

# Complex Tissues

Composed of a mix of cell types

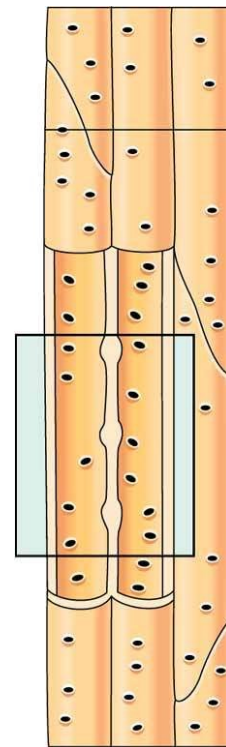
Xylem

Phloem

Epidermis

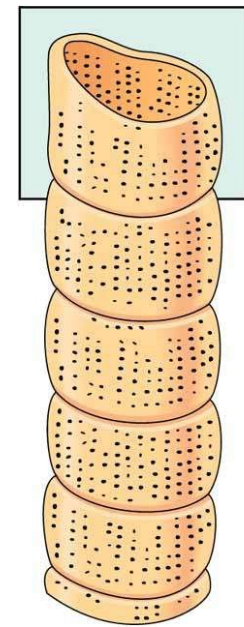
# Xylem

- Conducts water and dissolved minerals
- Conducting cells are dead and hollow at maturity



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tracheids

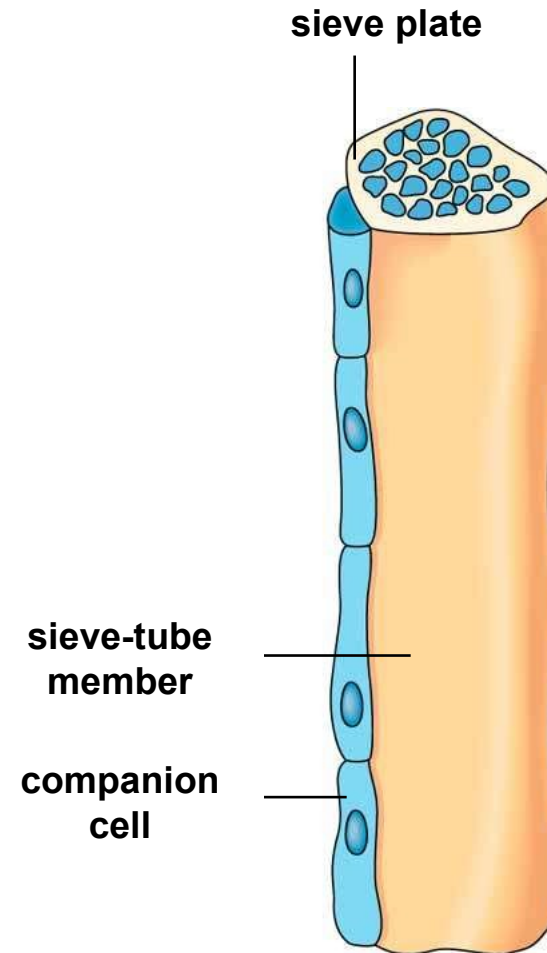


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vessel  
member

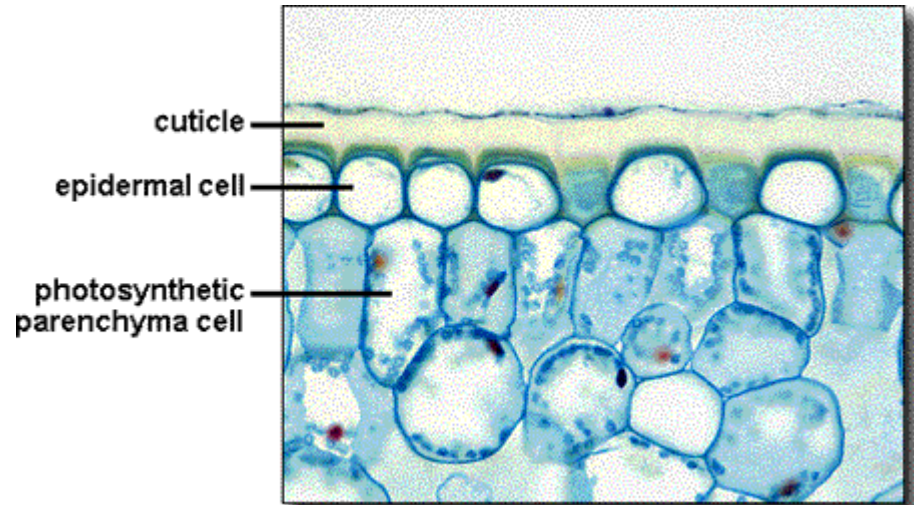
# Phloem: A Complex Vascular Tissue

- Transports sugars
- Main conducting cells are sieve-tube members
- Companion cells assist in the loading of sugars

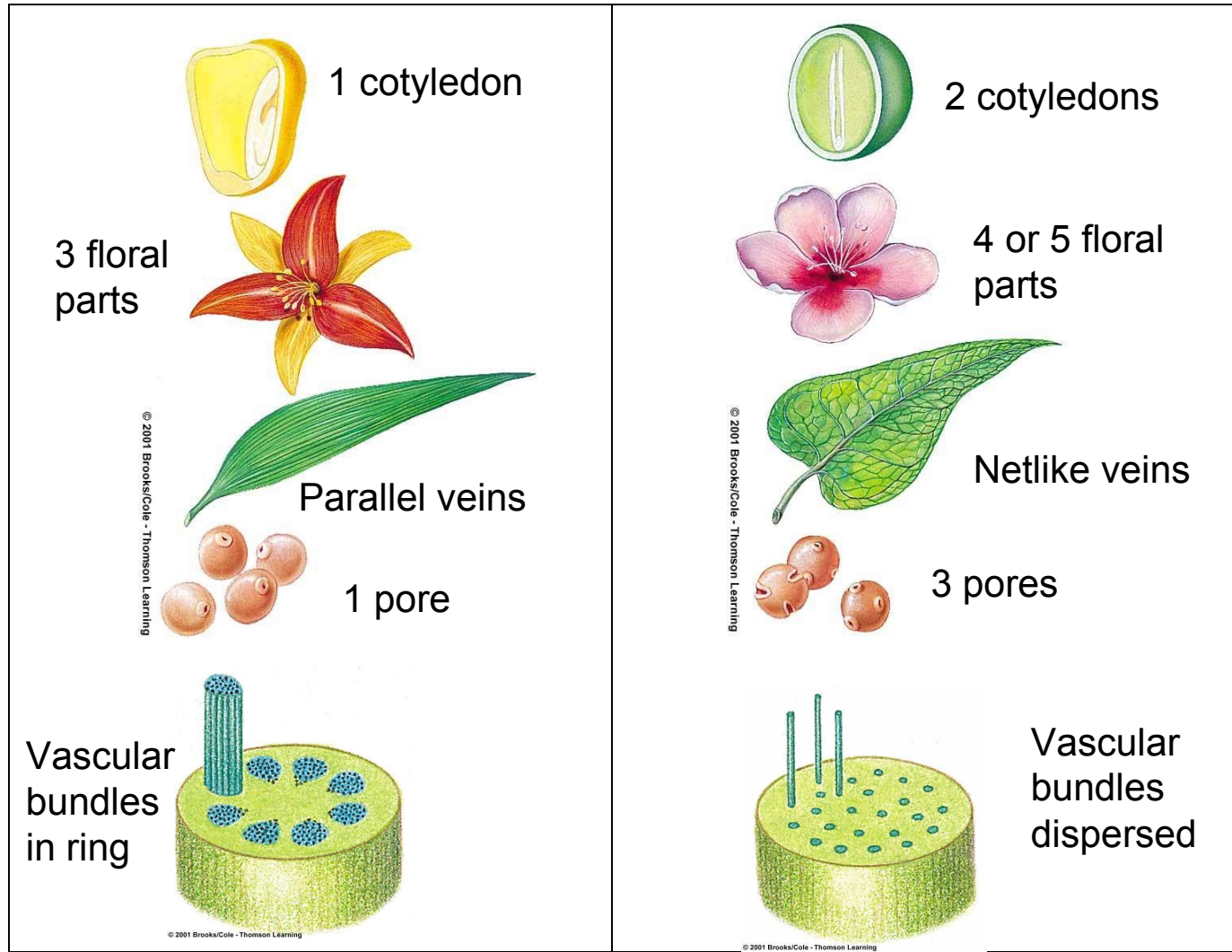


# Epidermis: A Complex Plant Tissue

- Covers and protects plant surfaces
- Secretes a waxy, waterproof cuticle
- In plants with secondary growth, periderm replaces epidermis

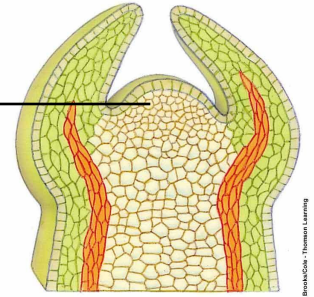


# Monocots and Dicots – same tissues, different features



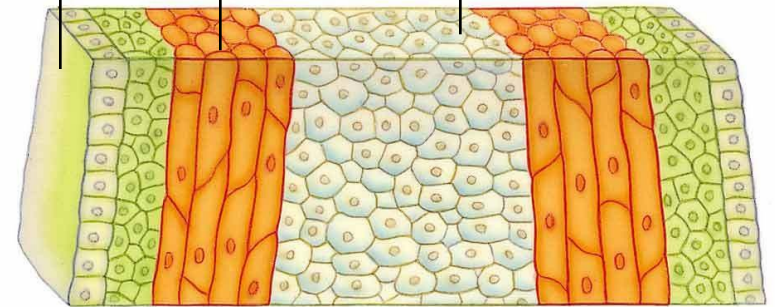
# Shoot Development

shoot apical meristem

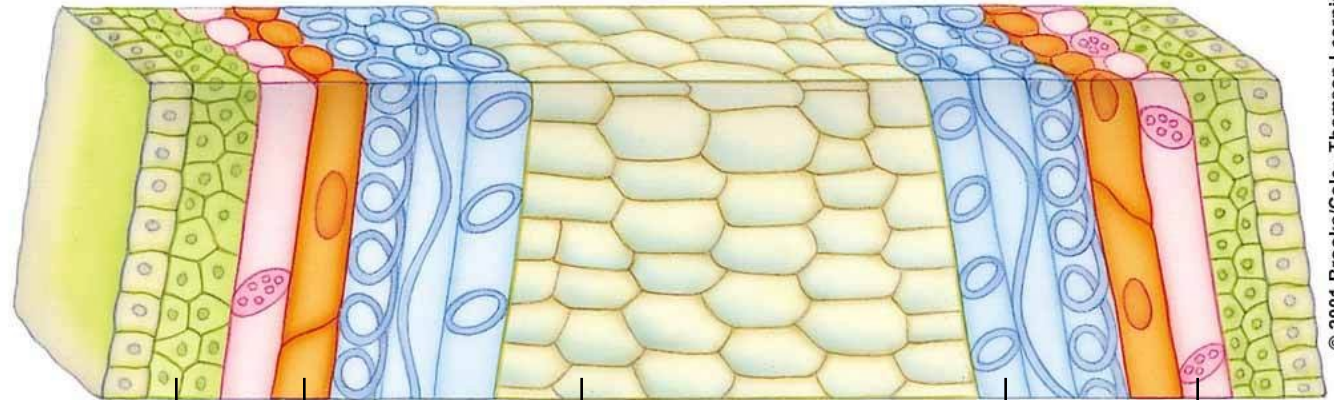


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protoderm procambium ground meristem



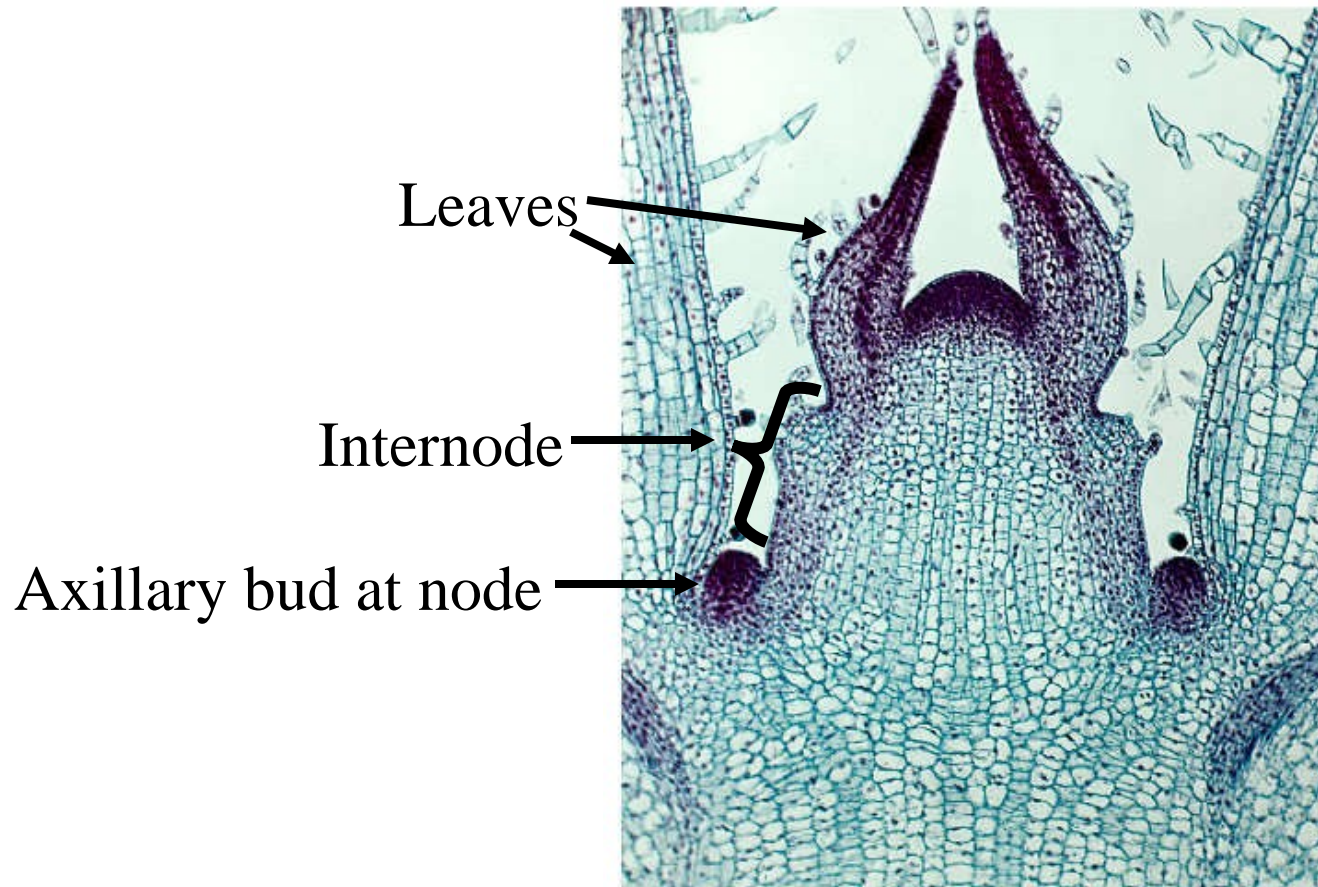
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cortex procambium pith primary xylem primary phloem

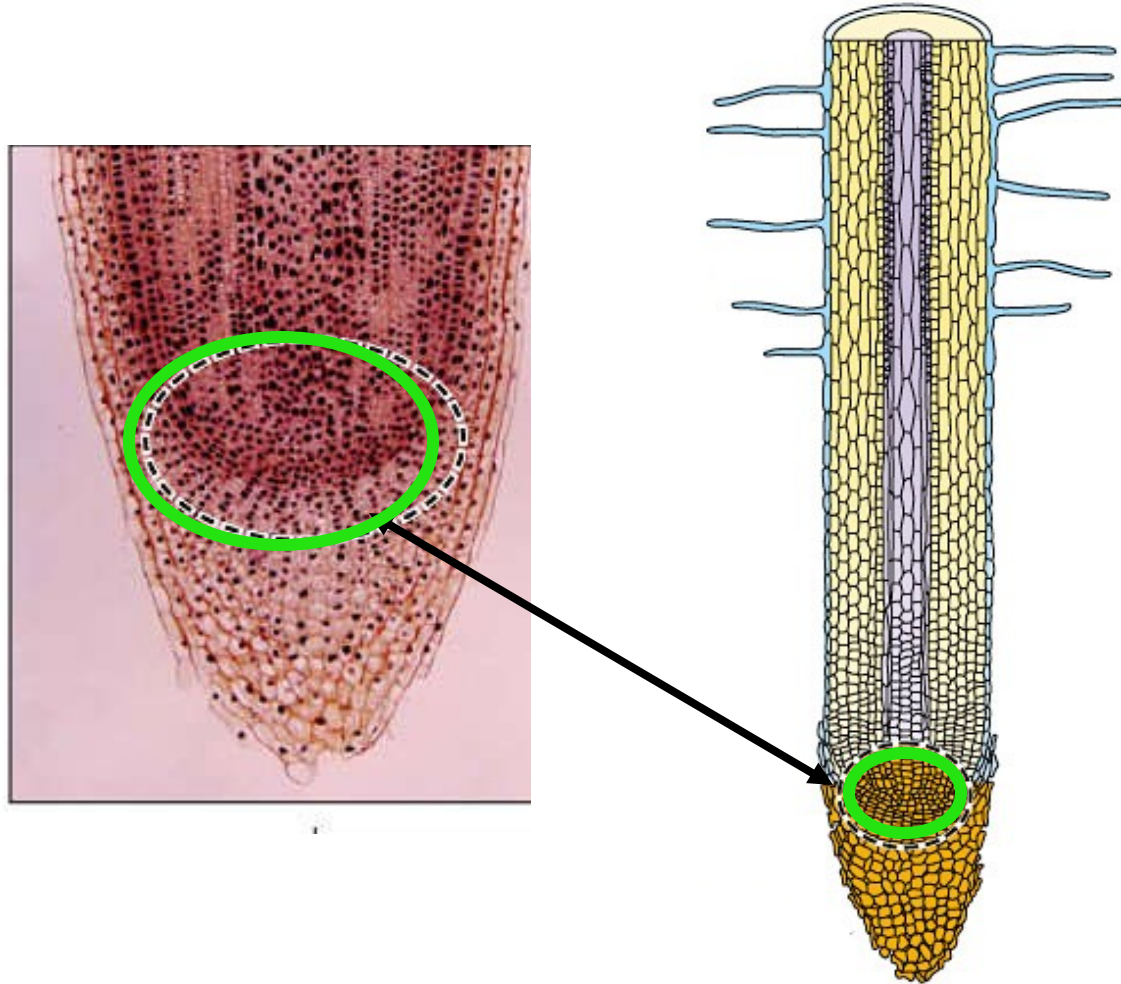
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Bud = undeveloped shoot of meristematic tissue



Longitudinal section of terminal bud

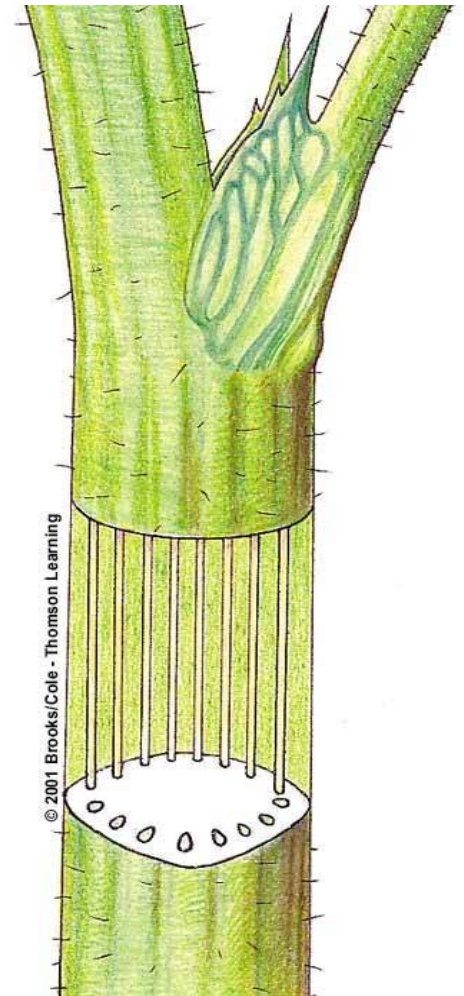
# Roots also have meristems



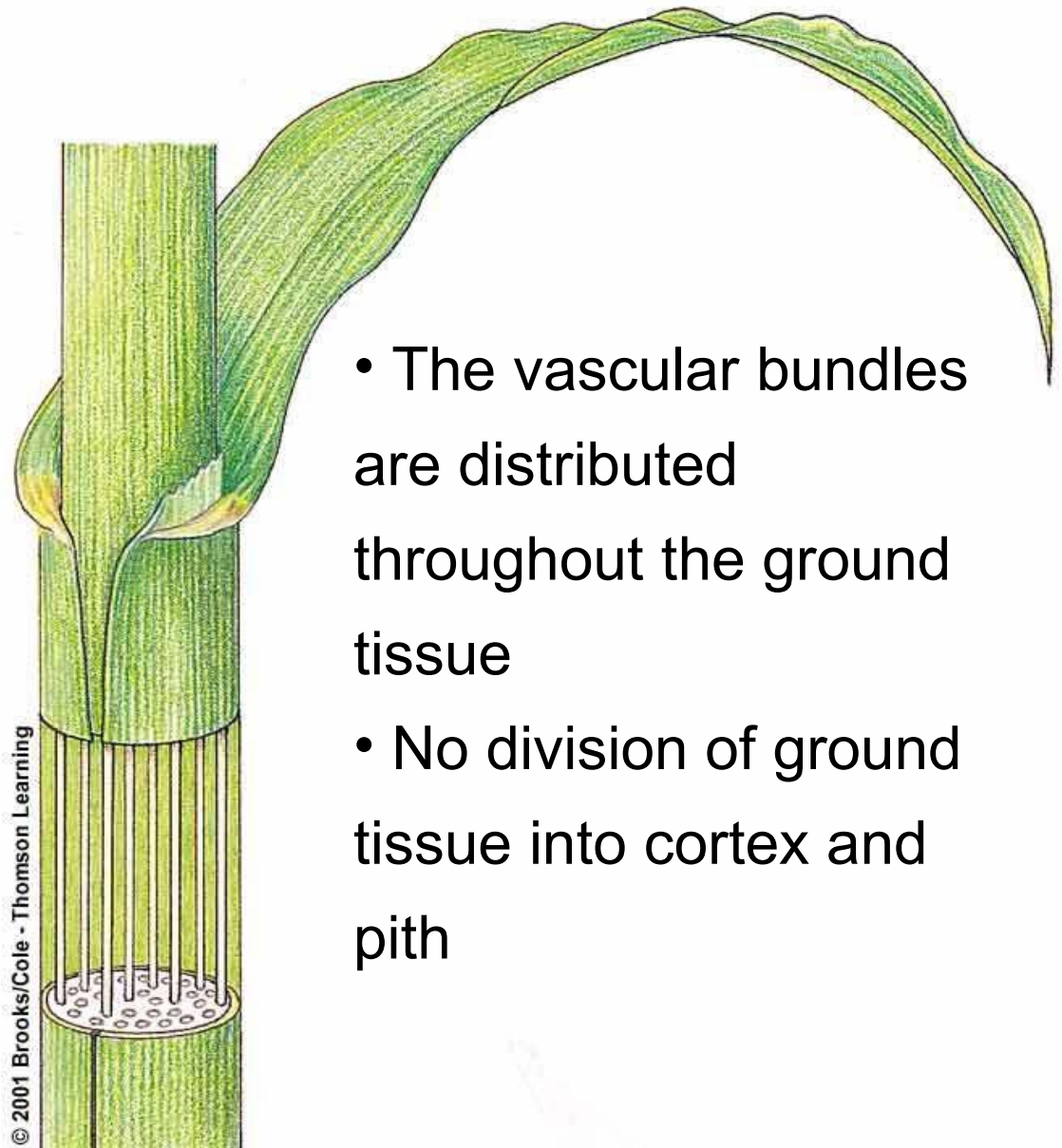


# Internal Structure of a Dicot Stem

- Outermost layer is epidermis
- Cortex lies beneath epidermis
- Ring of vascular bundles separates the cortex from the pith
- The pith lies in the center of the stem



# Internal Structure of a Monocot Stem

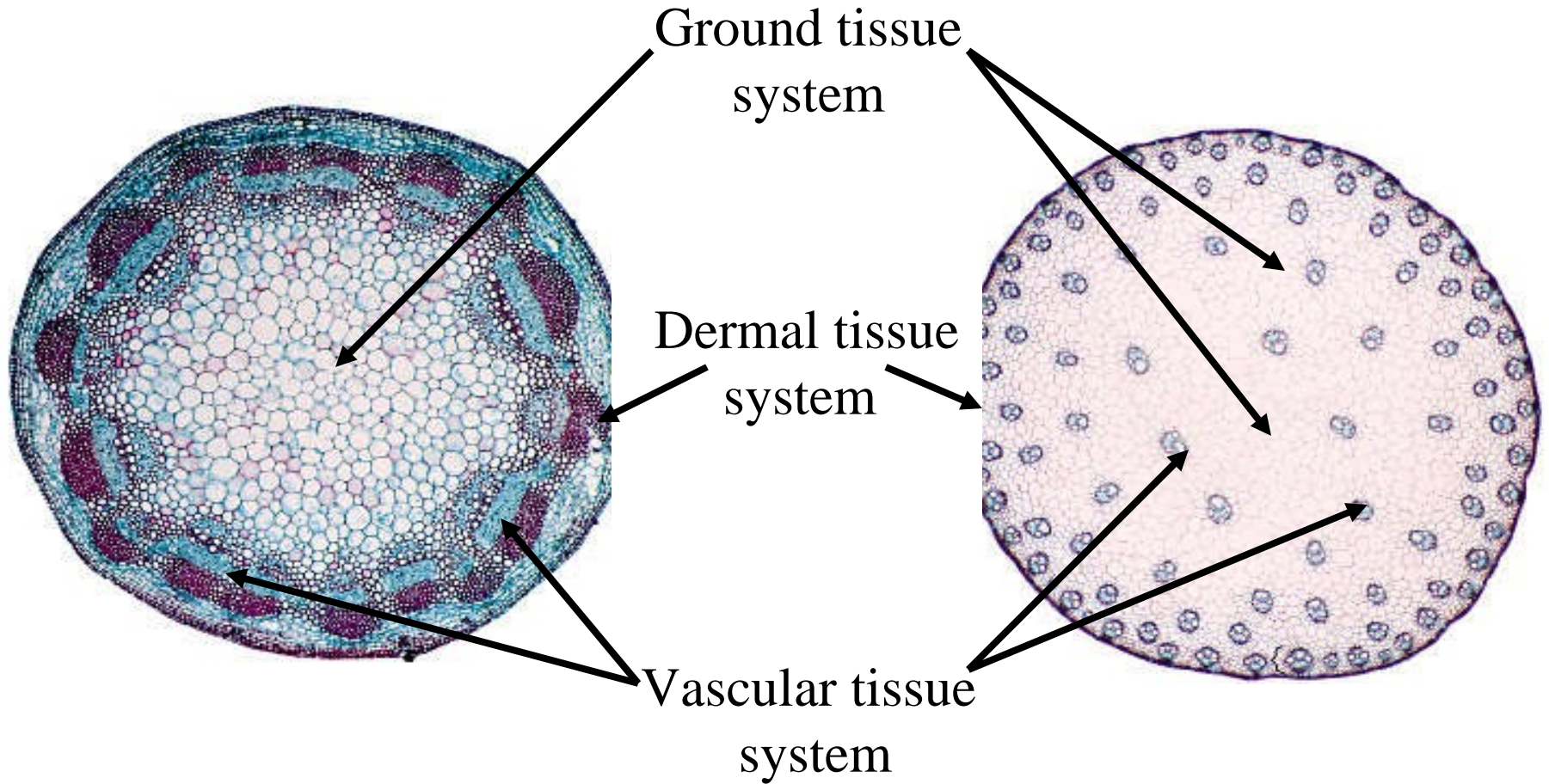


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- The vascular bundles are distributed throughout the ground tissue
- No division of ground tissue into cortex and pith

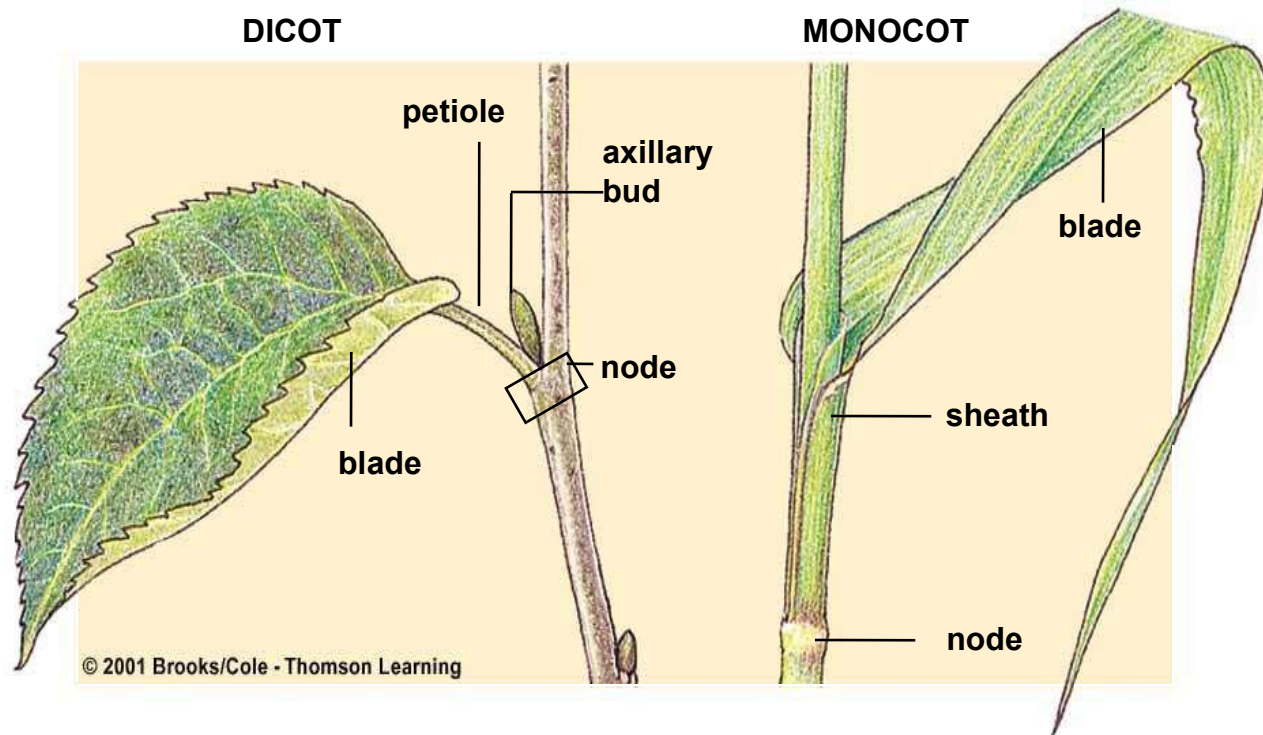
# Dicots

# Monocots



Dicots and Monocots have different stem and root anatomies

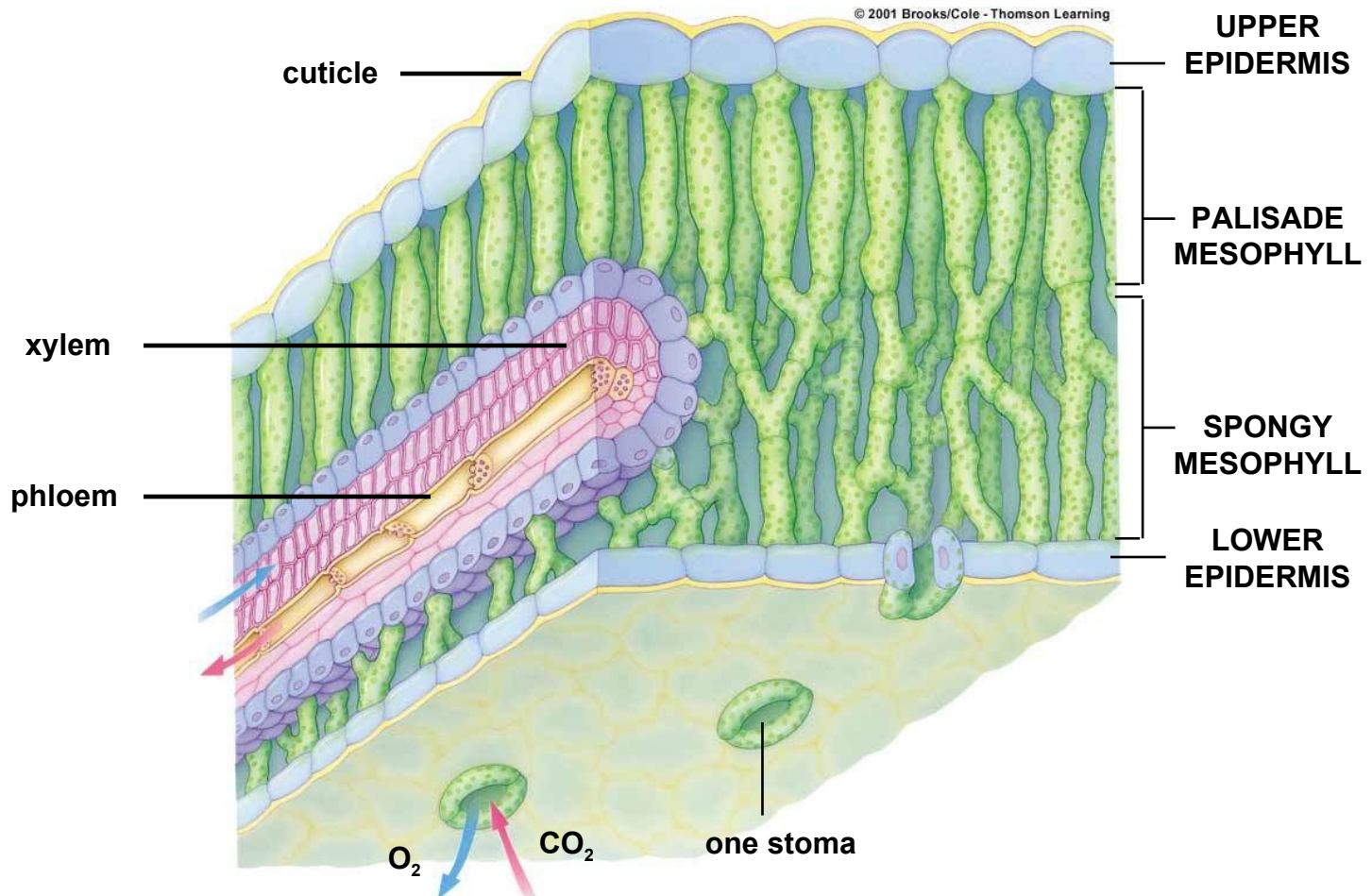
# Leaf Gross Structure



# Adapted for Photosynthesis

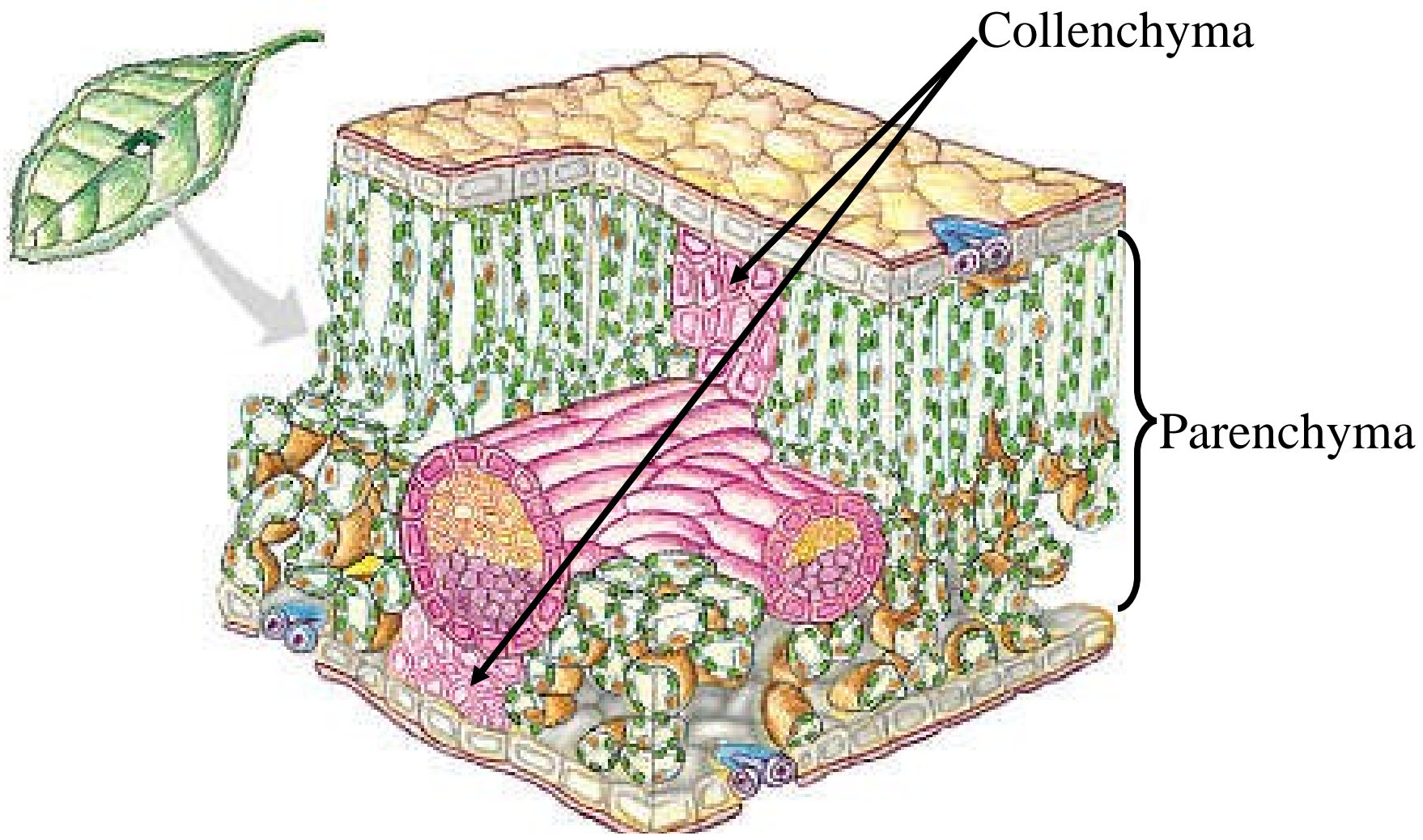
- Leaves are usually thin
  - High surface area-to-volume ratio
  - Promotes diffusion of carbon dioxide in, oxygen out
- Leaves are arranged to capture sunlight
  - Are held perpendicular to rays of sun
  - Arrange so they don't shade one another

# Leaf Structure



# Mesophyll: Photosynthetic Tissue

- A type of parenchyma tissue
- Cells have chloroplasts
- Two layers in dicots
  - Palisade mesophyll
  - Spongy mesophyll



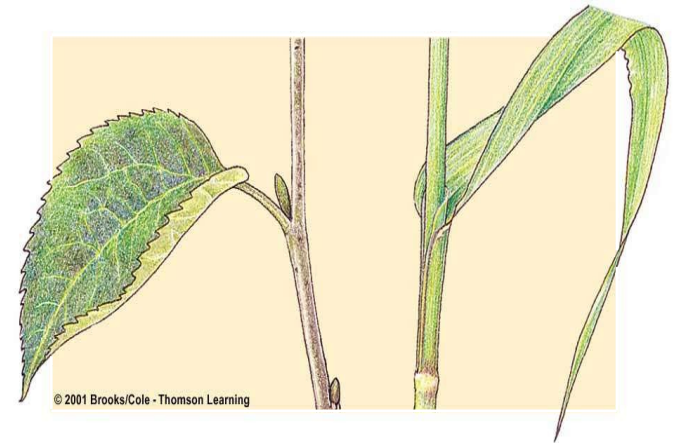
Collenchyma

Parenchyma

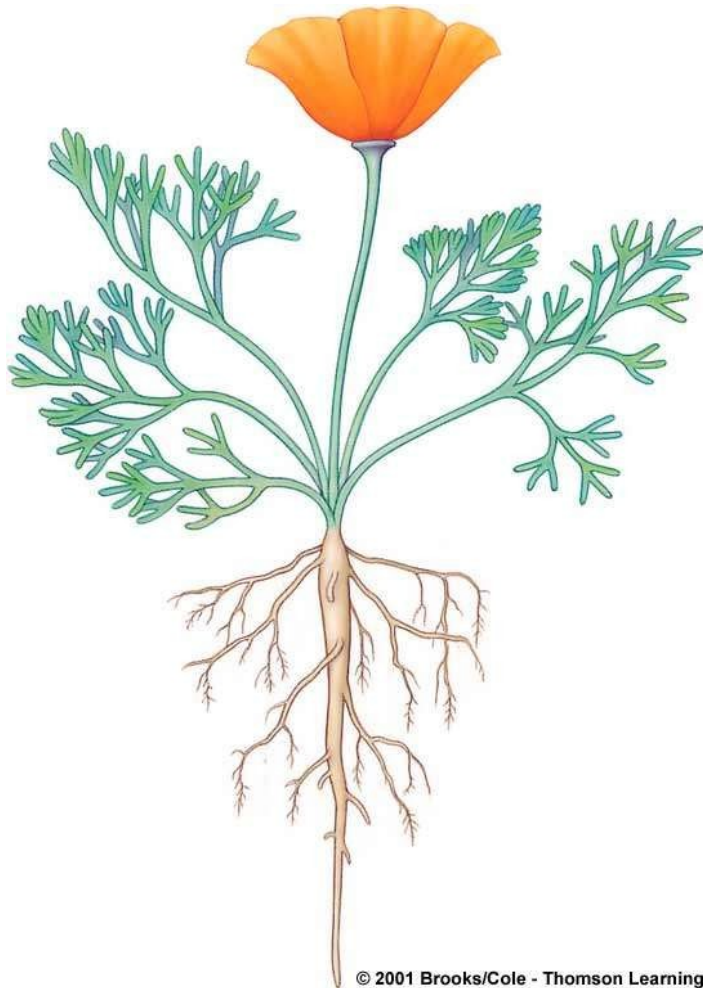


# Leaf Veins: Vascular Bundles

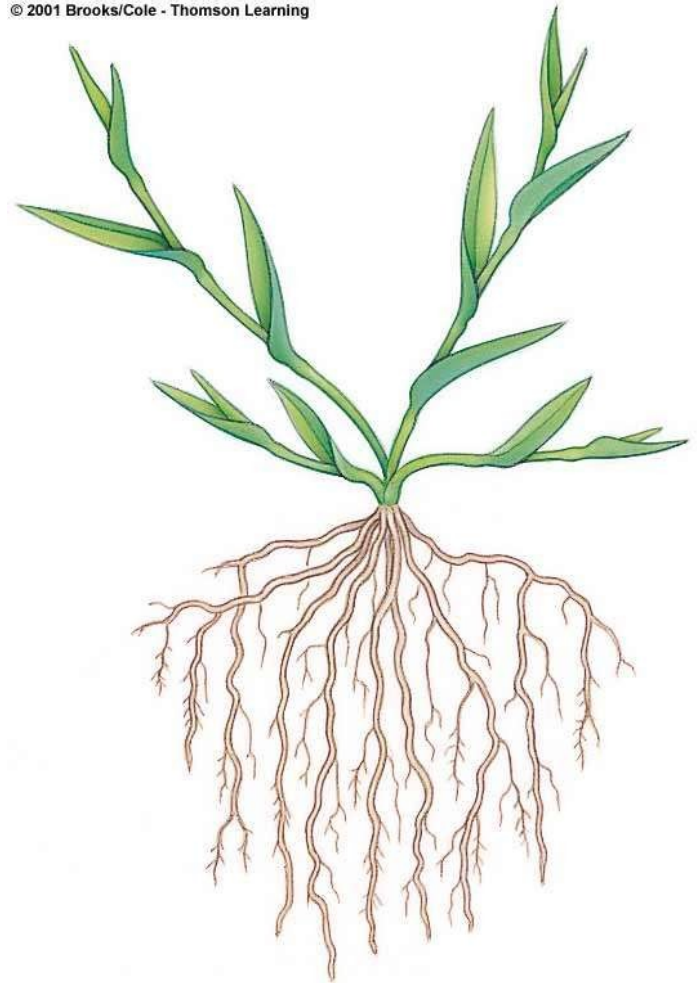
- Xylem and phloem –  
often strengthened with fibers
- In dicots, veins are netlike
- In monocots, they are parallel



# Root Systems



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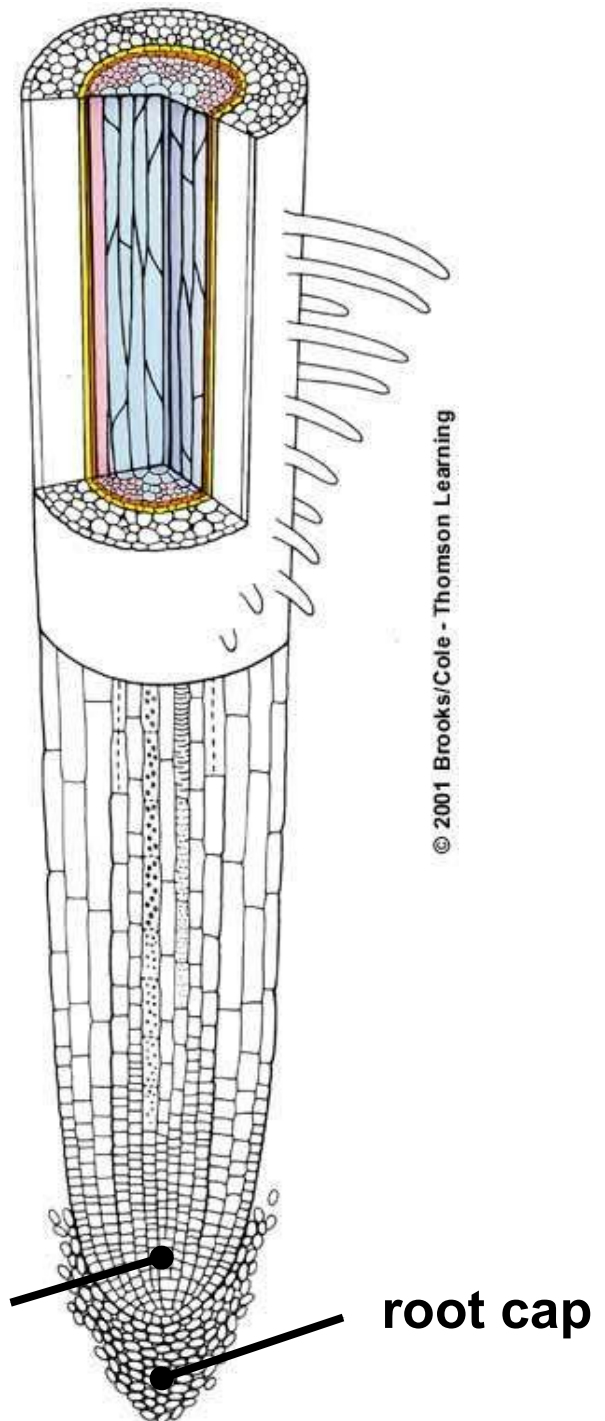


# Root Structure

- Root cap covers tip
- Apical meristem produces the cap
- Cell divisions at the apical meristem cause the root to lengthen
- Farther up, cells differentiate and mature

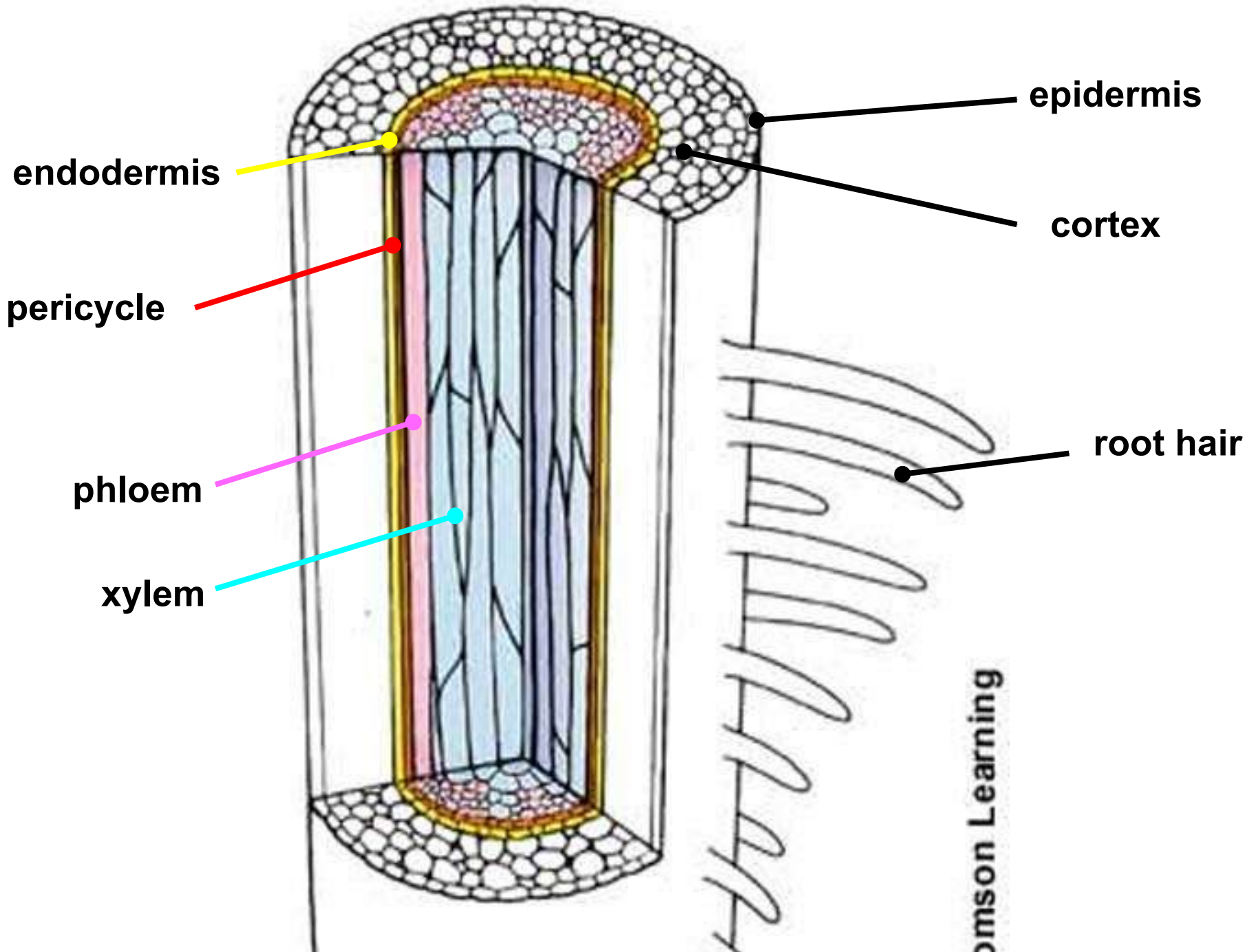
root apical  
meristem

root cap



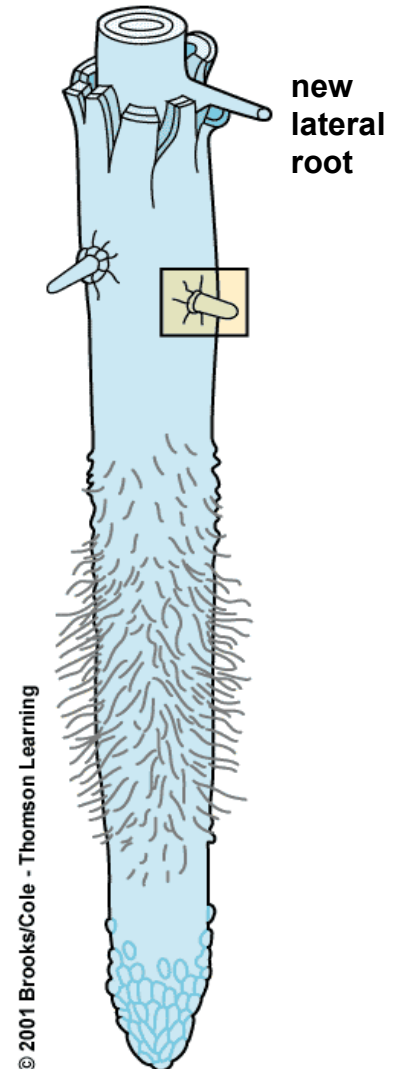
# Internal Structure of a Root

- Outermost layer is epidermis
- Root cortex is beneath the epidermis
- Endodermis, then pericycle surround the vascular cylinder
- In some plants, there is a central pith



# Root Hairs and Lateral Roots

- Both increase the surface area of a root system
- Root hairs are tiny extensions of epidermal cells
- Lateral roots arise from the pericycle and must push through the cortex and epidermis to reach the soil

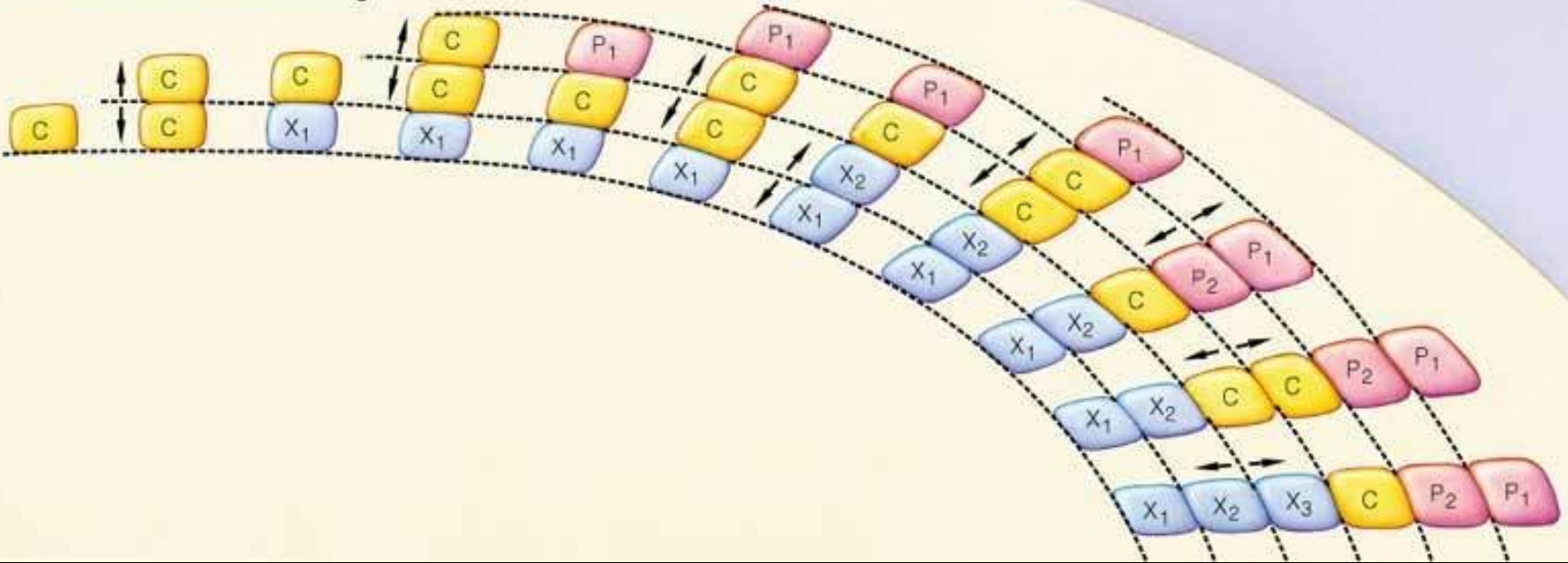


# Secondary Growth

- Occurs in perennials
- A ring of vascular cambium produces secondary xylem and phloem
- Wood is the accumulation of these secondary tissues, especially xylem

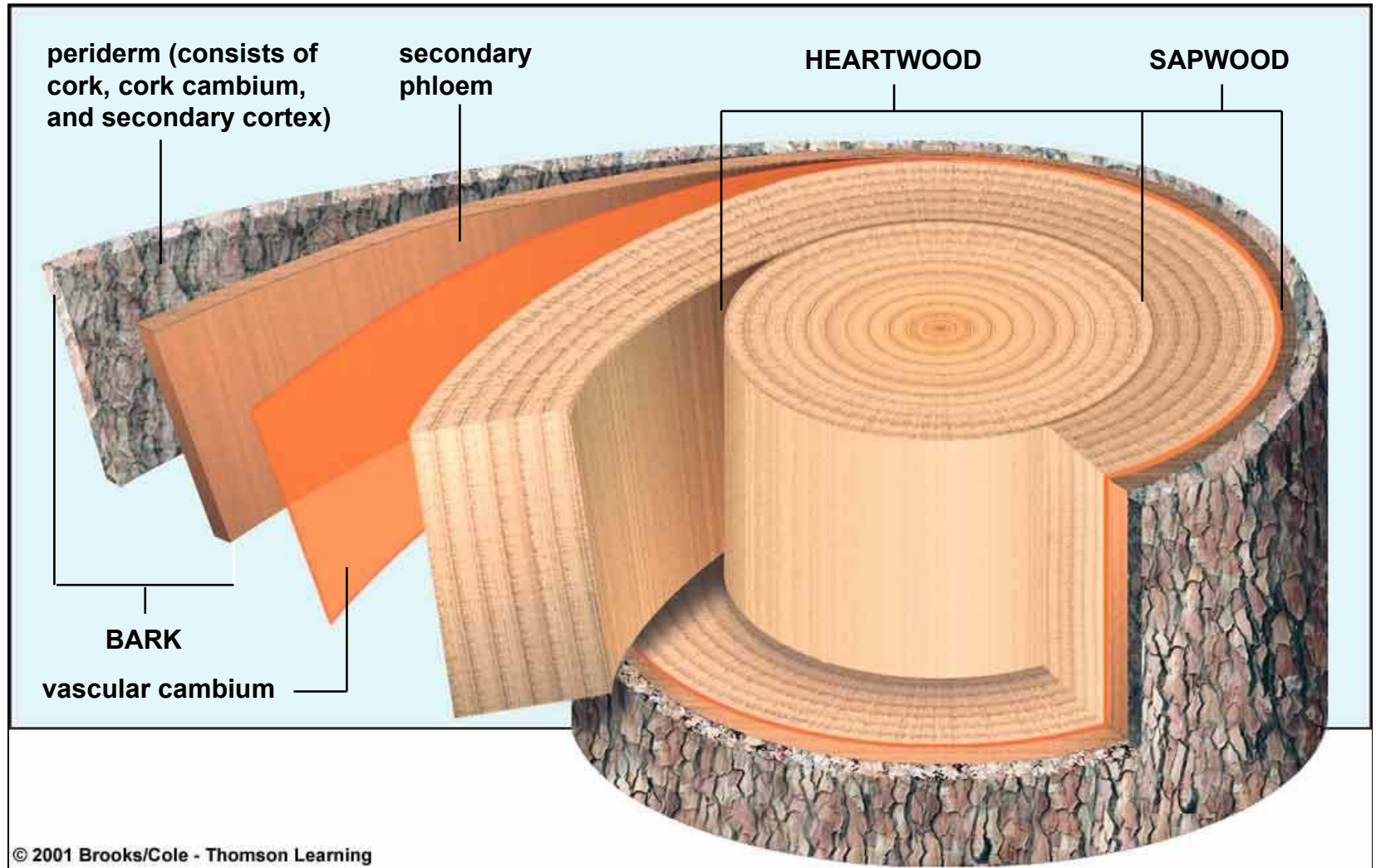
# Secondary Growth

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# Woody Stem



# Annual Rings

- Concentric rings of secondary xylem
- Alternating bands of early and late wood
- Early wood
  - Xylem cells with large diameter, thin walls
- Late wood
  - Xylem cells with smaller diameter, thicker walls

# Types of Wood

- Hardwood (oak, hickory)
  - Dicot wood
  - Xylem composed of vessels, tracheids, and fibers
- Softwood (pine, redwood)
  - Gymnosperm wood
  - Xylem composed mostly of tracheids
  - Grows more quickly