Botany Basics

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Botany is...
The study of plants.

Plants in our Ecosystem
- Capture sun’s energy
- Food source
- Replenish atmospheric oxygen
- Participate in water cycle
- Moderate world climate
- Provide shelter
- Source of numerous raw materials

Botany Applied
- Identify plants
- Grow & propagate plants
- Influence flowering & fruit production
- Control unwanted growth
- Maintain plant health
- Modify plant features

Reading Assignment
extension.oregonstate.edu/mg/botany/

Basic Classifications
- Vascular vs. Non-vascular
- Seed vs. Seedless
- Flowering vs. Flowerless
- Big 2 Vascular Plant Divisions
  - Flowering Plants (Anthophyta)
  - Cone Bearing Plants (Coniferophyta)
Plant Life Cycles

- **Annuals** - complete life cycle (seed to seed) in one year
- **Biennials** - require all or part of 2 years to complete life cycle
- **Perennials** - live longer than 2 years
  - **Herbaceous** - soft stems that die back in winter
  - **Woody** - trees, shrubs, etc.

Monocots vs Dicots

<table>
<thead>
<tr>
<th>Structure</th>
<th>Monocots</th>
<th>Dicots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed Leaves</td>
<td>One</td>
<td>Two</td>
</tr>
<tr>
<td>Vascular System</td>
<td>Xylem &amp; phloem in bundles, dispersed in stem</td>
<td>Xylem &amp; phloem in rings, xylem inner ring, phloem outer ring</td>
</tr>
<tr>
<td>Floral Parts</td>
<td>Usually threes or multiples of three</td>
<td>Usually in multiples of four or five</td>
</tr>
<tr>
<td>Leaves</td>
<td>Often parallel-veined</td>
<td>Generally net-veined</td>
</tr>
</tbody>
</table>

Vascular Plant Structure

- **Roots**
- **Stems**
- **Leaves**
- **Flowers**
- **Fruit & Seeds**

Root Functions

- Absorb nutrients
- Absorb moisture
- Anchor plant in soil
- Support stem
- Store food
- Propagate vegetatively

Root Structure

- Lateral Root
- Primary Root
- Root Hairs
- Root Tip
- Root Cap
- Zone of Elongation
- Meristematic Zone
- Zone of Maturation
**Root Anatomy**

- **Epidermis**
- **Cortex**
- **Endodermis**
- **Xylem**
- **Phloem**

**Root Tissues**

- Xylem - conduct water & nutrients
- Phloem - carry sugars & starches
- Endodermis - contain vascular tissues
- Cortex - primary tissue surrounding vascular bundle
- Epidermis - outermost layer of plant tissues, protective layer

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**Stem Functions**

- Support buds
- Support leaves
- Support flowering/fruiting structures
- Carry water & minerals
- Carry food (photosynthates)
Introduction to Botany: Plant Anatomy
Master Gardener Training Series

Stem Structure Quiz

Herbaceous Stem Anatomy

Herbaceous Vascular Arrangements in Stems

Monocot Vascular Arrangement

Lenticel (breathing pore)

Bud Scale Scar

Node

Internode

Terminal Bud

Axillary or Lateral Bud

Node

Node

Leaf Scar

Apical Meristem

Axillary Bud

Node

Internode

Node

Xylem

Phloem

Vascular Bundles

Herbaceous Monocot

Herbaceous Dicot

Air Space

Xylem

Phloem

Support Cells
**Dicot Vascular Arrangement**

- Support Cells
- Phloem
- Vascular Cambium
- Xylem

**Stem Tissues**

- **Herbaceous Monocot**
  - Vascular Bundle
  - Epidermis
  - Cortex
  - Ground Tissue
  - Vascular Cambium
  - Pith

- **Herbaceous Dicot**

**Woody Stem Growth**

- Woody Stem, Secondary Growth

**Woody Stem Anatomy**

- Heartwood - nonfunctional xylem
- Inner Bark (phloem)
- Vascular Cambium
- Sapwood - functional xylem
- Outer Bark

Stem Tissues

- Xylem - conduct water & minerals
- Phloem - carry sugars & starches
- Epidermis - Outermost layer of plant tissue, protective layer
- Cortex - primary tissue surrounding vascular bundles
- Pith - thin-walled cells at center of stem

Specialized Above-Ground Stems

- Crowns - compressed stems with leaves and flowers on short internodes
- Spurs - short side stems arising from main stem, often bear fruit on trees
- Stolons - fleshy or semiwoody, elongated, horizontal stems, often at soil surface

Specialized Underground Stems

- Tuber - enlarged, short, fleshy underground stem tip
- Rhizome - horizontal underground stem, may be compressed and fleshy or slender with elongated internodes
- Bulb - short, compressed, underground stem with central bud at tip of stem, surrounded by fleshy scales (leaves)

Specialized Underground Stems

- Corm - solid, swollen underground stem with dry, scale-like leaves
- Tuberous stem - short, flat, enlarged underground stem with buds and shoots at top and fibrous roots at bottom
Leaf Functions

- Photosynthesis - use sunlight to make food
- Respiration - use food to make energy
- Transpiration - lose water (as vapor) to atmosphere

Leaf Parts

- Lamina (blade)
- Petiole
Leaf Anatomy

- Cuticle
- Upper Epidermis
- Palisade
- Mesophyll
- Vascular Bundle
- Spongy Mesophyll
- Intercellular Chamber
- Lower epidermis
- Cuticle

Leaf Model

- Upper epidermis
- Palisade mesophyll
- Spongy mesophyll
- Lower epidermis
- Vascular Bundle
- Xylem
- Phloem
- Stoma

Stoma & Guard Cell

- Stoma
- Guard Cell

Stomatal Control

- Open
- Closed

Leaf Surface

- Image A
- Image B

Leaf Forms
Types of Leaves

- Scale leaves (cataphylls) - enclose and protect rhizomes and buds
- Seed leaves (cotyledons) - store food for seedlings
- Spines & Tendrils - protect or help support
- Storage leaves - found on bulbous plants & succulents, store food
- Bracts - modified, often brightly-colored leaves around flowers

Flower Functions

- Exchange pollen
- Achieve fertilization
- Produce seed

Flower Anatomy
**Flower Types**
- Complete
  - all floral organs present (sepals, petals, stamens, pistil)
- Incomplete
  - flower lacks 1 or more of the 4 organs

**Flower Types**
- Perfect - has both stamen (male organs) and pistil (female organ)
- Imperfect - having only one type of organ
  - Staminate - male organ present
  - Pistillate - female organ present

**Imperfect Flowers**
- Staminate
- Pistillate

**Species with Imperfect Flowers**
- Monoecious
  - both pistillate and staminate flowers occur on same plant
    - birch, pecan, squash
- Dioecious
  - pistillate are on one plant, staminate on a different plant
    - ginkgo, holly, pistachio, kiwi

Petals

Sepals
Pollination
- Exchange of pollen
- Numerous mechanisms
  - insects, birds, bats, wind, rain
- Flowers are optimized for their pollination vector

Fertilization
- Pollen Grain
- Pollen Tube
- Ovary
- Ovule
- Stigma
- Style

Types of Fruit
- Simple - develop from one ovary (may have multiple seeds)
- Aggregate - develop from a single flower with multiple ovaries
- Multiple - develop from a tight cluster of separate flowers

Fruit
- Petal
- Stigma
- Stamens
- Style
- Ovary
- Floral Tube
- Ovule
- Sepal
- (becomes seed)

Seeds
Seed Anatomy

- Embryo - miniature plant in an arrested state of development
- Endosperm - food supply (can be comprised of proteins, carbohydrates, fats)
- Seed coat - hard outer covering that protects from disease and insects; also repels water

Germination

- Activation of embryo within seed
- Preceded by water penetrating seed coat
- Oxygen, favorable temperature, and (in some species) light required

Germination of a Dicot

Germination of a Monocot

The Incredible Vascular Plant