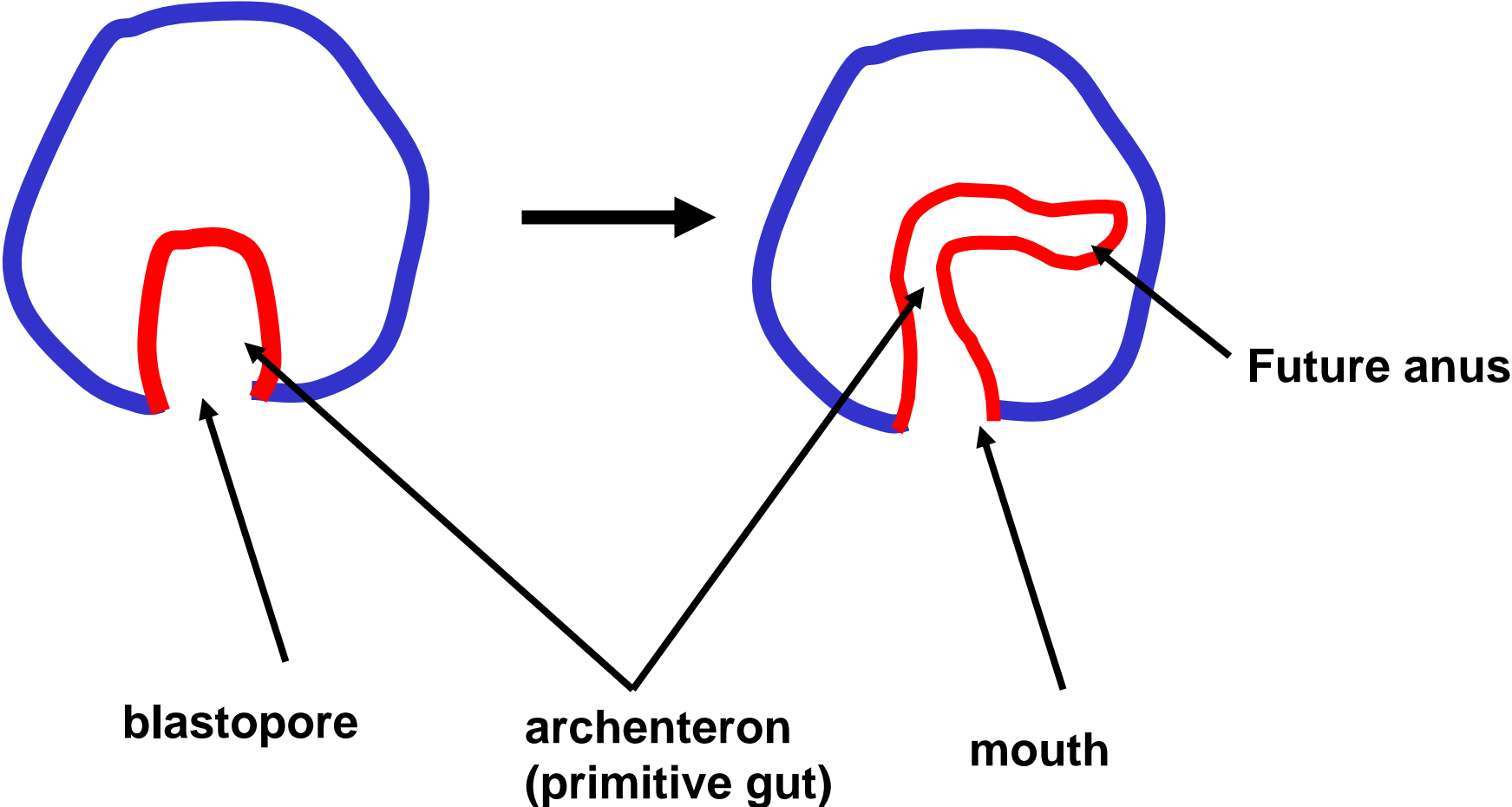
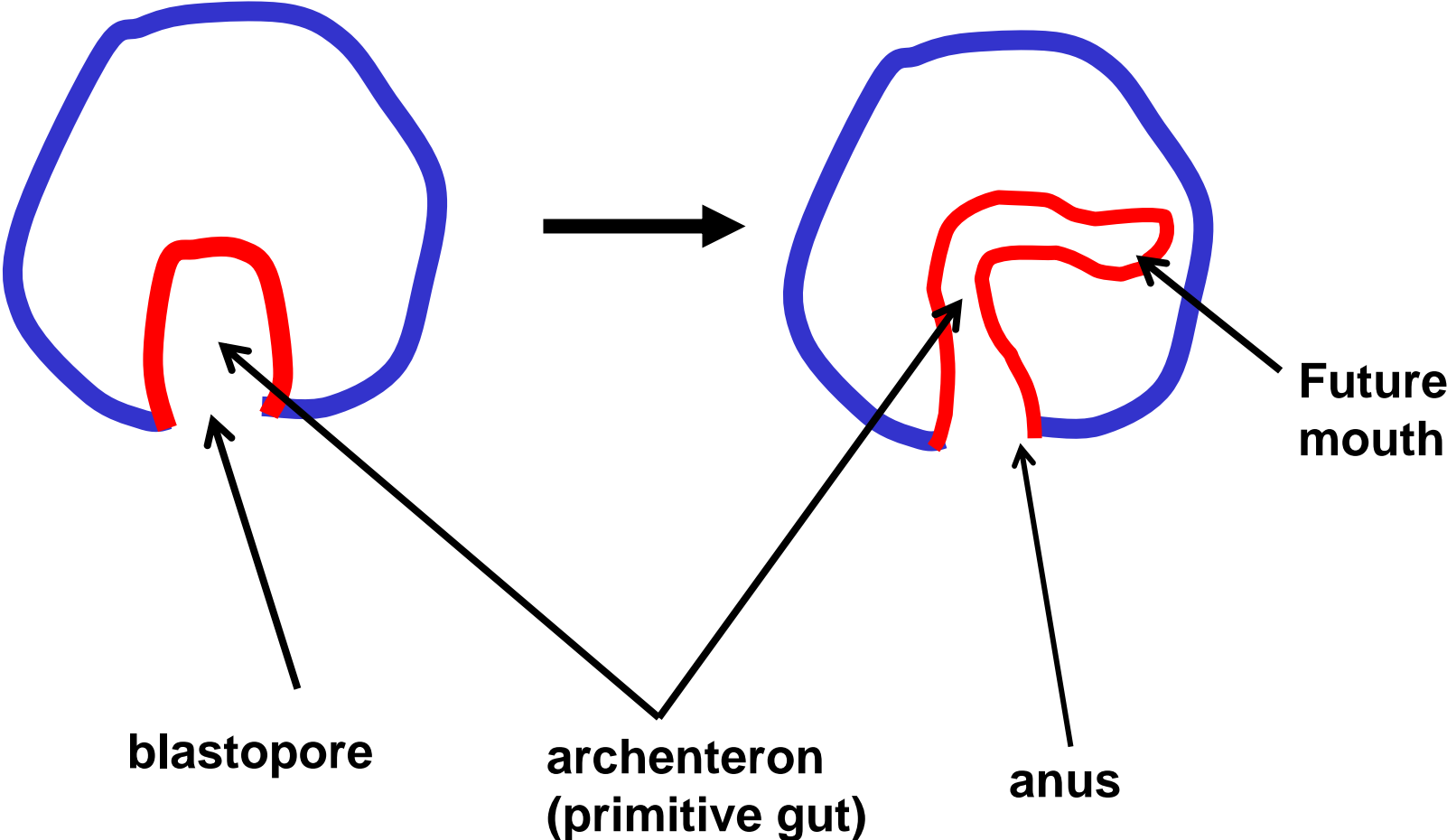


Protostome: blastopore becomes the mouth and the anus forms secondarily

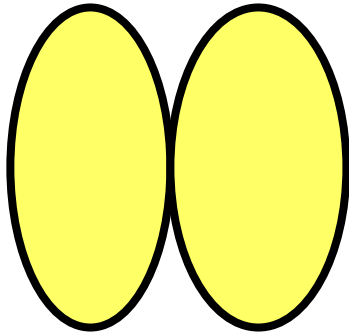


Deuterostome: blastopore becomes the anus and the mouth forms secondarily

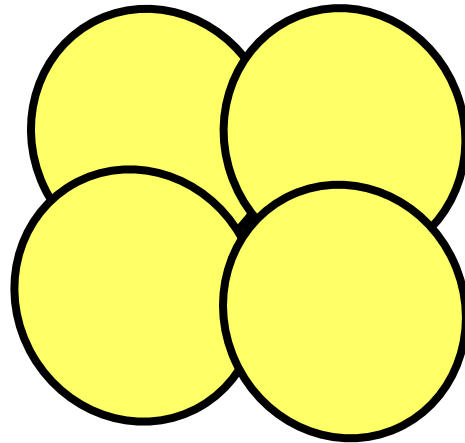


Protostome: spiral Cleavage

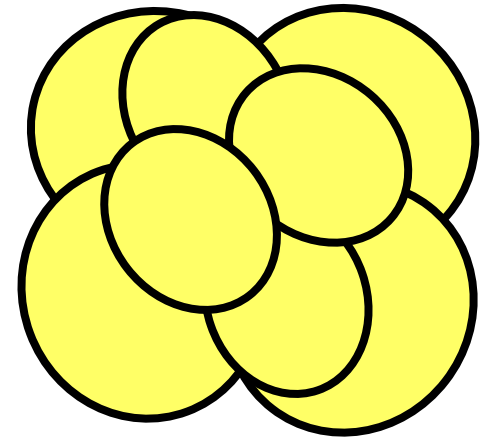
2 cells



4 cells



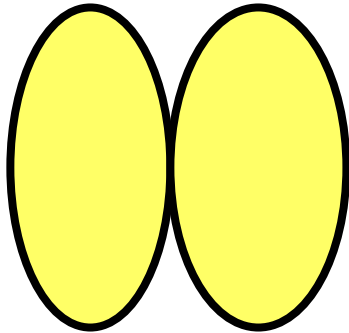
8 cells



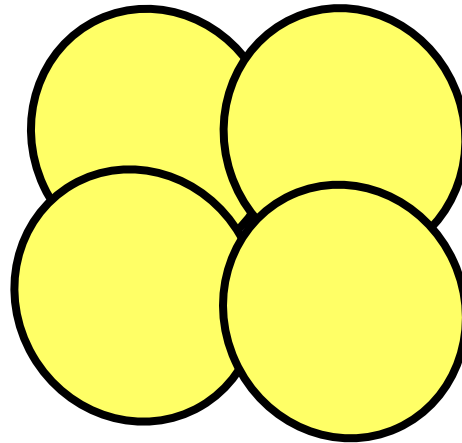
Blastomeres divide at an oblique angle to one another, so that each lies in the furrow created by the cells beneath them

Deuterostome: Radial Cleavage

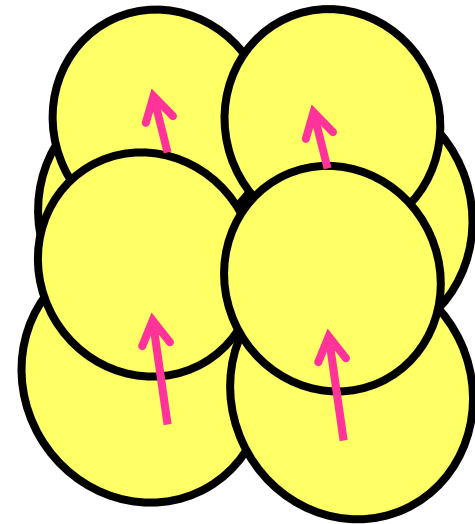
2 cells



4 cells

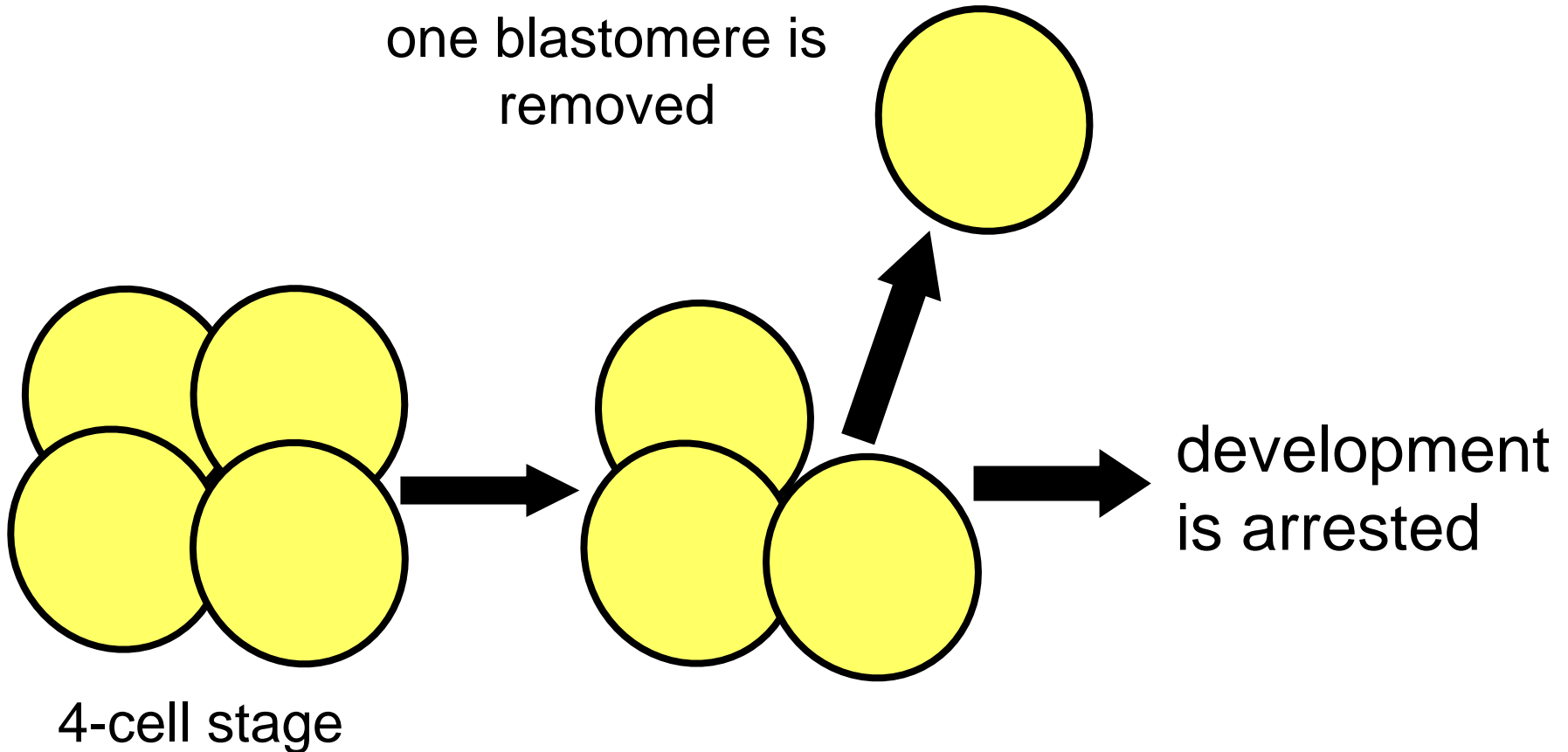


8 cells

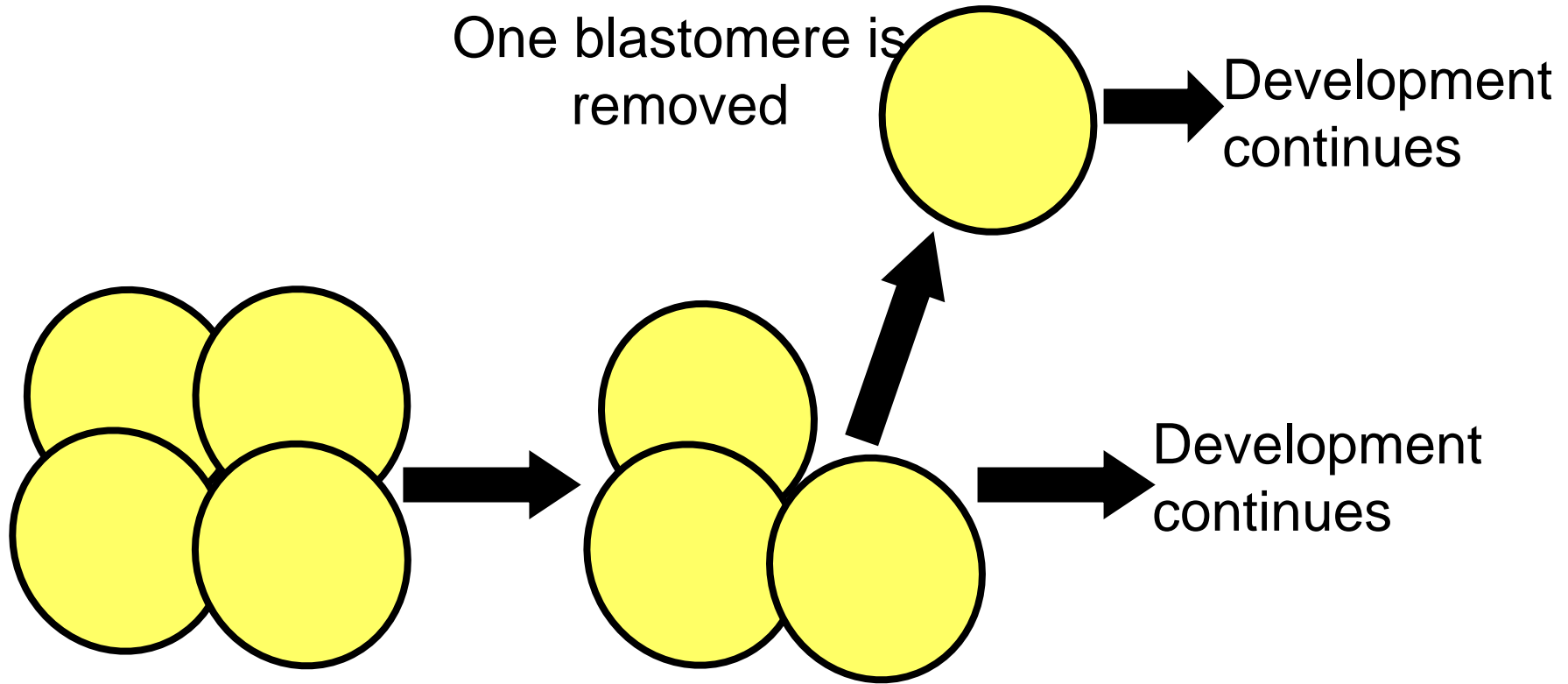


Blastomeres divide in a symmetrical fashion, producing layers of cells directly on top of one another

Protostome: mosaic Development



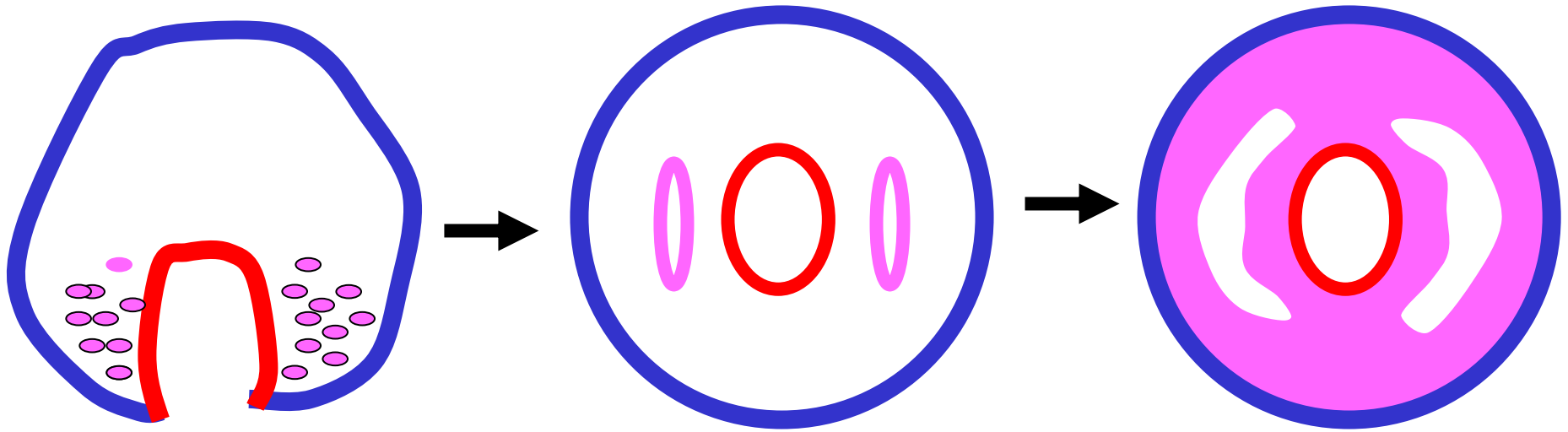
Deuterostome: regulative Development



4-cell stage

→ each blastomere is capable of regulating its development even when separated from the others

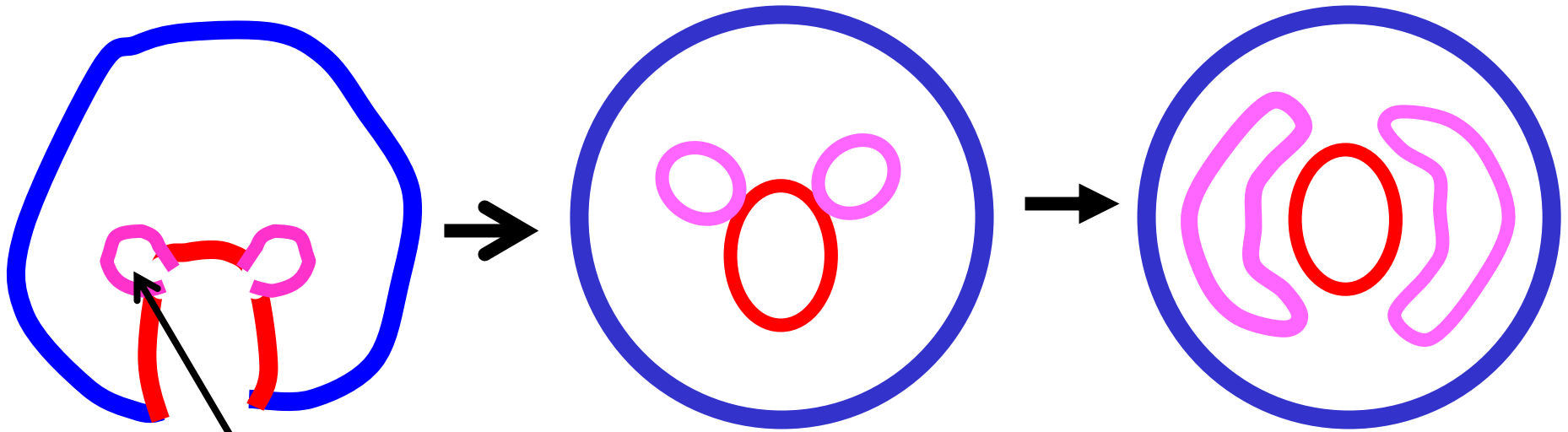
Protosome coelom formation: schizocoely



ectoderm
endoderm
mesoderm

coelom forms from a
split in the mesoderm

Deuterostome coelom formation: enterocoely



early
mesodermal
pouch

ectoderm

endoderm

mesoderm

coelom forms from an
outpocketing of the
archenteron

Protostome vs Deuterostome

Protostome

- blastopore becomes the mouth
- spiral / determinate cleavage
- mosaic development
- schizocoely

(Annelida, Arthropoda, Mollusca, Bryozoa*)

Deuterostome

- blastopore becomes the anus
- radial / indeterminate cleavage
- regulative development
- enterocoely

(Echinodermata, Chordata)



Phylum Annelida

the segmented worms



© David Scharf



Corbett Bank/istock.com

Annelida Characteristics

Triploblastic

Organ level of organization

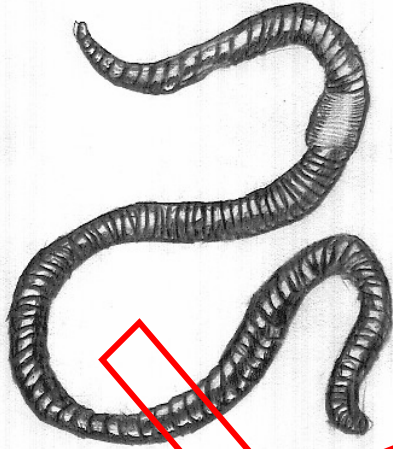
Bilateral Symmetry

Cephalization

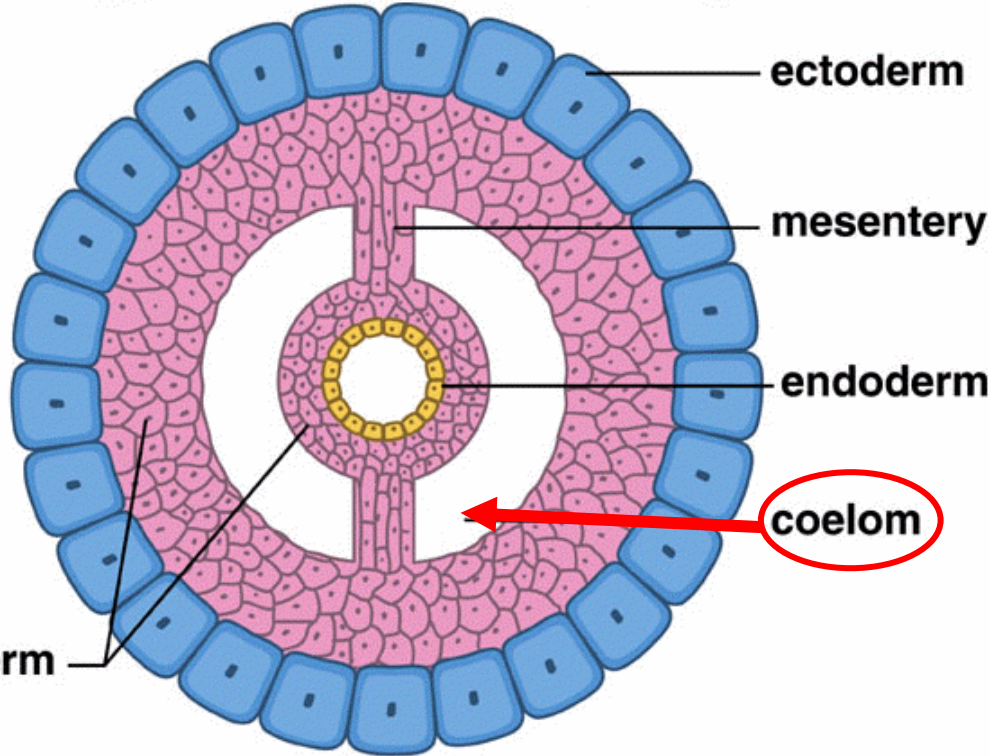
Annelida Characteristics

Eucoelomate

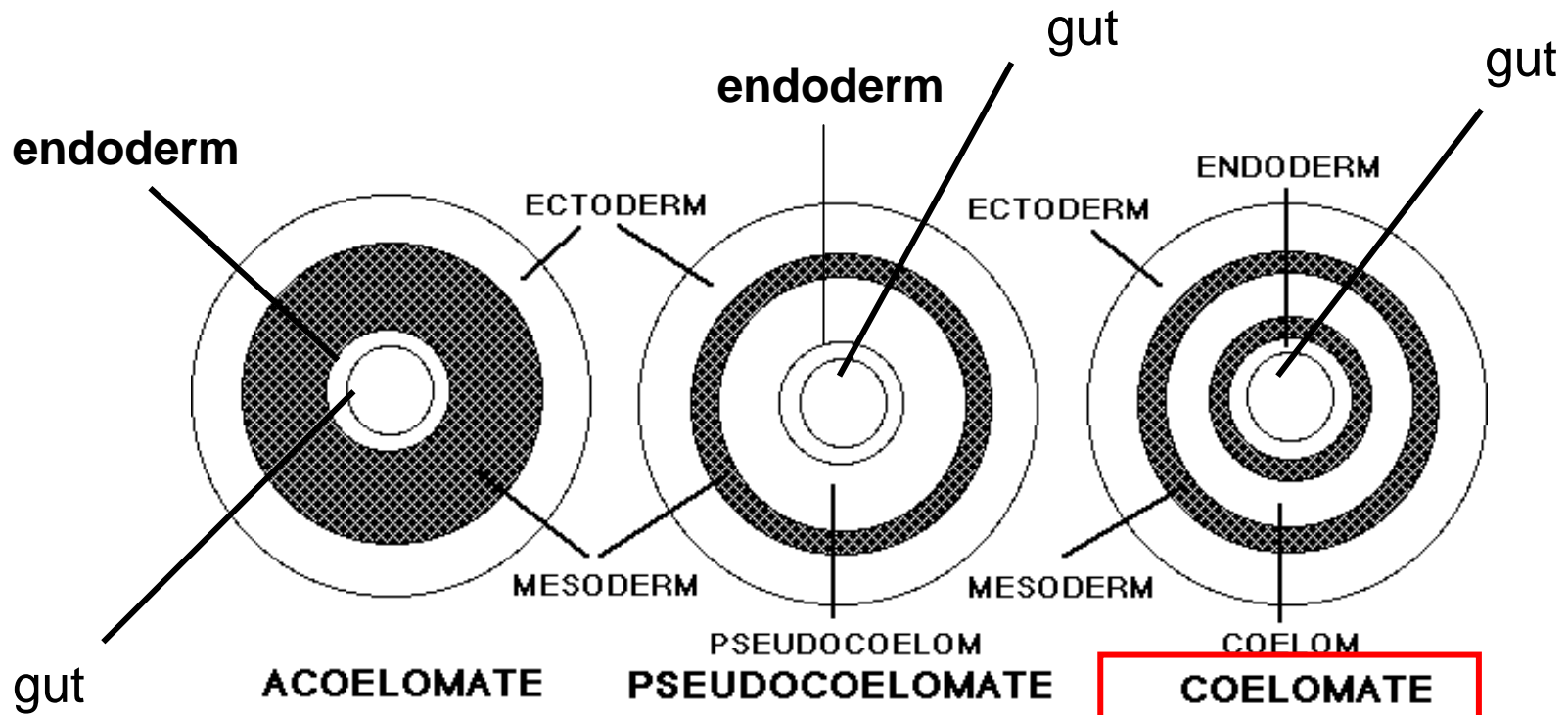
Have a “true” body cavity that is completely surrounded by mesoderm



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**c. Coelomate molluscs annelids arthropods
echinoderms chordates**



REDRAWN FROM: WHARTON, 1986 (PAGE 9)

Annelid Characteristics

the coelom

- is a closed, fluid filled cavity that surrounds the gut
- the fluid within acts as a circulatory system
- mesodermal membranes (mesenteries) suspend organs in the coelom

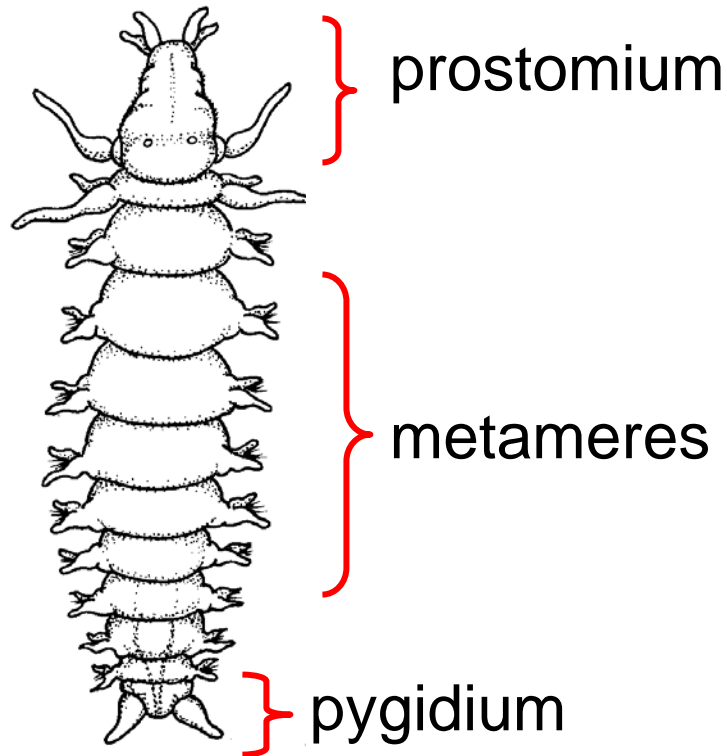
Annelida Characteristics

Protostome development

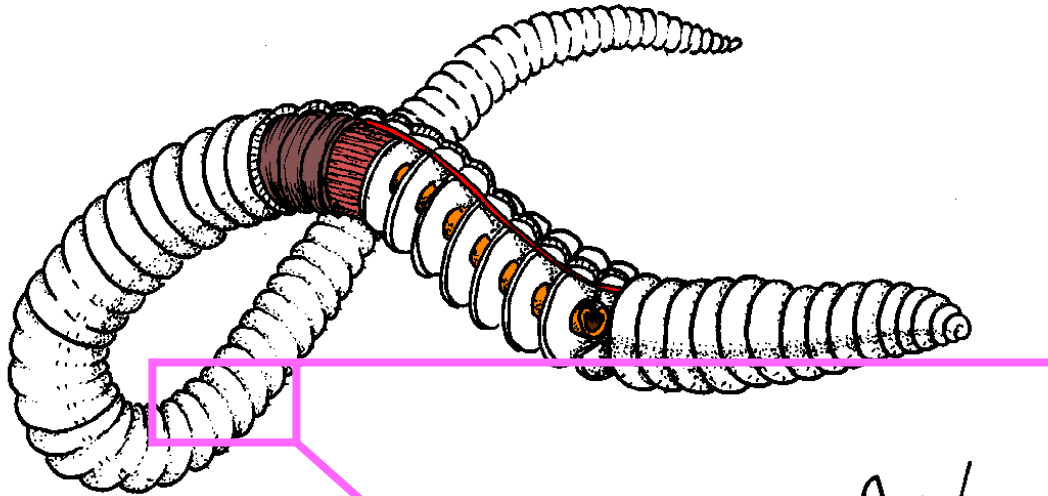
- blastopore becomes the mouth
- spiral / determinate cleavage
- mosaic development
- schizocoely

Annelida Characteristics

Body Plan



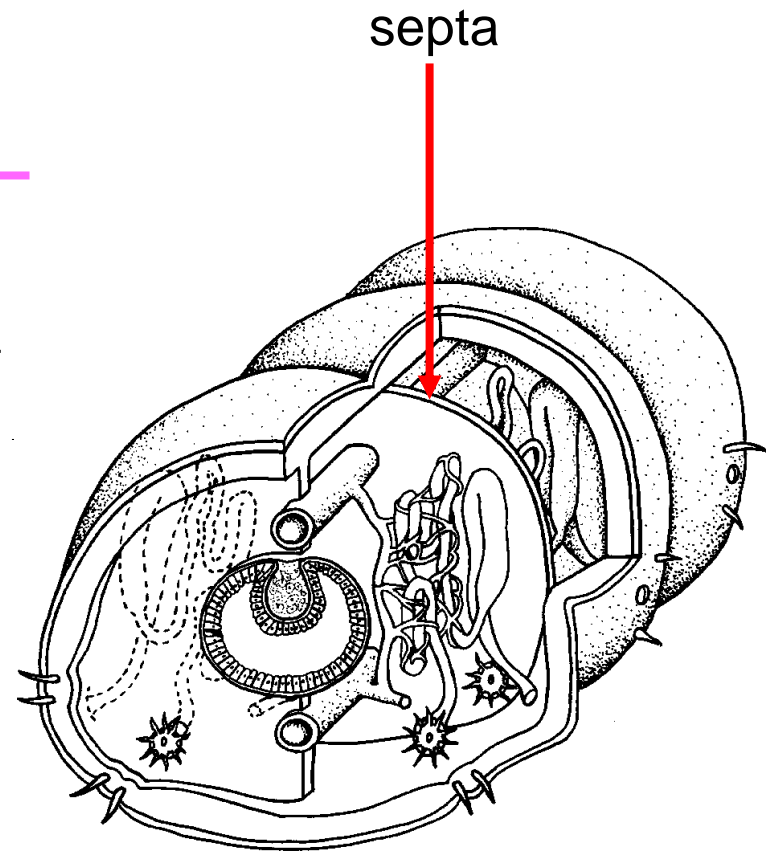
Metamerism: The body is made up of serially repeating, coordinated segments called metamerites that are separated from one another by septa.



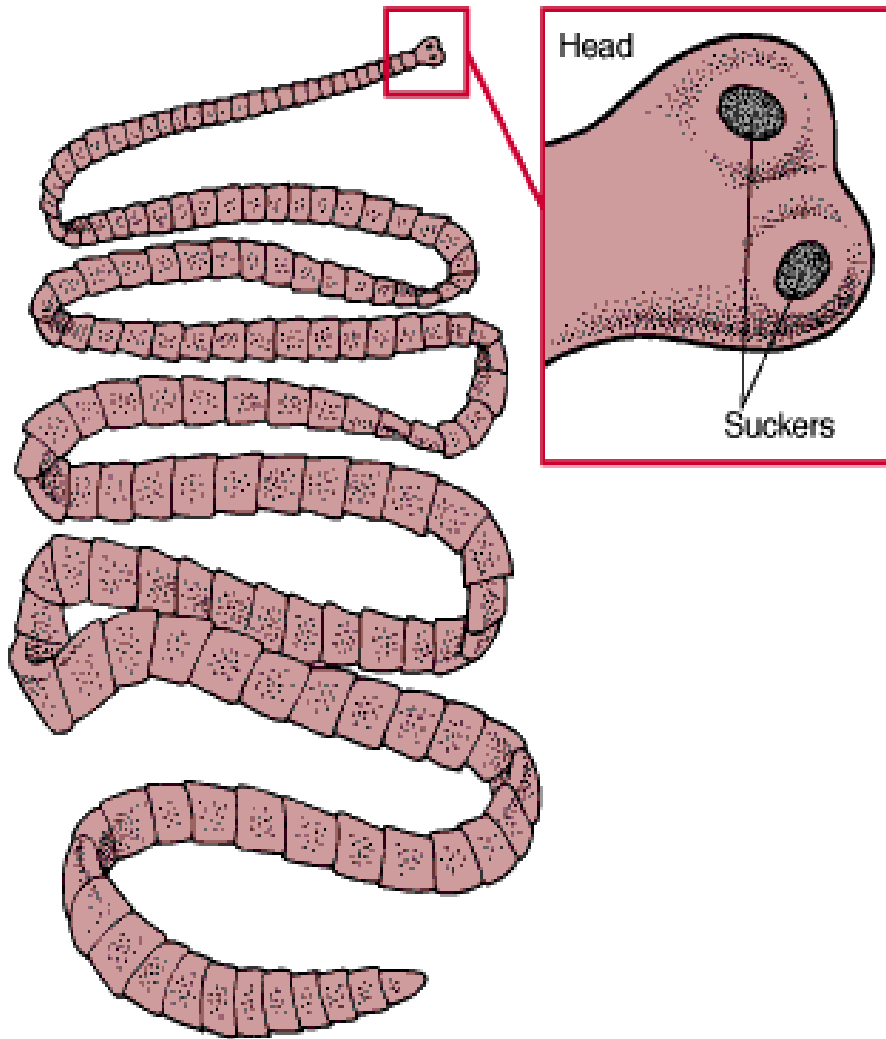
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Livingstone © BIODIDAC

Each metamere contains sets of repeating organs (e.g. gut, blood vessels, nerve cord, excretory organs)



Livingstone © BIODIDAC



How are proglottids different from true metameres?

1. Proglottids are not coordinated.
2. Proglottids only contain reproductive organs.

Annelid Characteristics

Feeding and Digestion

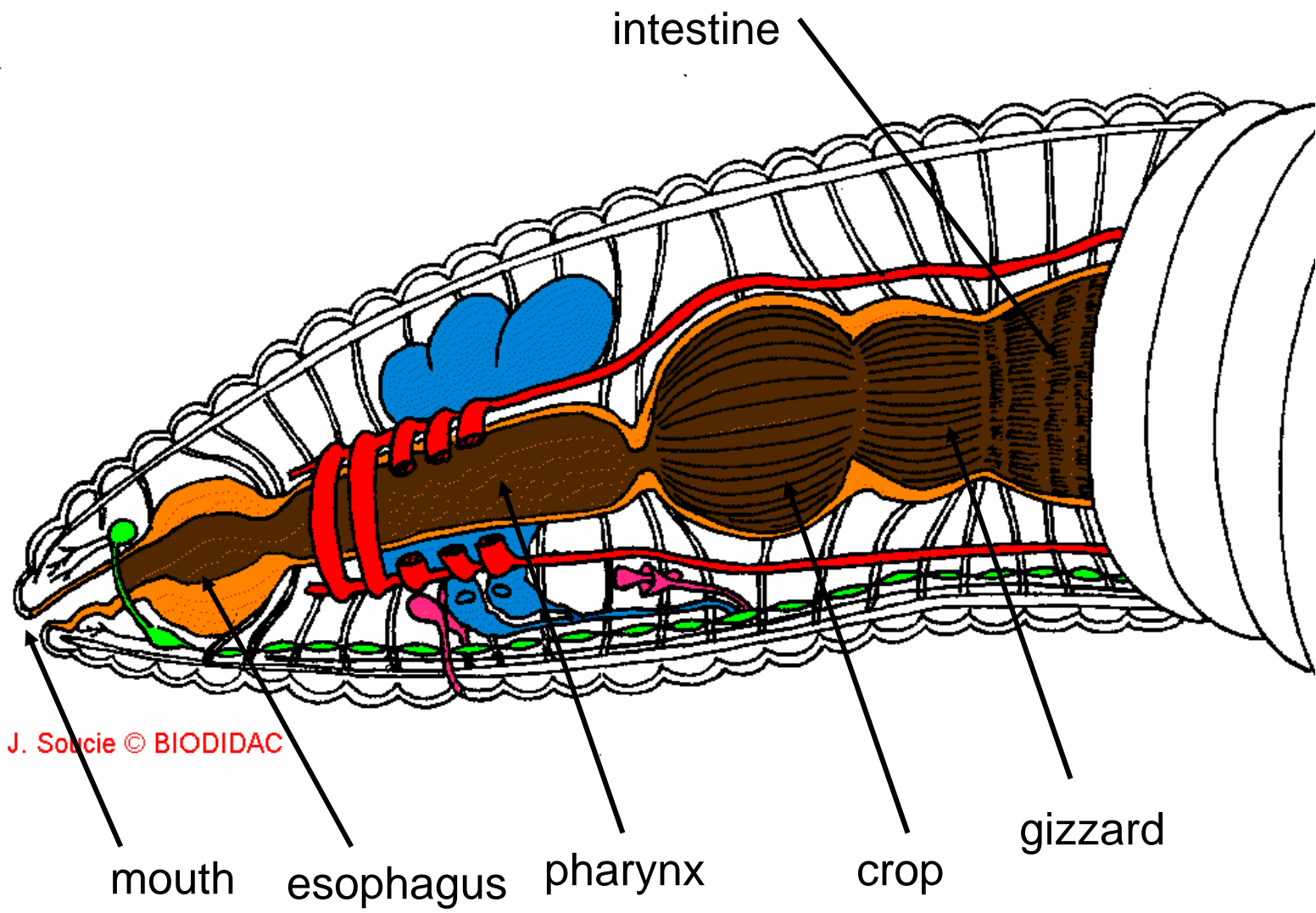
- Free living and parasitic species



Annelid Characteristics

Digestive System

- complete
- regional specialization



intestine

J. Soucie © BIODIDAC

mouth

esophagus

pharynx

crop

gizzard

Annelida Characteristics

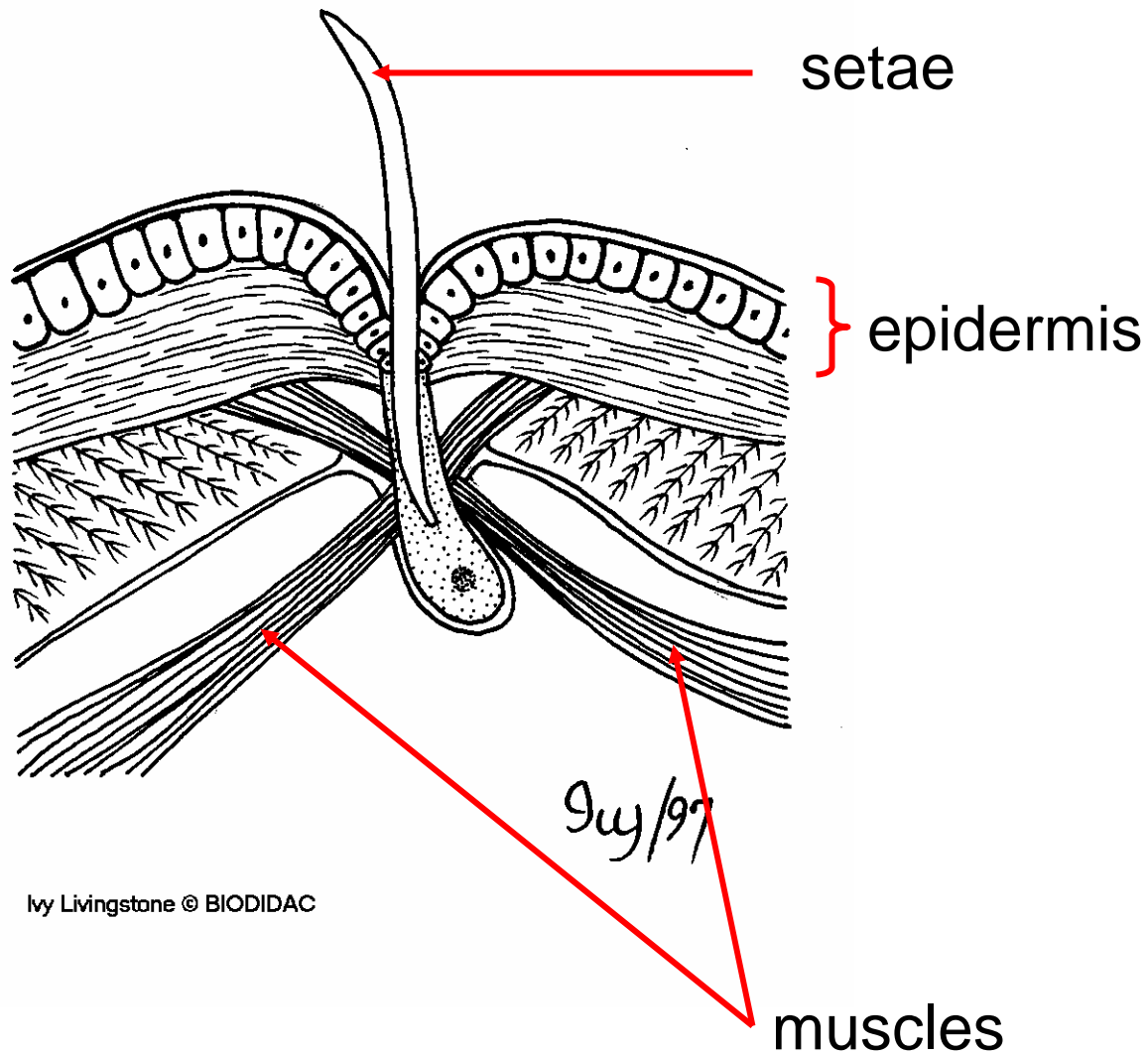
Skeletal System

- fluid in coelom acts as a hydrostatic skeleton

Annelida Characteristics

Locomotion

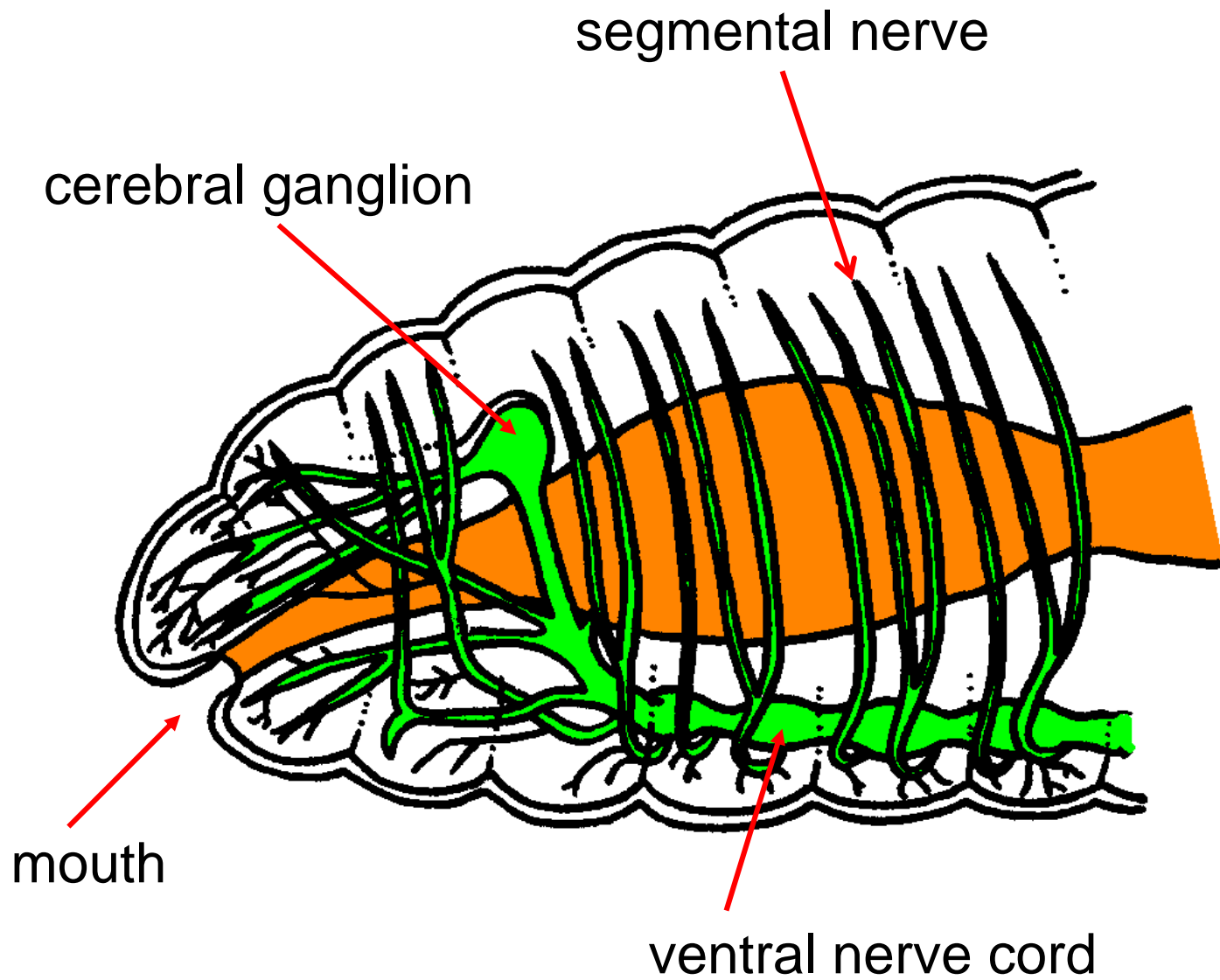
- both longitudinal and circular muscles
- most have setae (chitinous bristles secreted by the epidermis) that aid in locomotion and burrowing



Annelida Characteristics

Nervous system

- 2 cerebral ganglia
- a ventral nerve cord with 2 ganglia per metamere.
- In some species, sensory organs such as eyes, palps, and tentacles have arisen



Annelid Characteristics

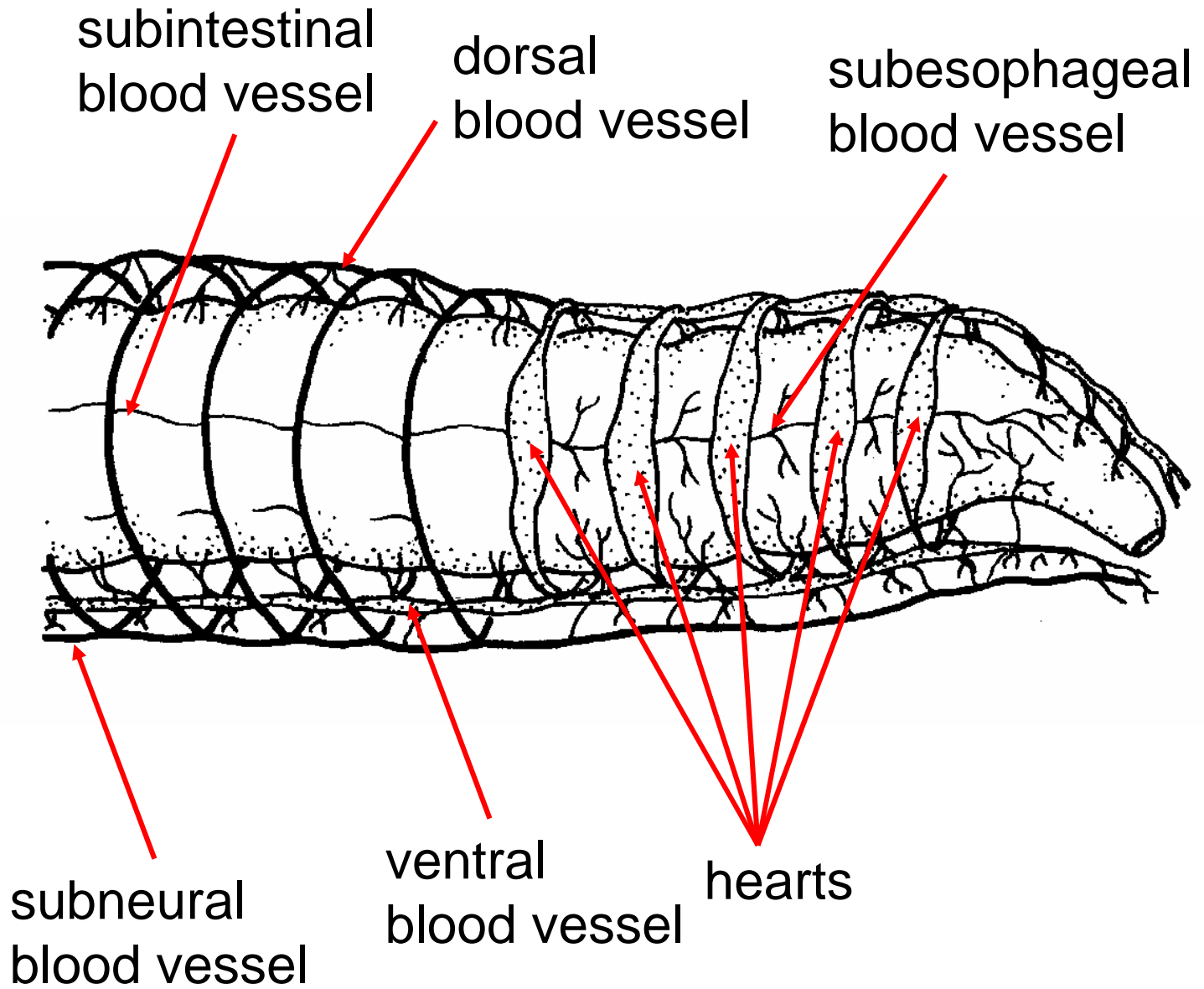
Gas exchange

- mainly by diffusion
- Some Annelids have specialized structures for gas exchange (e.g. parapodia, gills)

Annelid Characteristics

Circulatory System

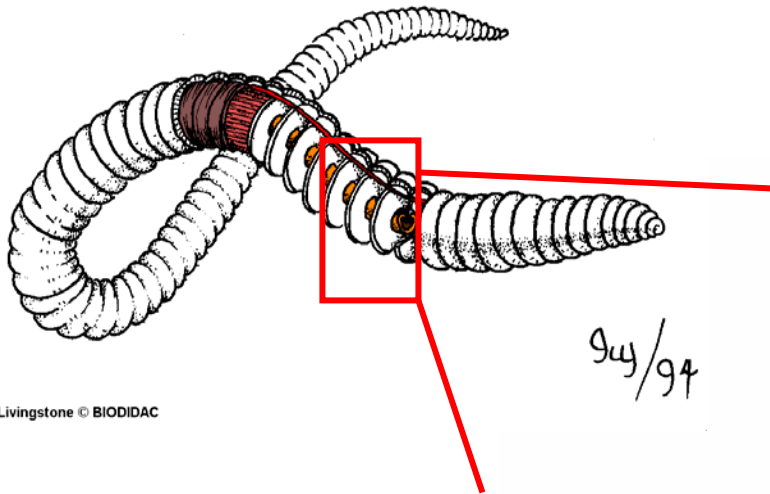
- closed circulatory system composed of blood vessels (some of which are contractile and act as “hearts”)
- some circulation is also accomplished by the coelomic fluid



Annelid Characteristics

Excretion/ osmoregulation

- excretion is accomplished by organs called nephridia (singular nephridium)
- there are usually 2 nephridia per metamere

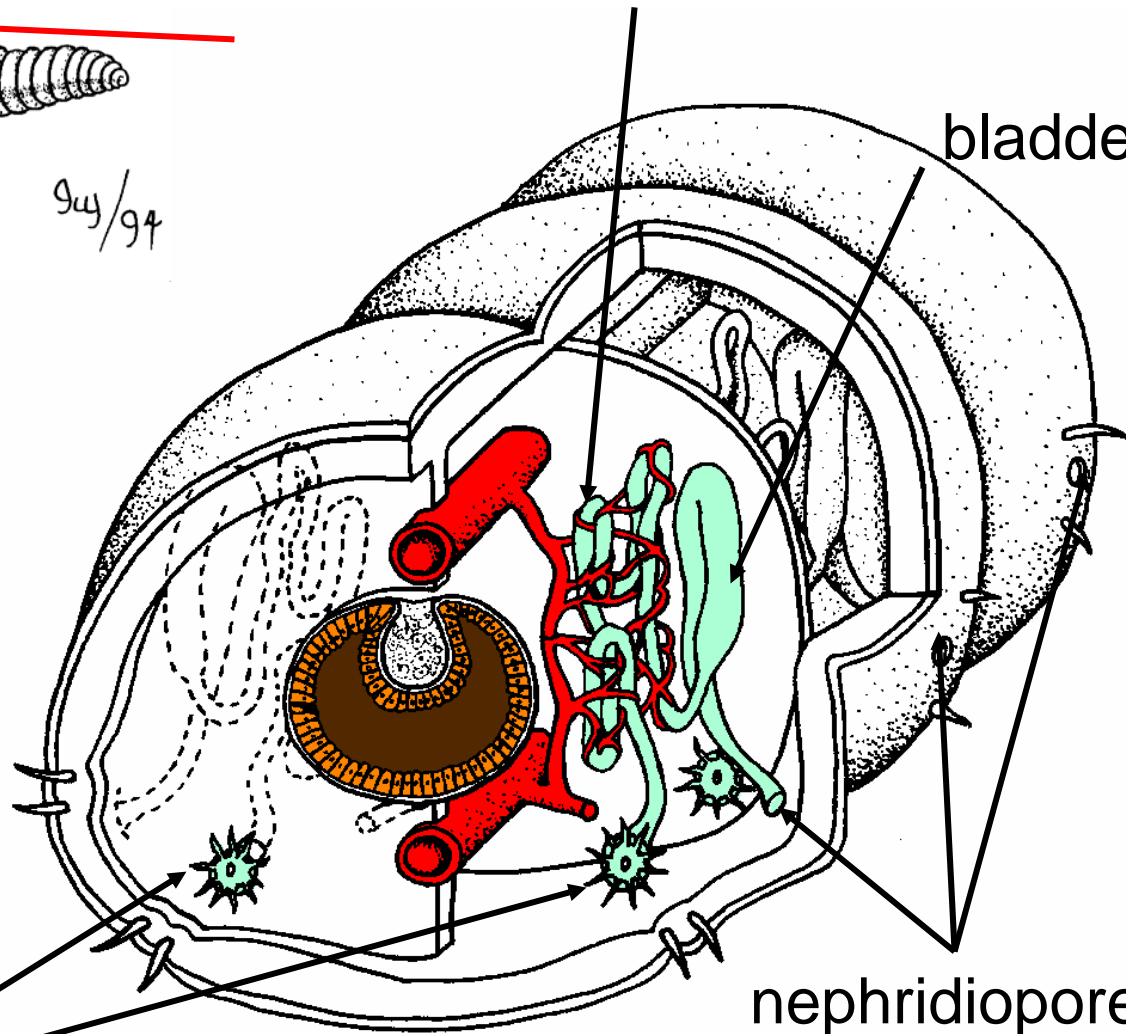


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tubules and capillaries

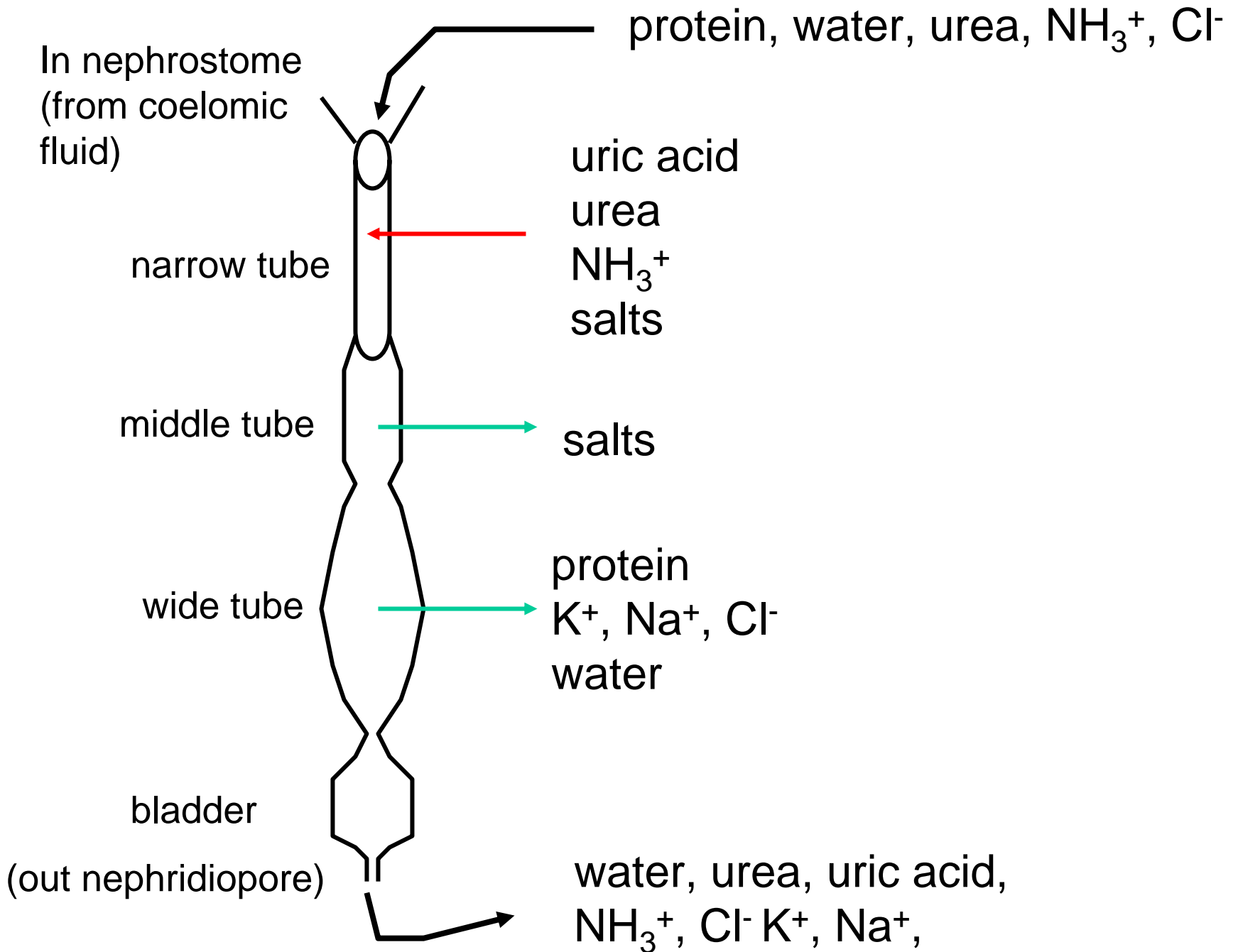
bladder



nephrostome

nephridiopores

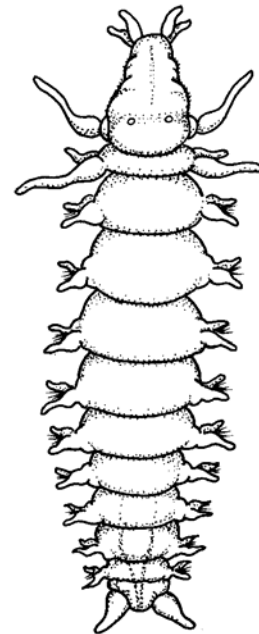
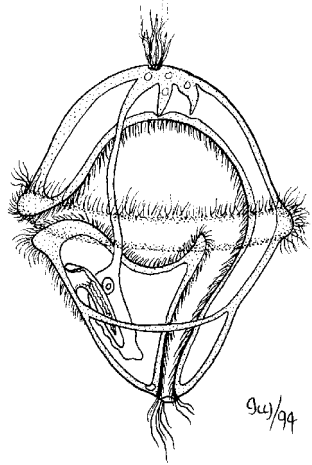
J. Soucie © BIODIDAC



Annelid Characteristics

Reproduction

- sexual: monoecious or dioecious
- Most species have a trochophore larva



Phylum Annelida

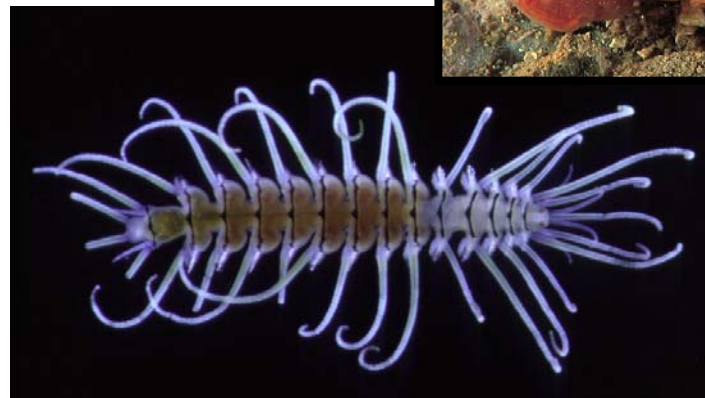
Class Polychaeta

Class Oligochaeta

Class Hirudinea

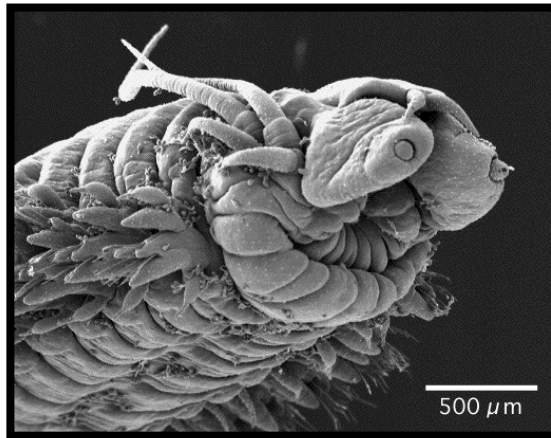


Class Polychaeta



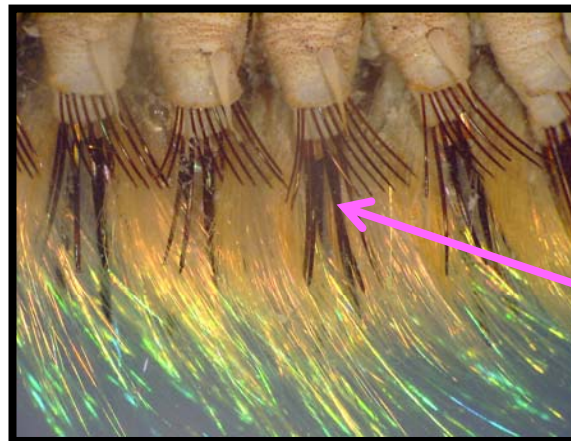
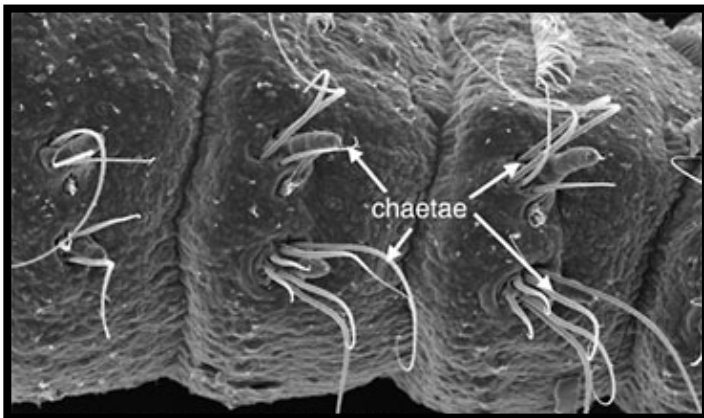
Class Polychaeta

- all marine
- this class contains 2/3 of all known Annelids (approx. 10, 000 species)
- have a well developed head with specialized sense organs

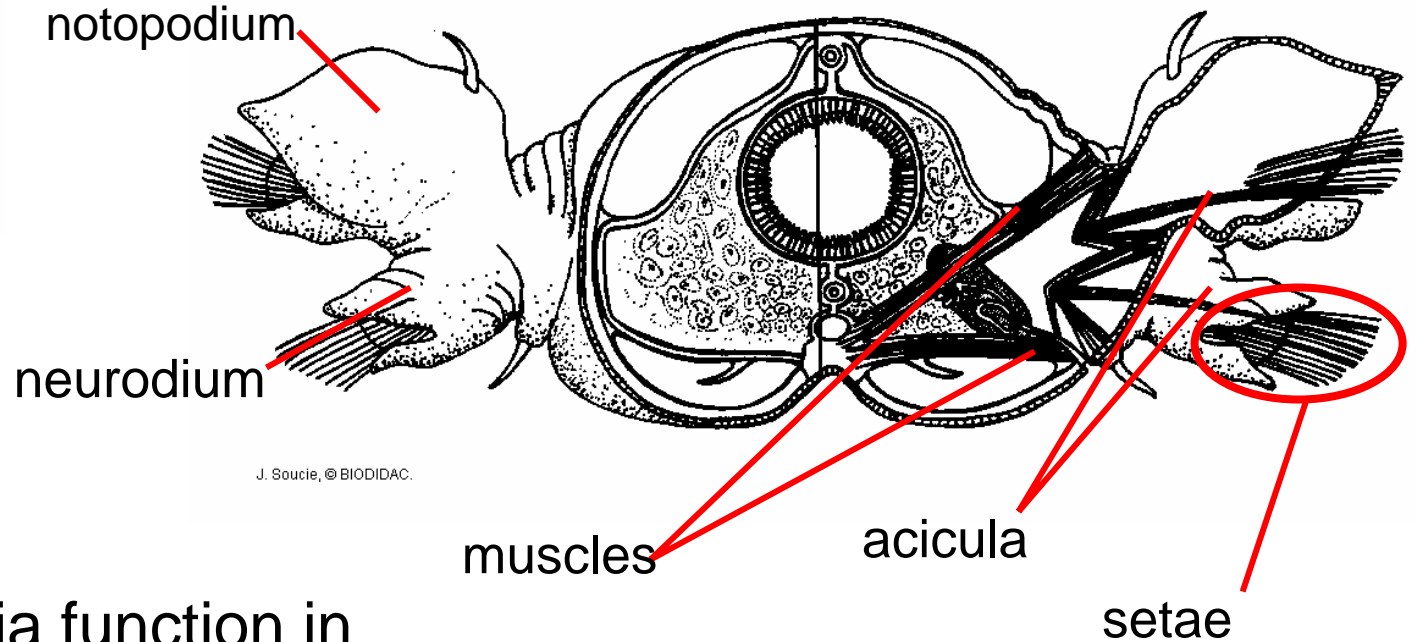
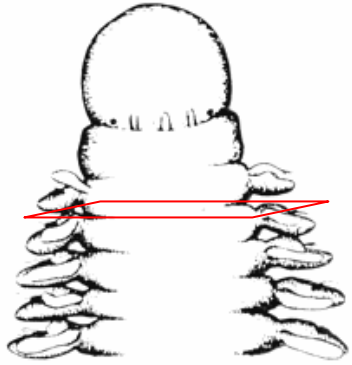


Class Polychaeta

- have many setae (chitinous bristles secreted by the epidermis)
 - (Poly = many, chaeta= setae)
- these setae are arranged in bundles on paddle-like appendages called parapodia

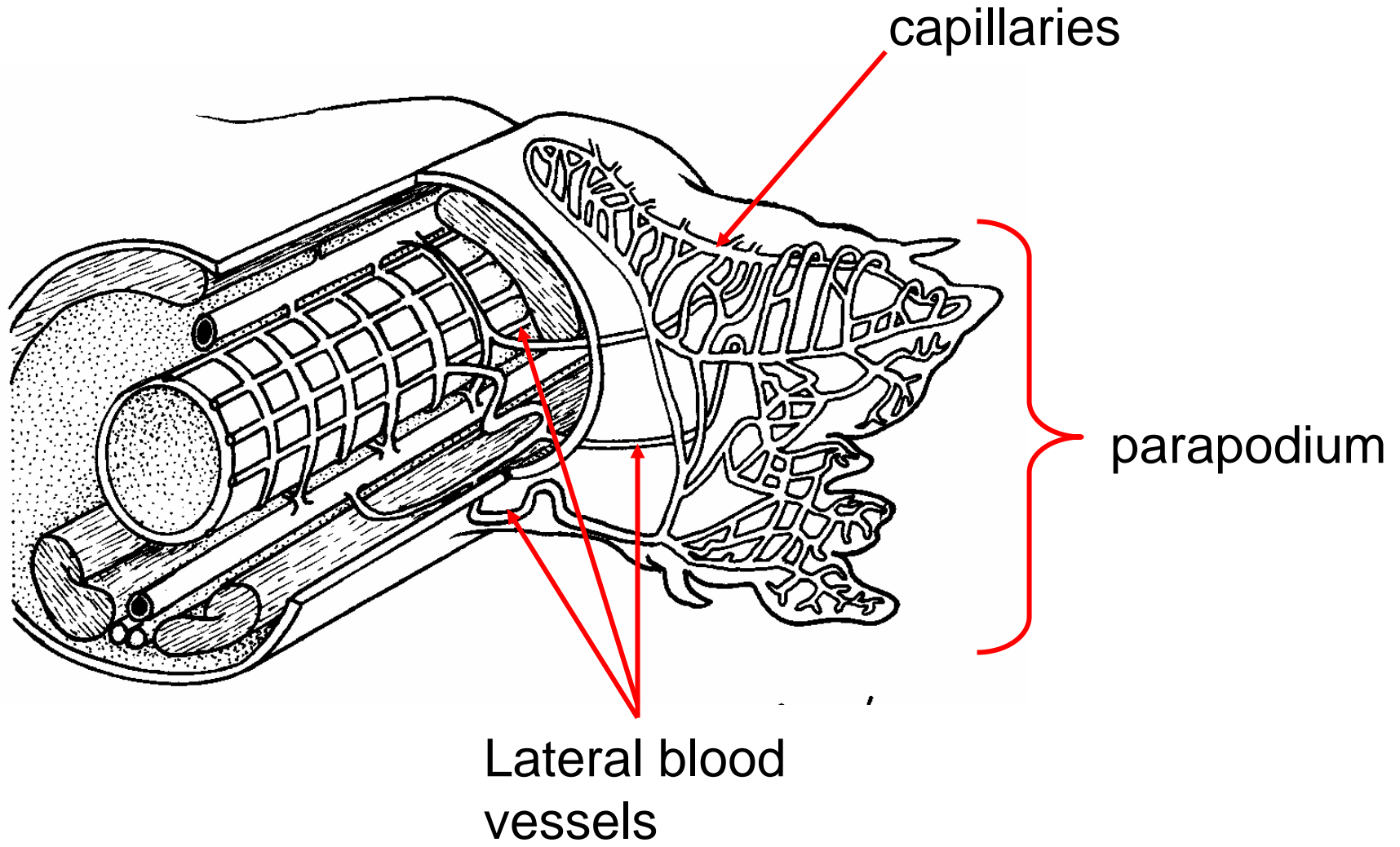


Class Polychaeta



J. Soucie, © BIODIDAC.

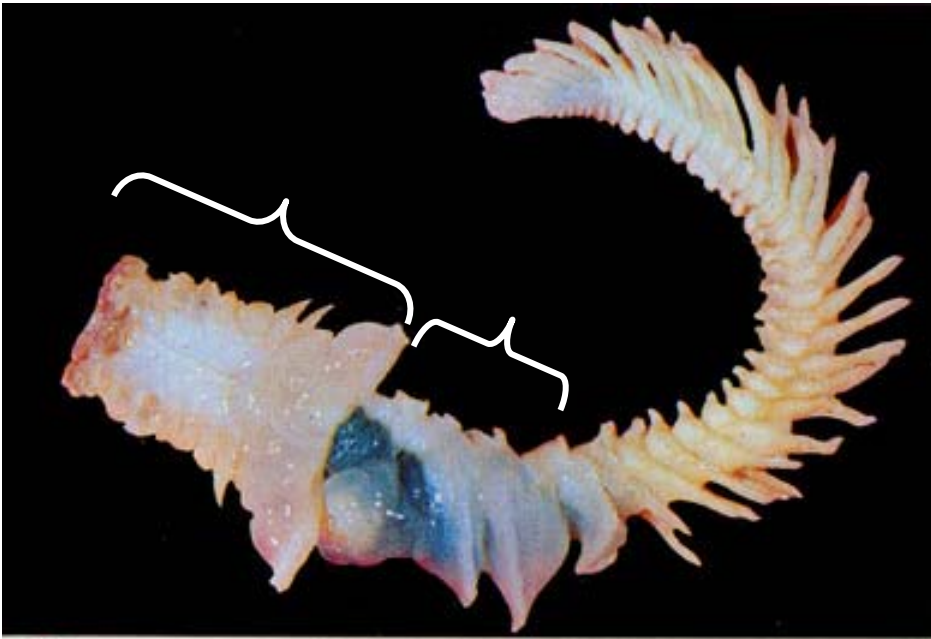
The parapodia function in gas exchange, locomotion, and feeding.



Class Polychaeta

Tagmatization (tagmosis)

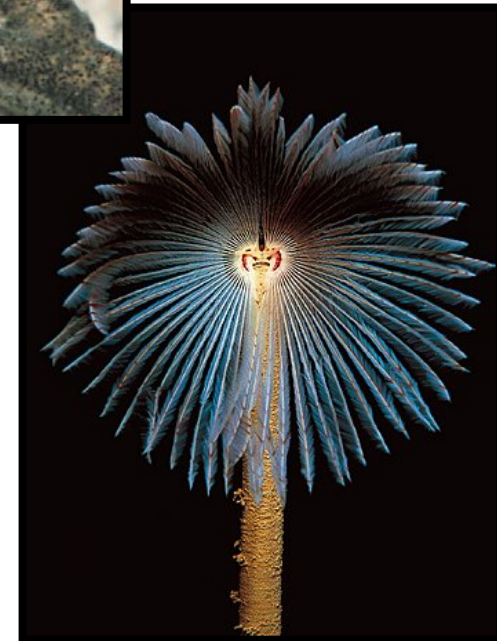
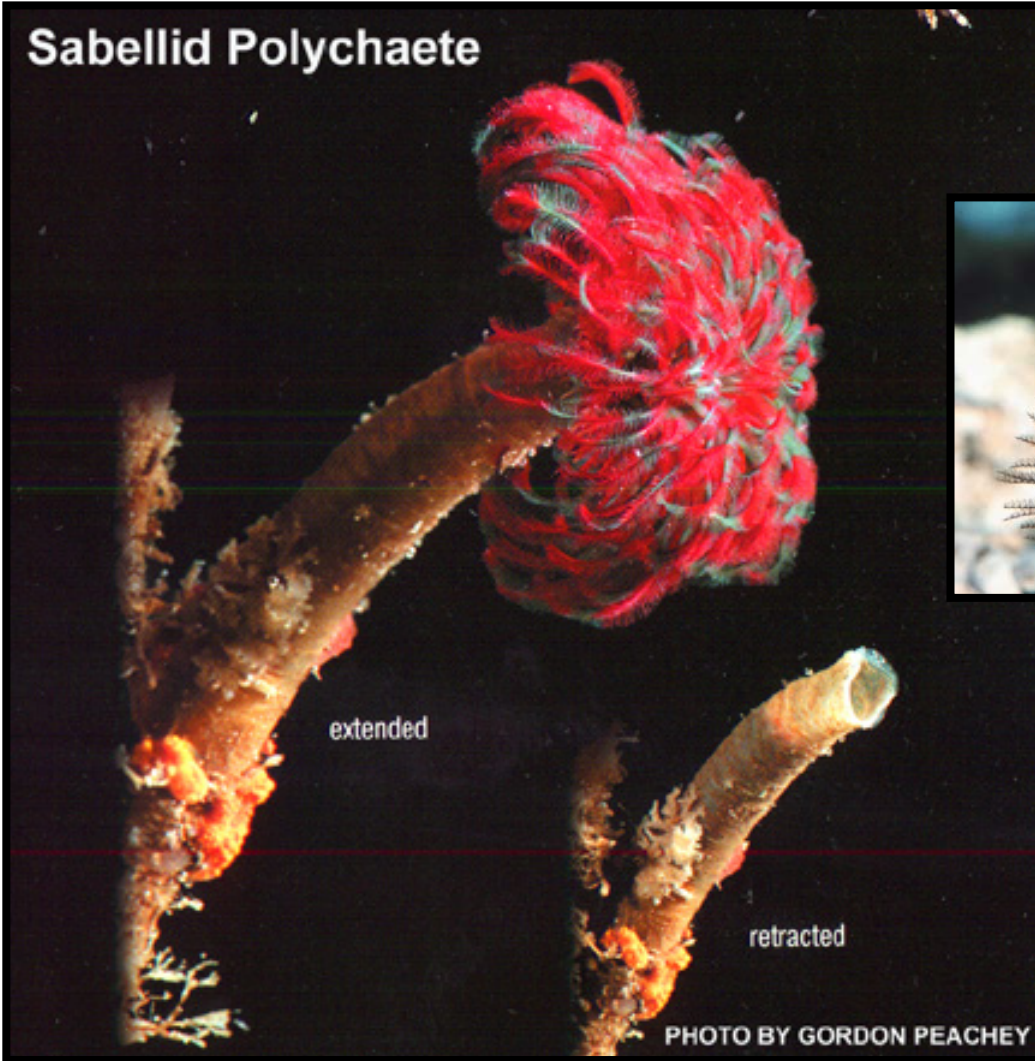
- the fusion and specialization of formerly metameric segments



Class Polychaeta

Sabellid Polychaete

Many are filter-feeders with specialized structures



Class Polychaeta



Many are predatory with specialized structures



Class Polychaeta



Many construct their own homes out of CaCO_3 or sand debris and mucous



Class Polychaeta

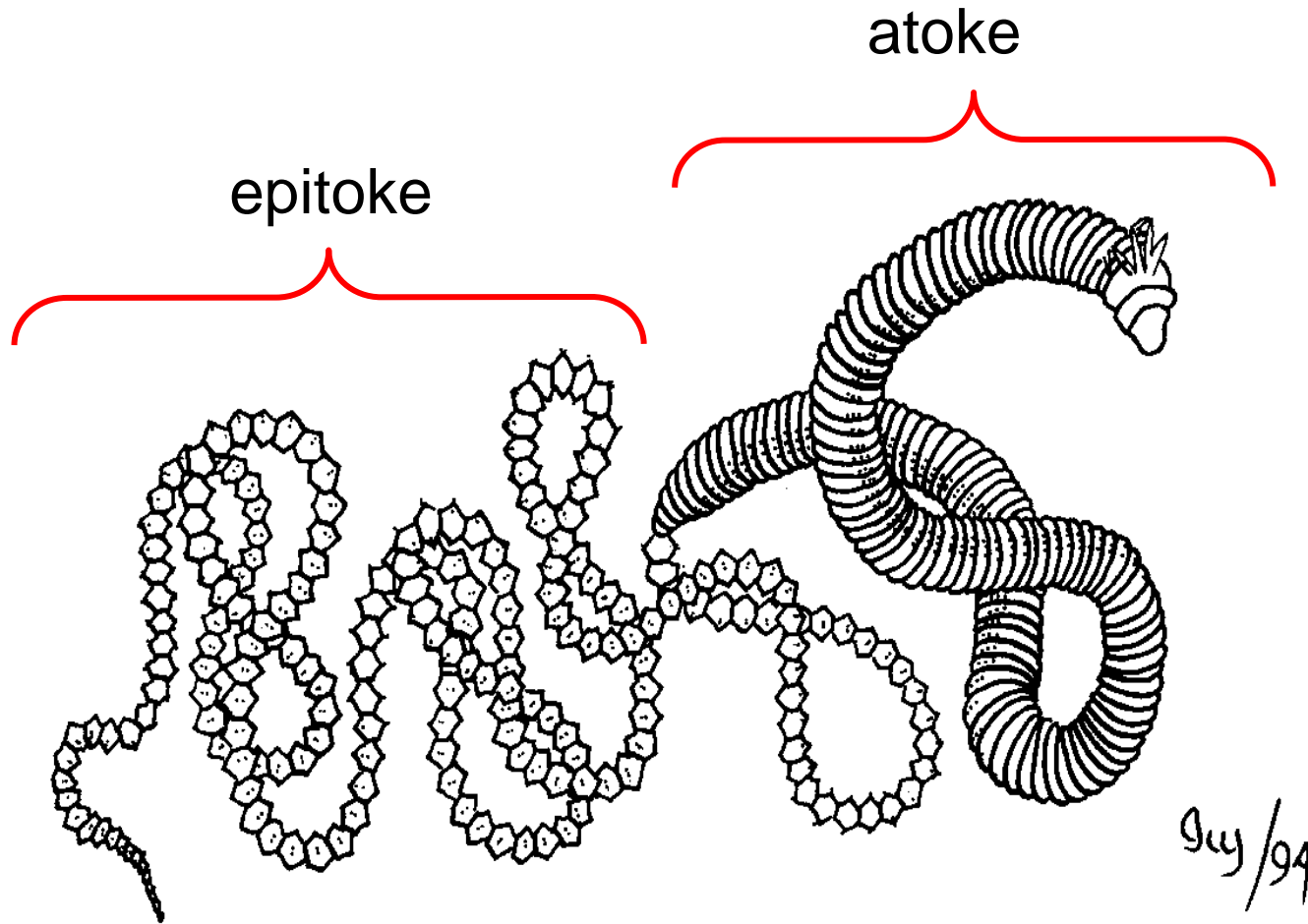
Reproduction

- usually dioecious
- no permanent sex organs; gametes are shed into coelom
- fertilization is usually external
- indirect development → trocophore larvae



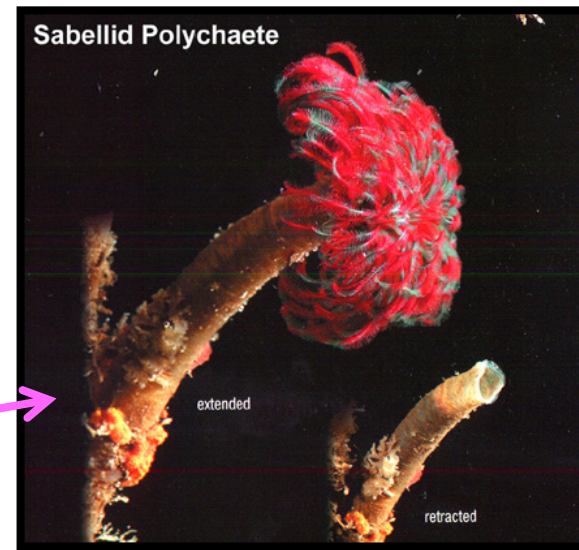
Class Polychaeta

Epitoky



Ecology

- Polychaetes often have effective defense strategies:
 - some have tubes to hide in
 - some have vicious jaws
 - some have modified “stinging” setae



a fireworm



Ecology

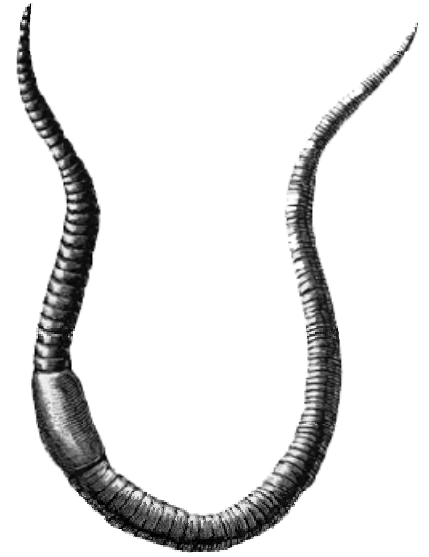


- **Some Polychaetes have a mutualistic relationship with their host**

- **for example, many scaleworms are found near, or in the mouth, of brittlestars, starfish, and sea urchins.**

- **The scaleworm eats its host's leftovers and with its vicious jaws, it will attack any predator trying to eat it's host.**





Class Oligochaeta



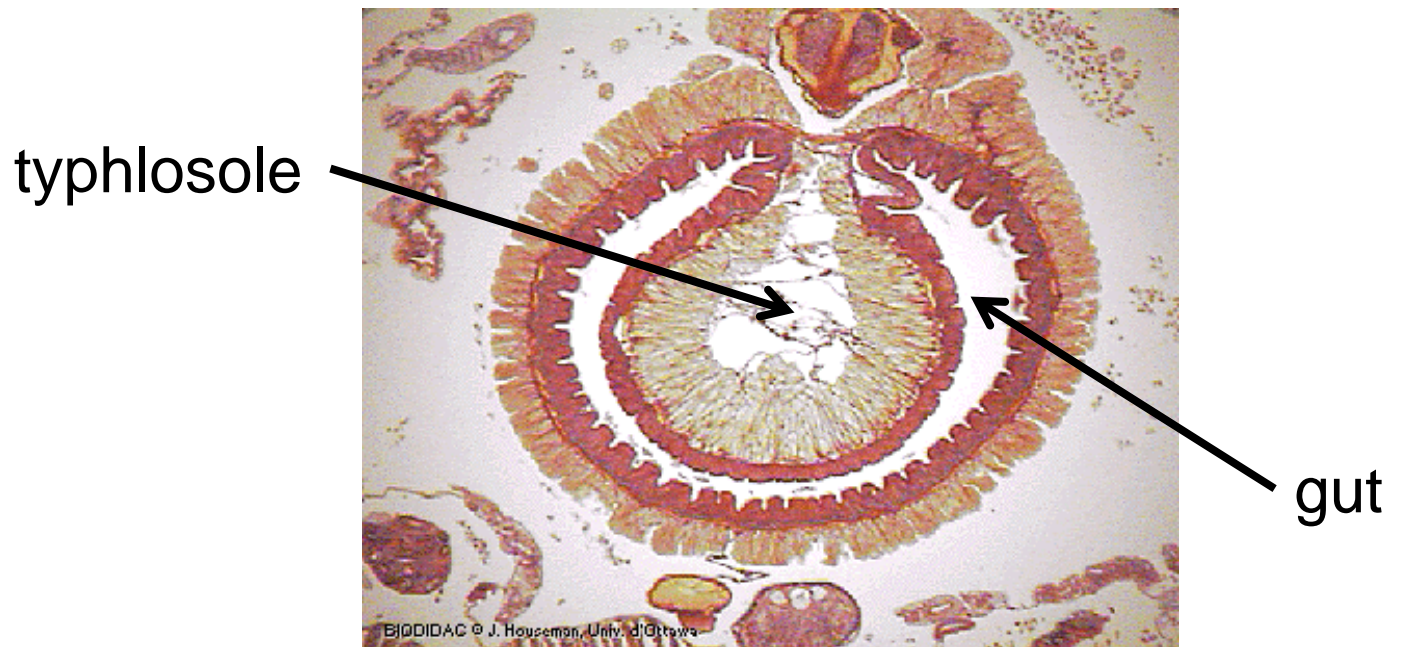
Class Oligochaeta

- terrestrial, freshwater and marine
- approx 2, 000 species
- have few setae (Oligo = few, chaeta = setae)
- usually feed on detritus
(decaying organic matter)
- have specialized digestive system to obtain the maximum amount of nutrients out of the detritus (e.g. typhlosole, gizzard, crop...)

Class Oligochaeta

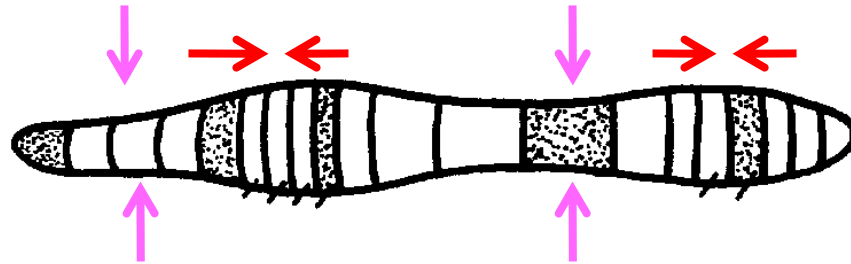
typhlosole-

- infolding of the dorsal side of the intestine
- increases surface area for absorption of nutrients



Class Oligochaeta

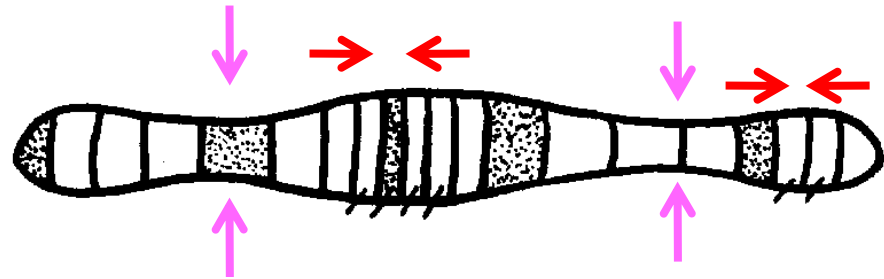
Locomotion



↓
Circular muscle
contraction



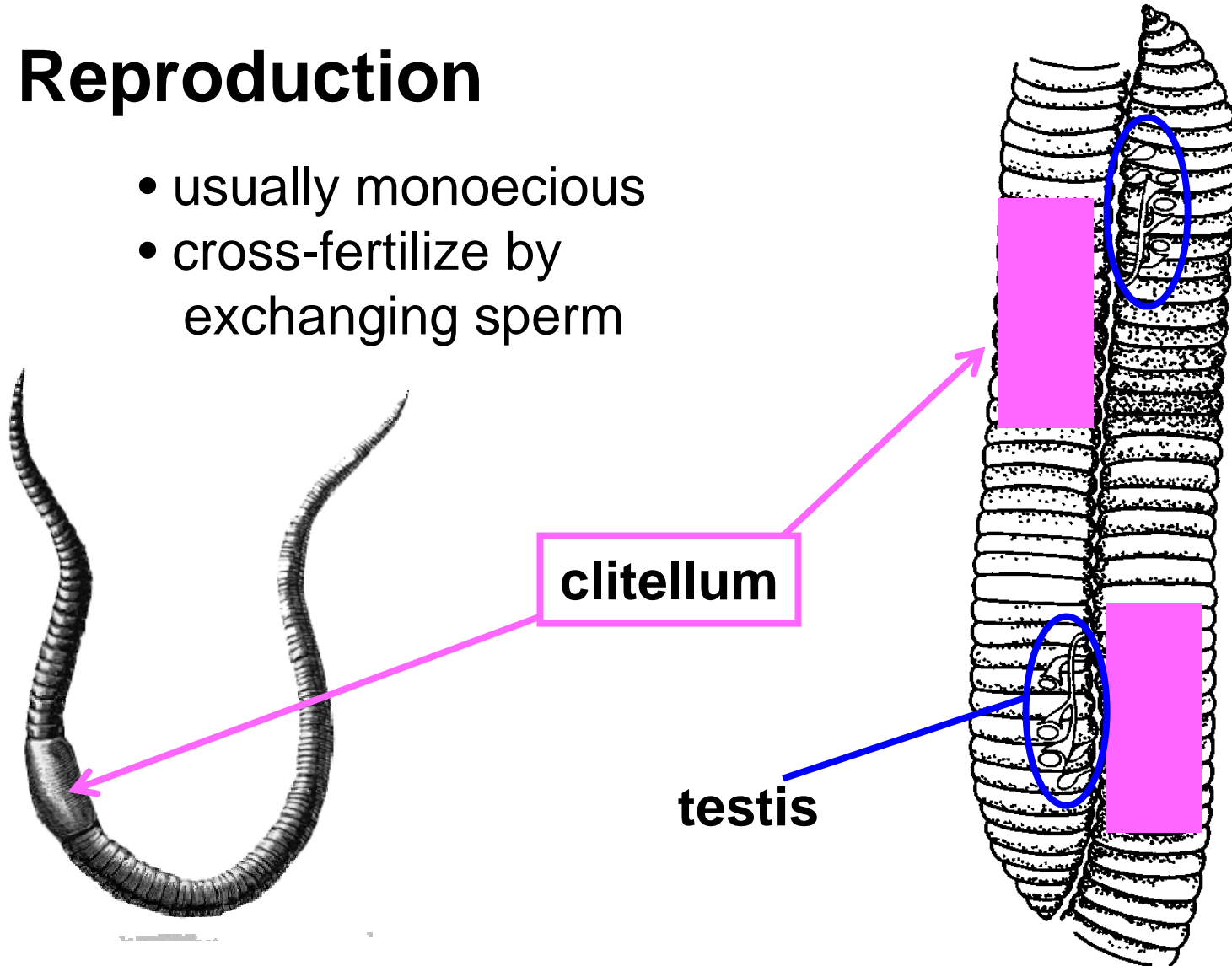
→ ←
Longitudinal
muscle
contraction



Class Oligochaeta

Reproduction

- usually monoecious
- cross-fertilize by exchanging sperm



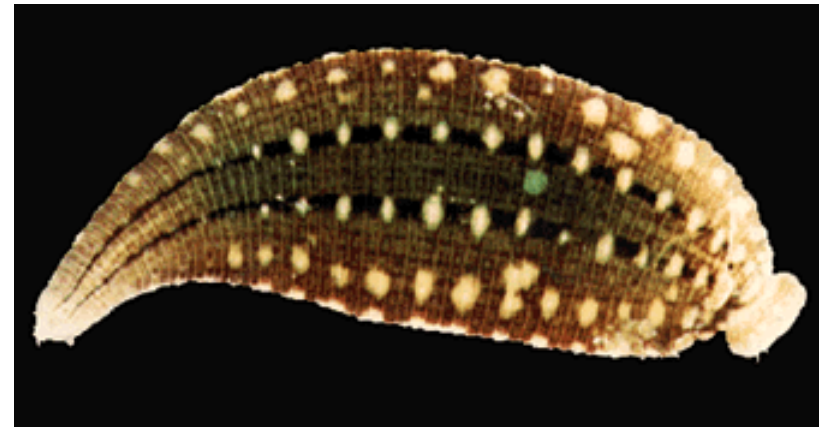
Ecology

- Earthworms are essential soil aerators
- If all the material ever moved through earthworms was piled up, the heap would rise 30miles , more than 5 times the height of Mount Everest!!
- Worm Grunting:

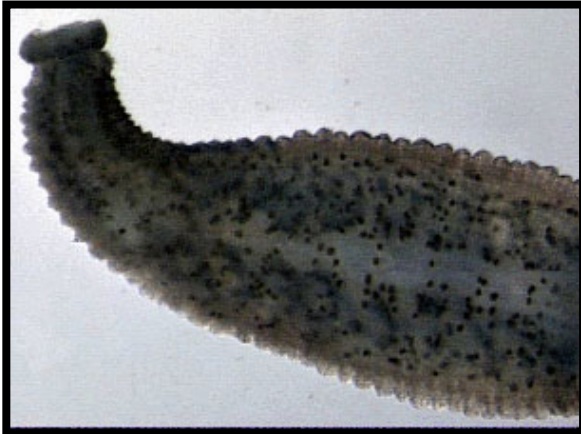


A saw or leaf spring
of a pick-up

stob

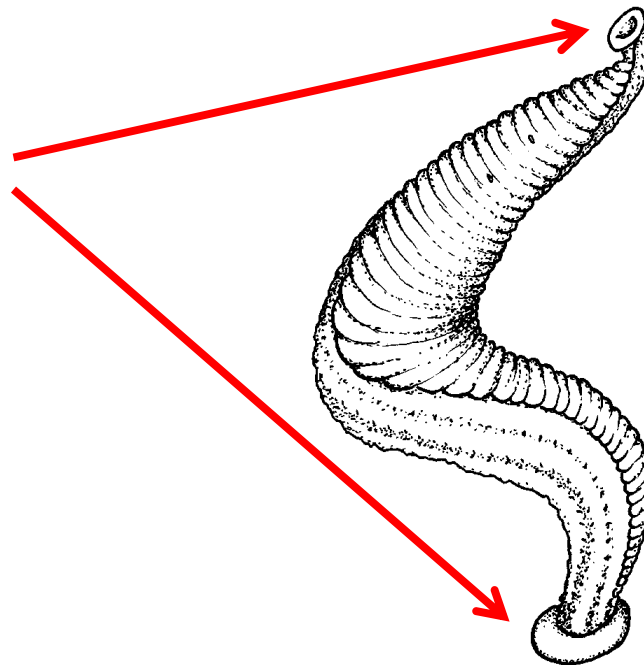


Class Hirudinea



Class Hirudinea

- usually freshwater but there are some marine and terrestrial species
- no septa between metamereres
- no setae
- have 2 suckers



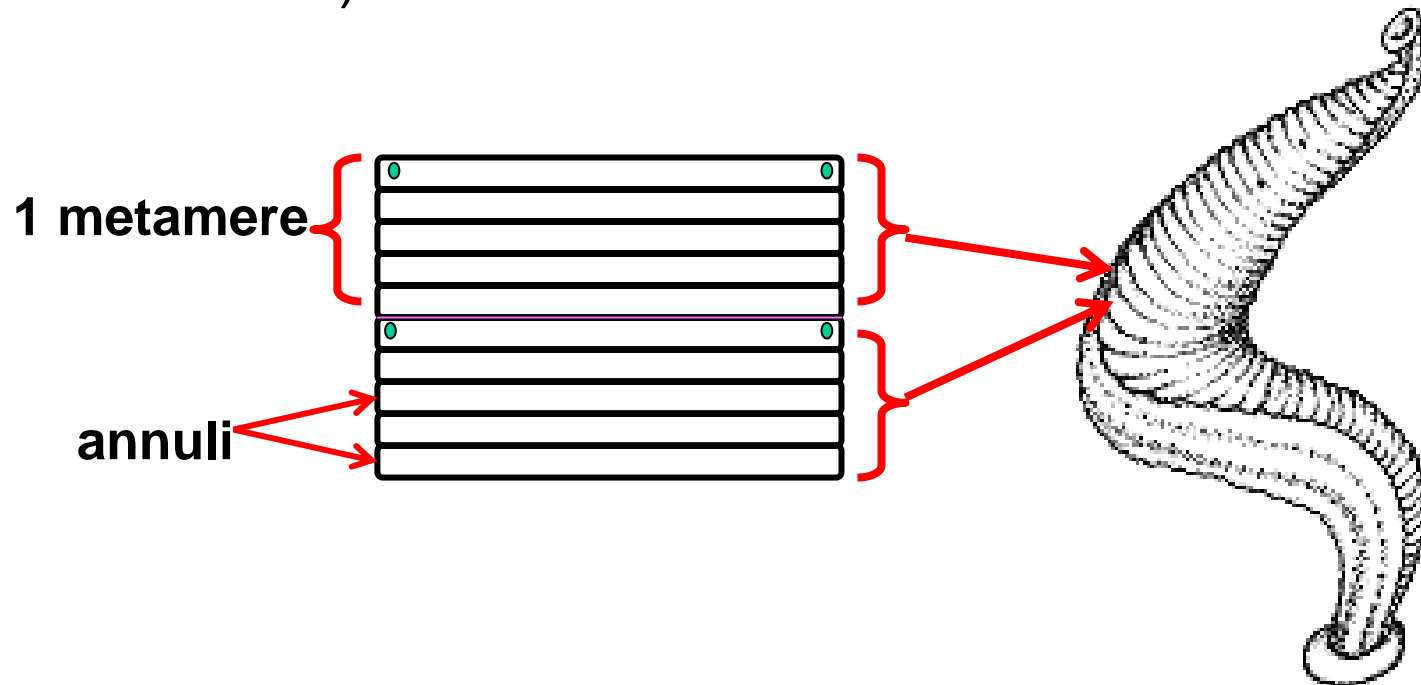
Class Hirudinea

- have an extendable proboscis for feeding



Class Hirudinea

- usually have a fixed number of segments (34)
- each metamere consists of several annuli (think accordion)



Uringstone © 1999/04/04

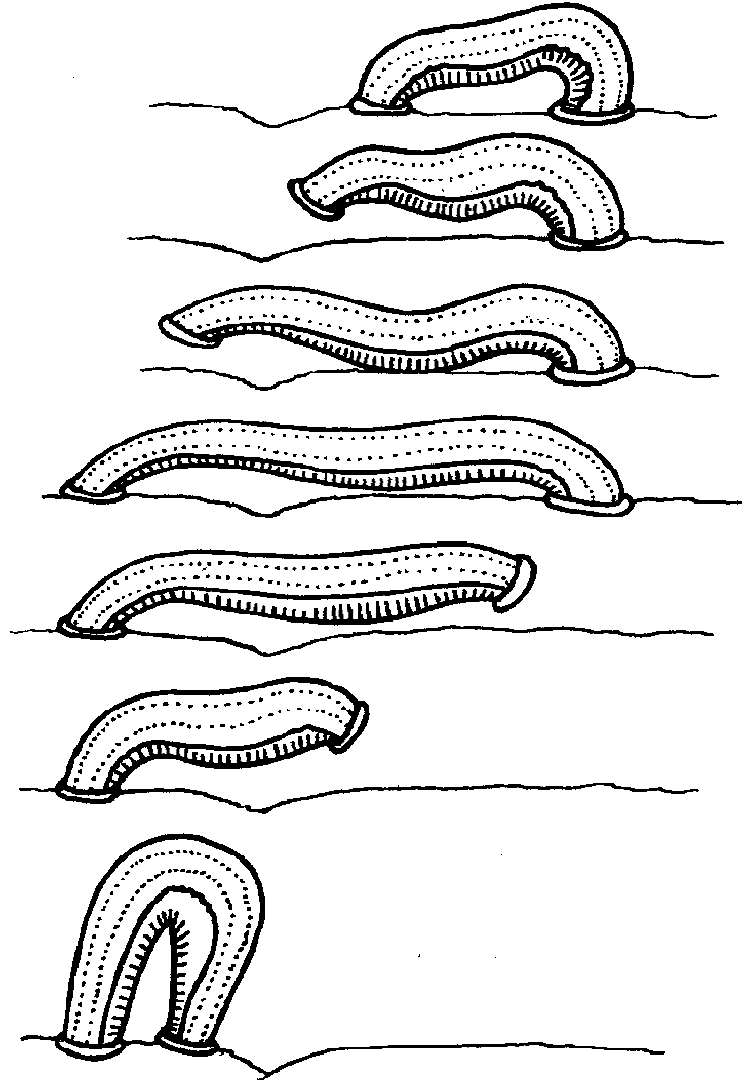
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Class Hirudinea

Locomotion

Lack septa between metameres, so they are incapable of moving like Oligochaetes.

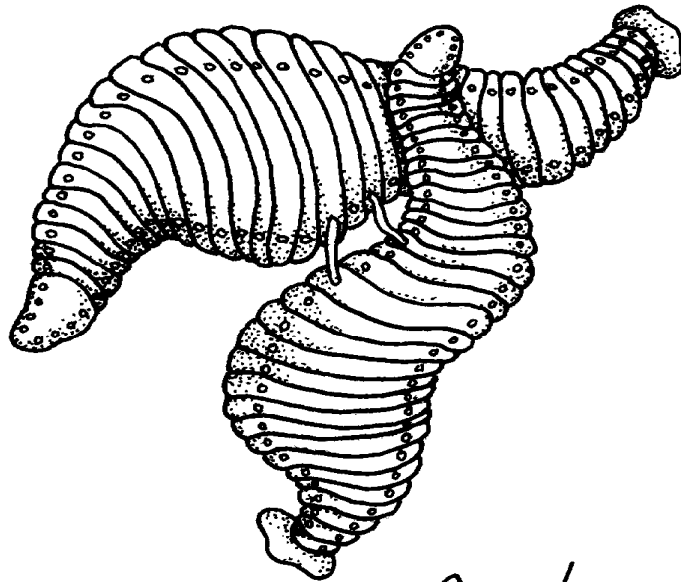
Instead, they use their anterior and posterior suckers to move.



Class Hirudinea

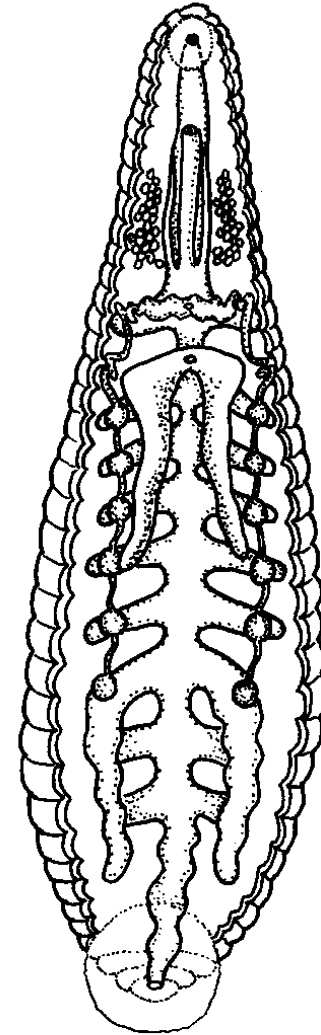
Reproduction

- usually monoecious
- cross-fertilize by exchanging sperm



9/11/99

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9/11/97

Ivy Livingstone © BIODIDAC

Ecology

- Although some leeches are parasitic blood suckers (can be temporary or permanent), many are predators.

