

Food Digestion

Feeding strategies and adaptations

Biology:



What is Life? Properties of Life

Cellular Structure: the unit of life, one or many

Metabolism: ~~photosynthesis, respiration, fermentation,~~
digestion, gas exchange secretion, excretion, circulation –
processing materials and energy

Growth: cell enlargement, cell number

Movement: intracellular, movement, locomotion

Reproduction: avoid extinction at death

Behavior: short term response to stimuli

Evolution: long term adaptation

Food Digestion

Intracellular

Food digested inside the cell.

Waste must be eliminated from cell.

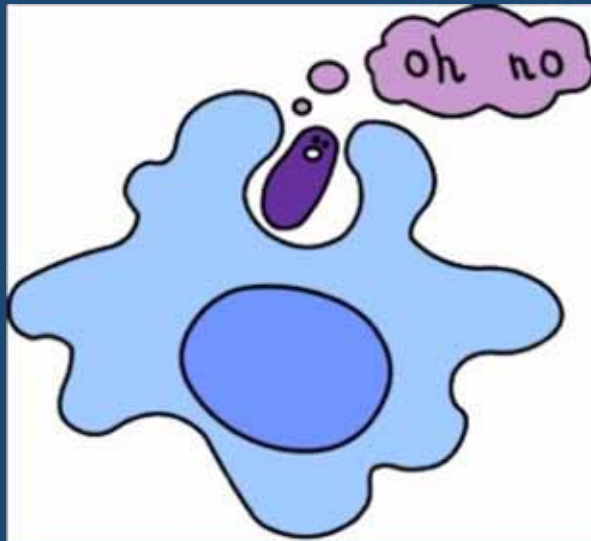
Extracellular

Food digested outside the cell (cavity, gut).

Only digested products enter cells.

Intracellular Digestion

- Mainly seen in protists.
 - *Amoeba*, *Paramecium*



Flash animation of intracellular digestion in poriferans.

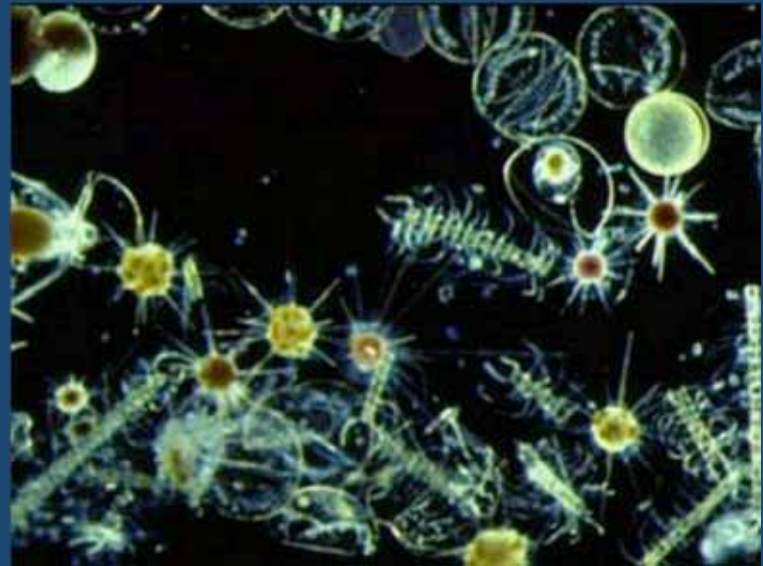
<http://www.biology.ualberta.ca/courses.hp/zool250/animations/Porifera.swf>

Extracellular Digestion Strategies

- Suspension feeders
 - Feeding on particles suspended in water
- Deposit feeders
 - Feeding on surface or subsurface debris
- Mass feeders
 - Feeding on mass chunks of plants or animals

Suspension Feeders

- Feeding on bacteria, phytoplankton, zooplankton, detritus
- Adaptations:
 - Filters
 - Setae
 - Tentacles or tube feet



Filter Feeders

Rare

Pushing water through a filter on a small (invertebrate) scale is very difficult.

Like pushing syrup through a coffee filter
Harder to maintain inertia

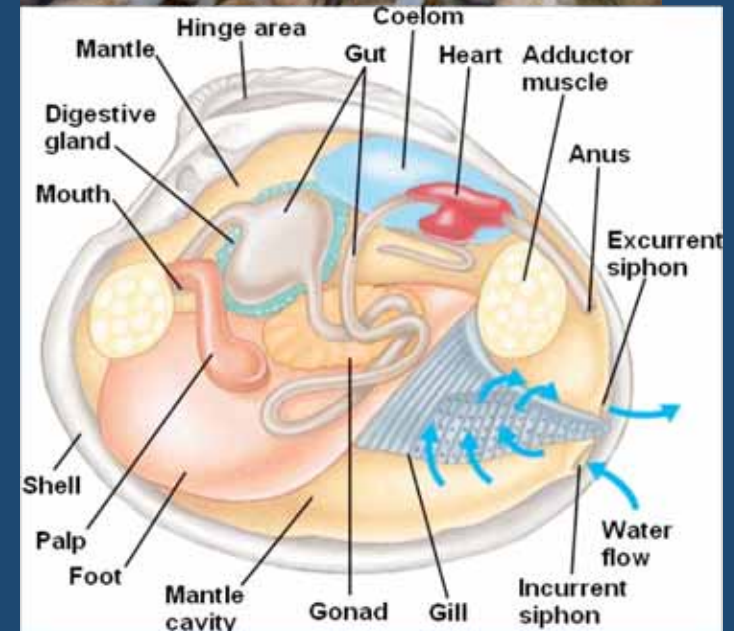
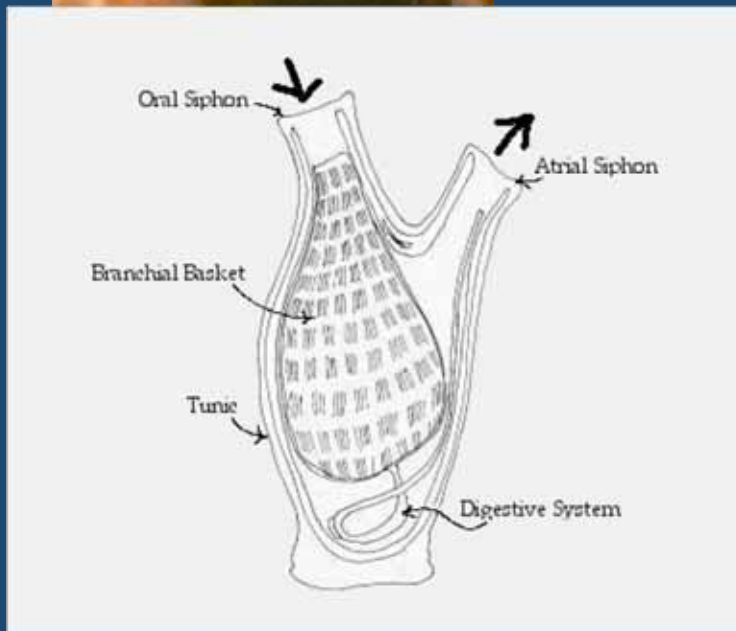


Filter Feeders

SubPh. Urochordata
"Tunicate"



Cl. Bivalvia



<http://prospect.rsc.org/blogs/cw/2008/03/>

<http://wn.com/bivalve>

<http://depts.washington.edu/fh1k12/links/StudentProjects/Tun.biology.html>

<http://jklsciencelab.weebly.com/clam-dissection.html>

Filter feeders and Bioaccumulation

“The biological sequestering of a substance at a higher concentration than that at which it occurs in the surrounding environment or medium.” - U.S. Geological Survey, 2007

Biologists Clam Up Waterways To Determine Sources Of Pollution

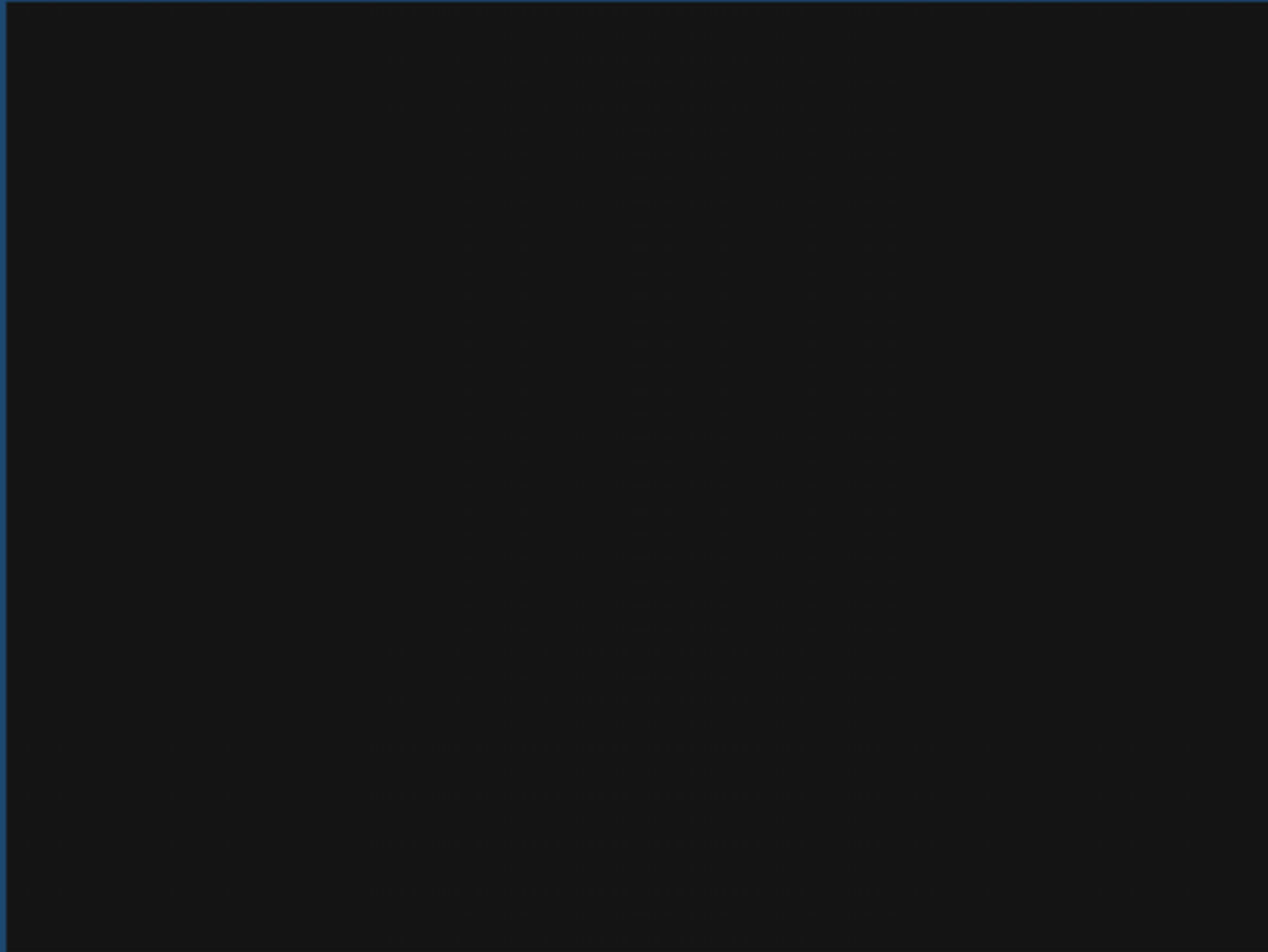
Looking for pesticides, lead, arsenic and PCB



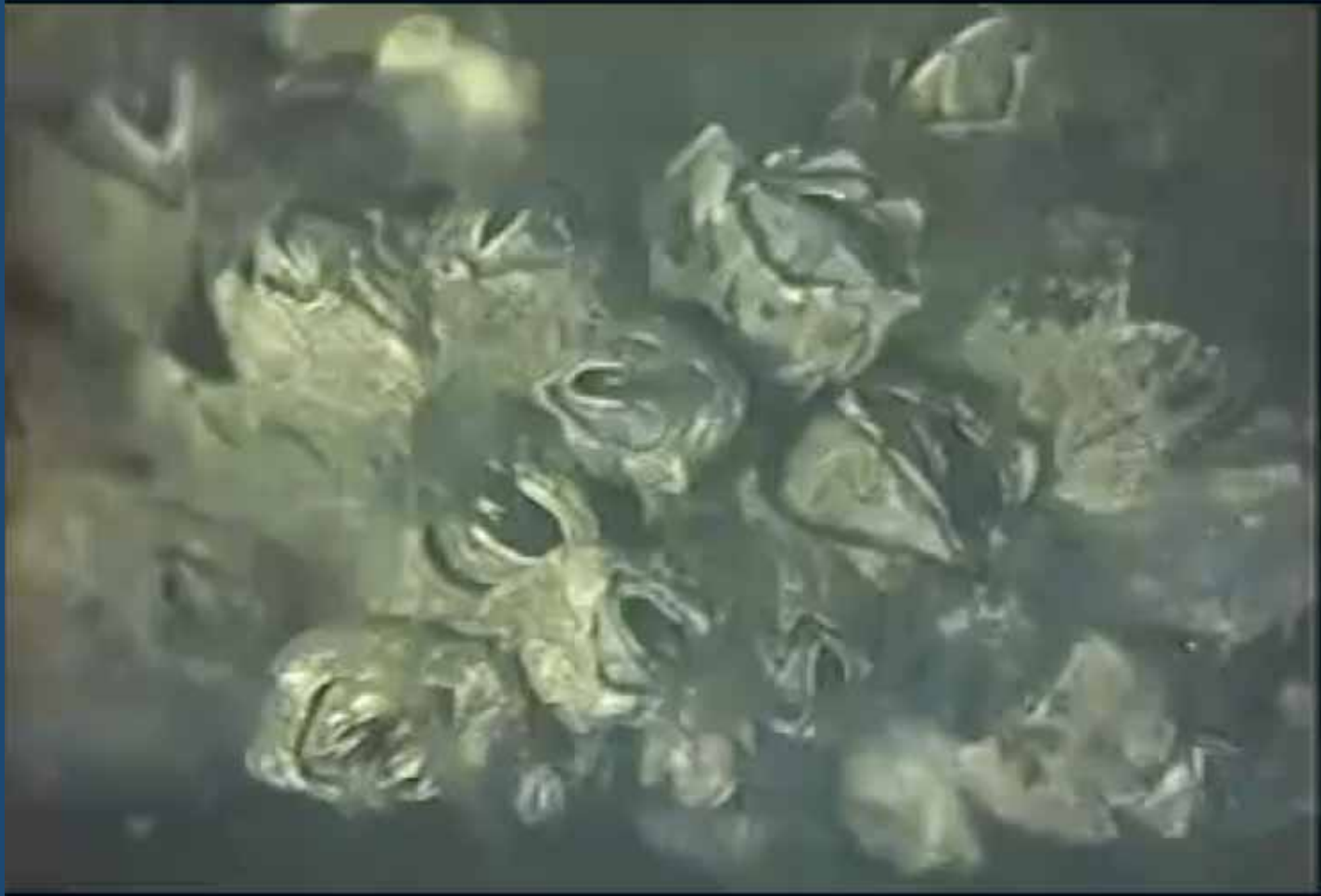
http://www.sciencedaily.com/videos/2009/0110-clam_cleanup.htm

<http://toxics.usgs.gov/definitions/bioaccumulation.html>

Porcelain crab suspension feeding



Barnacles suspension feeding



Tentacle or tube feet suspension feeding



Cl. Crinoidea

Deposit Feeders

- Direct deposit feeding
 - Swallow large quantities of dirt/sediment
- Selective deposit feeding
 - Feed only on the top layer of dirt/sediment

Direct deposit feeders

- Examples:
 - earthworms, polychaete annelids
 - Can digest up to 500x their weight a day!



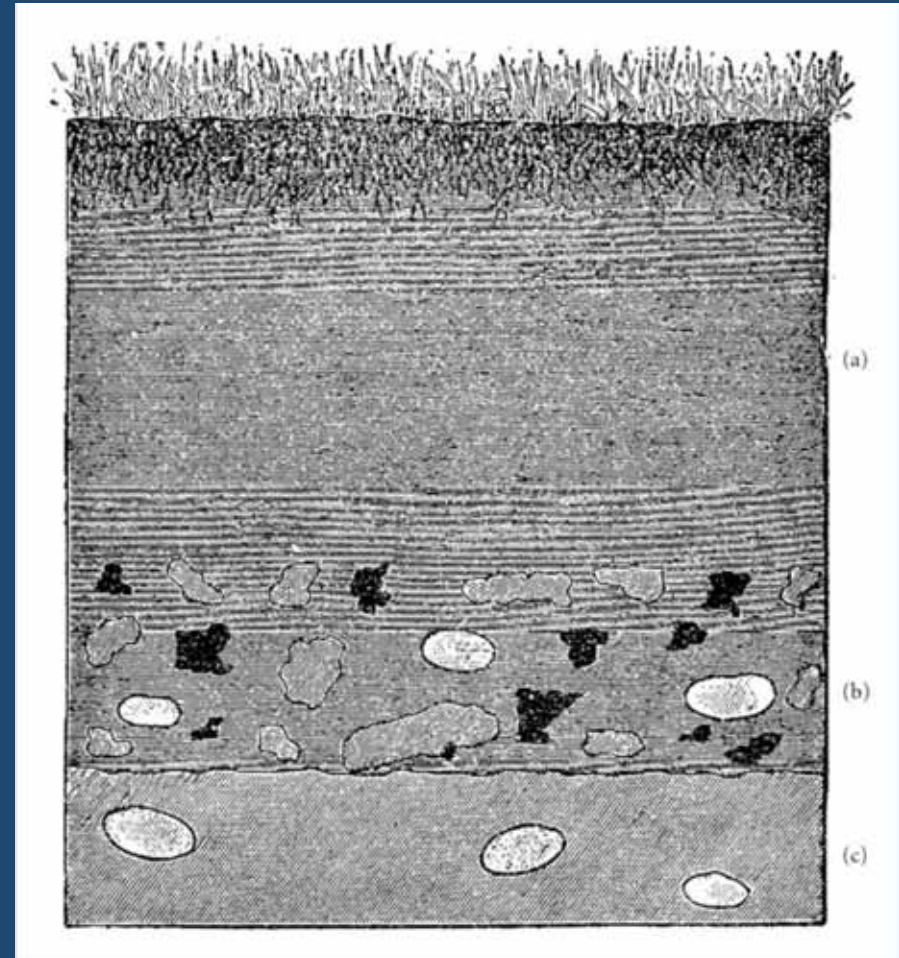
The Formation of Vegetable Mould, through the Actions of Worms, With Observations on their Habits (Darwin, 1881)

>30 year experiment

Conclusion

These deposit feeders improve soil texture and enrich the soil.

Also tested their response to stimuli:
light, touch, bad breath.



Selective deposit feeders

- Only feed on the top layer of sediment
 - This is where most of the bacteria, detritus, and protists are found
 - This layer also includes all of the feces deposited from other animals



Selective deposit feeders

- Without something eating all the “organic debris,” it would accumulate, which would increase bacterial growth and eventually lead to anaerobic conditions and the growth of sulfur-reducing bacteria



Question

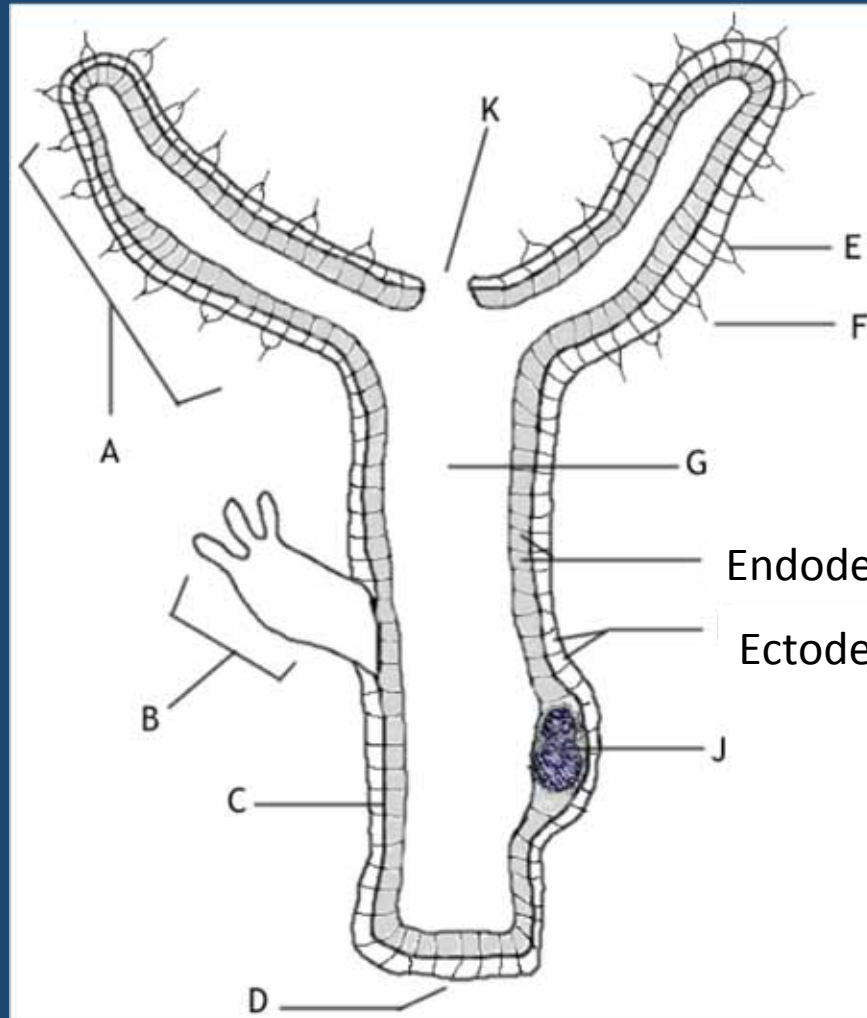
- Instead of using filters to feed, most suspension feeders use what adaptation?

Mass Feeders

Evolution of the gut

- Mass Feeders
 - Consume chunks of plant or animal matter
- In most cases, these chunks are processed in a gut or gut cavity

Gastrovascular cavity (Gastrodermis)



General cnidarian polyp
(P. Cnidaria)

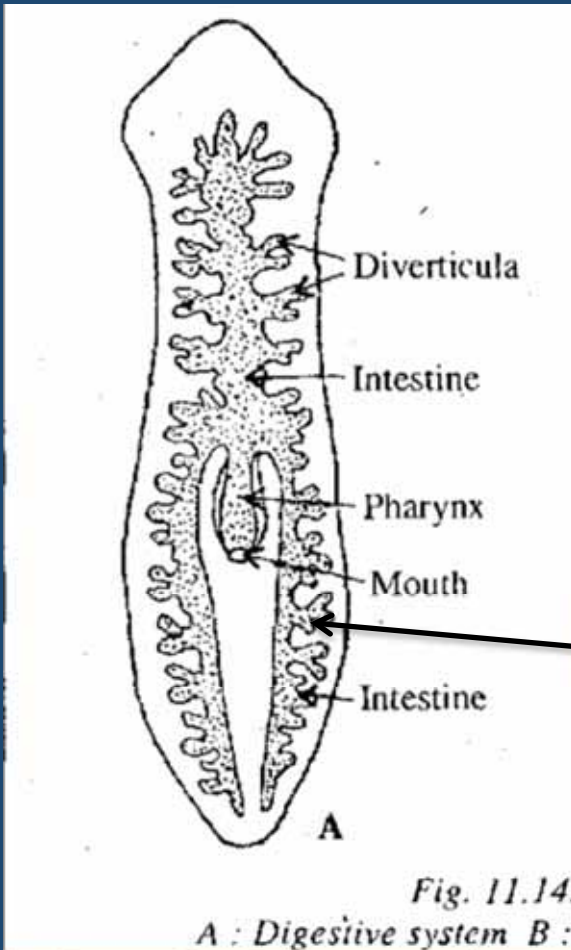
No circulatory system

Food must reach cells via
diffusion

Endoderm (gastrodermis)

Ectoderm

Incomplete gut



- Ph. Platyhelminthes
- Food is eaten, digested, and removed from the same opening
- Why is this branched?

Complete Gut

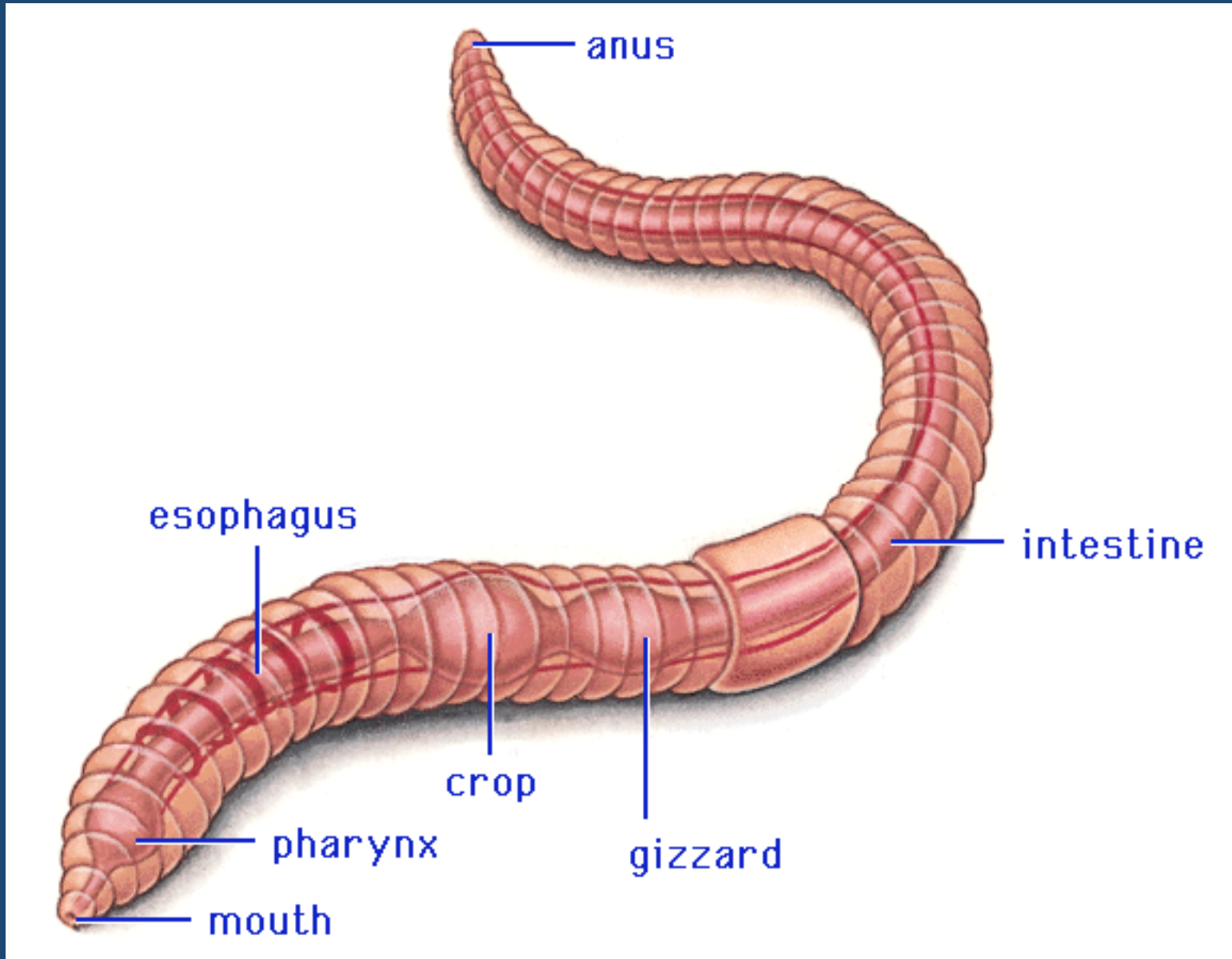


Pharynx

Intestine

- Mouth and anus present
- Ph. Nematoda
- Specialization of gut seen

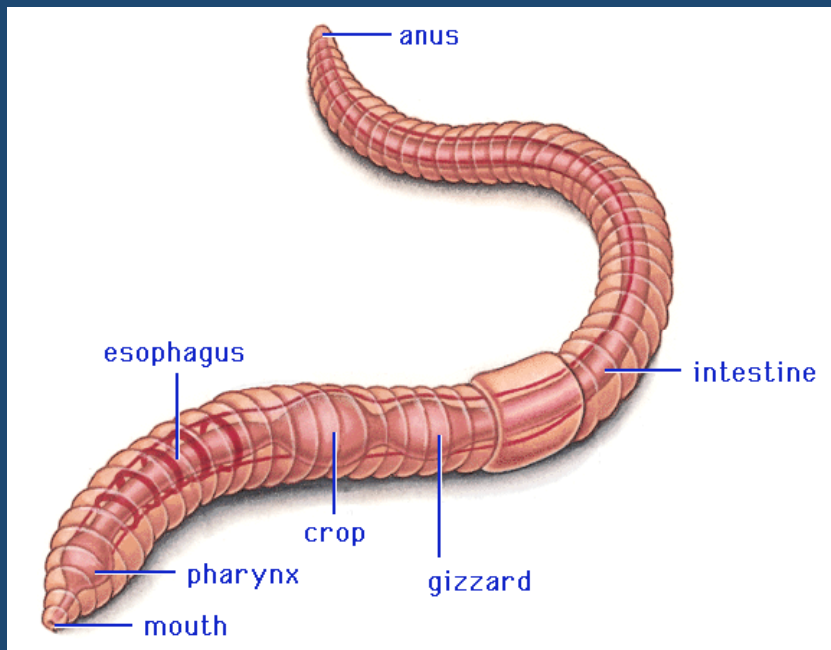
Earthworms also have a complete gut



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Cl. Oligochaeta

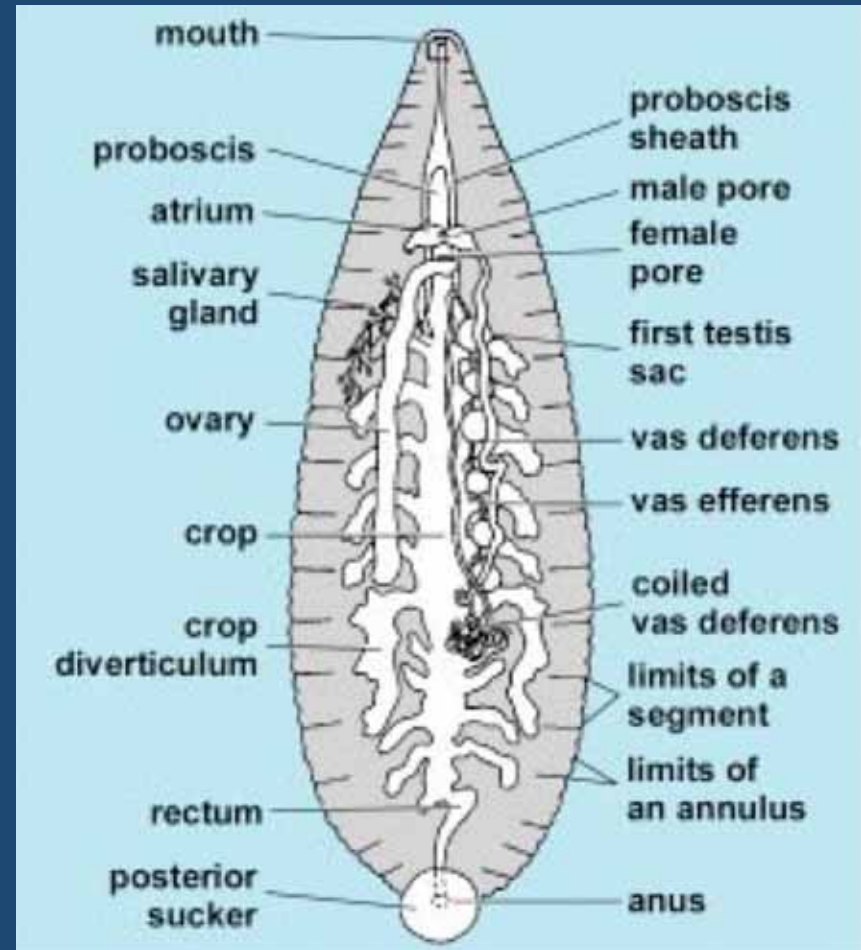
Gut specialization



- Esophagus / Pharynx
 - muscles
- Crop
 - Storage
- Gizzard
 - Mechanical processing
- Intestine
 - Enzymatic processing
 - Nutrient uptake

Leech gut

- Bacteriocytes hold mutualistic bacteria
- Crop diverticula extended to hold even more blood
- One meal may take 6 months to digest



Mass feeders

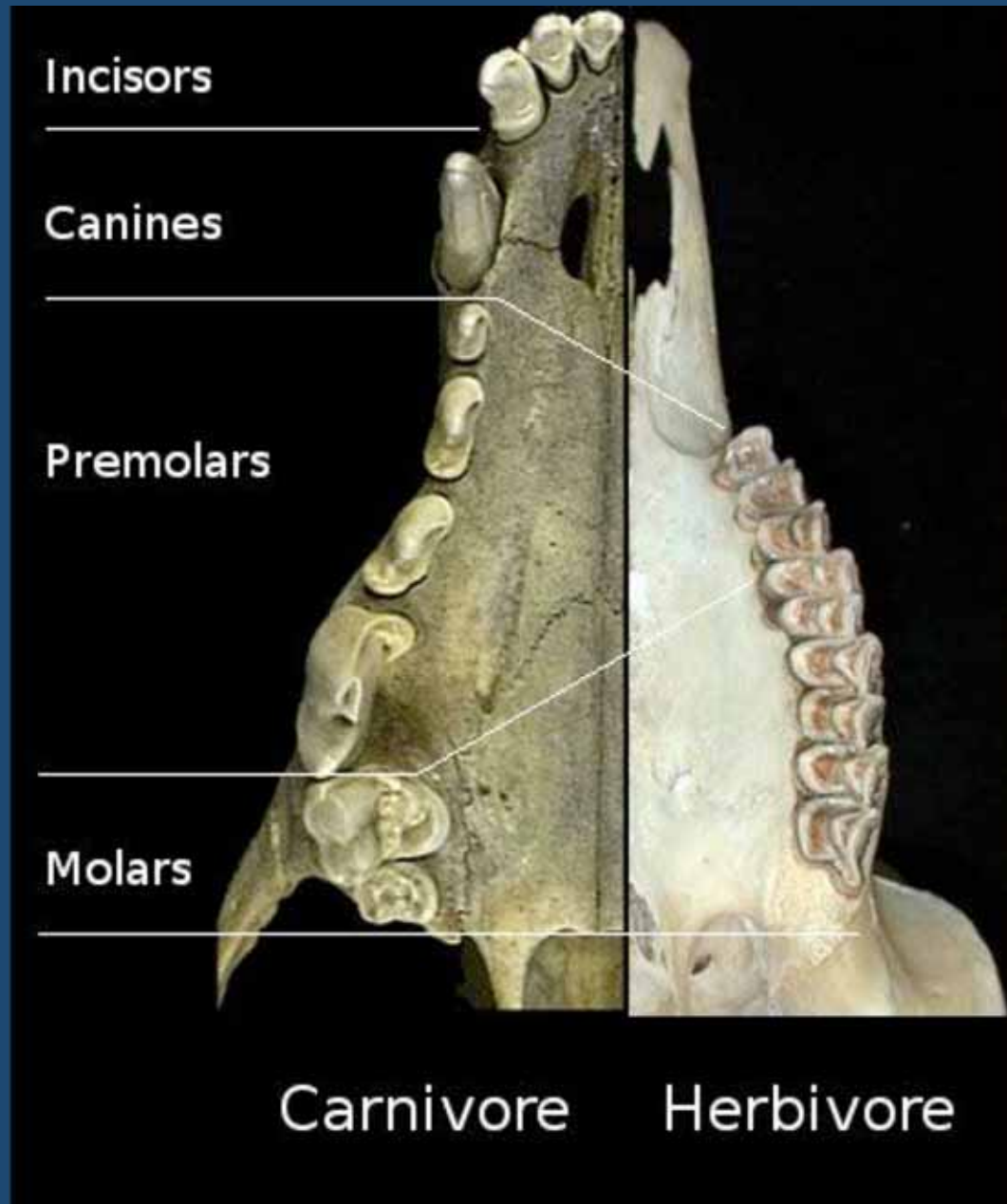
Herbivores

Carnivores

Teeth modified to rasp,
cut

Teeth modified to tear, rip





Carnassial teeth

