Evolution II

Bryophytes & Pteridophytes

March 10, 2008

Review Questions (last lecture)

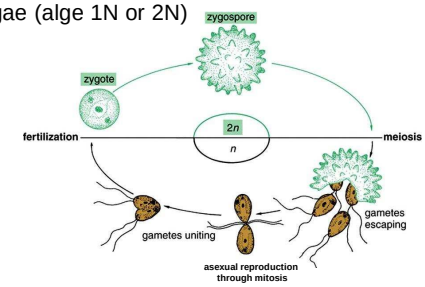
- Draw an evolutionary tree for domains and kingdoms
- What distinguishes and *Archaebacteria and Eubacteria* (list up to three milestones)?
- What distinguishes *Eucaryotes* from *Procaryotes* (*Archaebacteria* and *Eubacteria)*?
- What is the most important role of *Eubacteria* in terrestrial ecosystems?
- How did mitochondria and chloroplasts develop? What is the technical term for this development?
- Give two examples of endosymbiosis that can be seen as an equivalent to symbiogenesis.
- What are the arguments in favor of the endosymbiont theory?
- Name 3 Domains, 4 Kingdoms, and 5 Phyla of the plant kingdom
- What distinguishes plants from animals? What distinguishes plants from fungi?

Review Questions (last lecture)

- What are the two major traits that are used to distinguish the phyla of the plant kingdom (e.g. red algae, brown algae, … etc)?
- Name a type of brown algae that you probably eat every day.
- What is "agar" used for and what algae produces it (name phylum)?
- What algae is responsible for "red tides" (name phylum)?
- What phylum is most closely related to land plants? What do these algae have in common with land plants? Is this phylum a monophyletic group?
- What algae are responsible for building limestone (name phylum)?
- Describe or draw an annotated diagram of the most basic life cycle (using the vocabulary: Zygote, Gamete, Mitosis, Meiosis, Haploid, Diploid, Fertilization). Give an example of a species or name a phylum where this life cycle can be found.

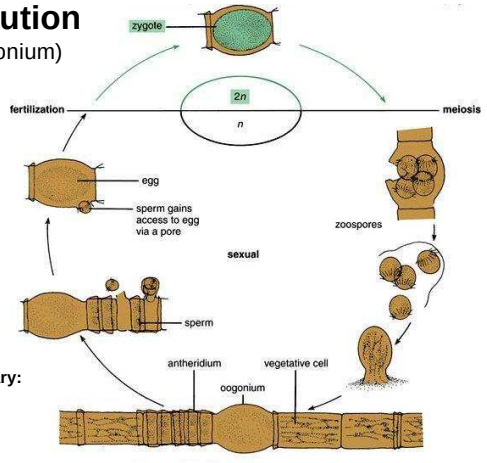
Open questions:

- What's the advantage of sexual reproduction?
- What is the best time for sexual reproduction?
- What is the advantage of male and female gametes?
- How would you modify the lifecylce below to create a multicellular algae (alge 1N or 2N)



The Solution

(© Oedogonium)



New vocabulary:
- Antheridium
- Oogonium

Do we have a complete plant, yet?

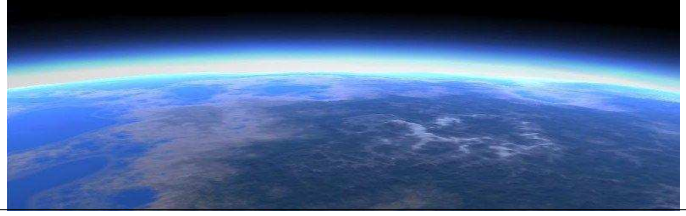
- Photosynthesis & chlorophyll
- Starch as photosynthate storage
- C/e- donor metabolism (respiration)
- Nucleus, mitochondria, chloroplasts,
- Cellulose cell walls
- Sexual reproduction
- Multicellular organism

Missing:

- Embryo with leaves (cotyledons), apical meristems and root meristem.
- Structural and functional differentiation: leaves, shoot, and root.
- Tissue differentiation: vascular tissue, cuticula, stomata (not all plants).
- *Group of land plants also called Embryophytes*

The right time to step on land

- 3 billion years ago cyanobacteria evolved with modern photosynthesis pathways and started to increase oxygen in atmosphere
- 1 billion years ago we had primitive algae with chloroplasts
- Ozone layer started to effectively block deadly UV radiation about 500 million years ago
- 500 to 400 million years ago, terrestrial plants appeared

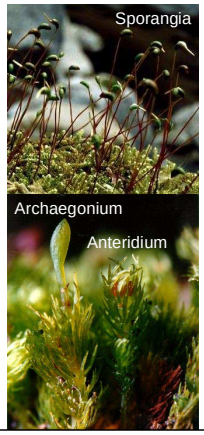


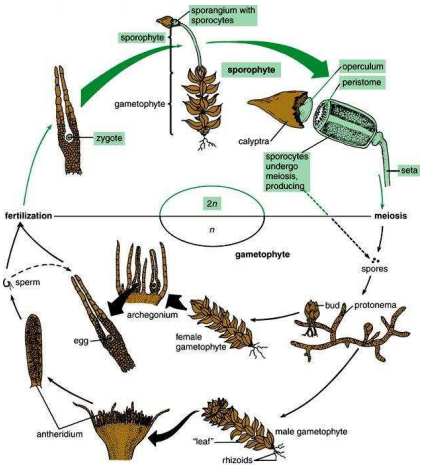
Phylum: Bryophytes
(Liverworts & Mosses)

First land plants = **Nonvascular** plants similar to today's liverworts and mosses had

(1) fatty cuticula,
(2) zygotes > embryos
(3) specialized tissues
(4) multicellular sporangia and gametangia

Mosses
same principle

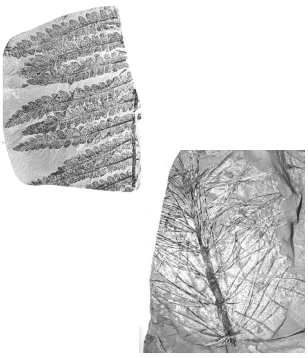




Phylum: Pterophytes "& relatives"
(Seedless Vascular Plants)

Milestones

(1) modern shoot and root meristems
(2) phloem and xylem
(3) specialized tissues
(4) new life cycle (details follow)

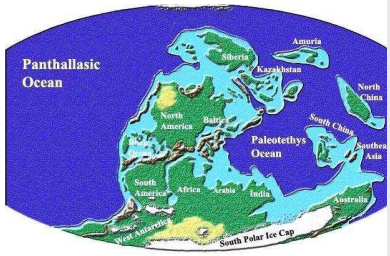


Pteridophyte Groups

Club Mosses | Horsetails | Ferns

Gluttony of early vascular plants (our fossil fuel reserves)

Carboniferous Period (350-300 Ma)



Tropical conditions almost everywhere
Ice age caused by consumption CO_2 at the end of the Carboniferous Period

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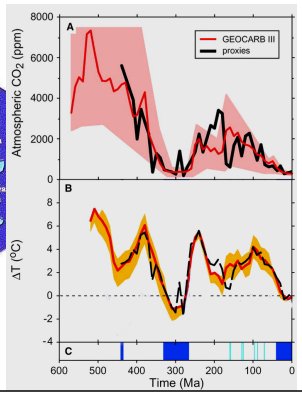
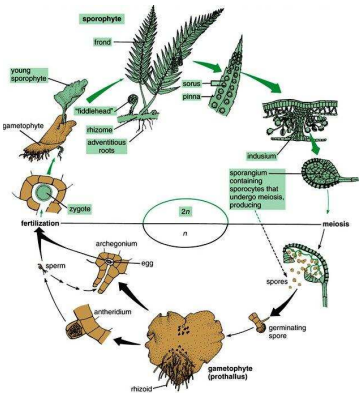


Major change in the life cycle of club mosses, horsetails, and ferns



Recap: what you should know

- **Taxa, milestones, and trivia: Phyla:** *Bryophytes* (Mosses & Liverworths), *Pteridophytes* (Ferns, Horsetails & Club Mosses)
- **Vocabulary:** *Sporophyte, Sporangium, Gametophyte, Antheridium, Oogonium*, Vascular and non-vasular plants.
- **Concepts:** Life cycle evolution: Algae►Mosses, Algae►Ferns

Review Questions

- What are characteristics that all plants have in common (land plants and algae)?
- What are the characteristics that distinguished the first land plants from green algae?
- When did the first land plants first appear? Why didn't they appear earlier?
- What are the evolutionary milestones of *Bryophytes* (liverworts and mosses)?
- What are the evolutionary milestones of *Pteridophytes* (seedless vascular plants)?
- List three major groups of seedless vascular plants
- Explain and draw the life cycle of a moss (Bryophytes)
- Explain and draw the life cycle of a fern (Pteridophytes)

Review Questions

- What is the key difference in the life cycle of Bryophytes and Pteridopytes?
- Explain these vocabulary: Gametophyte, Sporophyte, Gamete, Spore, Sporangium, Archaegonium, Antheridium.
- Why/when are mosses dependent on very wet environments? How can they survive in deserts?
- What happens at the cellular level when mosses desiccate and rehydrate?
- What species of moss is of major commercial importance in Canada?
- What groups of seedless vascular plants were prevalent in the Carboniferous period?
- What happened during the carboniferous period in terms of the global carbon cycle and global environments?