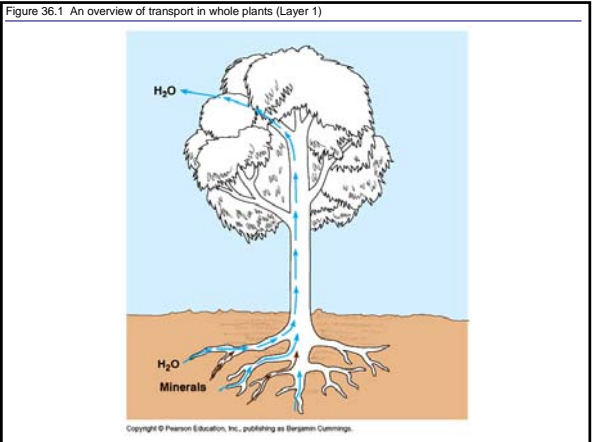


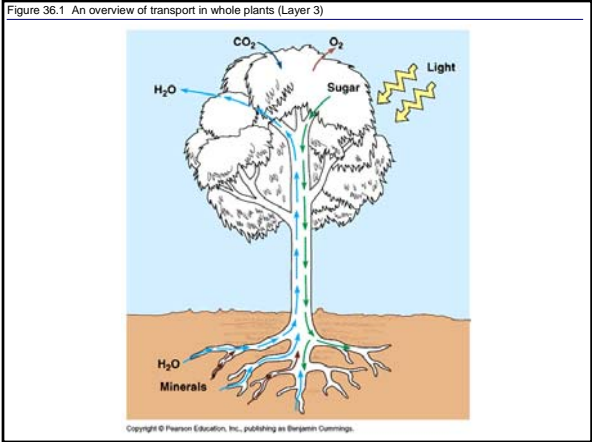
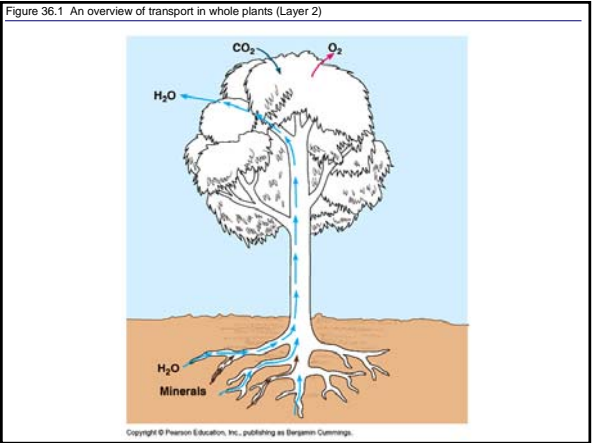
As in animals...

...form follows function in plants.



Roots vs Shoots

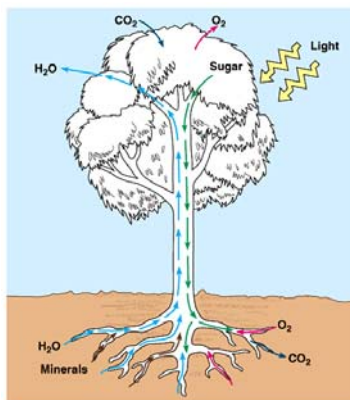
- Xylem carries water and minerals from soil-to-root-to stem.



Roots vs Shoots

- Xylem carries water and minerals from soil-to-root-to shoot.
- Phloem carries sugars from shoots to roots.

Figure 36.1 An overview of transport in whole plants (Layer 4)



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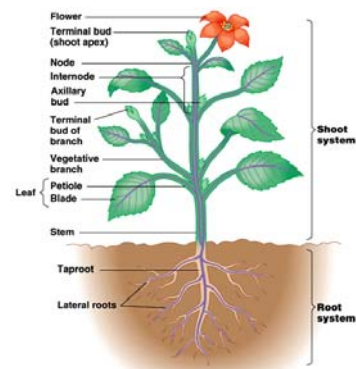
Roots vs Shoots

- Xylem carries water and minerals from soil-to-root-to shoot.
- Phloem carries sugars from shoots to roots.
- Shoots are autotrophic; roots are heterotrophic.
- Shoots and roots are interdependent “systems”.

The shoot system

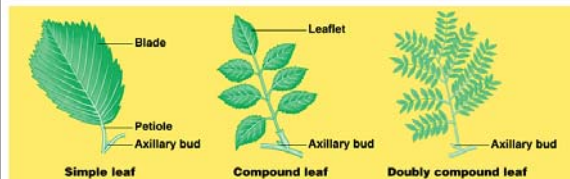
- Shoot system is above ground
- Shoot = stems, leaves, buds, flowers, and fruits
- Stems are an alternating systems of “nodes” and “internodes”
- Leaves attach to stems at nodes by “petioles”
- Leaf morphology can be highly variable
- Buds may be axillary or terminal
- Terminal buds inhibit development of lateral buds = “apical dominance”

Figure 35.2 Morphology of a flowering plant: an overview



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Figure 35.5 Simple versus compound leaves



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The shoot system

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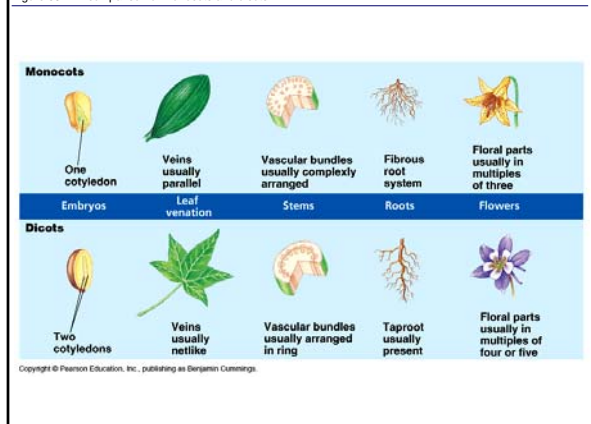
Monocots vs dicots

- Both are angiosperms
- There are around 275,000 species
- Distinguished based on morphology

Monocots vs dicots

- Dicots = two cotyledons = seed leaves; monocots = one seed leaf
- Dicots = one large “taproot” with lateral roots; monocots = fibrous roots
- Dicots = netted veins in leaves; monocots = parallel veins in leaves
- Differ in arrangement of vascular bundles
- Example of a dicot = a bean plant
- Example of a monocot = a corn plant

Figure 35.1 A comparison of monocots and dicots



Five major cell types of plant tissues

- Parenchyma cells
- Collenchyma cells
- Sclerenchyma cells
- Tracheids and vessel elements of water-conducting xylem
- Sieve-tube members of food-conducting phloem

Figure 35.11 The three major categories of plant cells

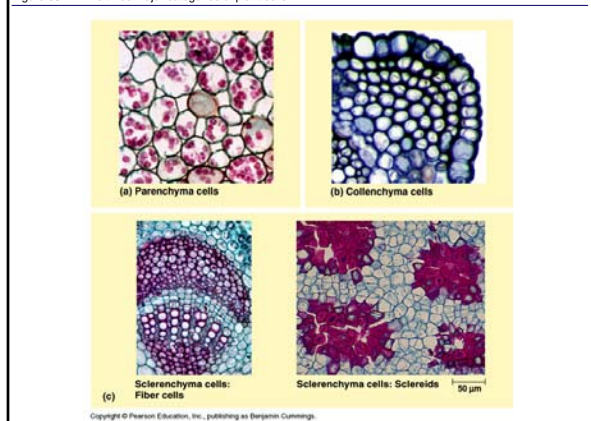
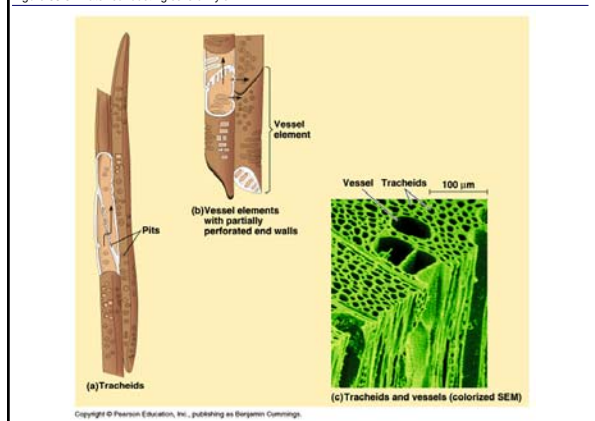


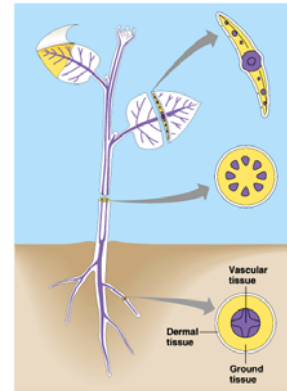
Figure 35.8 Water-conducting cells of xylem



The five major cell types comprise three tissue systems

- Dermal system (epidermis) = root hairs, trichomes, cuticle
- Vascular system = xylem and phloem
- Ground tissue system
- Ground tissue = space between vascular and dermal tissues = the bulk of a young plant
- Ground tissue is composed of parenchyma, collenchyma, and/or sclerenchyma cells

Figure 35.7 The three tissue systems

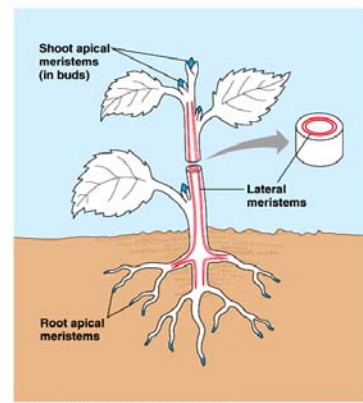


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Plant growth

- Most plants grow throughout their lifetimes = indeterminate growth
- Annual plants complete their life cycles in \leq year
- Biennials complete their life cycles in two years or less
- Perennials take more than two years to complete their life cycles
- Plants grow from internal embryonic tissues called meristems
- Plants grow in length (elongation) and girth
- “Primary growth” = elongation = is from “apical” meristems at the tips of roots and stems = root apical meristems and shoot apical meristems
- “Secondary growth” is found only in woody plants and is from “lateral” meristems

Figure 35.12 Locations of major meristems: an overview of plant growth

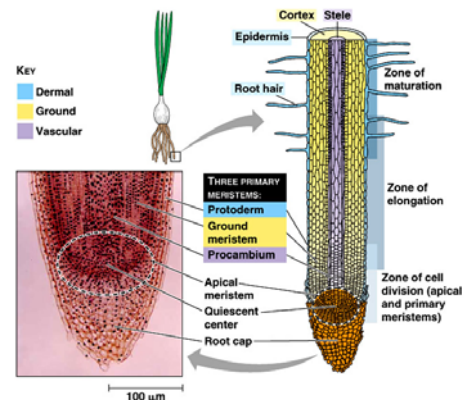


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Primary growth of roots

- Three root zones: cell division; elongation; maturation
- Protoderm gives rise to dermal tissue
- Procambium gives rise to vascular tissue
- Ground meristem gives rise to ground tissue

Figure 35.14 Primary growth of a root

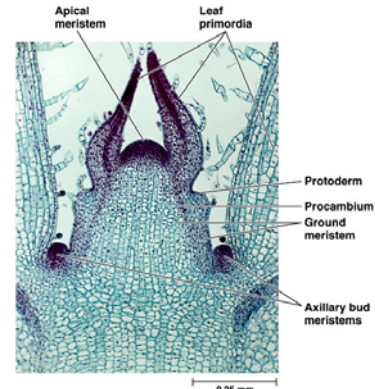


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Primary growth of shoots

- Shoot apical meristem includes protoderm, procambium, and ground meristems
- Shoot growth is “modular”
- Leaves arise from “primordia” on the flanks of the shoot apical meristem

Figure 35.17 The terminal bud and primary growth of a shoot

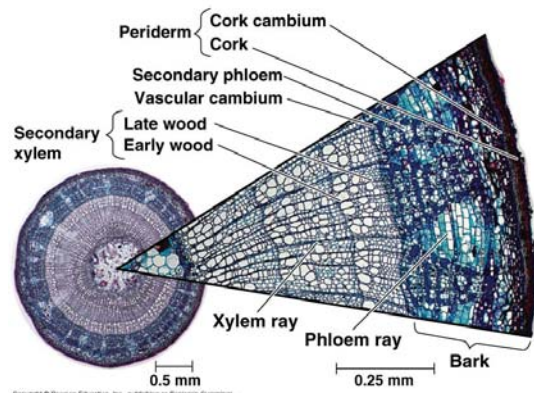


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Secondary growth of woody plants

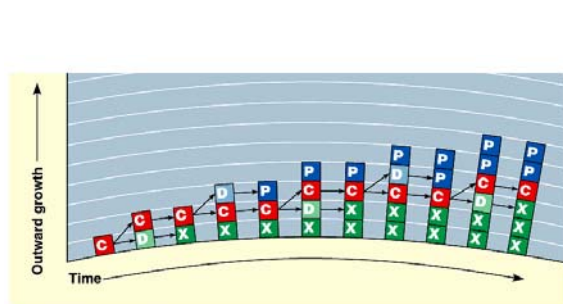
- Occurs from lateral meristems = vascular cambium and cork cambium
- Vascular cambium yields secondary xylem and phloem from cells called “initials”
- The cork cambium yields cork
- Cork cambium + cork = periderm
- Periderm + secondary phloem = bark
- Primary and secondary growth occur simultaneously but in different parts of the plant

Figure 35.22 Anatomy of a three-year-old stem



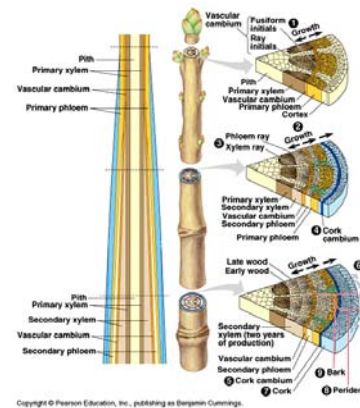
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Figure 35.20 Production of secondary xylem and phloem by the vascular cambium



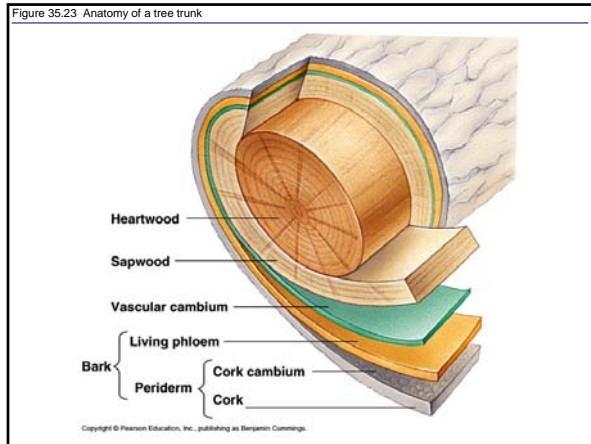
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Figure 35.21 Secondary growth of a stem (Layer 3)



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Figure 35.23 Anatomy of a tree trunk



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