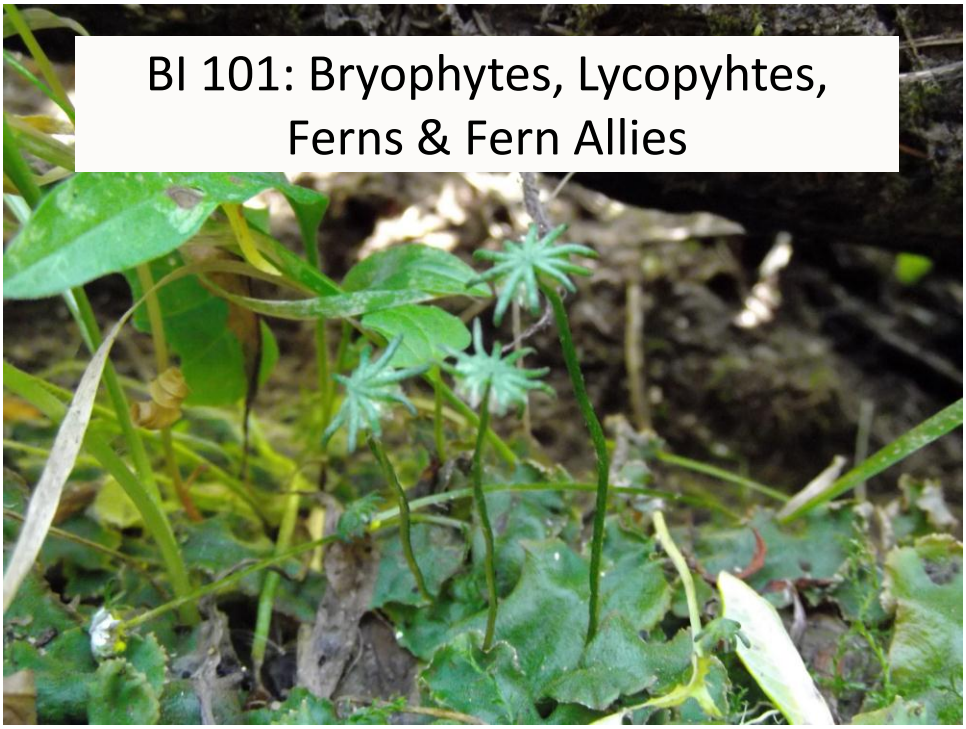


BI 101: Bryophytes, Lycopyhtes, Ferns & Fern Allies

1. What are the differences between life on land and life in the water?

2. What types of adaptations are needed to move from water to land habitat?

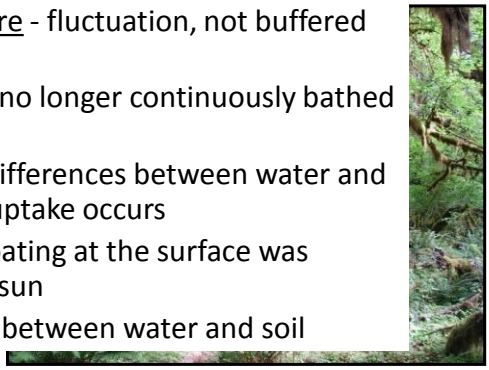
Discuss in groups

5 min

Adaptation to Land

For a Plant: What are the differences between life on land and life in the water?

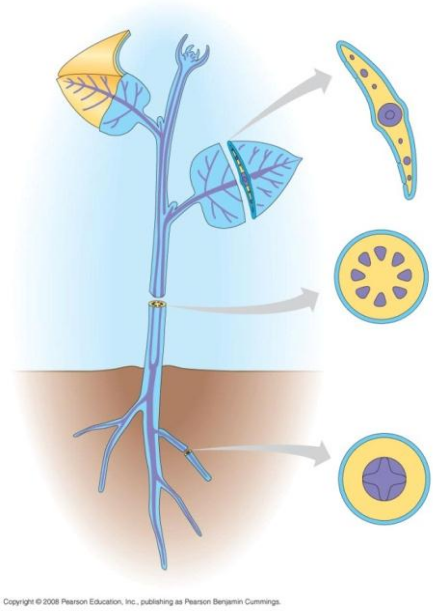
- Variation in temperature - fluctuation, not buffered by water
- Variation in moisture - no longer continuously bathed in water
- Nutrient availability - differences between water and soil and how nutrient uptake occurs
- Gravitational force - floating at the surface was sufficient to get to the sun
- Substrate - differences between water and soil



Adaptation to Land

What types of adaptations are needed to move from water to land habitat?

- Protection against water loss
  - Cuticle to prevent water loss
  - stomata for regulation
- Ability to tolerate variation in temperatures
- Roots for anchoring to substrate and nutrient absorption
- Protection for gametes: specialized structures
- Gametes (sperm) do not require water
- Development of vascular tissue



Vascular tissue

Stomata

Land plants Origins

- Shares most recent common ancestor with Green algae (Chlorophyta)
  - Aquatic origin
  - 476 million years ago

- Researchers have identified green algae called ***charophyceans*** as the closest relatives of land plants.

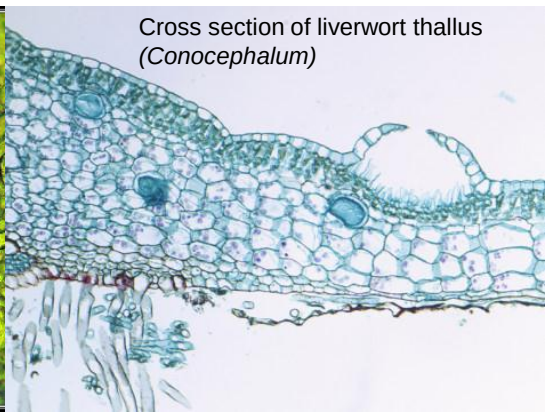
Common name:
- stoneworts

Bryophytes

- True organs lacking
  - *thallus* (unspecialized cells in plant body)
  - *rhizoids* (root hair like structures)
    - anchorage function only
  - Pores: allow gas exchange; don't close
  - Surface covered in waxy **cuticle**
- conducting tissues absent or primitive
- water required for fertilization
- Gametophyte generation dominant

Bryophytes: pores

- Bryophytes like moss and liverworts lack true stomata
- Have pores that are always open



Cross section of liverwort thallus *(Conocephalum)*

Why so tiny?

Bryophytes have life cycles dominated by gametophytes

Cellular reproduction

- Mitosis
  - Asexual
  - Genetically identical offspring (clones)
  - Produces diploid cells (2n)
- Meiosis
  - Sexual reproduction
  - Genetic variation
  - Produces gametes (sperm & egg)
  - Produces haploid cells (1n)

Bryophytes: Non vascular plants: Moss

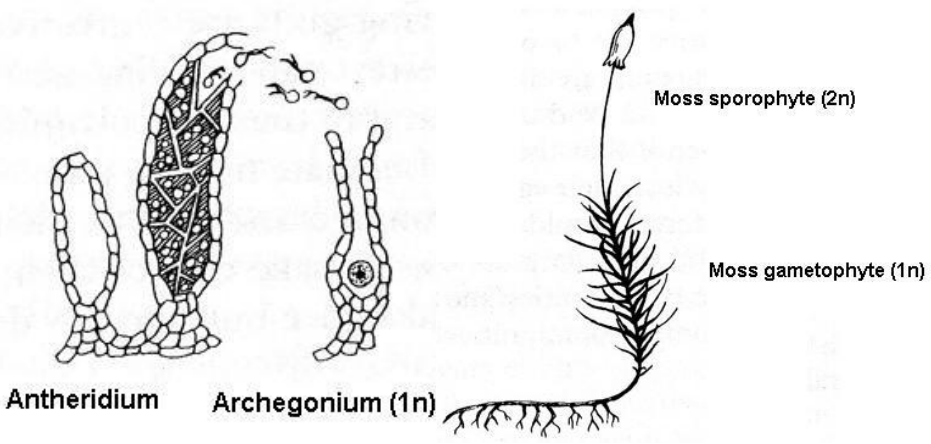
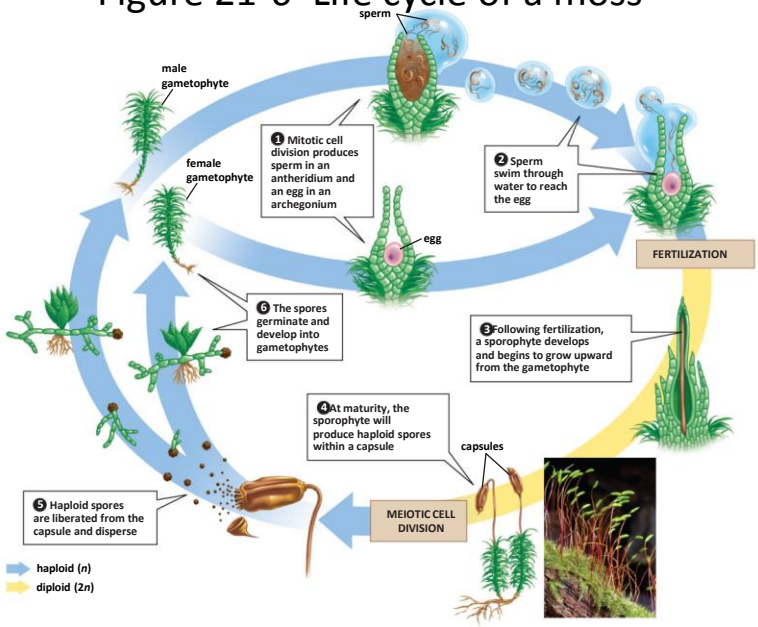


Figure 21-6 Life cycle of a moss



Bryophytes: non vascular plants: Liverworts

9,000 species

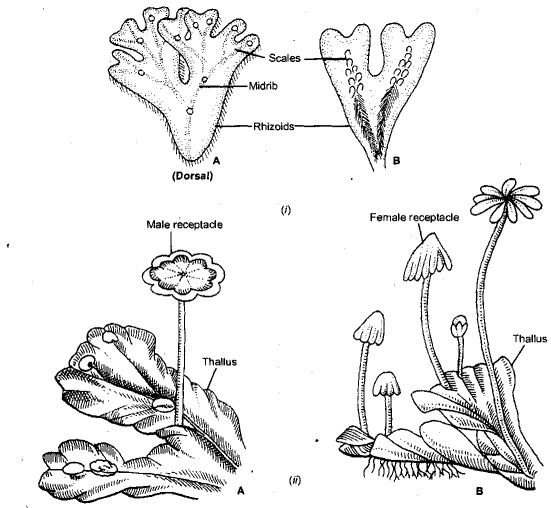
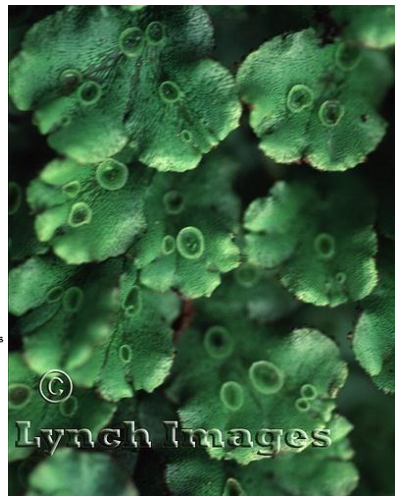


Fig. 3.6. Thalloid bryophytes : (i) Riccia (*A*) Dorsal view (*B*) *Ventral view* (*ii*) Marchantia (*A*) Male thallus (B) Female thallus.



Gemmae cups

Create liverwort Clones!

Hornworts!

Carboniferous ~300 mya

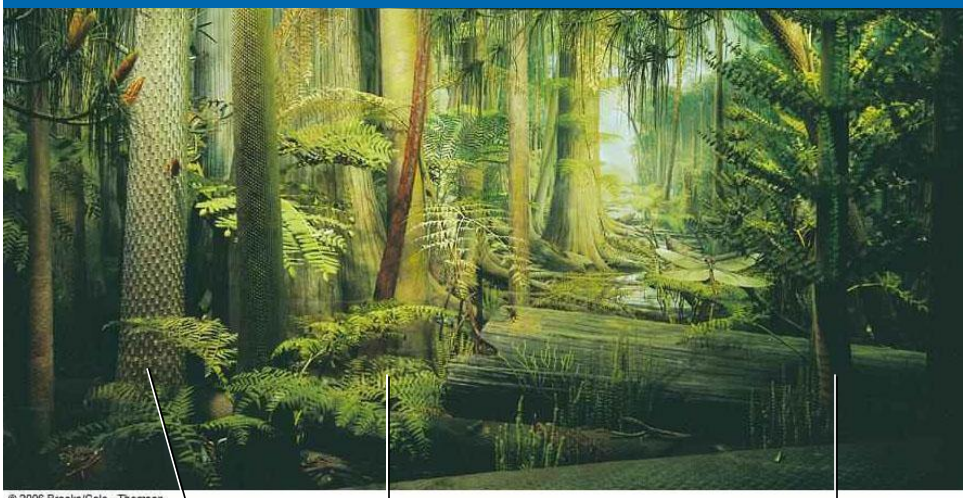


Fig. 23-13c, p.380

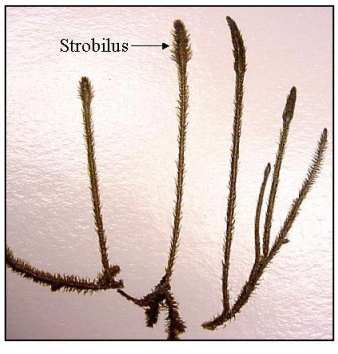
Vascular plants: Derived adaptations

- Vascular tissue: conducts water and nutrients throughout the plant
- Plant organs: roots, stems, leaves
- Stomata for gas exchange
- Sporophyte generation dominate (plant spends more of its life in the sporophyte (2n) generation

Lycophytes: "club mosses"

Lycophytes: "club mosses"

Division Lycophyta

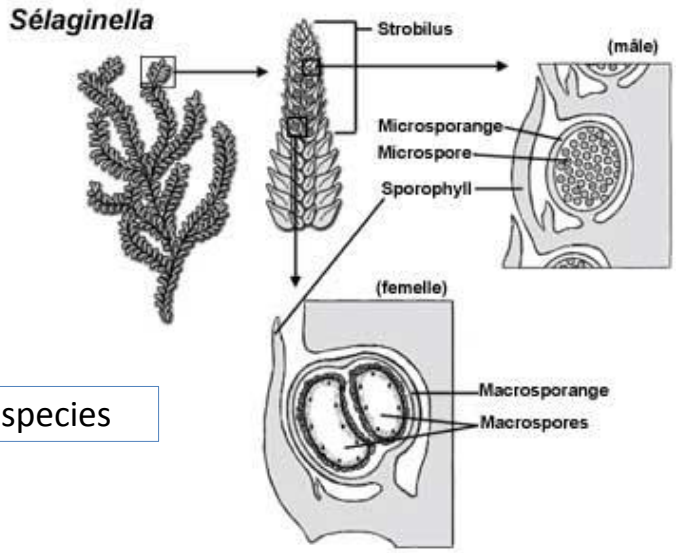


Genus *Lycopodium*

Strobilus: where spores are produced via meiosis

11,500 species

Lycophytes: “club mosses”

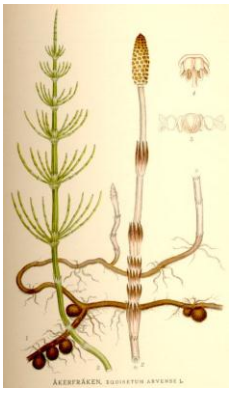


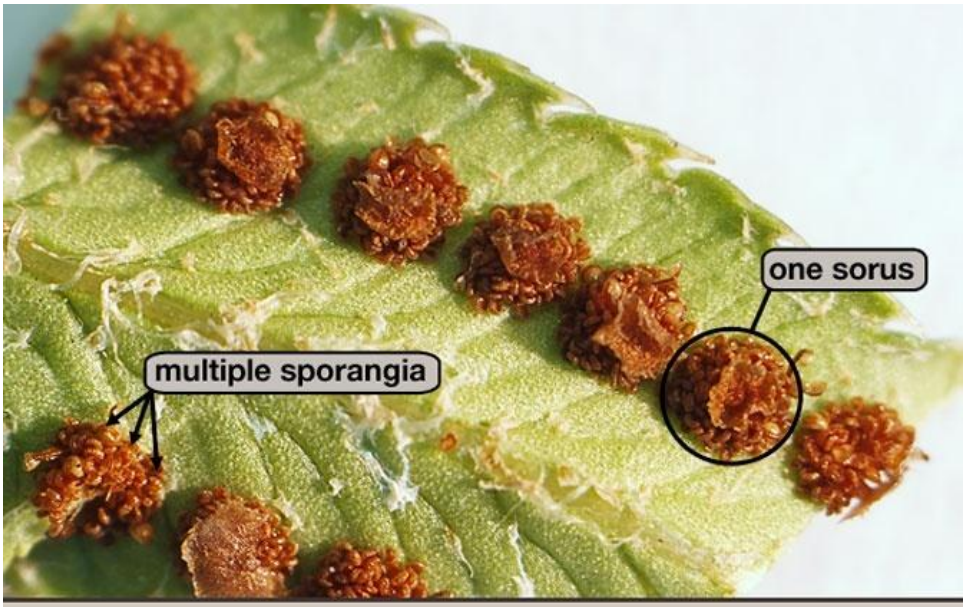
11,500 species

Strobilus: where spores are produced via meiosis

Pterophytes (ferns and allies)

- 12,000 extant species, mostly in the tropics; many extinct
- roots, stems & leaves present
- sporangia variable in **Sori**, not strobilus





Fern sori on the underside of a frond

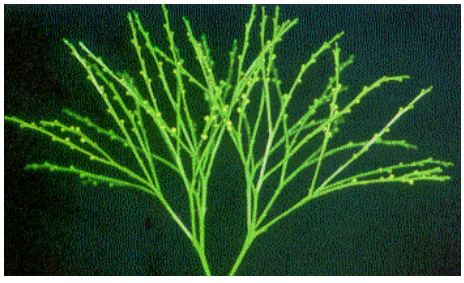
Pterophytes (ferns and allies)

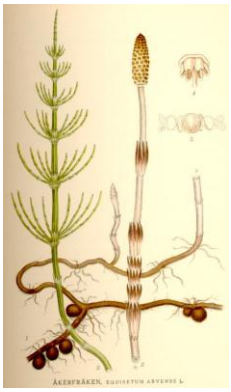
Psilotales: whisk ferns

- Often lack roots & leaves

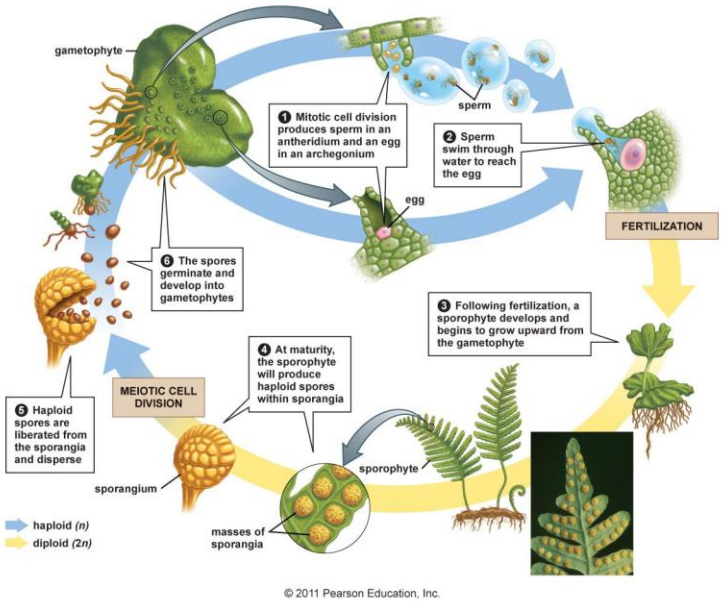
Equisetales: horsetails

- Contain silica



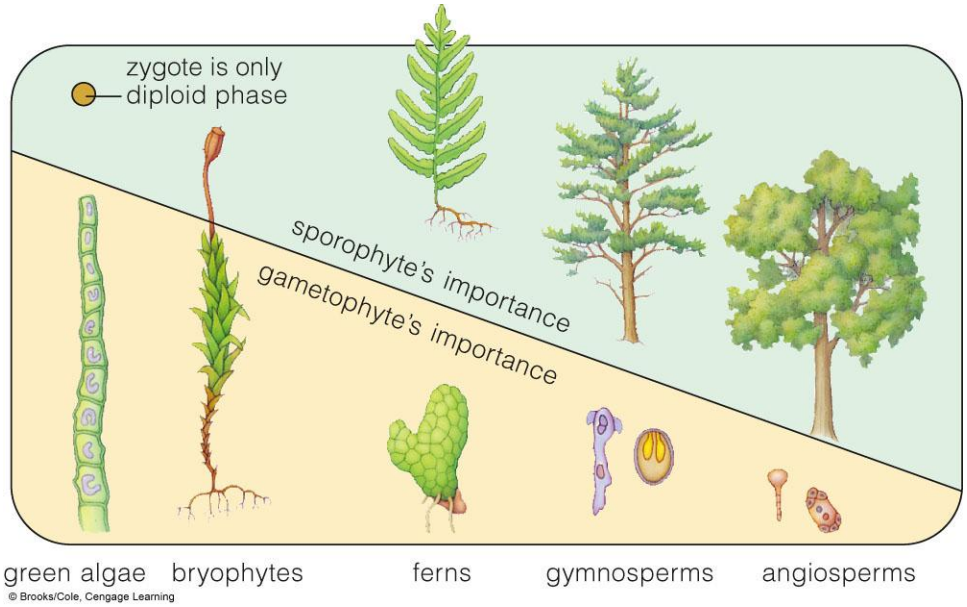


Pterophyte: Fern Life cycle



Alternating Generations

In more advanced plants, the ***sporophyte*** generation



TRENDS THROUGH TIME

Ancestral ⟷ Derived

Mosses & Liverworts

Non-vascular
Gametophyte-dominant
Sperm require water
Homospory

Club mosses,horsetails, whisk ferns & ferns

Vascular
Sporophyte-dominant
Sperm require water
Some use heterospory

Plants we'll cover next week…

Vascular
Sporophyte-dominant
Sperm don't need water
Seeds!