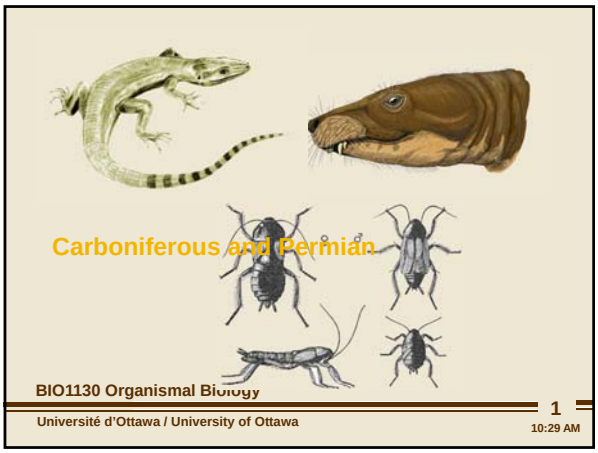
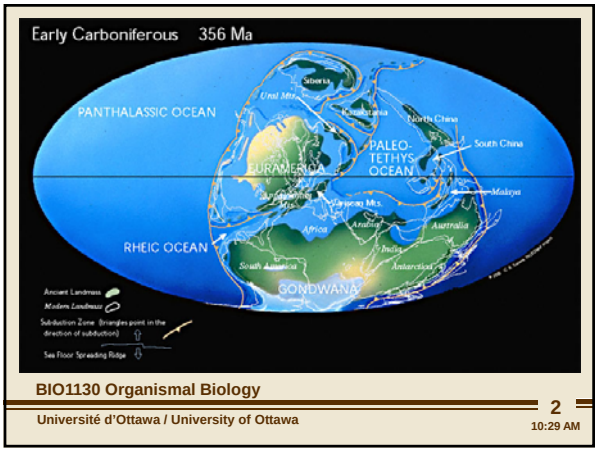
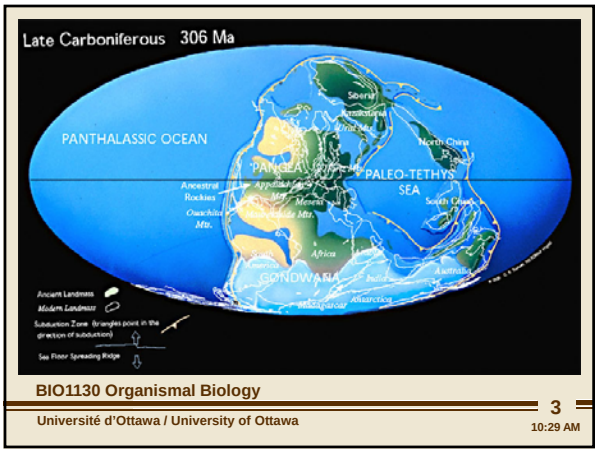
Carboniferous and Permian periods

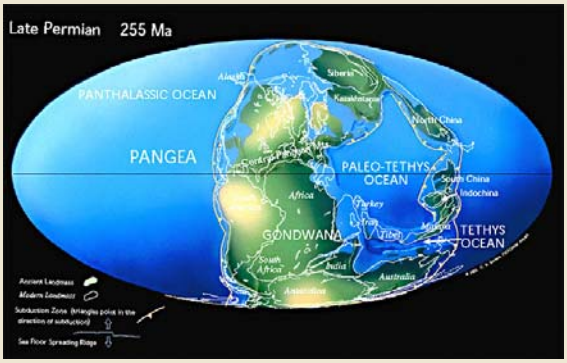


going go experiece largest mass extinction ever.





Carboniferous and Permian periods



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biggest change is the plants and development.

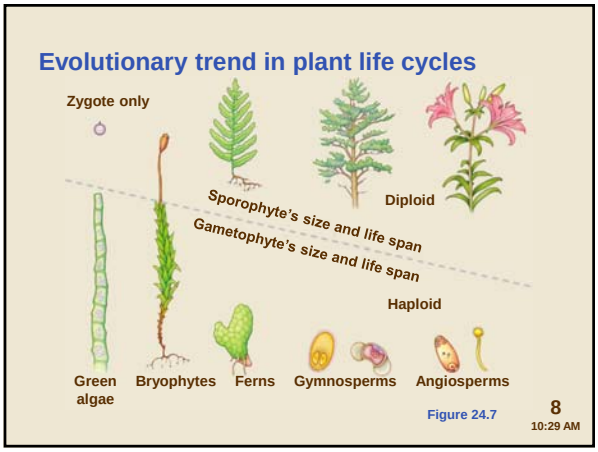
period of massive of productivity in plants. Starts raising oxygen levels.

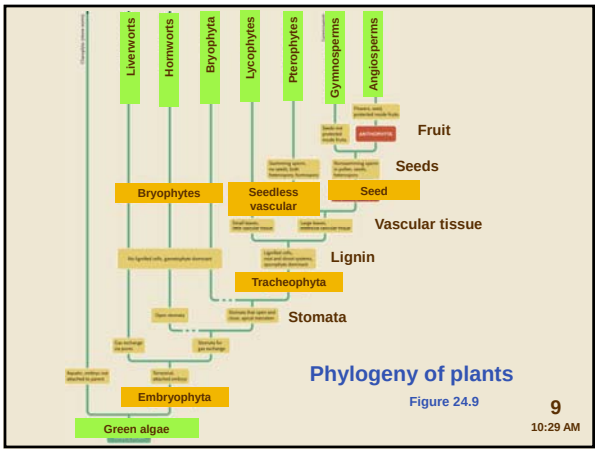
Carboniferous and Permian periods

big innovation is the plants are going to start to pull together the

seperate life cycle sof the gametophyte and sporophyte.

its going to make polin to fertilize.

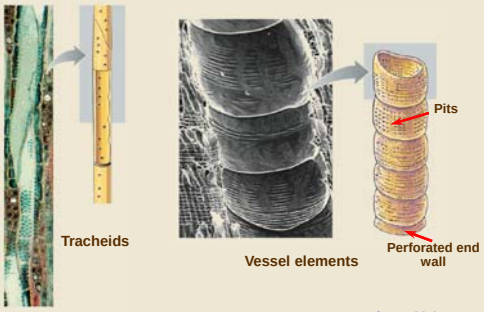




vascular tissues becomes lignified.

Lignin produces xylem and Phloem

Evolution of plant vascular tissues



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plasma dismata- materia to diffuse from cytoplasm to cytoplasm. these specializations will die but will have formed the cell walls. creating the water transport system of plants. connecting everything from leavs to the roots. (hollow tubes) lignin as it dies is a reinforcing structure of plants.

Lignin

- Hydrophobic
- Indigestible
- Bacterial and fungal lignases
- Toxic

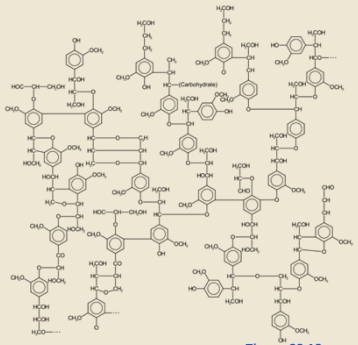

Figure 23.18

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lignin is a scary chemical compound.

it is hydrophobic- makes sense, slip through non stick. doesnt react so the water is not absorbed by lignin

indigestible- cannot be broken down. consequence, no recycling of plant tissue in carboniferous. they fossilized creating coal.

it is toxic.

bacteria and fungi will break it down. fungi has not showed it self yet, needs to diversify. once it does show up everything will go in balance.

Spores vs. seeds

- **Homosporous**

Sporangia → Spores → Bisexual gametophyte → sperm or eggs

- **Heterosporous**

Microsporangia → Microspores → Male gametophyte → sperm
Megasporangia → Megaspores → Female gametophyte → Eggs

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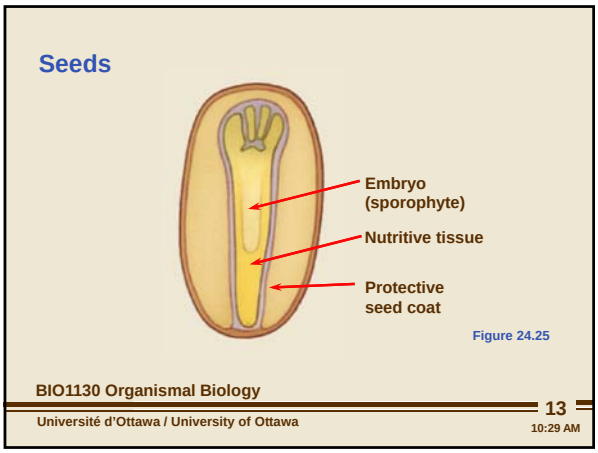
switch from spores cant distinguish whether to turn into sperm or egg. they create micro and mega spores. they are sporangia that produce little small spors that ...

~~move from homo to heterosporous. it is waterproof so it~~ can move from air.

plants that only make 1 type of spore= Homosporous. gametophyte that develops from it is bisexual, can make both sperm and eggs.

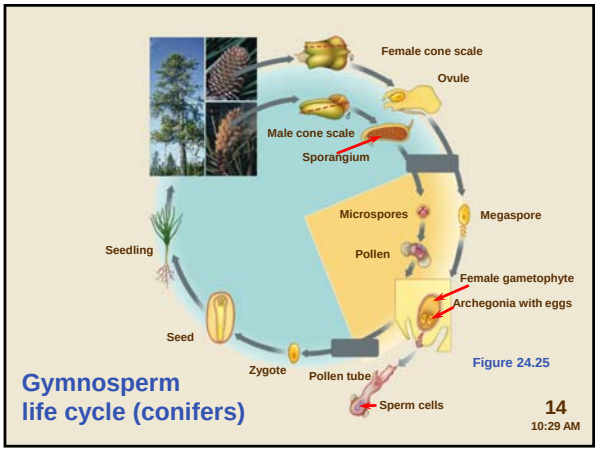
Gymnosperms and angiosperms are heterospores. produce 2 types of ~~spores, 1 smaller then the other in a sporangia. smaller ones~~ 1 microspores that develop into male gametophyte. produced by meiosis, undergo mitosis to produce pollen grain.

megaspores develop into female gametophyte.



sporophyte surrounding by nutrient tissue. sporophyte will grow into plant.

this complex structure makes seeds ideal packages for sheltering an embryo from drought, cold etc. as a result they experience high survival rates. it can also be transported far from its parent. Can stay in their seed for a long time before germinating and growing. waiting for the right conditions.

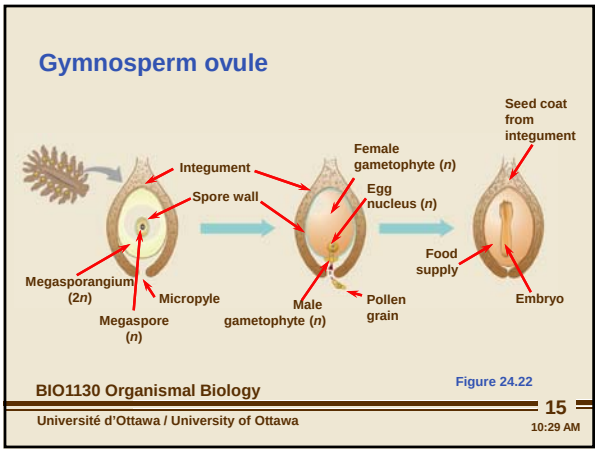


top of tree- female cones. they contain eggs to be fertilized.

in summer/spring yellow cones are male. they are sporangia which are haploid , 4 products of miosis do not seperate from each other making different roles. 2 becomes nuclei.

microspore move and find megaspore in the female cone. will undergo meisis but only 1 is retained other 3 are not used. they will form inside female cone turn itself to archagonian. female scales open, polin goes in by water or wind and the scale will close with water traped and fertilize the egg inside. undergo mitotic divisions that creates an embryo making the diploid stage of the life cycle.

pollen tube: when pollen grain lands on female tissue the pollen germinates into pollen tube, a cell that grows through female gametophyte , carries nonmotile sperm to egg.



takes 2 years, after 2 years the process will repeat.

for first time managed to waterproof the life cycle.

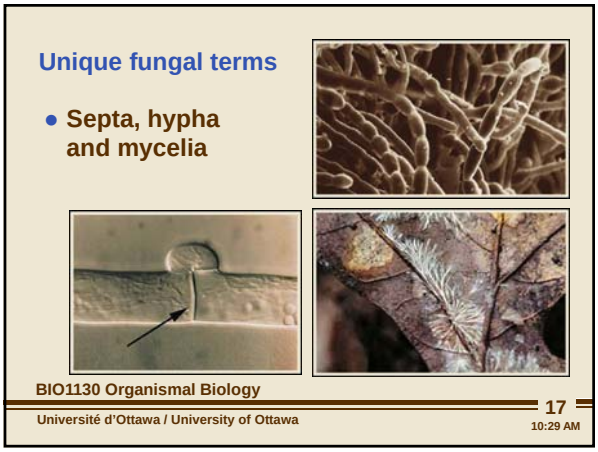
sporophyte has done is to interlanilize the gametophyte process and keeping the egg moist.

ovule: structure where egg develops inside a gametophyte that is retained not only in spore wall but also inside megasporangial tissue.

when fertilized, an Ovule becomes a seed. fertilized egg will produce an embryo surrounded by nutritive tissue. sporangial tissue becomes seed coat.

once fungi eating lignin comes.

originally classified as plants because earliest classification schemes had only 2 kingdoms, Plant and animal.

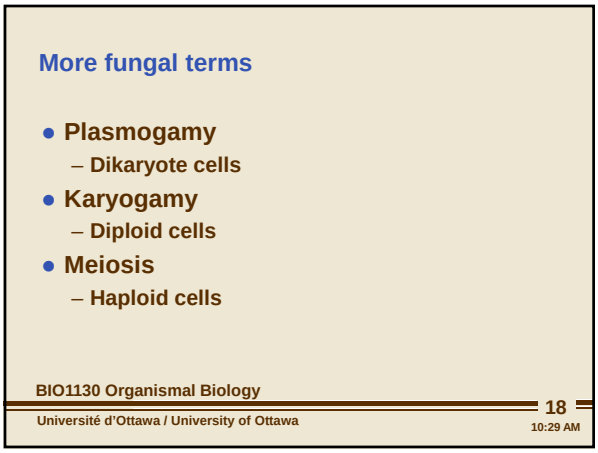


hypha are tubes of cytoplasm surrounded by cell walls made of chitin.

growth of mycelia is directed towards food source, use Apical growth.

food is absorbed through pores of Hypha. Some Hyphae have Septa (walls that separate Hypha into compartments)
are strand of cells linked end to end with incomplete communication of cells. A hypha can be wrapped around together to make mycelia. it is a giant organism of interconnected strand of cells that share the cytoplasm. All over the surface hypha can secrete chemicals that can breakdown nutrients and be used as food source.

fungi do not contain cellulose. spread their hyphy, huge surface to volume ratio, threads digest the leafs externally and is absorbed internally.



when form diploid state, the nuclui dont fuse. they stay haploid, only in certain times the fuse to form diploid.

karyogamy: bringing together 2 nuclei in 1 common cytoplasm, quickly followed by nuclear fusion.

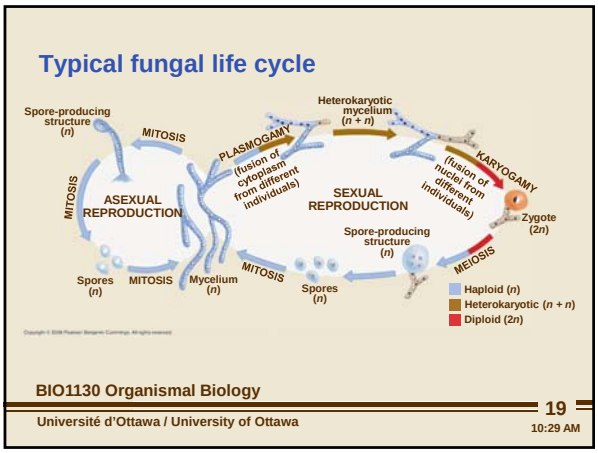
plasmogamy: Fusion of 2 haploid cells

meiosis: produce genetically distinct haploid cells.

Plasmogamy > Karyogamy > Meiosis

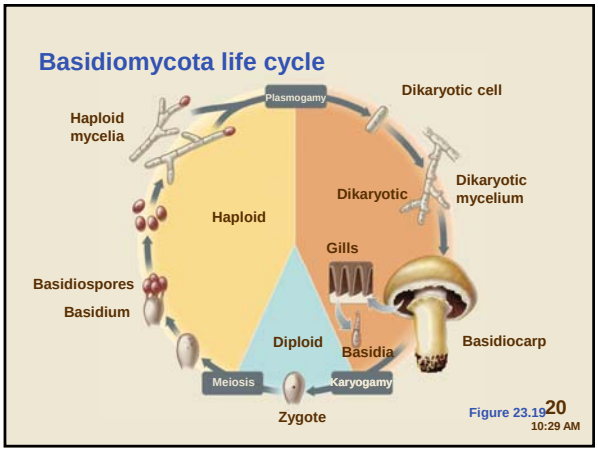
Carboniferous and Permian periods

look in bio notes for ascomycota. better then this v



fungal spores settle down and go cell division. all cells are connected to each other. they grow, branch, grow, branch.

at one point, two different fungi meet and fuse together. dissolve cell wall and fuse their cytoplasm. getting two seperate nuclei and they will branch and grow. call them Dichariotic n + n. at some point the two nuclei will fuse to form zygote. zygote becomes structures that will support spores.

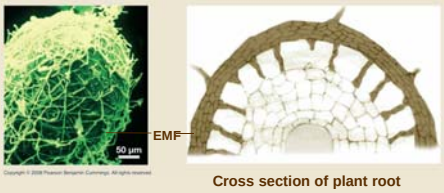


when it is really moist, water will go to the dikarotic and puff up the the fungi. once time is right they will release their spores.

water goes and makes the zygote that will rise.

if plant is left without any fungi will not do well.

Types of fungal mutualism
Ectomycorrhizal fungi (EMF)



Cross section of plant root

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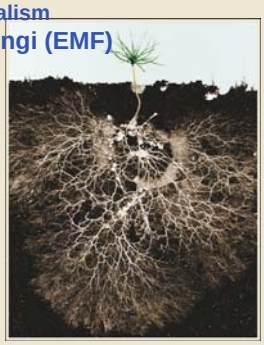
every plant in the world will have interaction with 1 of 2 type of fungi.

EMF- root is surrounded by fungi. fungi can break down minerals and is supplying minerals to the plant, minerals that cant get itself. in return plant is supplying fungi with sugar.

Types of fungal mutualism
Ectomycorrhizal fungi (EMF)



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actual root is very small. the rest is fungi.

Types of fungal mutualism
Arbuscular mycorrhizal fungi (AMF)

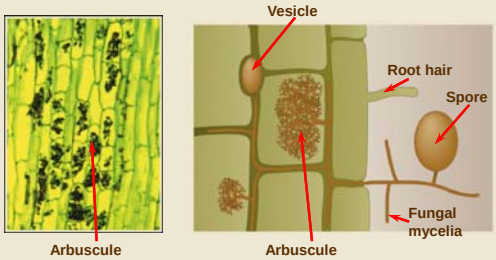

Figure 23.11

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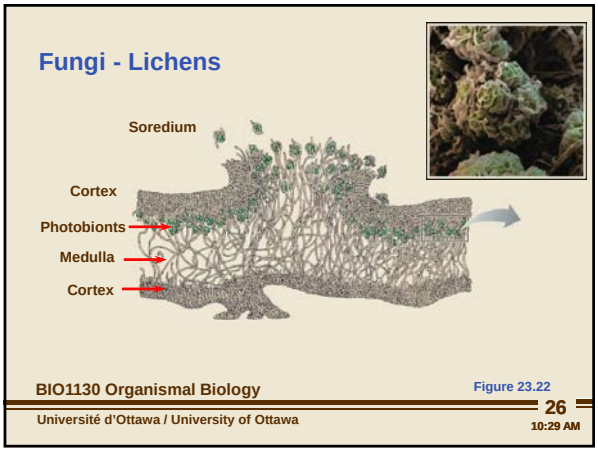
some fungi actually invade root cells and are inside. association between fungi and plant is ancestral. oldest and most abundant type of Mycorrhizal.

represent one of these early associations. unique symbiosis occurring.

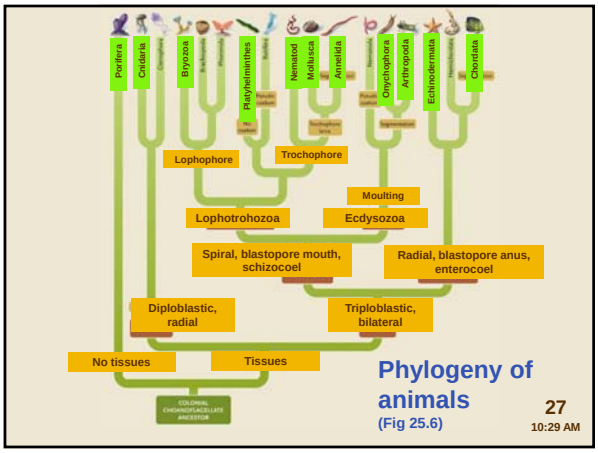
lichen: compound organism formed by association between fungus and green algae or Cyanobacteria. Secrete acids to break down rocks turning them into soil to support plant growth.

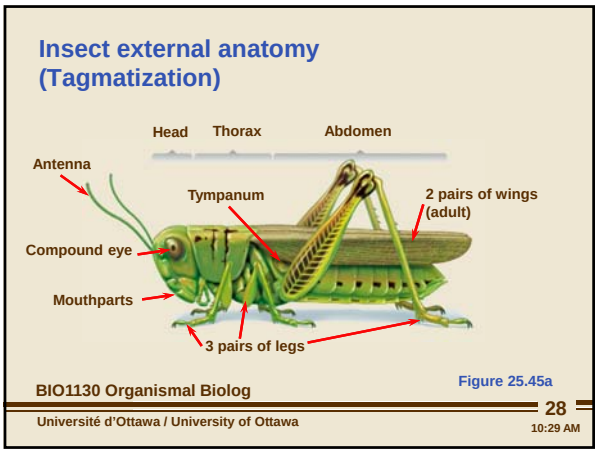


it is wrapping its fungal tendrals

they can dry out entirly all they need is water and they will regrow.

reproduce asexually by specialized fragments such as Soredia. Each soredia consists of photobiont cells which becomes fungis primary source of carbon.

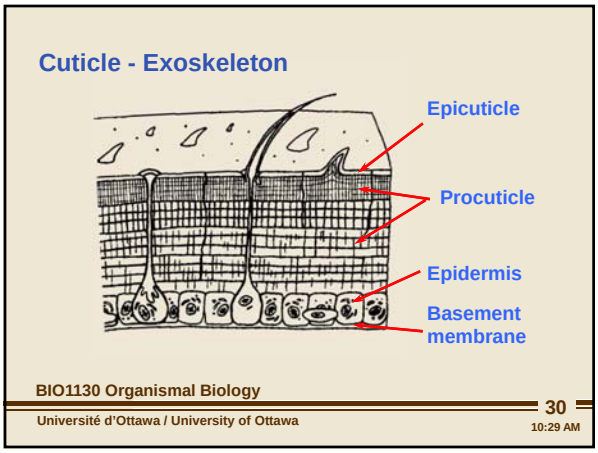




arthropods take segmentaion further. thorax is purly locomotor. inside is nothing but musculuture that drives it. Abdomen ability to contract to consume food.

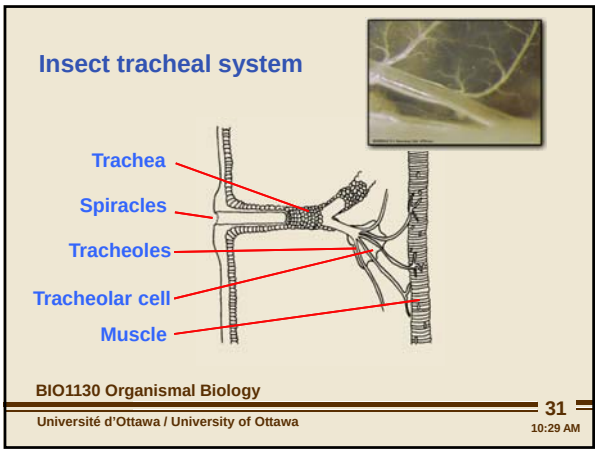
most important thing is that they will aquire ability to fly.

when they develop flight, they can disperse to other areas where there are no animals, or to lay eggs in secure location or to find mates. they are feeding on sporangia. Feeding on fertilized sporangia in combs. happend 250 million years ago. lady bugs are the most advanced. have a protective cover to secure its delicate wing inside.

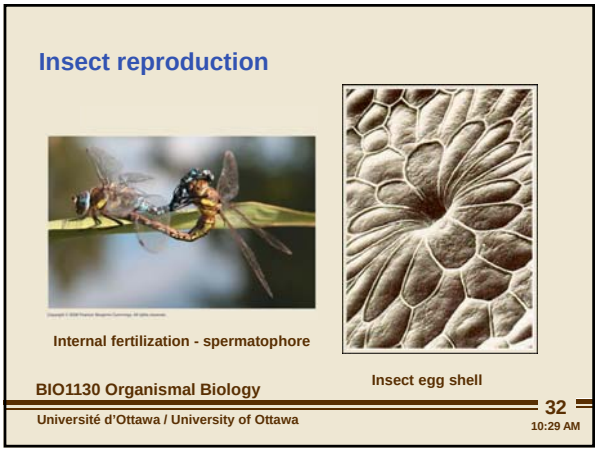


cuticle in 2 peices. Procuticle is the rigidity and strongness.

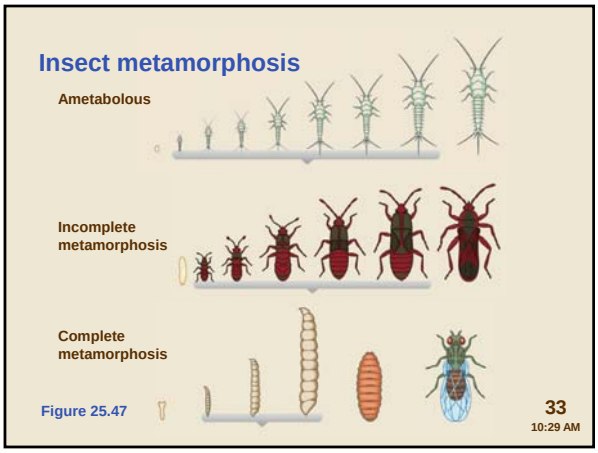
epicuticle makes it water proof for an insect.



how to deal with loss of water across gas exchange surface, they have openings are spiracles that lead to tubles that get smaller and smaller, air goes into center of body in waterproof tubles. only at the end of tubes they are not waterproff to allow gas exchange. mitochondria is supplied with air. gas exchange occurs in Tracheolara cell. air can be quickly exchanged. supplying air internally into tissues.



waterproof shell called a chorion, sperm cant get into cell. female leaves 1 opening big enough for only 1 sperm.



they also developed metamorphisis. that means in complete there is an extra intermediate stage.

incomplete- adults and young feed on the exact food.

in complete- they feed on different things throughout their growth.

ametamorphisis- same thing just get bigger and bigger.

Amphibians

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amphibians make transition onto land.

Amphibian food

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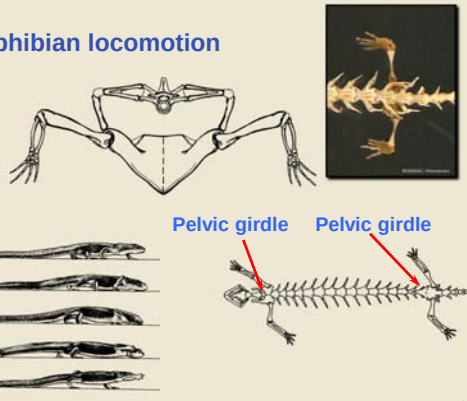
when it comes on land, make use of the food reserve on flies. feed with their tongue, fire it out to trap the insects. owes its success to the insects.

Amphibian locomotion



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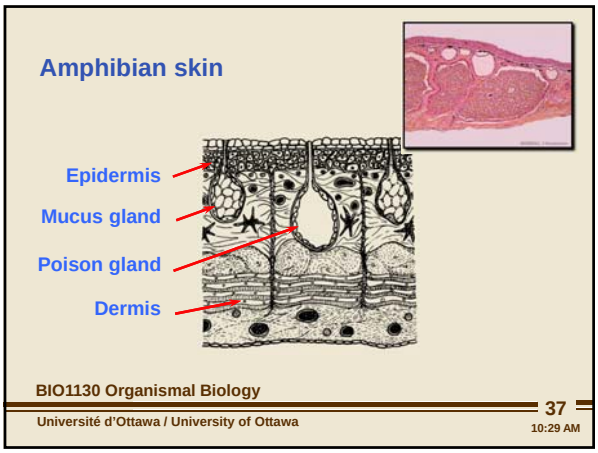
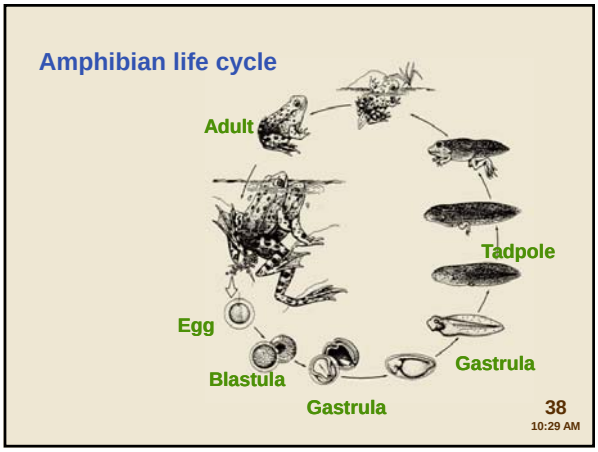
develop tetrapod stance. fins has become set of limbs, limbls are attacehd to pectoral girdle. same movement with fish like but its with limbs.



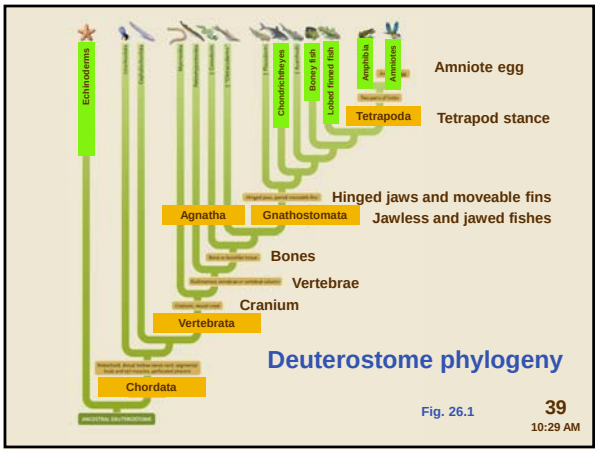
cant waterproof their surface. Important in gas exchange. gas exchange through skin. Cant have protective skin.

if they start to dry out the mucus gland will secrete fluid on top of skin to weten it.

Poison gland used to protect itself. Since no protective skin. secretes poison on its skin.

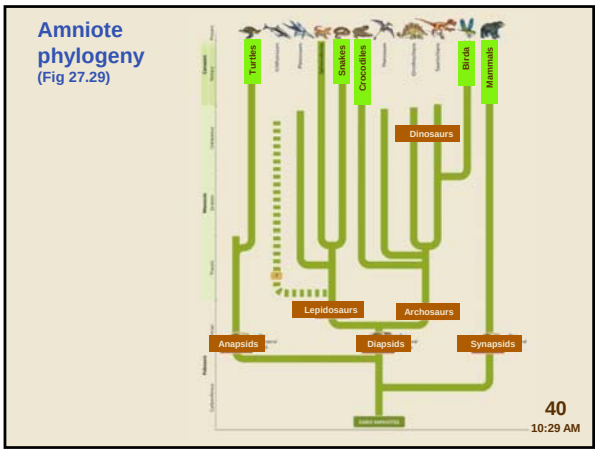


have to return to aquatic environment to lay eggs. Different mechanism evolved so they dont have to always go back to water systems. Ex: can lay eggs in plants, their mouths, stomach.



Amniote egg introduced.

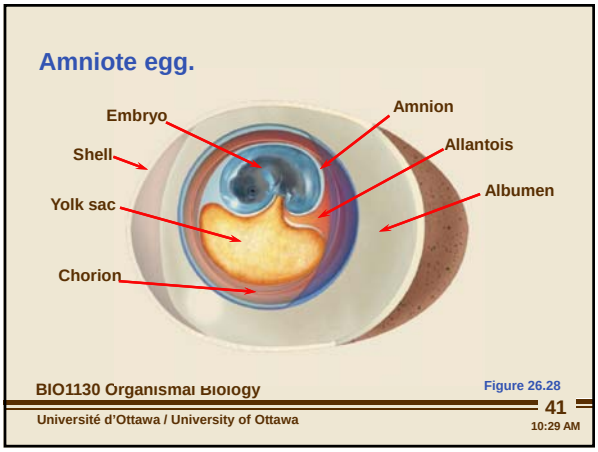
Carboniferous and Permian periods



3 key features that allow amniotes to live on dry land.

1) skin is waterproof because of keratin and lipids.

2/3) amniotic egg, yolk for nutrition, membranes protect egg and allow for gas exchange and excretion. excrete uric acid stored in allantois which later becomes the bladder.



final solution for vertabrates to move on land.

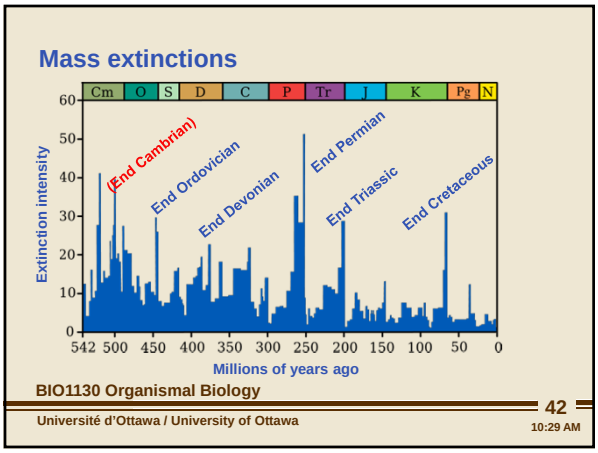
create membrane bound bag filled with fluid in which the development will proceed. Yolk sac used for nutrition for development in amnion.

Albumen when broken down is fluid like.

All waste goes to Allantois.

Reptiles used this first.

Amnion: Fluid filled sac that surrounds embryo during development.

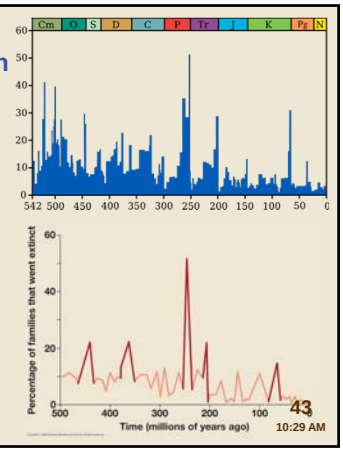


95% of diversity will disappear.

biggest extinction

Types of extinction

- Background extinction
- Mass extinctions



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defined as 50% or more of the genus is extinct in taxonomic heirarchy.

background extinction- directional selection, extinction of a species

Causes of mass extinction

- Asteroid impacts
- Elevated Carbon dioxide
  - Flood basalts
  - Volcanoes
  - Gas hydrates
- Marine anoxia
- Sea level changes

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No corralation between meteroite impacts and mass extinction except for end cretacious.

Carbon dioxide- green house gasses will cover earth rising temperatures. Elevation of C02 in atmosphere also goes into the oceans and replaces the oxygen.

Flood basalts: major contributor to CO2 and greenhouse gases

Archaea: methanogens produce methane, because of cold temperatures methane is released as liquid and is mixed with water and is solidified (frozen). When earth warms up they will become gasses and is released.

Flood basalts

video

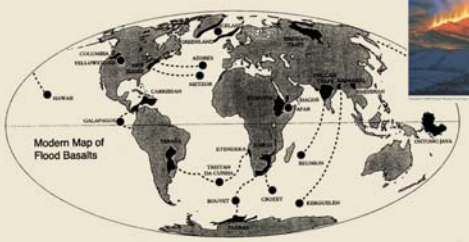

Figure 27-15

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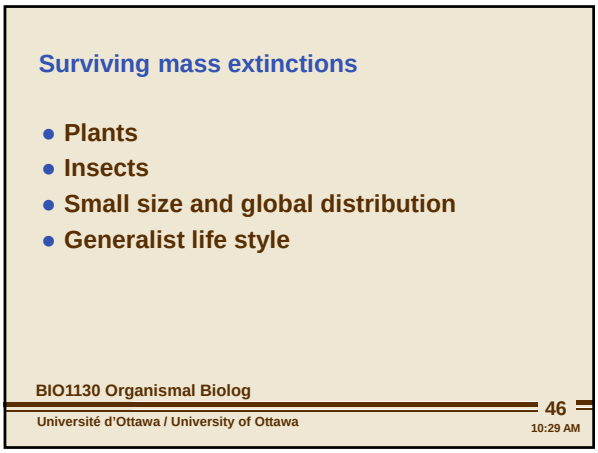
as continents pull apart the mantle is so thin that it bursts and errupts causing magma to come up. Can be big as thousands of miles long. have potential to produce large amounts of greenhouse gases. These line up with major mass extinctions on the planet. Believe that permian had all of these involved

Carboniferous and Permian periods



plants rarely affected by mass extinction. Spores are resistant to extinction . Spores will germinate bringing back the plant cycle.

Insects: incomplete metamorphosis, burrowrs, large distribution (will become extinct in one part of the worse, but still exist another part)

Generalist: dont have specific food source or habitat.

Lost: specialists.