

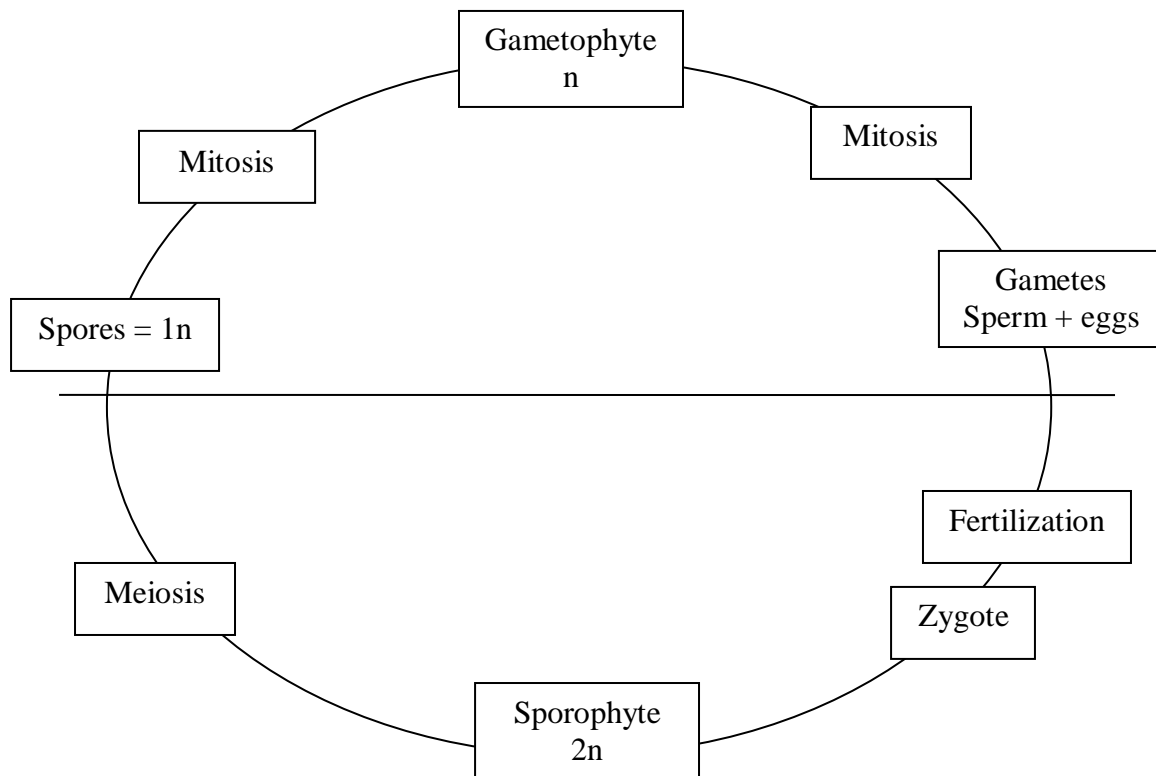
## Kingdom Plantae: Non-vascular Plants

The Plant Life Cycle: Alternation of Generations

- Haploid generation = *Gametophyte*
- Diploid generation = *Sporophyte*

“male and females”

### Plant Life Cycle



Gametangia and Sporangia

Different dominant stages in different types of plants.

Two adult forms (although for most land plants gametophyte is parasitic)

## **The Bryophytes: Mosses, Hornworts and Liverworts**

- Unique, dominant generation is gametophyte (conspicuous)
- Flagellated sperm (need water)
- Small, compact, close to ground
- Lacks transport vessels and supportive tissue
- No true leaves, stems or roots
- Absorb nutrients + water from surroundings
- Rhizoids
- Asexual + sexual reproduction
- (not a monophyletic group)

### Moss Life Cycle:

1. Gametes develop in Gametangia on gametophyte
  - a. Archegonia
  - b. Antheridia
2. Fertilization
3. Mitosis = Sporophyte development
4. Meiosis in sporangia at tips of Sporophyte
5. Spore released and undergo mitosis

### Bryophyte Diversity:

#### A. Liverworts

1. Most similar to green algae
2. 6,000 species
3. Gemmae

#### B. Hornworts

1. 100 species
2. Horn-shaped, single chloroplast

#### C. Mosses

1. 10,000 species

## Kingdom Plantae: Seedless Vascular Plants

### Seedless Vascular Plants: The Ferns

- true ferns, whisk ferns, horsetails, club mosses
  
- dominant Sporophyte, highly reduced gametophyte
- gametophyte and Sporophyte still separate
- once dominant plant form
- live in drier habitats
- flagellated sperm (require water)
- fossil fuels and coal forests

### Life Cycle:

1. gametes produced in Gametangia on underside of gametophyte
2. sperm swim to egg, fertilization, zygote on gametophyte
3. Sporophyte develops on gametophyte (grows out of)
4. sporangia produce haploid spores
5. spores released (50 million per season)

### Fern Structure:

- 1) roots and rhizomes
- 2) nonvascular stems
- 3) leaves = fronds
- 4) sori = clusters of sporangia on underside of frond
- 5) fiddleheads

### Fern Diversity:

- 250,000 species

## Kingdom Plantae: Angiosperms – The Flowering Plants

- Produce flowers (modified leaves)
- Produce fruit
- Dominant plant form
- Most foods and materials

### Division Split into Two major Groups

#### 1) Monocots

- a. one cotyledon
- b. veins usually parallel
- c. dispersed vascular bundles
- d. floral parts in multiples of 3
- e. fibrous root system

#### 2) Dicots

- a. two cotyledons
- b. veins usually branched
- c. vascular bundles usually in ring
- d. floral parts in multiples of 5
- e. taproot system

### Plant Body:

1. Roots
2. Shoots

### **ROOTS:**

- Roots Systems
  - Taproot
  - Fibrous root

- Root Hairs
- SHOOTS:**
- Stems and Leaves
- Stem structure
  - Nodes
  - Internodes
  - Terminal buds
  - Axillary buds and axillary regions
  - Leaf scars
  - Leaves
    - Blades
    - Petioles
- Apical Dominance

### Root and Shoot Modifications

1. tubers
2. rhizomes
3. rhizoids
4. stolons (runners)
5. grasses
6. flowers
7. needles
8. thorns
9. nodules: auxiliary organisms = symbiots
  - a. bacterial
  - b. fungal

### Plant Organs

1. Leaves
2. Stems

### 3. Roots

#### **Plant Cells and Tissues**

##### I. Plant Cells

- 1) Parenchyma
- 2) Collenchyma
- 3) Sclerenchyma
  - a) Fibers
  - b) Sclereids
- 4) Water conducting cells
  - a) Tracheids
  - b) Vessel Elements
- 5) Food conducting cells
  - a) Sieve-tube Members
  - b) Companion Cells

##### II. Plant Tissues

- 1) Simple tissues: composed of only one cell type
  - a) Parenchyma
  - b) Collenchyma
  - c) Sclerenchyma
  
- 2) Complex Tissues: composed of many cell types
  - a) epidermal tissue system (epidermis)
  - b) vascular tissue system
  - c) ground tissue system

#### **Root and Stem Structure**

## Epidermis

- skin of plant
- protection and defense
- cuticle

## Vascular Tissue

- vascular bundles or rings
- change from young to old
- two types:
  1. Xylem: water and dissolved nutrients; composed of water conducting cells, parenchyma, + Sclerenchyma
  2. Phloem: sugar; composed of sieve-tube members, parenchyma, + Sclerenchyma

## Ground Tissue

- Collenchyma and parenchyma
- Storage and support
- Cortex
- Endodermis
- Pith

## **Monocots and Dicots Compared**

### **Leaf Structure**

- Cuticle
- Upper epidermis
- Mesophyll (ground tissue)
  - Palisade mesophyll
  - Spongy mesophyll

- Veins (or vascular traces)
  - Xylem
  - Phloem
  - Sheath cells
- Lower epidermis
- Stomata and guard cells
- Cuticle

## Plant Growth

Indeterminate vs. Determinate Growth

Annuals and Perennials

Meristems = actively dividing cells

### I. Primary Growth

- Lengthwise growth in a plant
- Apical meristems = tips of roots and shoots
- Root caps
- Primary xylem and primary phloem
- Leaf primordia

### II. Secondary Growth

- Increase in girth
- Lateral meristems: vascular cambium and cork cambium



- Secondary xylem + secondary phloem
- Wood and direction of growth
- Cork: dead with thick wax walls

### Structure of Wood

- Wood (everything internal to vascular cambium)
  - a. Heart wood
  - b. Sap wood
  - c. Wood rays
  - d. Wood rings
- Bark (everything external to vascular cambium)
  - a. Secondary phloem
  - b. Cork cambium
  - c. Cork
  - d. Epidermis (in some)

### The Life Cycle of a Flowering Plant

- Alternation of generations
- Overview of life cycle
- Sporophyte is dominant stage

### The Flower:

- Specific part of angiosperm for reproduction
- Flower structure:
  - Sepals
  - Petals
  - Stamens (male organs)
    1. Anthers
    2. Filaments
  - Pistils (female organs)

1. Stigma
2. Style
3. Ovary
  - Carpels
  - Ovules

Pollen grains = male gametophyte

Embryo sac = female gametophyte

Pollination and Fertilization

Double Fertilization

Germination

Ovules = seed development

- Endosperm
- Seed coat
- Seed dormancy

Fruit = a matured ovary

- Simple (one carpel, one flower)
- Aggregate (many carpels, one flower)
- Multiple (many flowers)

## **Plant Nutrition and Transport**

Nutrients from air and soil:

- water, minerals and oxygen from soil
- carbon dioxide from air

## Solute Uptake by Roots:

- *Intracellular Rout*
- *Extracellular Route* and the Casparian strip (endodermis)

All nutrients must pass through the cell membrane of the endodermis before entering the xylem

## Water Movement

- Xylem sap
- Root pressure
- Transpiration
- Transpiration-cohesion-tension mechanism (siphon)

## Transpiration and Guard Cells

## Food Movement

- Phloem sap
- Pressure-flow mechanism (diffusion)

## Nutrients and Soil

Topsoil

Humus

Fungi and Bacteria