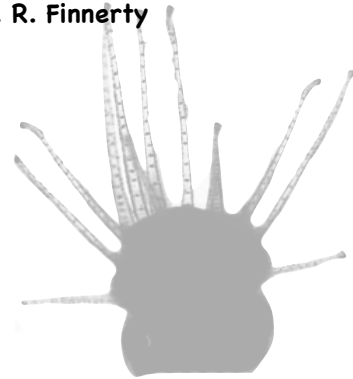


Tropical Marine Invertebrates

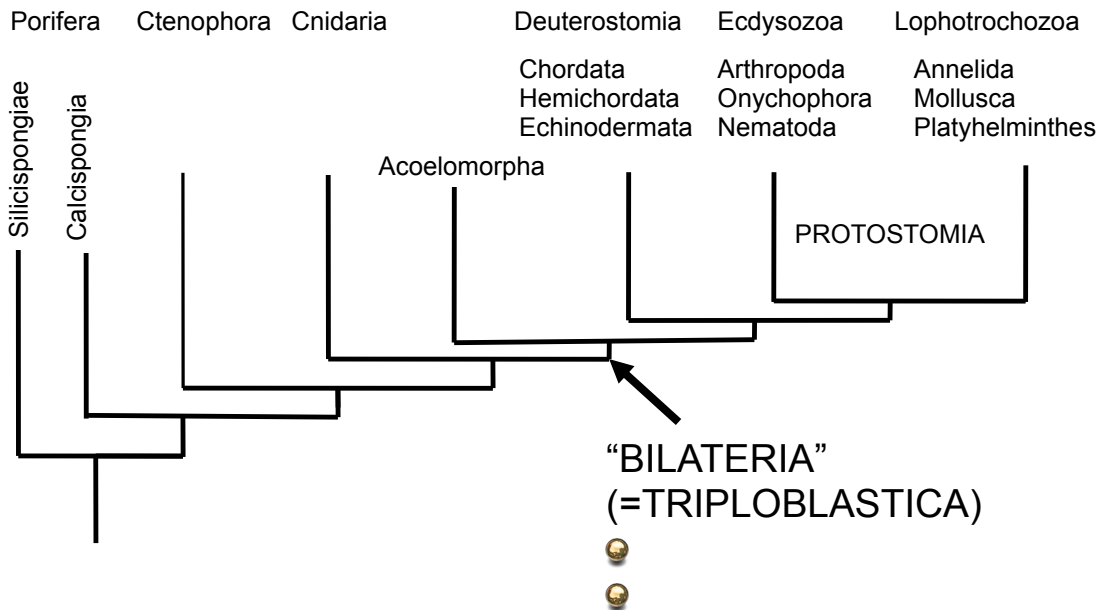
CAS BI 569

Phylum ANNELIDA

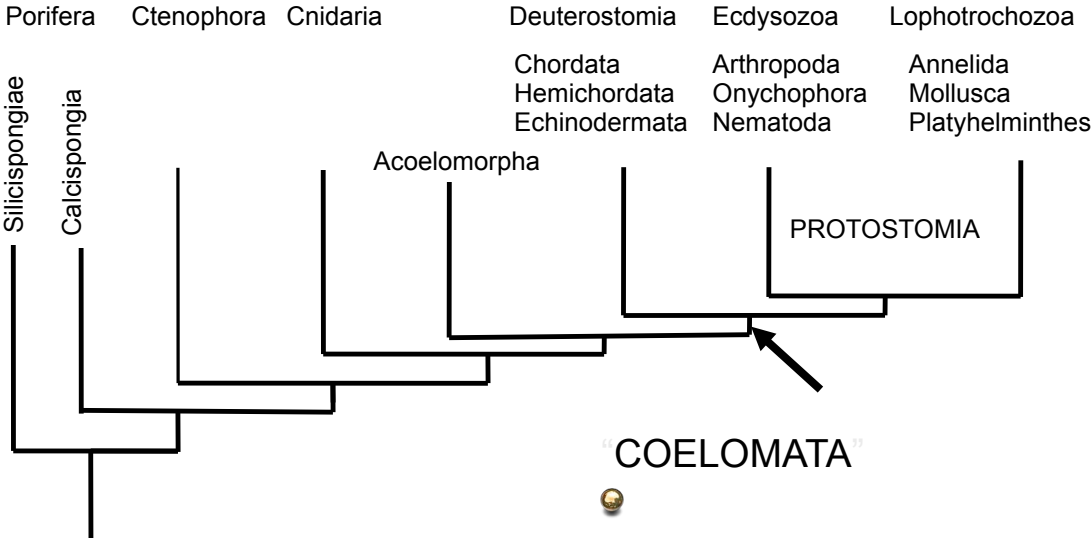
by J. R. Finnerty



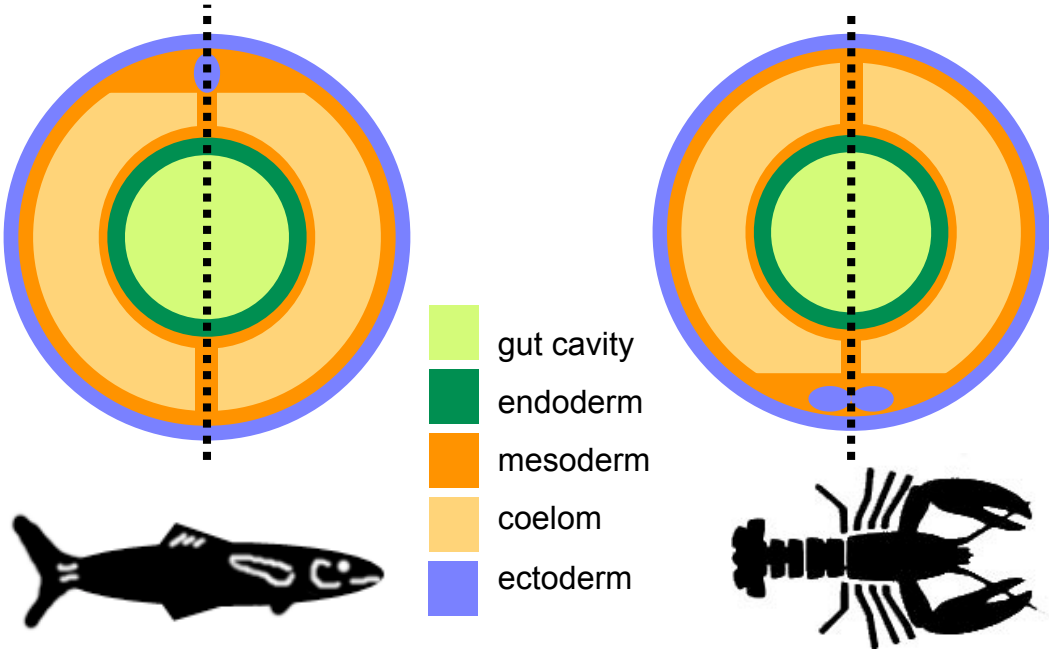
Phylum ANNELIDA



Phylum ANNELIDA

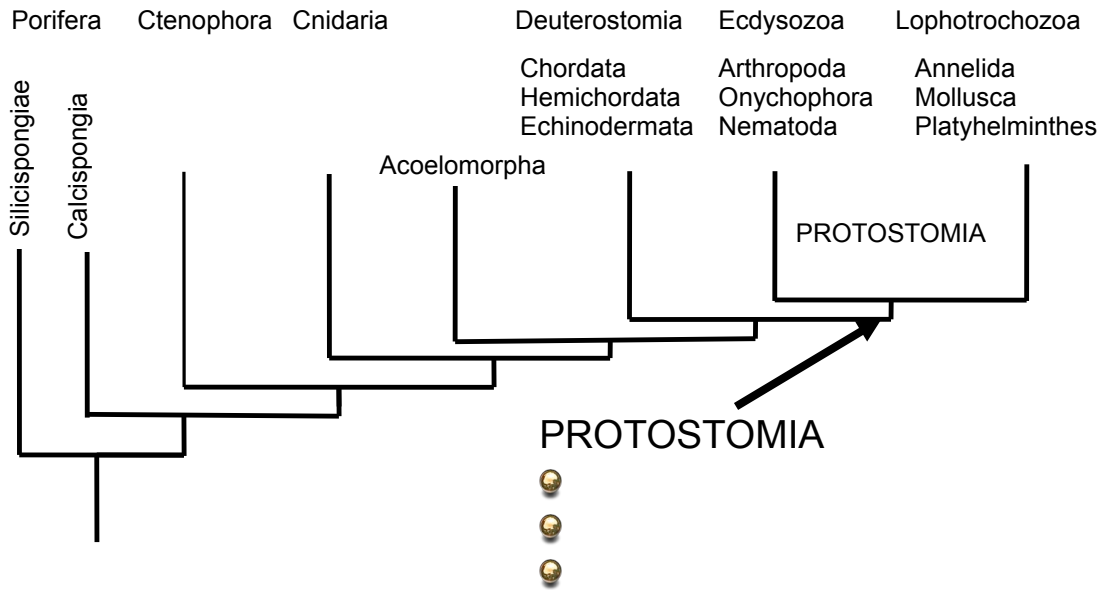


Coelomata



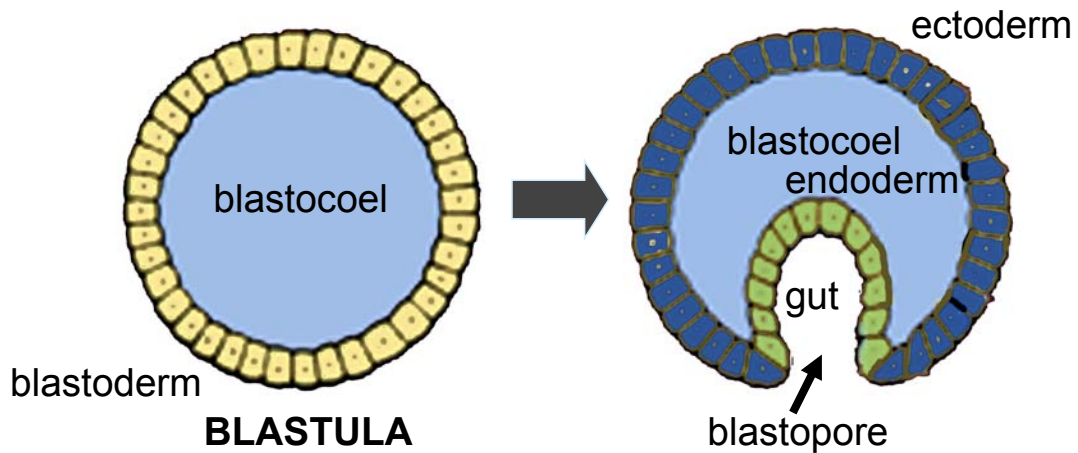
[note: dorso-ventral inversion]

Phylum ANNELIDA



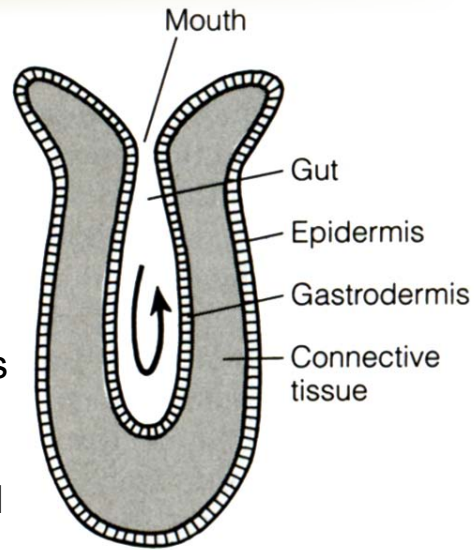
The Blastopore

➤ Forms during gastrulation

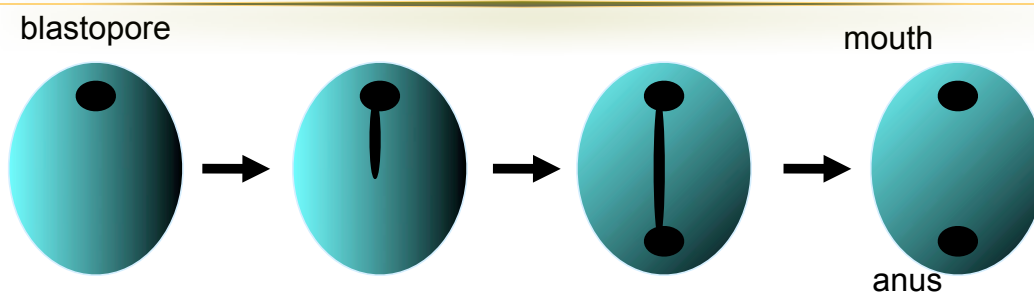


The Gut

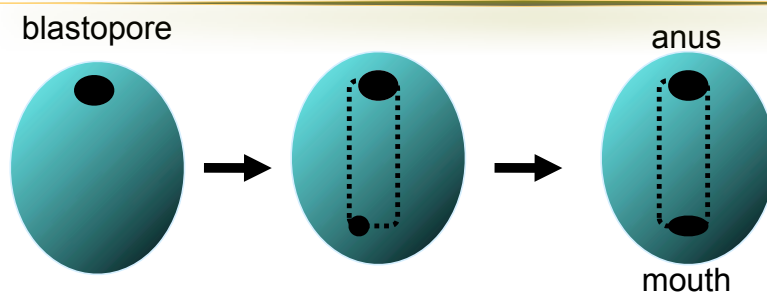
- “internal, epithelium-lined cavity for the digestion and absorption of food
- sponges lack a gut
- simplest gut = blind sac (Cnidaria)
- blastopore gives rise to dual-function mouth/anus
- through-guts evolve later
- Protostome = blastopore contributes to the mouth
- Deuterostome = blastopore becomes the anus; mouth is a second opening



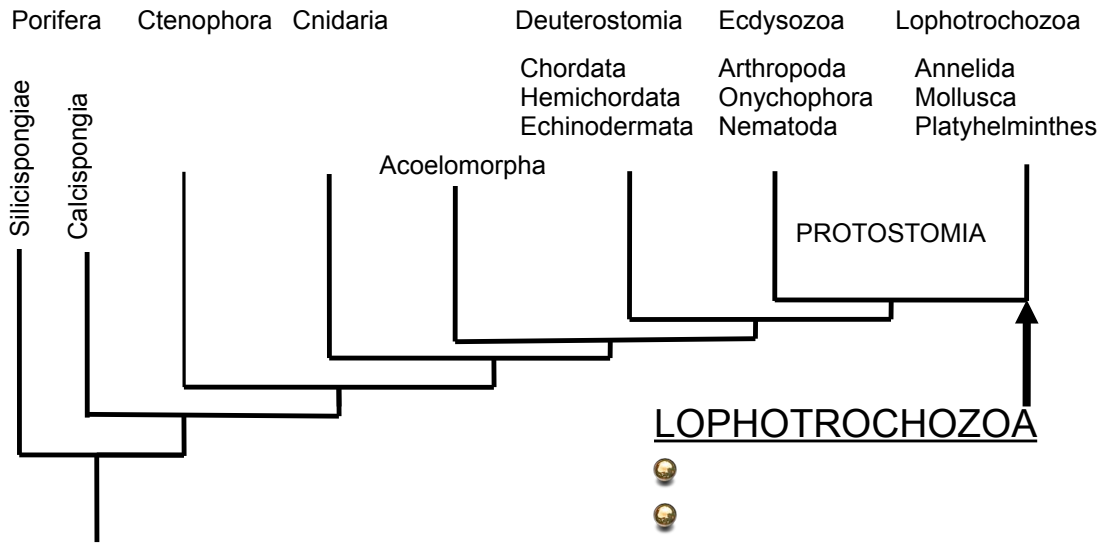
Protostomy



Deuterostomy



Phylum ANNELIDA



Trochophore Larvae in Annelids



(from Nielsen, 1995, *Animal Evolution*)

Phylum Annelida

- ~12,000 described species.
- from *annulus* (Latin for ring)
- traditionally comprised of segmented worms.
- diverse feeding modes
 - suspension feeding
 - deposit feeding
 - scavenging
 - herbivory
 - carnivory
- Microscopic to 3 meters long (giant earthworms of Australia).
- Diverse sexual and asexual reproductive strategies.



Recent Additions to the Phylum

- Three other phyla of marine worms may be nested within the phylum Annelida, and so may be more properly regarded as members of the Annelida and not independent phyla.
- **Echiura**—151 species of “spoonworms”
- **Sipuncula**—150 species “peanut worms” that superficially resemble burrowing sea anemones.
- **Pogonophora**—~80 species of “bearded worms” are deepwater tube-dwelling animals that occur on continental slopes and in rifts.
- All are coelomate, spiral cleavers, with trochophore larvae.
- The echiura and the sipuncula are unsegmented.
- The pogonophora are segmented in the posterior opisthosoma region.

Sipuncula

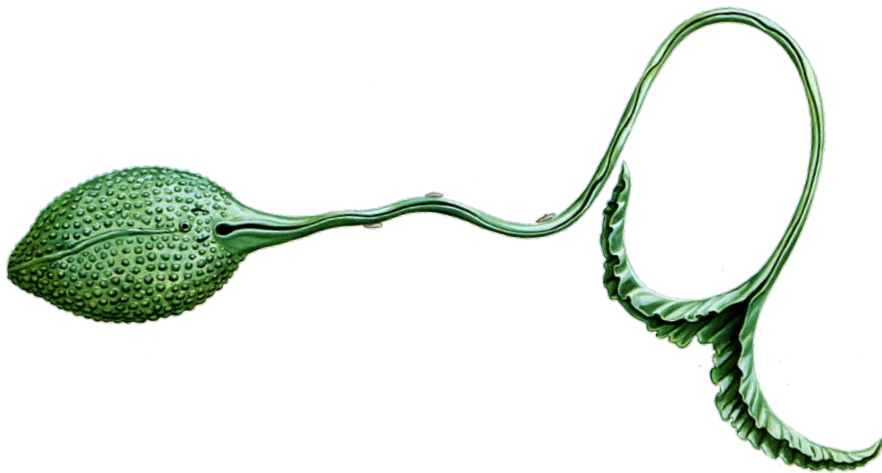
“peanut worms”



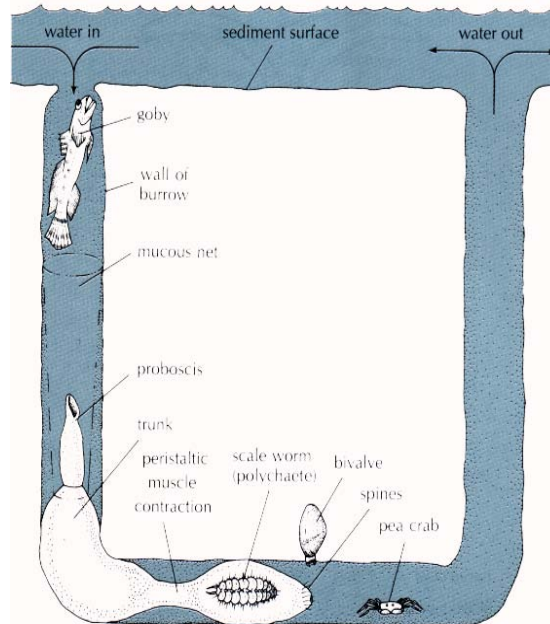
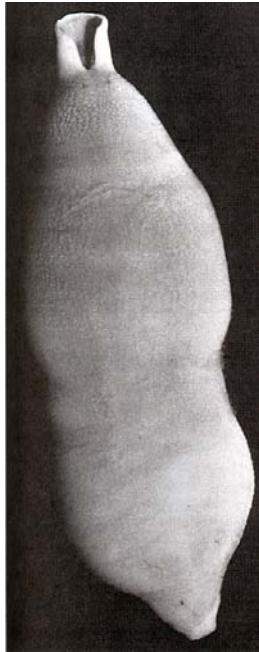
Phascolosoma

Echiura

“spoon worms”



tube dwelling filter feeders



Pogonophora



Riftia

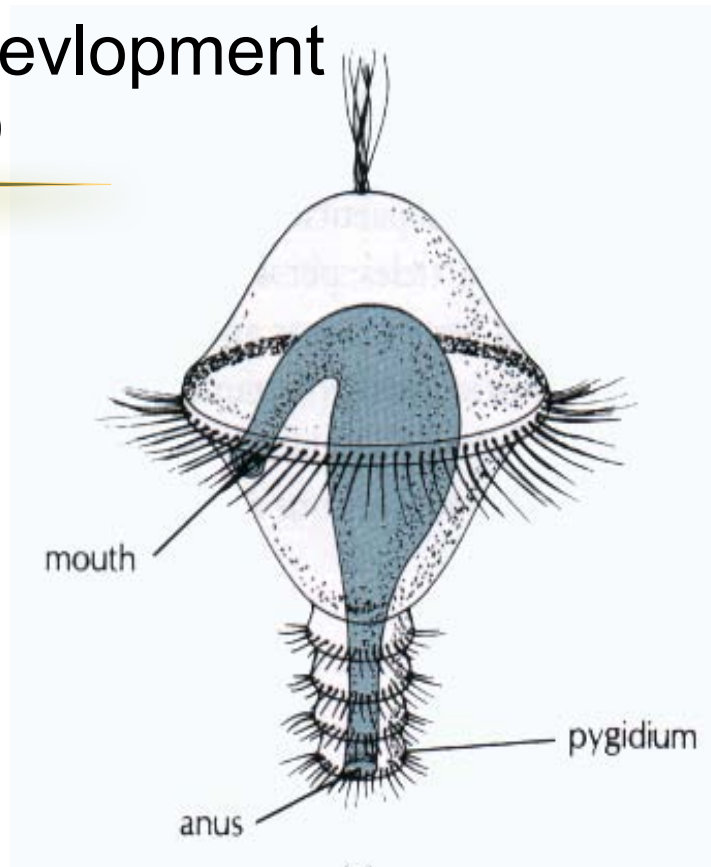
“Traditional” Annelida

- Three classes
- class POLYCHAETA (“many chaetae”)
- class OLIGOCHAETA (“few chaetae”) ~3500 species
- class HIRUDINEA ~500 species of leeches

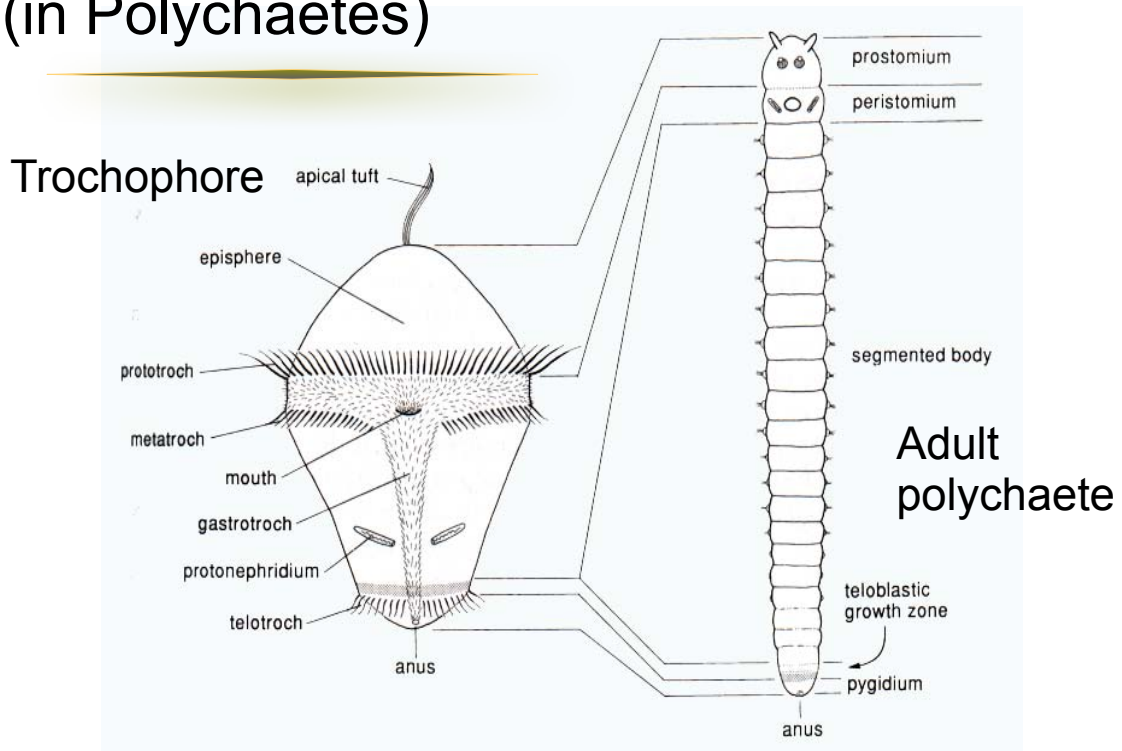
Polychaeta

- class POLYCHAETA (“many chaetae”)
 - **chaetae** = chitinous bristles projecting from epidermis
 - ~8000 species
 - segmented
 - almost exclusively marine
 - paired appendages called **parapodia**
 - ciliated sensory pits called **nuchal organs**
 - The sexes are separate.
 - Fertilization is external.
 - free-living trochophore larva (primitive for the phylum).
 - lack permanent gonads.
 - In six or more segments, gametes are produced by the mesodermal lining of the coelom.
 - Asexual reproduction is common.

Late Larval Development (in Polychaetes)



Late Larval Development (in Polychaetes)



Abundance & Ecology

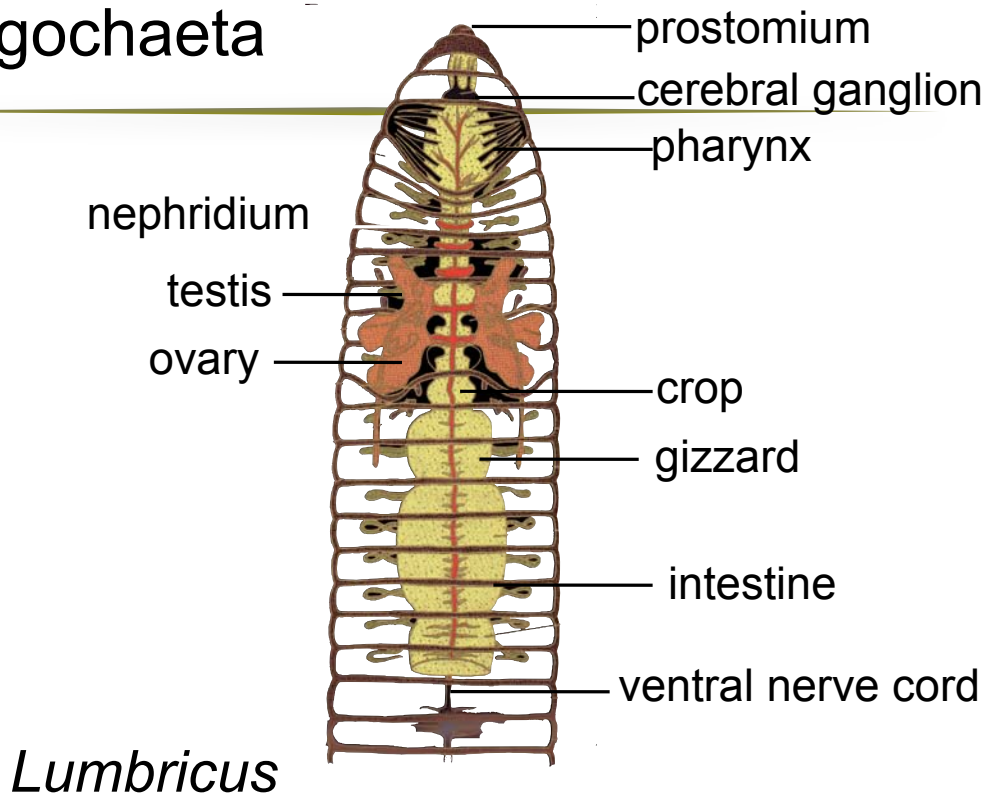
- 🕒 “Burrowing and tube-dwelling polychaetes commonly occur in enormous numbers on the ocean floor...”
- 🕒 “In Tampa Bay, Florida, for example, the average density of polychaetes is 13,425 individuals per square meter.”
- 🕒 “In general, such populations do not seem to be limited by food resources, at least not in shallow water. Predation and other pressures usually prevent annelid, mollusc, and other infaunal populations from ever reaching the carrying capacity of the habitat. When areas in the York River estuary of the Chesapeake Bay were protected from fish and crabs by means of wire cages, over half of the species in the polychaete population increased from two to many times their numbers in unprotected conditions.”

—Ruppert et al., *Invertebrate Zoology* (7e)

Oligochaeta

- 🕒 class OLIGOCHAETA (“few chaetae”)
 - 🕒 ~3500 species
 - 🕒 few **chaetae**
 - 🕒 segmented
 - 🕒 marine (200 spp), freshwater, & terrestrial environments
 - 🕒 lack paired appendages (**parapodia**)
 - 🕒 lack ciliated sensory pits (**nuchal organs**)
 - 🕒 outcrossing simultaneous hermaphrodites
 - 🕒 fertilization is internal.
 - 🕒 direct developers with no free-living larva
 - 🕒 **clitellum**—*a reproductive organ that helps to generate a cocoon around the fertilized embryos*
 - 🕒 possess permanent gonads.
 - 🕒 do **not** undergo asexual reproduction

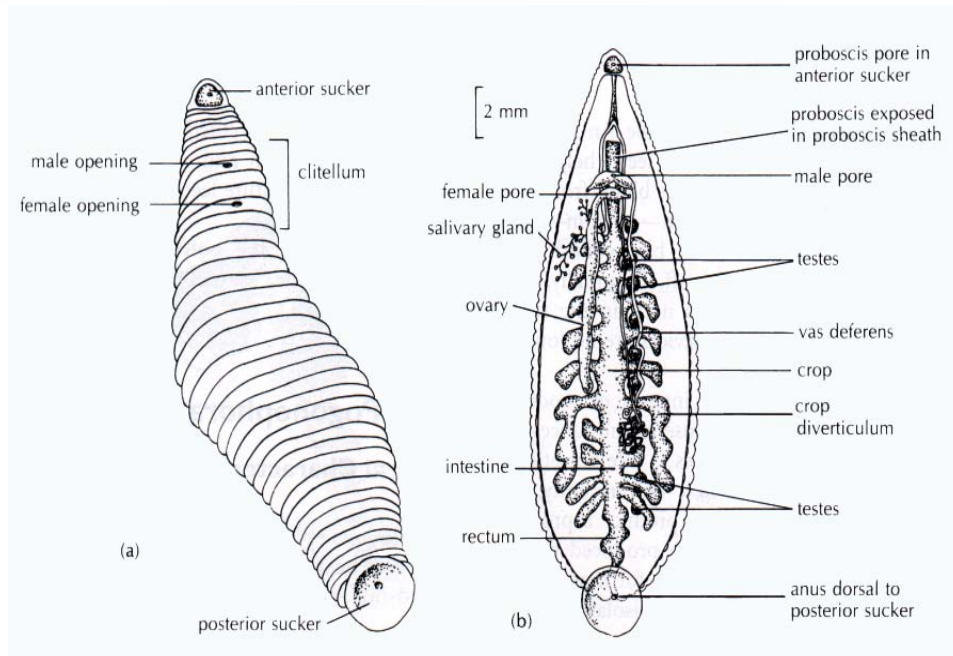
Oligochaeta



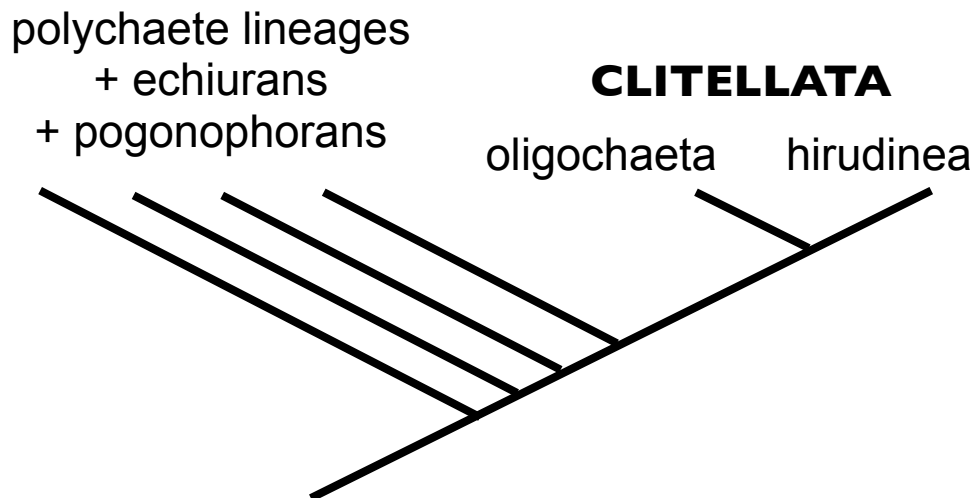
Hirudinea

- class HIRUDINEA (“leeches”)
- ~500 species
- lack **chaetae**
- clearly segmented during development (33 segments) but reduced metamerism evident in the adult
- marine, freshwater, & moist terrestrial environments
- lack paired appendages (**parapodia**)
- lack ciliated sensory pits (**nuchal organs**)
- anterior and posterior suckers & dorsal anus
- outcrossing simultaneous hermaphrodites
- fertilization is internal.
- direct developers with no free-living larva
- **clitellum**
- possess permanent gonads.
- do **not** undergo asexual reproduction

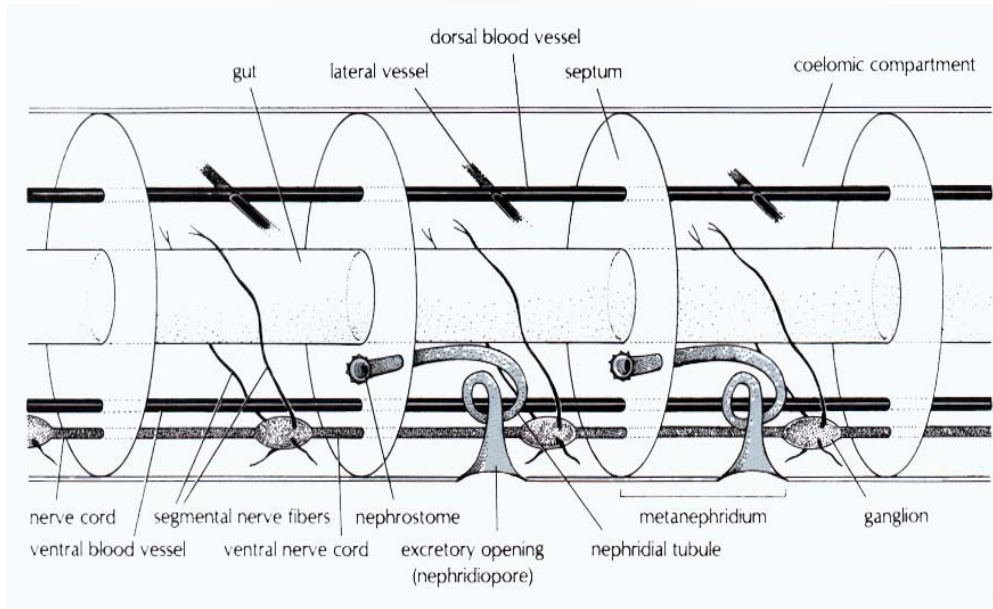
Leech Bodyplan



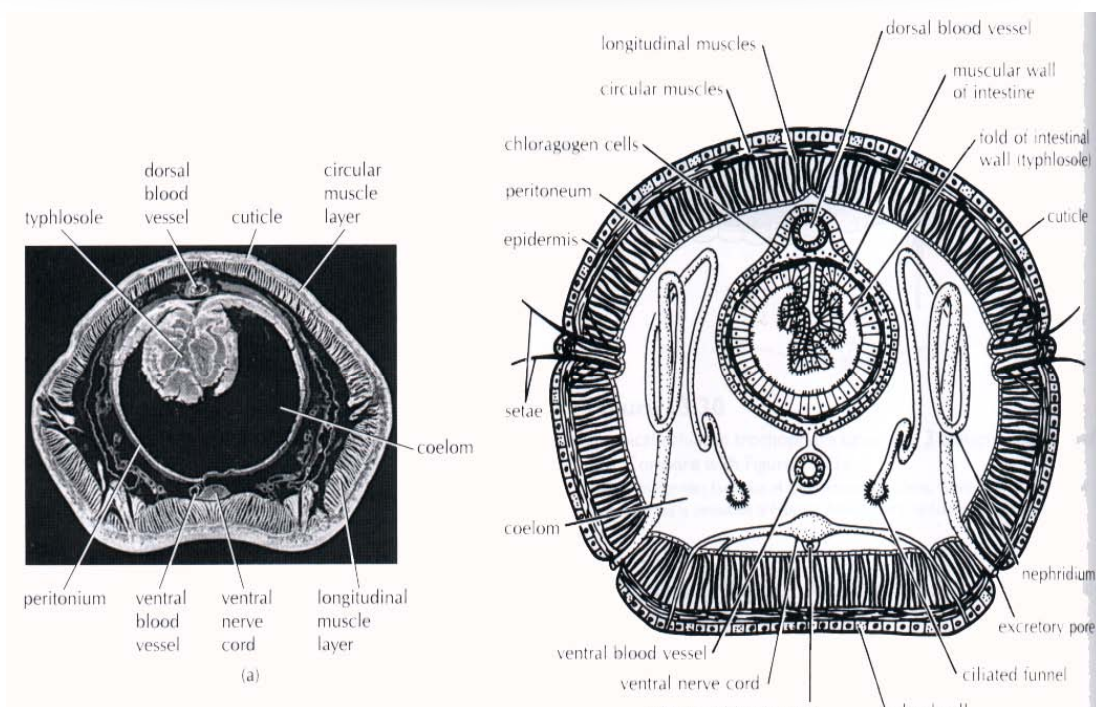
Annelid phylogeny



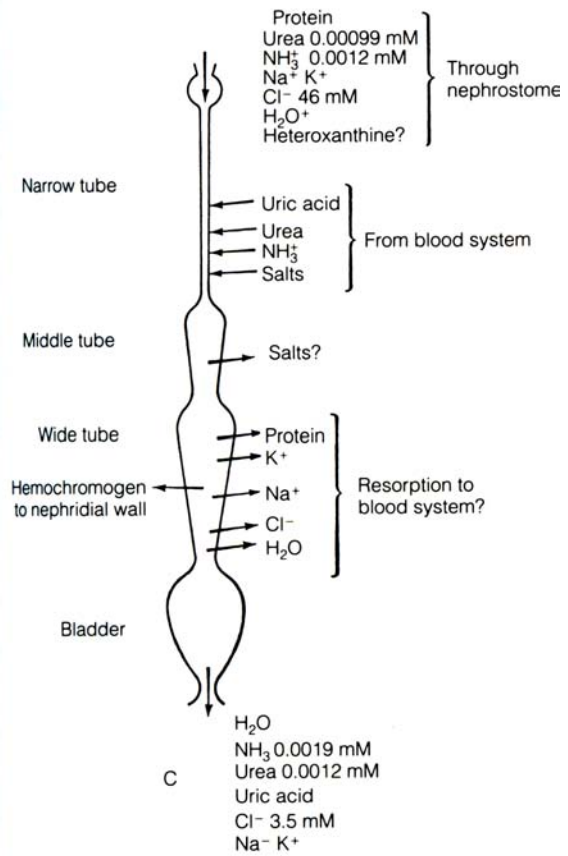
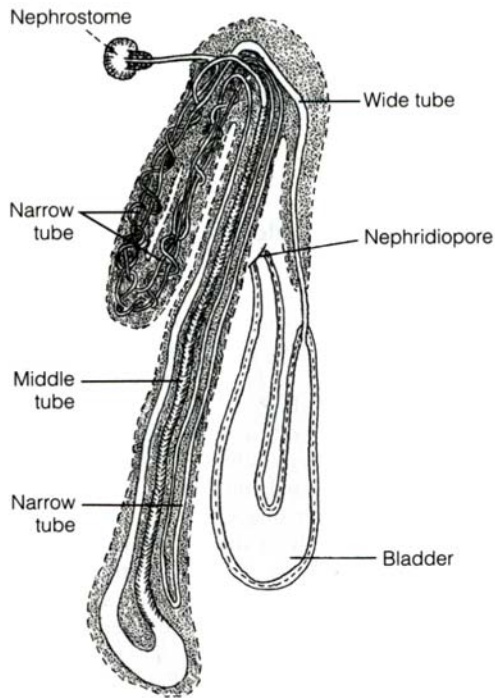
Annelid Segmentation



Annelid Cross section



Nephridia



Nitrogenous waste

↑ **H₂O solubility**

↑ **Toxicity**

N

Ammonia

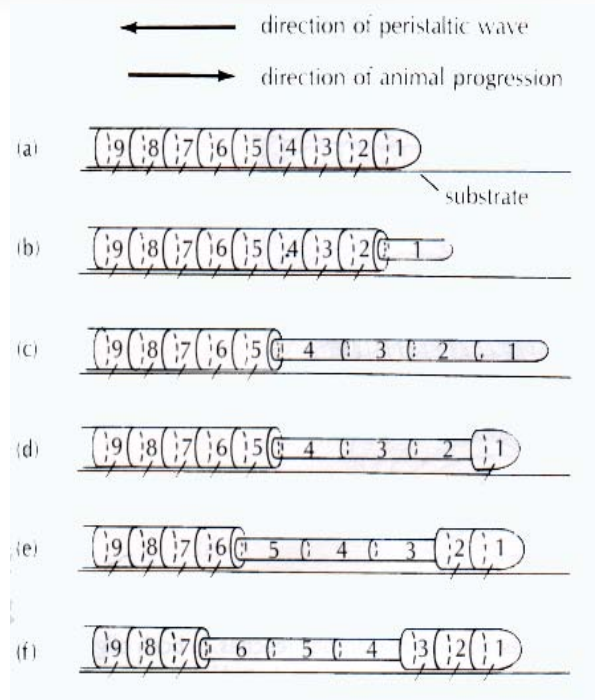
NC(=O)N

Urea

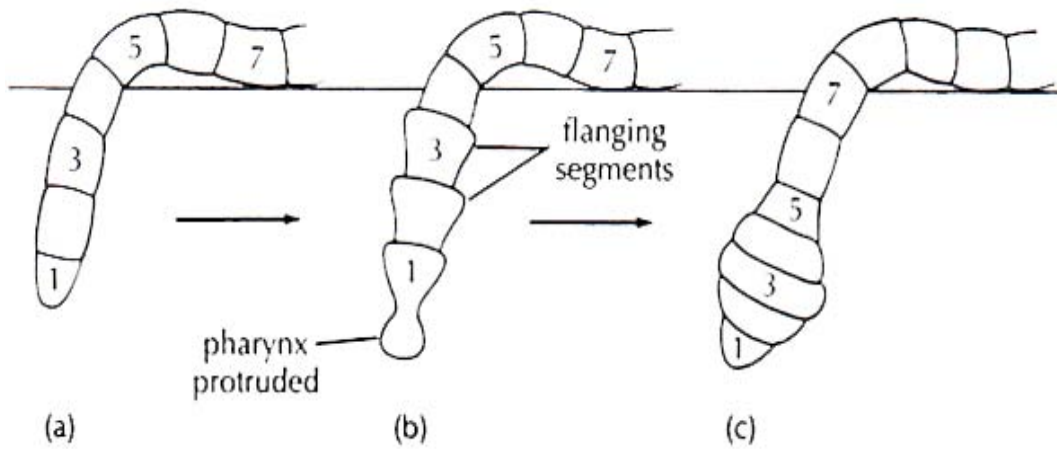
C1=NC2=C(N1)C(=O)N(C(=O)N2)C(=O)O

Uric acid

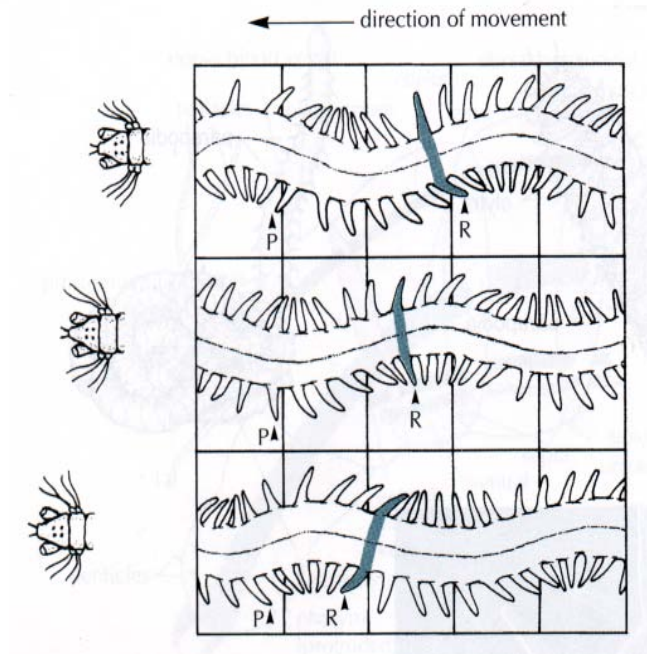
Annelid Locomotion



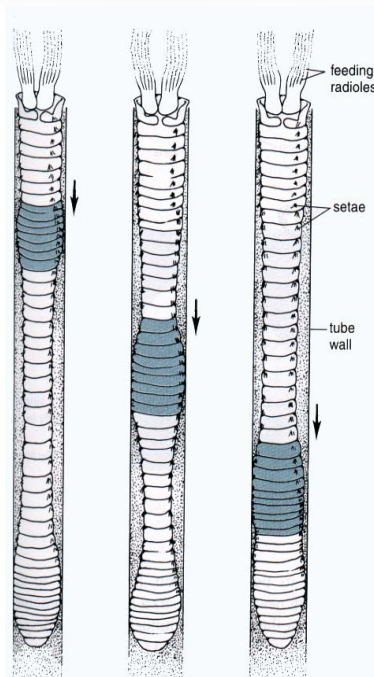
Annelid Burrowing



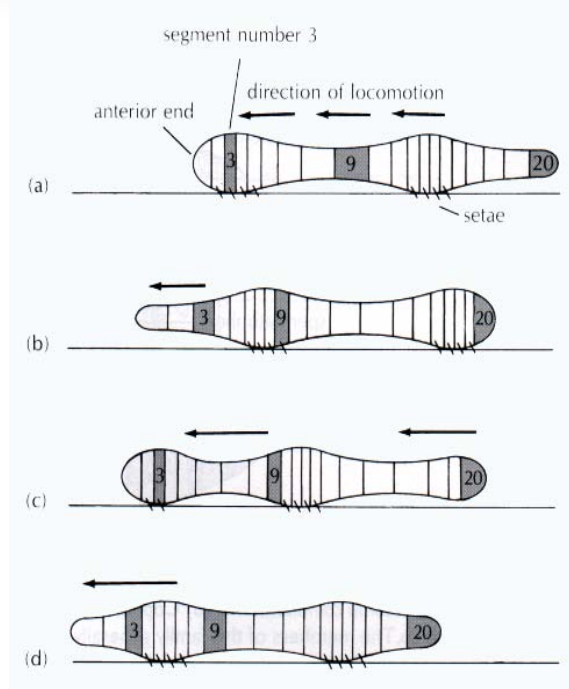
Sinusoidal Locomotion with Parapodia



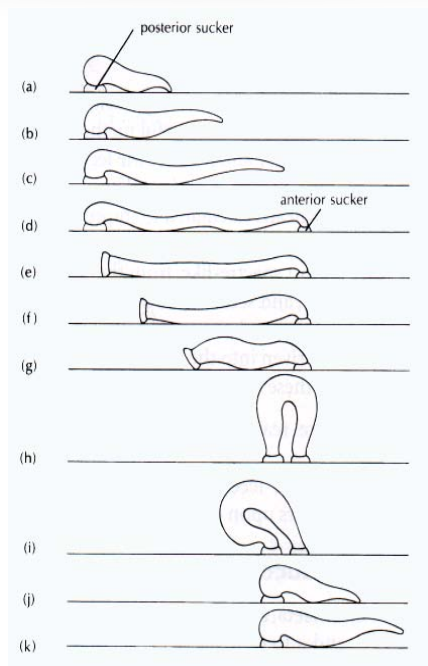
Peristaltic Waves [in tube-dwelling polychaete]



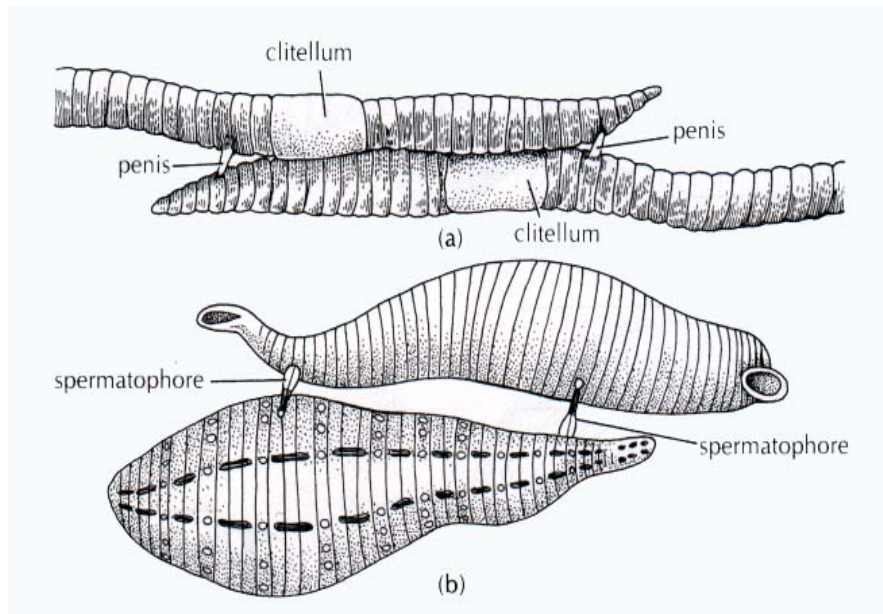
Annelid Locomotion



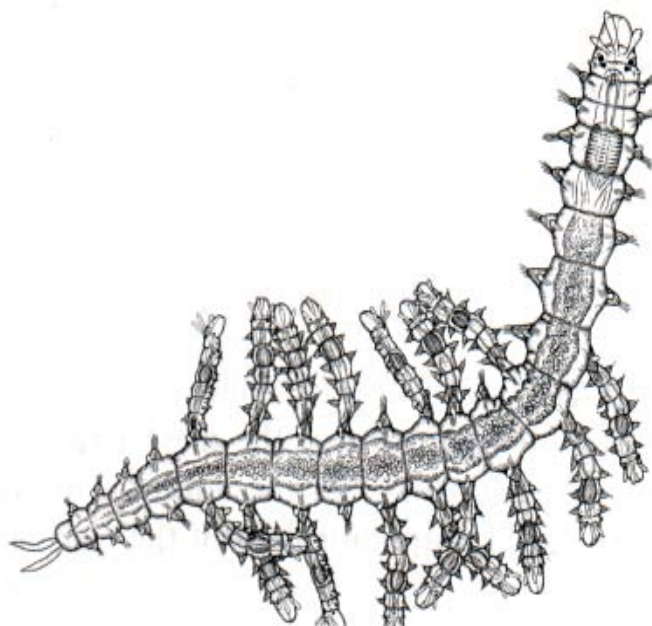
Inchworm Locomotion in Leech



Fertilization in Clitellates



Asexual Reproduction



Exogone gemmifera