Chapter 29

Introduction to Terrestrial Plants
Kingdom Plantae

- Characteristics (notice characteristics that enable a terrestrial existence!!)
  - Apical meristems
  - Alternation of generation life cycle
    - Haploid gametophyte
    - Diploid Sporophyte
  - Multicellular reproductive organs
    - Spores produced in sporangia
    - Gametes produced in gametangia
      - Sperm \(\rightarrow\) antheridium
      - Egg \(\rightarrow\) archegonium
Plant Characteristics
Continued

- Apical Meristems – plants exhibit localized growth at meristems. Apical meristems increase the length of plant parts
  - Zone of cell division (mitosis)
  - Zone of elongation
  - Zone of maturation (differentiation of cells)
• Alternation of generation life cycle
  – KNOW THIS!!!!!!!!!!
Plant Characteristics
Continued

• Multicellular reproductive structures
  – Sporangium → spores
  – Gametangium
    • Antheridium → sperm
    • Archegonium → egg
  – Fertilization produces a zygote that develops into multicellular embryo – nutrition of this embryo comes from adjacent maternal tissues
Evolution of Terrestrial plants

• Terrestrial plants are thought to have evolved from an aquatic green algae.
  – Similar to *Chara* or other green algae from today.
Classification of Plantae

• Three informal groups
  – Bryophytes (Non-vascular plants)
    • No vascular transport tissues (xylem & phloem)
    • No true stems, leaves, roots
    • Small and live in very moist habitats (Mesic habitats)
    • Gametophyte dominated life cycle
  – Seedless Vascular Plants
    • Xylem & phloem present
    • True stems, leaves, roots
    • Homosporous
    • Sporophyte dominant life cycle
  – Seed plants (gymnosperms and angiosperms)
    • Heterosporous
    • Sporophyte dominated life cycle
    • Produce seeds
### Table 29.1  Ten Phyla of Extant Plants

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Number of Known Species</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nonvascular Plants (Bryophytes)</strong></td>
<td></td>
</tr>
<tr>
<td>Phylum Hepatophyta</td>
<td>Liverworts</td>
</tr>
<tr>
<td>Phylum Bryophyta</td>
<td>Mosses</td>
</tr>
<tr>
<td>Phylum Anthocerophyta</td>
<td>Hornworts</td>
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<tr>
<td><strong>Vascular Plants</strong></td>
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<tr>
<td><strong>Seedless Vascular Plants</strong></td>
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<tr>
<td>Phylum Lycophyta</td>
<td>Lycophytes</td>
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<tr>
<td>Phylum Monilophyta</td>
<td>Monilophytes</td>
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<tr>
<td><strong>Seed Plants</strong></td>
<td></td>
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<tr>
<td><strong>Gymnosperms</strong></td>
<td></td>
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<tr>
<td>Phylum Ginkgophyta</td>
<td>Ginkgo</td>
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<tr>
<td>Phylum Cycadophyta</td>
<td>Cycads</td>
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<tr>
<td>Phylum Gnetophyta</td>
<td>Gnetophytes</td>
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<tr>
<td>Phylum Coniferophyta</td>
<td>Conifers</td>
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<tr>
<td><strong>Angiosperms</strong></td>
<td></td>
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<tr>
<td>Phylum Anthophyta</td>
<td>Flowering plants</td>
</tr>
</tbody>
</table>
The diagram illustrates the evolutionary timeline of land plants. It begins with an ancestral green alga and shows the progression of plant evolution:

1. **Origin of land plants**
2. **Origin of vascular plants**
3. **Origin of extant seed plants**

The timeline is marked in millions of years ago (mya), with key milestones including:

- **Liverworts**
- **Mosses**
- **Hornworts**
- **Lycophytes (club mosses, spike mosses, quillworts)**
- **Monilophytes (ferns, horsetails, whisk ferns)**
- **Gymnosperms**
- **Angiosperms**

The diagram also categorizes plants into nonvascular (bryophytes), seedless vascular, and seed vascular plants.
The Bryophytes

- Small, non-vascular herbaceous
  - (green soft tissues; wort = herb)
- Live in mesic (moist) habitats
- Spores germinate into a filamentous (branched, single strand of cells) protonema.
- The protonema contains an apical meristem and will develop into the gametophyte
- Anchored into soil by rhizoids (root-like)
- Entire plant is photosynthetic
- Must be kept moist!!
- Flagellated sperm
  - Gametophyte generation – antheridia and archegonia
  - Sporophyte generation – reduced and grows attached to gametophyte – seta – capsule (w/sporangium) - foot
Liverworts (Phylum Hepatophyta)

- **Thallus**
- **Gametophore of female gametophyte**
- **Sporophyte**
- **Marchantia polymorpha**, a “thalloid” liverwort
- **Marchantia** sporophyte (LM)
- **Plagiochila deltoidea**, a “leafy” liverwort

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Mosses (Phylum Bryophyta)

Polytrichum commune, hairy-cap moss

- Capsule
- Seta

Sporophyte (a sturdy plant that takes months to grow)

Gametophyte
Seedless Vascular Plants

• Importance of vascular tissue
  – Transport of water (xylem) and products of photosynthesis (phloem)
  – Strength – rigidity
  – Allows for larger size
  – Evolved these adaptations to lessen the importance of water
  – Still possess flagellated sperm (water important to complete life cycle)
  – Sporophyte dominant
Lycophytes (Phylum Lycophyta)

Selaginella moellendorfii, a spike moss

Isoetes gunnii, a quillwort

Strobili (clusters of sporophylls)

Diphasiastrum tristachyum, a club moss
Phylum Monilophyta - ferns and fern allies

- Ferns - Most common of all seedless plants alive today
- Leaves – fronds (young croziers or fiddleheads)
- Roots
- Stem (horizontal underground → rhizome)
Phylum monilophyta – horsetails – 900 spp.

- Reduced leaves
- Photosynthetic stem
  - Hollow impregnated with silica
- Genus *Equisetum*
  - Most common
Phylum Monilophyta – whisk ferns – 12 spp.

- Genus *Psilotum* – whisk fern
- Dichotomous branching
- Photosynthetic stem
- Spherical groups of sproangia

*Psilotum nudum*, a whisk fern

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**Homosporous spore production**

- Sporangium in sporophyll → Single type of spore → Typically a bisexual gametophyte → Eggs
- Sperm

**Heterosporous spore production**

- Megasporangium in megasporophyll → Megaspore → Female gametophyte → Eggs
- Male gametophyte

- Microsporangium in microsporophyll → Microspore → Sperm