



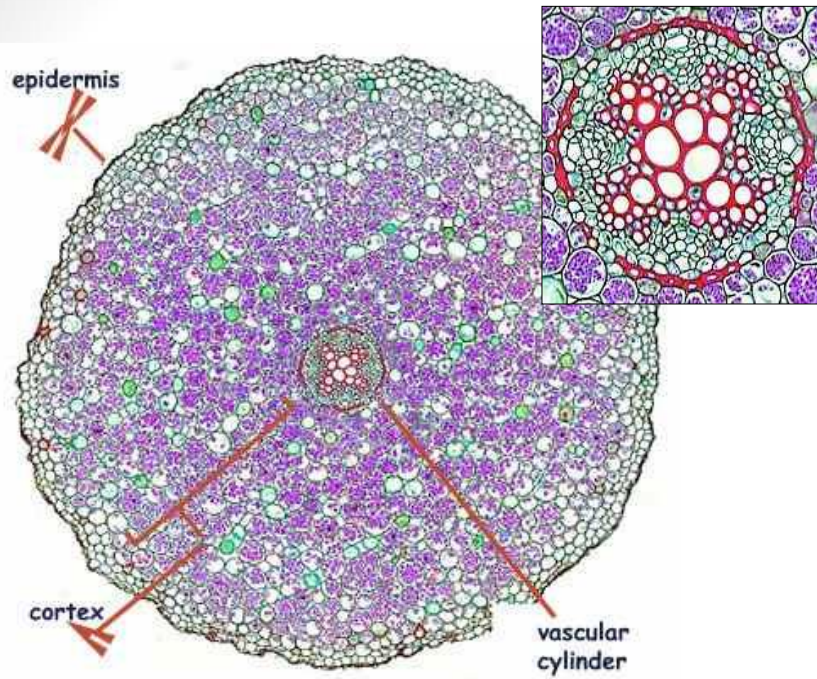
- Chapter 35~
Plant Structure and Growth

Plant Organization

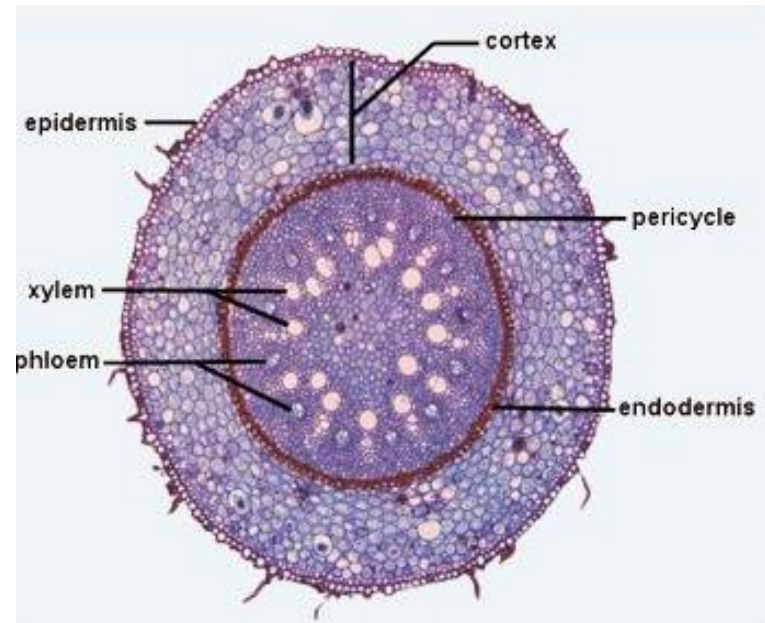
- Plant morphology is based on plant's evolutionary history
- Need to draw in nutrients from the ground and the air
- Plant Organs
 - Root system = roots
 - Shoot system = leaves and stems

Roots

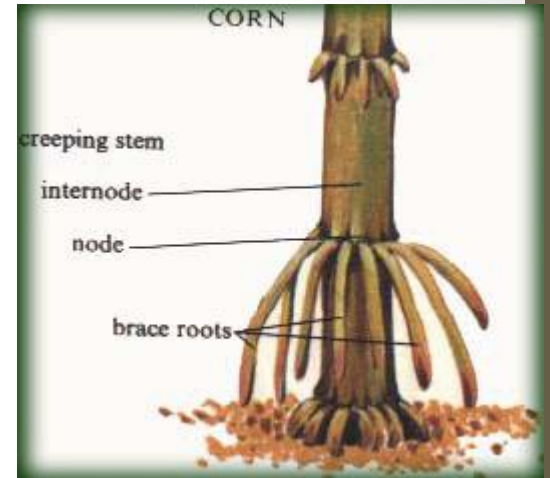
- Function: absorbs minerals and water and can store carbohydrates
- Types: **fibrous**, **taproot** and **lateral roots**, **adventitious** (arising from other organs – stems or leaves), **prop** (aerial roots), **storage**, pneumatophores (air roots)
- Root hairs = tiny hairs that increase surface area of the root, but not anchorage



Eudicot Root



Monocot Root





Storage roots

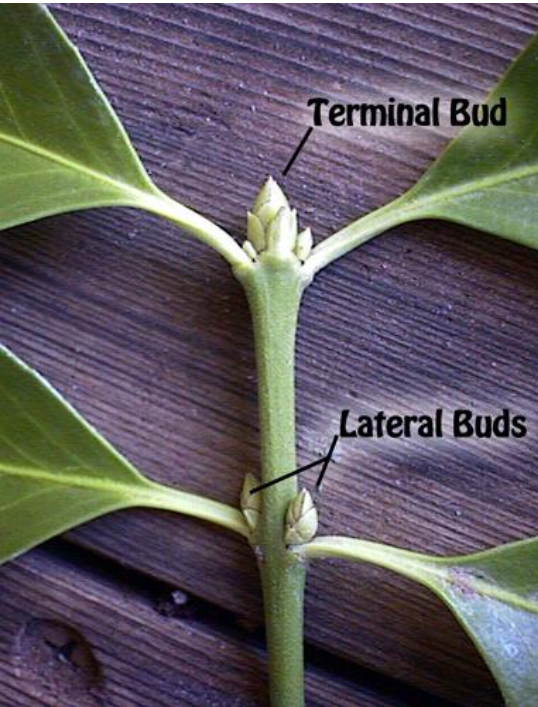
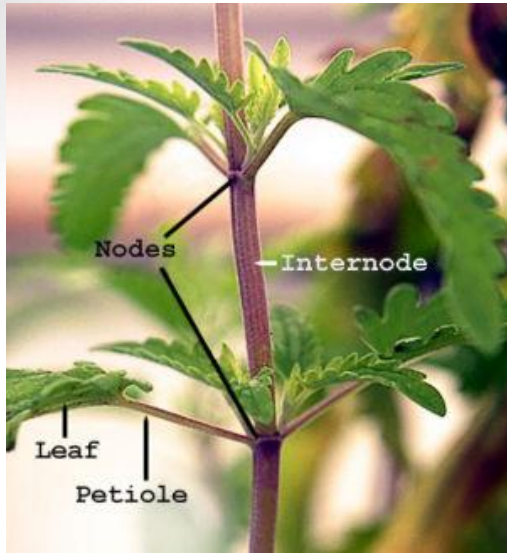
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

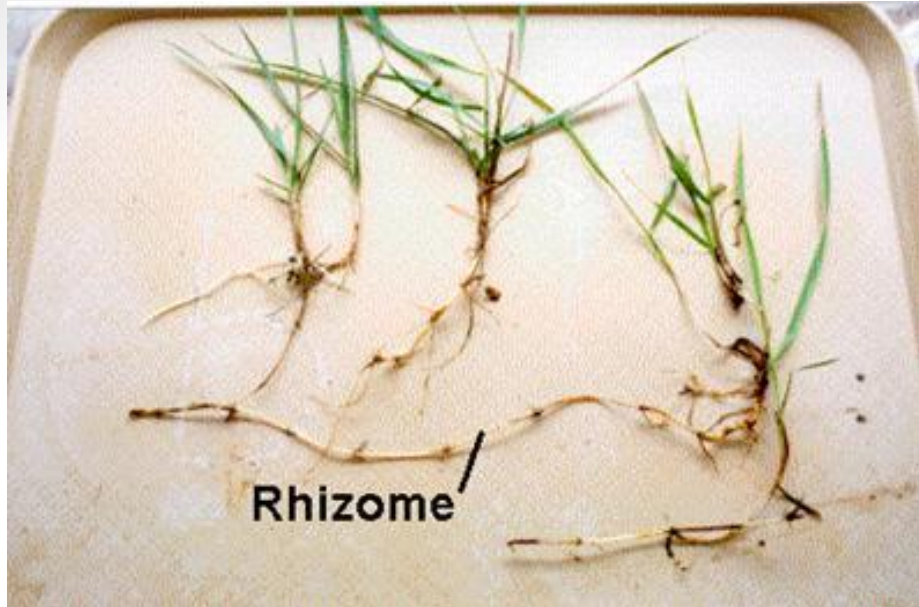
Stems

- Function: attachment of leaves, transport
- Structure: **nodes** (leaf attachment), **internodes** (between leaves), **axillary bud** (forms lateral shoots), **apical/terminal bud** (shoot elongation)
- Types: **Rhizomes** (horizontal shoot that grows just below the surface), bulbs, **stolons** (horizontal shoots that grow above ground), tubers

Stems

- Apical dominance= inhibition of axillary buds by apical buds; helps to increase exposure to light after damage
 - Cut off apical buds to allow plant to grow fuller





Leaves

- Function: photosynthetic organ
- Structure: blade, petiole (joins leaf to stem), and veins (vascular tissue)
- Adaptations: tendrils, spines, storage, reproduction



Plant Tissue

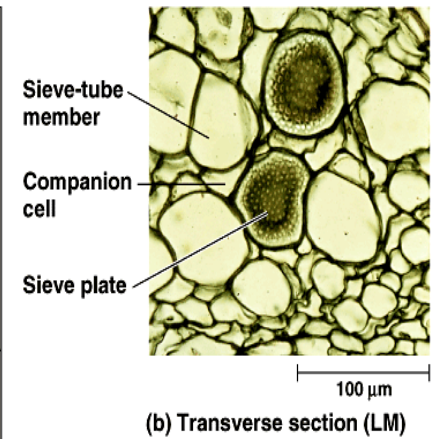
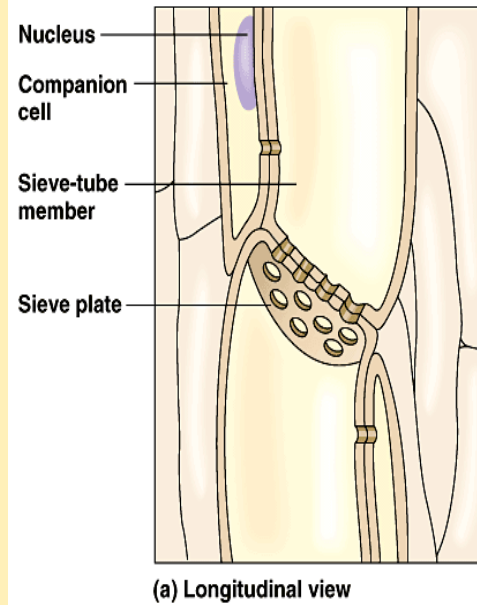
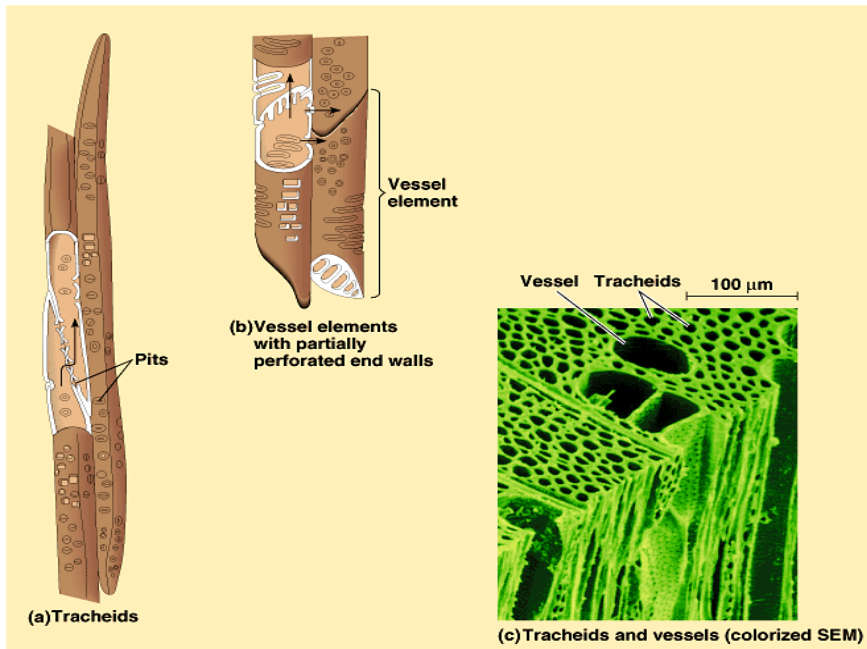
- Dermal, Vascular, and Ground
- Dermal (epidermis): single layer of cells for protection
 - Cuticle – waxy film covering the epidermis
 - Periderm – replaces the epidermis in some types of plants (part of bark)

Plant Tissues

Vascular (material transport)

- **xylem**: water and dissolved minerals roots to shoots
 - tracheids & vessel elements: xylem elongated cells dead at maturity
- **phloem**: food from leaves to roots and fruits
 - sieve-tube element: phloem tubes alive at maturity capped by sieve plates
 - companion cells (non-conducting) connected by plasmodesmata
- stele = vascular tissue of root and stem

Plant Tissues



Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

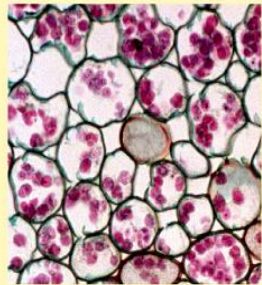
Plant Tissues

- **Ground (photosynthesis, storage, support):**
 - pith (internal to vascular tissue)
 - cortex (external to vascular tissue)

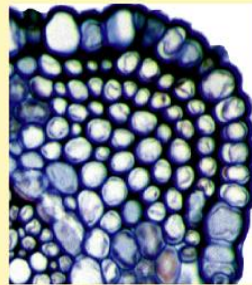
Plant Tissue Cell Types

- Parenchyma

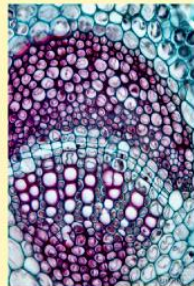
- primary walls thin and flexible; no secondary walls; large central vacuole; most metabolic functions of plant (chloroplasts)



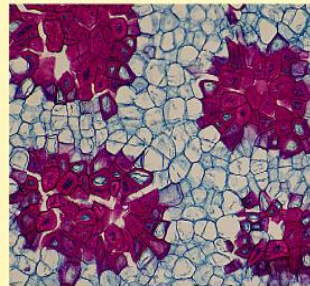
(a) Parenchyma cells



(b) Collenchyma cells



(c) Sclerenchyma cells:
Fiber cells

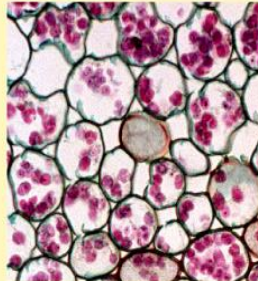


Sclerenchyma cells: Sclereids 50 μ m

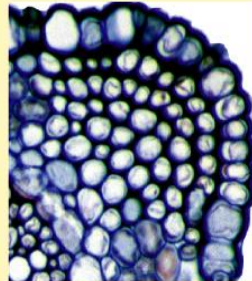
Plant Tissue Cell Types

- Collenchyma

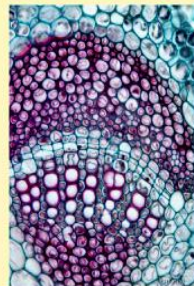
- unevenly thick primary walls used for plant support in young plant structures (no secondary walls; no lignin)



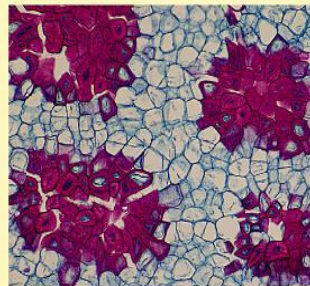
(a) Parenchyma cells



(b) Collenchyma cells



(c) Sclerenchyma cells:
Fiber cells



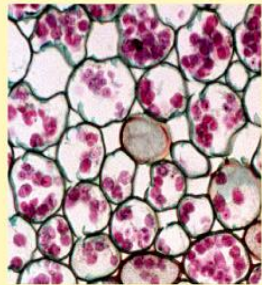
Sclerenchyma cells: Sclereids

50 μ m

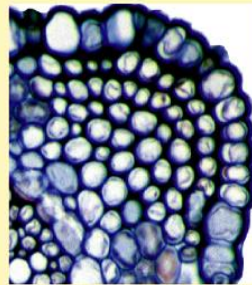
Plant Tissue Cell Types

- **Sclerenchyma**

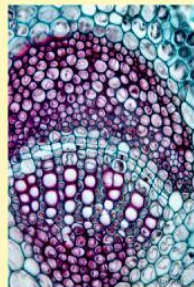
- support element strengthened by secondary cell walls with lignin (may be dead; xylem cells); fibers and sclereids for support



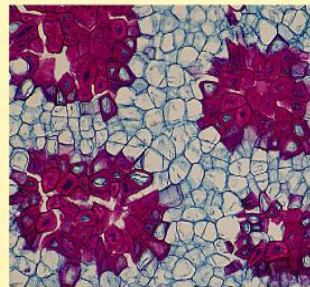
(a) Parenchyma cells



(b) Collenchyma cells



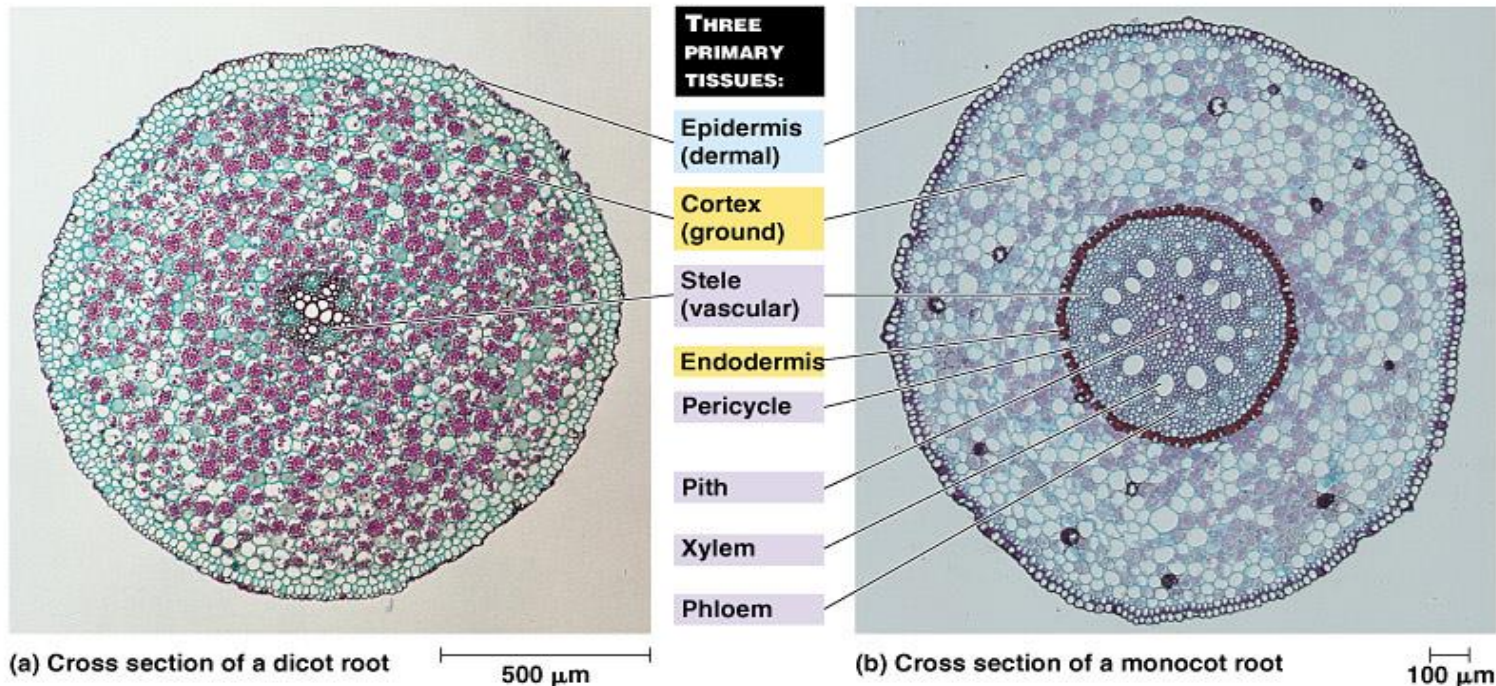
(c) Sclerenchyma cells:
Fiber cells



Sclerenchyma cells: Sclereids | 50 μ m

Primary Tissues of Roots

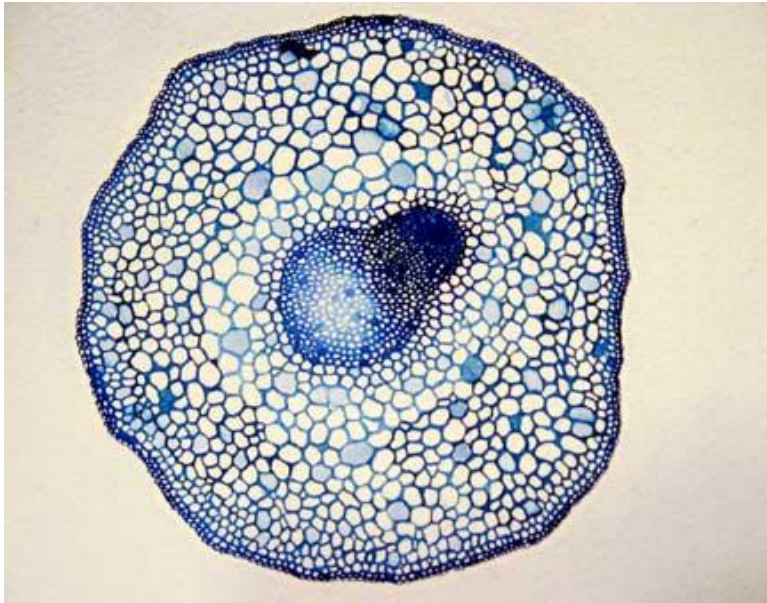
- *Stele* = the vascular cylinder where both xylem and phloem develop
- *Cortex* = region of the root between the stele and epidermis (innermost layer: *endodermis*)



Primary Tissues of Roots

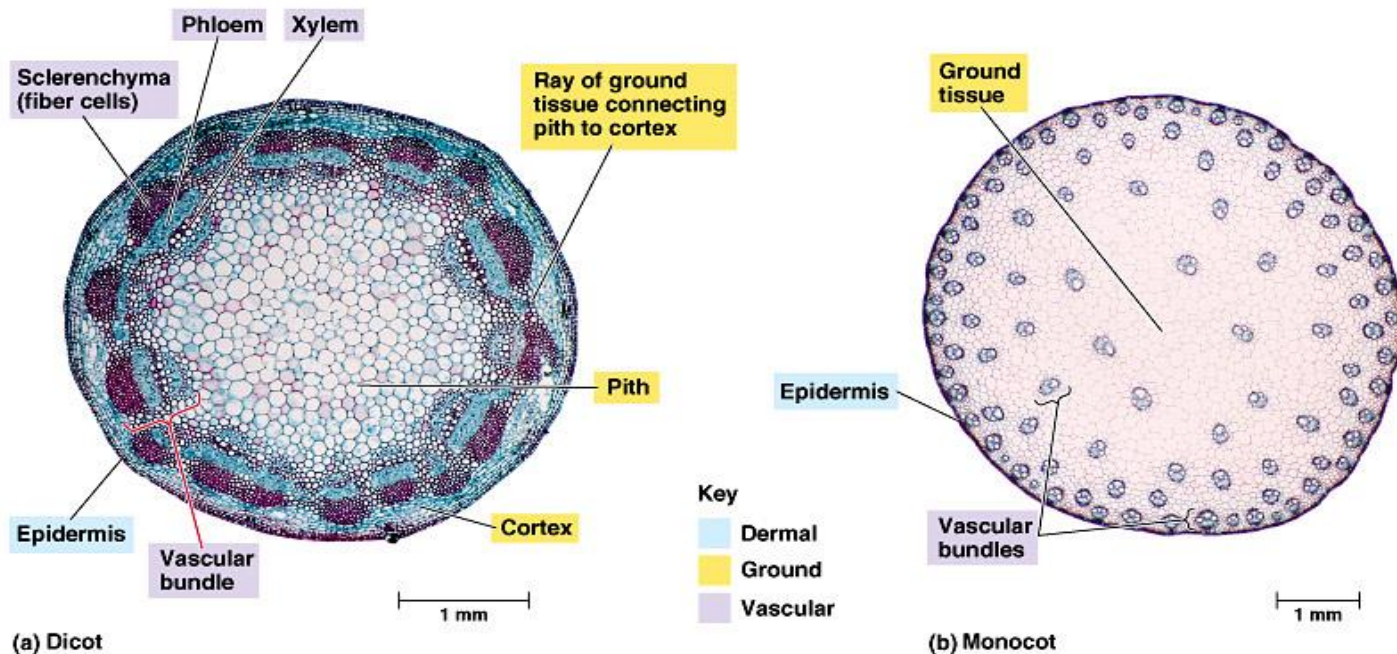
- *Lateral roots* = arise from *pericycle* (outermost layer of stele); just inside endodermis, cells that may become meristematic

Lateral Root Growth



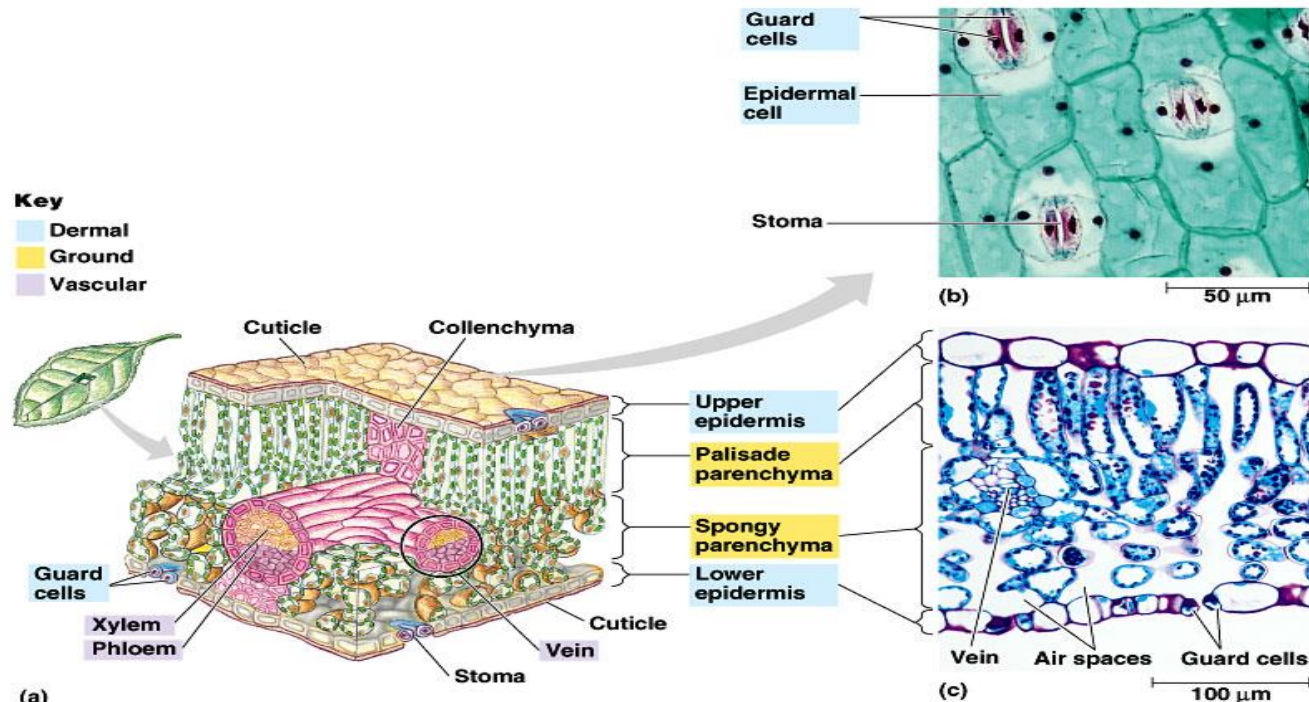
Primary Tissues of Stems

- Vascular bundles (xylem and phloem)
- Surrounded by ground tissue
- Mostly parenchyma; some collenchyma and sclerenchyma for support



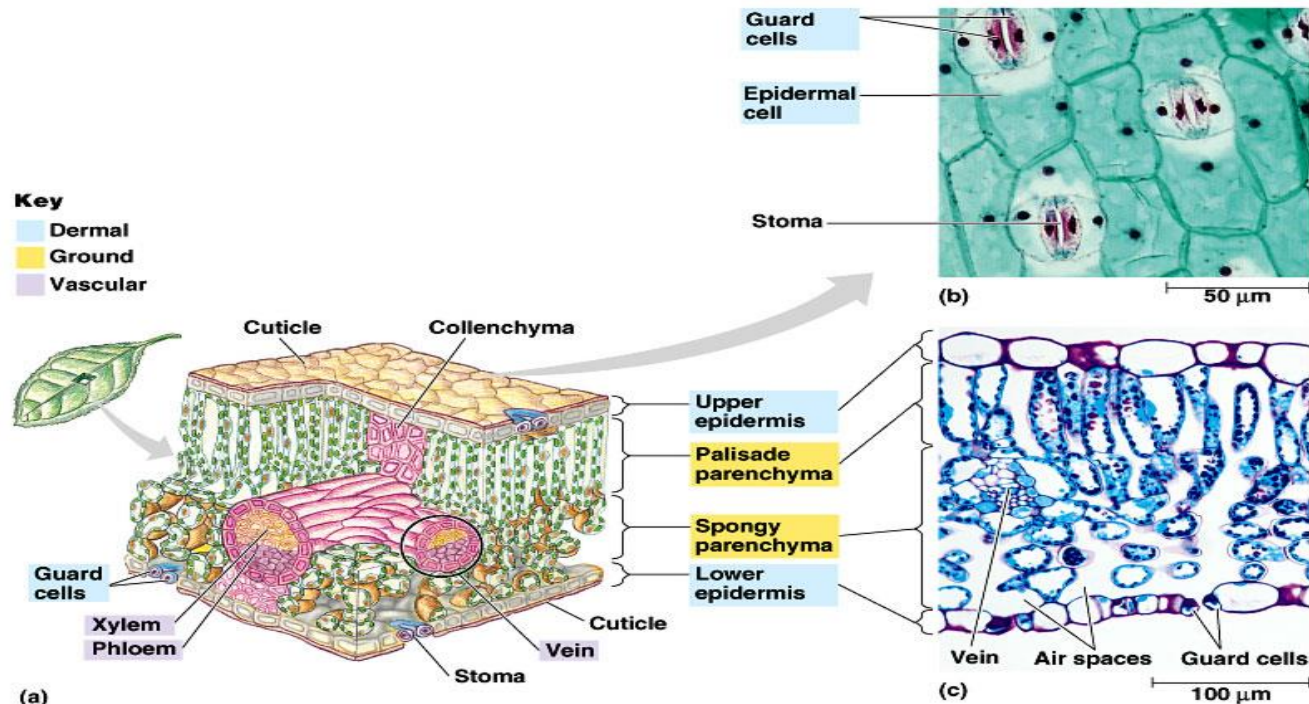
Primary Tissues of Leaves

- Epidermis/cuticle (protection; desiccation)
- *Stomata* (tiny pores for gas exchange and transpiration)/*guard cells* (regulate pore opening and closing)



Primary Tissues of Leaves

- *Mesophyll*: ground tissue between upper and lower epidermis (parenchyma with chloroplasts); palisade (most photosynthesis) and spongy (gas circulation)



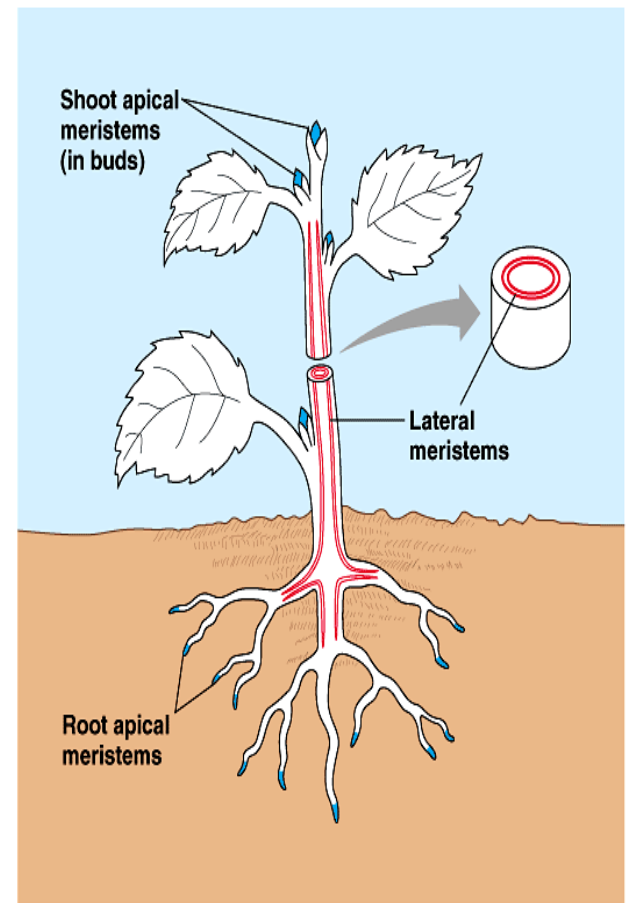
Plant Growth

Meristems = perpetual embryonic tissue

- *apical*: tips of roots and buds; primary growth
- *lateral*: cylinders of dividing cells along length of roots and stems; secondary growth (wood)

Life Cycles

- *annuals*: 1 year (wildflowers; food crops)
- *biennials*: 2 years (beets; carrots)
- *perennials*: many years (trees; shrubs)



Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

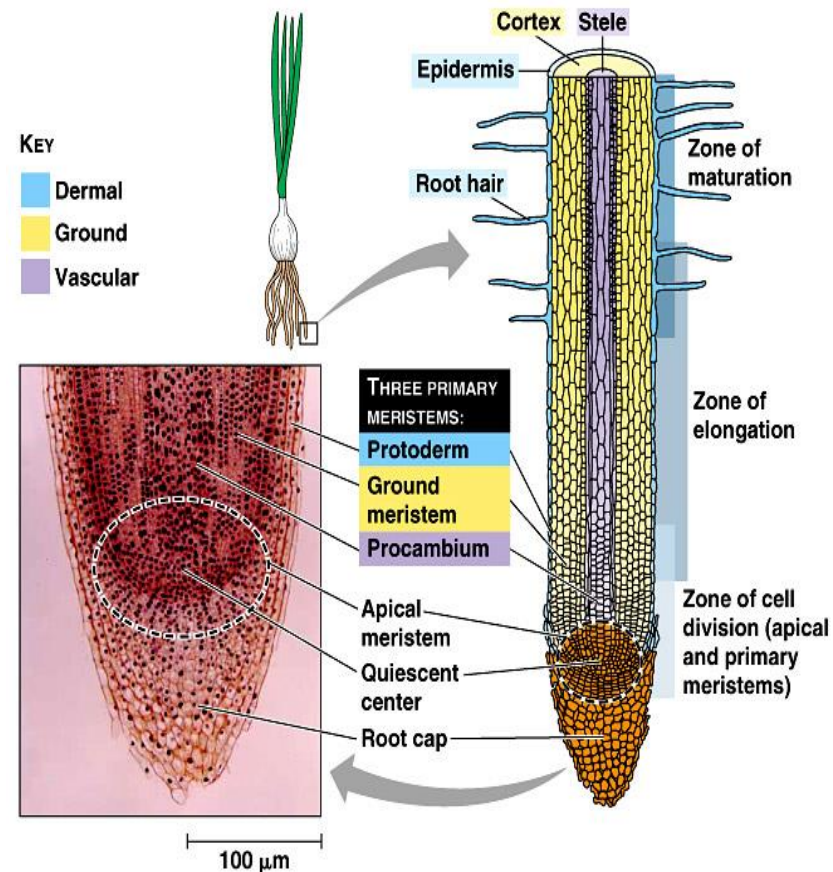
Primary growth

Roots

- *root cap* = protection of meristem
- *zone of cell division* = primary (apical) meristem
- *zone of elongation* = cells elongate; pushes root tip
- *zone of maturation* = differentiation of cells (formation of 3 tissue systems)

Shoots

- Grows from apical meristem and axillary buds (form lateral shoots)

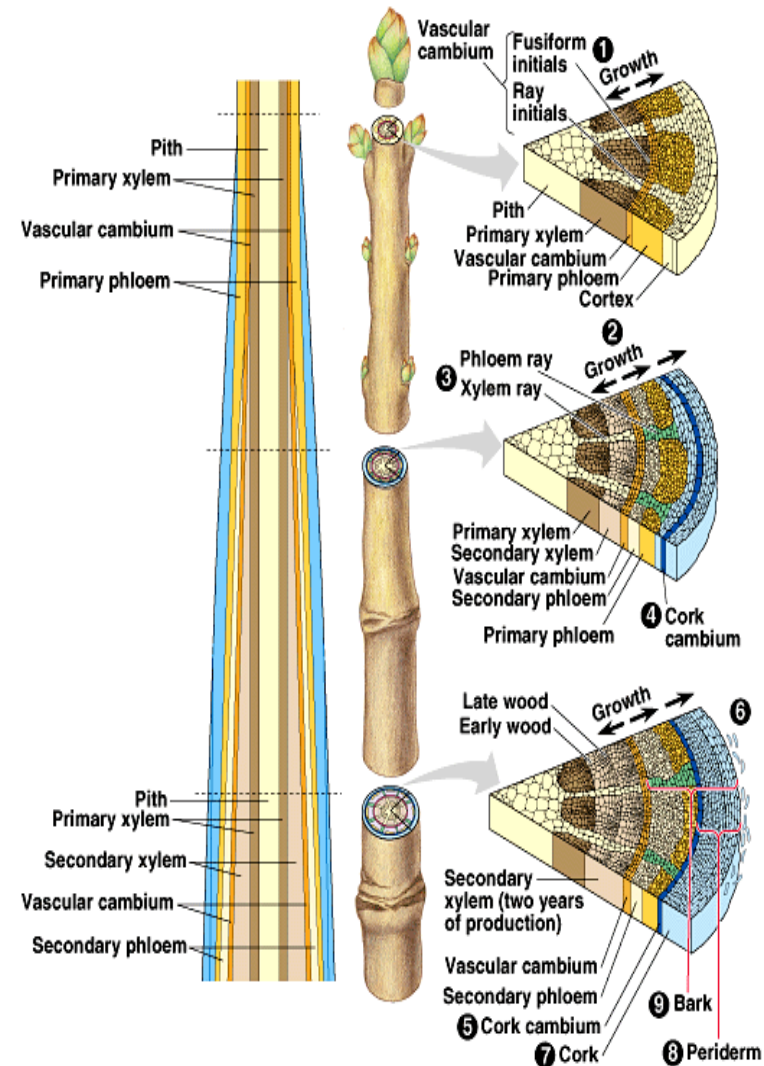


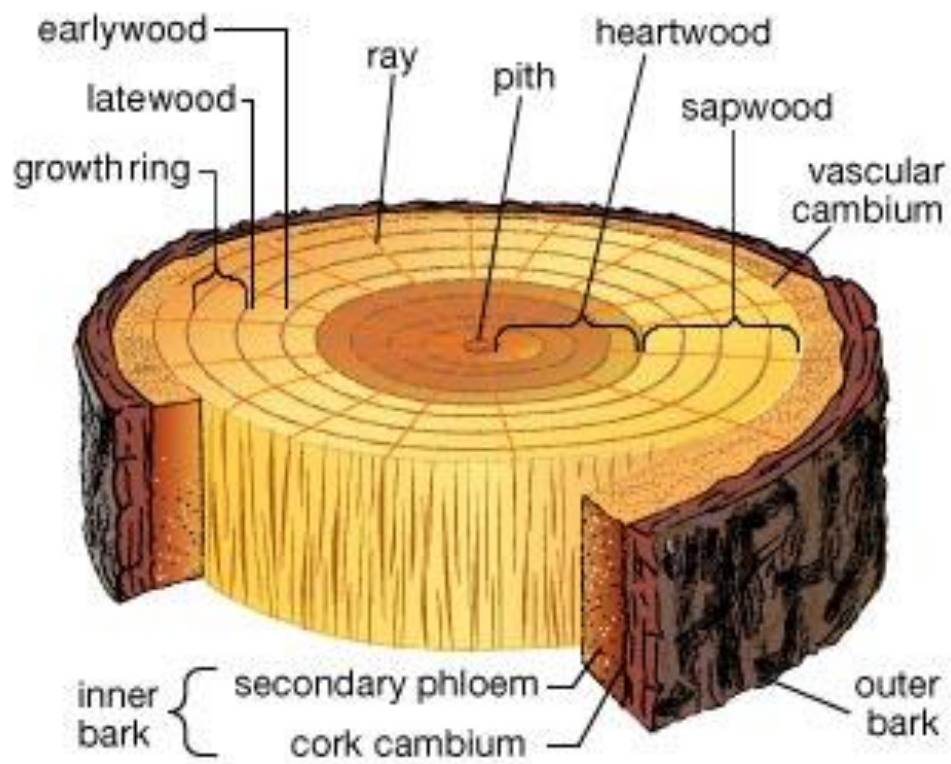
Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

Secondary Growth

Two lateral meristems

- *Vascular cambium* = produces secondary xylem (wood) and secondary phloem (diameter increase; annual growth rings)
- *Cork cambium* = produces thick covering that replaces the epidermis; produces cork cells; cork plus cork cambium make up the *periderm*;
 - *Bark* = all tissues external to vascular cambium (phloem plus periderm)





© 2006 Merriam-Webster, Inc.