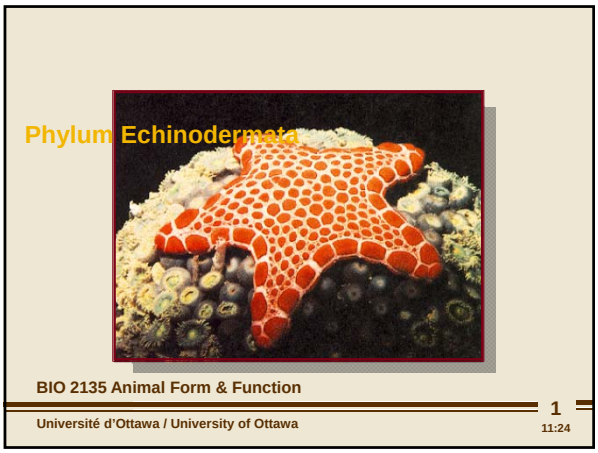
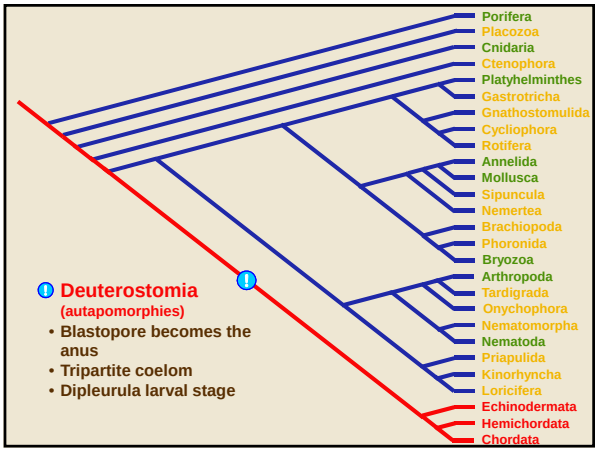
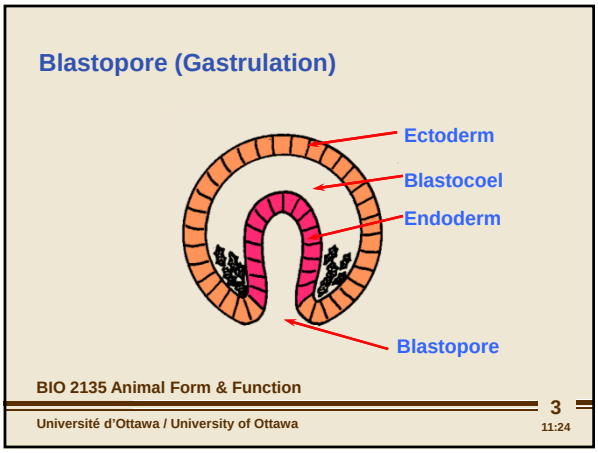
Echinodermata



other major branch in evolutionary tree

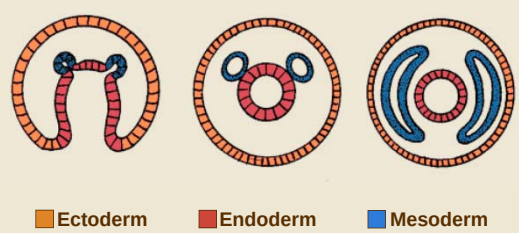


see beginning of deuterostome lineage
point where blastopore became the anus -enterocoely
group that is counterpoint to protostomes
have unique dipleurula larval stage



when you have a blastula - have a single ball of cells
-have development of two epithelial layers - inner and outer
-made by the invagination of the blastula
-then get proliferation of mesoderm

Enterocoelous coelom



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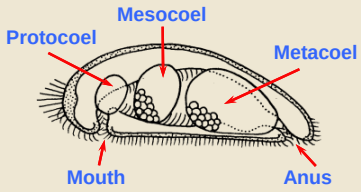
4
11:24

in deterostome line, have enterocoelous coelom formation - little pockets came off the gut to make bubbles
bubbles expanded and filled the space in between
most animals that have enterocoelous are deuterostome
-one group - bryozoans - but they are derived group

Tripartite coelom



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5
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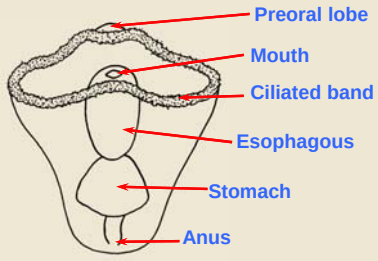
when bubbles come of the gut, there are technically three of them that are connected to each other
-proto, meso, and metacoel (bryozoans also had this)

Dipleurula larva



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6
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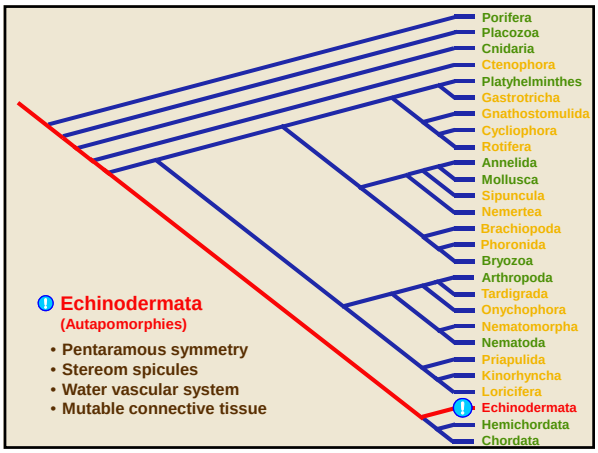
upside down umbrella with ciliated band with a mouth in a center
when it swims brings food to the mouth and goes out the anus

Echinodermata



look at echinoderms - sea star, sea urchin

-have radial symmetry - based on fives - pentaramous

have unique water vascular system - mechanism of moving sea water in their body that they are going to use as a hydrostatic skeleton to move their main locomotory structure/ feeding structures (tube feet)

they have an internal skeleton- endoskeleton

-calcarious skeleton that makes up their bodies are covered with skin - organized in spicules

-blocks of mineralized calcium that are connected to each other

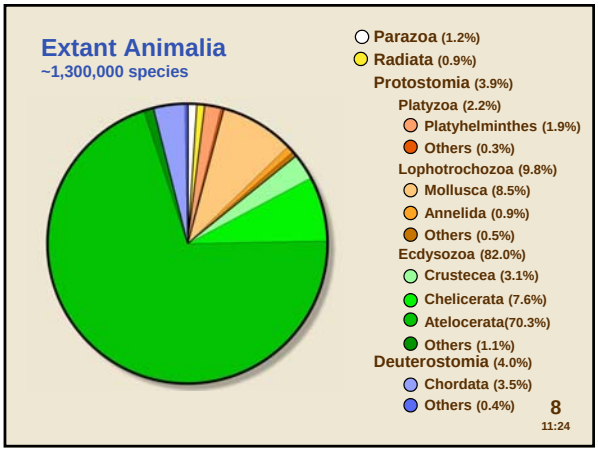
-calcium is not solid but spongy - have lots of openings to them

-calcareous spicules highly porous, spongy block of calcium tissue that makes up their fundamental unit of their skeletons

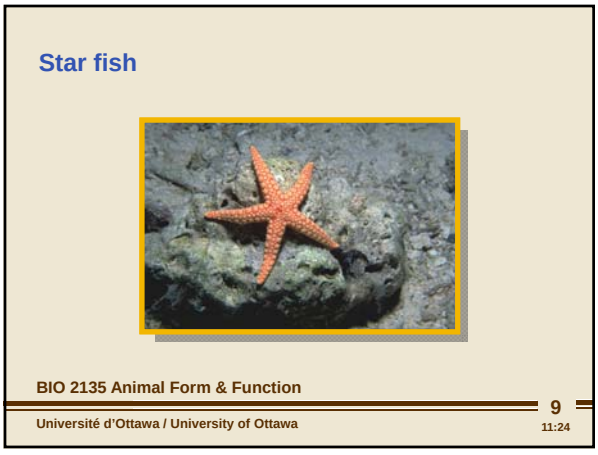
-also able to take spicules and connect them with connective tissue

-the tissue that holds the main elements of their skeleton together have a unique characteristic

-able to change its consistency - can be liquid/fluid/jelly - can be solid and lock pieces of cuticle together (under nervous control - can tell when they are loose and change their shape)



not a lot out there



sea star

Sea urchins

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10

11:24

pencil urchins

Sand dollars

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11

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flattened sand dollars - hide in the sand

Brittle stars

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12

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brittle stars - have serpentine arms

- they can disconnect (collagenous tissues) their arms which they can regenerate later

Sea cucumber

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sea cucumber - big and slow moving- have unique strategy of defense - by throwing out their digestive tract on top of whatever is trying in eat it

Ancient Echinoderms

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why were a group that were bilaterally symmetric choose to have radial symmetry
with radial symmetry- normally think sessile, no cephalization
when echinoderms appeared- they were sessile and on stocks attached to the substrate
had their arms pointing up - on arms, had tube feet that were catching organic debris/ food that was falling down the water column - move it to the mouth to feed
-catches organisms that die before they fall to the ground where burrowers are found

Ancestral echinoderms

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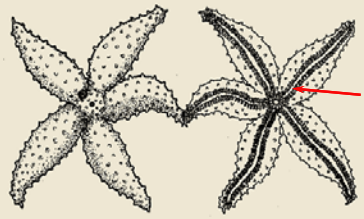
fossils of early groups, always had arms
only one group that is sessile - everything else has changed
body plan - so good that when they become mobile - they detach from the substrate - flip themselves so their mouths are against the substrate - tube feet that were there were used to move along the substrate

Echinoderm surfaces



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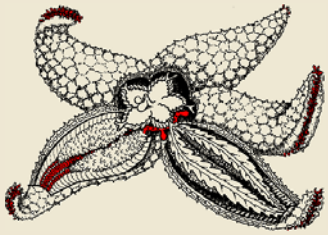
underside of the sea star- can see all of the tube feet

Water vascular system
(Ambulacral system)



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tube feet are part of the water vascular system - filled with sea water
- each are a little hydrostatic skeleton - that are going to be used for locomotion

Role of the water vascular system

- Locomotion
- Circulation
- Respiration
- Excretion

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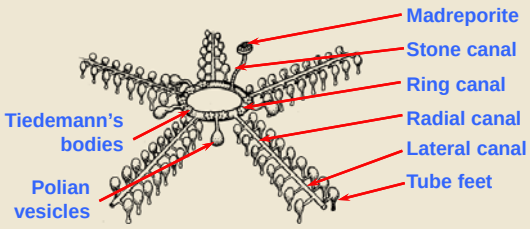
18
11:24

on top of locomotion - sea water that circulates - also a transport fluid
-can diffuse oxygen for respiration, movement of nutrients, excretion of nitrogenous waste out the body
water vascular system is very important - has a lot of roles

Water vascular system



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19
11:24

have an outside opening - madreporite - where the sea water goes in
- it doesnt pump water, it is just a puddle of water
-have cilia inside that are beating that move it around but it is just a reservoir of water
there are polian vesciles that will fill up with extra water if needed but not an active circulatory system
-just a pool of sea water - no cells in it - when cell appear, usually from the tiedemann bodies - cell that will cut down on any bacteria or other bad things in water

Tube feet

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20
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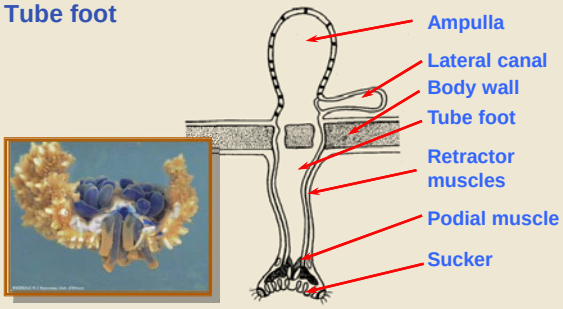
tube feet that extend down - see a small hydrostatic skeleton with a suction cup at the end

Tube foot



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21
11:24

have a connection into the rest of the water vascular system - have a valve that shut, which allows it to become a small hyfrostatic skeleton
-have a resevoir on top - ampulla
in the foot there are muscles that contract that tilt the foot to go in different directions
at the base of the foot there is a sucker will a podial muscle attached to it that can pull the base up to make a suction attachement to the substrate
-helps with locomotion

Movement of tube feet

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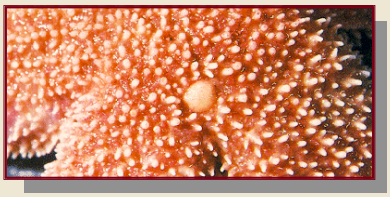
end up with a series of tube feet that are constantly being lifted and attached to allow the organism to move across the substrate

also able to capture food and prey

Body wall



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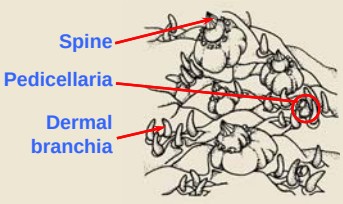
sea stars are covered in spines

Pedicellaria



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24

11:24

not only are they covered in spines, also have structure - pedicellaria that are sticking outside of the surface as well

-two little ossicles of the skeletal structure - like pincers

-animal is so slow moving - use pincers to prevent another organism were to settle on top of it

-spines will do the same thing

-whole outer surface is covered with cilia that will beat and create a water current

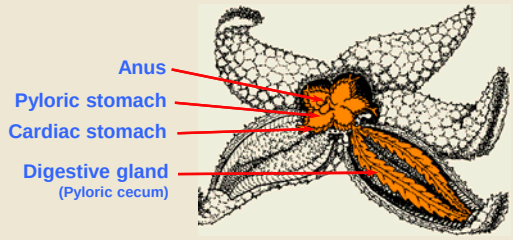
-moves sediments off of the skin

-skin also has finger like extensions - dermal branchia - extensions of the coelomic space inside the star fish - acts as another respiratory surface

have a tripartate coelom is the group (pro, meso, metacoel)

metacoel made the water vascular system, mesocoel makes the body cavity

Digestive system



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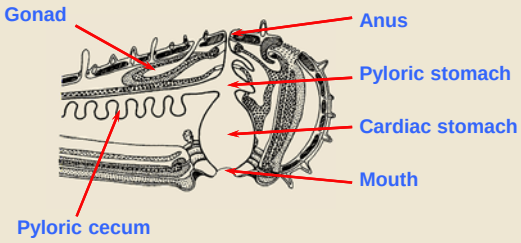
25
11:24

most of the group is carniverous
have big digestive glands inside (pyloric cecum) extend out to each arm - where food will be broken down and digested
have two components to the stomach
pyloric - fixed inside which branch out to the pyloric cecum
cardiac - towards the outside

Sea star



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26
11:24

brings food into the cardiac stomach, to the pyloric stomach which is then sent out to the pyloric cecum
when it becomes reproductive, the gonads proliferate/expand inside each arm
have them sit directly adjacent to the digestive gland to get the most amount of nutrient possible
the cardiac stomach is eversible, can be squeezed out
starfish are predator that will chase down a meal - turn their stomach inside out and surround the meal ex corals -release digestive enzymes to liquefy the polyps in the coral reefs and then the cilia brings the food up
another type of coporeal digestion
eat bivalve/calms - so they eat things that are slower then them or sessile

Feeding

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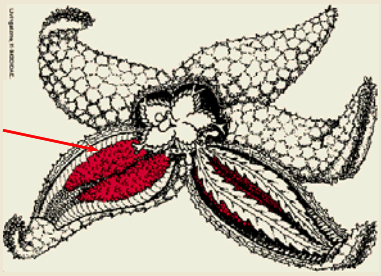
27
11:24

Reproductive system



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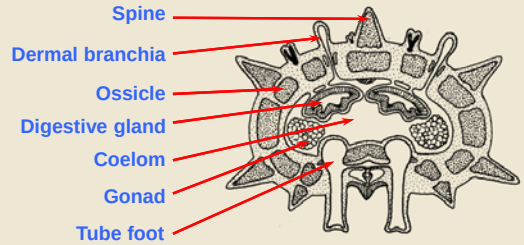
all you see inside are the digestive ceca and the gonads

Sea star arm



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cross-section
water vascular system- prominent feature are the tube feet with the suction cups and the ampullar head (metacoel) tube feet have great exchange surfaces for gas - nitrogenous waste and co2 out, o2 in
mesocoel the other body cavity that contain the digestive glands and the gonads - lines this whole other space extends to the outside -dermal branchia- to do the same thing
the two compartments are separate, do not have a connection
at the ampulla - part attached to the tube foot that goes inside the body cavity - body cavity goes around the ampulla so it has two cell layers
-have gas exchange between the water vascular system to the coelomic cavvity -
-function as one, separated by a single cell membrane
within the body cavity where there is the digestive glands releasing nutrients into the coelomic fluid, they are being mixed around by the cilia that are inside- but they are also diffused into the ampulla so that the musculature of the tube feet get nutrients - everything is shared through this layer
only has these two systems, so it can only live in marine environments, have no way to osmoregulate if it were to move to freshwater environments

Echinoidea
Sea urchins

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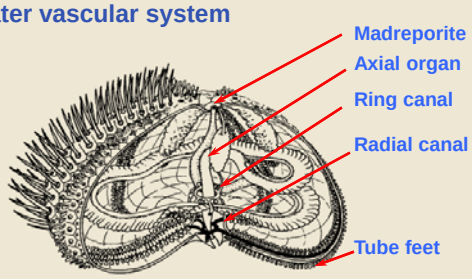
sea urchins can have really long spines that they can walk on
have a ball and socket joint
modified to be a herbivore - feed on poor nutrient food like plants - lacks a lot of important amino acids and proteins

Echinoidea
Water vascular system



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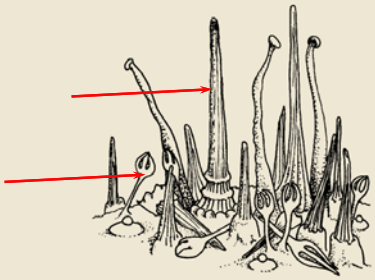
31
11:24

what happens when you need to be a herbivore- have to lengthen the digestive tract
-normally contains little spaces and pouches so it can properly digest plant material
digestive tracts spirals from the oral opening in one direction and curls back on itself to get to an anus located at the top
huge surface area processes the plant material
-if food is nutrient poor - need to give it in the digestive tract for as long as possible to extract all possible nutrients
suspended from the top of the shell are the 5 pairs of gonads

Echinoid spines and pedicellaria



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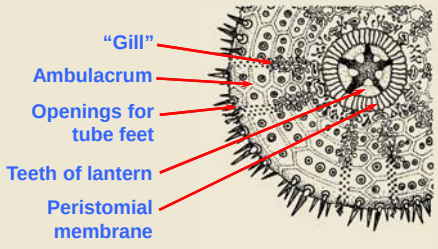
32
11:24

body wall has a lot of spines
if long, need to have tube feet to extend past them

Echinoidea
Oral surface



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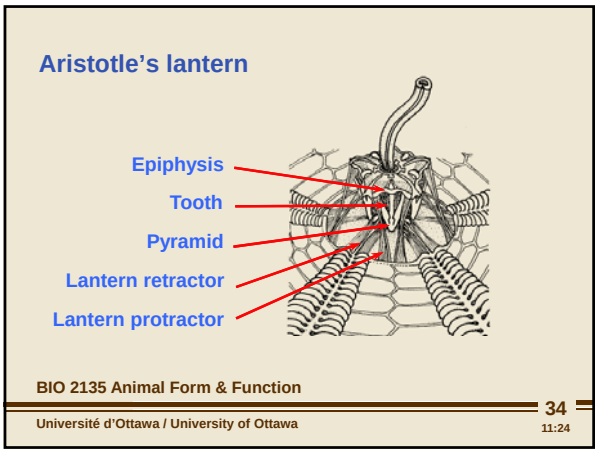
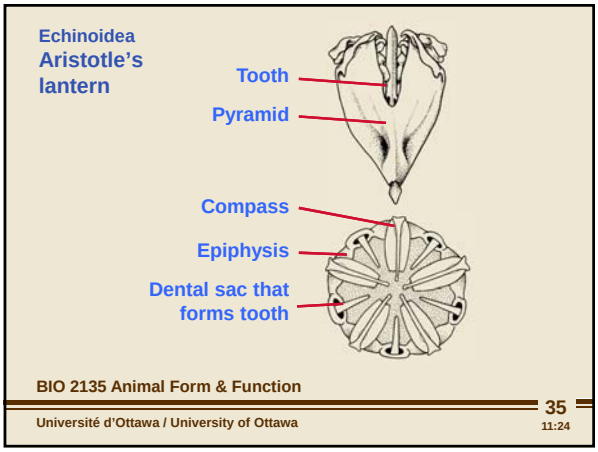
33
11:24

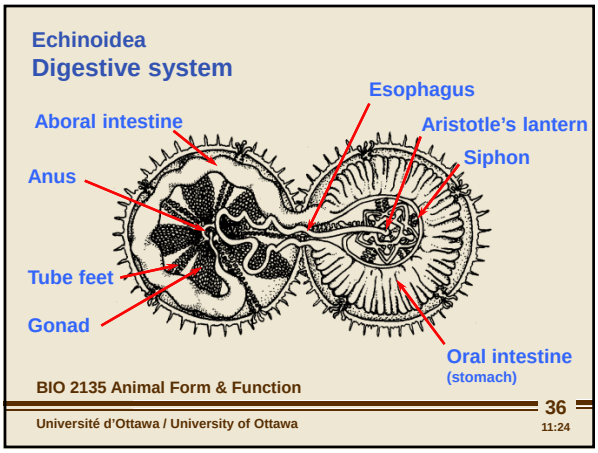
other adaptation on oral surface - feeding
sea urchin has five sets of teeth, aligned with the rows of where the tube feet are located (pentaramous organization)



part of aristotle's lantern - bones have lots of detail that allow the plant to be ripped up
whole lantern is suspended by muscles that can push the lantern out - so teeth can be pushed out/in/tilted



have five pyramidal teeth - can be spread apart or closed for biting motion
pyramid tooth has a smaller tooth inside of it - cutting surface
-eventually wears down but it is constantly regenerated from the top
end up with an organism that can process large amounts of plant material



the digestive tract - can see the lantern and the esophagus coming out
esophagus propels the food to the digestive tract in the first half
animal was consuming chunks of plants but also a lot of water
-need to concentrate the food
in the first part of the stomach there is a second tube - siphon
-as food enters the oral intestine, the water is pulled out of it can put into a separate set of plumbing making the food concentrated
higher concentration of food allows the enzymes to work better - at this point, try to absorb as much nutrients as possible
for the other half - aboral intestine - water that was taken out of the meal previously if put back in
-in processing the food, it became a rigid mass that could tear the digestive tract
by putting the water back in, makes the undigested food more liquid which can be excreted out
has a large butthole to get rid of the plant material that could not be digested