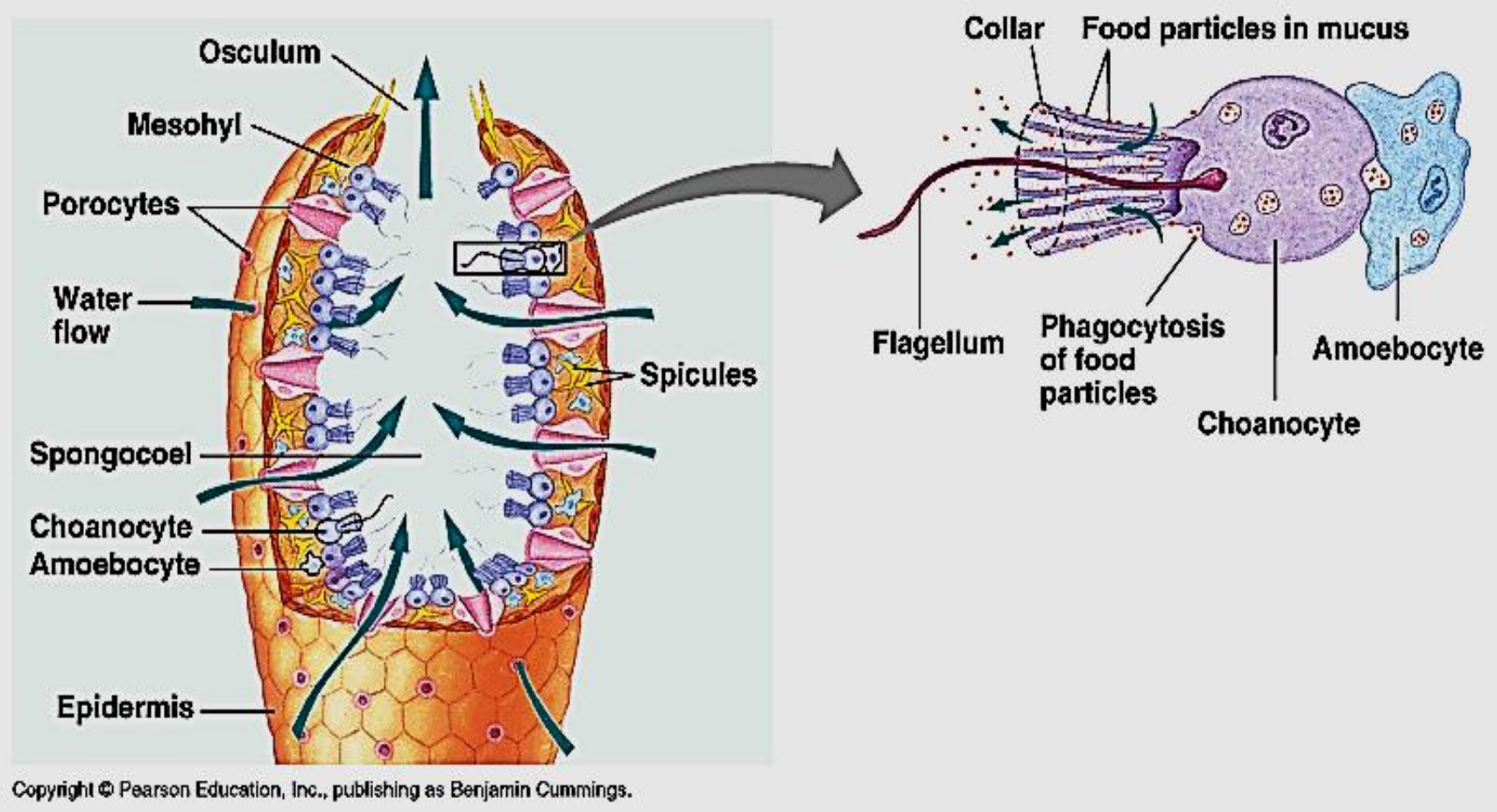
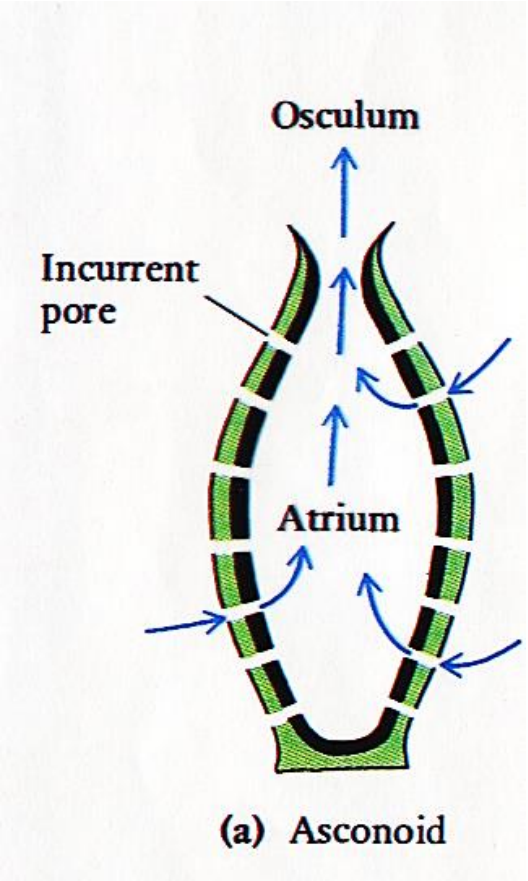


Image Source: Campbell, N.A. & Reese, J.B. (2002). *Biology (6th Edition)*. New York: Benjamin Cummings.

Types of Sponges (Canal Systems)

A. Asconoid Sponges



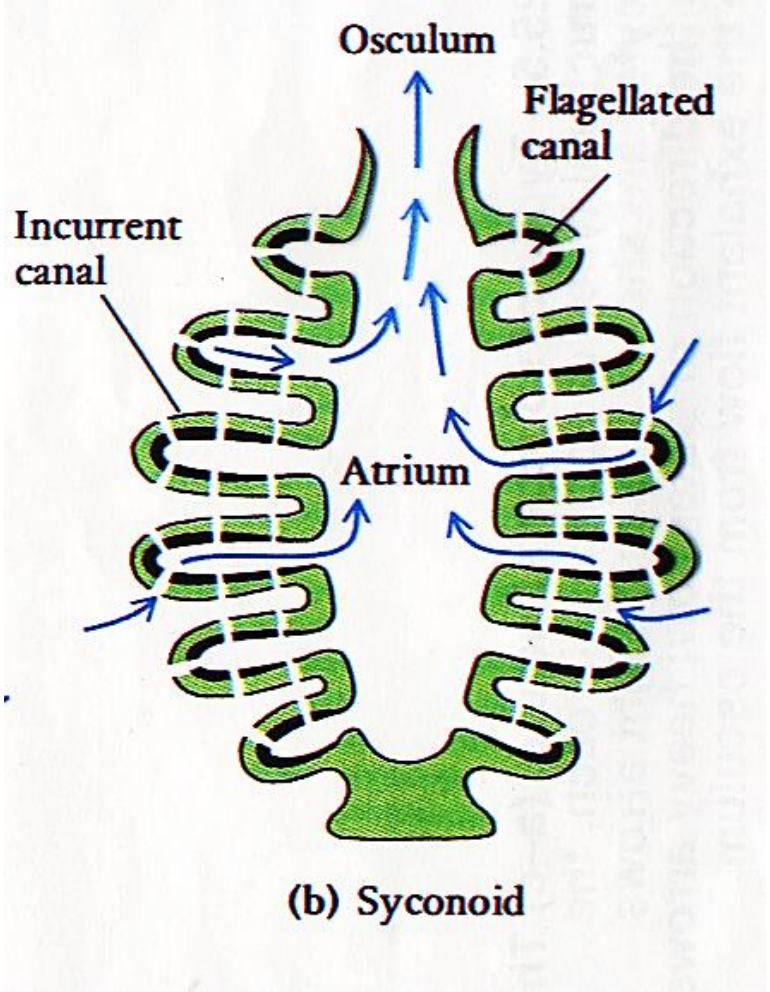
- Simple vaselike structure
- This stucture puts limitations on size; (increase in volume without a corresponding increase in the surface area of the choanocytes)

- Watch video

Types of Sponges (Canal Systems) cont.

B. Synconoid Sponges

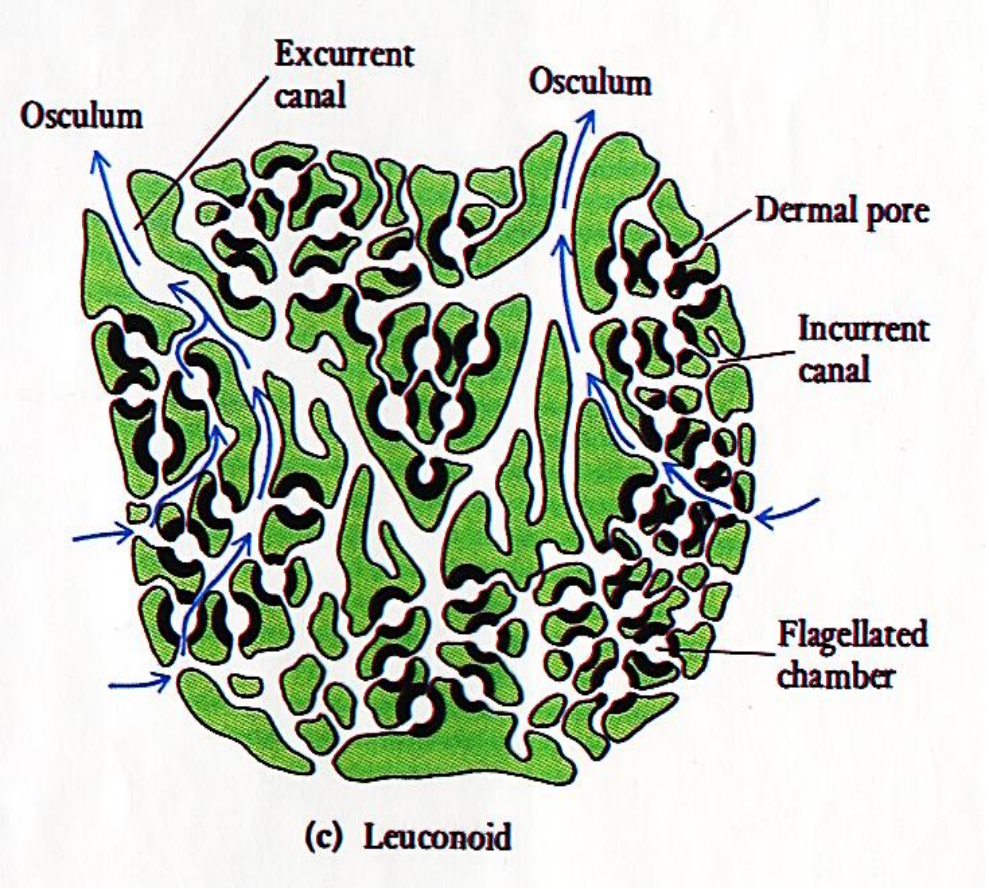
- The flagellated choanocyte layer has undergone folding forming finger like projections
- There is a single osculum, but the body wall is more complex, with water being received through incurrent canals, which pass it along to radial canals through to the spongocoel
- Results in an increase in the surface area which allowed sponges to increase in the size



Types of Sponges (Canal Systems) cont.

C. Leuconoid Sponges

- No atrium; several small chambers in which choanocytes are located
- There is a whole series of incurrent canals leading to the choanocyte chambers; water is discharges through excurrent canals
- The leuconoid sponges exhibit a significant increase in surface area and are, therefore, among the largest sponges



Phylum Porifera (Cont.)

- **Asymmetrical (no symmetry)**
- **Lack true tissues**
- **Represent the most primitive animals**
  - **They have been evolving the longest!**

- **Where do they live? (Habitat)**
  - **Fresh water and salt water**
- **How big are they? (Size)**
  - **2 cm to 2 meters**

Phylum Porifera (Cont.)

- **What do they eat? (Diet)**
  - **Filter feeders**
  - **Filter bacteria, protists, and small crustaceans from the water**

- **How do they move?**
  - **Mobile only as larvae**
  - **Sessile (do not move) as adults**

Phylum Porifera (Cont.)

- **How do they reproduce?**
  - **Asexually**

    Budding
    - Produce internal buds called **gemmules** which grow into new sponges

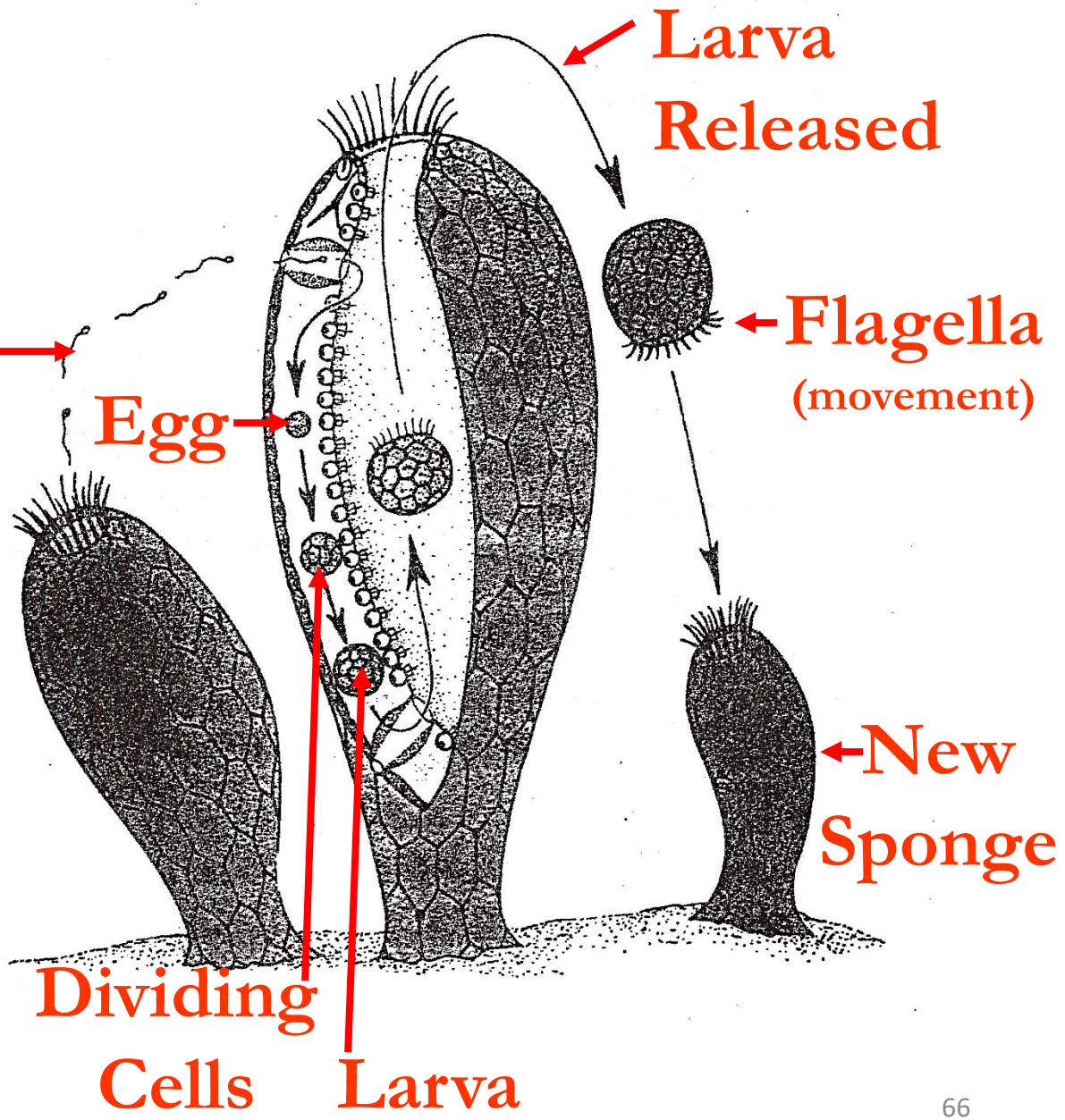
    Regeneration
    - Able to regrow missing parts
  - **Sexually (Hermaphrodites)** خنثي
    - Both male and female sex cells made by **ameobocytes**
    - Sperm released from osculum of one sponge and enters the pores of another sponge– sperm of one sponge fertilizes the egg of another sponge

Life Cycle of a Sponge

- **Sexual Reproduction**

Egg and sperm meet.

New sponge is <u>not</u> identical to parents



Red Barrel Sponge

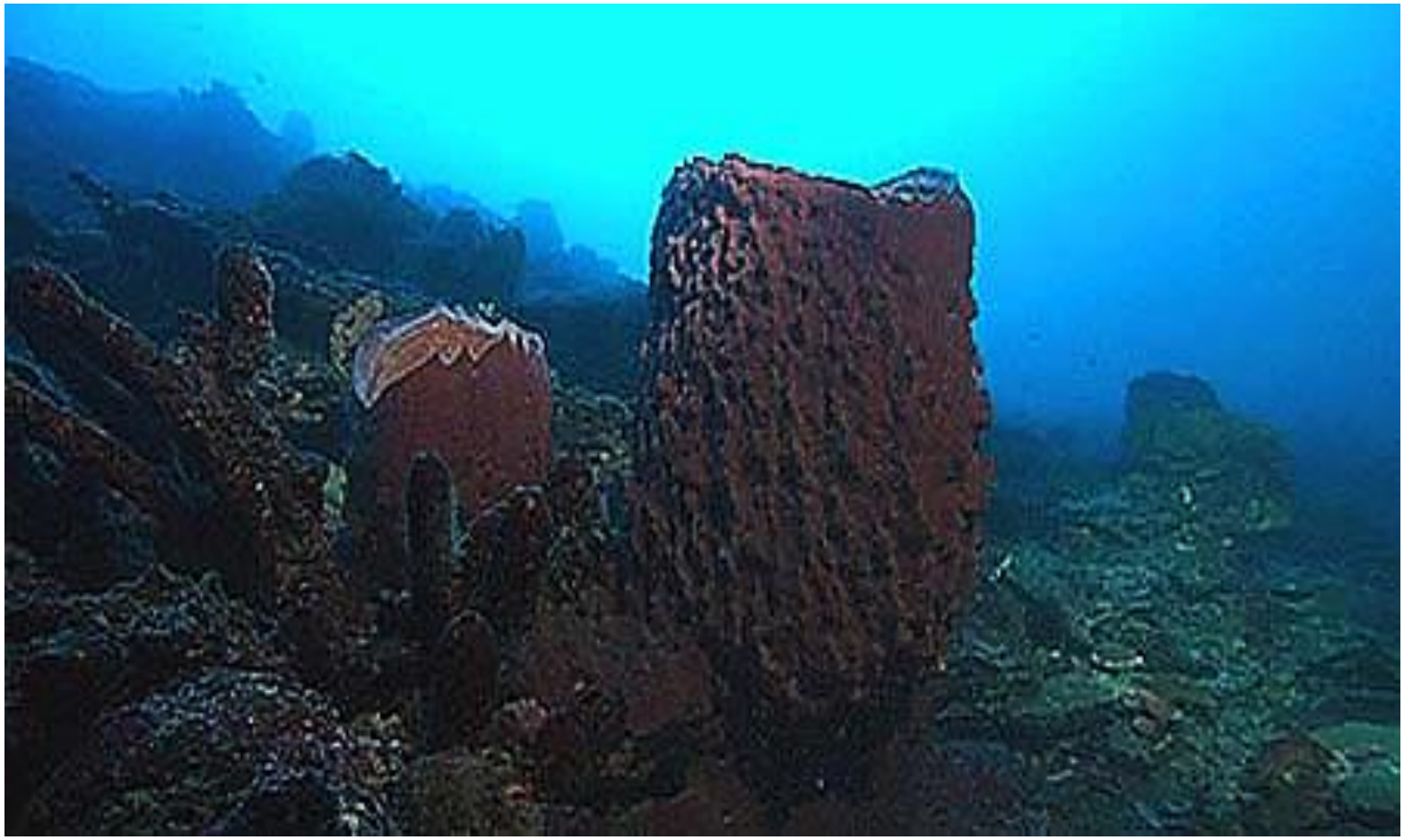


Image Source: http://www.pbs.org/kcet/shapeoflife/animals/porifera1.html

Branching Sponge

Image Source: http://www.pbs.org/kcet/shapeoflife/animals/porifera2.html

Tube Sponge

Image Source: http://www.pbs.org/kcet/shapeoflife/animals/porifera3.html

Indonesian Sponge

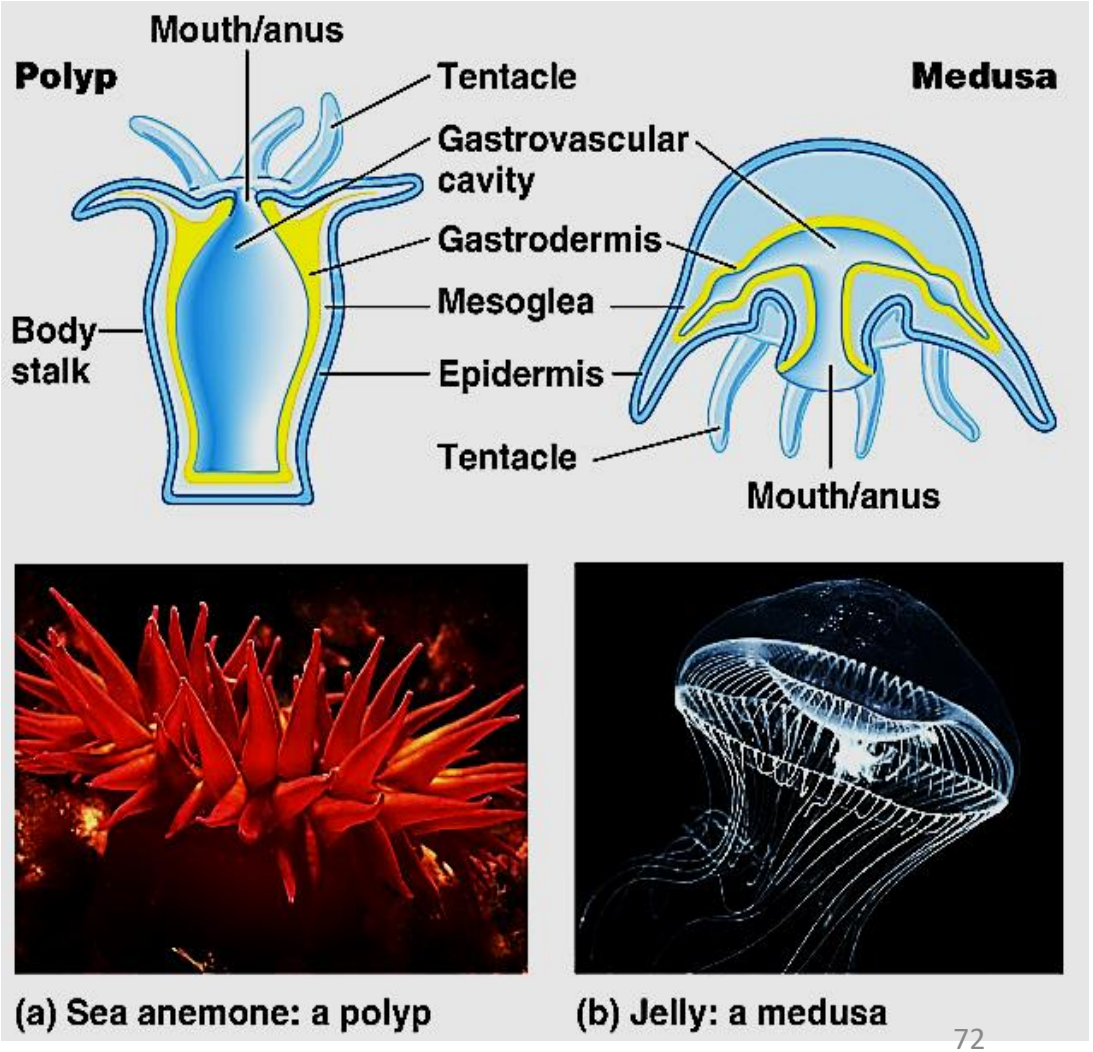
Image Source: http://www.pbs.org/kcet/shapeoflife/animals/porifera5.html

Examples of Sponge Spicules

Image Source: http://www.pbs.org/kcet/shapeoflife/animals/porifera4.html

Phylum Cnidaria
(Jellyfish, Sea Anemones, & Corals)

- **Exhibit Radial Symmetry**
- **2 Forms**
  - **Polyp**
    - Sessile form (vase shape)
  - **Medusa**
    - Swimming form (umbrella shape)



Phylum Cnidaria (Cont.)

- **2 Body Layers**

Epidermis (outer layer) & Gastrodermis (inner layer)

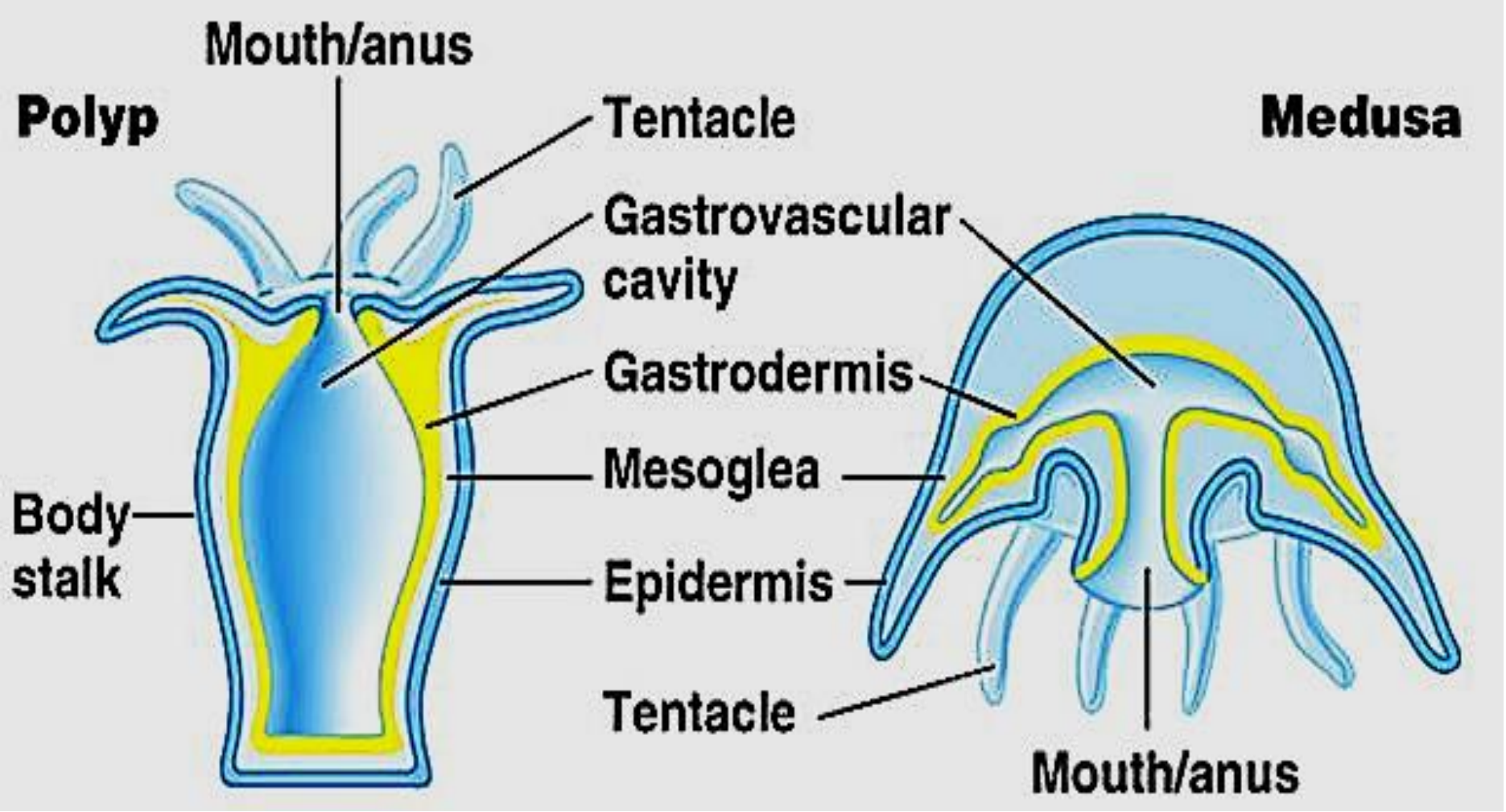
- **Mesoglea**

Jelly-like substance in between inner and outer layer

- **Gastrovascular Cavity (GVC)**

Empty space where digestion takes place

Anatomy of a Jellyfish



Phylum Cnidaria (Cont.)

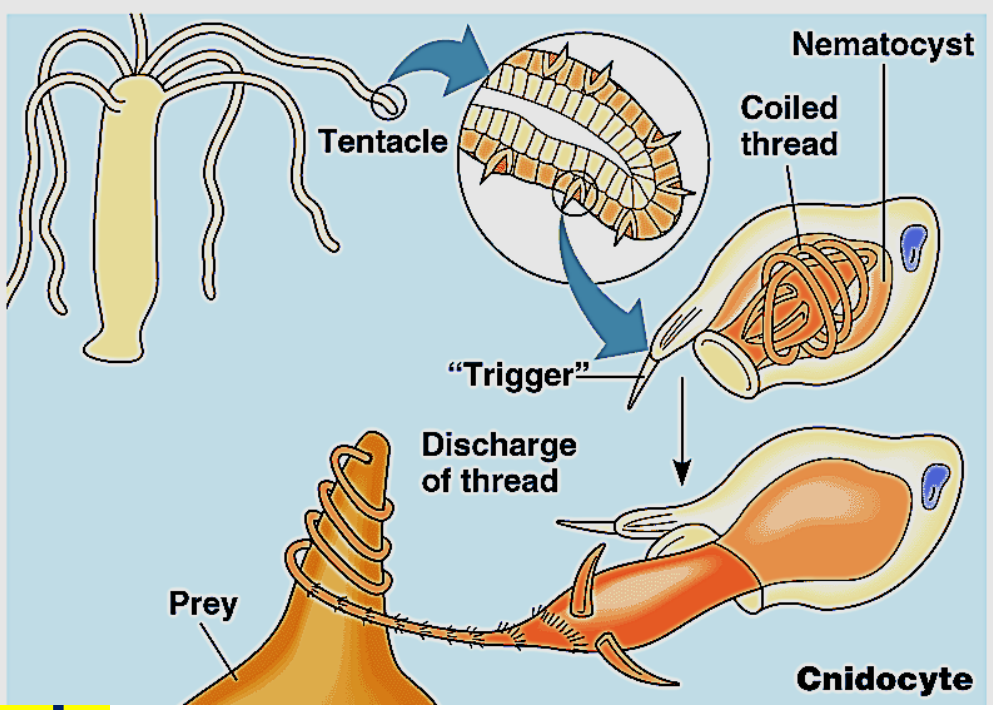
Cnidocytes and Nematocytes

Cnidocytes =

specialized cells used fo defense

Nematocytes =

structures inside the cnidocyte that contain stinging filaments



The filaments have sharp tips that can inject poison into victims

Phylum Cnidaria (Cont.)

- **1st Nervous System**

- Porifera have **no developed nervous system**
- Cnidarians have a **primitive nervous system**
- No brain, but rather a loose collection of nerves called **a nerve net.**
- Nerves **radiate throughout the whole body**

Phylum Cnidaria (Cont.)

- **Where do they live? (Habitat)**
  - **Mostly salt water**
  - **Hydra found in fresh water**

- **How big are they? (Size)**
  - **Can be up to 6.5 feet in diameter and have ~100-foot-long tentacles**

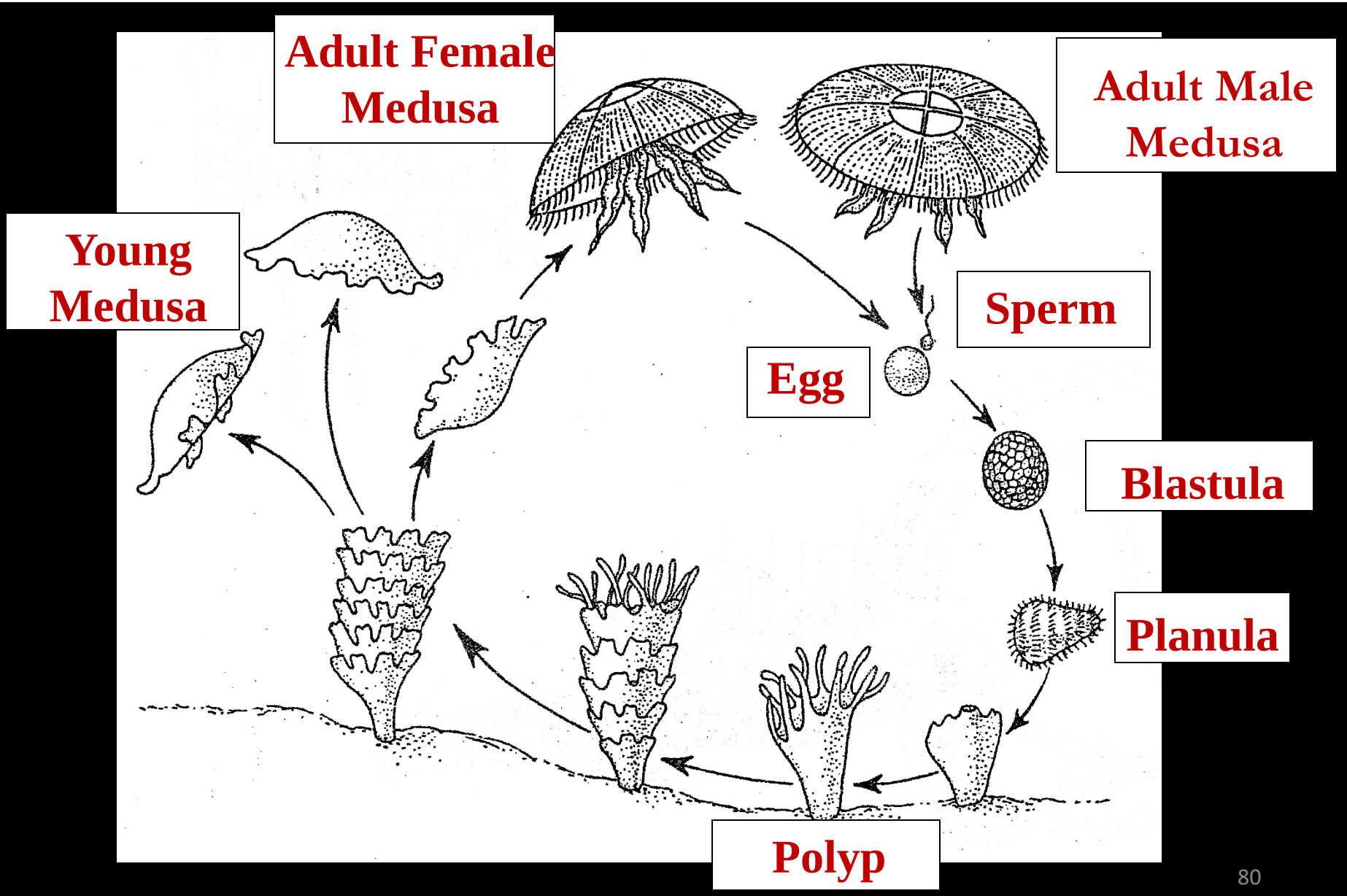
Phylum Cnidaria (Cont.)

- **What do they eat? How do they eat?**
  - **Tentacles capture small animals.**
  - **Nematocysts inject poison.**
  - **Tentacles push food into mouth**
- **How do they move?**
  - **If mobile, move by contraction and expansion of body**

Phylum Cnidaria (Cont.)

- **How do they reproduce?**
- **Asexually**
- Budding & Regeneration
- **Sexually**
- Adult medusa releases sperm and eggs into the water where external fertilization takes place → zygote
- Zygote forms the blastula (hollow ball of cells) and then forms a planula (ciliated larva)
- Polyp attaches to the ocean floor and develops mouth and tentacles
- Stacks of medusae form and then detach to form individual jellyfish

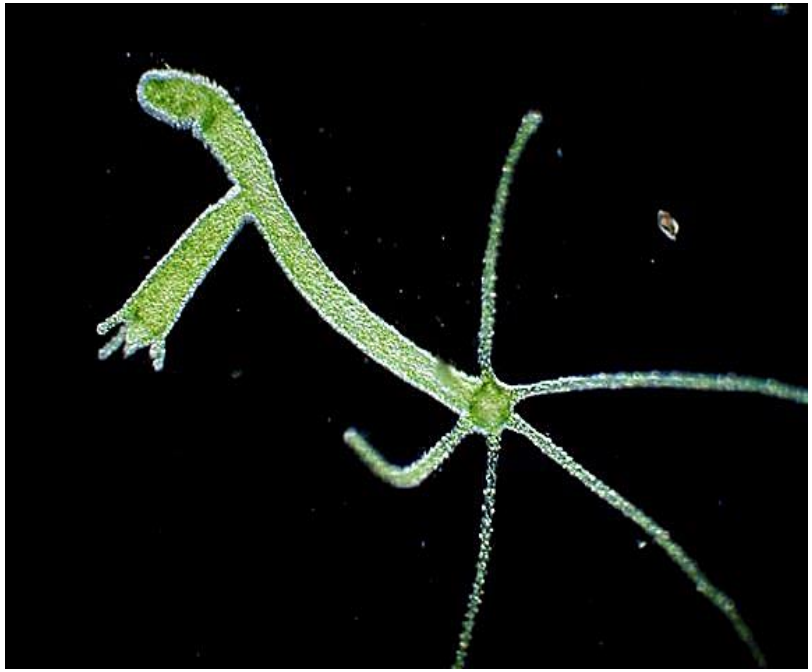
Life Cycle of Jellyfish



Class: Hydrozoa

- **Hydra**

Polyp form found in ponds and lakes



- **Portugese Man-of-War**

Found in tropical oceans

Very poisonous to fish and even humans

Watch video

Hydra Image Source: http://www.microscope-microscope.org/gallery/Mark-Simmons/images/hydra2.jpg

Image Source: http://animals.nationalgeographic.com/staticfiles/NGS/Shared/StaticFiles/animals/images/primary/portuguese-man-o-war.jpg

Class: Scyphozoa

- **Over 200 species**
- **Common jellyfish exist as both polyps and medusae**

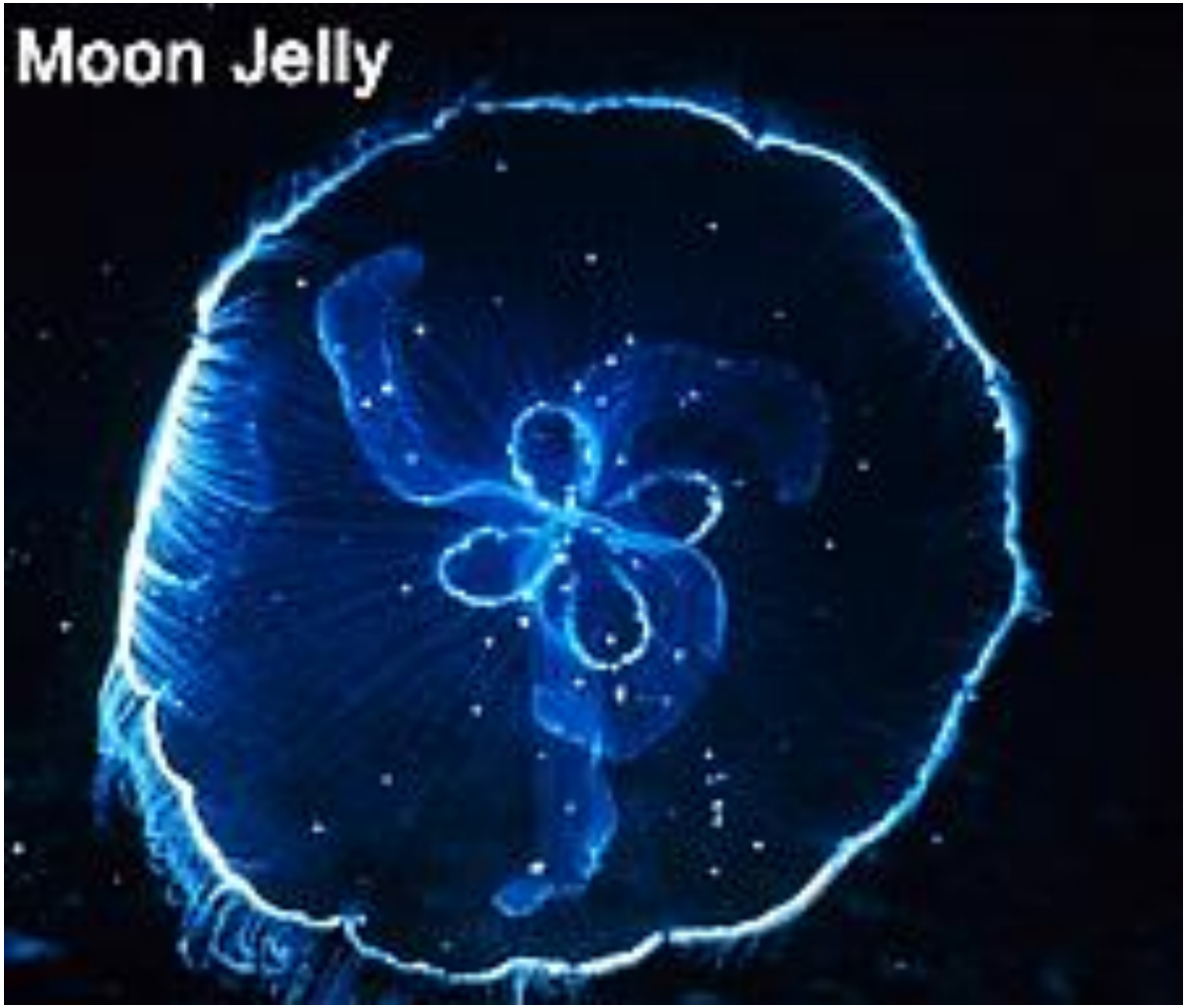


Image Source: http://www.dnr.sc.gov/marine/pub/seascience/jellyfi.html#life

Class: Anthozoa

- **Includes corals and sea anemones**
- All marine
- Medusa stage completely absent
- **Corals المرجان**
- Are polyps that live in small colonies
- Use nutrients from algae for energy
- Great Barrier Reef
- Largest coral colony on earth
- **Sea Anemones شقائق النعمان**
- Are polyps that use poisonous tentacles to feed on small fish

Coral Reef

Coral Polyps

Polyp Image Source: http://www.pbs.org/kcet/shapeoflife/animals/cnidaria2.html

Reef Image Source: http://www.chbr.noaa.gov/categories/raim/images/coral_01.jpg

Sea Anemone

Image Source: http://www.pbs.org/kcet/shapeoflife/animals/cnidaria8.html

Ctenophora (Comb Jellies)

- **Ctenophora** are technically a separate phylum from Cnidaria, but they are closely related.

- **Ctenophora**
  - Found in deep ocean
  - (Bioluminescence)

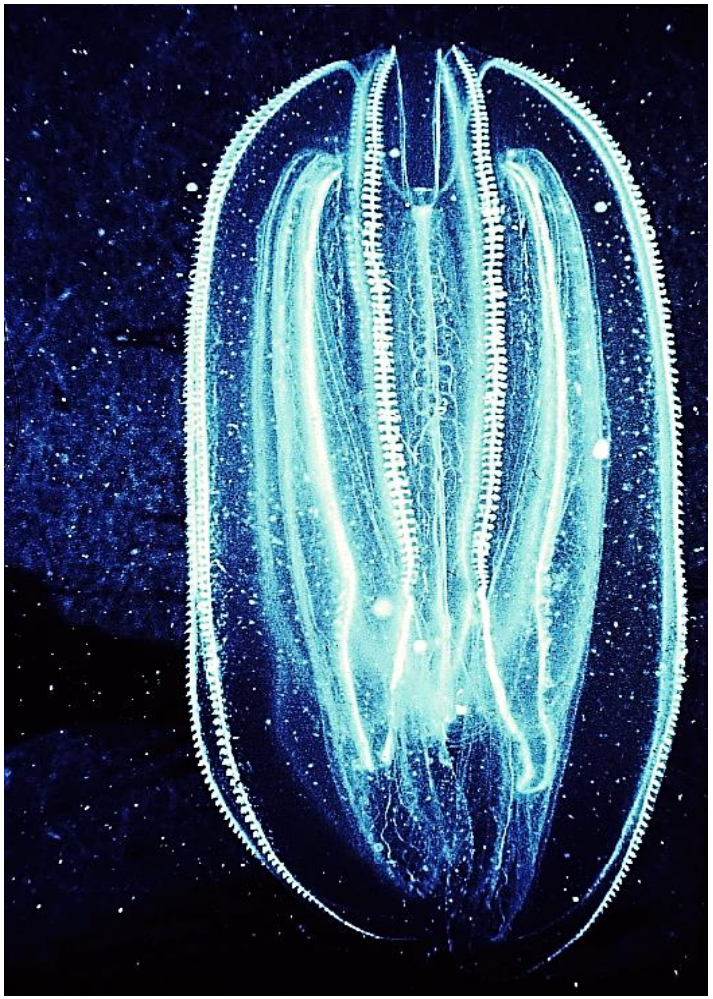
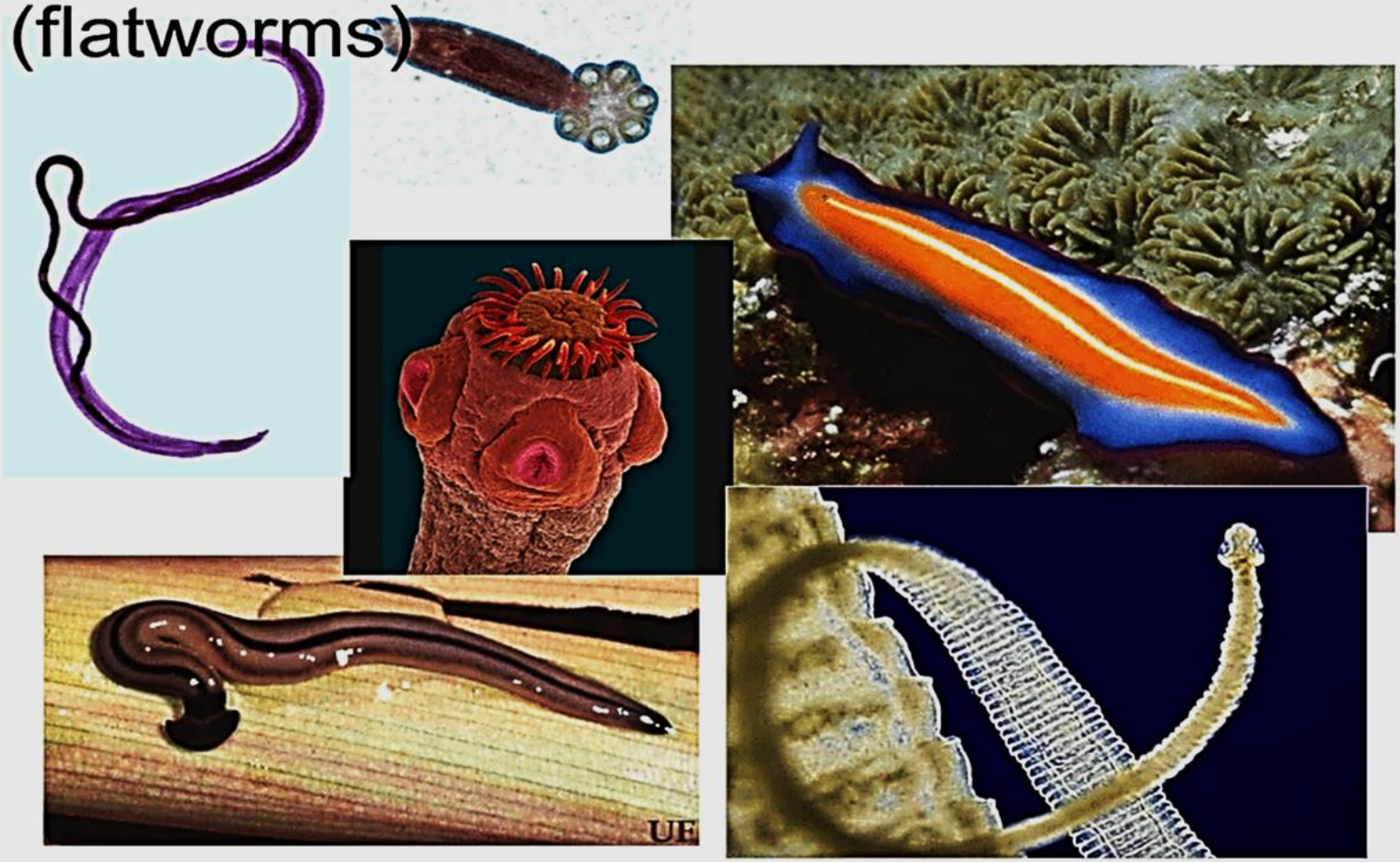


Image Source: http://www.mwra.state.ma.us/harbor/graphic/comb%20jelly.jpg

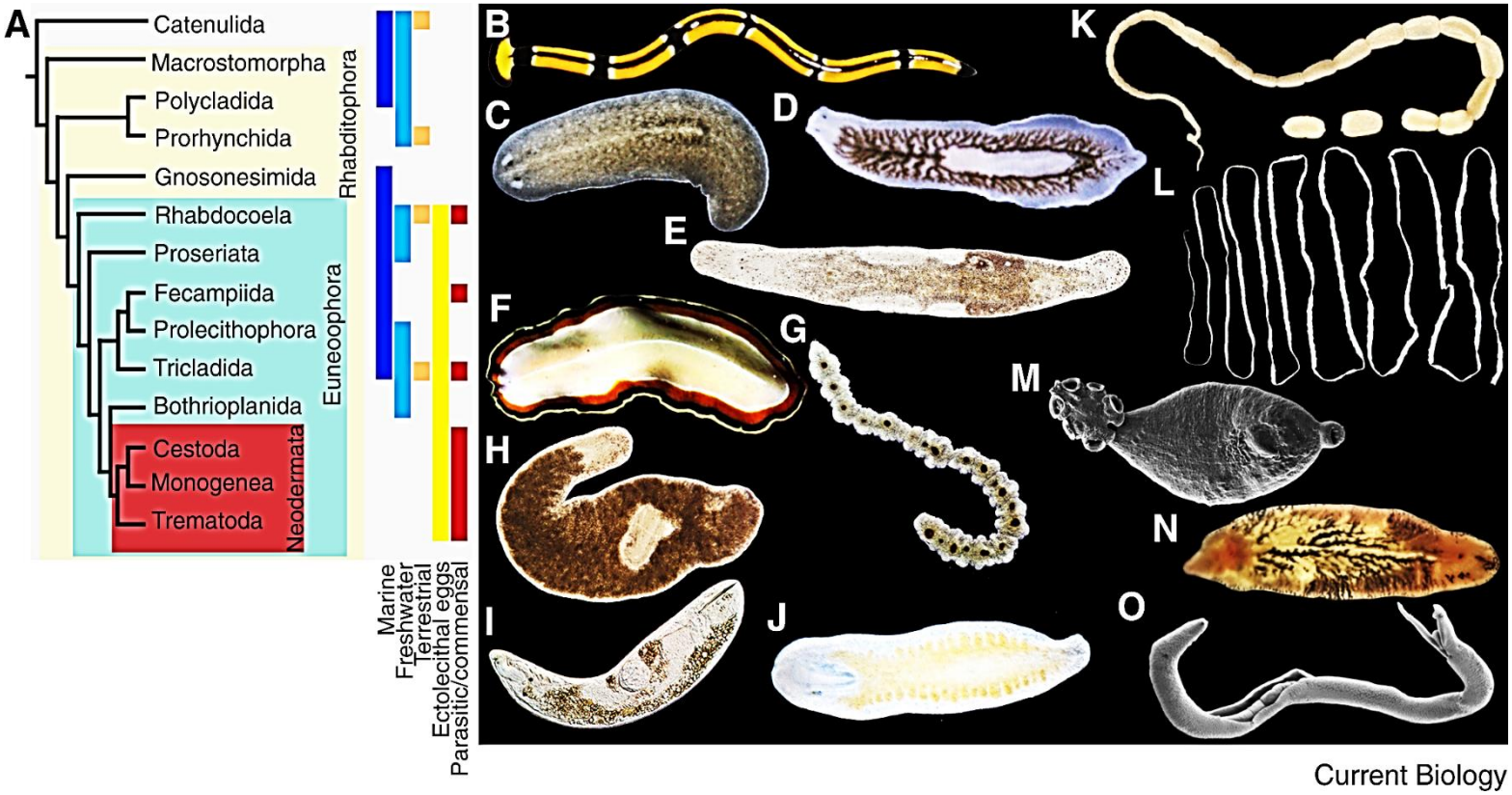
Phylum Platyhelminthes

(flatworms)



Phylum Platyhelminthes

Phylum Platyhelminthes



3 Classes

- **class: turbellaria**
  - ***planaria (free living)**
- **class: Trematoda**
  - ***flukes (parasitic)**
- **class: cestode**
  - ***tapeworms (parasitic)**

These three classes make up 18,000 species

Characteristics of Phylum Platyhelminthes (means "flat worm")

- **Three germ layers (triploblastic)**
- **Bilateral symmetry and cephalization**
- **Acoelomate; with no internal body cavity other than the digestive tract.**
- **The spaces between the organs are filled with mesodermal tissue called parenchyma**

- Nervous system consists of a pair of anterior organs called ganglia that are similar to a brain

- Excretory system of two lateral running canals connected to structures called flame cells

- No circulatory or respiratory organs; oxygen and carbon dioxide exchange occurs by diffusion

Ecology of Flatworms (Platyhelminthes)

- Many flatworms like the **turbellarians** are **free-living organisms** that dwell on the bottom of the ocean or freshwater habitats or moist places on land.

- All of the flatworms that belong to class **Trematoda, Monogenea, (flukes) and Cestoda (tapeworms) are parasitic.**

- Some are **ectoparasites** (live on the outside of their host) and others are **endoparasites** (live on the inside of their host).

- **Many have complex lifestyles that involve more than one host. The first host is often an invertebrate and the second a vertebrate.**

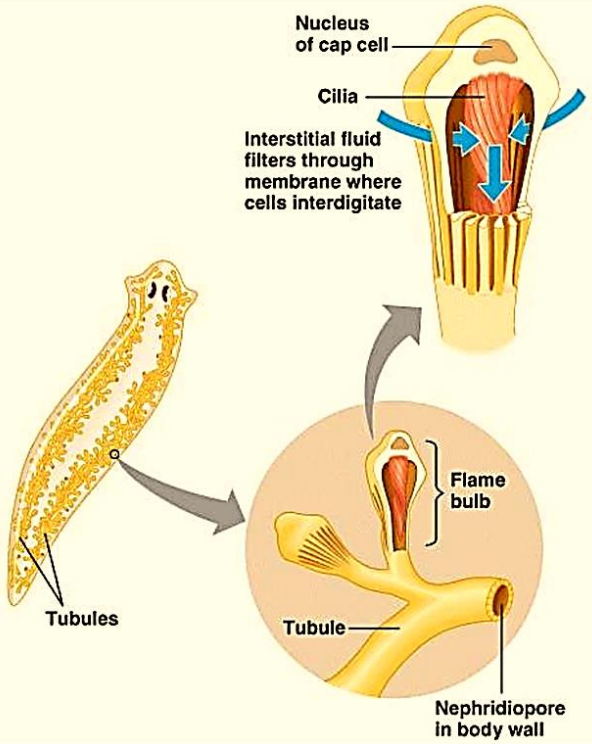
- **The digestive system of some flatworms is incomplete, having only one opening that serves as a mouth and an anus.**

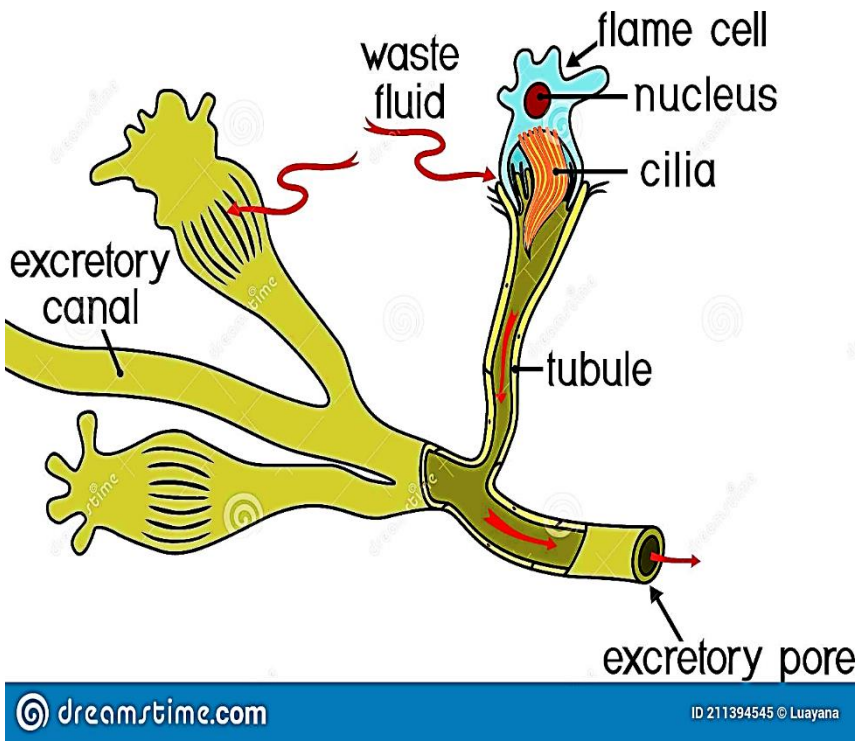
Excretory System in Platyhelminthes

- The excretory system of flatworms consists of a complex **network of cells called flame cells**
- Flame cells (**or protonephridia**) are similar to kidneys in other organisms.
- The flame cells **consist of a hollow cup filled with cilia** that beat and pump water and nitrogenous wastes out the body.
- When the **cilia beat, they resemble flames**, giving them their name.

Flame Cells (Protonephridia)

Excretory organs are **Flame cells (protonephridia)**





Nervous System of Flatworms

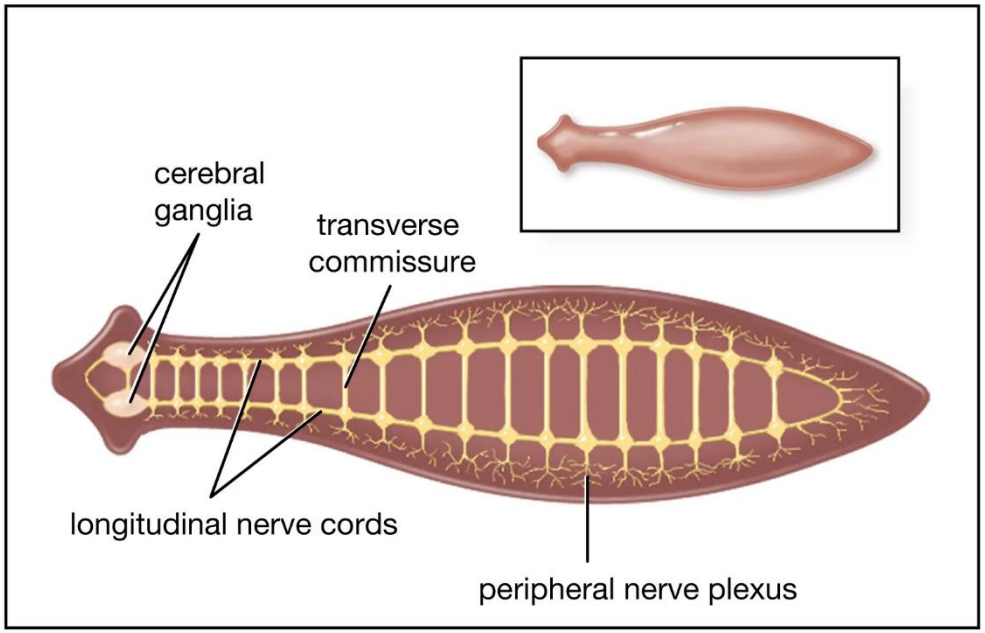
- Flatworms are the first animal we have discussed that exhibits **cephalization.**
- Cephalization means they **have a head (anterior) and tail (posterior) region**.
- Cephalization **allows animals to move** (**crawl, swim, fly etc**.) in a certain direction to search for resources.
- In order to move in a specific direction, the animal requires **a central nervous system**.

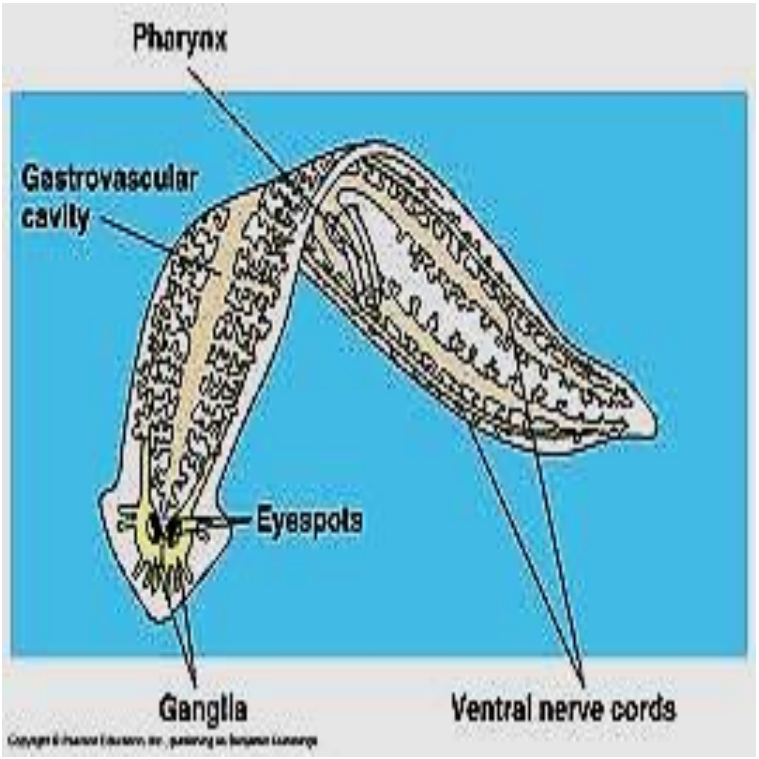
Nervous System of Flatworms

- The central nervous system in flatworms is a region of nerve tissue found at the **anterior end called a ganglion.**
- The ganglion **attaches to a pair of ventral nerve cords that run the length of the body.**
- The **nerve cords** are **sensitive to touch, chemical detection, equilibrium, water current direction and they can control muscular movement.**
- The ganglion are also attached to **eye spots** that are **sensitive to light**.

Nervous System of Flatworms

Nervous system of the flatworm *(Planaria)*

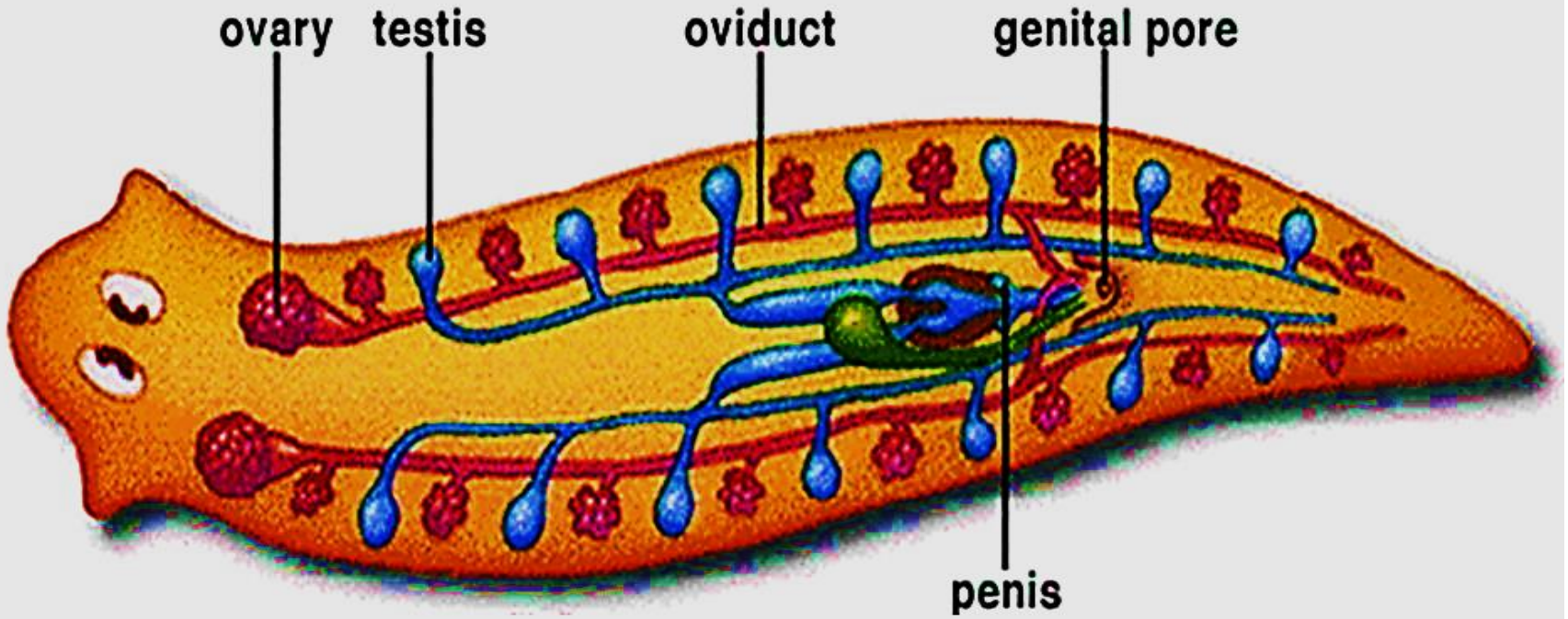




Reproduction of Flatworms

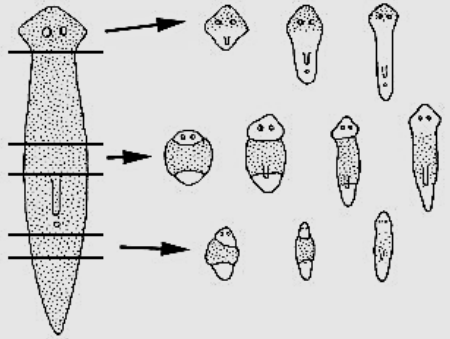
- Reproduce both **sexually** and **asexually**.
- **Sexual reproduction** usually occurs by cross fertilization (trading sperm) with other individuals.
- Most flatworms are **monoecious.** خنثي
- Only a few flatworms are **dioecious**. منفصل الجنس
- **Asexual reproduction** usually occurs by **fission** in which the organism separates into two halves and regenerate into two adults.
- In some flatworms, asexual reproduction can occur as thousands of juvenile offspring.

Reproductive system of Platyhelminthes

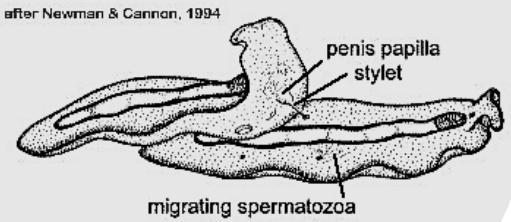


Flatworm Reproduction

- Asexual
  - Stretch or break apart
  - Each half becomes new animal



- Sexual
  - Hermaphrodites
  - Both transfer sperm to one another



Web link

1. Turbellaria: nonparasitic

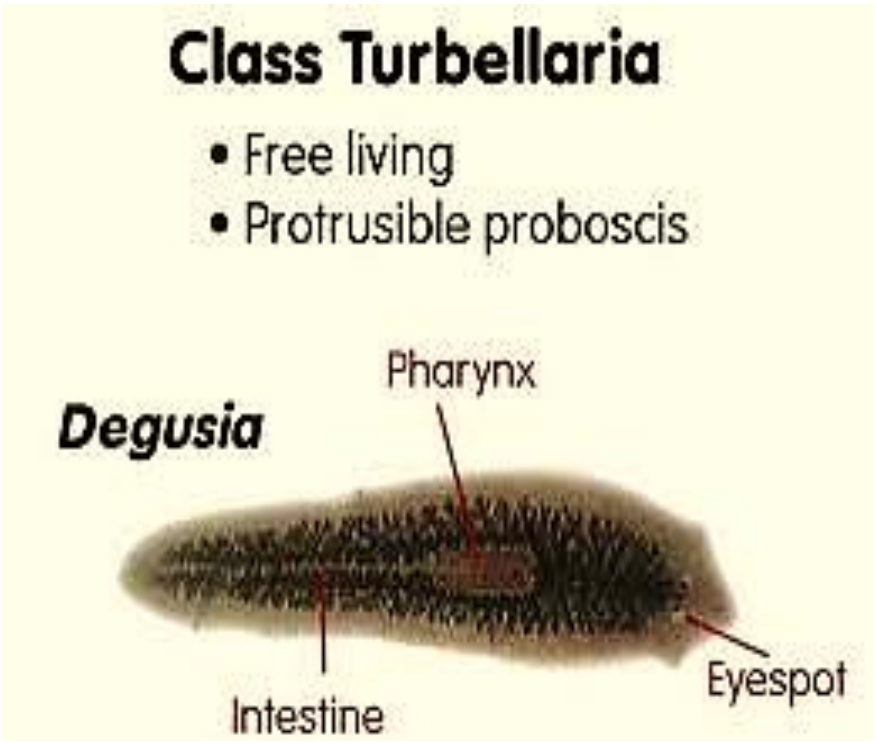
- Majority **live in ocean**
- Some in **fresh water**

  ***Planaria dugesia** (known as Planaria)
- Move in water using **wave like motion**

➡ Move on ground by **producing mucous** and using cilia to glide on it

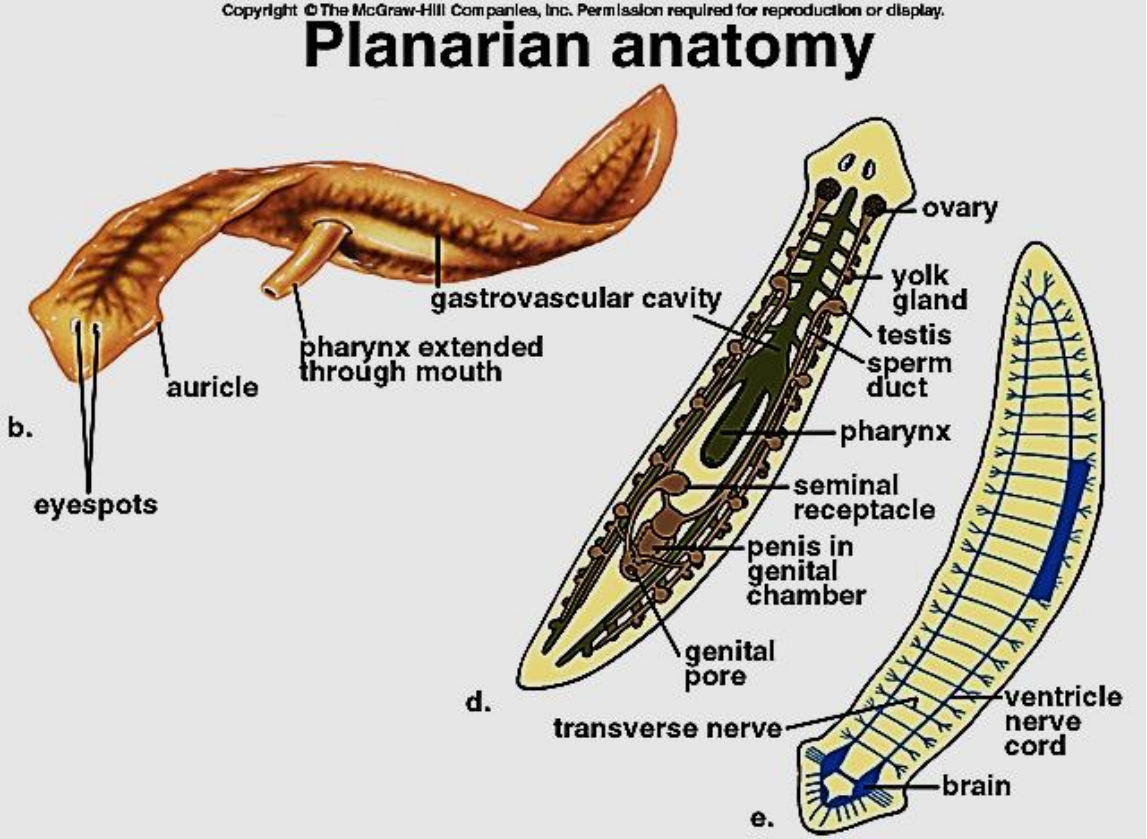
Pretty planaria, not all flatworms are ugly parasites

Class Turbellaria; Genus *Degusia,* common name Planaria



Planaria

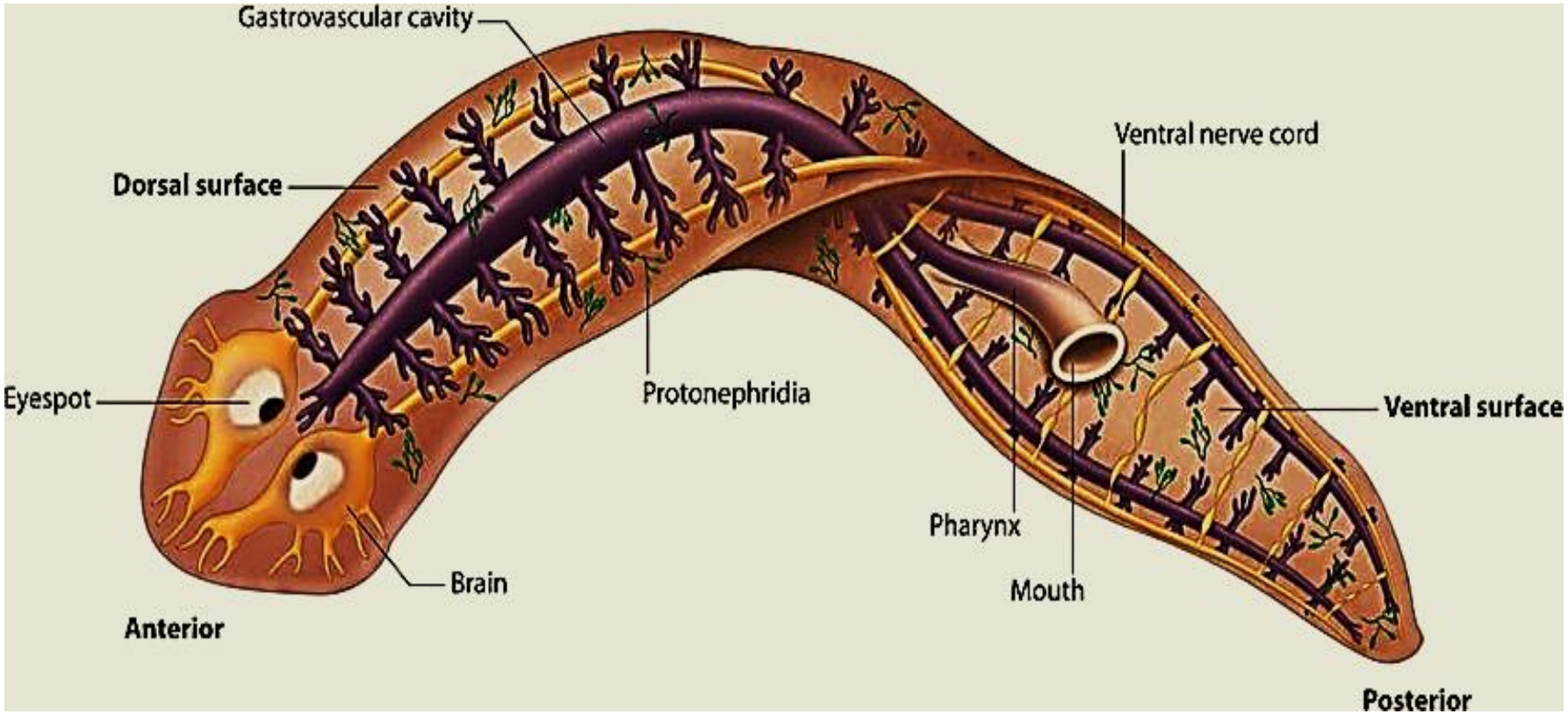
Planarian Anatomy



A. Digestion

- Feed on **decayed plant or animal**
- Food ingested through **pharynx** (muscular tube) extended through middle of body
- Goes to **gastrovascular cavity**
- Cells here **absorb nutrients**

Digestion


Gastrovascular cavity
Dorsal surface
Ventral nerve cord
Eyespot
Protonephridia
Ventral surface
Pharynx
Brain
Mouth
Anterior
Posterior

B. Excretion

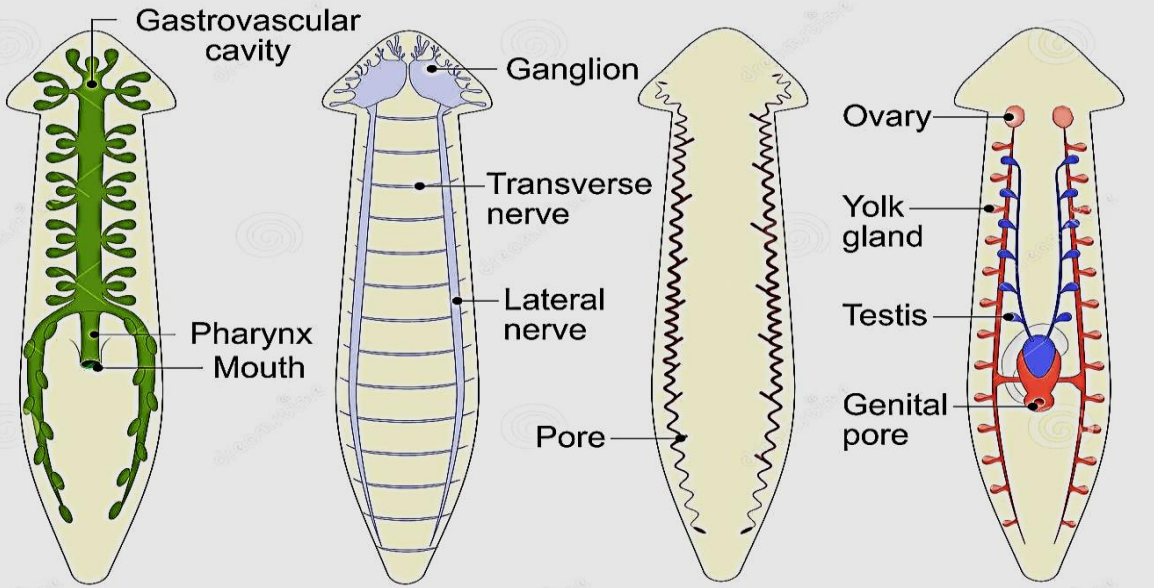
* To get rid of waste

- Through network of **excretory tubules**
- Run length of body
- Connects to **flame cell** which are enclosed tufts of beating cilia

C. Nerves

- 2 clusters of nerve cells at anterior end called **cerebral ganglia** which serves as simple brain
- Ganglia **receive information from sensory cells**
- Transmit **signals to muscles along nerves**
- **Has ability to learn moves from light**
- Uses **eyespot** near ganglia to sense environment

Planaria

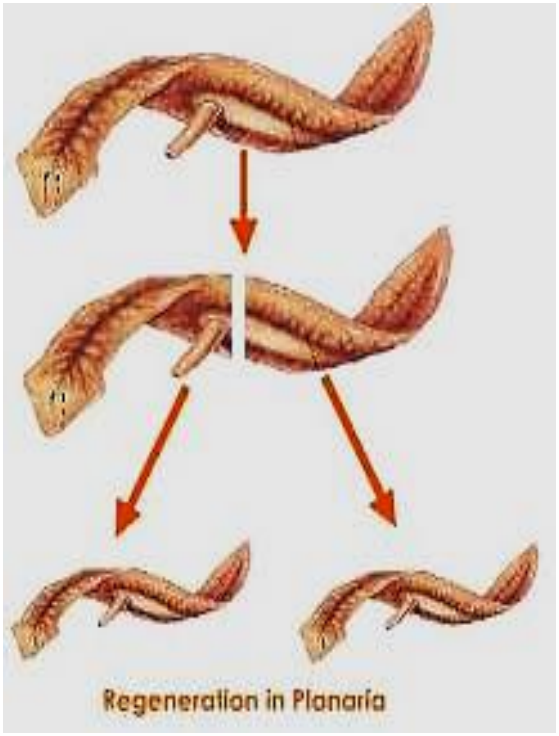


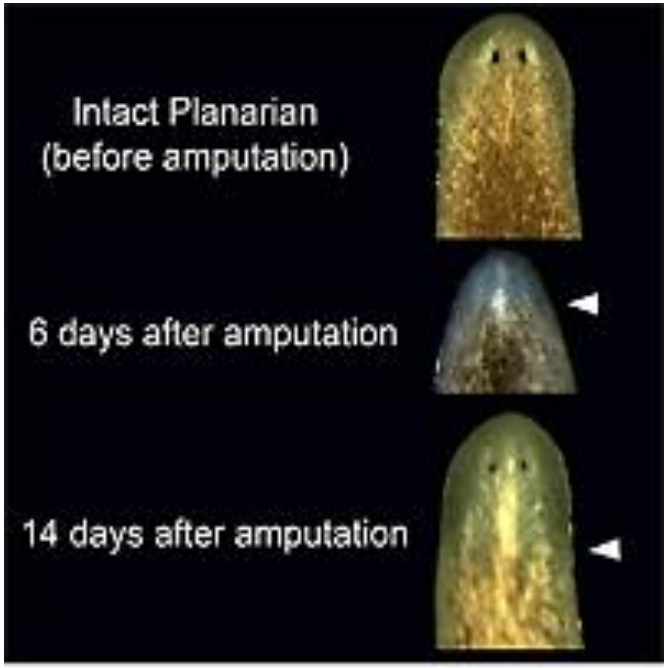
D. Reproduction

- **Hermaphrodites**
- When reproduce sexually, they simultaneously fertilize each other
- Usually **asexual in summer by regeneration**

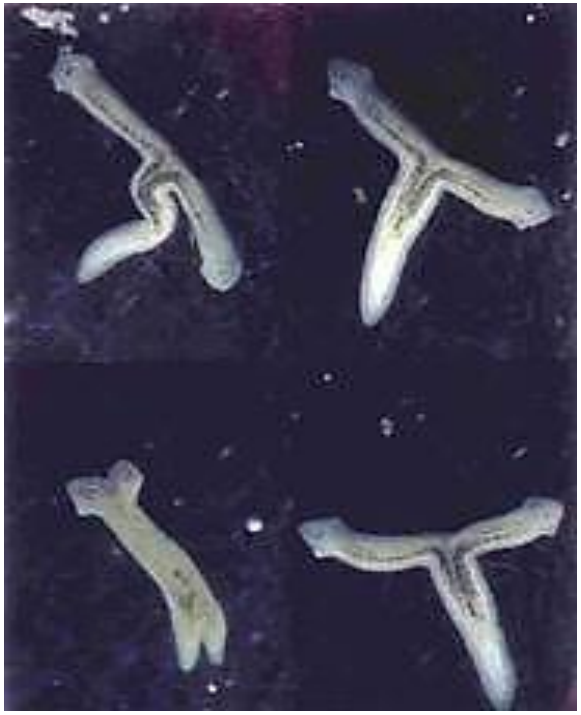
- They attach posterior end to something; anterior end moves until it splits.
- This is **fission**. Each half then regenerates into 2 complete planaria.

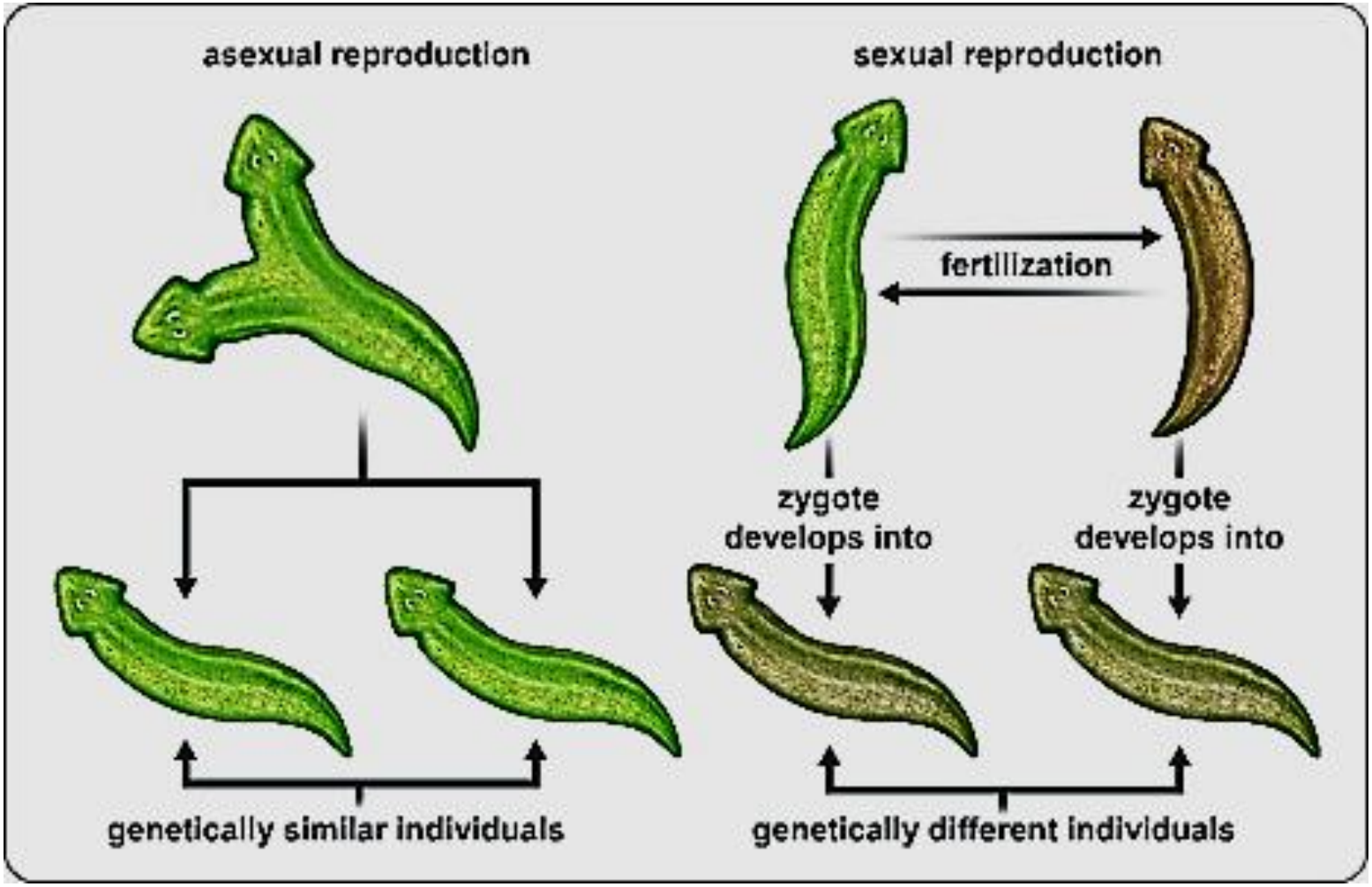
Regeneration of Planarian Flatworm

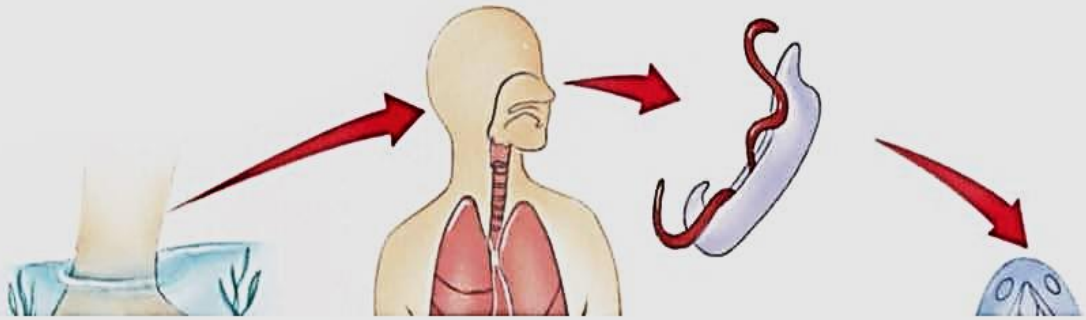




Regeneration over time. White arrowheads indicate the boundary of the blastema.




asexual reproduction
sexual reproduction
fertilization
zygote develops into
zygote develops into
genetically similar individuals
genetically different individuals



Class Trematoda

Phylum Platyhelminthes

Platyhelminthes

- ~ 20,000 extant species
- Parasitic + free-living
- Unsegmented flatworms

Taxonomy

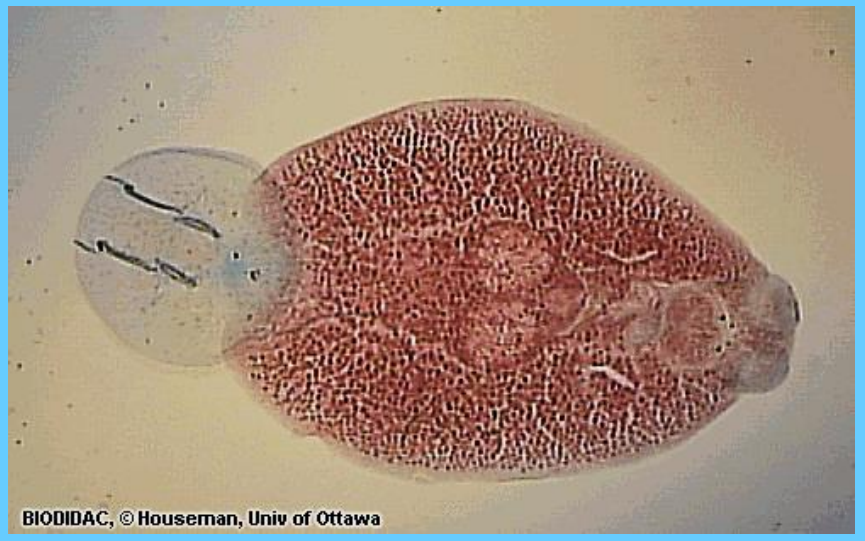
- Class Turbellaria
- Class Monogenea
- Class Trematoda
- Class Cestoda

Class Monogenea

- Monogenetic flukes (life cycle = one host)
  - Body covered by tegument
  - Oral sucker reduced or absent
  - Ectoparasitic (usually fish)

Class Monogenea

- Monogenetic flukes (life cycle = one host)
  - Eggs hatch into ciliated larvae = **oncomiracidia**
  - Mature and find host



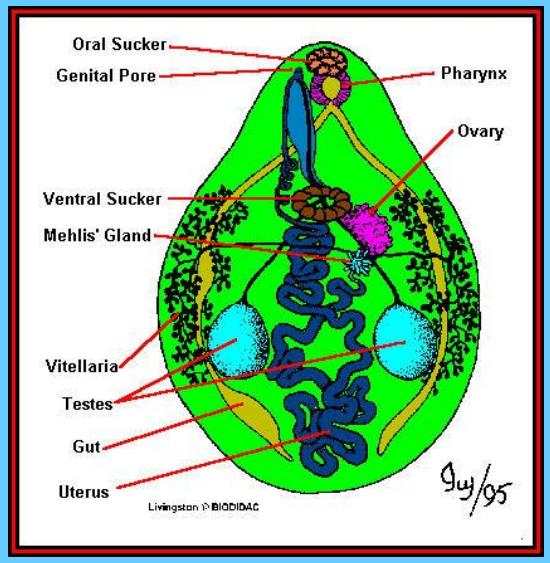
Class Trematoda

- Digenetic flukes (multiple hosts)
  - Body with tegument
  - One or more suckers present
  - Internal parasite

Fluke Digestive System

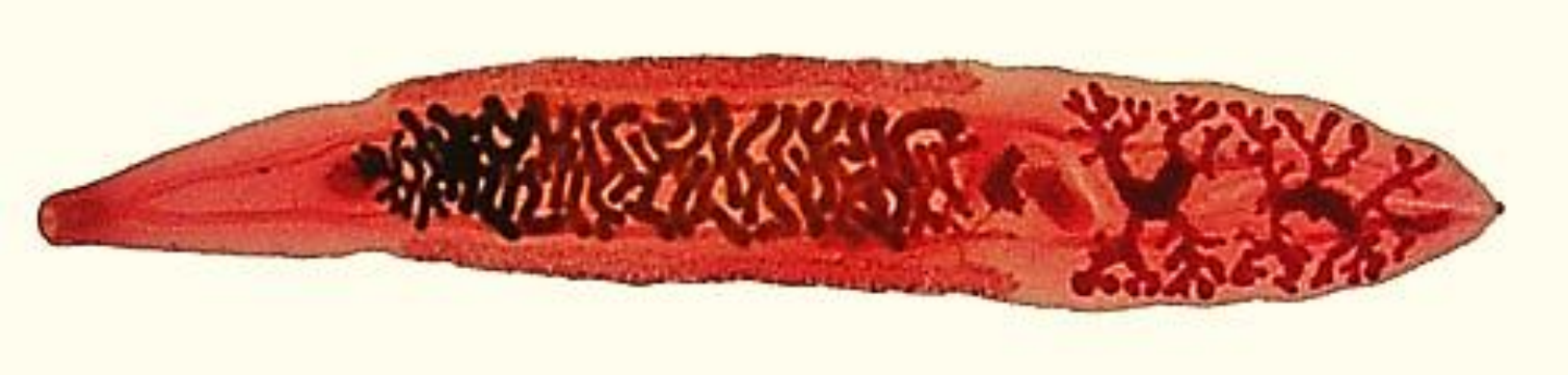
- Feed on host tissues and fluids (muscular pharynx)
  - Or, material in host gut

- **One-way digestive tract**: mouth, muscular pharynx, short esophagus, intestinal cecae



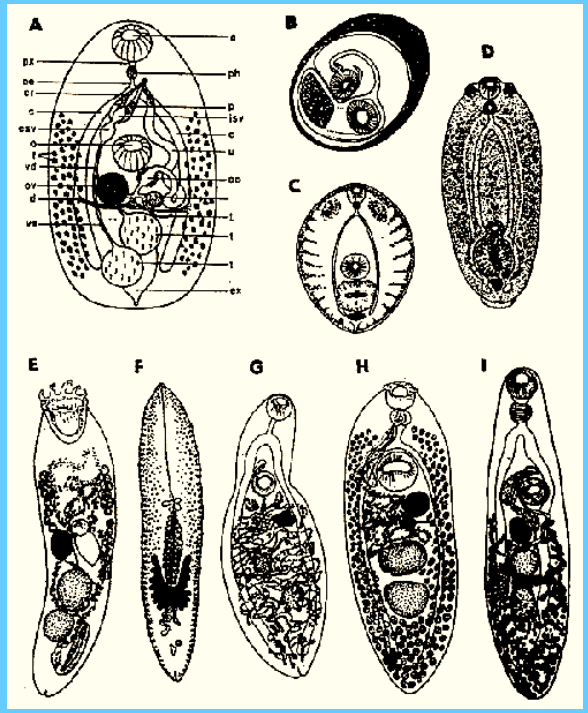
Fluke Nervous System

- Ladder-like
- Cerebral ganglion
- Suckers with tactile receptors مستقبلات لمسية (bristles شعيرات and spines أشواك)



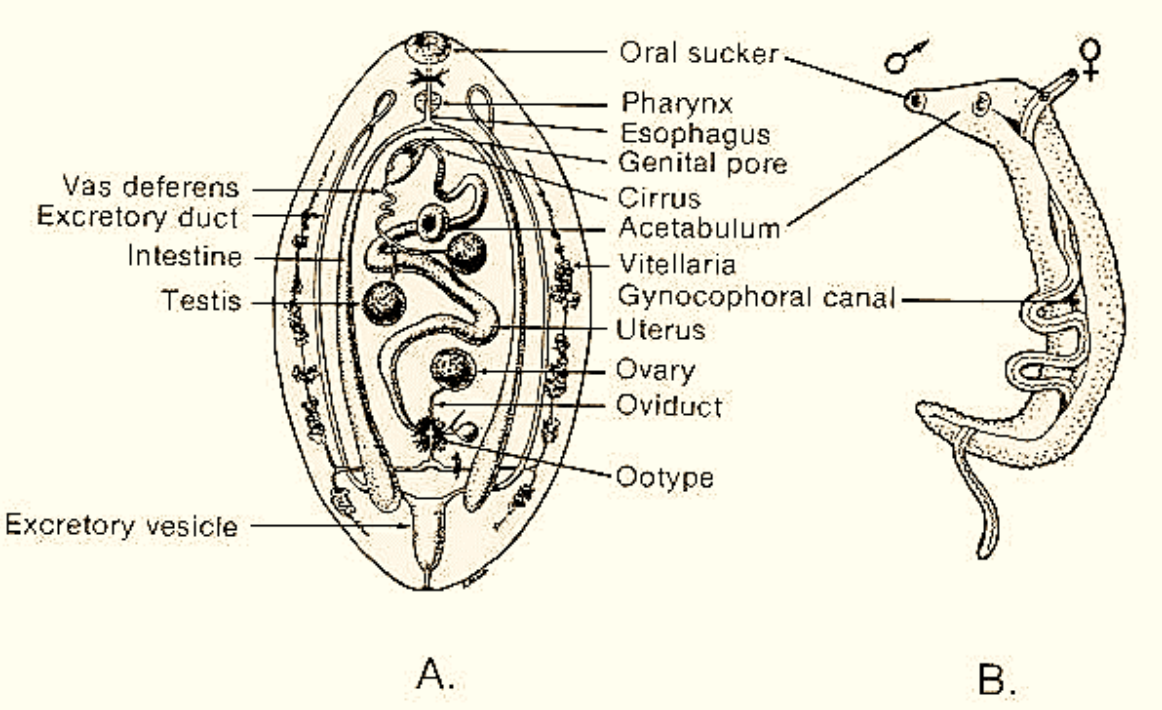
Sexual repro flukes

- Hermaphroditic
- Mutual cross fertilization
- **Male structures**
  - Variable testes
    - Monogenetic = many
    - Digenetic = two
  - Sperm-to sperm duct, copulatory apparatus, eversible cirrus



Sexual repro flukes

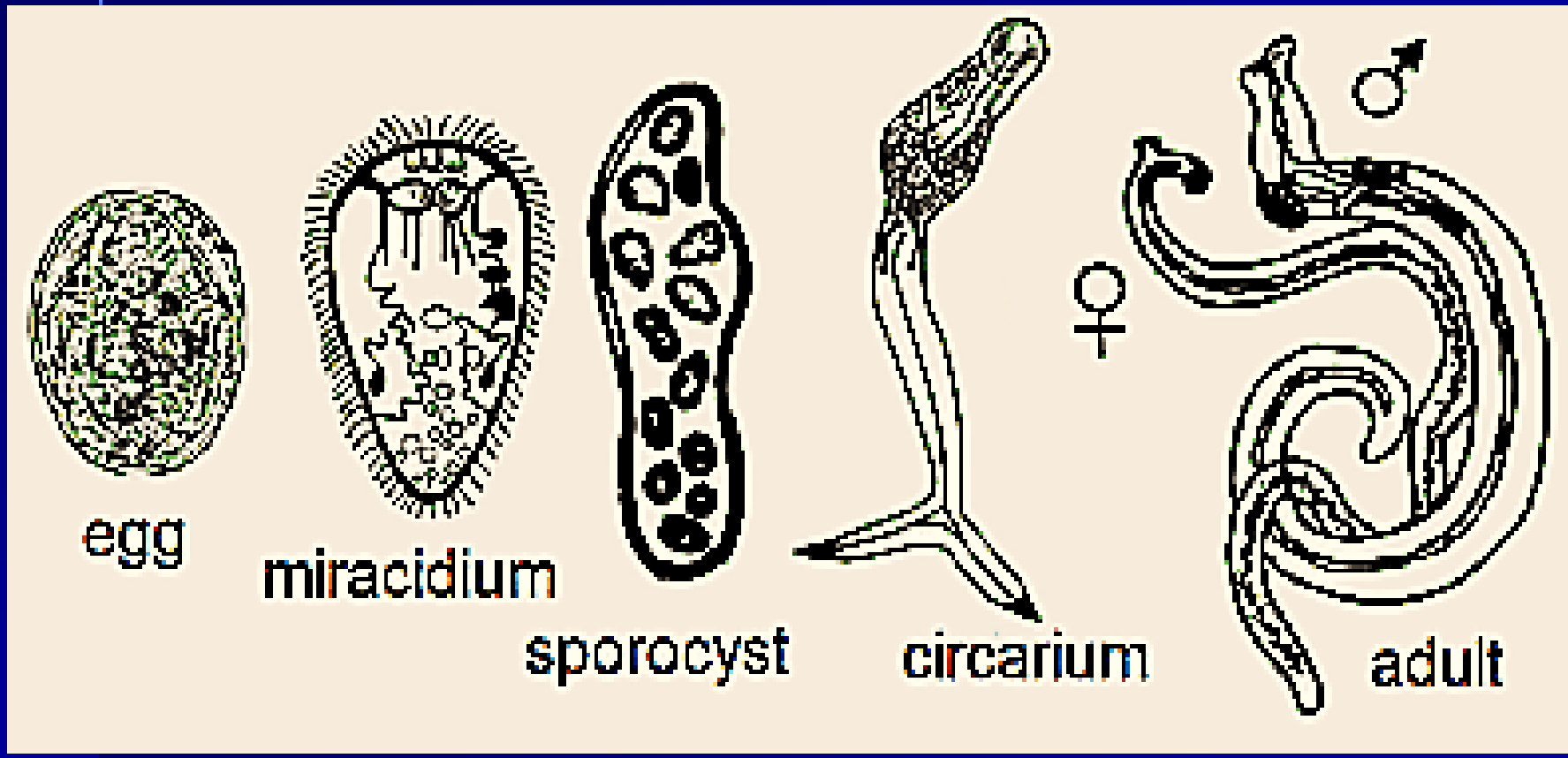
- **Female Structures**
  - Ovary to oviduct to ootype
  - Oviduct joined by vitelline duct
  - Seminal receptacle = blind pouch off oviduct
  - Single uterus



Sexual repro flukes

- These eggs make it to fresh water and develop into ciliated larvae.
- These larvae find a particular species of snail.
- They burrow into snail's tissue and asexual reproduction takes place.
- Snail is intermediate host (no harm is done here).
- Larvae develop tails and leave.
- Enter skin of human and begin cycle again.

Fluke life-cycles



Fluke life-cycles

- **Monogenetic**
  - One host
  - Mostly external parasites of fish
- **Digenetic**
  - Two or more hosts
  - Mostly internal parasites

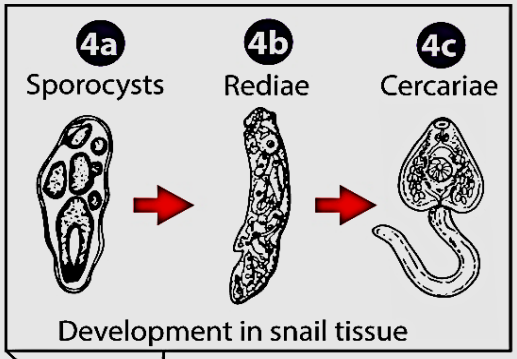
Fluke life-cycles

- **Digenetic *Fasciola* = sheep liver fluke**
  - Multiple hosts
  - Internal parasite of vertebrates
  - Intermediate host usually gastropod

DPDx

Fasciola spp.

CDC



5 Free-swimming cercariae encyst on aquatic vegetation.

6 Metacercariae on vegetation ingested by definitive host.

7 Immature flukes excyst in duodenum, penetrate intestinal wall, and migrate though liver parenchyma to biliary ducts.

4 Miracidia penetrate snail intermediate host.

Ruminants are the typical definitive hosts.

3 Miracidia hatch from eggs, seek out snail intermediate host.

2 Eggs become embryonated in water.

1 Unembroynated eggs are passed in feces.

F. hepatica *F. gigantica*

8 Adult flukes in hepatic biliary ducts

Infective stage

Diagnostic stage

Fluke life-cycles

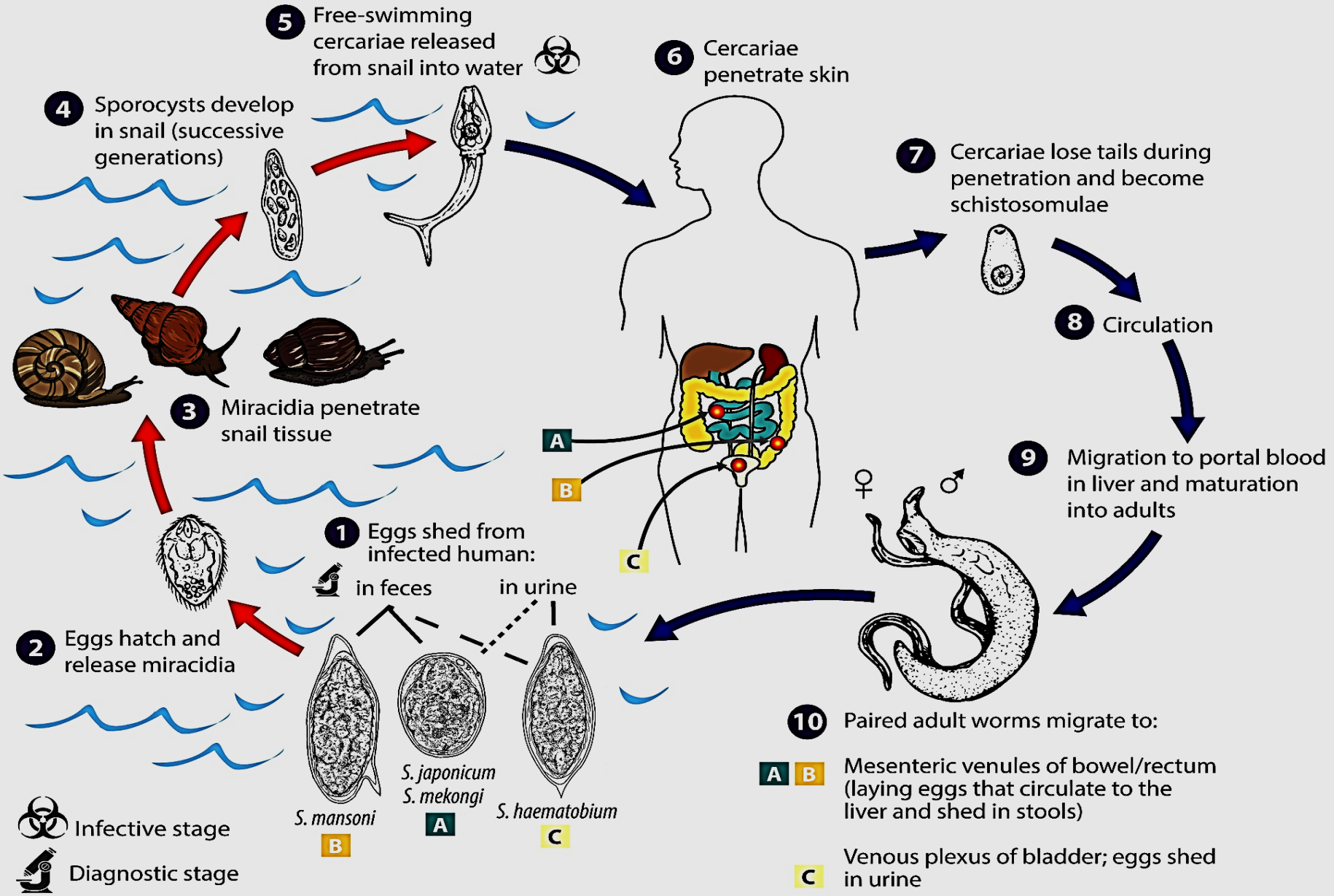
Schistosoma sp.

Schistosomiasis = disease with problems from egg production, fevers, eggs lodged in various tissues

DPDx

Schistosoma spp.

CDC



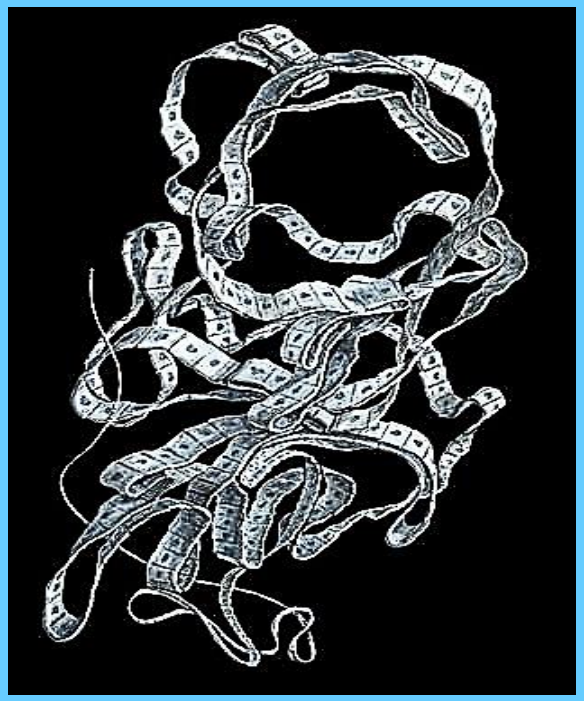
Cestoda (Tapeworms)

Taenia saginata

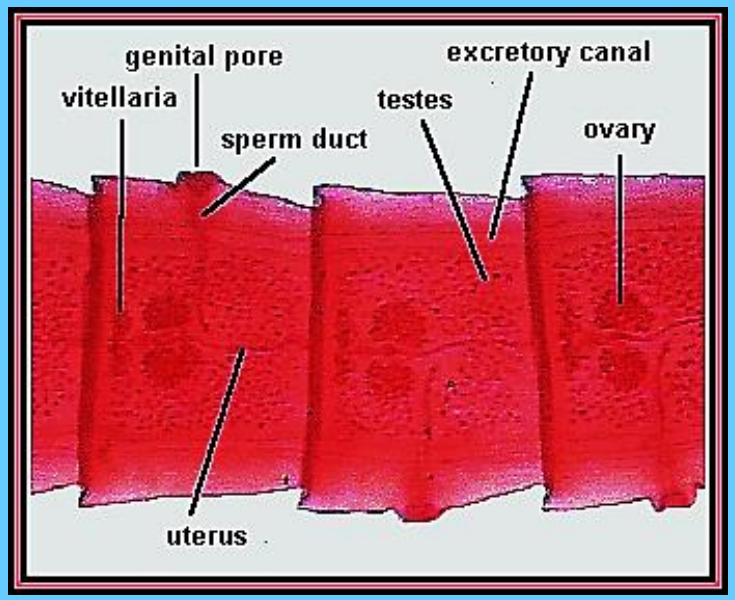
Taenia solium

Echinococcus granulosus

Class Cestoda



- Tapeworms
  - Internal parasite
  - Body with tegument
  - Body with anterior scolex, short neck and proglottids
  - No digestive system



Cestoda (Tapeworms)

- **General characteristics**

*Parasitize in the small intestine of humans.

* They are hermaphrodites and consist of the head (scolex), followed by an unsegmented germinative section (neck) and a posterior chain of segments (proglottids).

*There are no digestive organs, so nutrients are taken up through the absorptive integument.

Cestoda (Tapeworms)

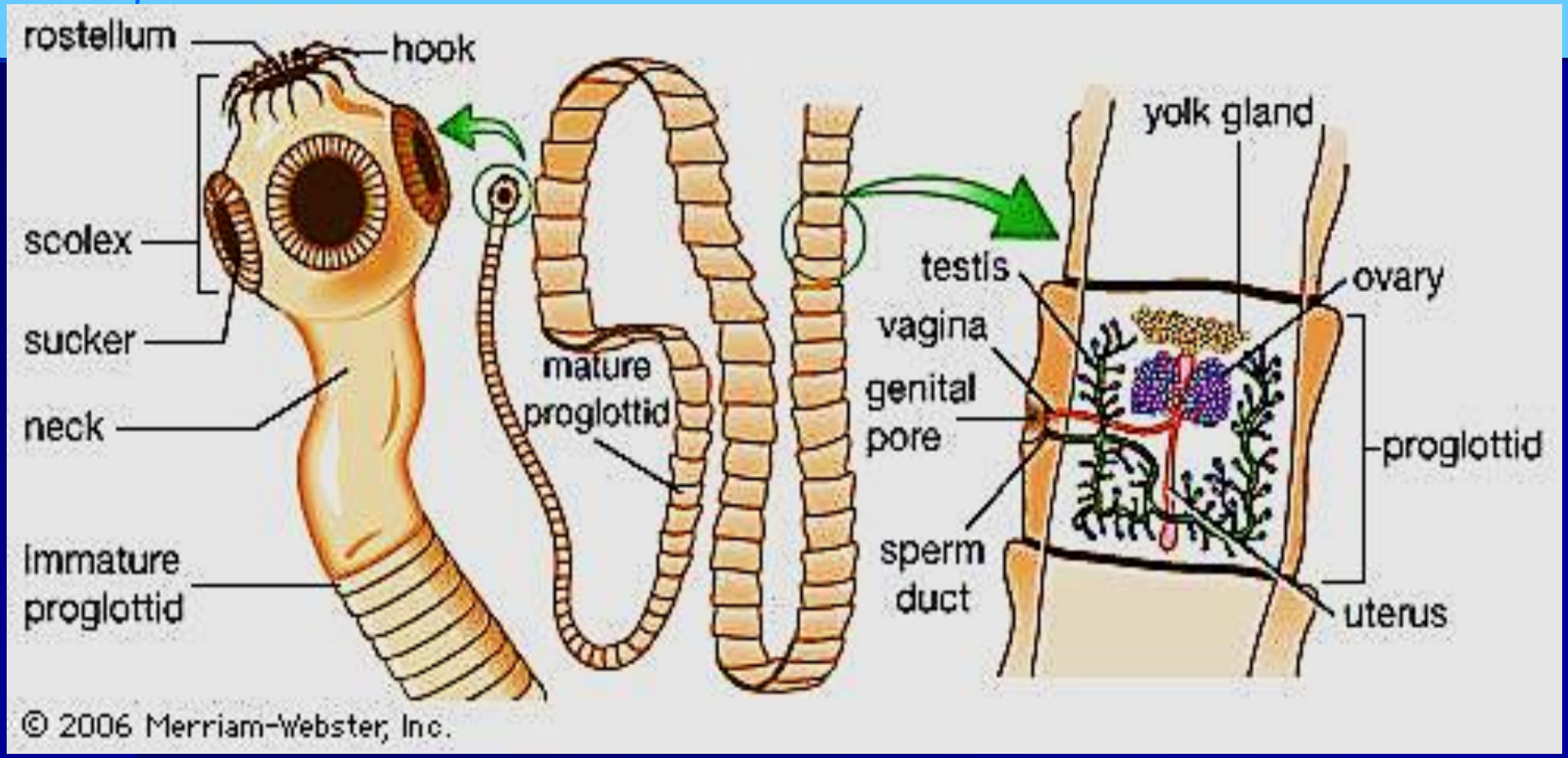
*The life cycle of cestodes include one or two intermediate hosts.

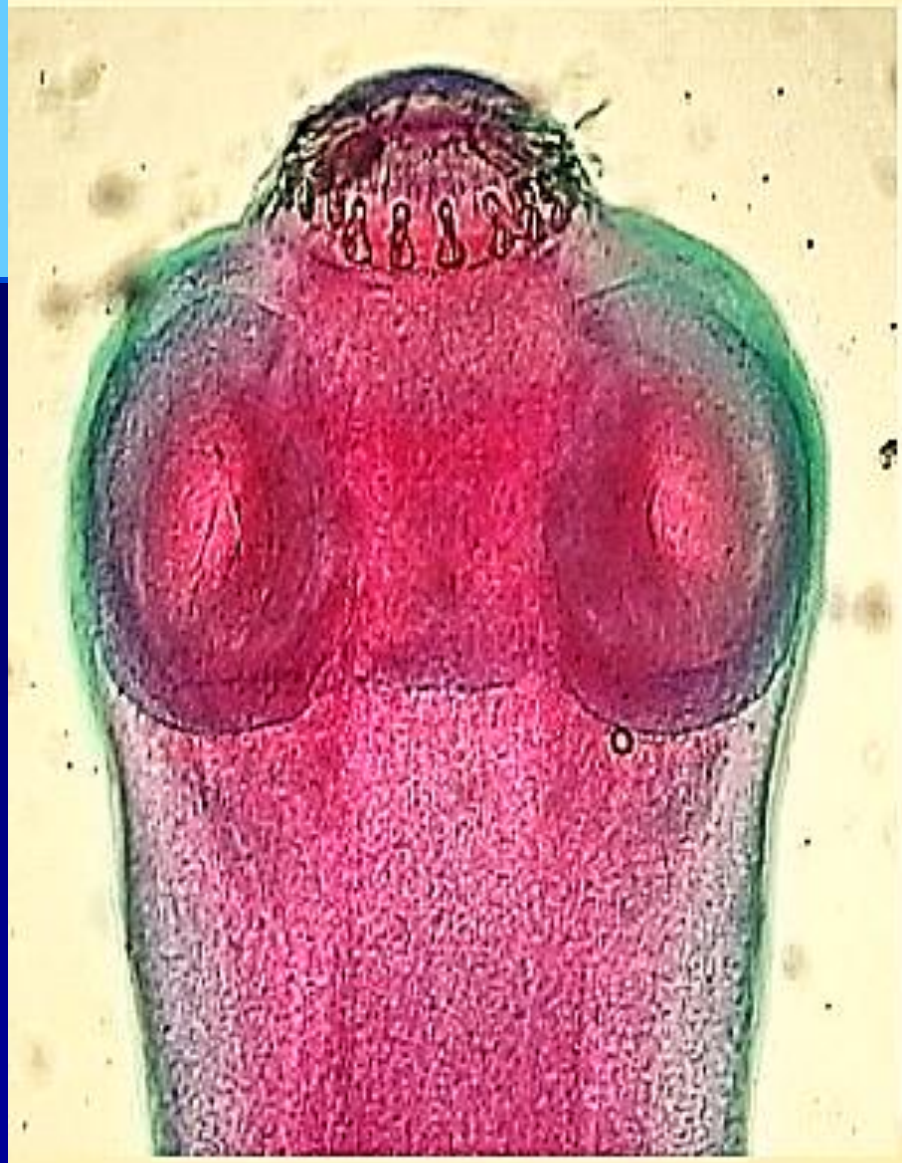
* Humans can also be infected by larval stages of various tapeworm species (cysticerci, metacestodes).

* These stages develop in body tissues and generally cause considerably greater pathological damage than the intestinal cestode stages.


Adult Taenia
© CD-ROM ILLUSTRATED LECTURE NOTES ON TROPICAL MEDICINE

Tapeworms = cestodes



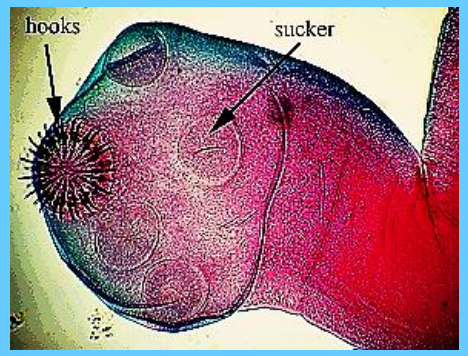



Taenia saginata
Gravid Proglottid
3mm

Tapeworms = cestodes

- **Locomotion**
  - Sedentary (جالسة غير متحركة): adult on host intestinal wall
  - Capable of muscular undulations

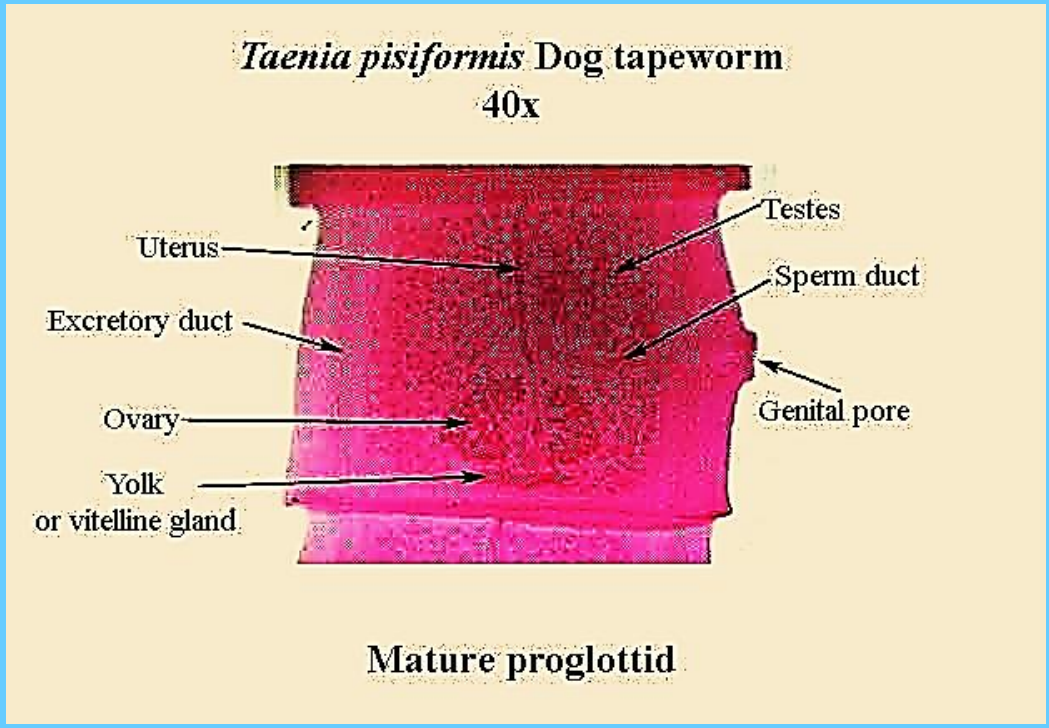
- **Attachment**
  - Scolex
  - Anterior with hooks or adhesive pad



Tapeworm digestion

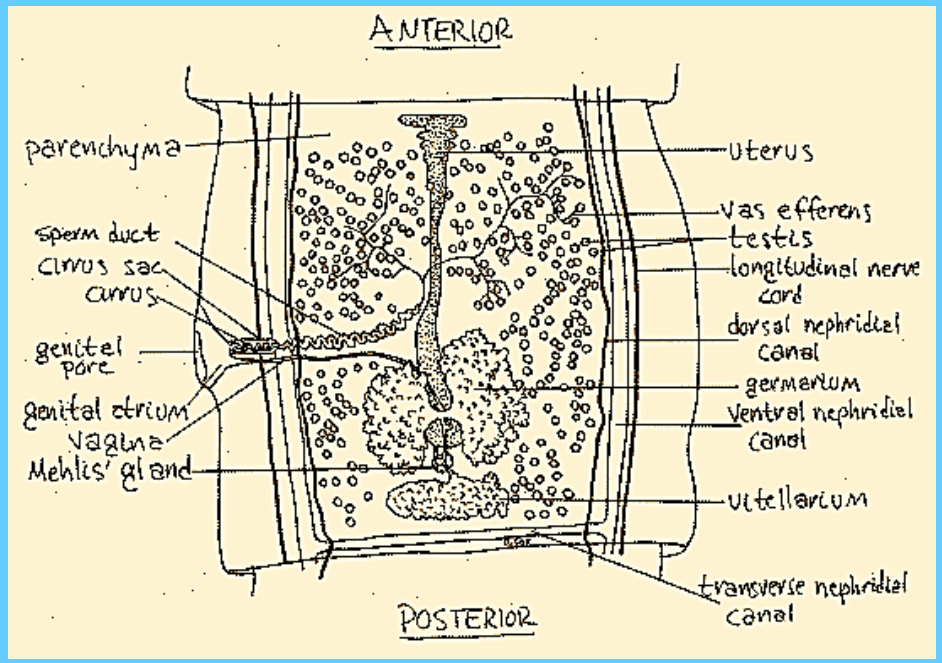
- No mouth, no digestive tract

- Nutrients absorbed across tegument



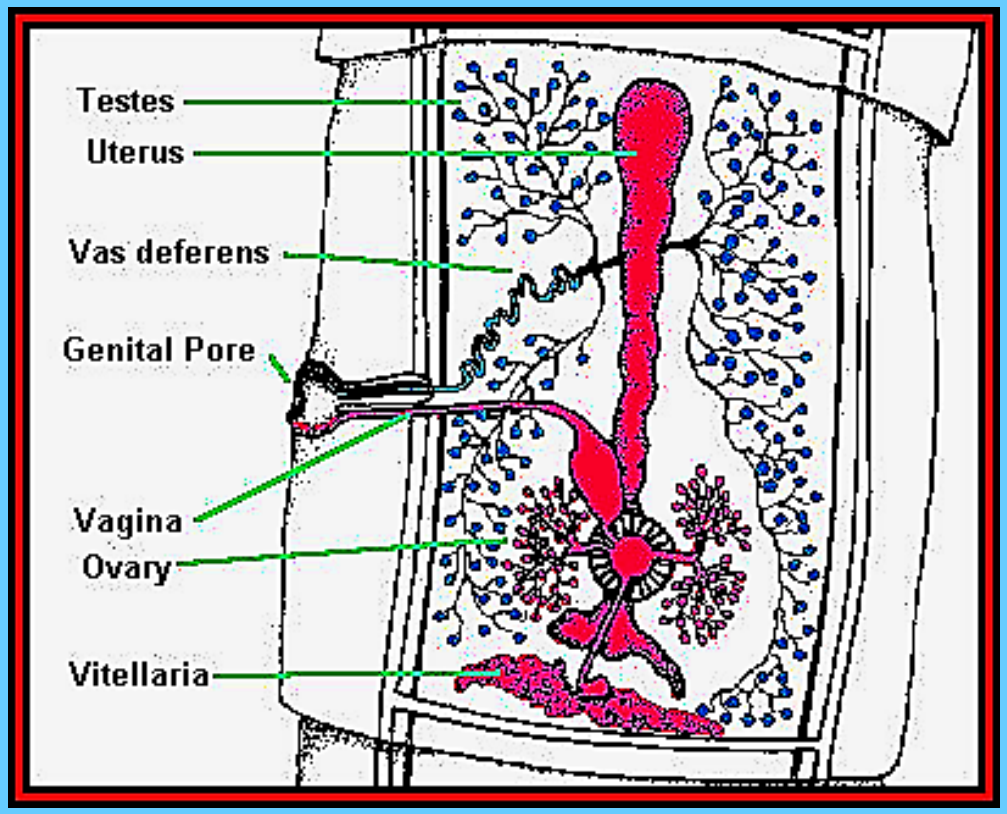
Tapeworm Nervous System

- **Cerebral ganglion**; nerve ring in scolex
- Each proglottid has additional ganglia; connect to longitudinal nerve cords
- Sensory organs reduced, tactile receptors in scolex



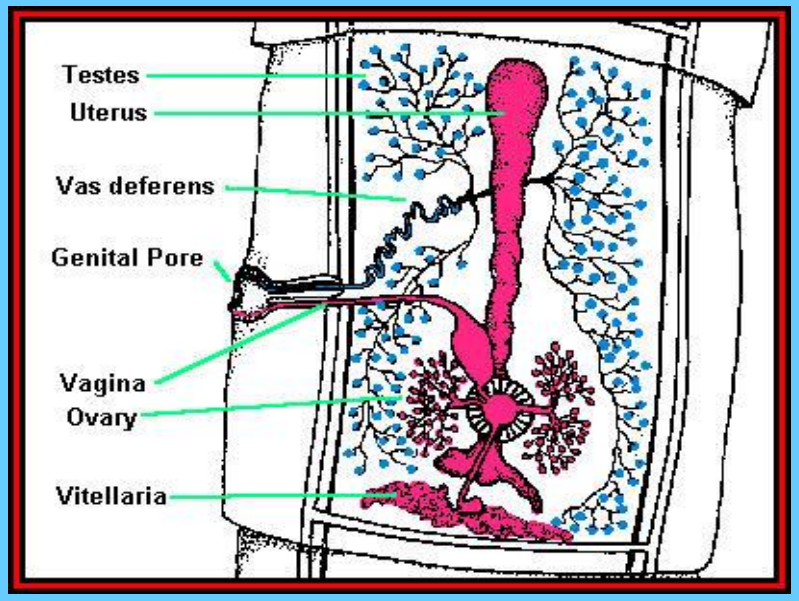
Sexual Repro: tapeworms

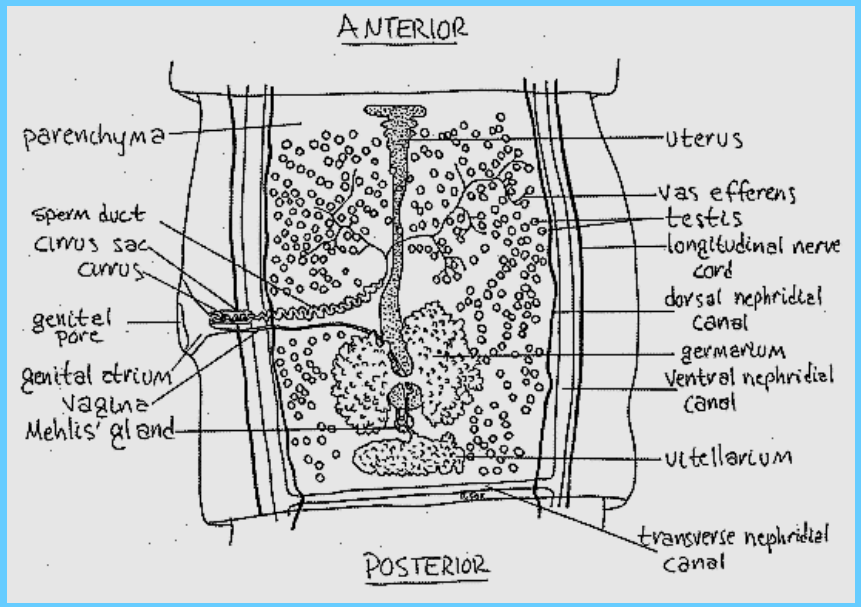
- Hermaphroditic
- Mutual cross-fertilization
- Self-fertilization in some



Mature Proglottids القطع اللسانية الناضجة

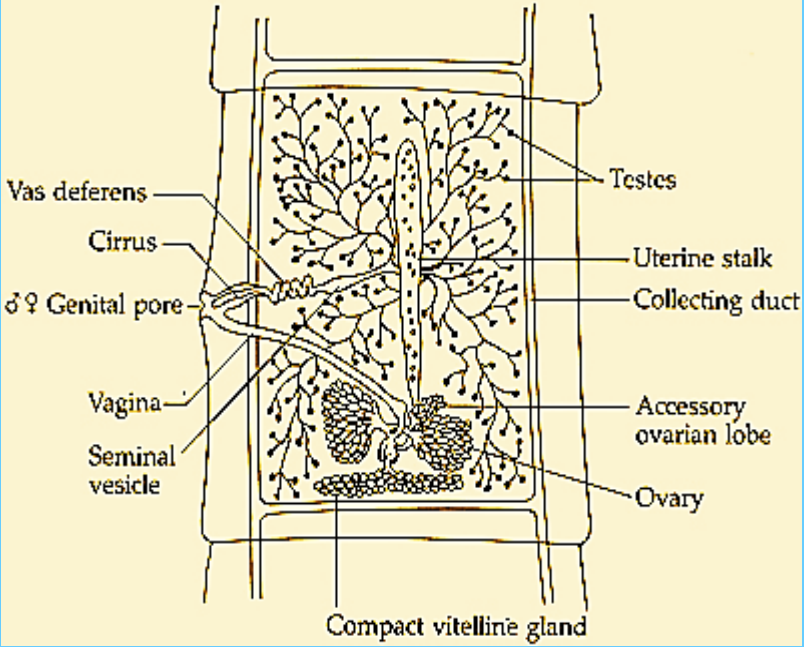
- Numerous testes along margins
- Collecting tubules to coiled sperm duct
- Vas deferens to genital pore
- Two ovaries
- Uterus = blind sac

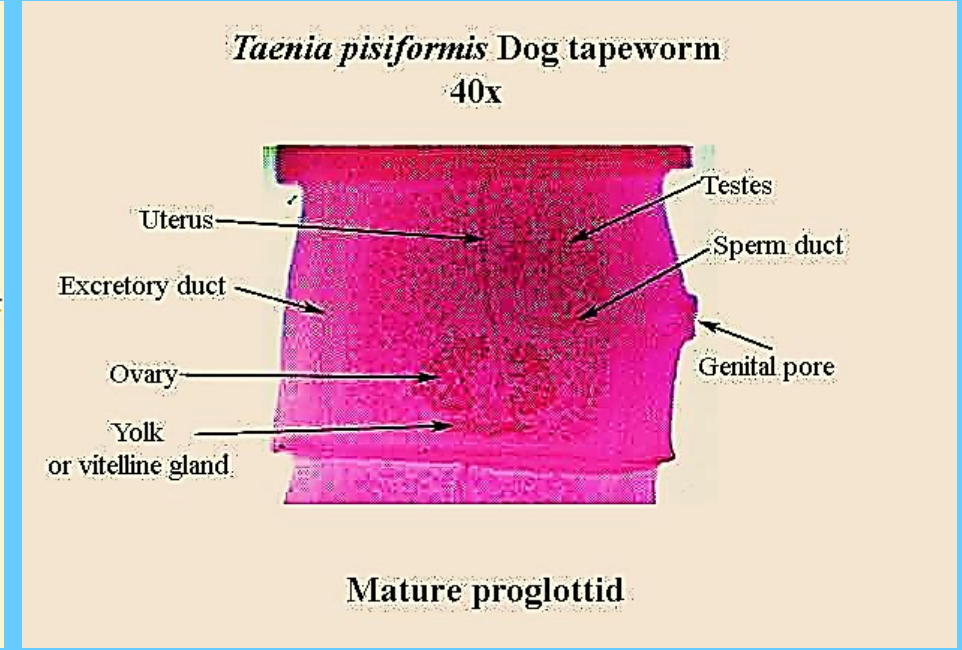




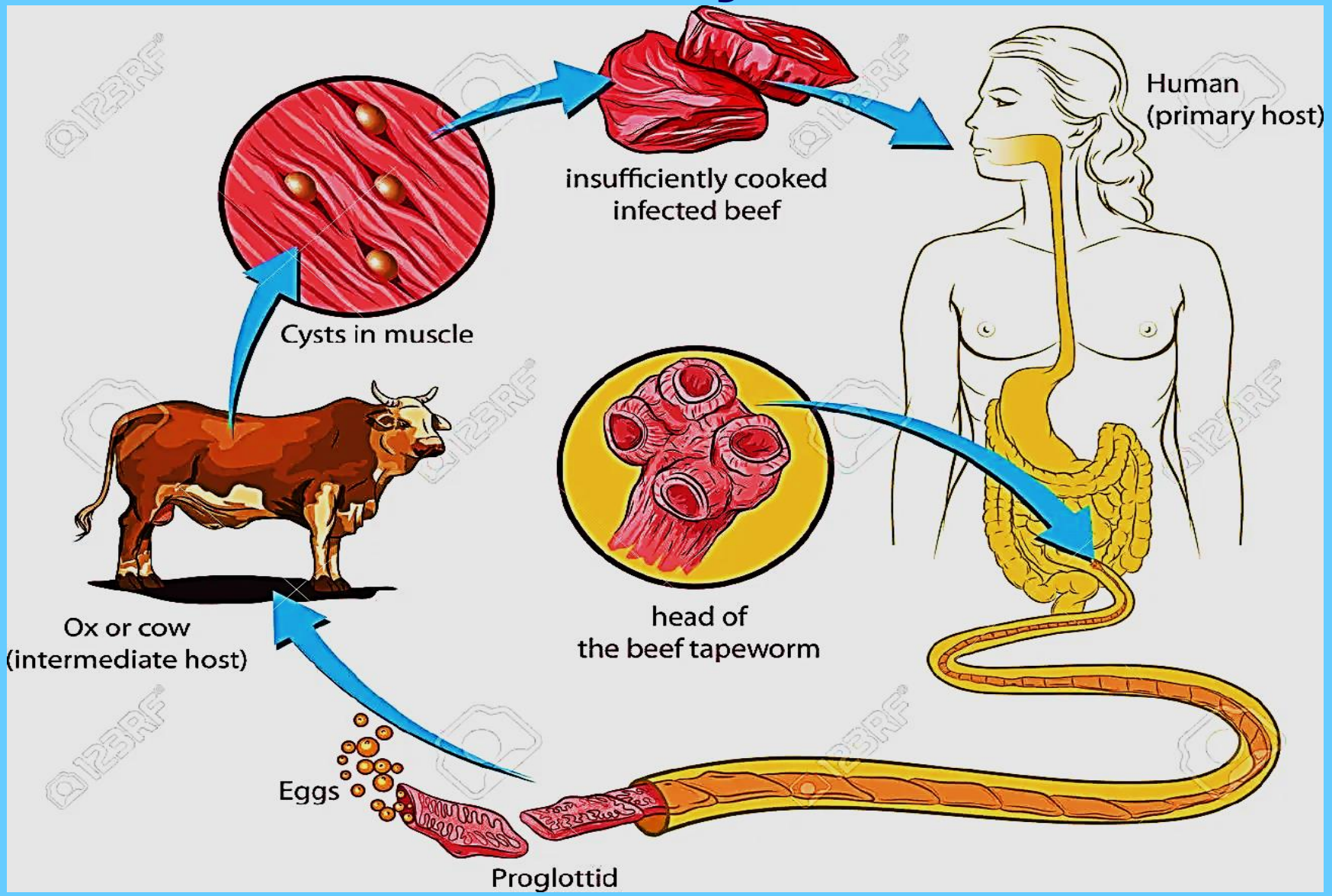
Tapeworm fertilization

- Cirrus of each mate inserted into genital pores
- Sperm stored; eggs fertilized in oviduct
- Capsule material and yolk cells stored in uterus
- When mature, proglottids break free

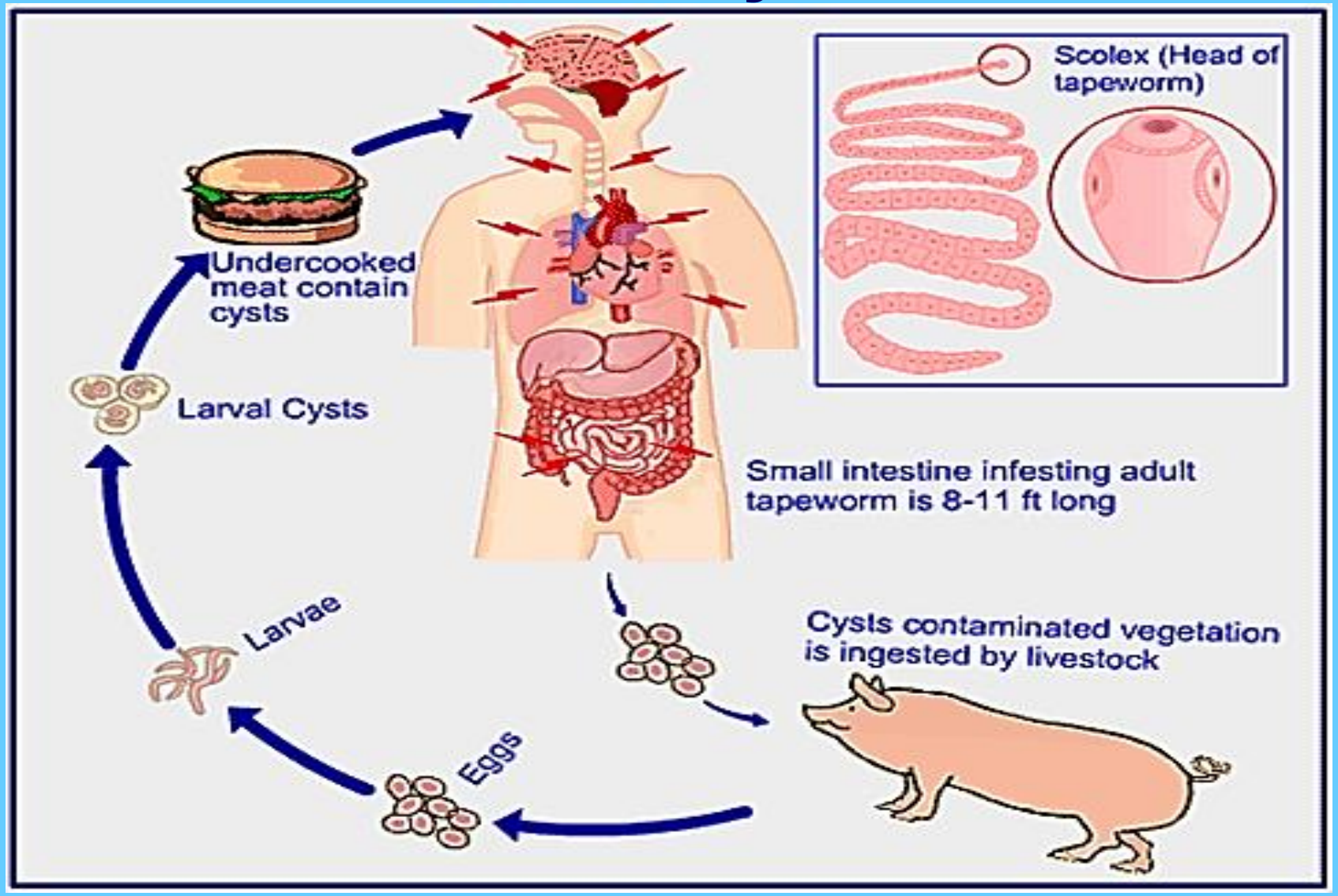


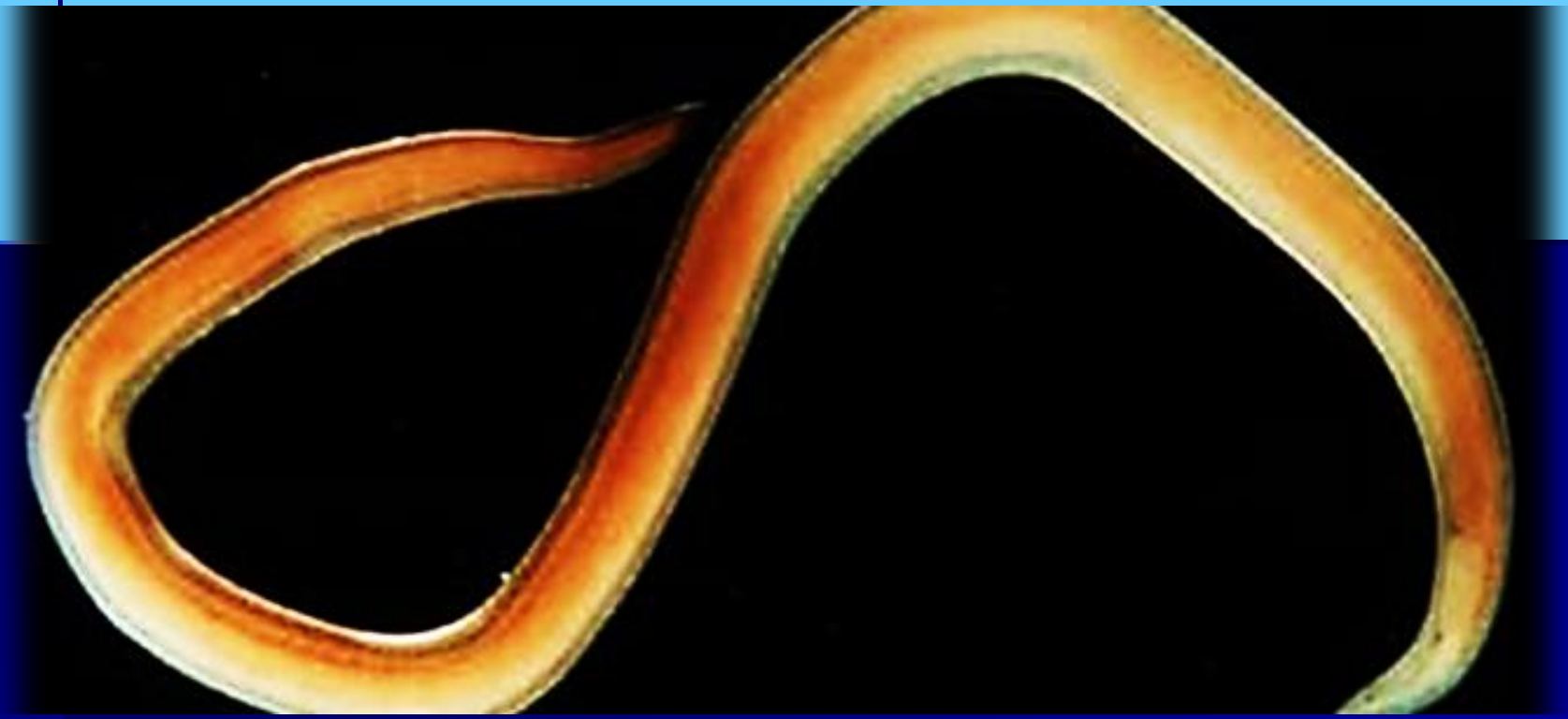


(Taenia saginata) Beef Tapeworm Life Cycle



(Taenia solium) Pork Tapeworm Life Cycle





Nematoda: Round Worms

What is a round worm?

- Slender, unsegmented worms with tapered ends.
- Range in size: microscopic to a meter (3 ft.) in length.
- Most are free-living (soil, salt flats, and water).
- Many others are parasitic.

Body Plan

- Pseudocoelom cavity that allows for a digestive tract, a mouth and an anus.
- Hydrostatic Skeleto

Movement

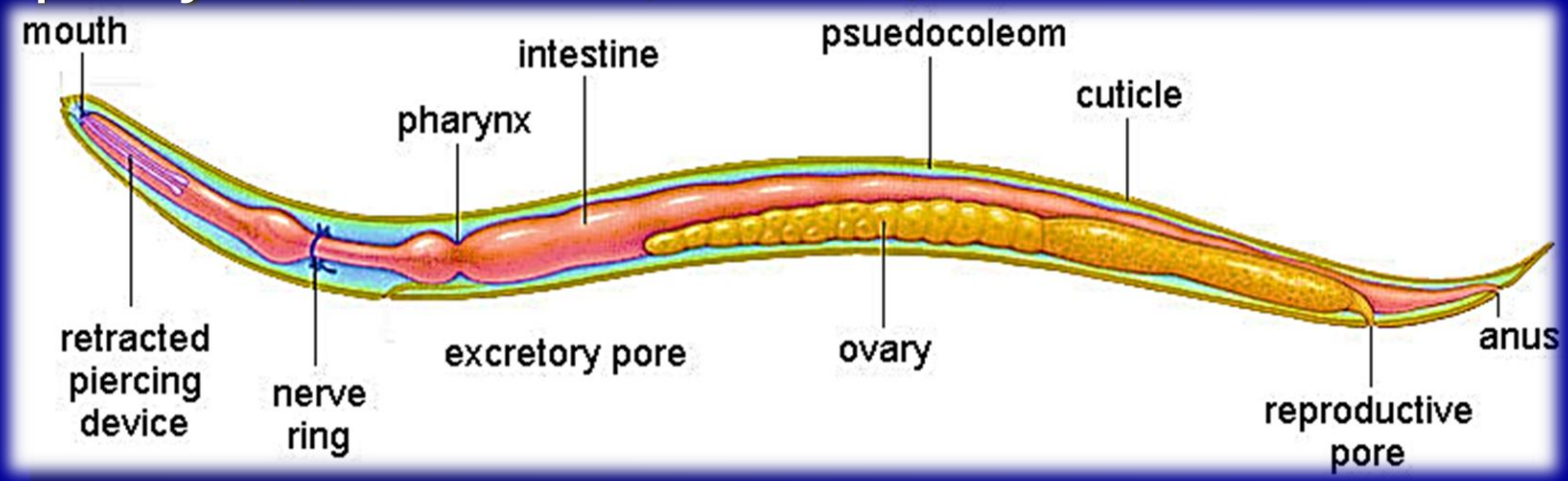
- Contracts muscles like a snake

Feeding

- Many free-living roundworms are predators with mouth-parts and spines to catch and eat prey.
- Others eat algae, fungi, or decaying matter.
- Others digest the bacteria and fungi that breaks down decaying matter.

Digestive Tract

- Complete digestive tract.
- Mouth surrounded by lips that have sensory organs.
- Mouth, teeth, jaws, buccal ‘mouth’ cavity, pharynx, intestines, rectum, anus.

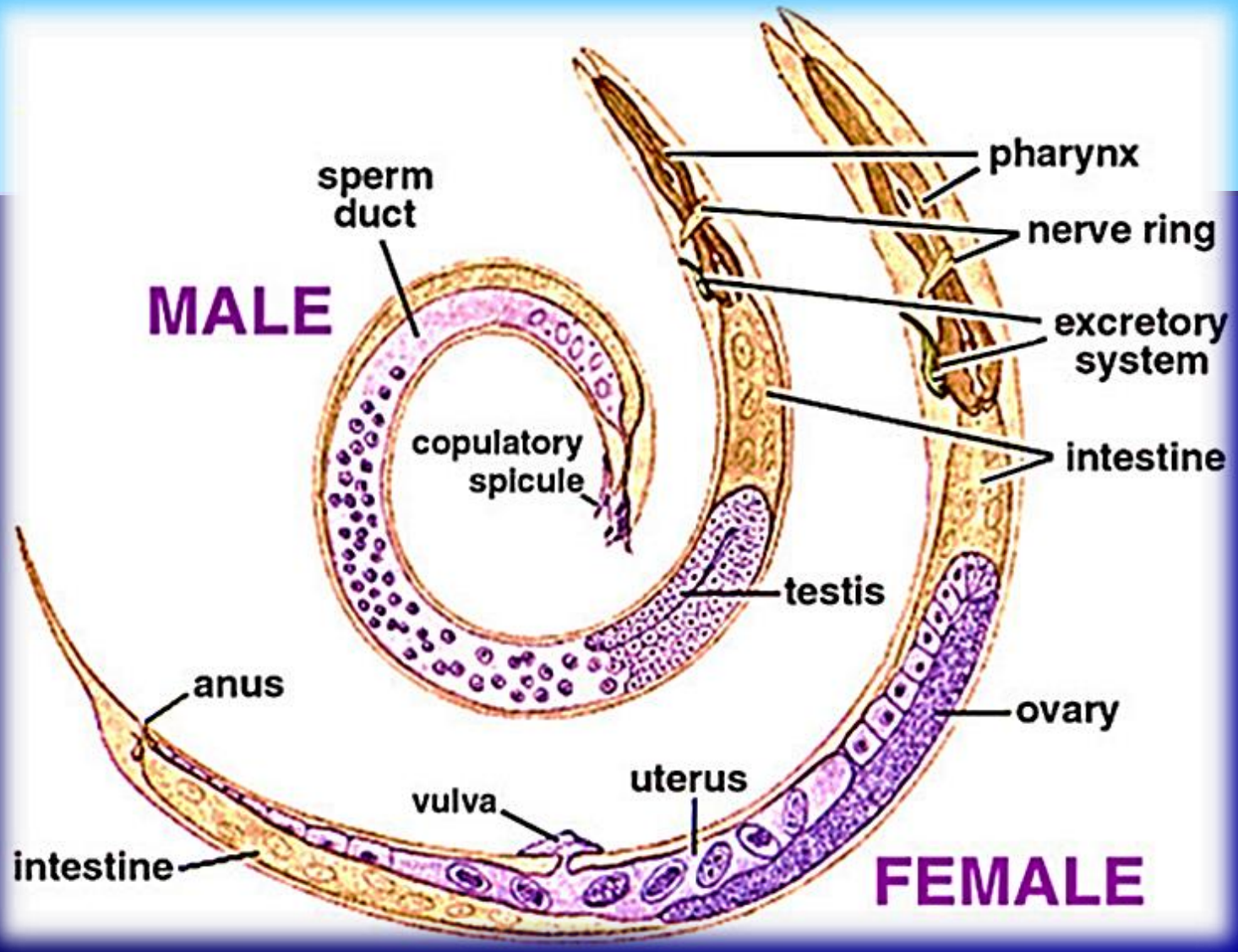


Respiration, Circulation, and Excretion

- Exchanges gases, nutrients, and metabolic wastes through **diffusion of their body walls.**

Nervous system

- Simple nervous system consisting of **several ganglia.**
- Several nerves extend from head (ganglia) through the length of the body.
- Nerves transmit sensory information and control movement.
- Some have **simple structures** that detects chemicals given off prey and predators.

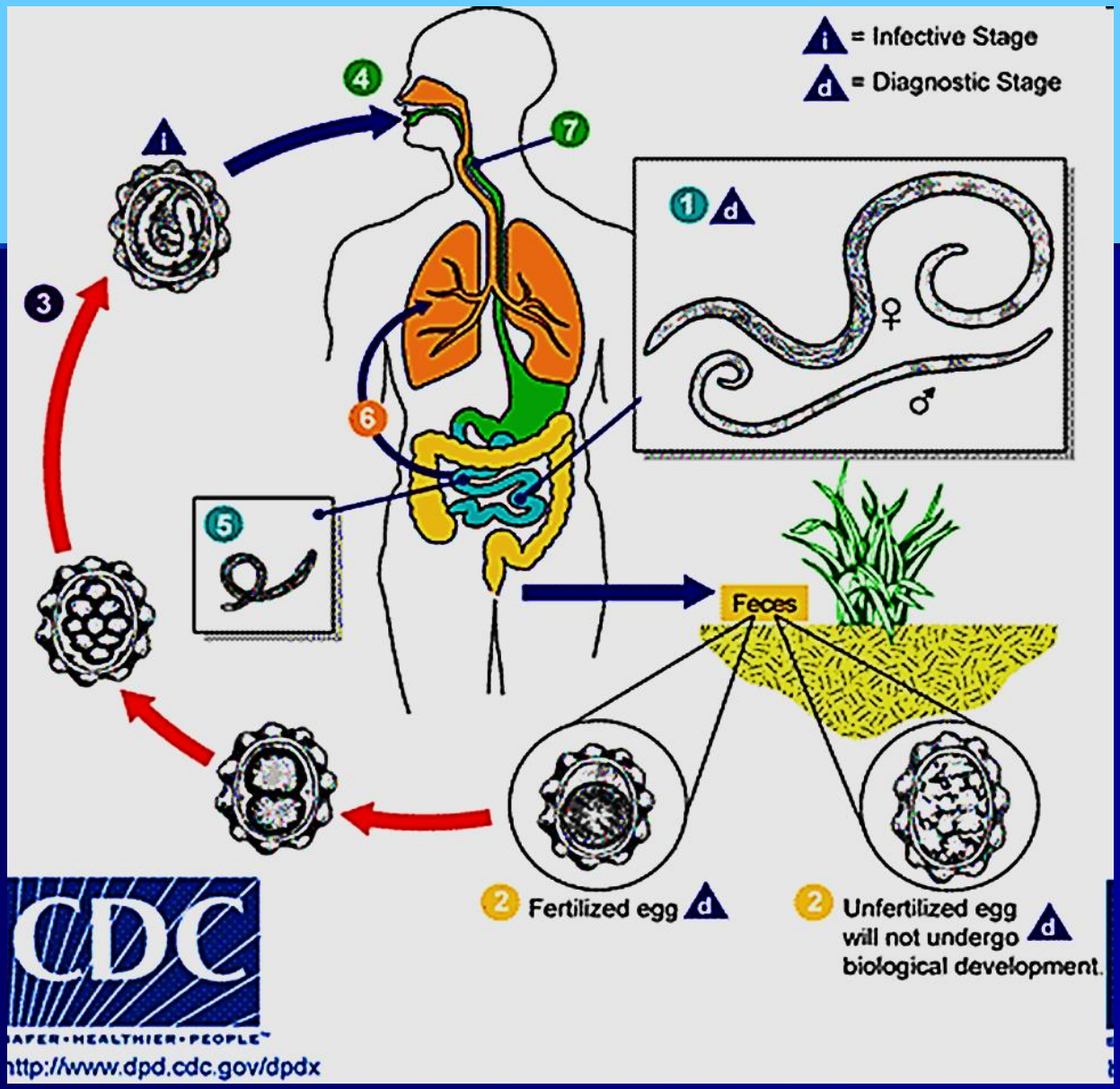

pharynx
sperm duct
nerve ring
MALE
excretory system
copulatory spicule
intestine
testis
anus
ovary
uterus
vulva
intestine
FEMALE

Reproduction

- Sexual reproduction with distinctive male and females.
- Internal fertilization.
- Parasitic roundworms often have lifecycles involving two or three different hosts or several organs within a single host.

Types of parasitic roundworms: 1- Ascarid worms

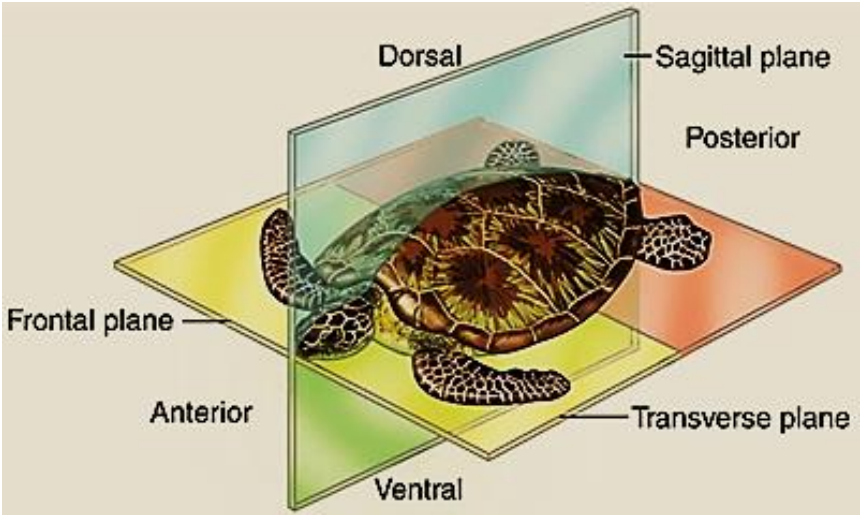
- Causes **malnutrition** in more than 1 billion people worldwide.
- Ascaris absorbs digested food from the host's small intestines.
- **Humans ingest food/water contaminated with Ascaris eggs.**
- The eggs travel to the small intestine and develop into larvae, where they mature and mate.
- Fertilized eggs are released and leave the host in feces.


i = Infective Stage
d = Diagnostic Stage
1 d
2 Fertilized egg d
2 Unfertilized egg will not undergo biological development. d
Feces
CDC
SAFER·HEALTHIER·PEOPLE™
http://www.dpd.cdc.gov/dpdx

Annelids

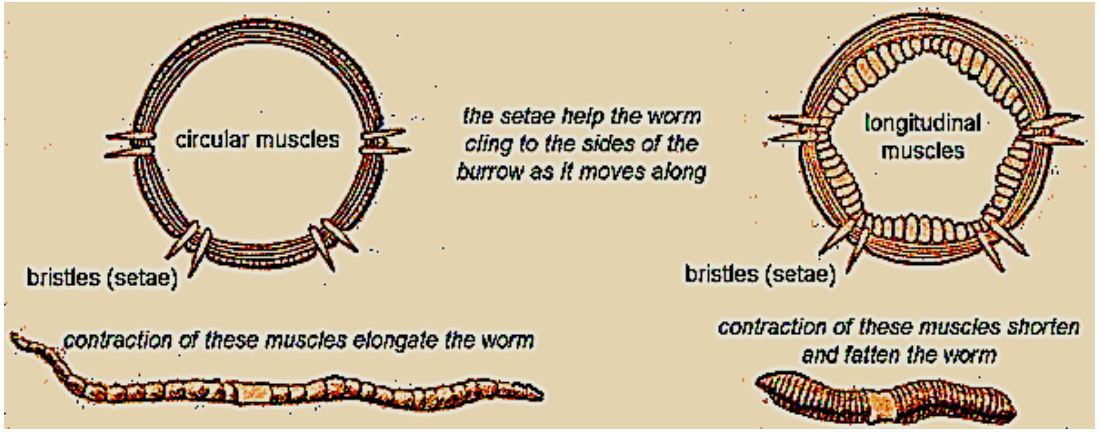
What type of symmetry do Annelids have?

- Bilateral symmetrical



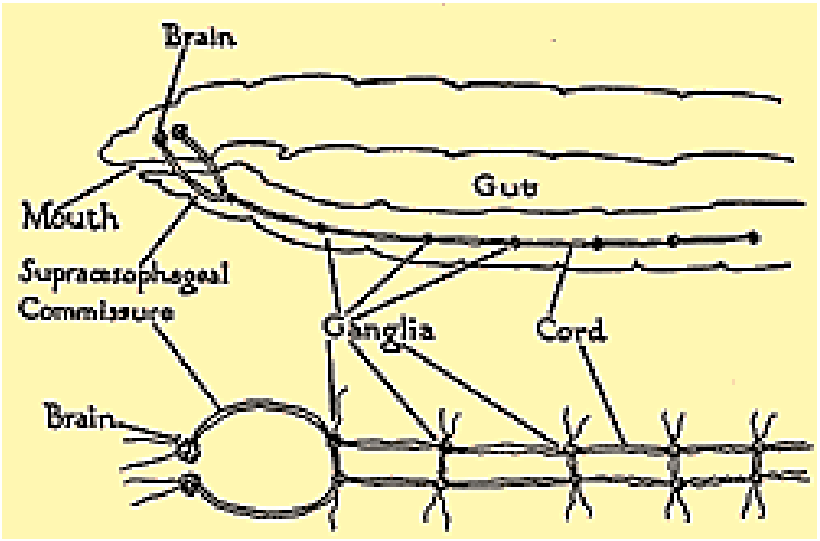
How do Annelids move?

- **Segmented body**
- 2 sets of muscles
  - Longitudinal- **expands**
  - Circular- **contracts**



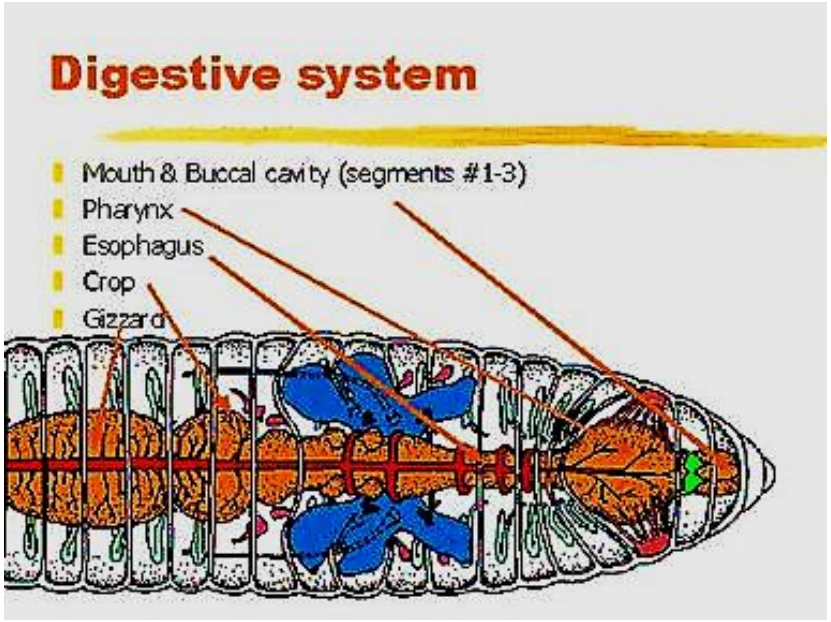
Nervous System

- Primitive brain
- Ring of nerves to ventral cord
- Lateral nerves and ganglia
- Sense organs



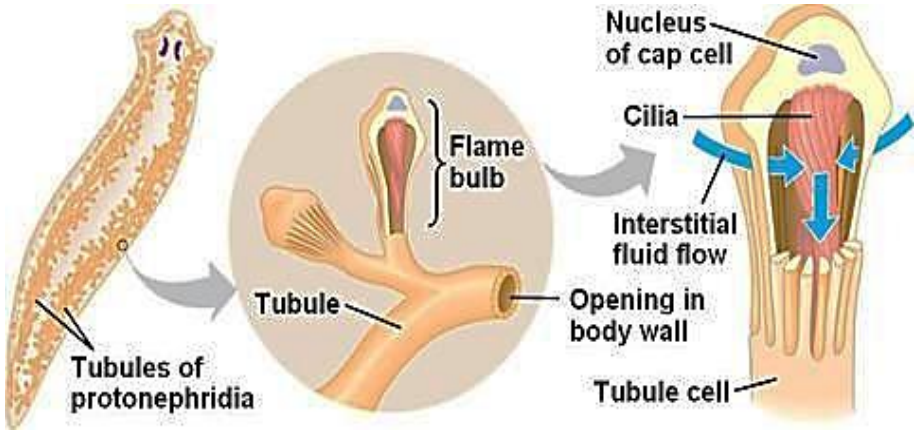
Digestive System

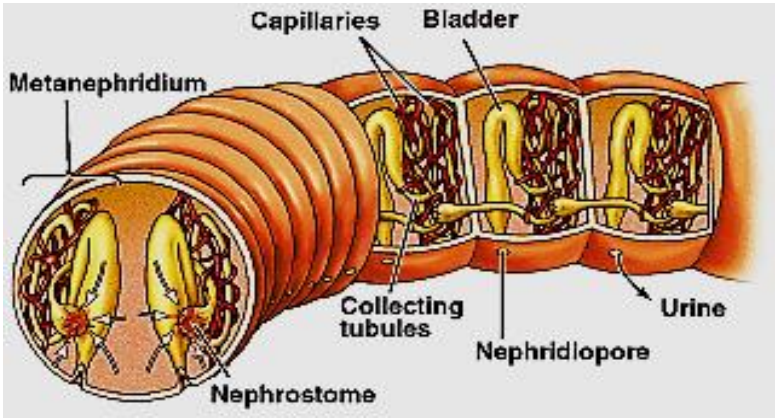
- Two way
- Unsegmented gut
- Mouth to end
- Separated by coelom



Excretory System

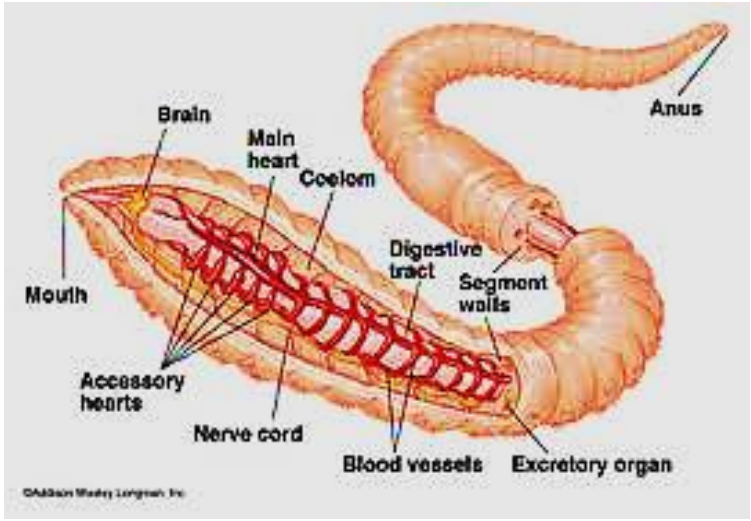
- **1- Protonephridia**
- Tubules end in cell
- Flagella and common duct
- **2- Metanephridia**
- Excrete ammonia products





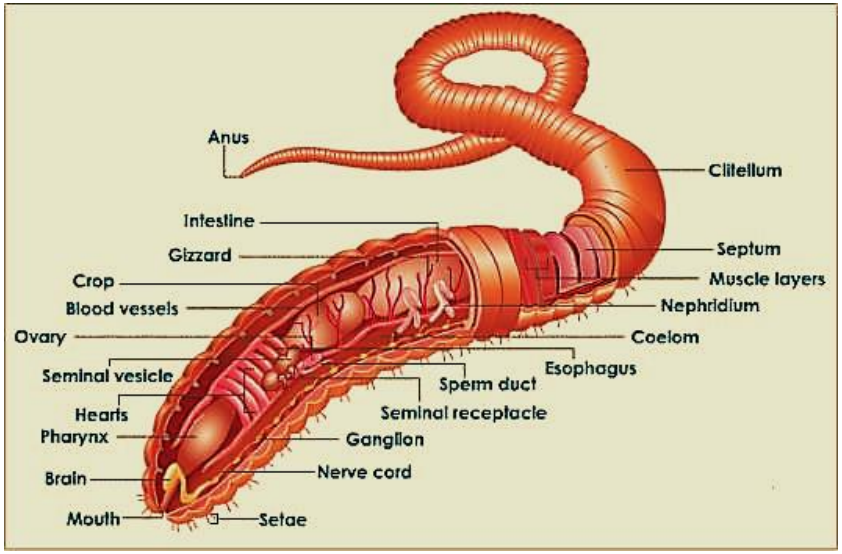
Circulatory System

- Closed, through diffusion.
- Hemoglobin (red/green).
- Through head (contractile vessels)
- Rest of body (lateral vessels).
- Contractile act as heart.



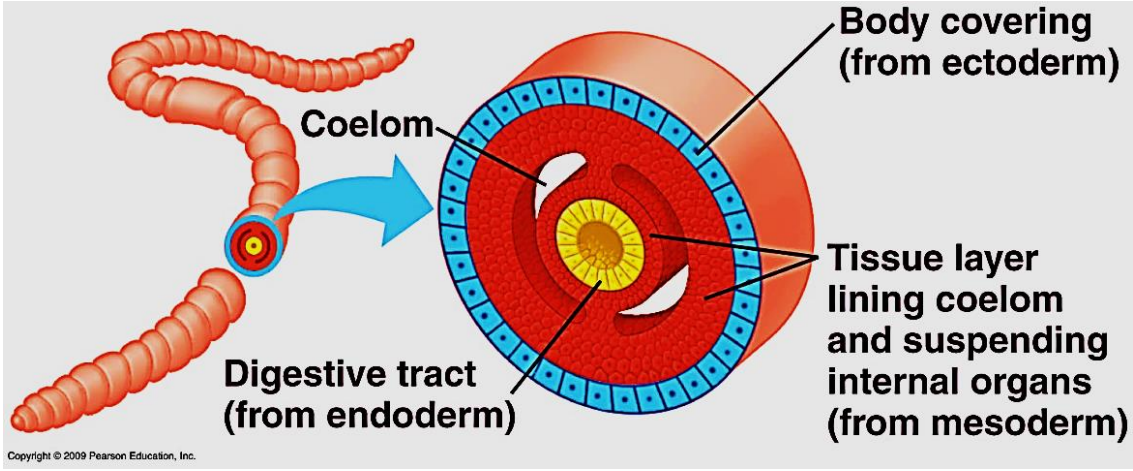
Respiratory System

- Through skin or gill filaments
  - Diffusion
- Oxygen carried
  - Hemoglobin



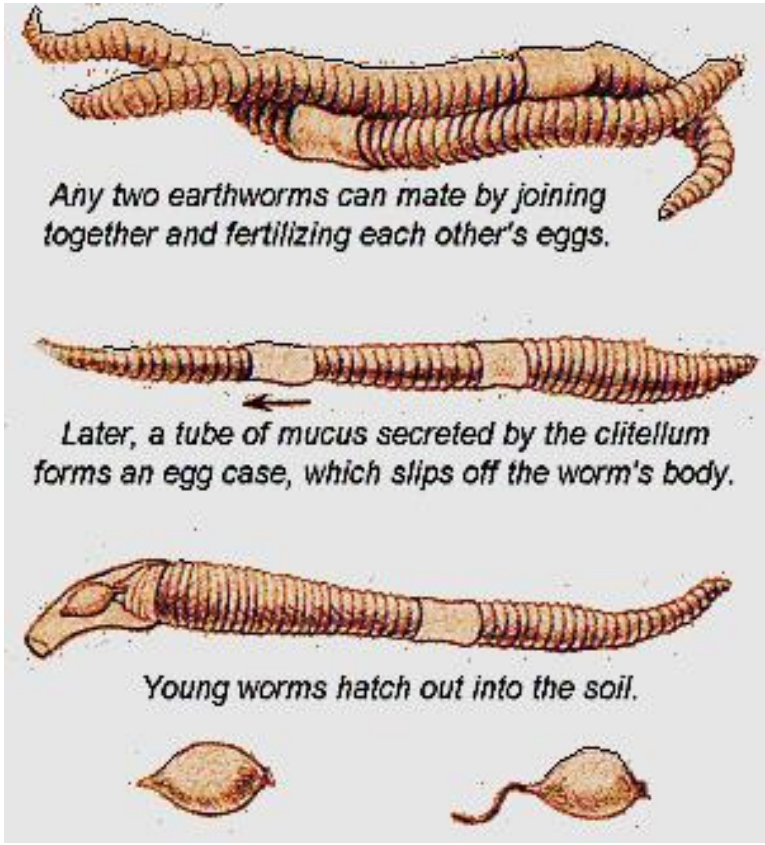
Support/Skeletal System

- Coelom Liquid filled
- “Inflates” annelids.



Reproductive System

- Sexual
- Some hermaphrodites
- Most- separate genders



Oligochaeta (few bristles)

- Specialized derived worms
- About 3000 species
- Less than 10 families
- Mostly small
- Few large and terrestrial (earthworms)

Oligochaeta (continued)

Polychaeta (many bristles)

- Almost entirely marine
- Important for benthic communities
- Very diverse, heterogeneous
- About 8000 species
- 80 families

Polychaeta- Bristle worms

- Polyphyletic class of annelid worms
- Each body segment has a pair of fleshy protrusions called parapodia that have many bristles called chaetae

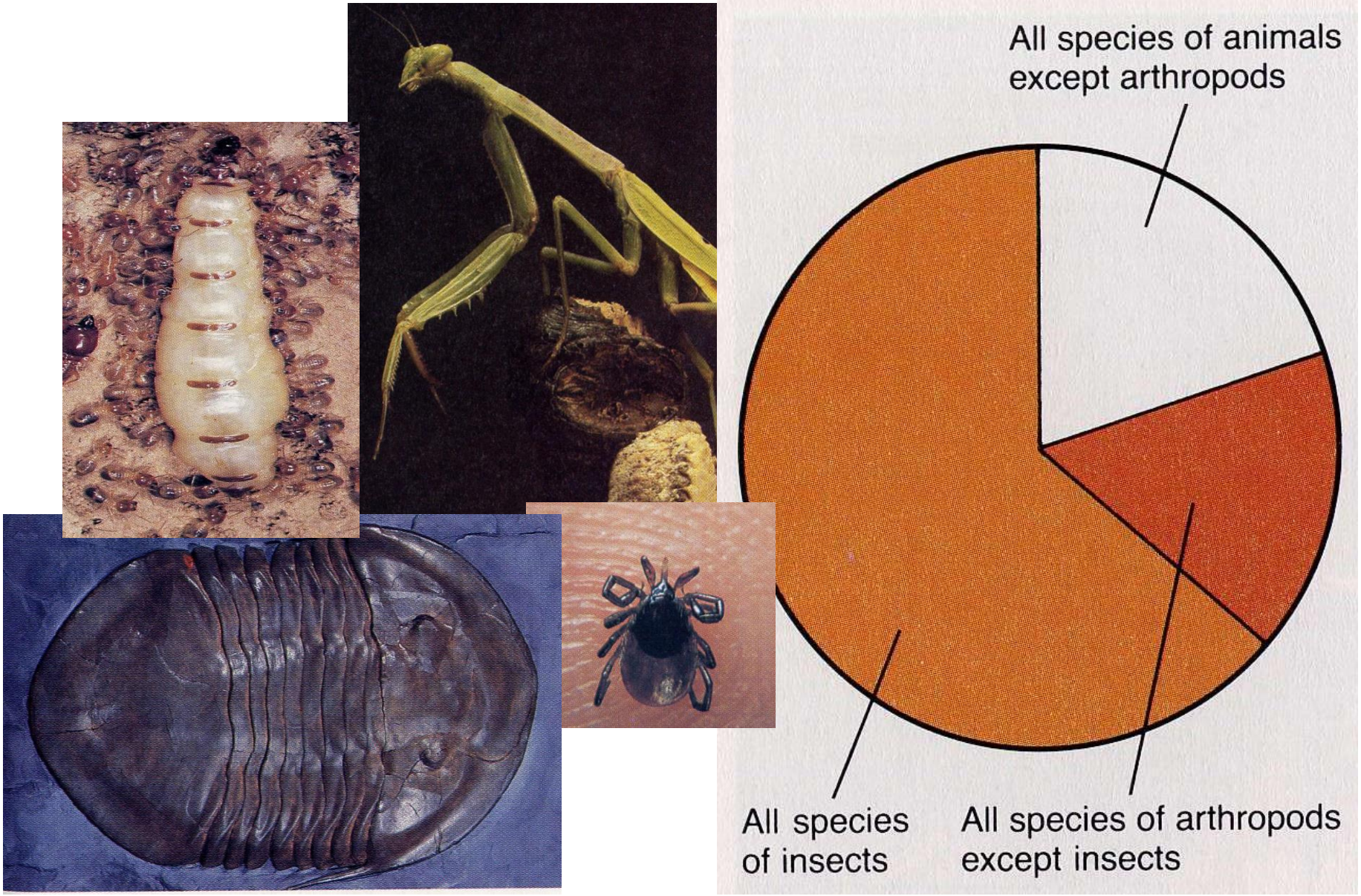
Hirudinea (leeches)

- Derived from oligochaeta
- Homologenous taxon
- About 500 species
- Relatively large (up to 30 cm)
- Always with 34 segments

Hirudinea- Leech

- Leeches are segmented worms that belong to the phylum annelid
- Always have 34 segments
- Marine and land

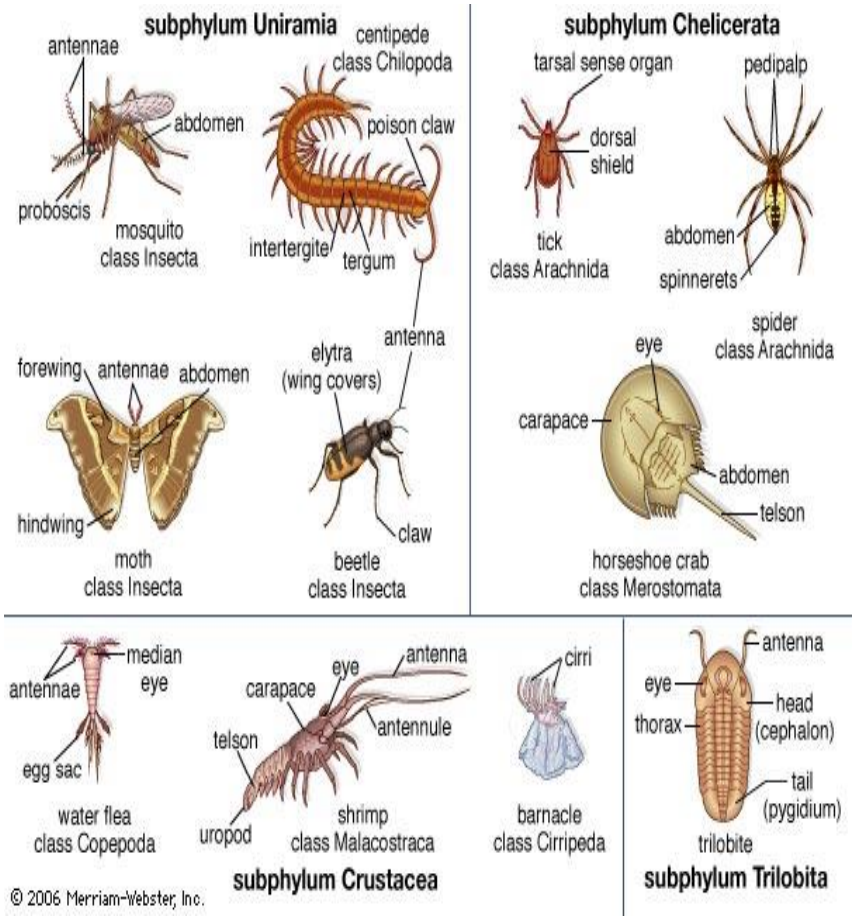
Phylum Arthropoda



Arthropods

General Characteristics:

- Jointed appendages
- Segmented bodies
- Exoskeleton (made of chitin that must molt to grow)
- Classified by number of legs and body segments.



Arthropods

Examples:

- Subphylum: *chelicerata*
  - Class: *arachnida*
  - 4 pairs of legs
  - 2 segments to body: cephalothorax and abdomen
  - Common examples: spiders, ticks, and scorpions

Arthropods

Examples:

- Subphylum: *uniramia*
  - Class: *chilopoda*
  - 1 pair of legs per segment
  - Common Name: centipedes

  - Class: *diplopoda*
  - 2 pair of legs per segment
  - Common Name: millipedes

Arthropods

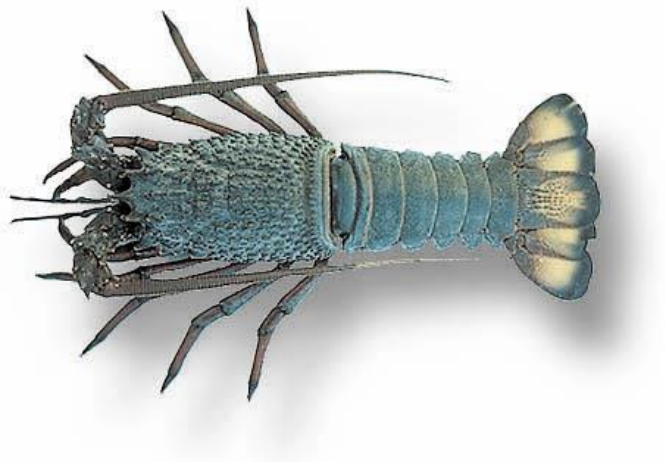
Examples:

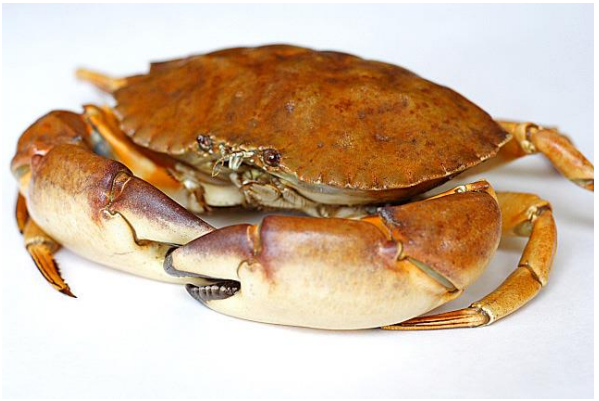
- Subphylum: *uniramia*
  - Class: *insecta*
  - 3 pairs of legs
  - 3 body segments: head, thorax, and abdomen
  - Common examples: butterflies, beetles and grasshoppers

Arthropods

Examples:

- Subphylum: *crustacea*
  - Class: *crustacea*
  - 5 pairs of legs
  - Common examples: crayfish, crabs, and lobster





Arthropods

Habitat:

- Aquatic (fresh and salt water)
- Terrestrial

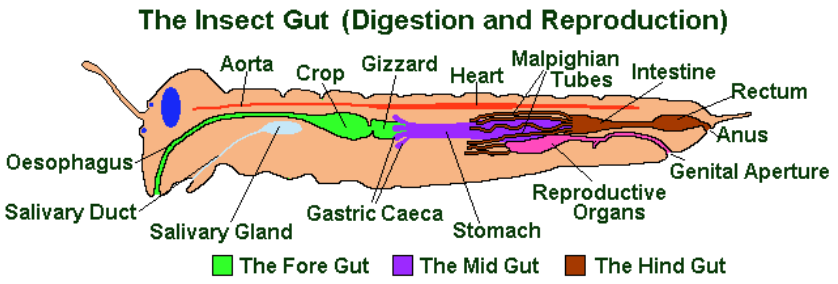
Arthropods

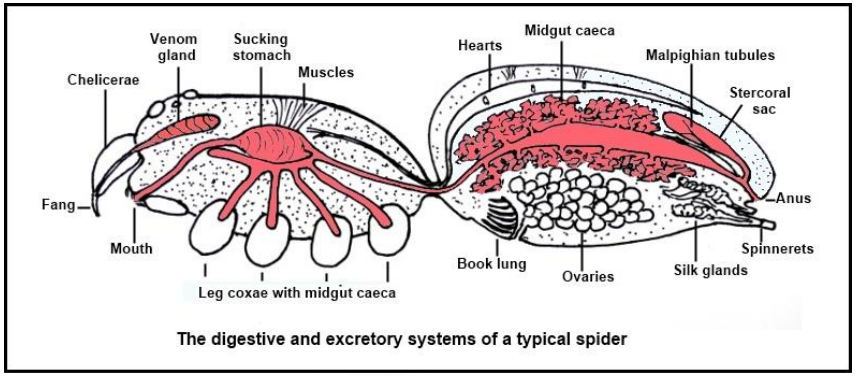
Nutrition:

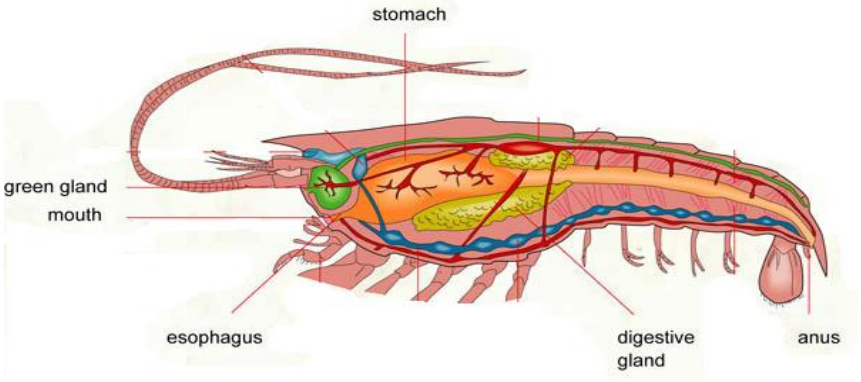
- Phyla includes all feeding types

Digestion:

- May have specialized mouth parts or appendages that aide with their type of feeding.
- Extracellular digestion
- Complete digestive system.



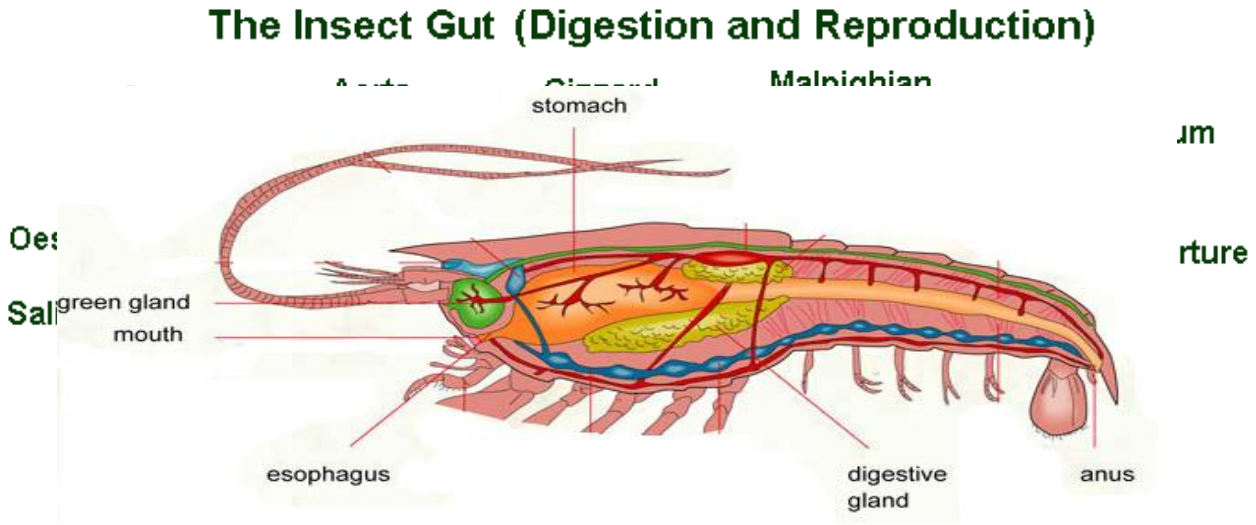




Arthropods

Excretion:

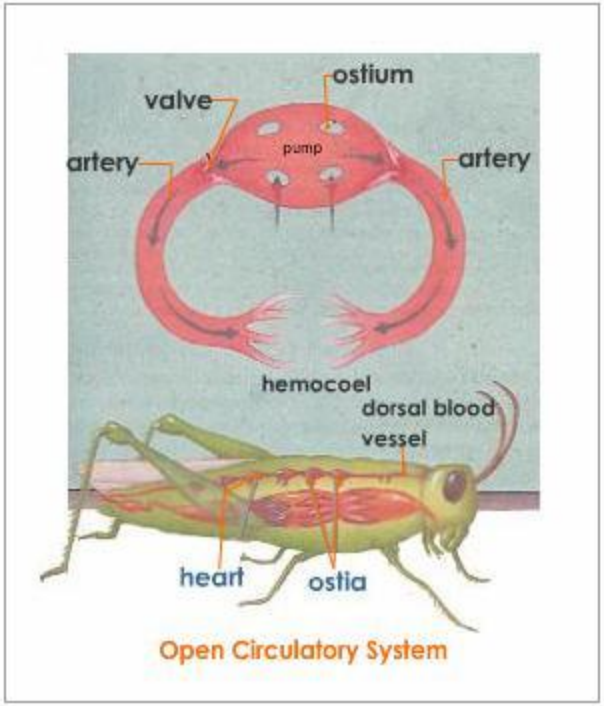
- Malpighian tubules- extract nitrogen containing wastes from the blood and then add them to digestive wastes moving through the digestive tract, released through the anus.
- OR green glands that function in a similar manner.



Arthropods

Circulation:

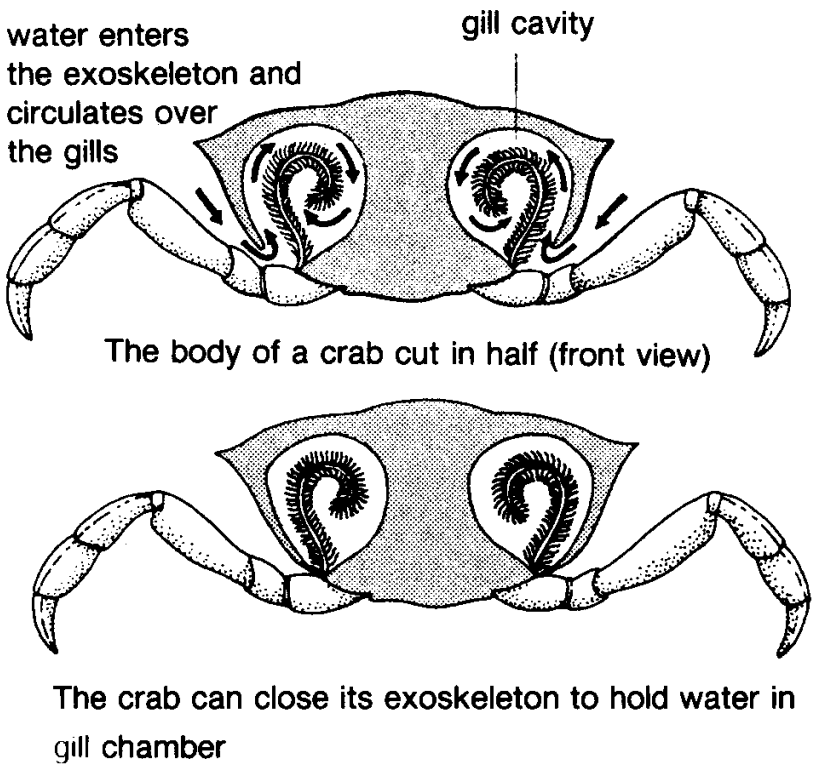
- Open circulatory systems pump blood into a hemocoel with the blood diffusing back to the circulatory system between cells. Blood is pumped by a heart into the body cavities, where tissues are surrounded by the blood.



Arthropods

Respiration:

- A tracheal system is used for respiration where air enter and leaves the body through holes in the abdomen called spiracles.
- OR Book lungs are made of many thin, hollow sheets of tissue that look like pages in a book.
- OR Oxygen is extracted from the water in some aquatic invertebrates using specialized respiratory structures called gills.



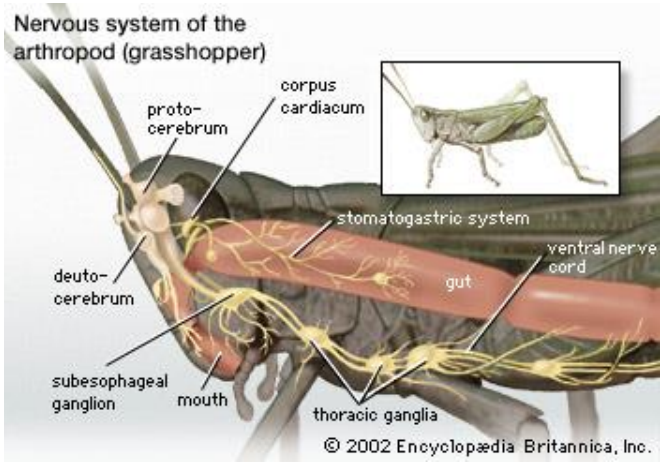
Arthropods

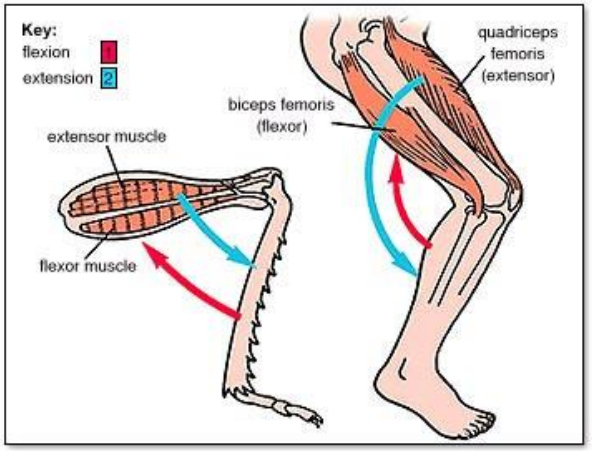
Nervous:

- Cephalized
- Brain and ventral nerve cord.
- Sense organs such as eyes, tympanum (hearing), antennae (taste and smell)

Mobility:

- Arthropods move with jointed appendages.

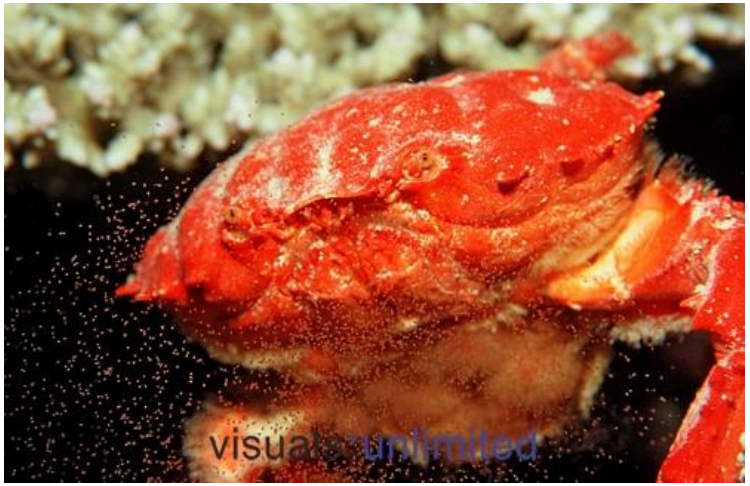




Arthropods

Reproduction:

- Sexual reproduction can be internal or external. In internal fertilization, the male inserts sperm inside the female's reproductive tract.
- External fertilization occurs when sperm is united with an egg outside of the body. Typically occurs in aquatic species.



Arthropods

Development:

- Protostomes
- Metamorphosis refers to the way that insects develop, grow, and change form. Metamorphosis actually means "change". There are two types of metamorphosis--incomplete and complete.

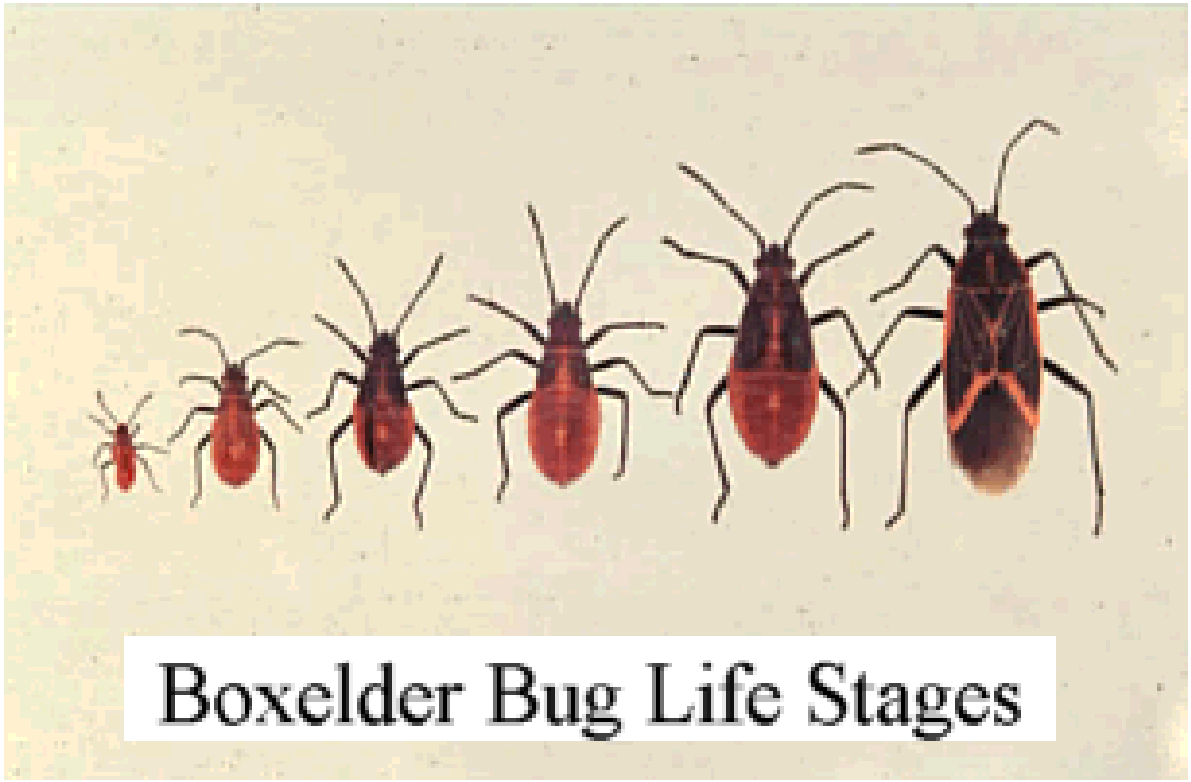
Arthropods

Development:

- In incomplete metamorphosis all life stages look similar, behave similar and the whole family can live and feed together. There are 3 stages:
  1. Egg
  2. Nymph
  3. Adult

  Ex.: grasshoppers, aphids, thrips, and earwigs

Arthropods



Arthropods

Development:

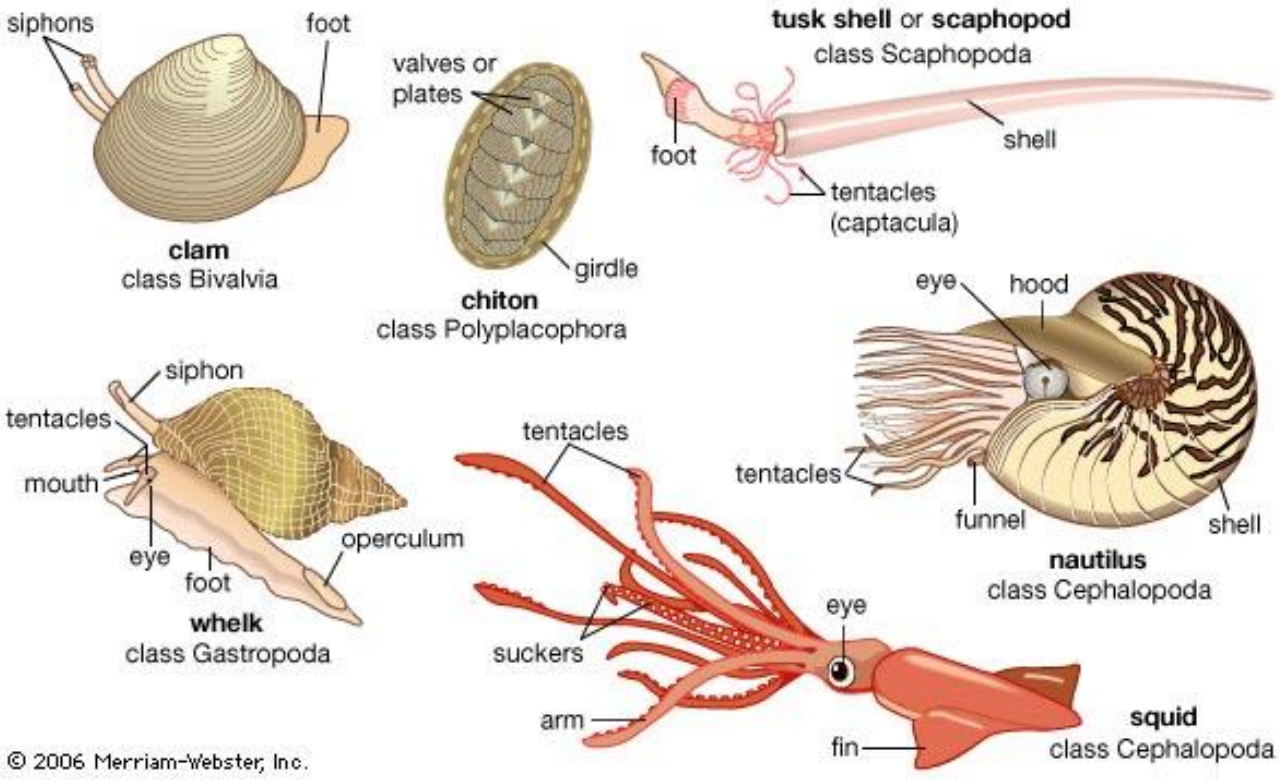
- In complete metamorphosis larvae do not look like the adult and are wormlike. They can live in a different environment and eat different food. It has 4 stages:
  1. Egg
  2. Larva
  3. Pupa
  4. Adult

  Ex. beetles, flies, butterflies, lacewings, and bees

Arthropods

Phylum: Mollusca

Mollusks are soft-bodied animals that usually have an internal or external shell.



The Mollusk Phylum has three Main classes:

1. Gastropods (ex. - snails)

2. Bivalves (ex. - clams)

3. Cephalopods (ex. – squid, octopus)

Class Bivalvia:

Bivalves have 2 shells held together by one or two powerful muscles.

Getting to know three ...

Bivalves.

Bivalves are well known for their two 1/2 shells hinged together. To open the shell ever so slightly they use a chitinous, elastic ligament and to close the shell they use 2 strong adductor muscles. Both the ligament and the adductor muscles are found on the hinge which has interlocking teeth.

Bivalves have no head and their brain is a small set of interconnected nerve cells known as *ganglia*.

As filter feeders that keep the water clean, bivalves play an important role in the ocean ecosystem. Adult bivalves have been known to filter up to 25 gallons of water a day. Filtering the water is also how bivalves get their food, tiny particles of detritus and algae.

Mussel

Scallop

Clam

Image (c) Mussel - fl.biology.usgs.gov, Scallop - sustainableseafood.net, Clam - sustainableseafood.net

Giant clam

Class: Gastropoda – Single shelled or shell-less and move with a muscular foot

Nudibranch

Sea hare

Snails

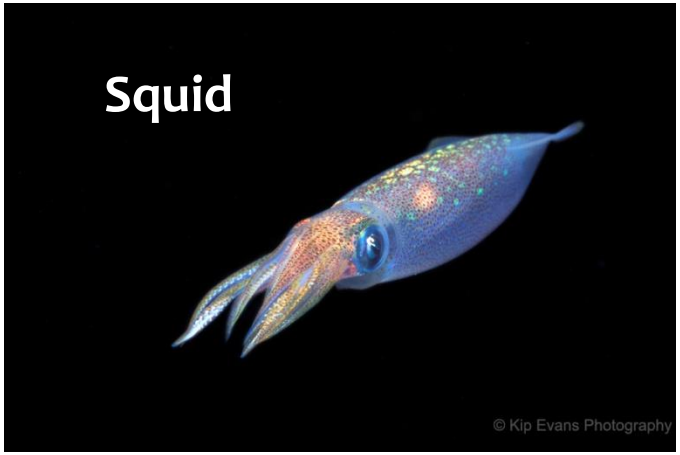
Slugs

Class Cephalopoda:

Head is attached to a single foot. Foot is divided Into tentacles or arms.

Octopus

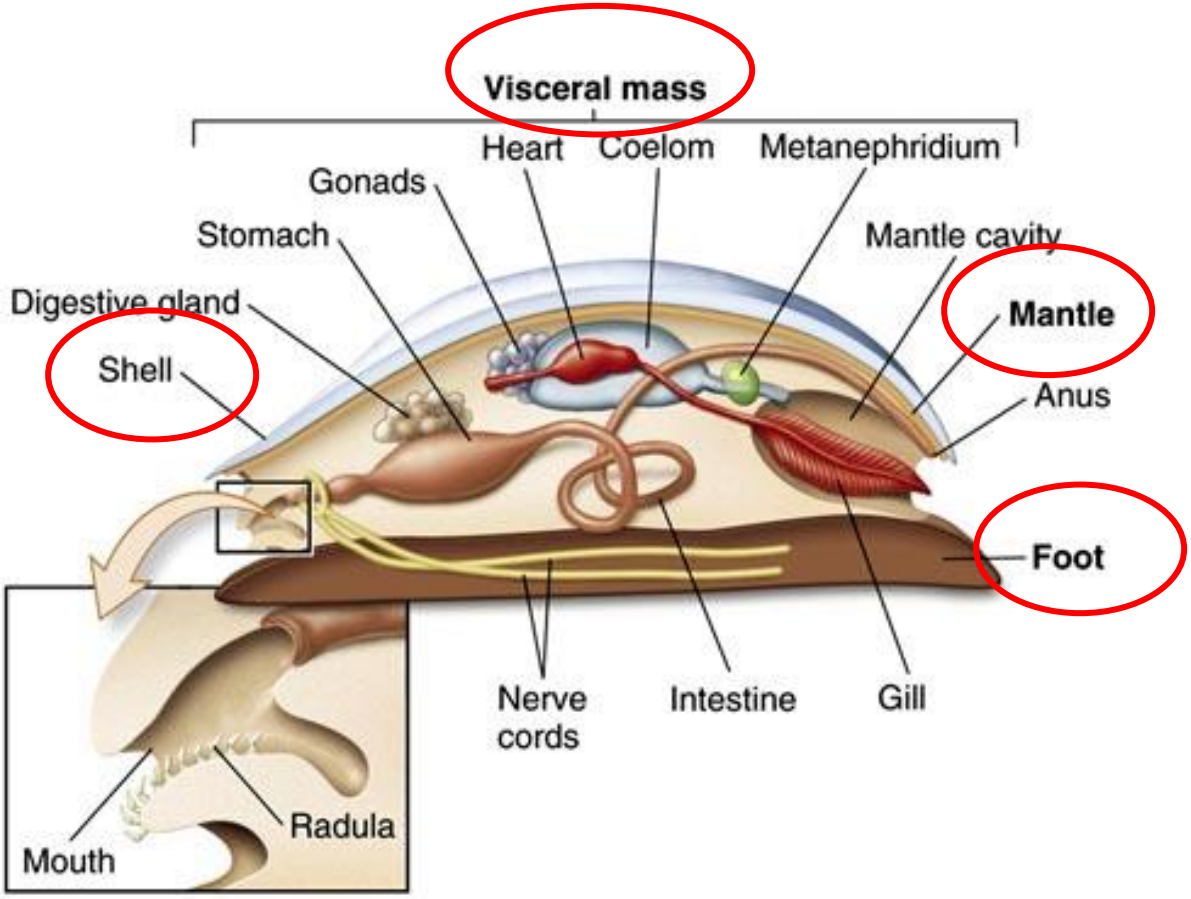
Nautilus



Cuttlefish

Characteristics:

- **Body has four parts: Foot, Mantle, Shell and Visceral mass**



- **Foot (Many forms): Used for crawling, burrowing and in the form of tentacles to capture prey.**

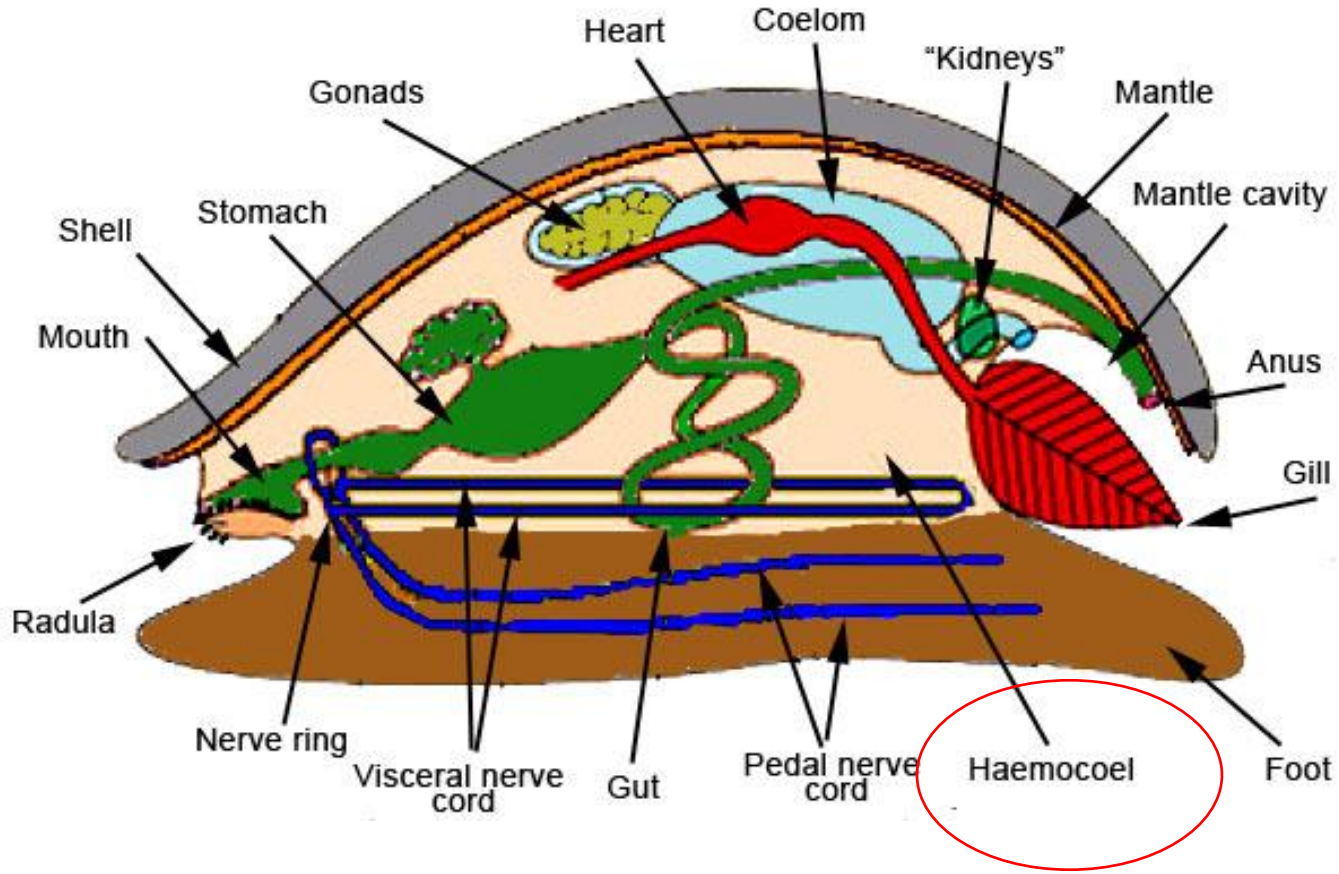
- **Mantle: Thin layer of tissue that covers the body like a cloak.**

- **Shell: Made by glands in the mantle that secrete calcium carbonate. In some groups the shell has been reduced or lost (slugs)**

- **Visceral mass – Internal organs**

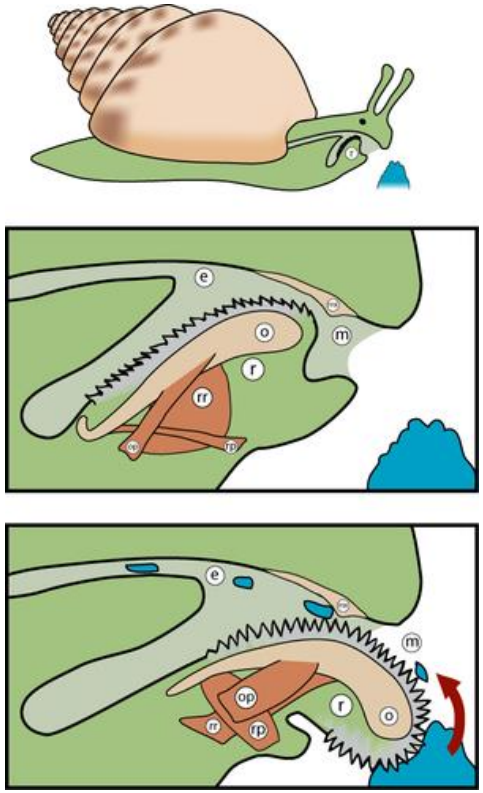
They can have an open or closed circulatory system. In an open system, the blood is pumped by a simple heart into the hemocoel.

<u>Hemocoel</u> = interconnected sinuses/spaces within the mollusk's body.

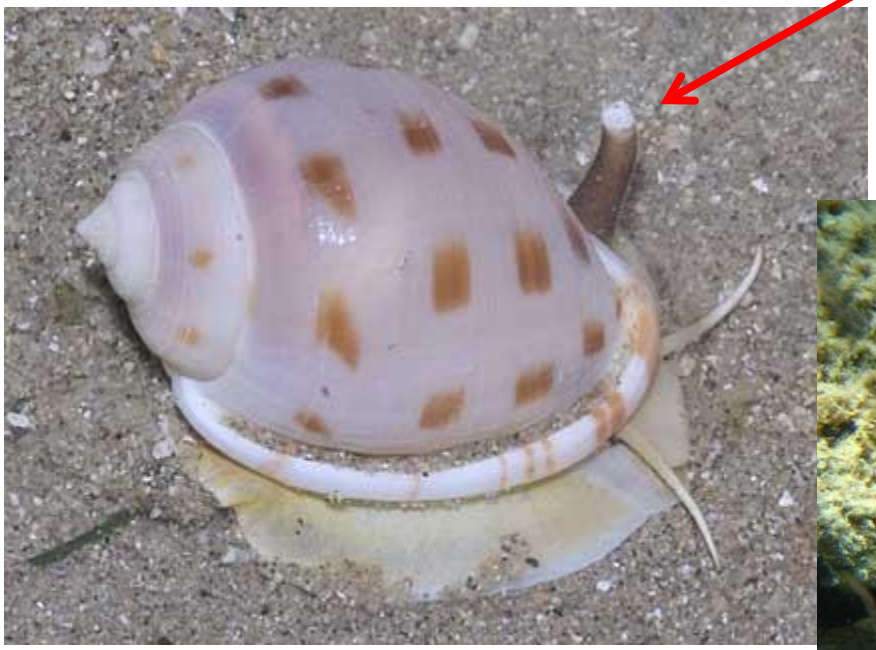


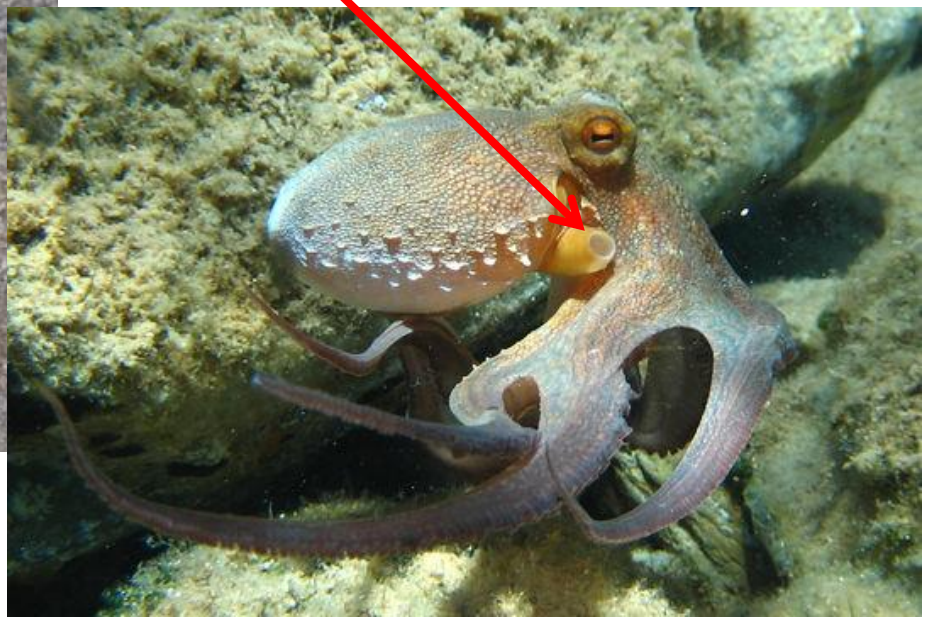
Specialized structures:

- **Radula for feeding – tongue with tiny teeth.**



- **<u>Siphon</u>: (In aquatic species) A tube like structure through which water enters and leaves the body.**

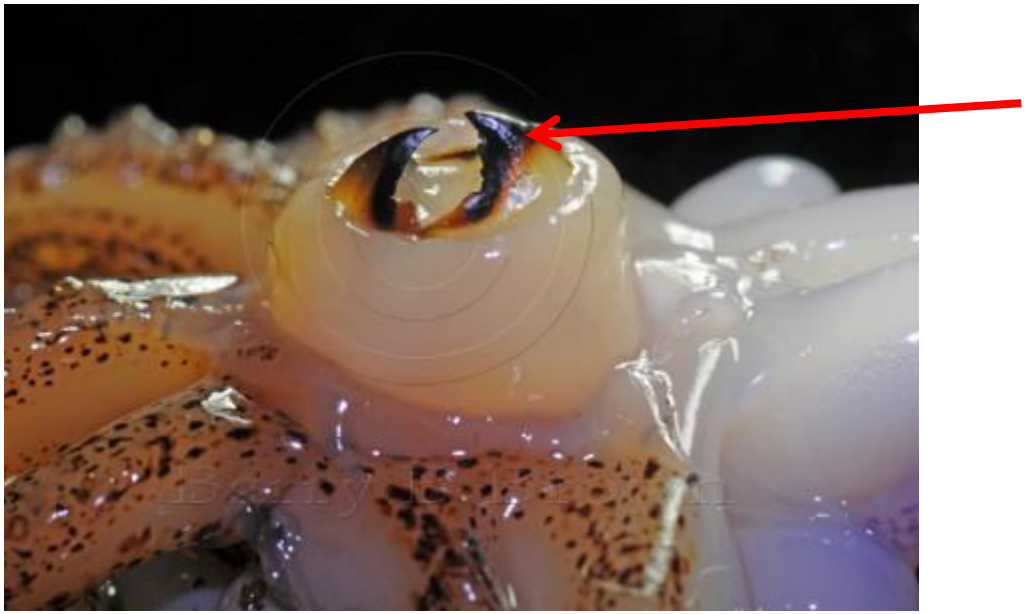




- **Nephridia to remove ammonia from blood; Help with excretion.**
- **Clams and other bivalves – ganglia and nerve cords, Octopi and squid – highly developed nervous system; they have well-developed brains.**
- **Aquatic snails, clams – have gills in their mantle cavity. They are called <u>ctenidia.</u>**

Mode of nutrition:

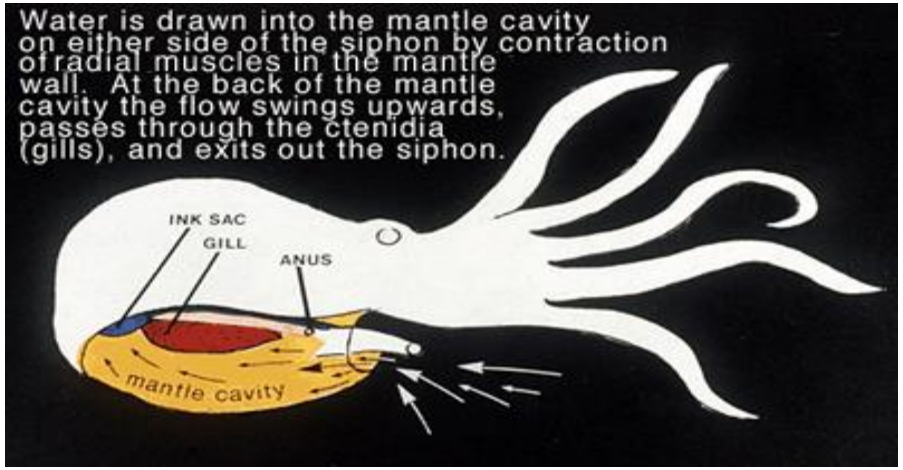
- They can be herbivores, carnivores, filter feeders or detritivores or parasites.
- Octopi and some sea slugs have powerful jaws to eat their prey.
- Some Octopi produce poisons to subdue their prey.

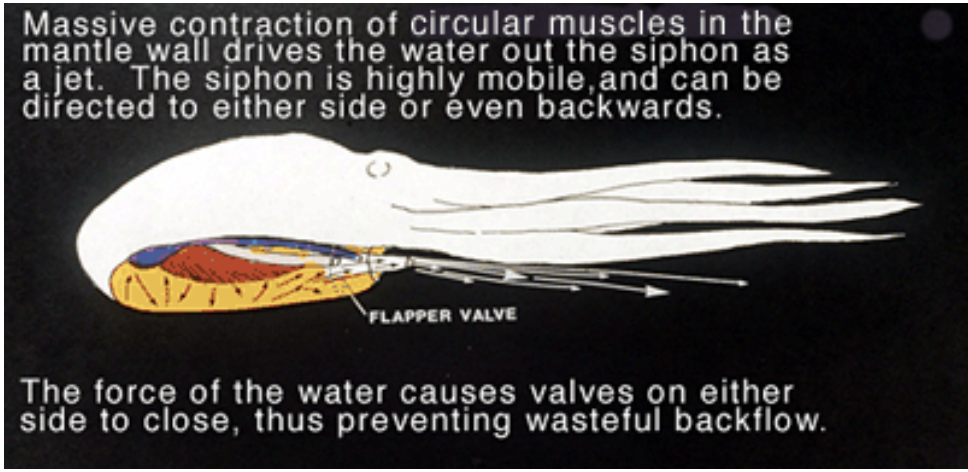


Mouth/Jaws of octopus

Movement:

- Snails secrete mucus at the base of the foot.
- Octopus uses jet propulsion





Reproduction:

<u>Reproduce in a variety of ways:</u>

- **Some have external fertilization – eggs and sperm released in water. Fertilized eggs then develop into larvae.**
- **In others fertilization takes place inside the female.**
- **Some are hermaphrodites. These usually fertilize eggs from another individual.**

Female octopus laying eggs,
She lays about 57 000 eggs

Over a period of about 6 months
She grooms and protects the eggs

Octopi hatching. Mom helps by blowing water currents across them to help them break free

Small octopus – mom usually dies;
Usually only about 2 of the 57000 survive.

Echinodermata – “Spiny skin”

Echinoderms

General Characteristics:

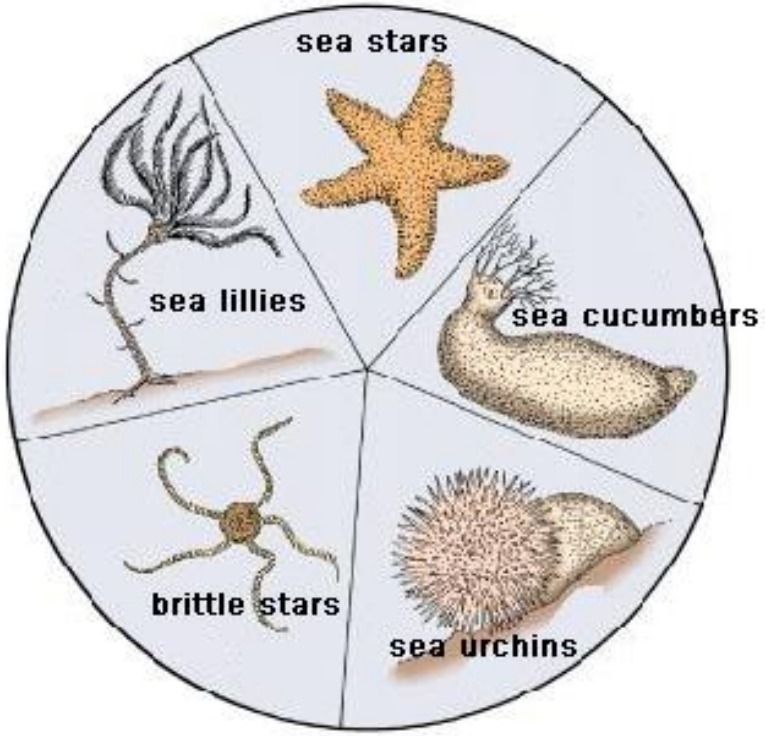
- Echinodermata –means Spiny skin
- Endoskeleton
- Radial Symmetry
- Tube Feet

Examples:

- Sea stars, brittle stars, sea lilies, sea cucumbers, sand dollars, and urchins

Habitat:

- Marine



Echinoderms

Nutrition:

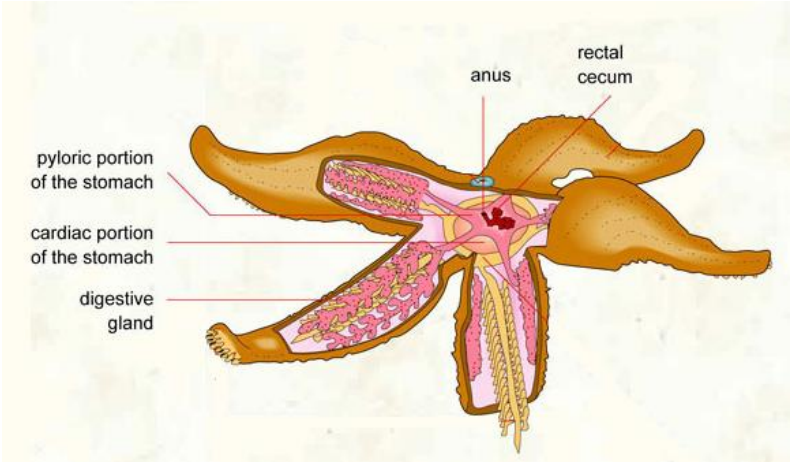
- Predators
- Have specialized mouth parts and appendages to catch and eat other small organisms

Digestion:

- Extracellular digestion
- Complete digestive system
- Some starfish can push their stomach out of their mouth and secrete enzymes outside the body to break down food and then pull the partially digested material inside the body

Excretion:

- Solid waste removed through the anus at the end of the digestive tract.



Echinoderms

Circulation:

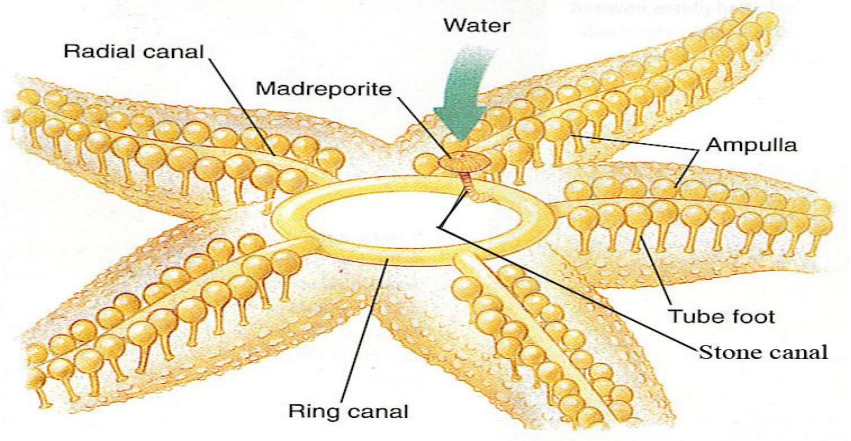
- Echinoderms have a water vascular system which is a system of water-filled canals that extend down each arm of an echinoderm.

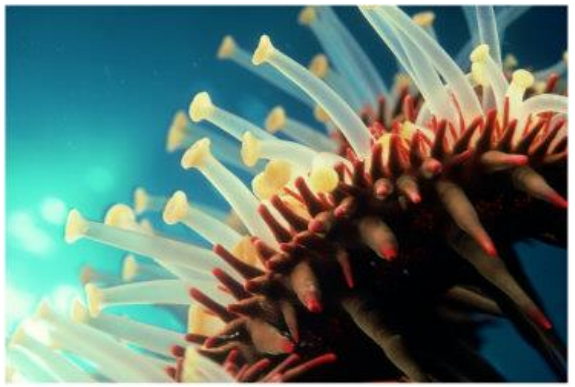
Respiration:

- As water is circulating through the water vascular system, oxygen is extracted from the water.

Mobility:

- Echinoderms move using tube feet controlled by the water vascular system.





Echinoderms

Nervous:

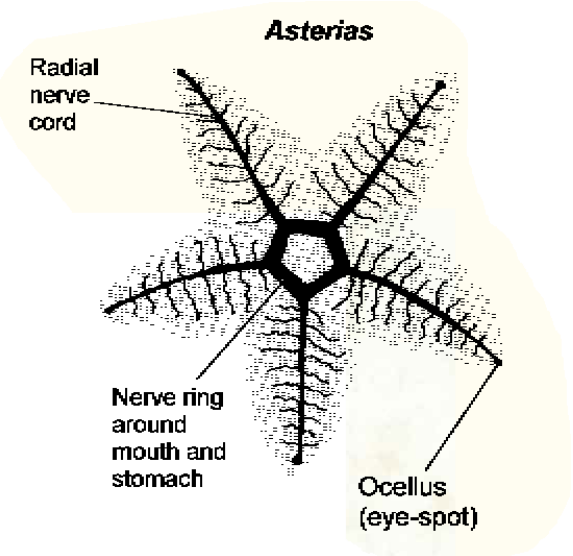
- Nerve ring around mouth with nerves in each ray
- Eyespot (light-sensitive) at the tip of each ray

Reproduction:

- Sexual
  - Dioecious (separate sexes)
  - Gonads in each ray
  - External fertilization
- Asexual
  - Fragmentation and regeneration

Development:

- Deuterostomes
- Larvae have bilateral symmetry which then develops into radial symmetery as adults.



Quiz!

2. What are the main sources of sensory input in Platyhelminthes?

a) Gastrovascular cavity

b) Ventral Nerve Cords

c) Ganglia

d) Eyespots

Quiz!

3. By which method do Planarians reproduce asexually?

a) Mitosis

b) Meiosis

c) Regeneration

d) Conjugation

Quiz!

4. Since Platyhelminthes lack a circulatory or respiratory system, how do they absorb those necessary nutrients?

a) They have a circulatory and respiration system

b) Absorption through the body wall

c) From bacteria that inhabit inside the organism

d) Absorption from food intake

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