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Learning goals

- Identify how land plants adapted to major challenges of living on land
- Distinguish between a sporophyte and gametophyte
- Compare and contrast the seedless nonvascular and vascular plants
- Explain the features of the seedless plant phyla

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Origin of land plants

- Green algae and land plants share a common ancestor 1 bya
- A single species of freshwater green algae (a charophyte) gave rise to entire terrestrial plant lineage
- Multicellular haploid and diploid stages

STREPTOPHYTES: THE GREEN PLANTS								
Charophytes	Embryophytes: The Land Plants							
	Nonvascular			Vascular				
	Seedless Plants Bryophytes			Seedless Plants			Seed Plants Spermatophytes	
				Lycophytes		Monilo-phytes		
	Liver-worts	Horn-worts	Mosses	Club Mosses		Whisk Ferns	Gymno-sperms	Angio-sperms
				Quillworts		Horsetails		
				Spike Mosses		Ferns		

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Adaptations to terrestrial life (present in some or all plant groups)

- **Waxy cuticle**: protects from desiccation
- **Development of** stomata **for** gas exchange
- **Tracheids** (in Tracheophytes) or **xylem** and **phloem** to conduct water and food
- Shift to **dominant diploid** generation to deal with increased mutation rates caused by UV radiation exposure

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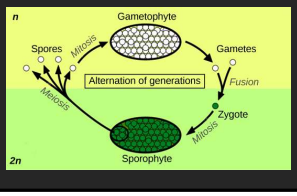
Review: Haplodiplontic life cycle



Sporophyte (diploid)

- Multicellular diploid stage
- Produce haploid spores by meiosis in the sporangia
- Diploid mother cells (sporocytes) undergo meiosis to produce haploid spores

Gametophyte (haploid)

- Multicellular haploid stage
- Starts with spore
- Produces haploid spores by mitosis
- Gametes fuse to form diploid zygote

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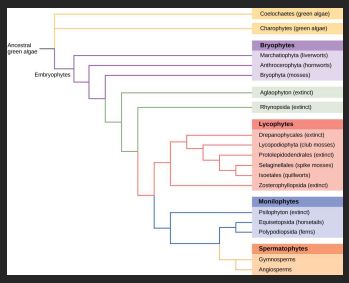
Phylogeny of land plants



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Bryophytes (non-vascular seedless)

- Closest living descendants of first land plants
- Gametophyte: conspicuous/ photosynthetic
- Sporophytes: small and dependent
- Require water for sexual reproduction
- Non-tracheophytes (lack tracheids)
- Mycorrhizal associations enhance water uptake

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Liverworts (Phylum Hepaticophyta)

- **Gametophytes:** flattened with liver like lobes
- Gametangia in umbrella-shaped structures
- Also undergo asexual reproduction

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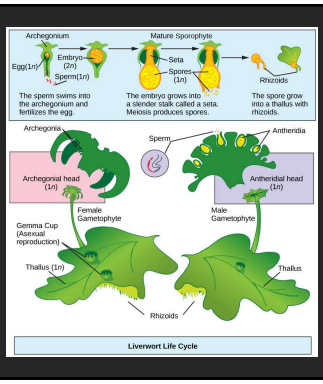

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Mosses (Phylum Bryophyta)

- **Gametophytes**: small, leaf-like structures around a stem-like axis
- **Rhizoids** anchor into substrate (made of water absorbing cells)
- Multicellular gametangia form at the tips of gametophytes
  - **Archegonia**: female gametangia
  - **Antheridia** – male gametangia (flagellated sperm must swim in water)

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Hornworts (Phylum Anthocerotophyta)

- **Sporophyte** is photosynthetic, have stomata
- Sporophyte is embedded in gametophyte tissue
- Live in symbiosis with cyanobacteria

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Understanding check

What is the gametophyte?

What is the sporophyte?

Only the gametophyte is photosynthetic in all seedless non-vascular groups except which one?

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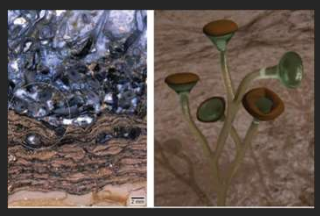
Early tracheophytes (vascular seedless plants)

- **Vascular tissues**: efficient water- and food-conducting systems
- No roots or leaves
- Haplodiplontic life cycle persists
- Gametophyte reduced in size relative to the sporophyte



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Vascular tissues

- **Xylem**: Conducts water and dissolved minerals upward from the roots
- **Phloem**: Conducts sucrose and hormones throughout the plant
- Enhanced height and size in the tracheophytes
- Develops in sporophyte but not gametophyte

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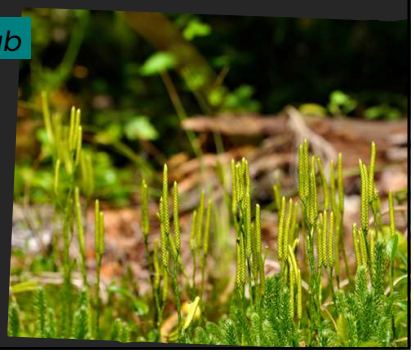
Lycophytes (club mosses)

- Similar to earliest seedless plants
- Worldwide distribution
- Lack seeds
- Resemble true mosses
- Sporophyte dominant: have leafy stems



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Euphyllophytes: Whisk ferns

- Found in tropics
- Sporophyte has forking stems, does not have true leaves or roots

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Euphyllophytes: Horsetails

- Single genus, *Equisetum*
- Sporophyte ribbed, jointed photosynthetic stems; arise from branching rhizomes with roots at nodes; has brush-like leaves

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Euphyllophytes: Ferns

- Most abundant group of seedless vascular plants
- Have rhizomes (underground stems)
- **Fronds** (leaves) that bear sori
  - **Sori**: clusters of sporangia
- Conspicuous sporophyte has vascular tissue and well-differentiated roots, stems, and leaves
- Flagellated sperm

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Understanding check

What is the function of xylem and phloem?

What is the relative size of the sporophyte to the gametophyte?

How does this compare to seedless non-vascular plants? Why is this important?

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Part II: Select seedless plant reproductive cycle

Map the general plant haplodiplontic life cycle → Map the moss life cycle

Map the fern life cycle

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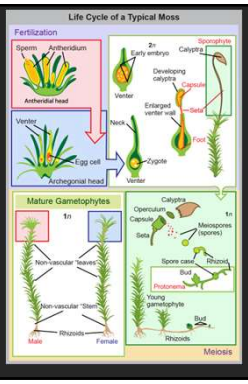

Moss reproduction

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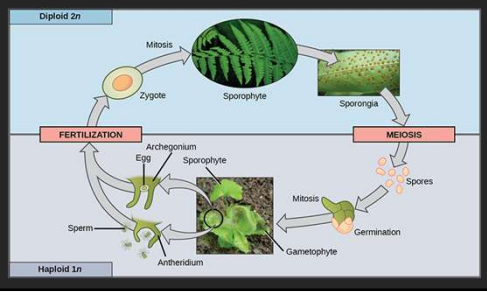
Fern life cycle



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