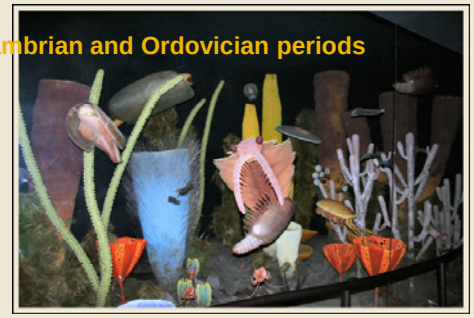
Cambrian and Ordivician

Cambrian and Ordovician periods



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Geological time scale and building height

(1floor – 60Ma, 72 floors, 12 feet/floor)

- **Major Eons (Ma)**
  - **Phanerozoic**
    - (550 Ma to present time, top 9 floors')
  - **Proterozoic**
    - (2,500 – 550 Ma, 33rd -63rd)
  - **Archaean**
    - (3,800 – 2,500 Ma, 12th – 33rd)
  - **Hadean**
    - (4,500 – 3,800 Ma, 0-12th)

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cambrian explosion

Geological time scale and building height

(1floor – 60Ma, 72 floors, 12 feet/floor)

- **Major Era**
  - **Phanerozoic**
    - Cenozoic (65 Ma to present time, 72nd floor)
    - Mesozoic (245-65 Ma, 65th to 71st)
    - Paleozoic (550-245 Ma, 63th to 65th)
  - Proterozoic (2,500 – 550 Ma)
  - Archaean (3,800 – 2,500 Ma)
  - Hadean (4,500 – 3,800 Ma)

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~~multi-cellular~~
mesozoic: on land organisms
paloezoic: animals and mammals

Paleozoic periods

- Paleozoic era
  - Cambrian 550-488 Ma
  - Ordovician 488-443 Ma
  - Silurian 443-416 Ma
  - Devonian 416-359 Ma
  - Carboniferous 359-299 Ma
  - Permian 299-245 Ma

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3:02 PM

multi-cellular life and animals all oddly in same time period
~~Ends with a large mass extinction~~ which only allows the survival of only a few organisms.

good light penetration, great for plenty of autotroph organisms (under water)
coast line where organisms originate from.

Figure 27-8

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Burgess shales – Yoho National park

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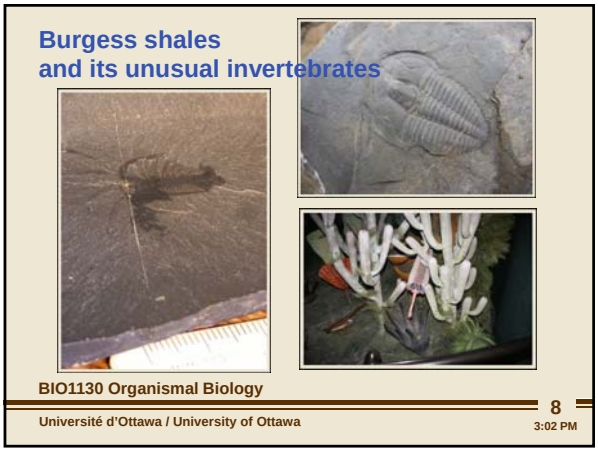
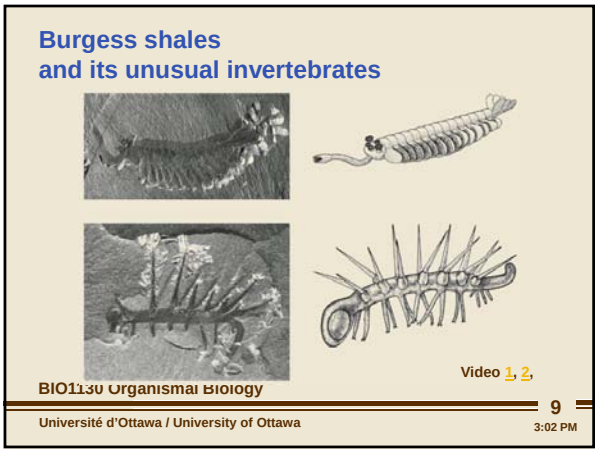
the organisms here fell to the bottom of the ocean and were covered with sediment rock, and the soft-bodied organisms were fossilized.

organisms with no similarities to ~~animals today and other organisms~~ such as trilibites





descendents of species we see today, eg, earthworms.

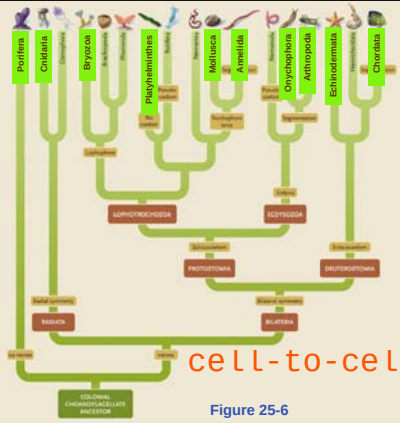


Figure 25-6

cell-to-cell communication

10
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Animal architecture

- Tissues
- Symmetry and cephalization
- Embryology
- Body cavities

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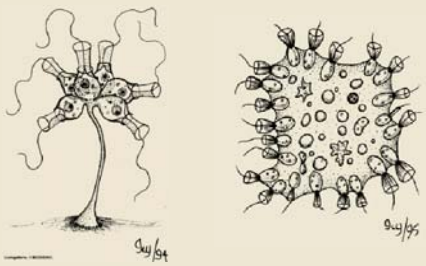
Colonial choanocyte ancestor



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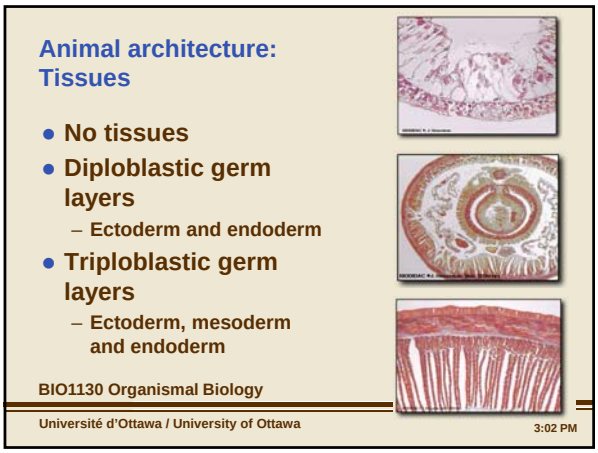
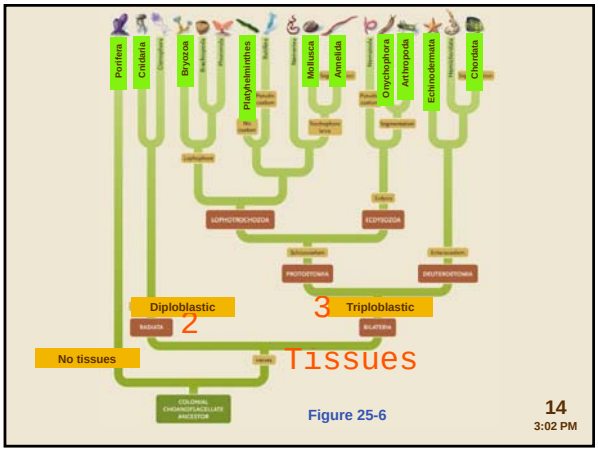
biochemistry of microtubules that create the flagella are the same as any on an animal

ancestor to every single animal today



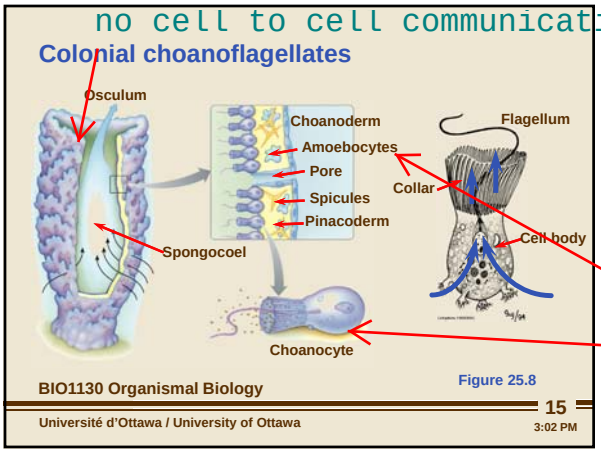
develop two tissues layers: endoderm, ~~ectoderm (outside).~~

muscles derived from mesoderm



sponges

no cell to cell communication thus no tissue, can pump water



passes food to amoebocyte because choanocyte cannot eat
amoebocytes lay down skeleton to hold up cell
its heterotropic
excess food exists plasma membrane and is moved to the choanoderm (not a true tissue)
still an animal needs food for energy

Sponge sex

- Choanoctyes become sperm
- Archeocytes (sponge stem cells) form egg

http://www.waterexplorer.com/il_cool102.htm

Figure 25.7

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16

3:02 PM

engulfes sperm cells with phagocytosis

through the water pump

Animal architecture
Symmetry and cephalization

- Assymetric
- Radial symmetry
- Bilateral symmetry and cephalization (head)

Figure 25.3

17

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all animals are going to have a mouth

zoologists locate organism mouth look at oral side and aboral side

sponges are assymetric

EXAM MATERIAL (look at lecture vid (oct 31)

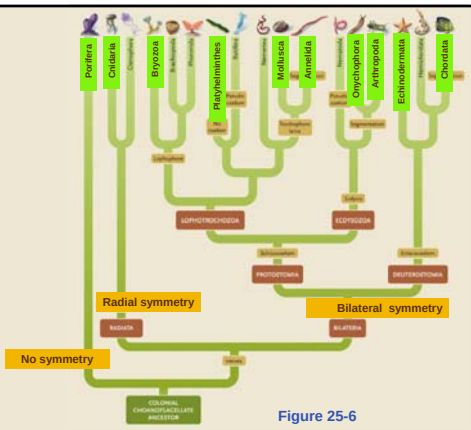

Figure 25-6

18

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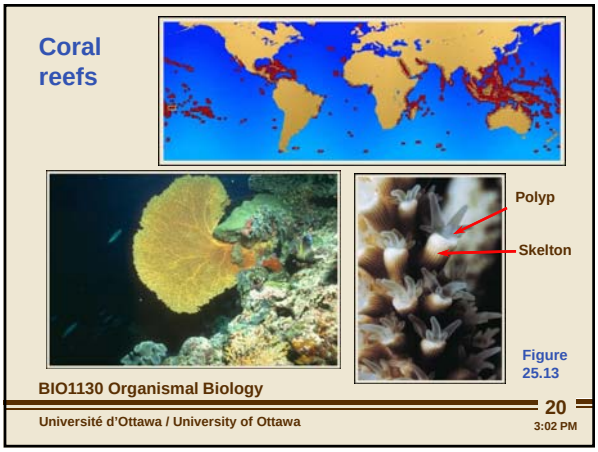
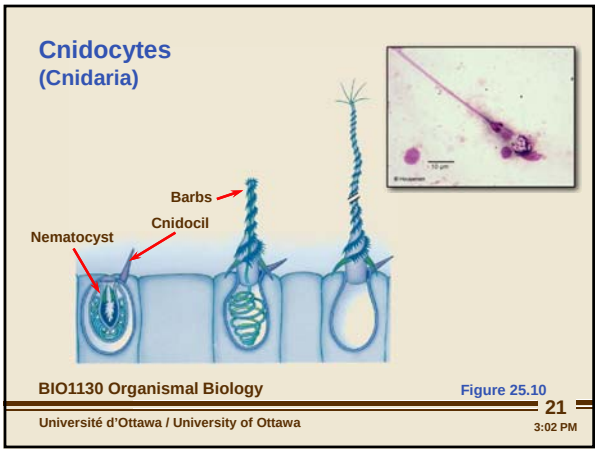
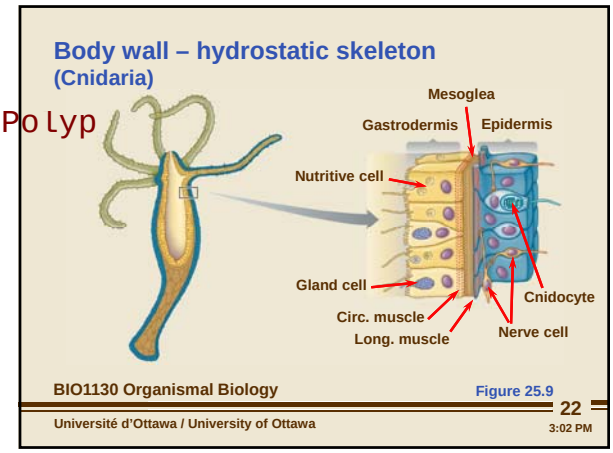
Cnidarians



Reef building during this time period



One of the first exclusive predators - the cnidaria
~~similar to a tazor~~
can use its body to pull prey back in



capture prey put it in digestive ~~cavity, then barf it out and digest it again.~~

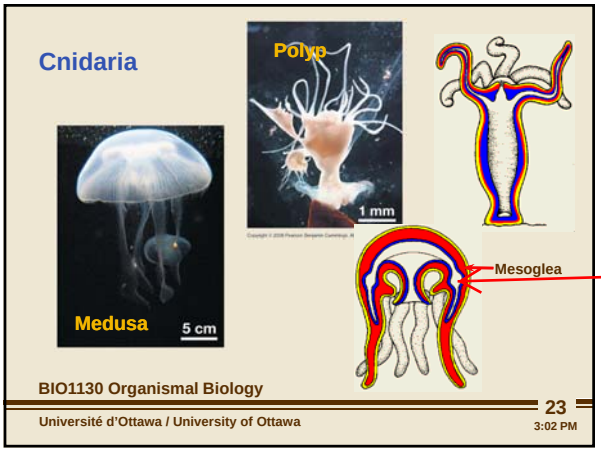
has no muscles or mesoderm

it has a hydrostatic skeleton

uses water-filled skeleton

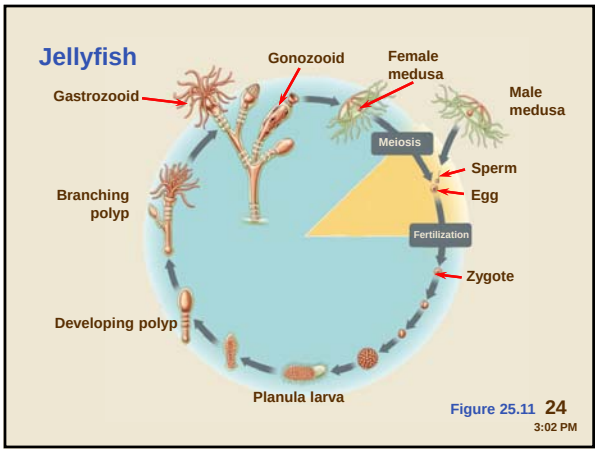
there is a fibre called the myoneme and it is contractive but it is not a mesoderm

there is a muscle that can stretch back to original form- origins of first skeleton



essentially a flipped polyp

jelly-fish in gatineau waters



Animal architecture

- Tissues
- Symmetry and cephalization
- Embryology
- Body cavities

Animal architecture

Embryology - cleavage

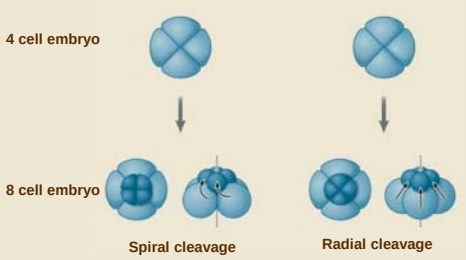


Figure 25.5a

Animal architecture

Embryology - gastrulation

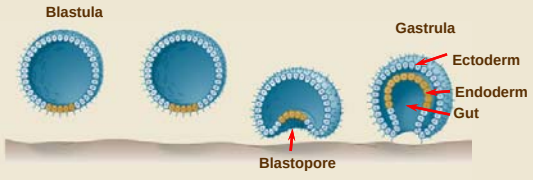
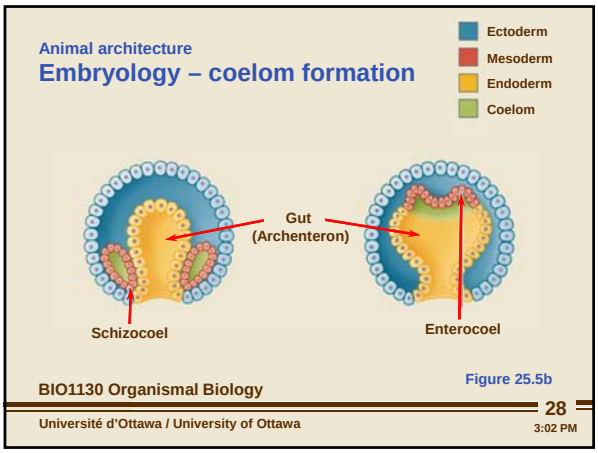


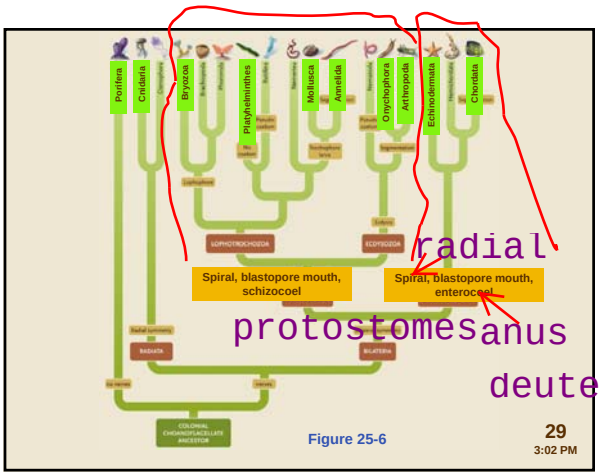
Figure 25.2



the mesoderm is the muscle

schizocoel: splitting mesoderm to make cavity difference is how it happens.

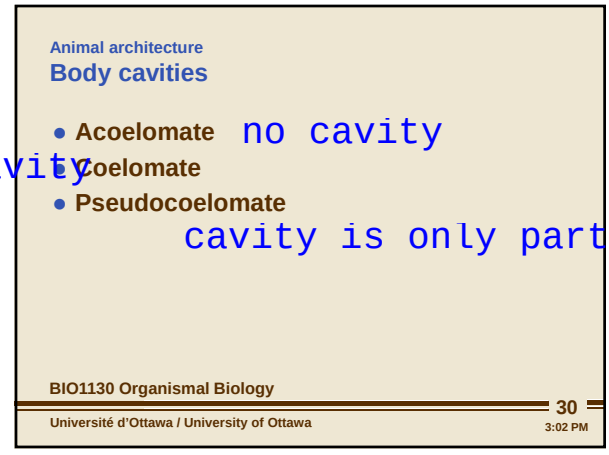
~~same products in both events~~ only



radial

protostomes anus

deuterostome

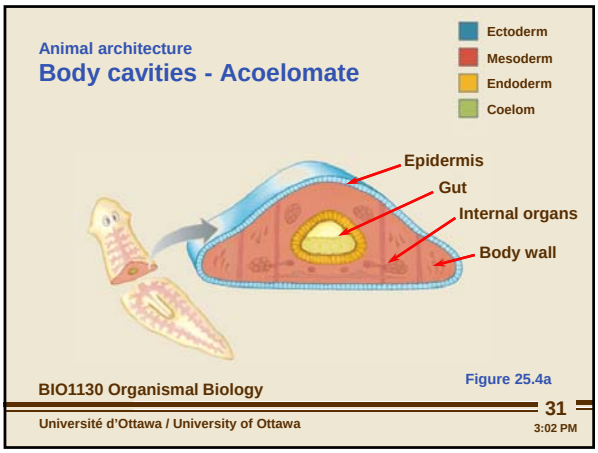


no cavity

cavity

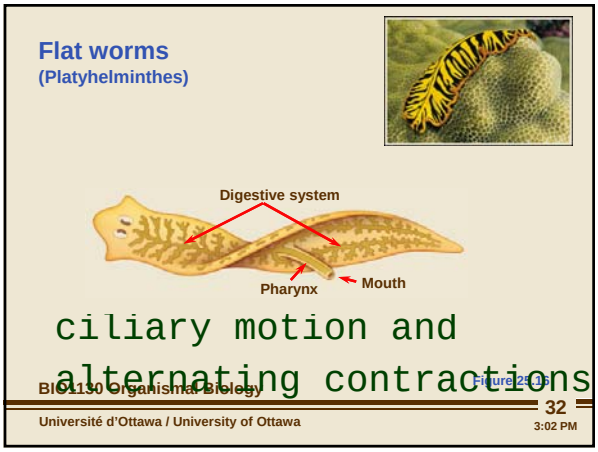
cavity is only partially lined with mesoderm

how they feed (animals), how they get around, how they adapt, their ~~reproductive cycle~~



flatworm lost its body cavity. It did this because its flatness gives it a really good surface-to-body ratio.

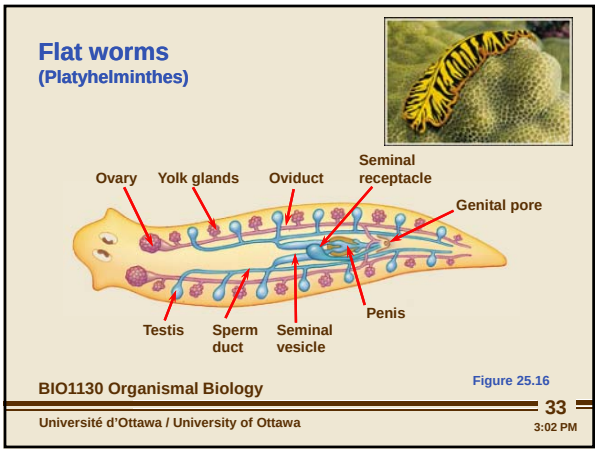
successful as parasites.



no anus, currents in digestive tract, use its pharynx to pull food in.

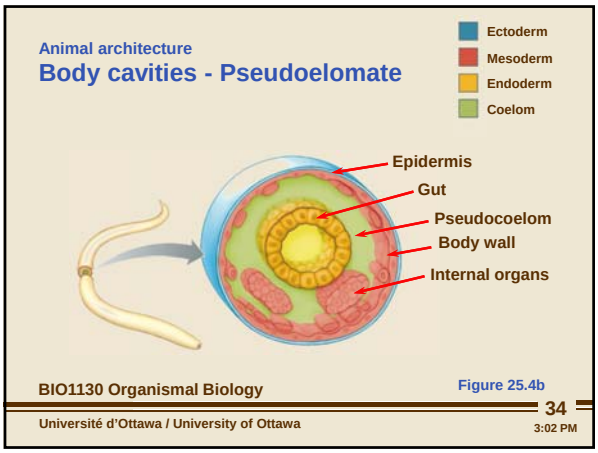
uses cilia that beat against substrate

second form of motion, contracts ~~circular muscles, uses spon~~gyness of tissues that fill the body, secrete glues to stick head in place, (works sort of like an accordion)

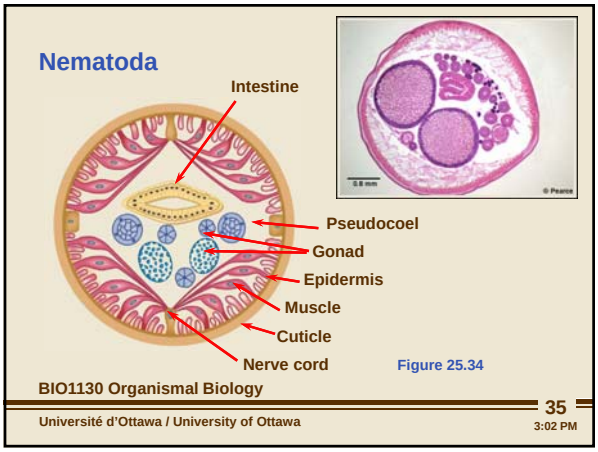


hermaphrodite (both sexual organs) every mating event produces a fertilized individual ~~(impregnated)~~.

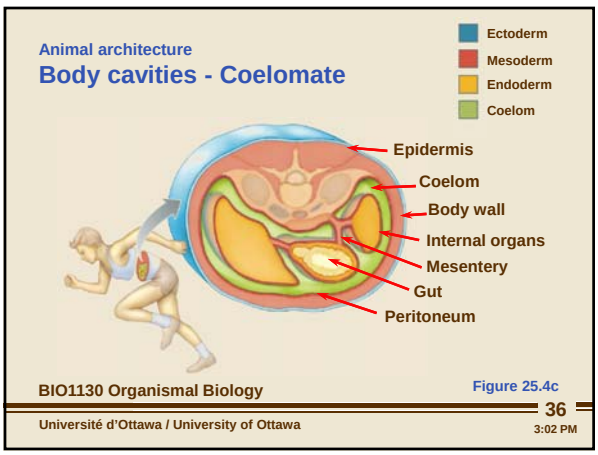
no variation if impregnated so sperm goes to seminal vesicle to be passed on to another flatworm into the seminal receptacle.



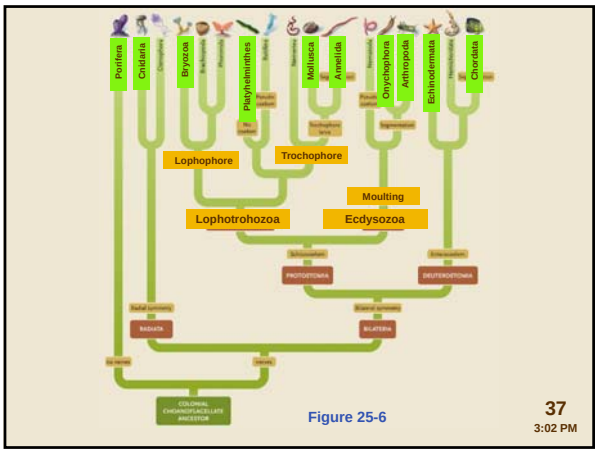
mesoderm doesn't completely line body cavity (in round worm).
The gut has no musculature



only have muscles on the outside they only have longitudinal muscles.
~~nematodes(nematode) live in~~ soil ~~where they can push with "s" shape~~ motion.
the gut is a single-cell layer thick.

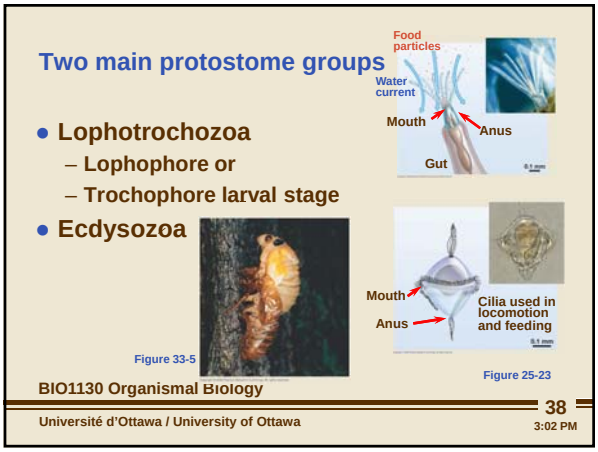


mesentery-holds organs in place



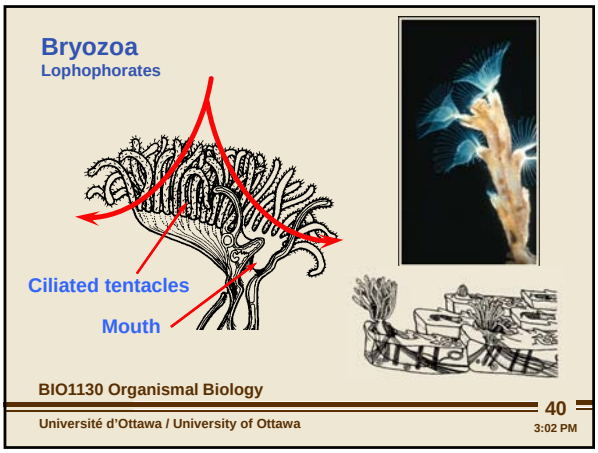
ecdysozoa have moulting
arthropoda are 95% of the animals

(listen to podcast)



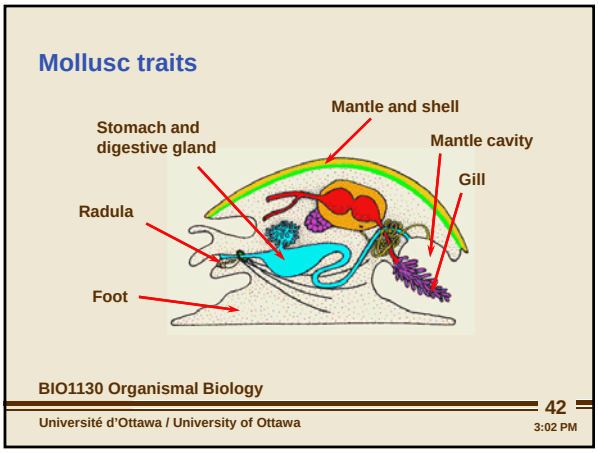
lophophore- feeding structure
trochophore- means they have one of the two

has a lophophore

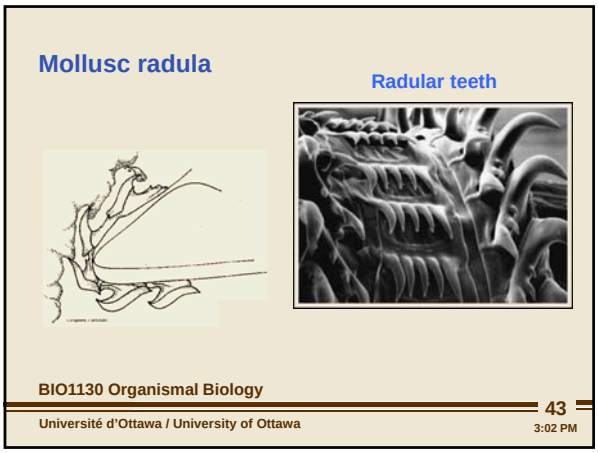


series of hollow tenticles that can extend out and can position ~~and wave it for anything it~~ needs ~~to do. Covered in cilia,~~ propel water into center, out at base of lophophore, cilia take material pass it down tentacles into mouth.

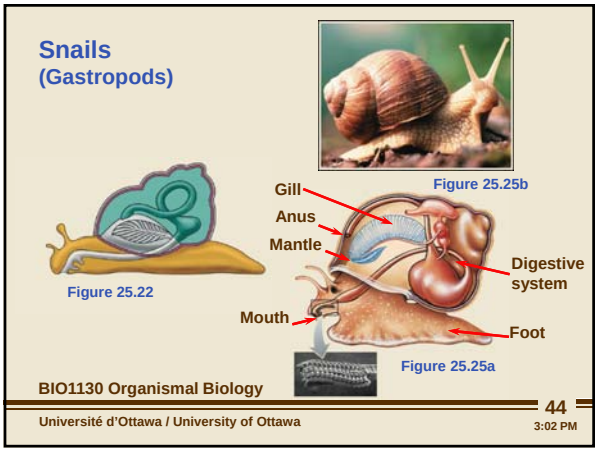
example of adaptive radiation. A system can be modified to carry out functions.
~~squid, snails, clams~~



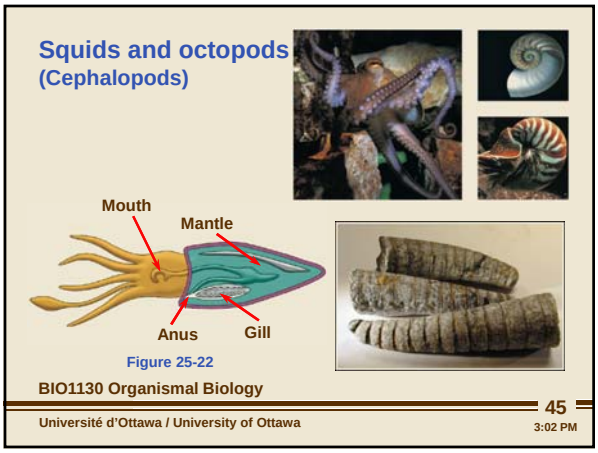
protective shell, secreted by epidermal layer. Uses calcium salts in water and solidify them into a shell.
~~develops feeding structure~~ called radula, like a tongue, but covered with teeth, can grind at material



scrape at organic material, grind it up like a phile or electric ~~grinder.~~

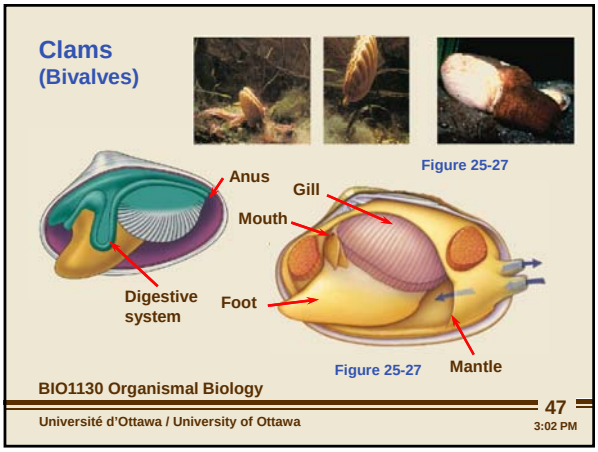


perfected its cavity that it hides in (adaptive radiation)
~~compacted and spiraled shell to make it easier to move and~~ not tip over, they can snap shell shut.
they are hermaphrodite organisms.

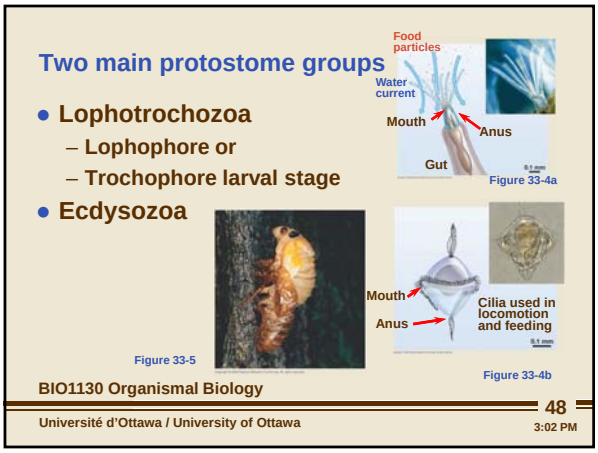


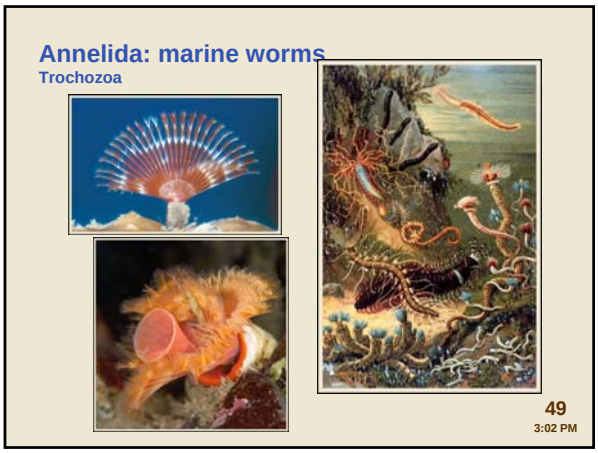
it tips over with big shell.
invertebrate

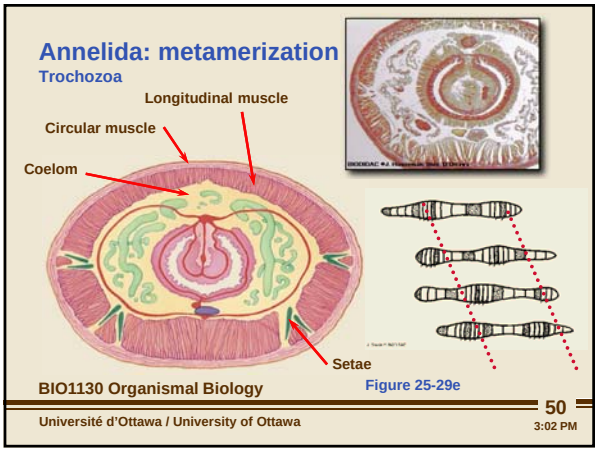
will discard their shells to adapt later on to compete against fish



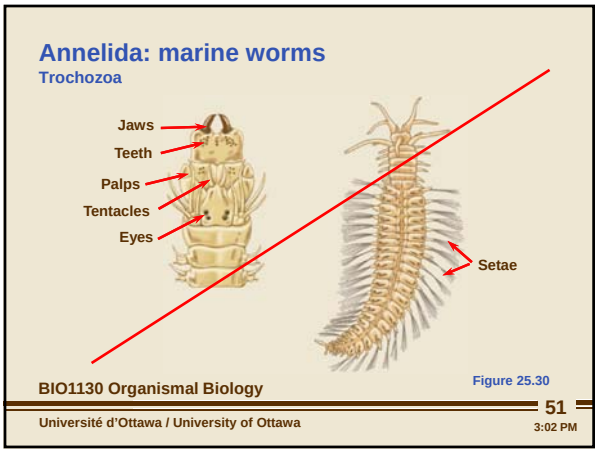
burry themselves into the sand. digestive system is a perfect particulate feeding system. pump the water to get the food.

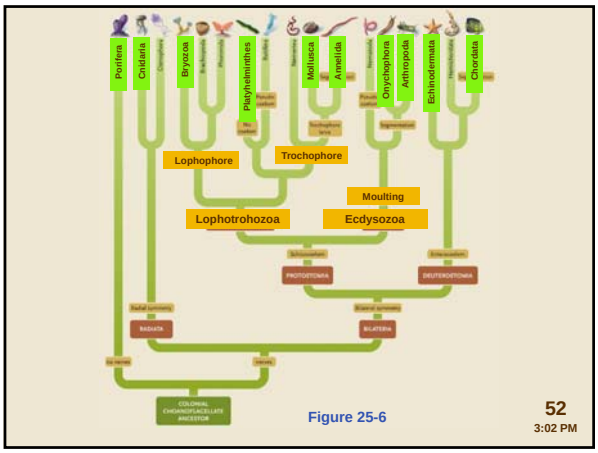


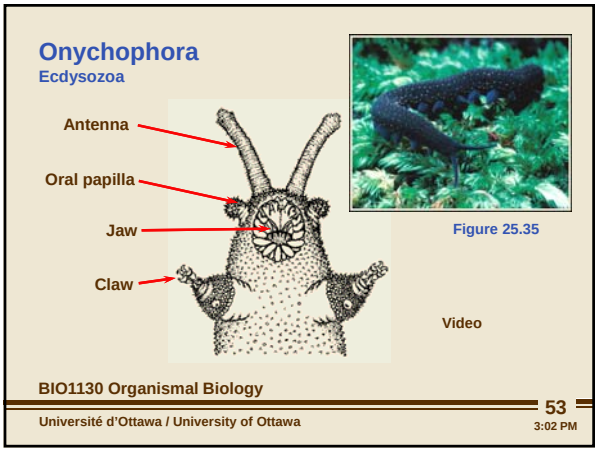




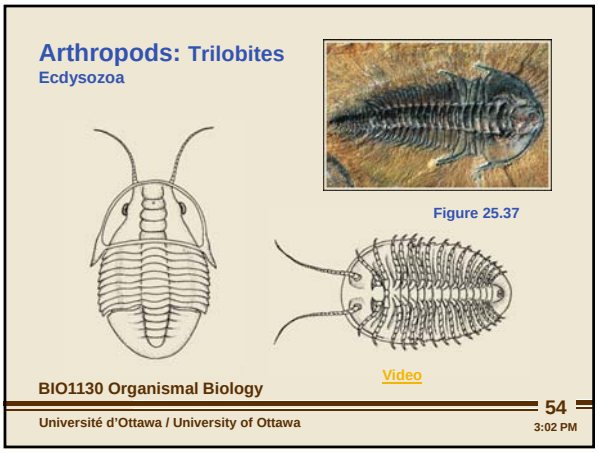
segments called metamere
annuli rings of worm
accordion shape
bristles stuck in and retracted
diameter is at its largest, on ventral side ct stick out (bristles) gripped in place, contract circular muscles and lengthens
same as flatworm movement, hydrostatic skeleton individual fluid filled parts
open mouth consume substrate and burrow through it(tunnel through)



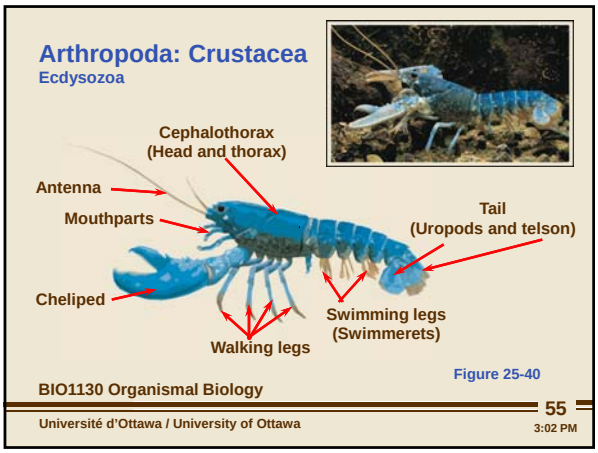




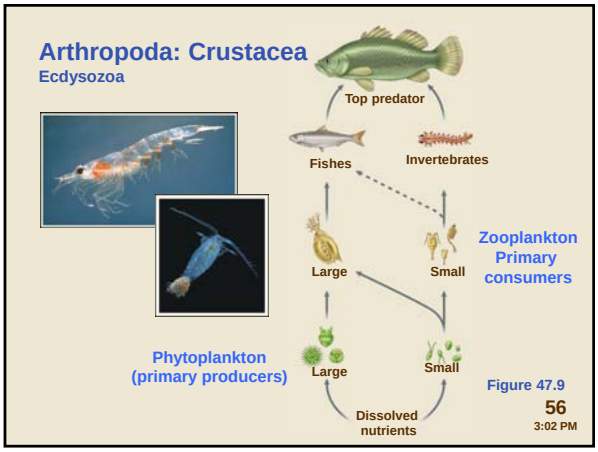
the velvet worm
found in burgess shales
made way up on land, still live there.
they are predators, completely blind.
spits out glue to attack and immobilize prey
lots of feet soft and silent
beginnings of first exoskeleton



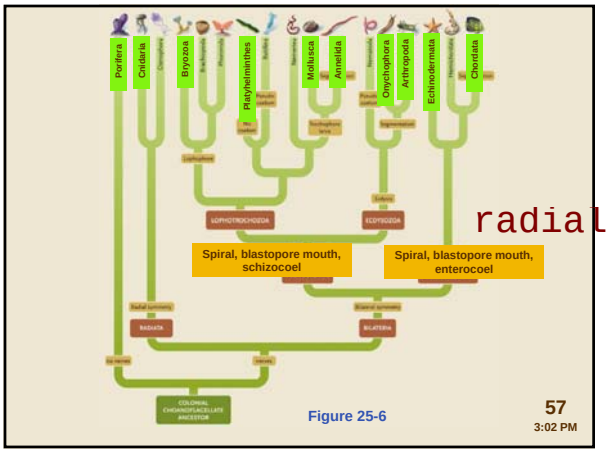
segments start to fuze together to carry out specialized functions



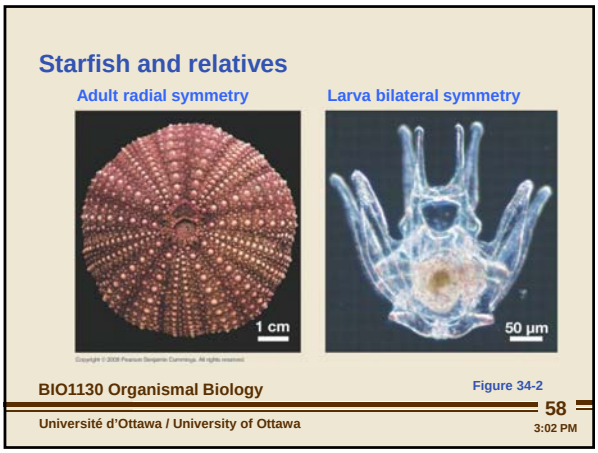
outer armor toughens up
fusing segments into functional units, called tagma

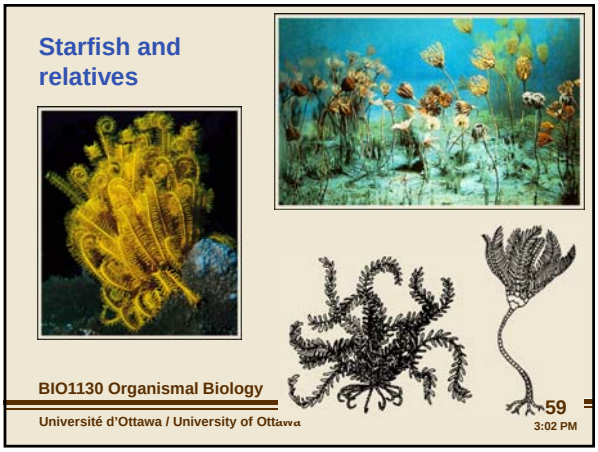


trap particulate easily are small zooplankton, most abundant component of ocean.
huge animals in water feed on these.
whales pump huge amounts of water through there oral cavities
swim to capture food, move all around

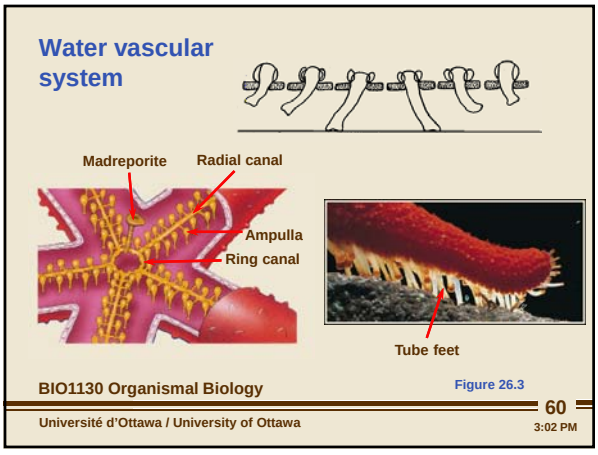


radial and anus





feeding with arms, trapping food



finger-like projections have capacity to move
circular and longitudinal muscles to move around
tube-feet pass from one to the next
thousands of independent hydrostatic skeletons
gave up immobility and become mobile
suction cup on ends of feed, lever itself along
starfish are all predators
stomach turns inside out and spits liquids to liquify clam
symmetry is based on 5, pentaradial symmetry

An explanation for the Cambrian explosion

- Snowball earth
- Burrowing
- Shelled arms race
- Developmental – *hox* genes

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61
3:02 PM

why did we see explosion in Cambrian

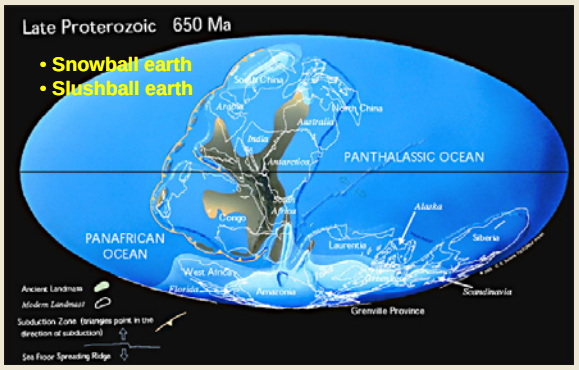

Figure 20.9

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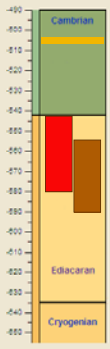
62
3:02 PM

snowball earth- whole planet froze
carbon dioxide + water equilibrium with hydrogen and HCO_3^- calcium
silica precipitates
no CO_2 blanket, earth cools, ice builds up at poles
light bounces back out to space
ice masses met in middle, completely froze planet
during the Proterozoic lots of oxygen omitted
carbon dioxide and methane, poorer insulated blanket
some people think it should be slushball earth, still areas of life
carbon dioxide slowly bring back life and slowly melt ice
once melt ice thermocapacity of land and ice accelerates this faster.
EXAM

Early animal evolution



Burgess shale fossils
505 Ma

Ediacara fossils
580-542 Ma

Doushantou fossils
580-542 Ma

Be sure to look at Knoll VR00314 for most recent data on this period and the evidence

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63
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Doushantuo fossils
590-565 Ma

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they look like embryo of two cell, 4,6, older than cambrian
some form of multicellular organism

Ediacaran fossils
580-542 Ma
(Mistaken point NFLD)

Protoanimals of Mistaken point
Australian footprints

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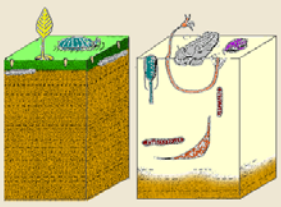
foot print, tracks, fish, all older than Cambrian
life before snowball earth and Cambrian

Cambrian burrowers

- Advantages
  - Feeding
  - Anchorage
  - Protection



Ediacaran benthic zone
Cambrian benthic zone

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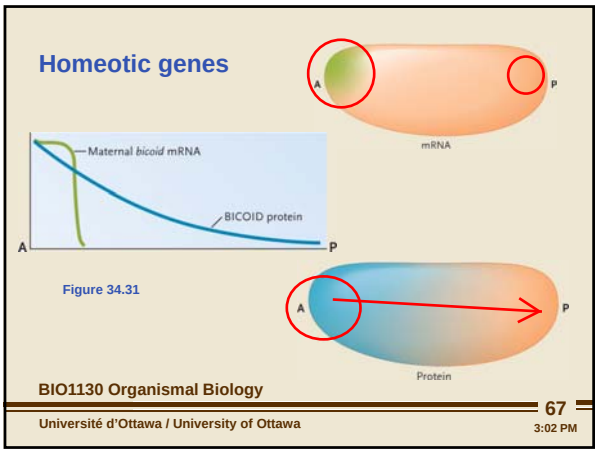
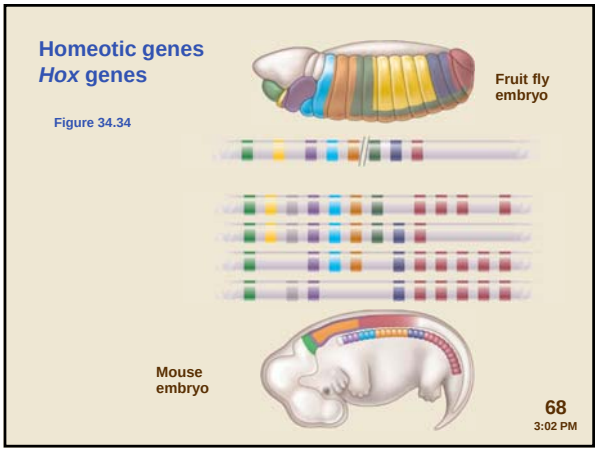
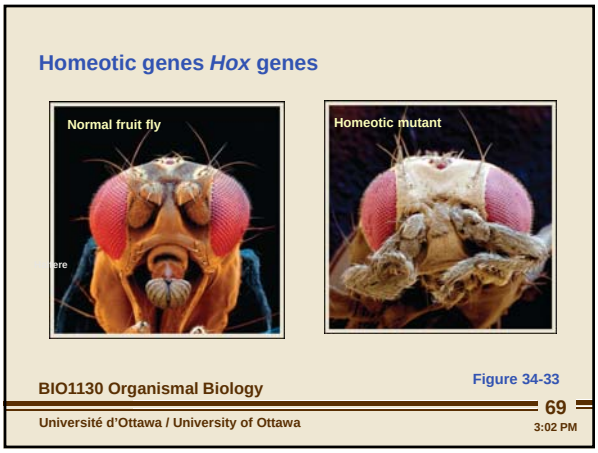
fossils of organisms burrowing



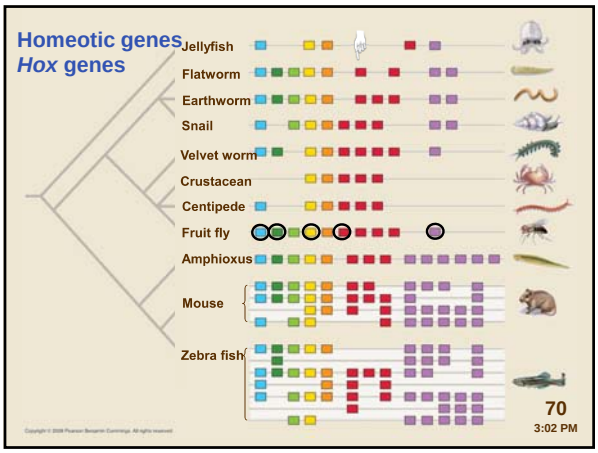
if you have an embryo (slug of cells)
how does it know posterior and anterior ends
set of transcription factors
message for protein to diffuse across, makes a gradient
gradients turn on and off genes



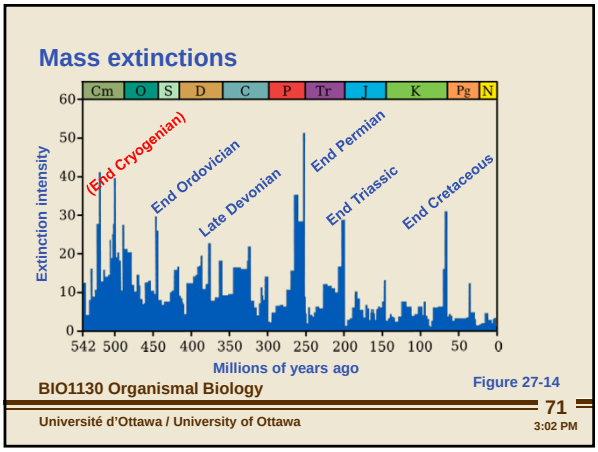
posterior and anterior genes
scientists looked at regulatory genes
arranged in same sequence
there is a transcription factor, if you see me you're going to make things at posterior end



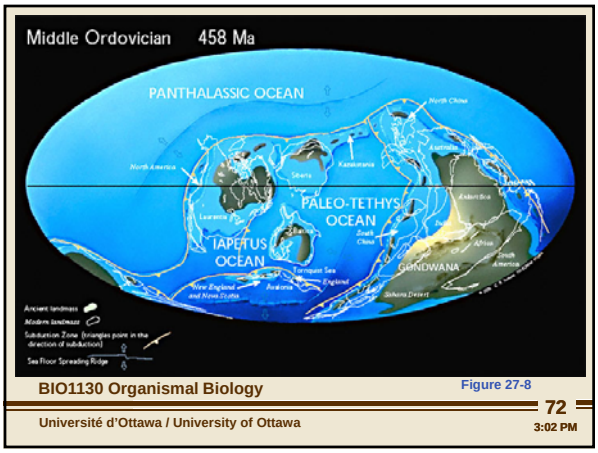
Cambrian and Ordivician



gene duplications
initial first genetics codings for patterns in animals was used over and over and over again
universal
colours represent what creates the pattern in multicellular organisms
(new habitats by burrowing)
body forms that burrowed, some secreted shells
same homeotic genes show up in plants, when plants come up on land



second largest mass extinctions of the planet



Mass extinctions

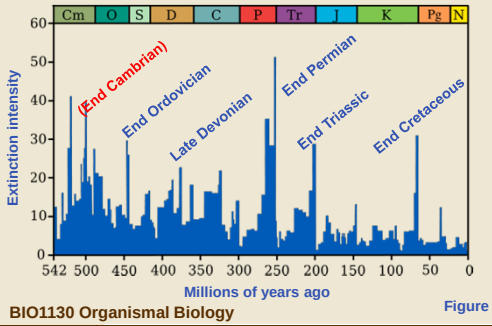


Figure 27-14

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73

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