Introduction to Botany. Lecture 29

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Outline

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Questions and answers

Quiz

Final question (2 points)

What is endoderm?

Final question (2 points)

What is endoderm?

- Tissue responsible for root pressure.

Kingdom Vegetabilia, land plants

Mosses

Three main phyla

- **Bryophyta**: gametophyte predominance
- **Pteridophyta**: sporophyte predominance, no seed
- **Spermatophyta**: sporophyte predominance, seed

Bryophyta

- $\approx 20,000$ species
- Sporic life cycle with gametophyte predominance
- Sporophyte reduced to sporogon (sporangium with seta), usually achlorophyllous, parasitic
- No roots, only rhizoid cells (long hairy dead cells capable for apoplastic transport)
- Poikilohydric plants
- Gametophyte starts development from protonema

Protonema

Life cycle of mosses

Covers: sporogon, biflagellate spermatozoa, the conflict between water cross-fertilization and wind distribution of spores which may be considered as “evolutionary dead end”.

Three main kinds (subphyla) of mosses

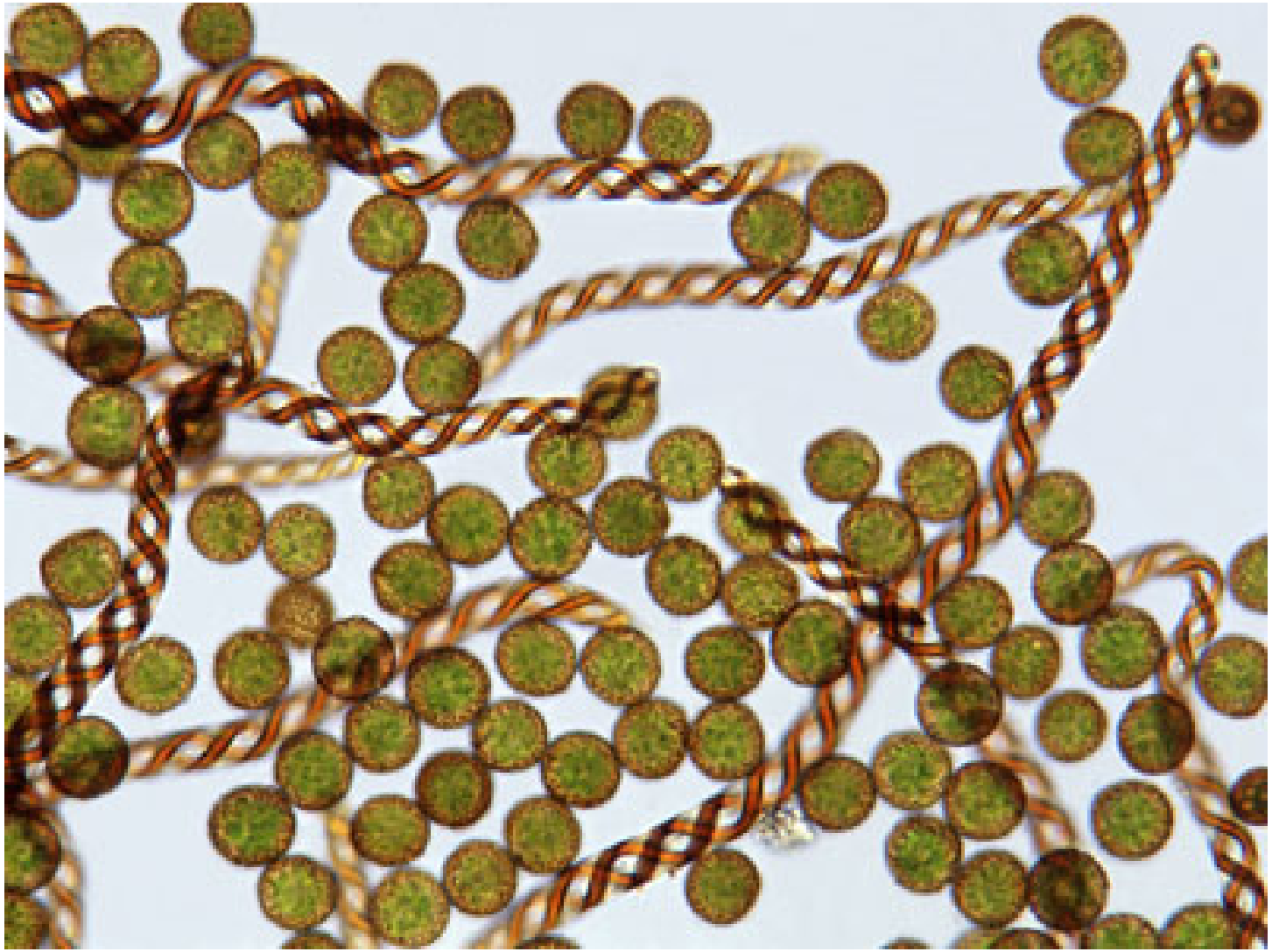
- **Hepaticae**—liverworts. Three classes, most primitive are Haplomitriopsida. Body leafy or thalloid, usually has dorsal and ventral parts, sporogon bag-like, without columella, spores with elaters.
- **Bryophytina**—true mosses. Six classes, most important are Sphagnopsida (peat mosses), Polytrichopsida (haircap mosses) and Bryopsida. Body radial, sporogon long, with columella, spores without elaters.
- **Anthocerotophytina**—hornworts. One class. Body flattened (thallus), sporogon long, green, sometimes branched, with columella and stomata, spores with elaters.

Mosses in the “evolutionary dead end”

- They resolved “skyscrapers problem” via gametophyte, not sporophyte
- Gametophyte needs water fertilization, which restricts the size and also requires the dense growing
- Also, root system is absent: this is an additional size restriction
- If sexual organs appear on the bottom of leafy shoot, sporogon (sporophyte) could not distribute spores with a wind
- The only way out is to “start over” from thallus and make sporophyte (which was highly specialized for the spore distribution) a main stage and reduce gametophyte

Haplomitrium gibbsiae, primitive liverwort

Elaters of liverworts (*Lepidozia* sp.)



Sphagnum sp. (Bryophyta, Sphagnopsida) with sporogons

Dawsonia superba (Bryophyta, Polytrichopsida)—the largest moss with vascular system

Bryum capillare (Bryophyta, Bryopsida)

Leiosporoceros dussii (Bryophyta, Anthocerotopsida)—primitive hornwort

Kingdom Vegetabilia, land plants

Ferns

Pteridophyta: ferns and allies

- $\approx 12,000$ species and six classes
- Sporic life cycle with sporophyte predominance
- Gametophyte is often reduced to **prothallium** (small hornwort-like plant), some Pteridophyta have male and female gametophytes
- Have true roots (only whisk ferns, Psilotopsida are exception)
- Homoiohydric plants (same as seed plants)
- Sporophyte always starts development from embryo located on gametophyte
- Have true xylem and phloem, but do not have secondary thickening (exceptions: fossils and extant *Isoëtes* and *Botrychium*)

Pteridophyta classes

- Subphylum Lycopodiophytina (lycophytes)
  - Class **Lycopodiopsida**
- Subphylum Pteridophytina (monilophytes)
  - Class **Equisetopsida** (horsetails)
  - Class **Psilotopsida** (whisk ferns)
  - Class **Ophioglossopsida** (ophioglossalean ferns)
  - Class **Marattiopsida** (giant, or marattialean ferns)
  - Class **Pteridopsida** (“true” ferns)

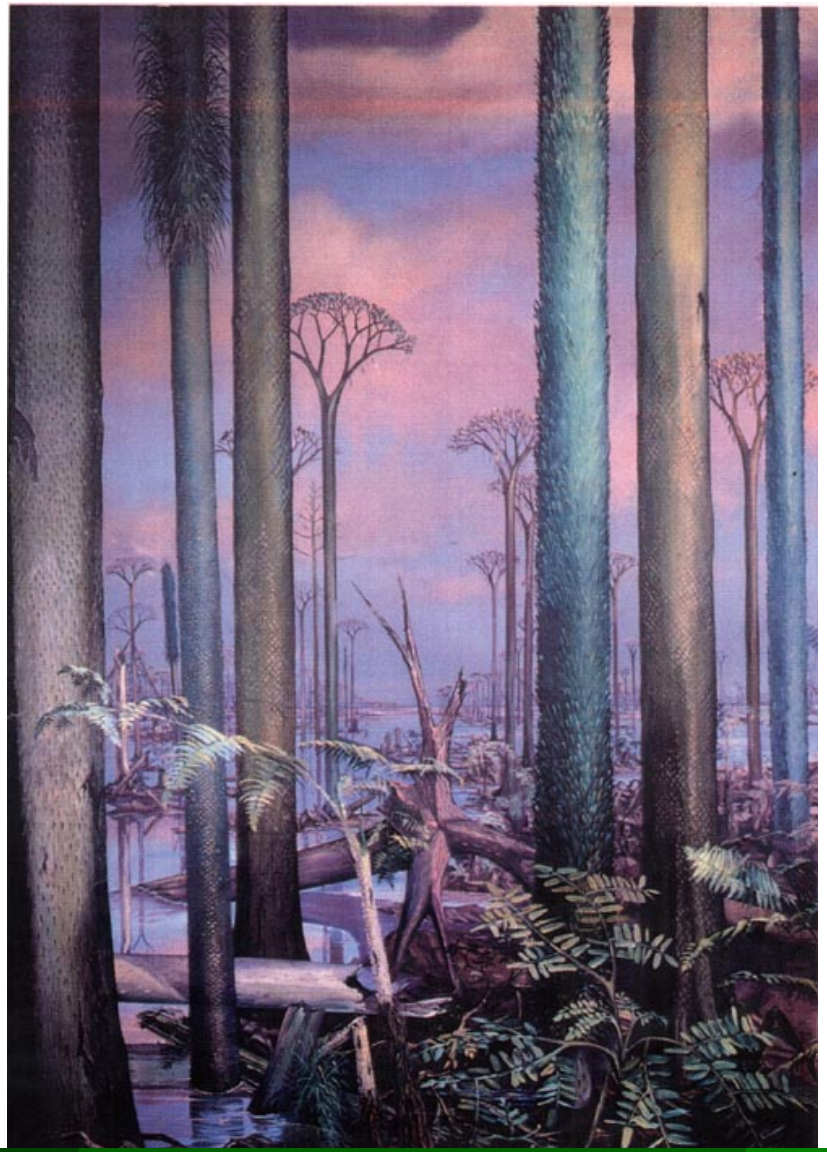
Lycopodiopsida

- Four main genera (*Huperzia*, *Lycopodium*, *Selaginella* and *Isoëtes*) and $\approx$ 1000 species
- Separate, **microphyllous*** lineage of Pteridophyta (all other groups are **megaphyllous**)
- Sporangia associated with leaves and often form **strobilus***. Spermatozoon typically with two flagella (like in mosses). Homosporous genera have achlorophyllous, mycoparasitic underground gametophyte.
- In the past, were dominant trees of Carboniferous tropical swamp forests (lepidodendrids) and their remains became a coal
- Two genera, *Selaginella* (spike moss) and *Isoëtes* (quillwort) are heterosporous.

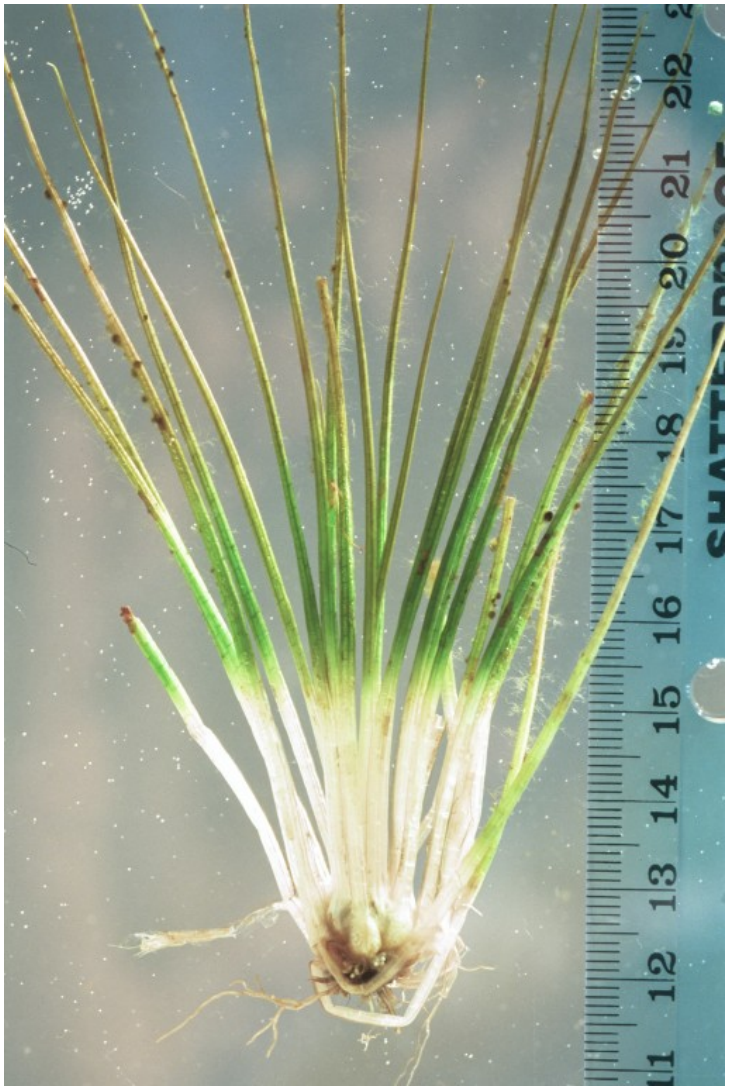
Tropical lycophyte, *Huperzia linifolia*

Phylloglossum drummondii, one of smallest lycophytes

Before: Chicago 300 Million Years Ago (lepidodendrids)



After: quillwort, aquatic lycophyte *Isoëtes* sp.



Final question (3 points)

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Why are mosses “evolutionary dead end”?

For Further Reading

A. Shipunov.
Introduction to Botany [Electronic resource].
Mode of access:
http://ashipunov.info/shipunov/school/biol_154