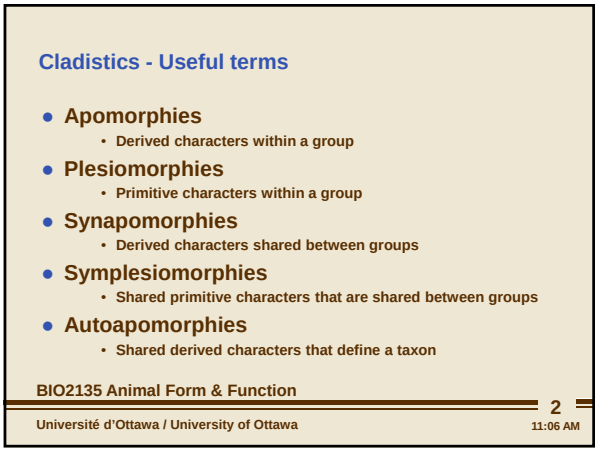
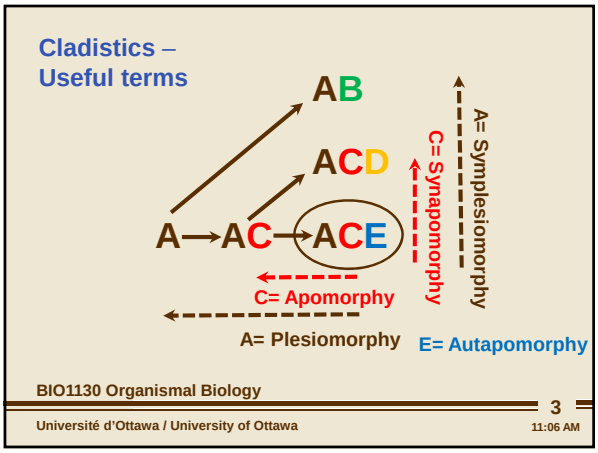
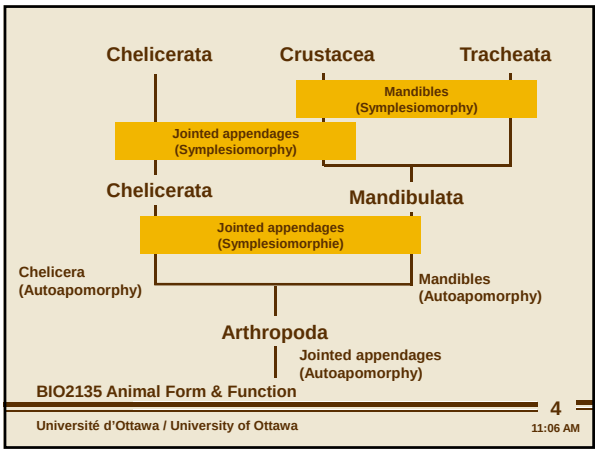


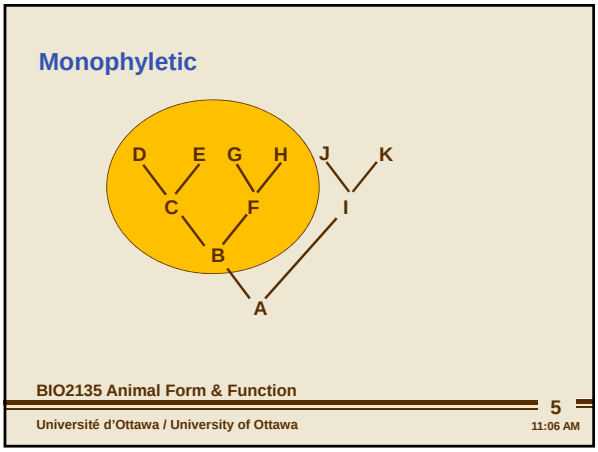
-before we find cladistics taking hold, its a way to do taxonomy
-looked at characters as advanced and primitive
-advanced was some that was labeled to show that it was something better than the past
-ex bilateral (adv) and radial (primitive) or is it another way around?
- there was no proof for what was the best architecture - all subjective
- point of cladistics - if an organism is an ancestor to the other ones - should be able to take any set of traits and put in advanced or primitive/ derived and ancestral
-known as 0 or 1
-every single trait should change when you look at them (doesnt matter what you are looking at) as long as the tree is built, it is the same every time
-hennig came up with words for cladistics
-apomorphies -derived characters (vertebrates at the bottom of the tree are fish and then get tetrapods, terrestrial etc) - appearance of appendages
-plesiomorphies - absent of appendages as fins in vertebrates
-everyone that has that trait must be related to each other
-synapomorphie- they share that trait - share common ancestor for derived
-symplesiomorphies- they share that trait - share common ancestor for primitive
-autapomorphies- suite of characters that is shared between a group of organisms and no one else has them, it defines the group (ex. in cnidara - only group that have cnidocytes)



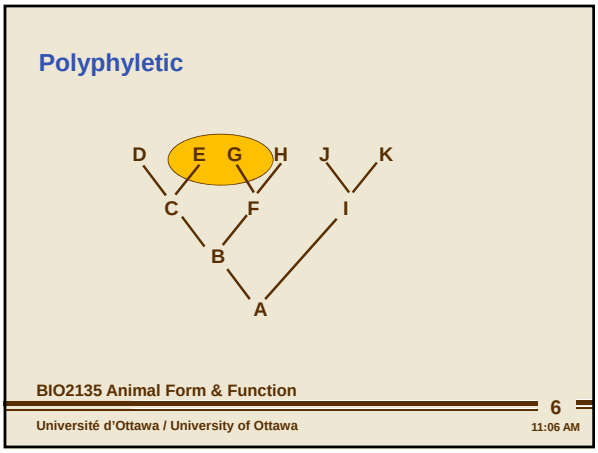
-A is a chracteristic that is all 3 groups, which are the descendants
-this means that A is a plesiomorphie - trait in ancestral history
-groups have autapomorphies that make them different but the things that stayed the same from before make them symplesiomorphy (baggage that was passed forward and shared)
-synapomorphy - things that were shared



example of a cladogram
-arthropoda is phylum with jointed appendages from an exoskeleton as an autoapomorphy
-in arthropods there are two main lineages
-chelicerata and mandibulata - have different ways for eating
-their symplesiomorphies is jointed appendages because it was shared with in the past
- as you move up in the tree- autoapomorphies become symplesiomorphies for the branches that come

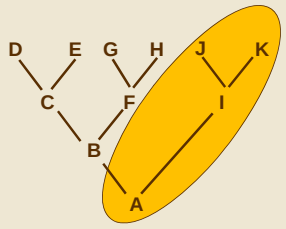


interested in monopheletic groups where we have a bunch of descendants from one ancestor, and from having this information we have the evolutionary sequence



grouping change cause a different tree was made -where you dont have all of the descendant
-ex arthropods
-called polyphyletic

Paraphyletic



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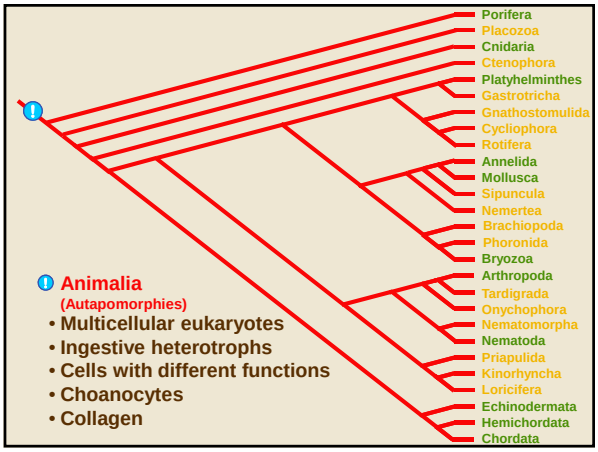
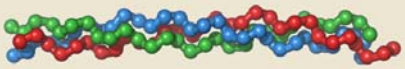
-mistake! create 2 different taxa with 2 different names
- this was done when morphology was an important way of looking at the world
-ex separation of birds and reptiles
-avies and reptiles - based on the fact that birds are so different
- eventually found out that bird fall into the lineages of reptiles



- now have general concensus
- animal autapomorphies
-use of adhesion - collagen

Collagen



- **Tropochollagen subunit**
- **High glycine/proline – gly-X-pro**

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-unique about collagen- fibrous protein, unique composition - 3 strands interwoven to get the tropochollagen subunit
-have high glycine and proline amino acids that alternate down the chain
-hydrogen bonded together - very stable and an excellent adhesive for holding cells together
-used to sticks cells into multicellular form

Cellular organization

- **Unicellular:** single cells
- **Parazoans:** without true tissues
- **Metazoans:** with tissues or organs

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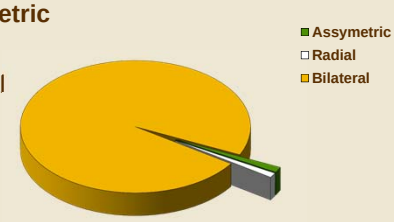
-majority of organisms that are going to look at are metazoans - ones that have true tissues or organ -have cell to cell communication
-other group called parazoans - one that have cells with different functions
-where division on tree occurs

Basic animal body symmetries

- Asymmetric
- Radial
- Bilateral



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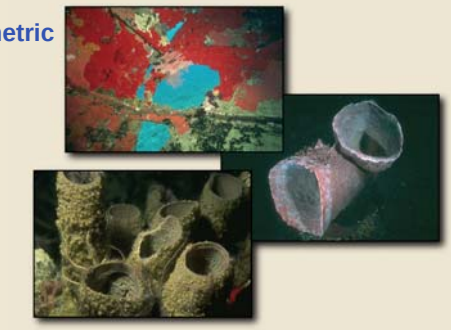
-at one point, division was based on symmetry - bottom of the tree was assymetric and then radial and then bilateral
-still holds

Assymetric



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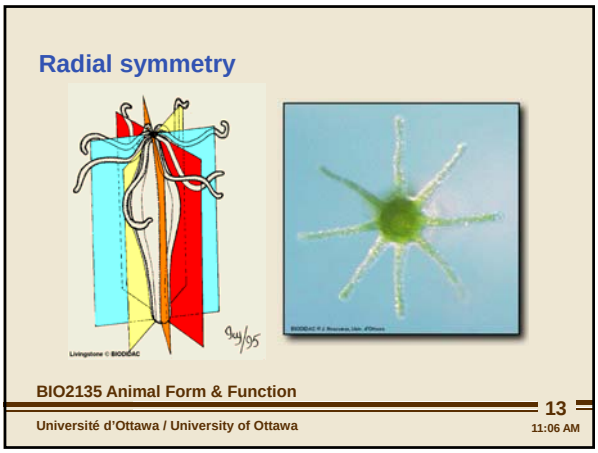
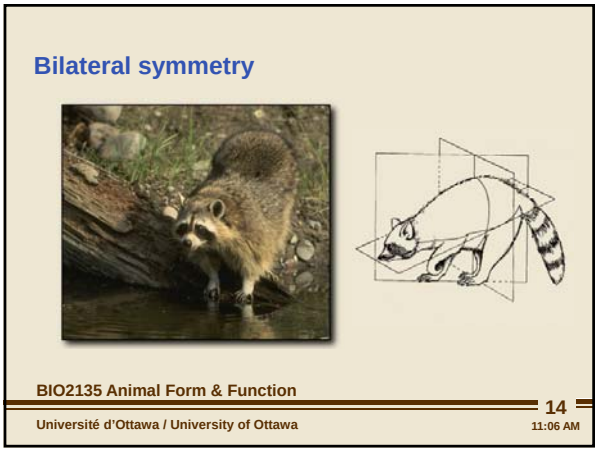
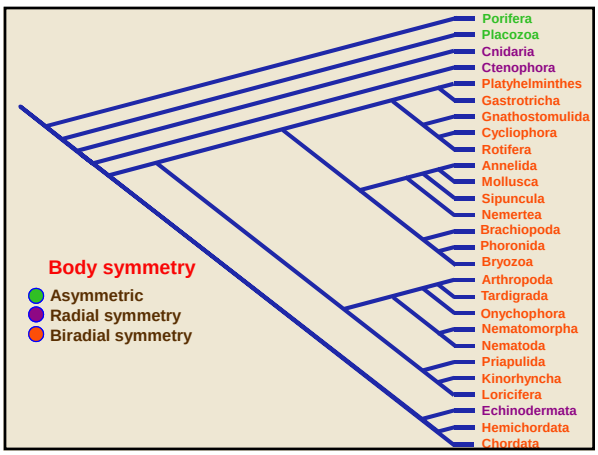
-in an organism that assymetric - no region of symmetry from one side to the other where you can cut and get equal parts



-when we have a digestive tract - a mouth and an opposite side -cut down the middle in multiple planes and acheive equality
-tend to be passive in their environment and float - send food around them



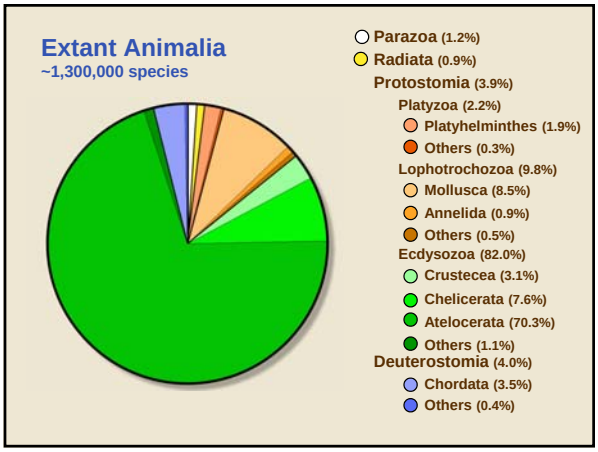
-symmetry that is most common - only has one plane through the organism that have identical halves
-animals that move in one direction - tend to see a concentration of sensory materials at the front
-also associated with increase mobility - successful plans



-first group is the sponges

Porifera

-usual group



-not big on the evolutionary tree
-phyla of which the porifora is the most common
-animals that have cells that are doing different functions - pumping water/wandering around/ transporting things
-havent seen cell to cell comunication or true tissue
-when we get communication - get metazoas

-come in variety of shapes and forms
-all sessile- all going to pump water - all has some kind of skeleton that is going to give structure and hold them up

Poriferan diversity - tube sponges

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19
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-finger shaped -always have a big exit point for water that is flowing out - filter water to get food

Poriferan diversity - barrel sponge

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-can be quite large

Poriferan diversity

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-can be colourful
- since they are sessile- they tend to produce toxics and poisons- reflected in appearance to defend themselves

Poriferan diversity – glass sponge

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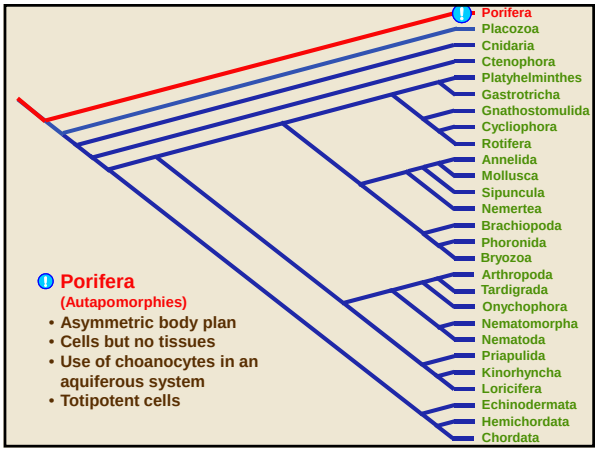
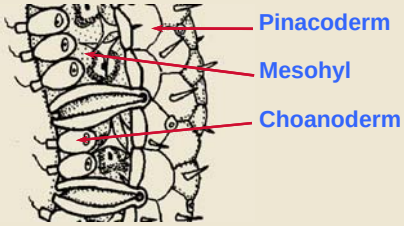
-in deepest parts of the oceans - can be made up glass
- with nothing but a skin a cytoplasm that feeds



-what did the prorifera add on top of the animal body plan (which were the collagen/heteratrophic/ingestion/ division of cell labour)
- they are going to be the animals that have cells but no tissue/assymetric body plan/ **have choanocytes that are organized in a water pumping system (aquiferous system)
- in echinoderms - have water vascular system - do not mix up*
-have totipotent cells - cell programming is not committed to any cell type
-cells that have different functions but they can revert back to any cell type
-ex. red and green sponge - cut up and mix - revert to archeocyte - move around and look for each other - once they recognize each other - eventually grow into a sponge again - like a stem cell
-has an assymetric body plan - sponges dont have tissues- no mouth/ oral opening
-ectoderm and endoderm and have a mouth- basis of symmetry

Cell layers NOT tissues



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-fair complexity in wall of the sponge
-two major cell layers that are present
-one on the outside
-one lining the inside of the cavity (spongocoel) of the sponge
-important not to call them tissues because there is no basement membrane or cell to cell communication - they are only attached by collagen
-outer pinacoderm covering the outside - made up of pinacocytes
-inner surface -choanoderm - where the choanocytes are
-inbetween there is a jelly like matrix - mesohyl
-important because there will be cells wandering in there, where the supporting structure/ skeleton will be
-pinocoderm and choanoderm are unique to sponges
- when we get true tissues - we get an outer ectoderm and an inner endoderm

Choanocyte function

- Food capture
- Ventilation
- Reproduction

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25
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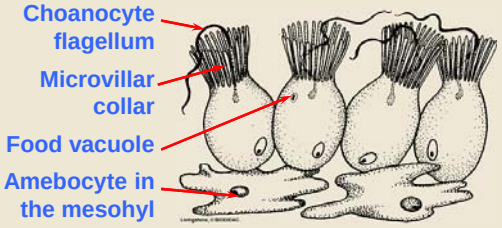
-very important as sponges use this organism to pump water
-have the flagellum beat to have water move between the microvilli of the collar where food will get trap
-also creates a water current for the whole organism
-important for exchange - for oxygen/ removing metabolic waste - water flowing through aquiforous system will help with ventilation and exchange with the outside world -also help with sending out sperm for reproduction

Choanoderm - Feeding and Digestion



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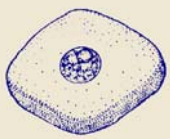
26
11:06 AM

-in the choanoderm - where they are all glue together - capable of capturing food, ingesting via phagocytosis and the food vacuole travels into the body - nourishes it
-any access food get passed to amebocytes (wandering cells in the mesohyl)
-they then transport food to the cell that cant capture food for themselves
-ex ameobocyte takes food from choanocyte or ameobocyte will carry food to the pinacocyte/pinacoderm cell on the outside wall

Pinacocyte



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27
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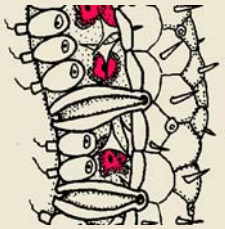
-on the very outside - pinacoderm - square shaped cells - embedded together to make a sheet, making the body wall of the sponge

Other cells



Archeocytes
(Amebocytes)

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28
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-amebocytes (archeocytes [term that says a cell can transform into any other cell])
-choanocytes are either made by cell division of other choanocytes of the archeocyte transformed into one
-they can also differentiate to become pinochoderm
-to identify the specialization of the ameobocyte, when calling it an archeocyte - recognize the fact that it can transform in to any other cell type

Sclerocytes

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29
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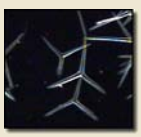
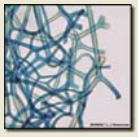
-sclerocytes - make the skeleton of the sponge
-secrete either calcium or silica in deep waters - makes spicules that are associates with the architecture of sponges that give the sponge it's shape

Sponge spicules - Skeleton

- Calcium carbonate
- Silica
- Spongin





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30
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- they are made up of calcium, silica
-another component call spongin - woven structure/ glass needles
-always a mix of skeletal elements
-soak them in acid- that would dissolve the calcium needles -gives a spongin spicule mass that is soft

Identifying sponge architectures
(Aquiferous system)

- Location of choanocytes
- How water reaches and leaves choanocytes
- Number of oscula
- Presence of porocytes

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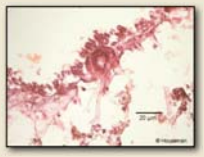
-three major architecture of sponges - each architecture must be efficient in pumping water
-first organism that figures out a way to pump large bodies of water and extract bacteria and small protist and use them as a food source
-with each architecture there is an increase in proficiency with how they pump water and capture their food
-4 things that should be looked at
-what part do we find choanocytes
-how does water get to choanocytes
-oscula - opening of where the water leaves
-water diffuses to through the body wall through the choanocytes and out the oscula -at the top of the sponge
-do we have porocytes - specialized cell that controls water movement

Asconoid sponges
Aquiferous system

Osculum
Spongocoel
Ostium
Porocyte



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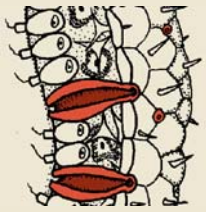
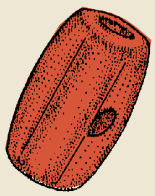
-simplest sponge structure - asconoid sponge
-these sponges are really small - due to the fact that they are not efficient at trapping water
-only group that has a porocyte
-water enters the sponge through a porocyte in the asconoid sponge and moves directly into the spongocoel where the choanocytes are
-choanocytes create a current where the water proceeds to leave via the osculum - will trap food in the collar as this happens
-only one osculum per sponge
-not efficient because food can pass through the porocyte go to the middle of the spongocoel and follow the current out and no food would be able to get trapped - another reason why it is small

Porocyte





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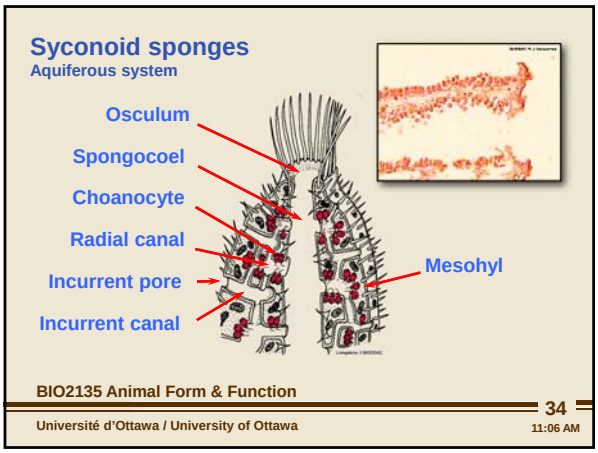
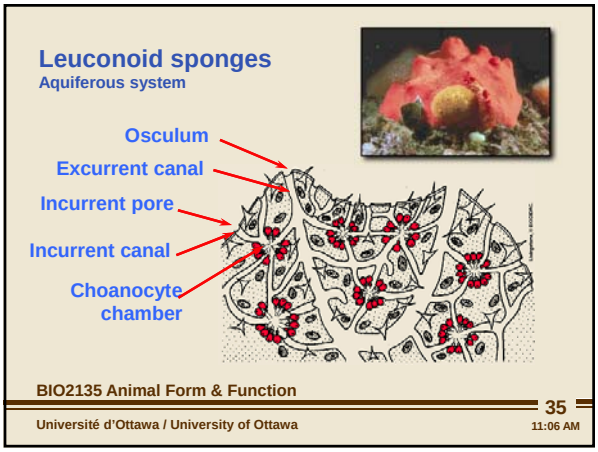
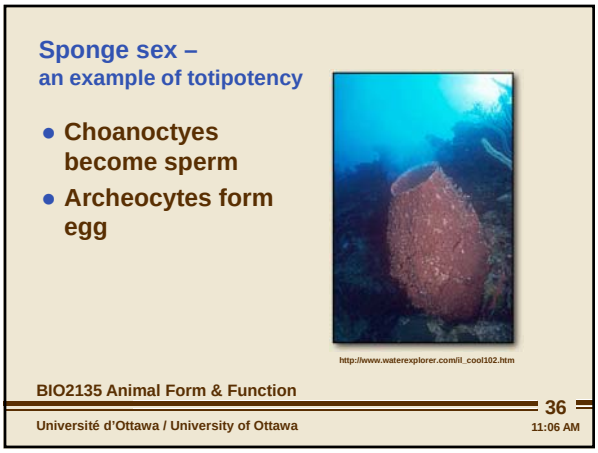
-a donut shaped cell that is embedded in the wall - water passes through the cell



-syconoid sponge next structure
-instead of having porocytes - the body wall is folded in on itself - like fingers
-there is an incurrent canal (around the fingers) and radial canal (inside the finger)
-have opening that go between the incurrent and radial canal
-when choanocytes create their current - they draw water into the incurrent pore -leads to incurrent canal and then into the radial canal -then forces it into the spongocoel and then out the osculum
-difference is- choanocytes are now lining the radial canal
-decrease the volume that choanocytes are processing- optimize the food that is extracted
-only the radial canal has choanocytes - where the food is going to be trapped
-decreased the diameter where the water is moving, increased likely hood that food will be captured

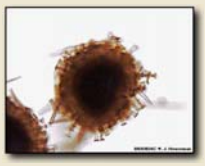


-most complex- the leuconoid sponge
-in these sponges - there are multiple oscula
-there are openings all over the surface - incurrent pores -lead to an incurrent canal -lead to a choanocyte chamber (space that is lined with choanocytes - where food will be trapped
-since the tubes are narrow the water moves very quickly to the chamber - where it slows down because the diameter is larger - give time to choanocyte to collect as much food as possible before leaving
-once water leave - possible for it to move to another choanocyte chamber where more food can be trapped again
-packet of water can go through several choanocyte chambers before leaving the sponge via any of the oscula present
-much more efficient way to capture food
-this is the most common structure - because most efficient



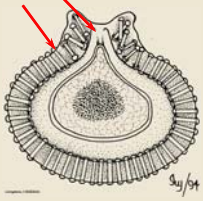
-only have one cell with motile structure on it - the flagellum
-choanocytes changes itself into a spream - move out of the osculum into the water
-female sponge - archeocyte becomes an egg
-sponge sperm is going to be pulled in with the water - choanocytes are going to trap it
-going to recognize that it is sperm of its own species -instead of ingesting it and breaking it down in a food vacuole- passes to an ameobocyte - and wanders through the mesohyl -until it finds the egg which will then be fertilized
- if it from a different species it will just eat it like regular food

Poriferan reproduction



Micropyle

Spicule



Sexual

Asexual

- **Budding**
- **Fragmentation**
- **Gemmule formation**

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37

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-asexual reproduction

-budding -growing a set of cell with the sole purpose that they are going to be released and settle back down and become a sponge

-fragmentation - a piece that breaks off unintentionally

-ex. broke off by a predator and then get dropped off somewhere and has the potential to grow into another sponge somewhere else

-gemmule formation - represents a whole bunch of archeocytes that are dormant that are put in an outer casing of pinacoderm - covered with spicules to protect it

-sponges that were able to live in fresh water systems - need to deal with the fact that environment is hypotonic to the sponge

-only animal left with contractile vacuole to deal with inundation

-they dry out in fresh water systems in cold water- leaving gemmules in their body wall - waiting for water to warm up - so the archeocytes and leave the gemmule via the micropyle to grow a new sponge

Quick Question

How did you prepare for today's class?

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38

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