Chapter 13

# Phylum Annelida

## The Ringworms -الديدان الحلقية

# Annelida: (Latin) = Ring

- **Defining Characteristics:**
  - *One or more pairs of chitinous setae.*
  - *Body segmentation (metamerism).*

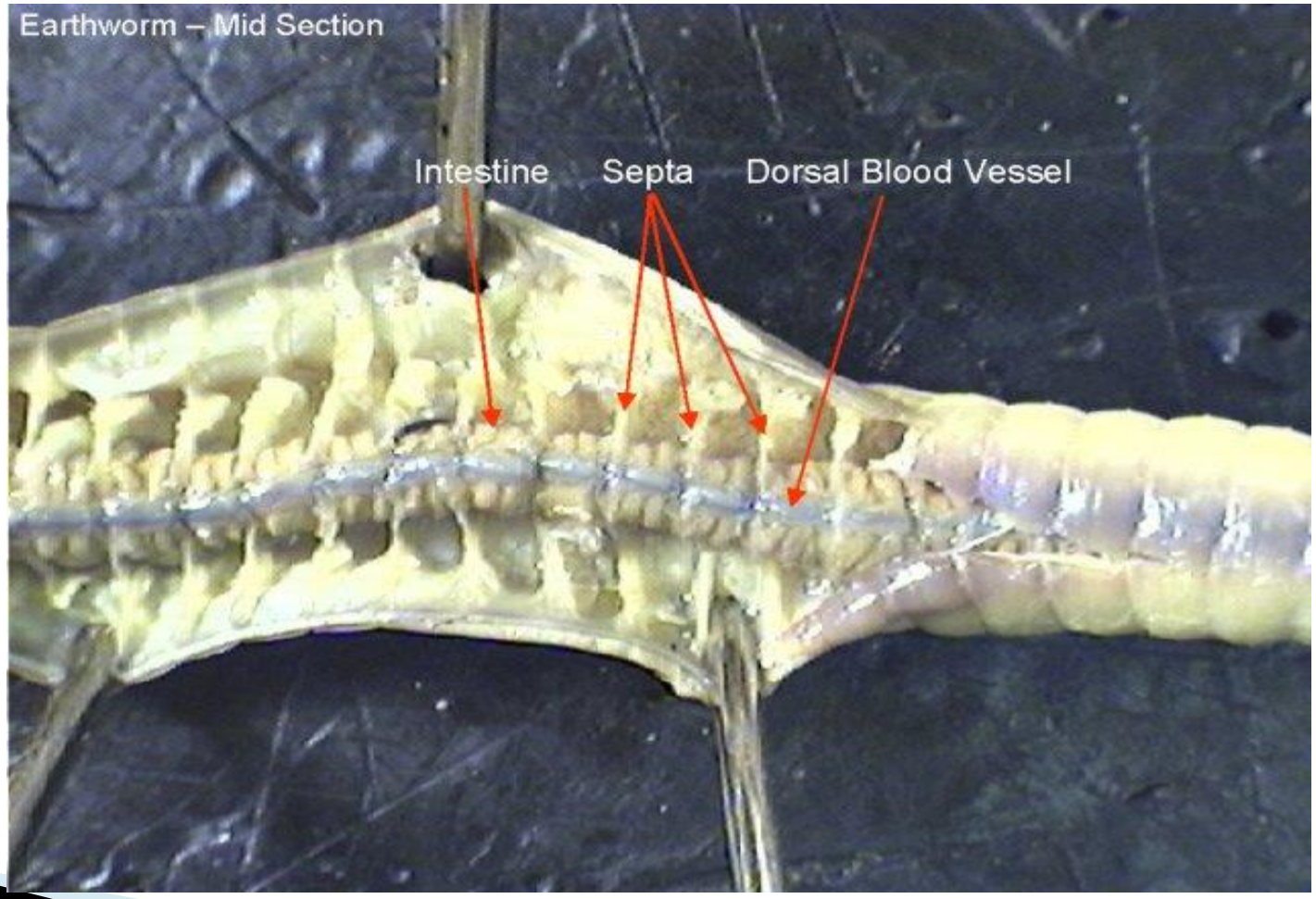

**Setae**

**Segmentation**

## General Characteristics:

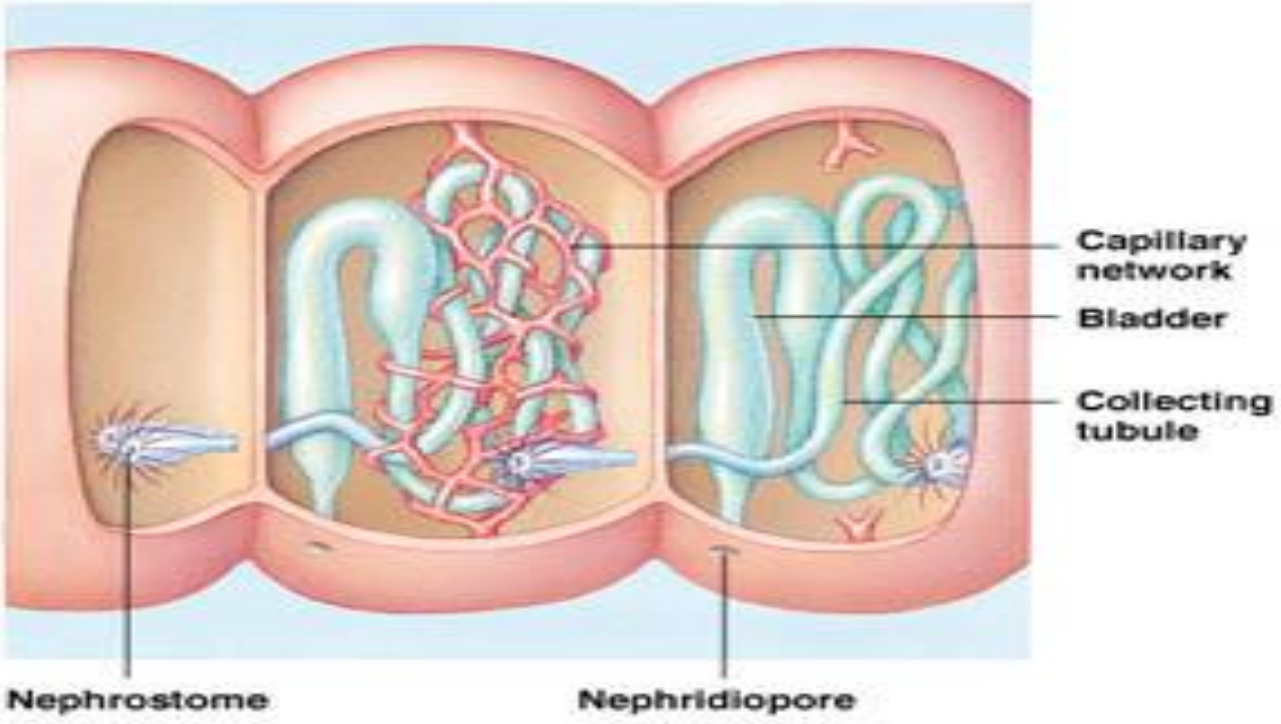
- 12,500 species have been described.
- All are **vermiform (worm-like).**
- Body is soft and circular.
- Repetition of segments and organs inside these segments is called **metamerism.**
- **Gas exchange** is through the thin **body wall** (as long as it remains moist).

- Segments are separated from each other by **septa** (thin sheets of mesodermally-derived tissues "**peritoneum**").



- Have **circular, longitudinal** and **oblique muscles** that help in movement.
- **Waste excretion:**
  - Some wastes are excreted **across the body surface**.
  - However, excretion generally occurs by means of **metanephridia** (1 pair/segment).
  - Wastes are collected through an opening of the metanephridia called **nephrostome**.

- Metanephredia open to the outside through a **nephridiopore**.
- In some species, metanephridia play a role in **gamete discharge** to the outside.

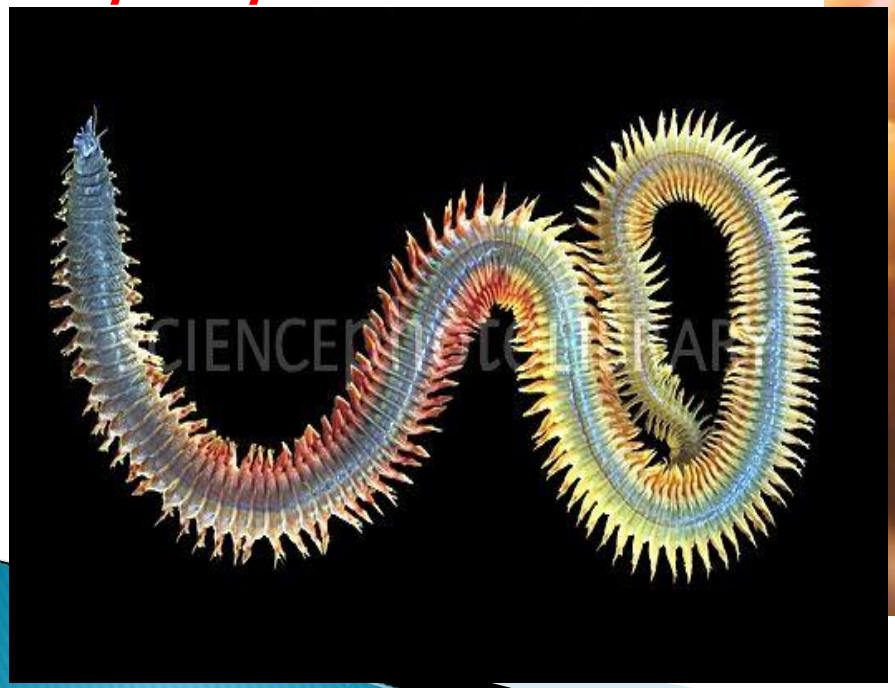


# Classification of Annelida:

- Class Polychaeta
- Class Clitellata
  - Subclass Oligochaeta
  - Subclass Hirudinea

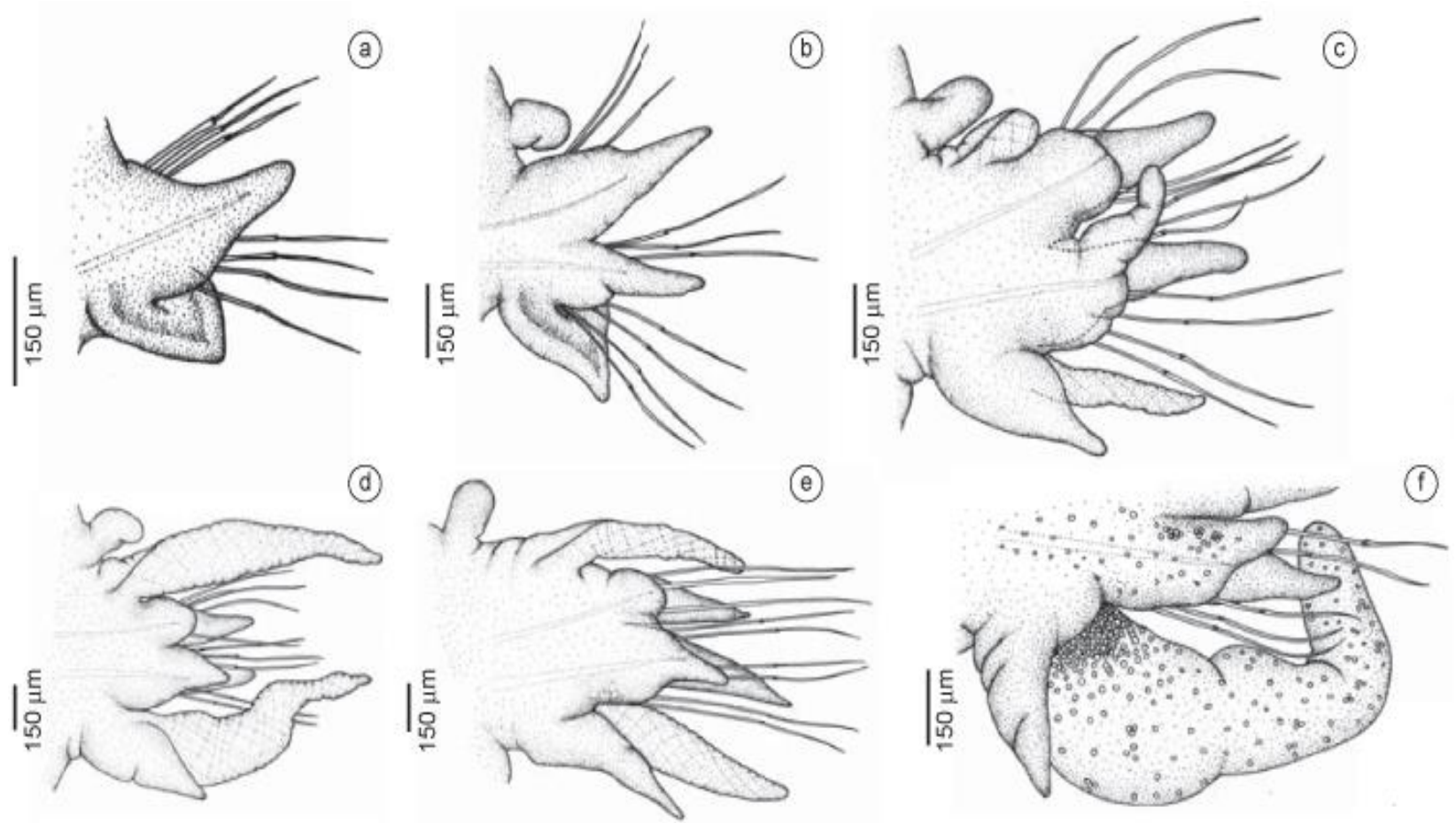
# Class Polychaeta:

- Polychaeta: G: poly: many, chaeta: setae.
- Defining characteristic:
  - *Paired lateral outfoldings of the body wall called parapodia.*

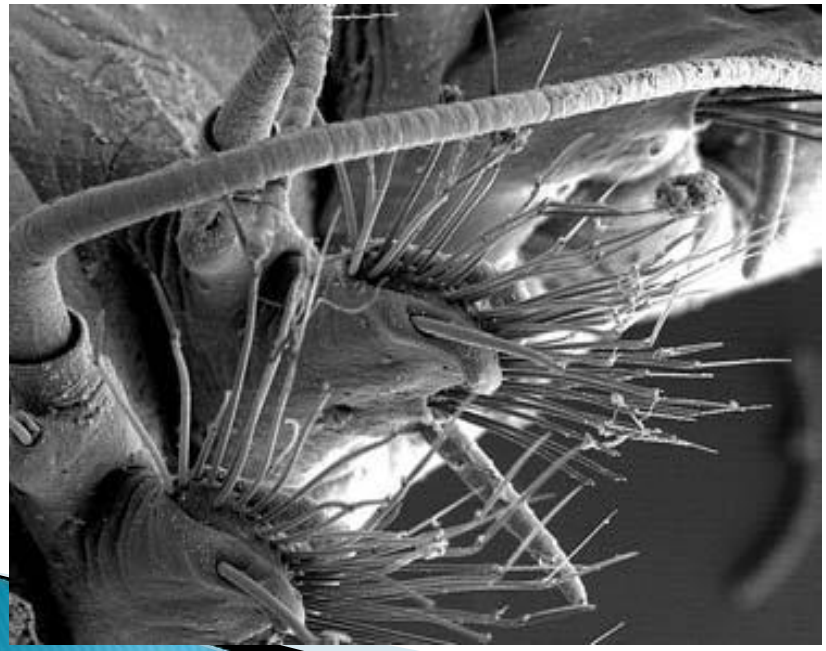


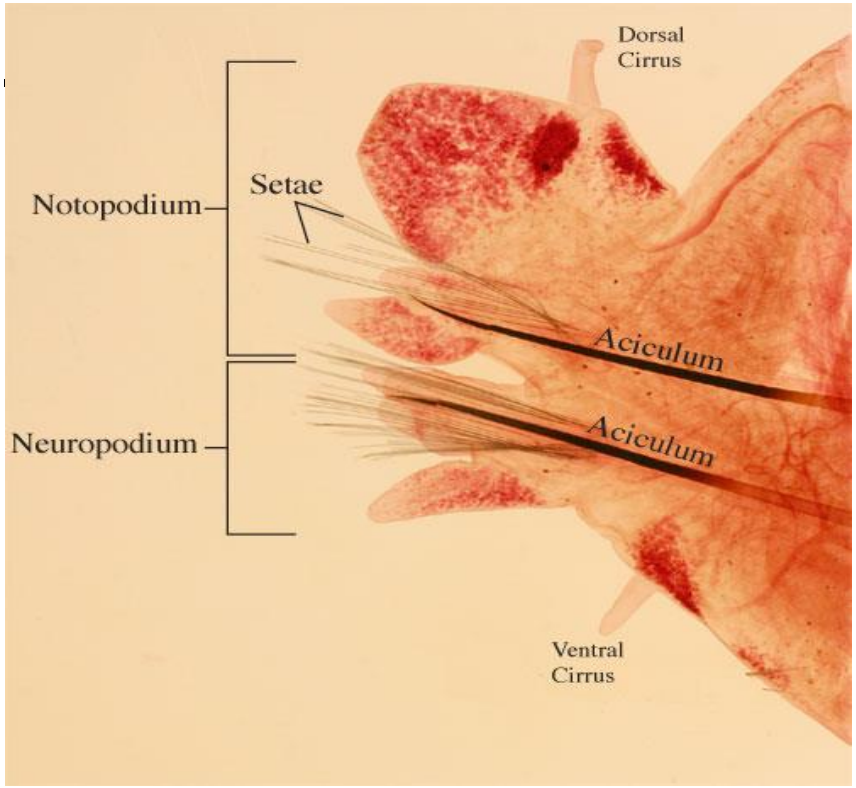
- The **largest class** (70% of all annelids).
- Nearly all members are marine.
- Have at least 1 **pair of eyes** and 1 **pairs of tentacles** on the anterior-most part of the body called **prostomium.**


- **Pparapodia** differ according to species (they help in classification).

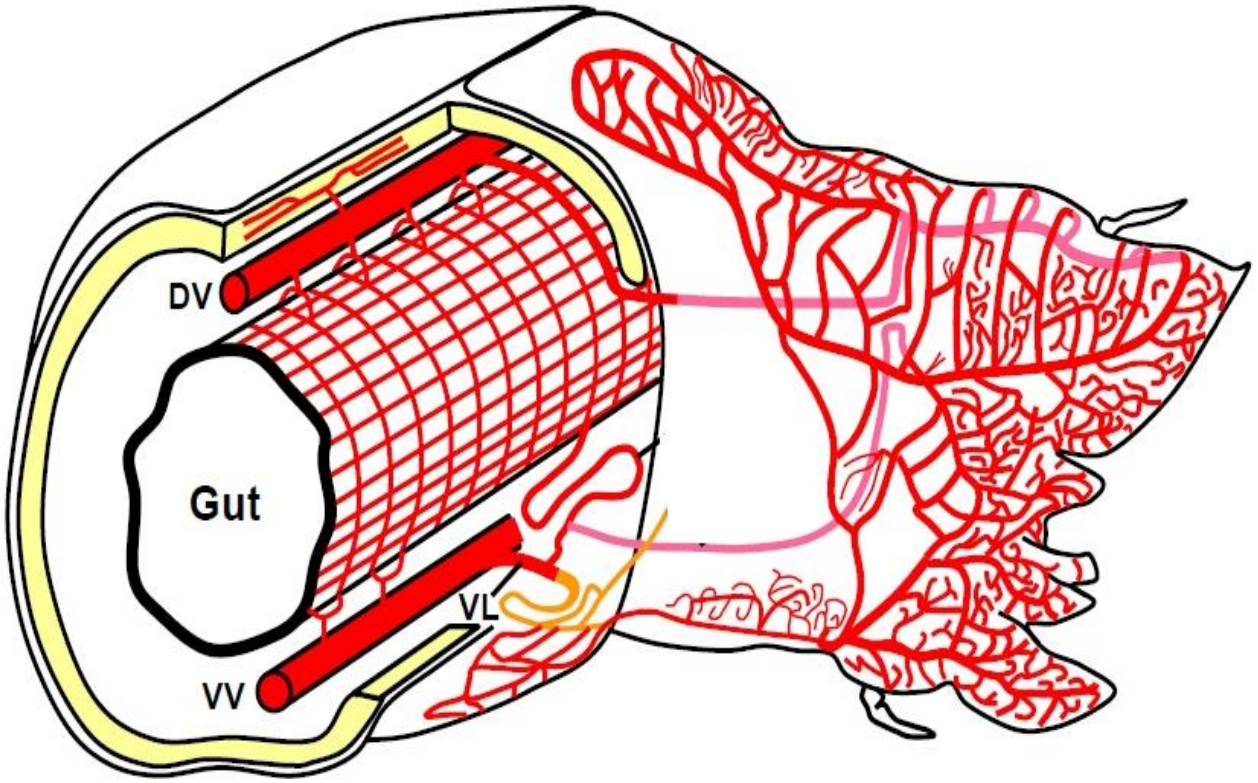


- Parapodia might be stiffened by chitinous rods called **Acicula.**
- In addition, bristle-like structure called **setae** protrude from each parapodia (could be *siliceous, chitinous, rarely calcareous*).



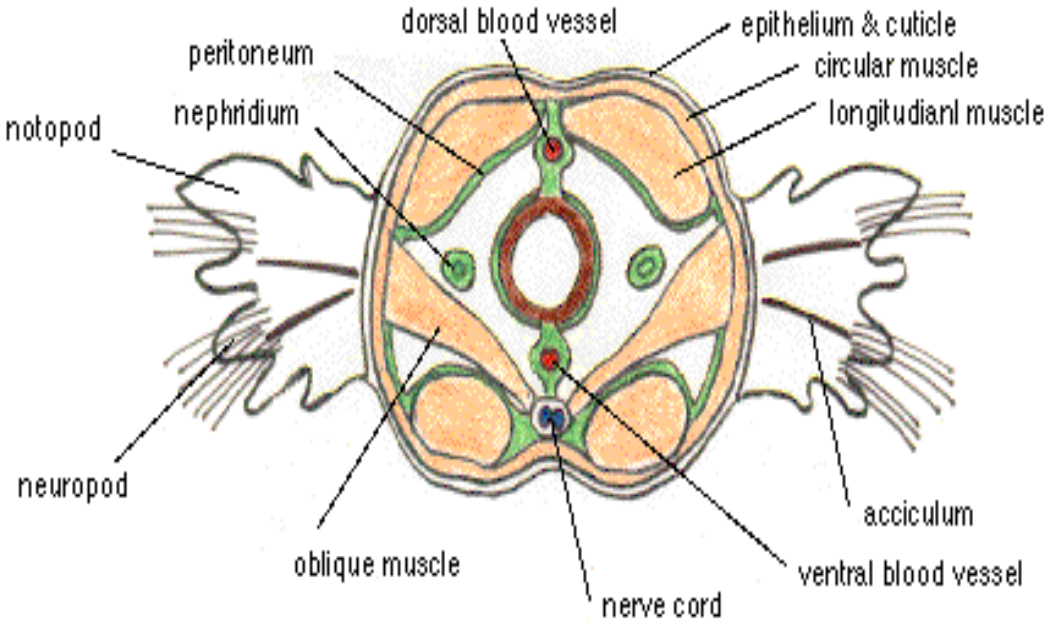


- **Parapodia function in:**
  - Gas exchange.
  - Locomotion.



- Body of some species is covered by a series of overlapping protective plates called **elytra.**

- Body is covered by a **non-living cuticle** that is secreted by the epidermis.
- Beneath the epidermis is a layer of **circular muscles** beneath which, another layer of **longitudinal muscles** is found.



# Polychaetes are divided into two groups:

- **Errant Polychaetes:**
  - Active mobile species.
  - Have well-developed parapodia with acicula and setae.
  - Have a well-developed head equipped with a toothed jawed protrusible pharynx.
  - They are mostly carnivorous.

- **Sedentary Polychaetes:**
  - These are **burrow-dwellers**, live in tubes.
  - Others live in burrows that they bore into calcareous substrates.
  - Parapodia are reduced, modified or absent.
  - Acicula is absent.
  - Most species lack proboscis.
  - They are suspension or deposit-feeders.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- **Digestive system:**
- The typical digestive system is **linear** with a **mouth** and **anus**.
- The digestive system is composed of **pharynx, esophagus, intestine and rectum**.
- In some species, evaginations of the gut from blind-ending **digestive gland** or **digestive caeca** increase the surface area for digestion and absorption.
- Digestion is mainly **extracellular.**

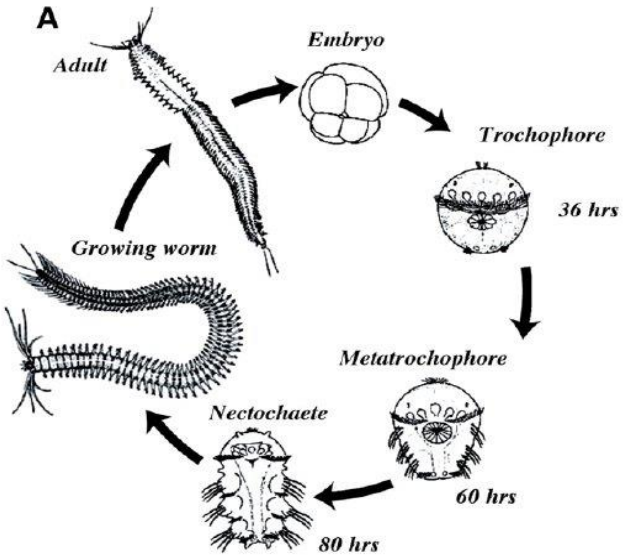
- **Nervous system and sense organs:**
- Polychaetes have a mass of **ganglia** (aggregation of nerve tissue) forming the **brain**.
- A single **nerve cord** (or a pair) extend from the anterior to the posterior of the Polychaete.
- Have different sense organs like: **touch receptors, statocysts, light receptors, vibration receptor and chemoreceptors.**
- The **eyes** of most species are **not image forming (light sensitive only).**

- **Circulatory system:**
- Generally, Annelids have a **closed circulatory system** composed of a **dorsal blood vessel** (*carries blood anteriorly*) a **ventral blood vessel** (carries blood posteriorly) and capillaries connecting the two.
- The **dorsal blood vessel contracts** to maintain the circulation.
- The blood of some species have **hemoglobin.**
- In addition some polychaetes have another pigment called **chlorocruorin** (green in color).

# Reproduction in Polychaetes:

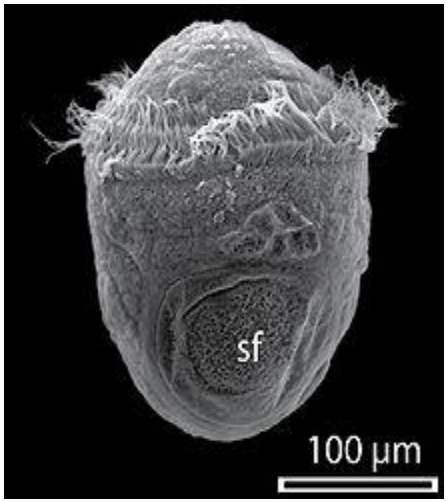
- **Sexually:** reproduction is **exclusively sexual** in most polychaetes and most species are **gonochoristic.**
- Gametes are produced by **peritoneal tissue**, rather than in distinct gonads.
- At least, **6 adjacent gonads** are involved in gamete production.

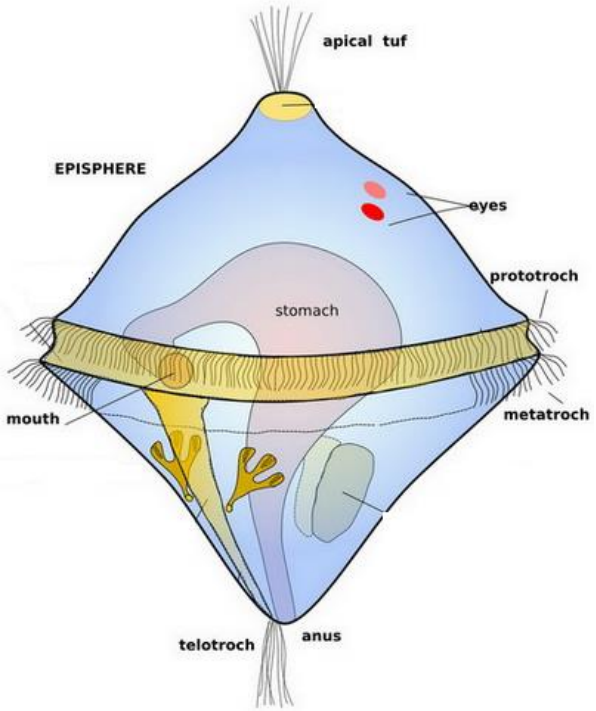
- Fertilization is usually **external**.



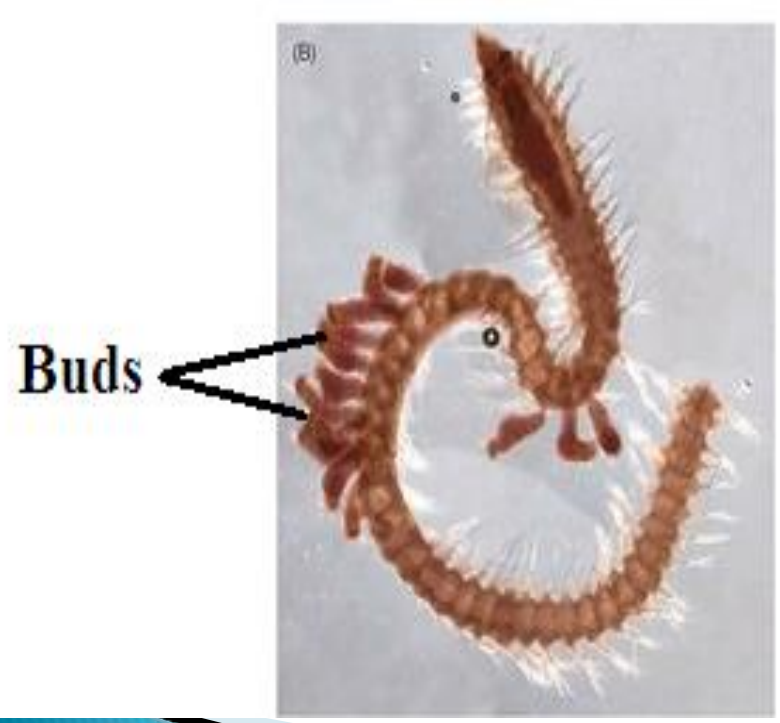
- Many tube-dwelling polychaete undergo **epitoky** (**Anon-reproductive** individual **(atoke)** undergo morphological changes in preparation for **reproduction** making a new form called **epitoke**).
- Epitoke is sexually mature and it can swim.

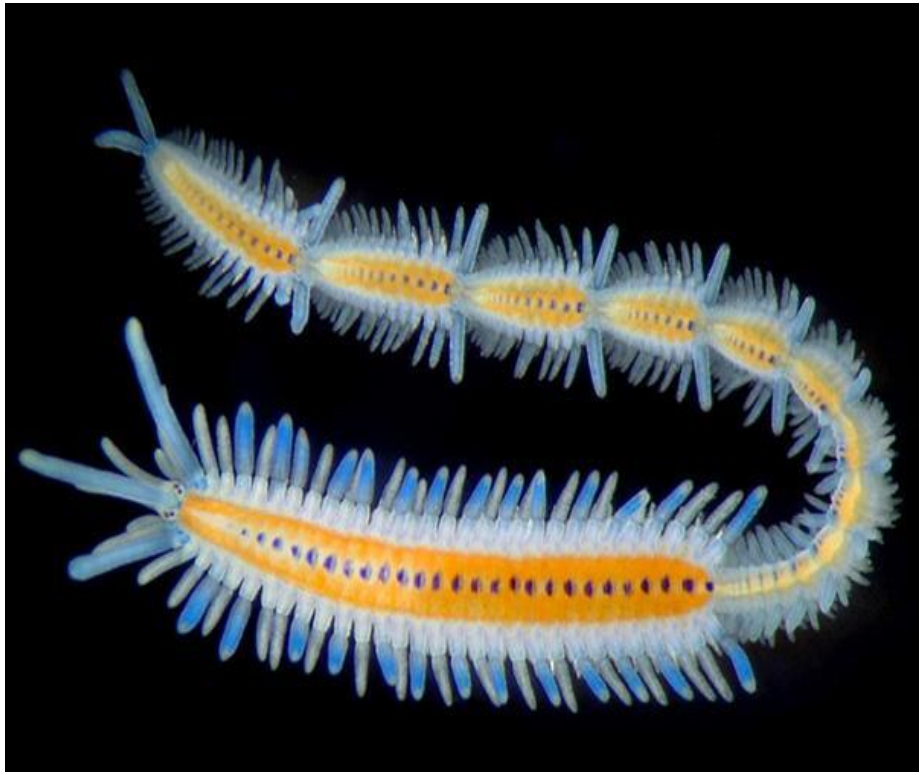
- The **larva** is **trochophore** (wheel-bearer).
- Larva bears three bands of cilia (**prototroch, telotroch and metatroch**).
- The posterior segment that carries the anus is called **pygidium.**

- **Asexually:** some can reproduce by:
  - **Budding** of the epitoke.
  - **Fragmentation** and regeneration of missing parts.



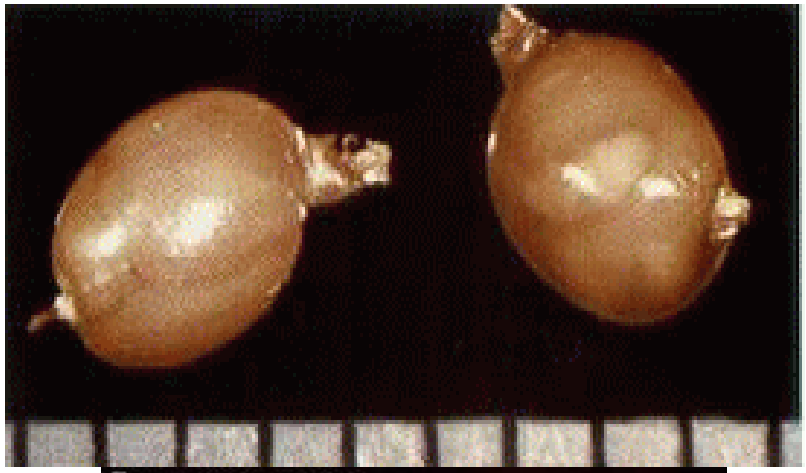



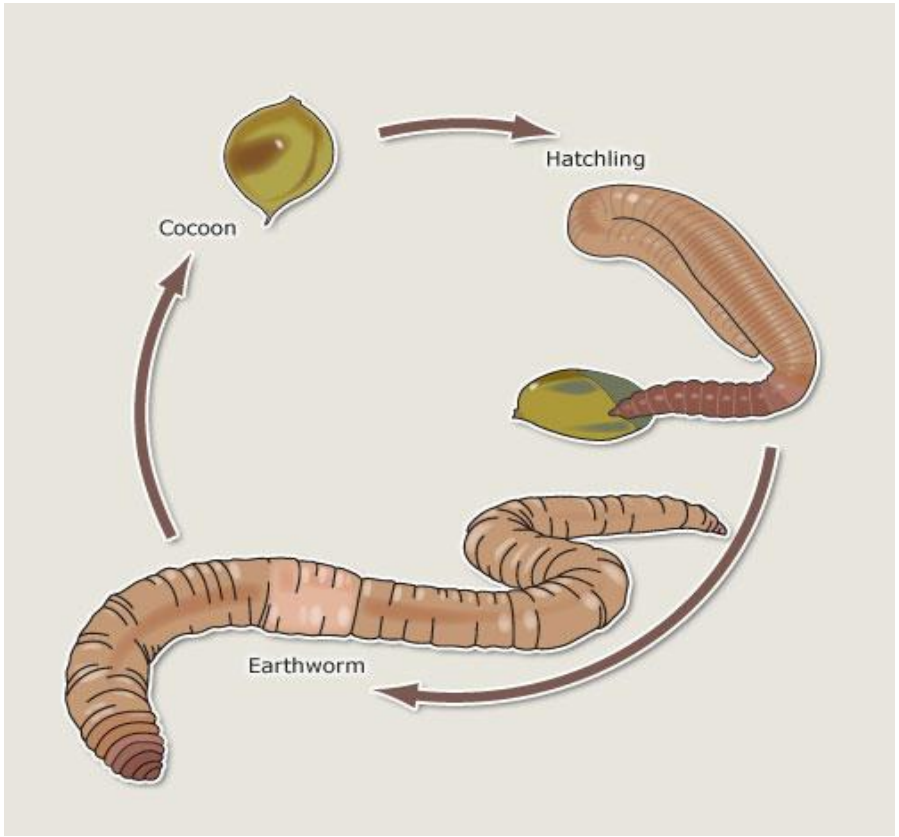
# Class Clitellata:

- **Clitellata**: L: **Clitell**: a **pack saddle**.
- **Defining characteristic**:
  - *Pronounced cylindrical glandular region of the body (**clitellum**) that plays important roles in reproduction.*
  - *Permanent gonads*.

- **This class includes 2 subclasses:**
  - **Subclass Oligochaeta (>80% of clitellata)**
  - **Subclass Hirudinea.**

- **Members of both subclasses:**
  - Are **hermaphrodites** and have **clitellum**.
  - Secrete a **cocoon** within which embryos develop.

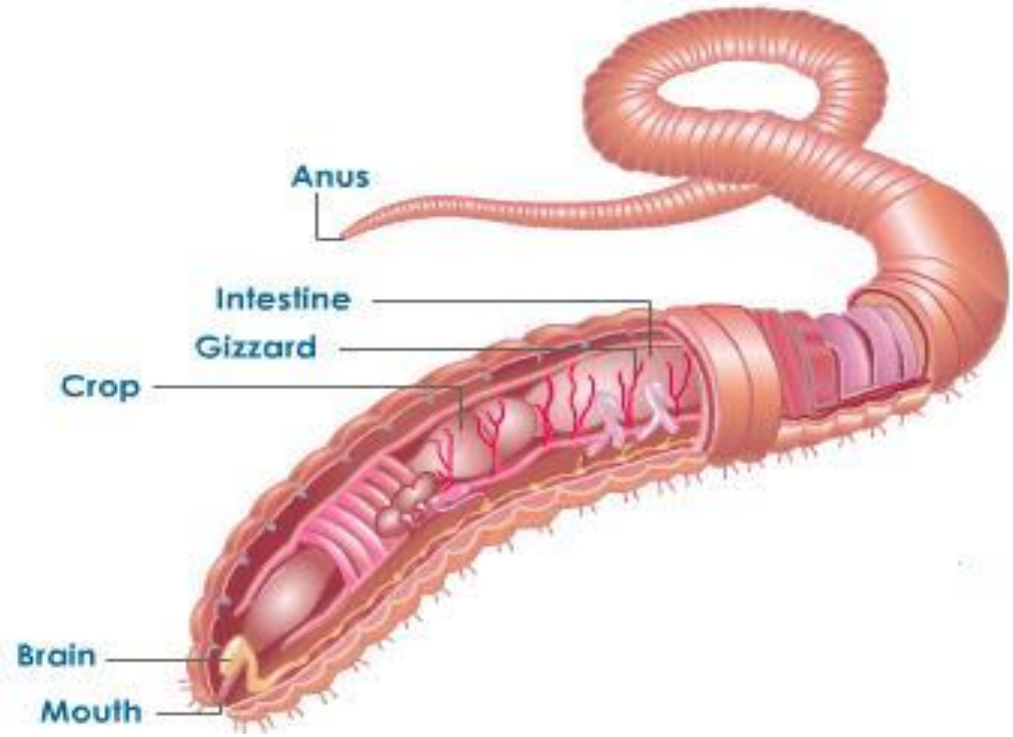


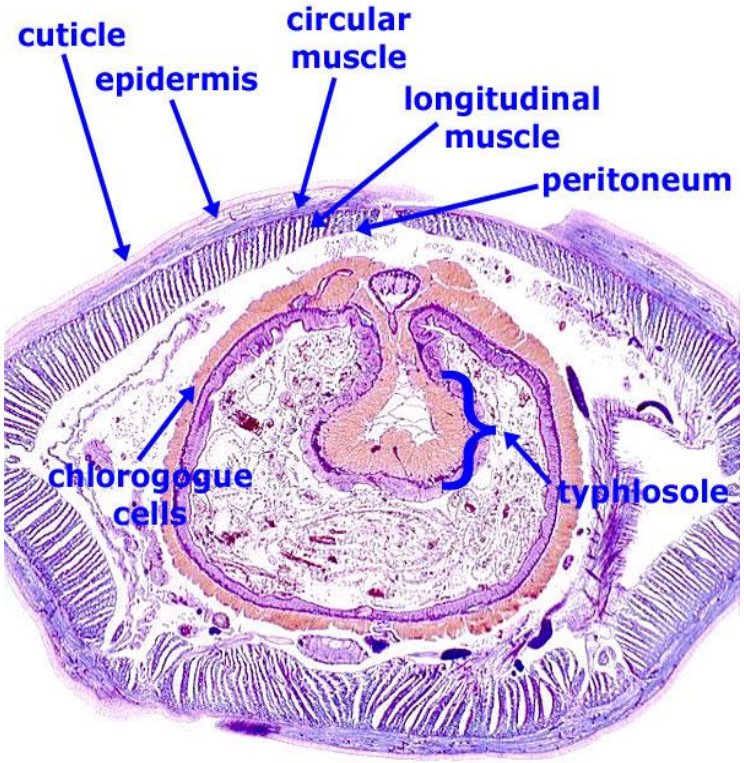



# Subclass Oligochaeta:

- **Oligochaeta**: G: **Oligo**: **few**; **Chaeta**: **setae**.
- About 3500 species. **Mostly freshwater** or **terrestrial** (few marine).
- The **Earthworm**, ***Lumbricus terrestris,*** is a familiar example of this subclass.
- **Parapodia are lacking** and the **prostomium lacks conspicuous sensory structures** (tentacles, eyes).
- Have **fewer setae** than Polychaetes.
- Respiration is through the **moist body surface**.
- Movement is by **peristaltic waves** of muscular contractions.

- **Digestive system:**
- The typical digestive system is **linear** with a **mouth** and **anus**.
- The esophagus may be modified to form a **crop** (food storage) and a **gizzard** (food grinding).
- The intestine of many species have a folding that increases the surface area and called **Typhlosole.**


Anus
Intestine
Gizzard
Crop
Brain
Mouth

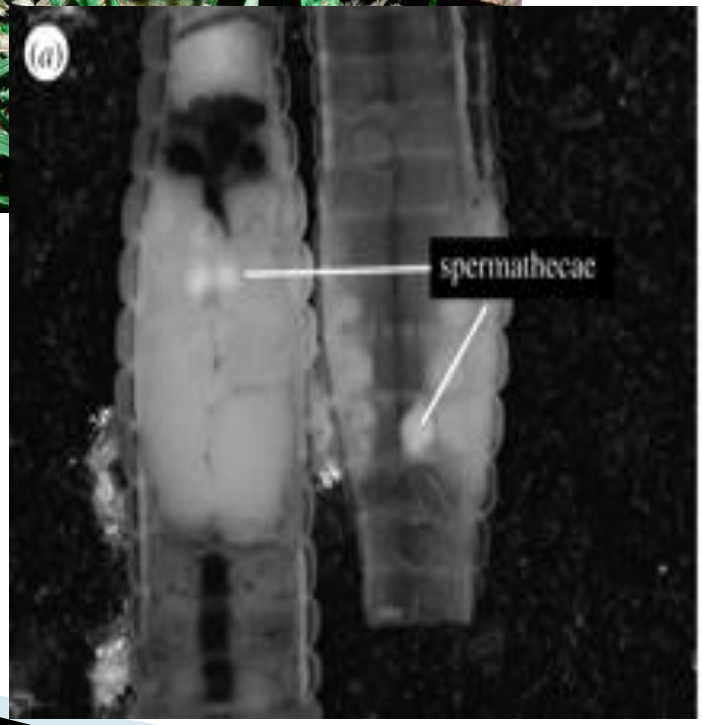

cuticle
epidermis
circular muscle
longitudinal muscle
peritoneum
chlorogogue cells
typhlosole

## Reproduction:

### Sexual:

- All oligochaetes are **hermaphrodites** and generally few segments are involved in gamete production.
- Gametes are produced by gonads (not from peritoneal tissues as in polychaetes).
- **Fertilization is cross and external (inside coccon).**
- Sperms are exchanged between two individuals and are stored in a **spermatheca**.


ARKive
www.arkive.org

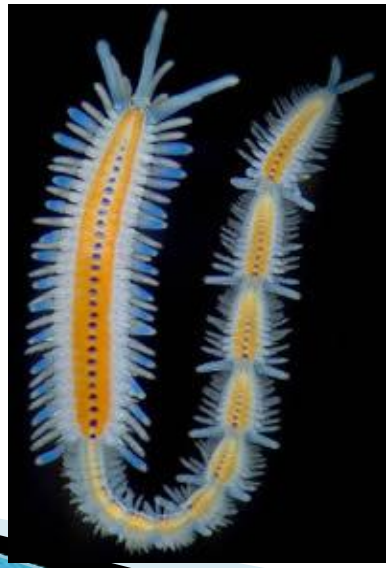

(a)
spermathecae


(b)
250 µm

- Have **no free living larva**.
- Full developed young emerge from the cocoon.

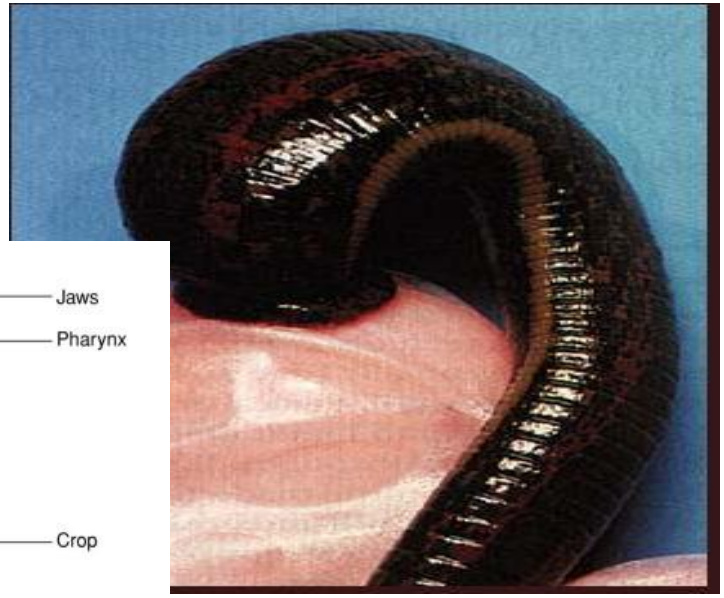
## Asexual:

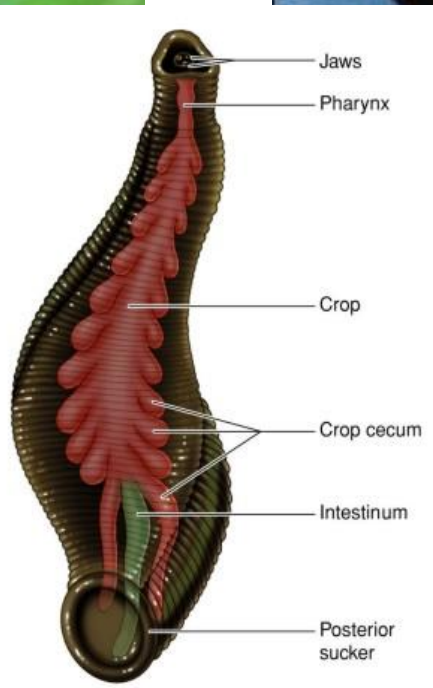
- Common especially in freshwater species.
- **By**: **Transverse division** into a number of segments, then **regeneration**
- **Parthenogenesis**: development of eggs without fertilization.



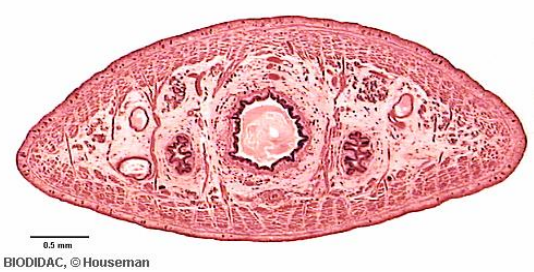
# Subclass Hirudinea:

- ***Hirudinea**: G: leeches.*
- *Defining characteristic: **posterior sucker**.*

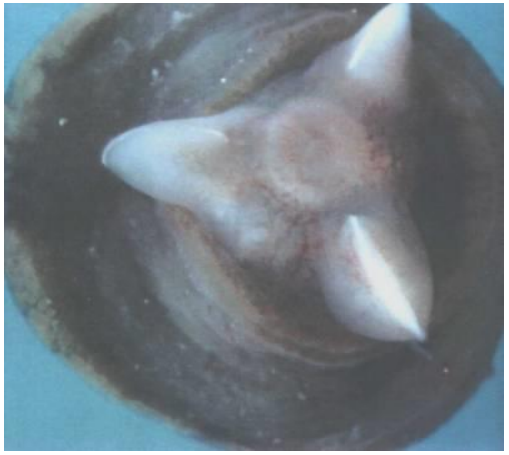





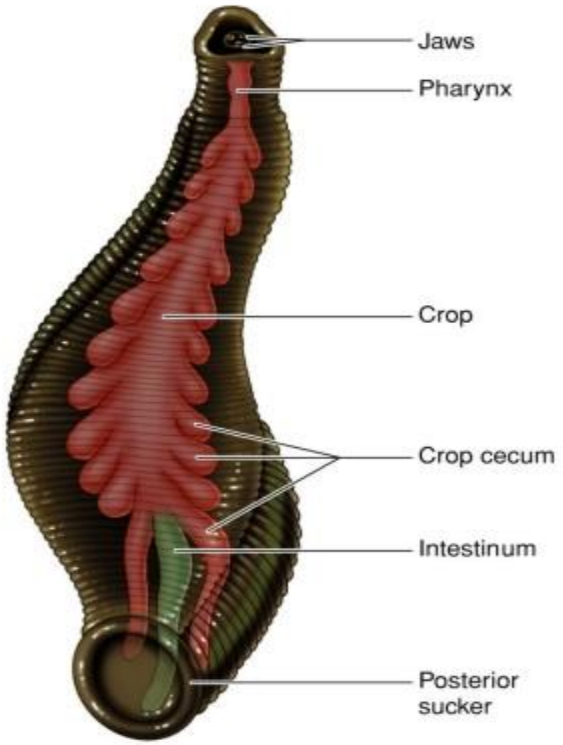
- Contains more than 500 species.
- Believed to have **evolved from oligochaetes**.
- Mostly **freshwater or terrestrial** (few marine).
- **Lack parapodia** and **head appendages**.
- No respiratory organs (simple diffusion only).
- Most **lack setae**.
- Body is **segmented but not septate**.
- Coelomic space is filled with connective tissue **called mesenchyme**.



- Movement is not by peristaltic movement, but **by suckers** (anterior & posterior)
- Leeches are **generally ectoparasites feeding on blood** of invertebrates or most commonly vertebrates. (non parasitic comprise 25%).
- Most have **3-toothed jaws** within the mouth to make an incision in the host.

- **Digestive system:**
- The **mouth** opens into a **muscular, pumping pharynx.**
- **Salivary gland** is associated with the pharynx **secrete Hirudin** (***an anticoagulant***).
- A **crop** and **digestive glands** are found in some species.



- Leeches are **used in medicine** since a long time:
  - Used to **reduce blood pressure** of patients.
  - Used to **suck blood after snakebite**.
  - An **anticoagulant (hirudin)** is excreted by leeches and is used in the treatment of blood clots.
  - Leeches secrete local **anesthetics and antibiotics**.
  - Used after surgery to reattach fingers or limbs.

## Reproduction:

- Leeches are **simultaneous hermaphrodites**.
- Have **no free-living larval** stage.
- Few segments are involved in gametogenesis.
- **Fertilization is internal** (exchange of gametes between 2 individuals).
- Embryos develop within **a cocoon.**
- Asexual reproduction is completely unknown.

*End of Chapter 13*