The Plant Body

Overview of Plant Morphology and Anatomy

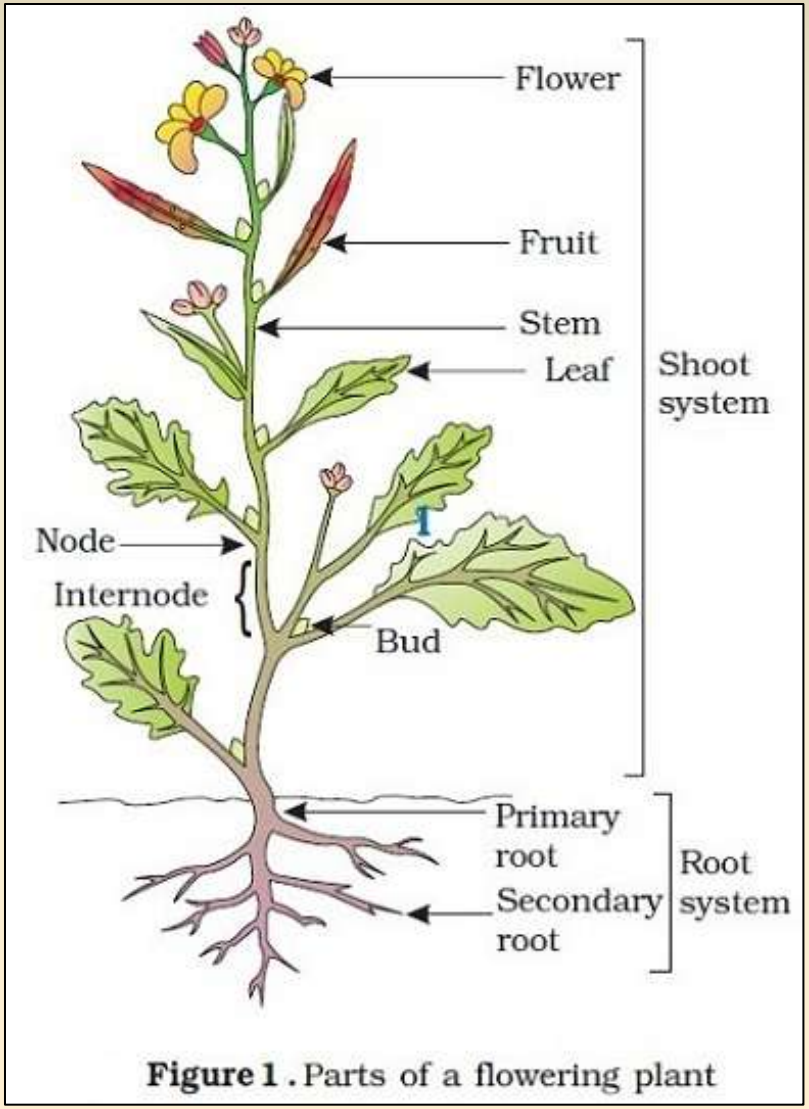
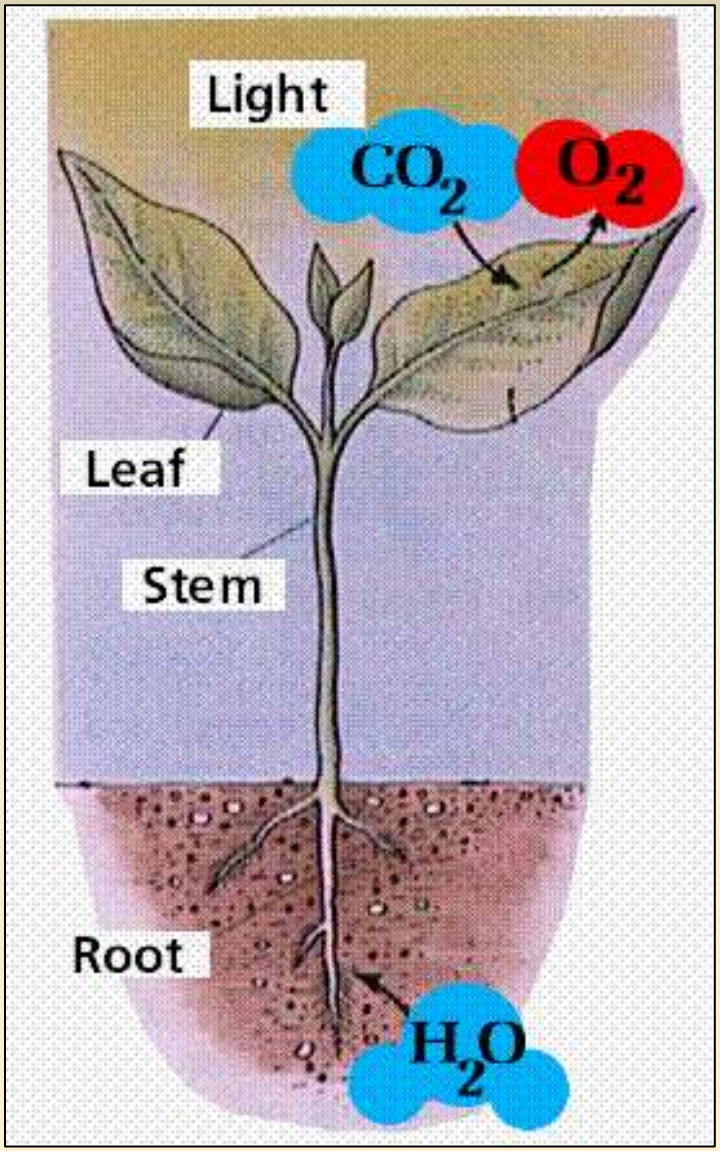


Figure 1 . Parts of a flowering plant

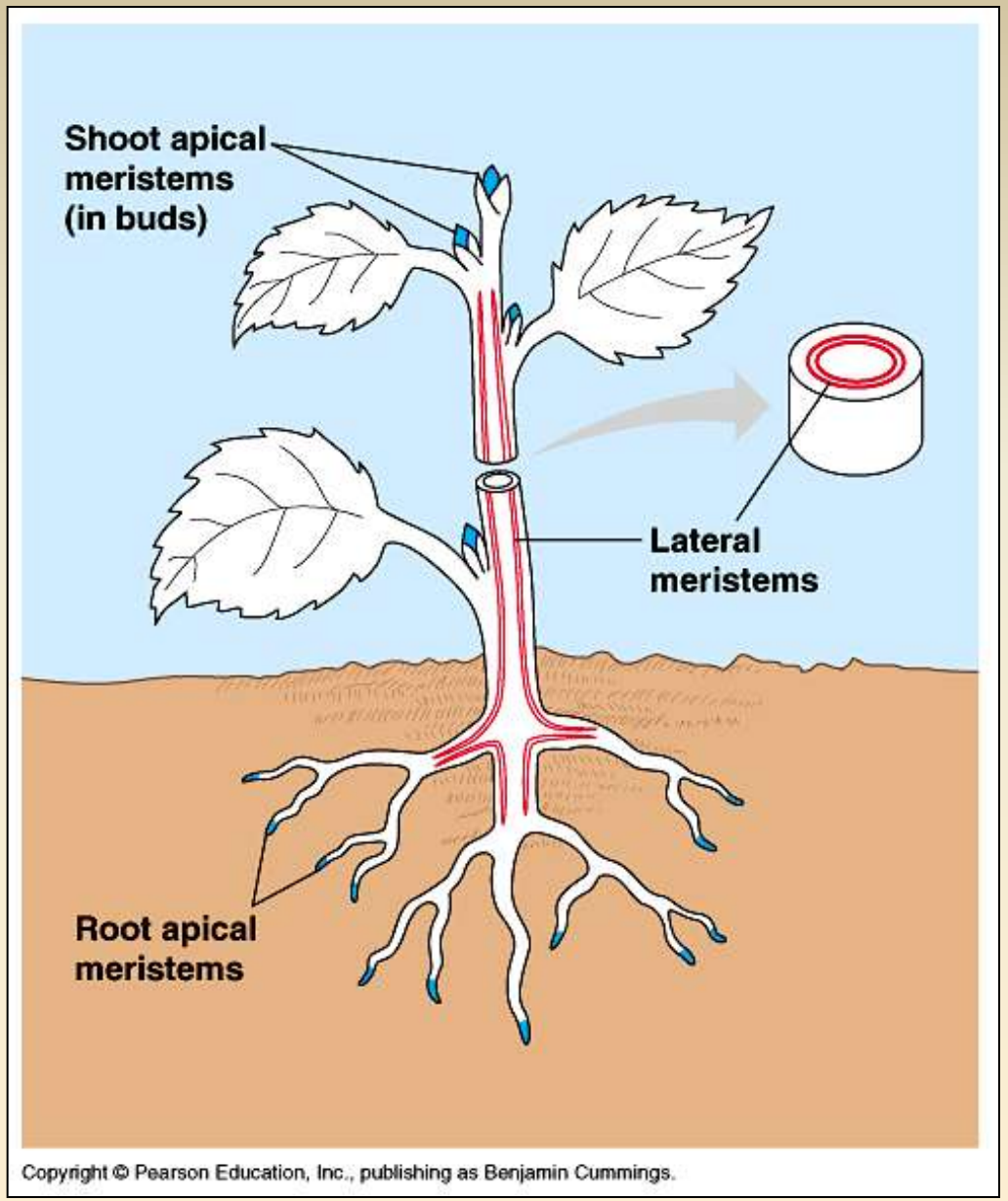
The Plant Body



Shoot System

Vascular System for transporting water and food up and down

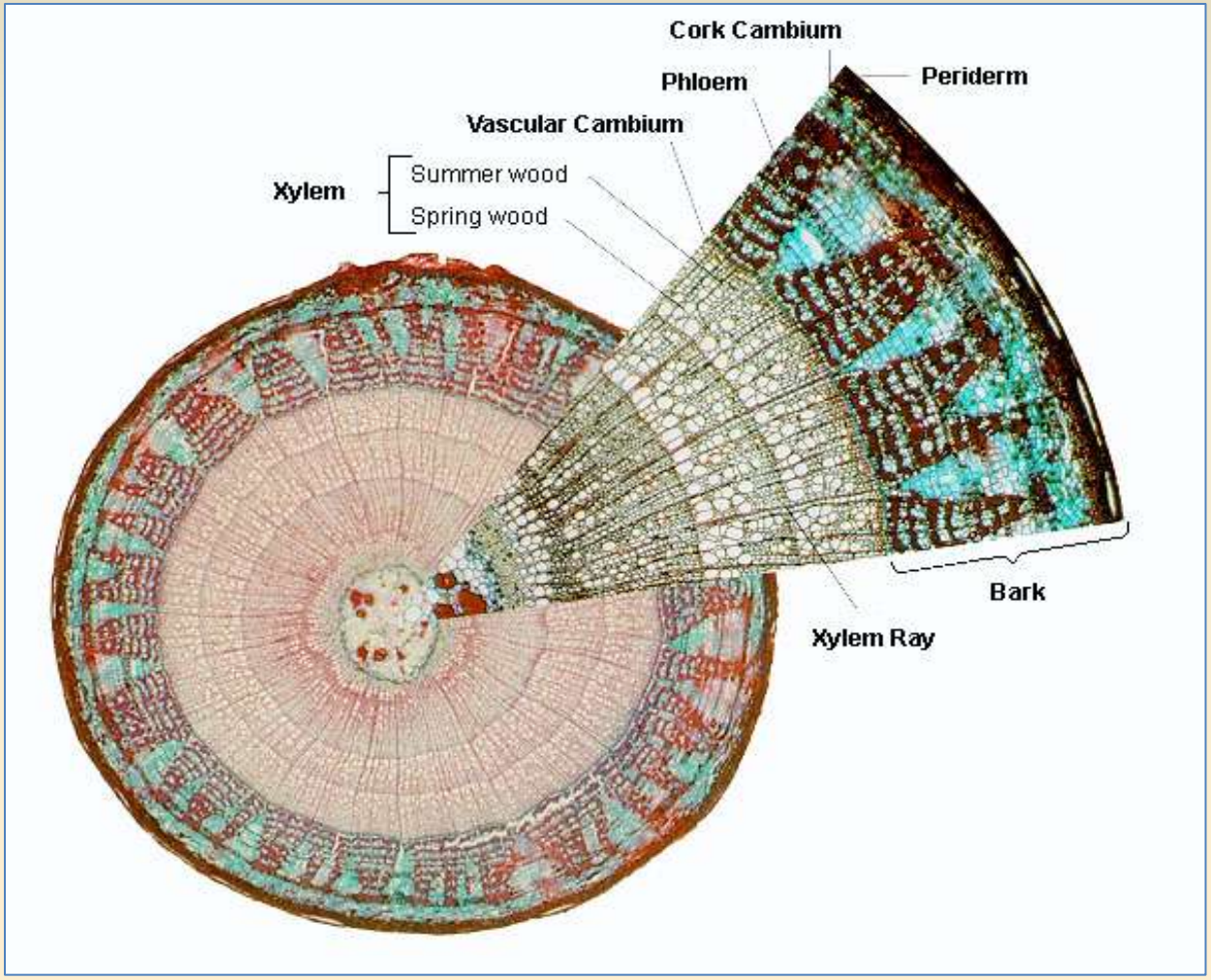
Root System



Primary Growth – Apical growth from meristems at the tips

Secondary Growth – Lateral growth in width from vascular cambium meristem

Secondary growth - lateral growth in width
Vascular cambium

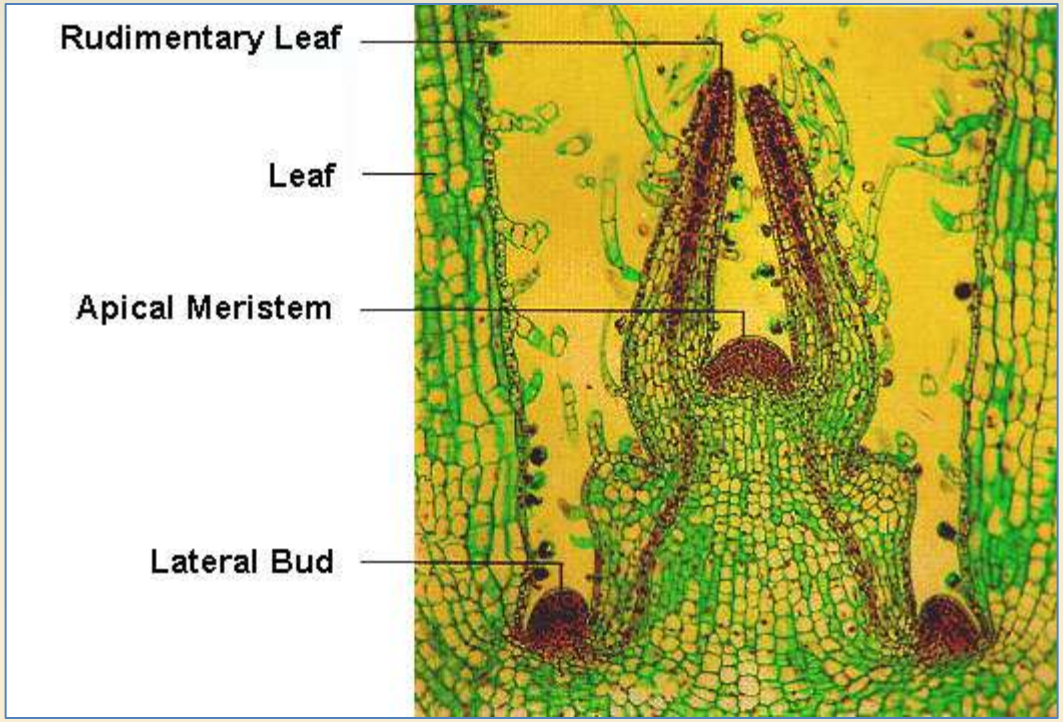


Plant Tissue Types

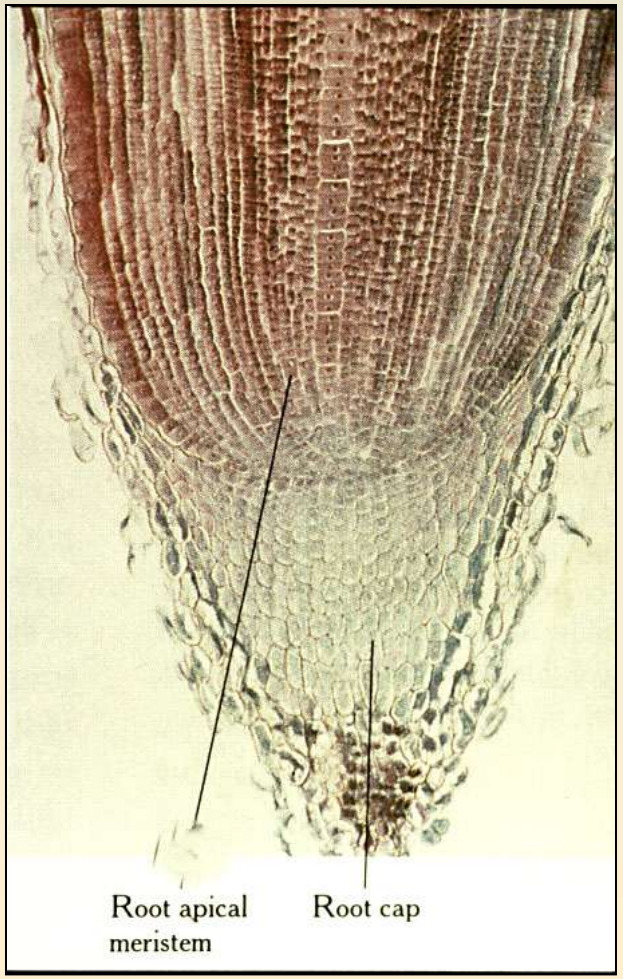
1. **Meristematic tissue** - site of growth in plant; origin of the other tissue types; apical meristems - site of primary growth; lateral meristems - site of secondary growth
2. **Dermal tissue** system - the outer protective covering of the plant
3. **Ground tissue** system - the inner supportive tissues of the plant – pith in herbaceous plants
4. **Vascular tissue** system - comprises the xylem and phloem - it is embedded within the ground tissue system – xylem forms wood in woody plants

1. Meristems - centers of cell division that produce new tissue of the plant body. Meristem cells divide, derivatives differentiate into other types of cells.

Stem Apex



Root Apex



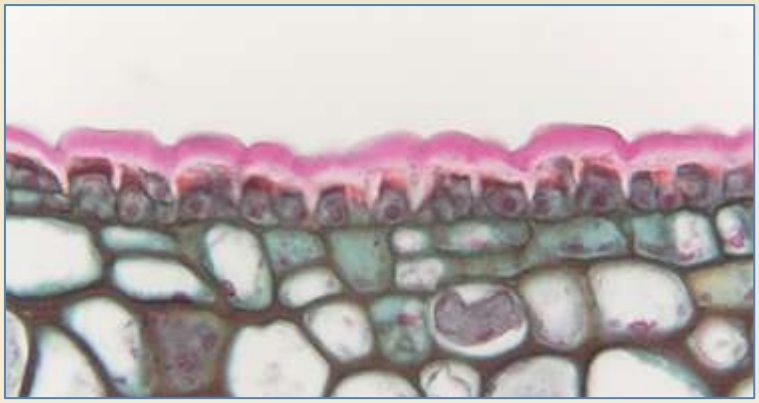
2. Dermal Tissue – outermost layers of the plant

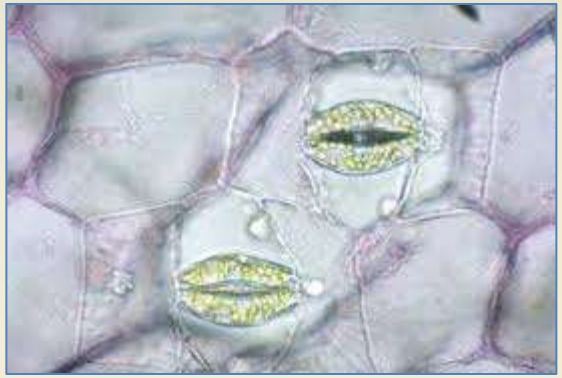
Cuticle – waxy outer layer

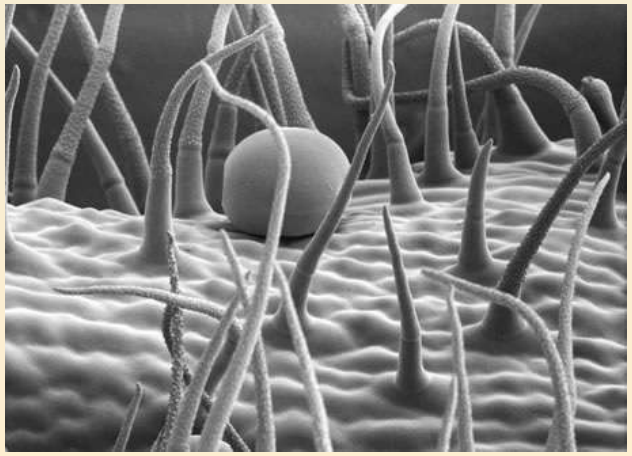
Epidermis – outer cell layer

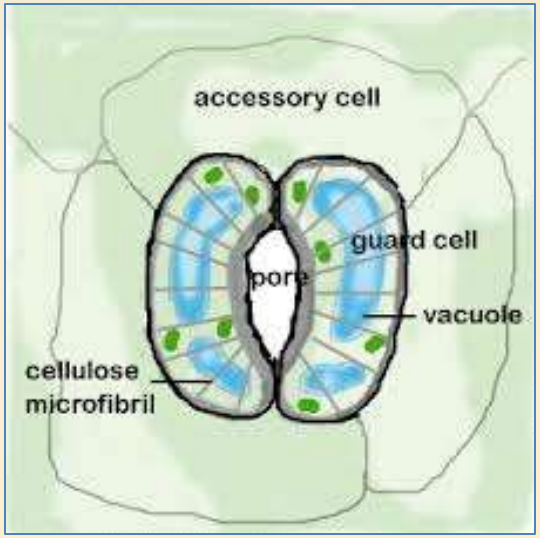
Trichomes (Hairs) and Glands

Stomata – allow air passage, open and close, how plants breathe



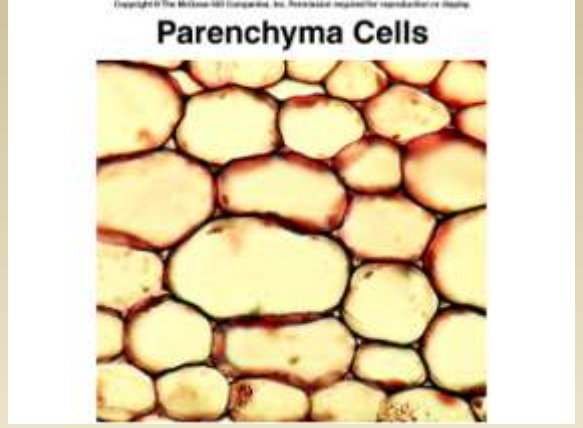


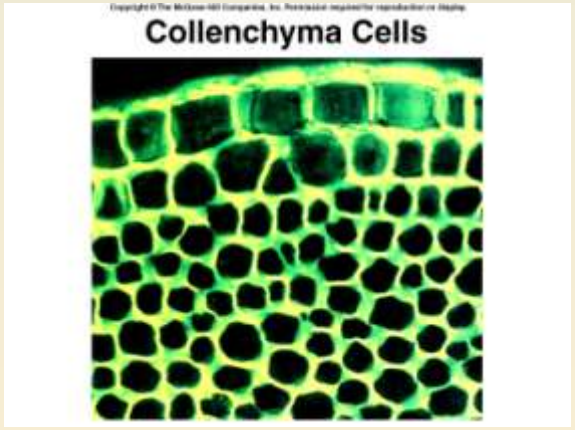




3. Ground Tissue – bulk of the plant, filler, storage functions

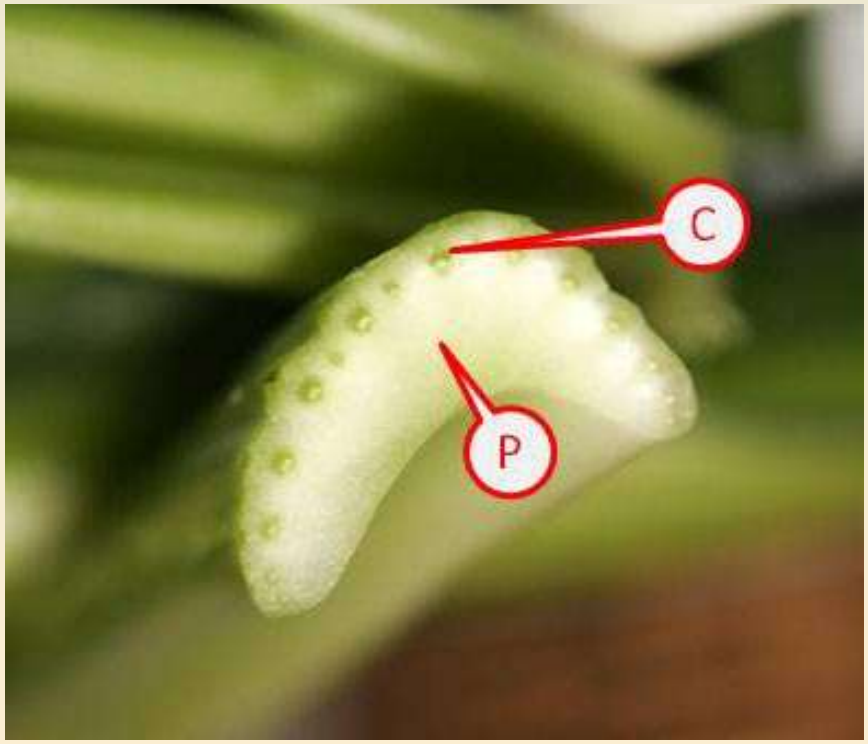
- Parenchyma – thin walled storage cells
- Collenchyma – flexible cells, in leaf petioles, bendable
- Sclerenchyma – toughened with lignin, hard, strong

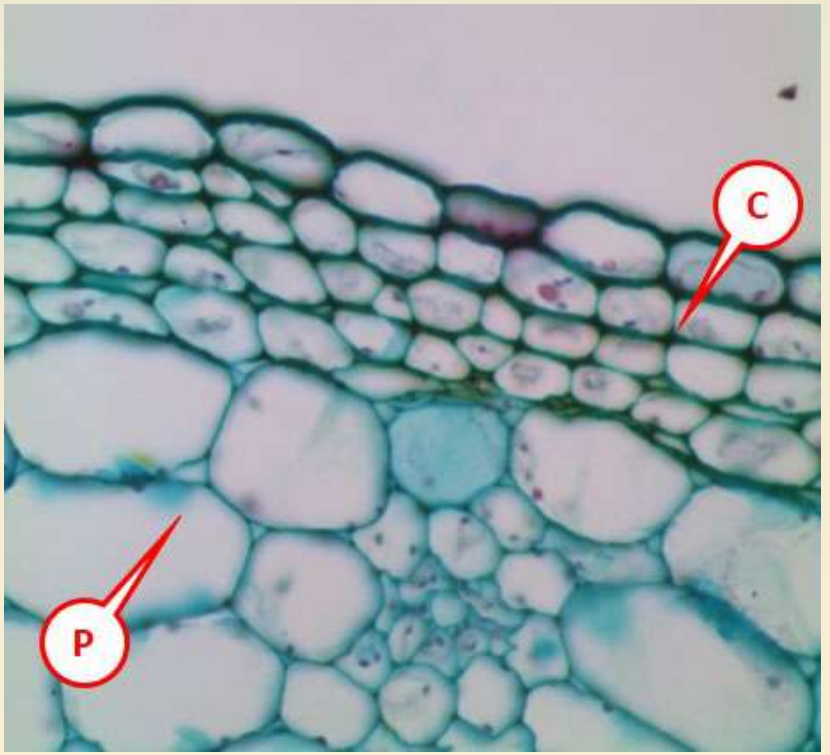




Parenchyma cells are large and only have thin primary cell walls. Notice the space between cells at the corners.

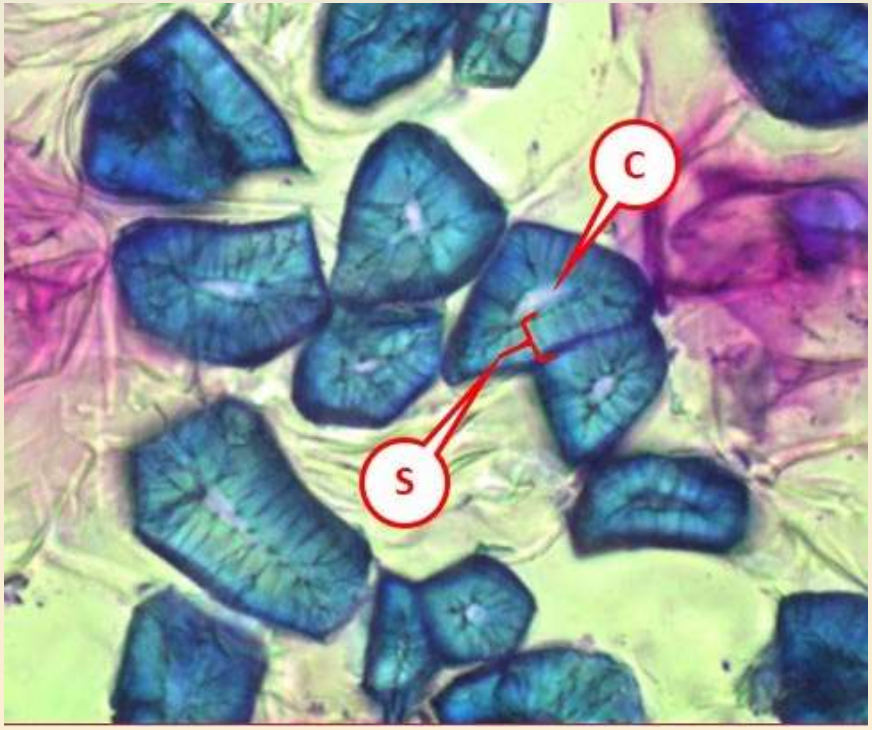
Collenchyma cells are involved in support. These are the "strings" inside of celery

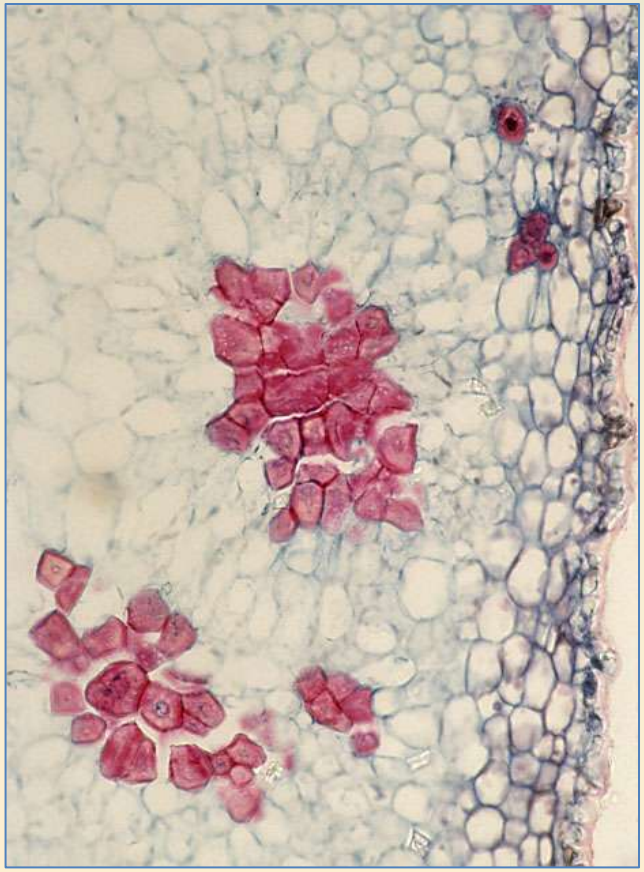




Sclerenchyma – secondary wall strengthened with lignin

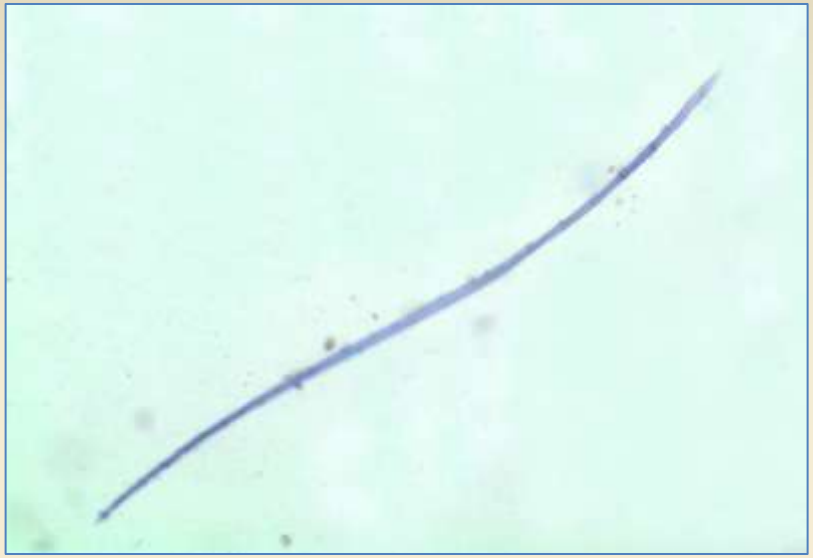
Sclereids – short compact fibers. Stone cells from a pear, the grit that we feel when we eat a fresh pear. This cell is now dead. 'C' is where the living cell was. 'S' is showing secondary cell wall.



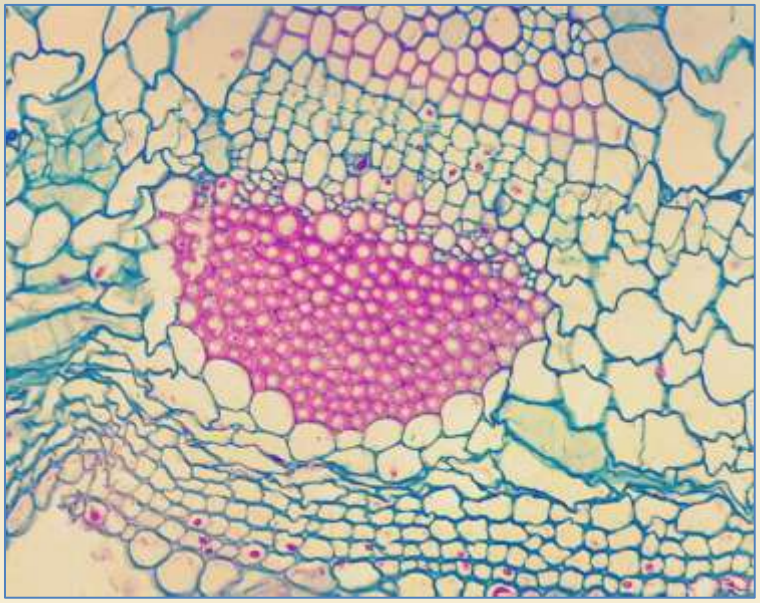


Sclerenchyma – secondary wall strengthened with lignin

Fibers - long and skinny sclerenchyma cells, tough, thick walls, dead at maturity.



Fiber from a papyrus plant. These fibers allowed the Egyptians to make ropes, boats and paper from the papyrus plant.



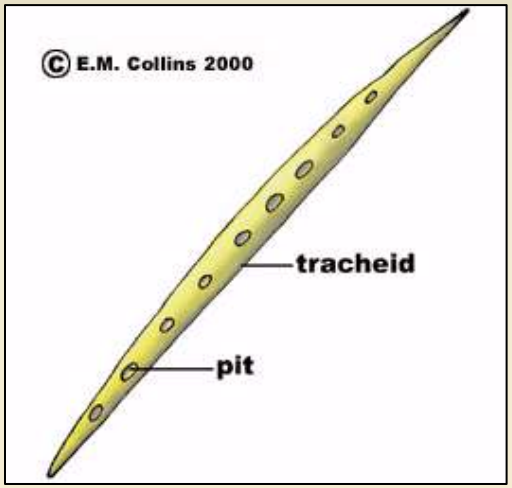
Fibers in a vascular bundle of *Helianthus* (sunflower). Not thick walls, and bright red stain. This is a cross-section.

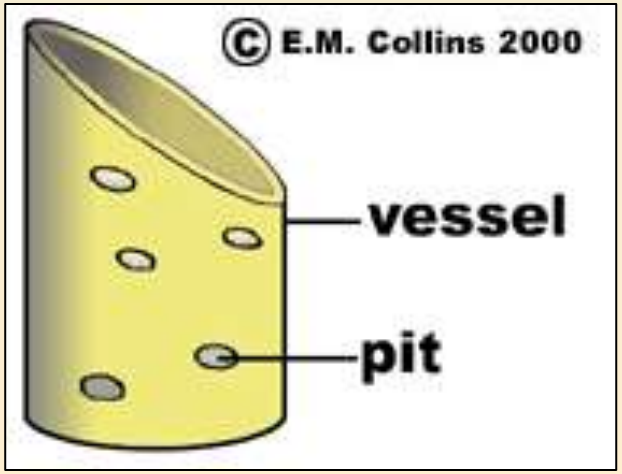
4. Vascular Tissue - conducting tissues in plants

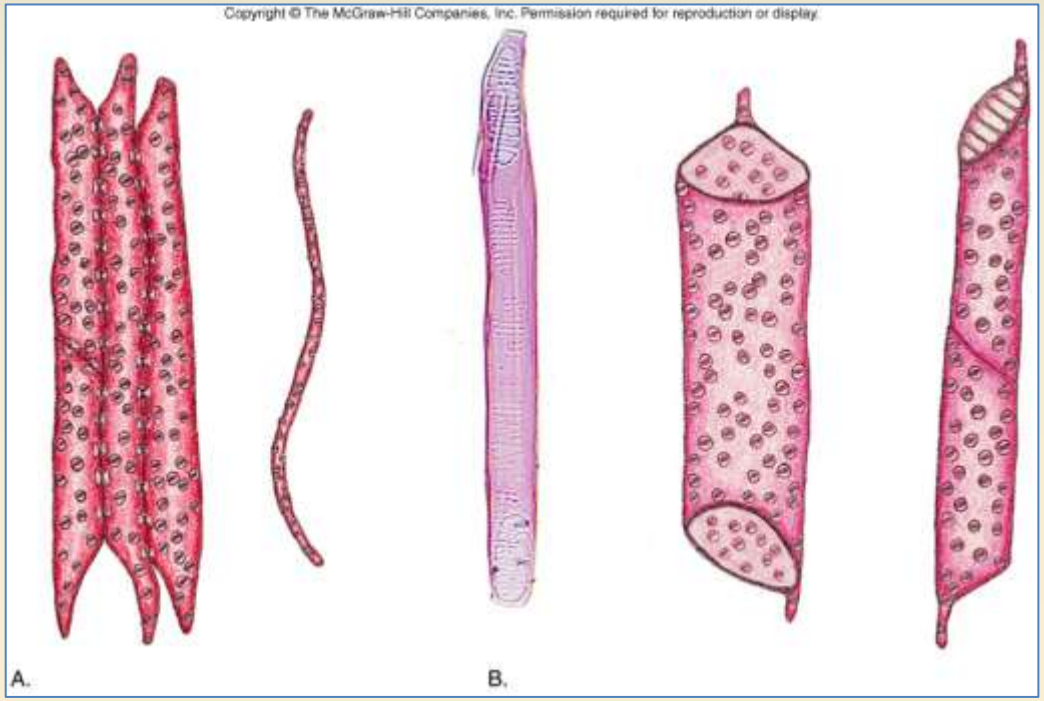
- **Xylem** – conduct water and minerals from soil throughout the plant. Wall strengthened with lignin.
  - Tracheids
  - Vessel Elements
- **Phloem** – conduct sugar produced by photosynthesis in leaves throughout the plant.
  - Sieve elements (tubes and companion cells)

Are to plants what veins and arteries are to animals

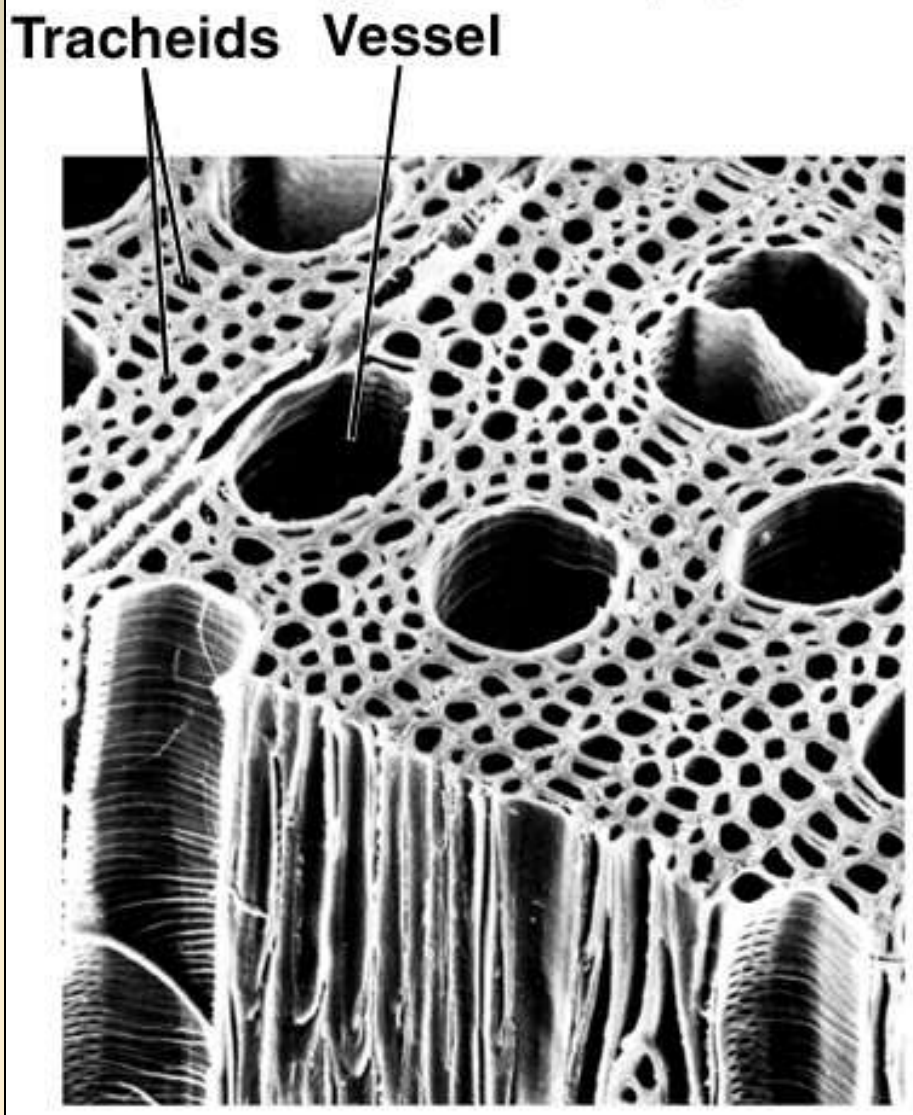
Xylem – Tracheids and Vessels conduct water





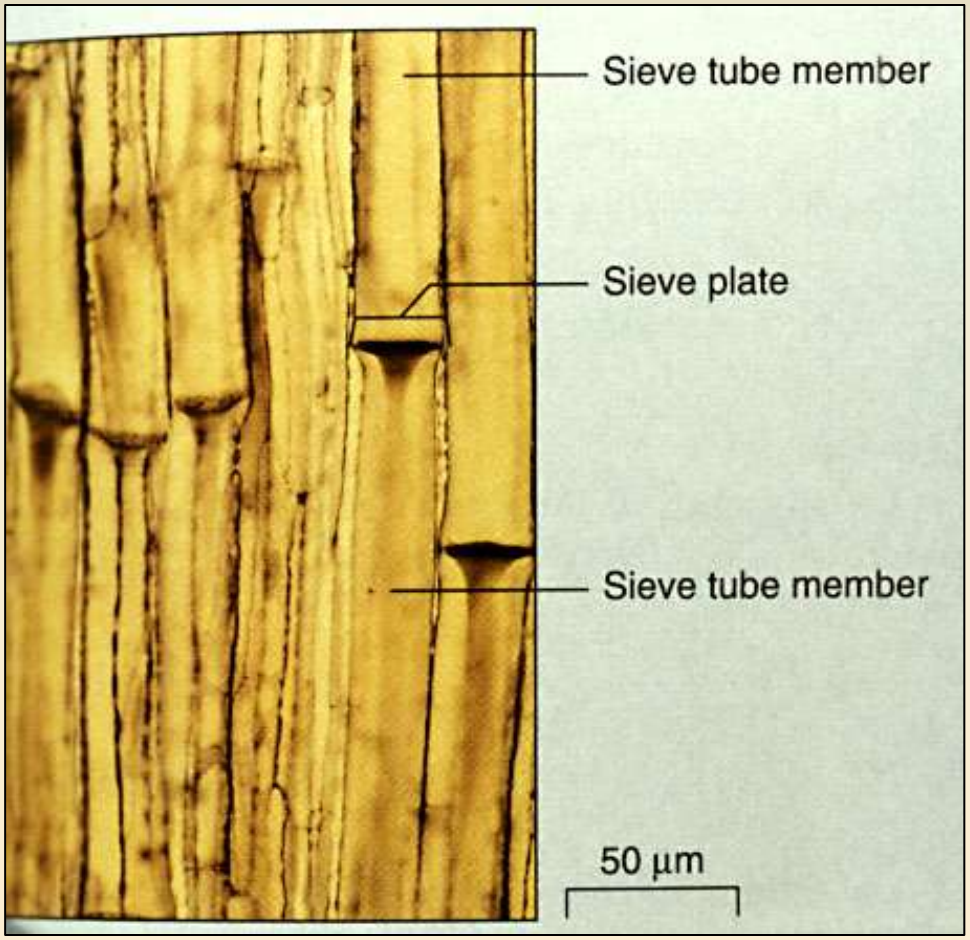


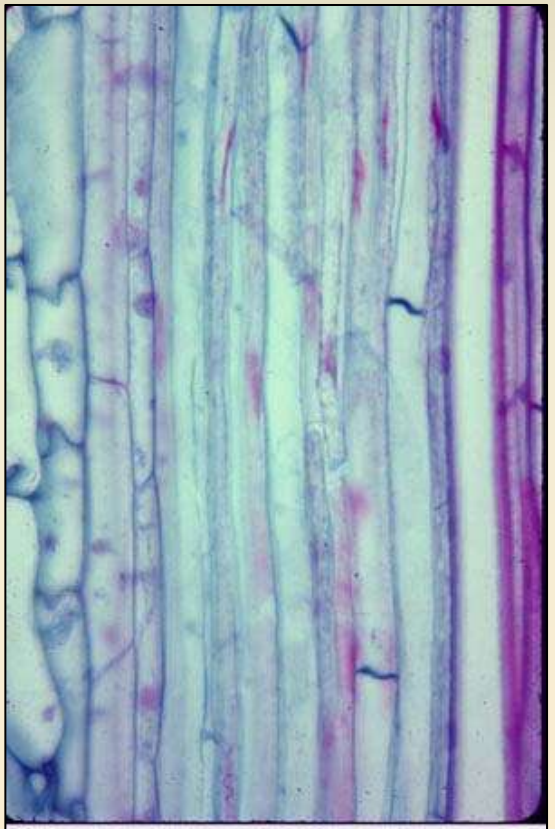
Vessels and Tracheids in Wood



Wood of Red Maple

Phloem conduct sugars

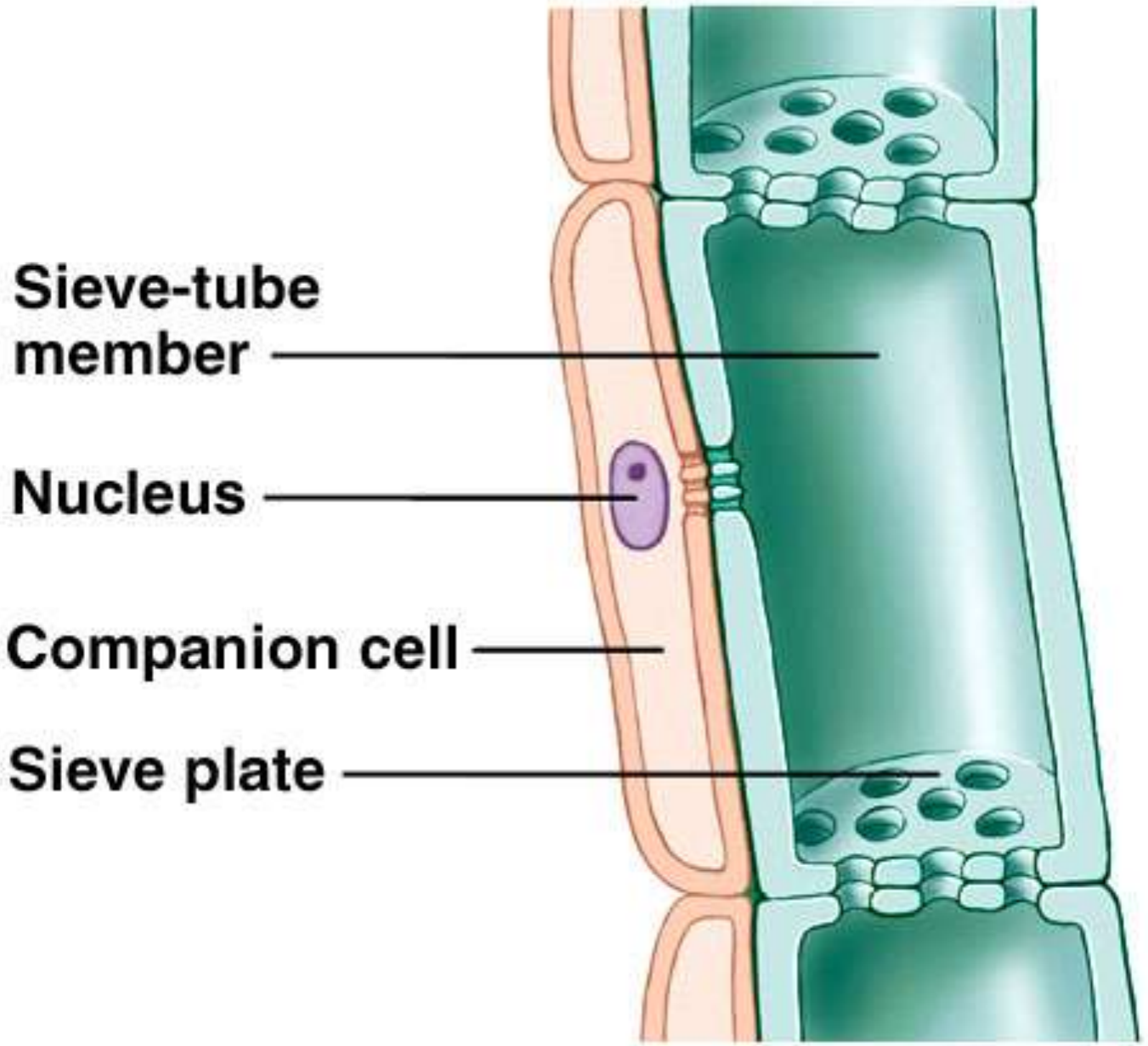




Zea stem longisection with sieve tube members, companion cells and sieve plates.

Fig. 38.14b

Sieve-Tube Member



Vegetative Organs

- Stems
- Leaves
- Roots

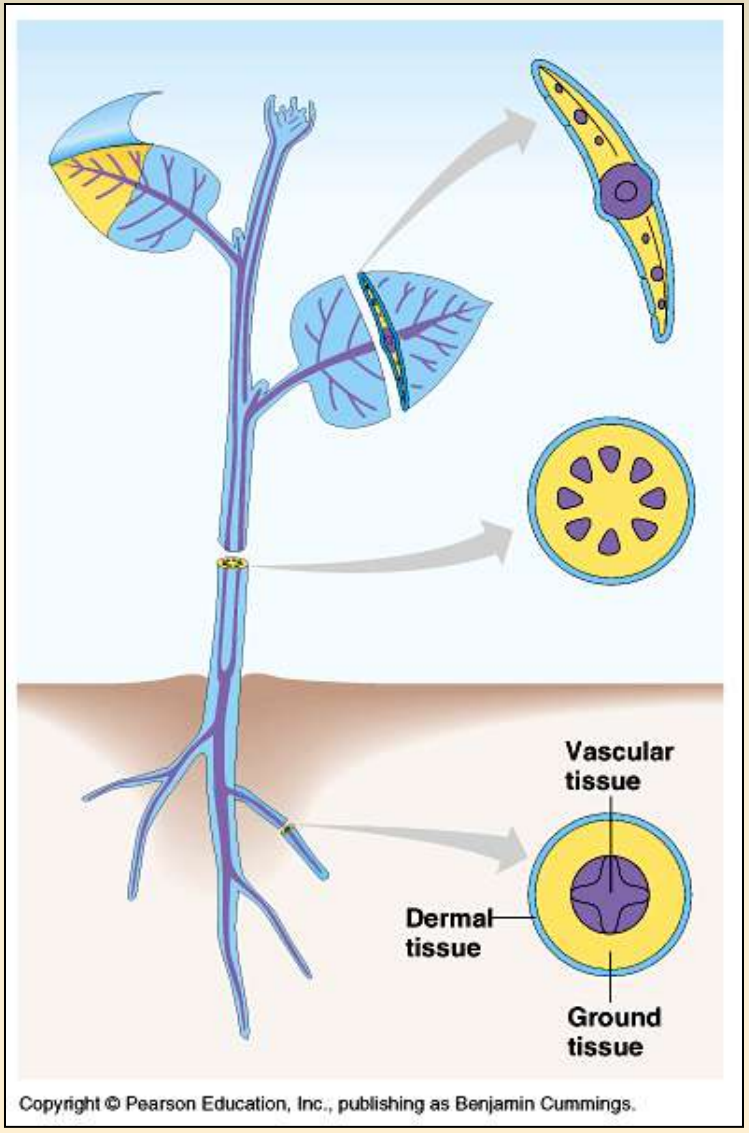
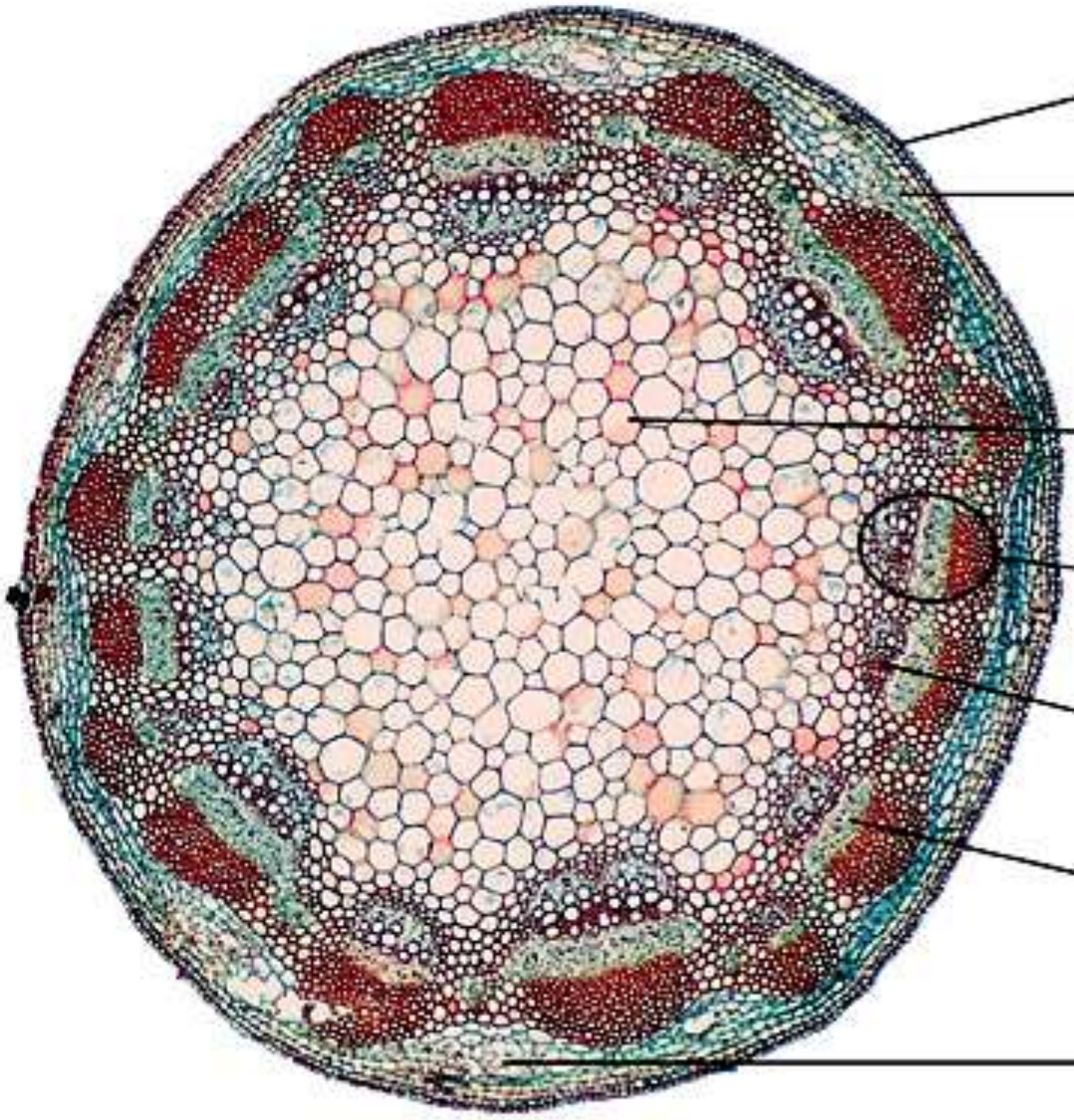


Fig. 38.25a

Dicot Stem



Epidermis (outer layer)

Collenchyma (layers below epidermis)

Pith

Vascular bundle

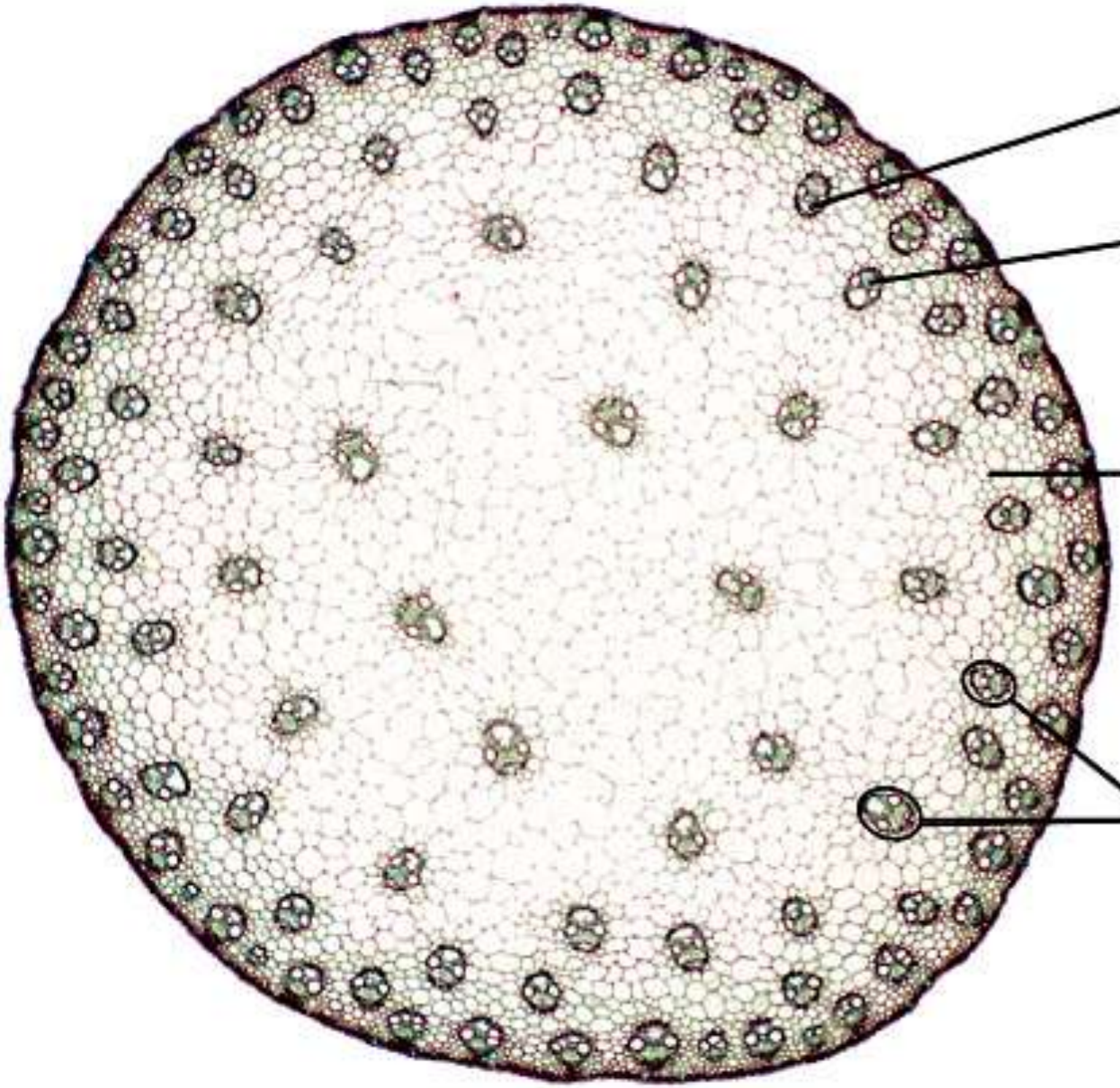
Xylem

Phloem

Cortex

Fig. 38.25b

Monocot Stem



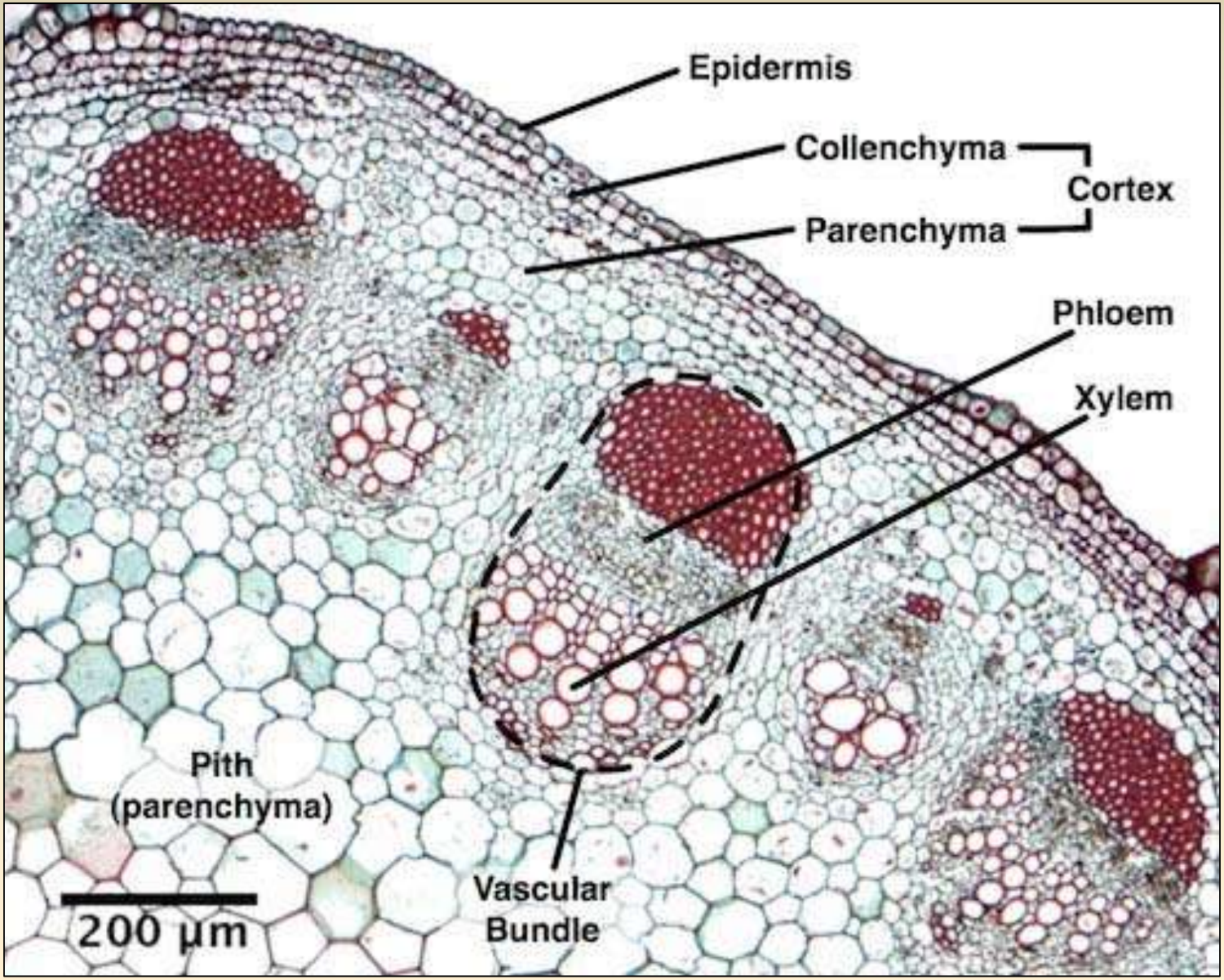
Xylem

Phloem

Ground tissue

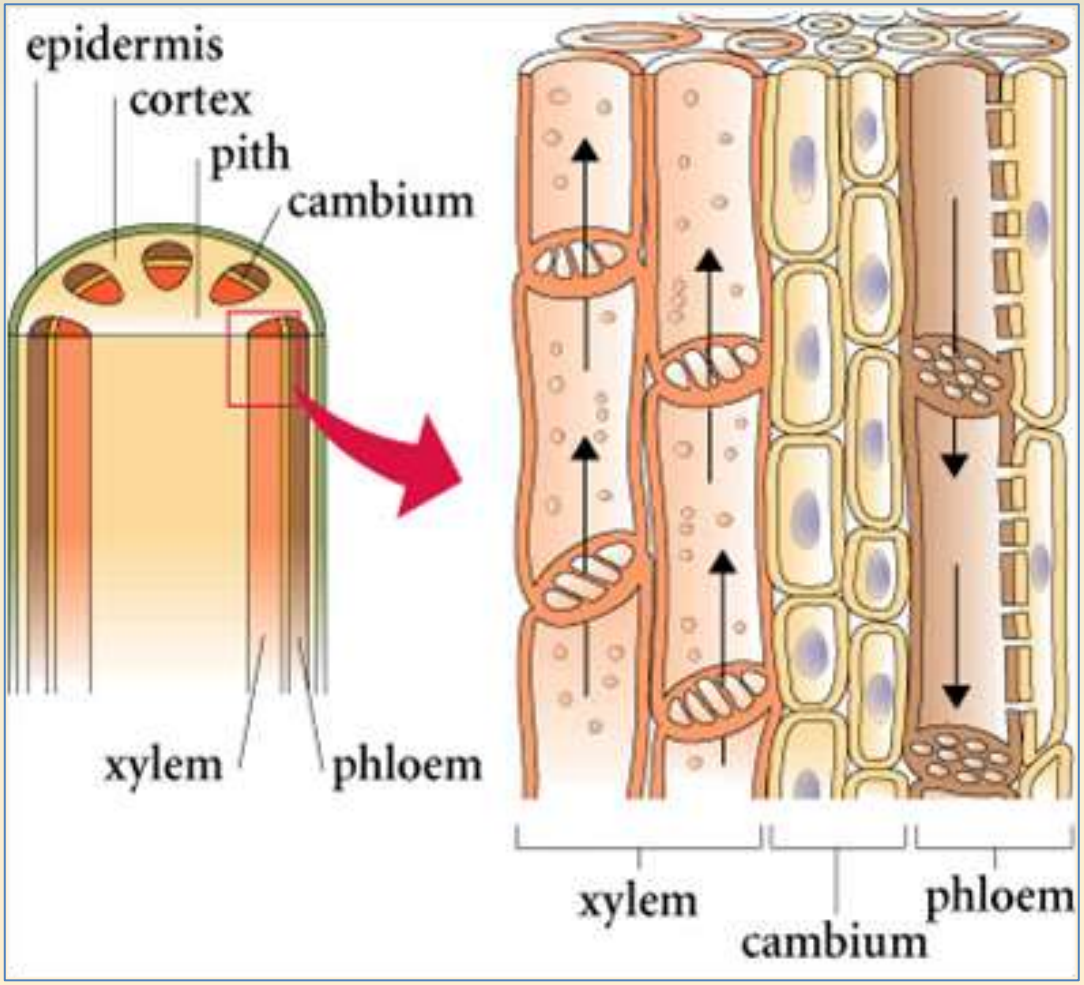
Vascular bundles

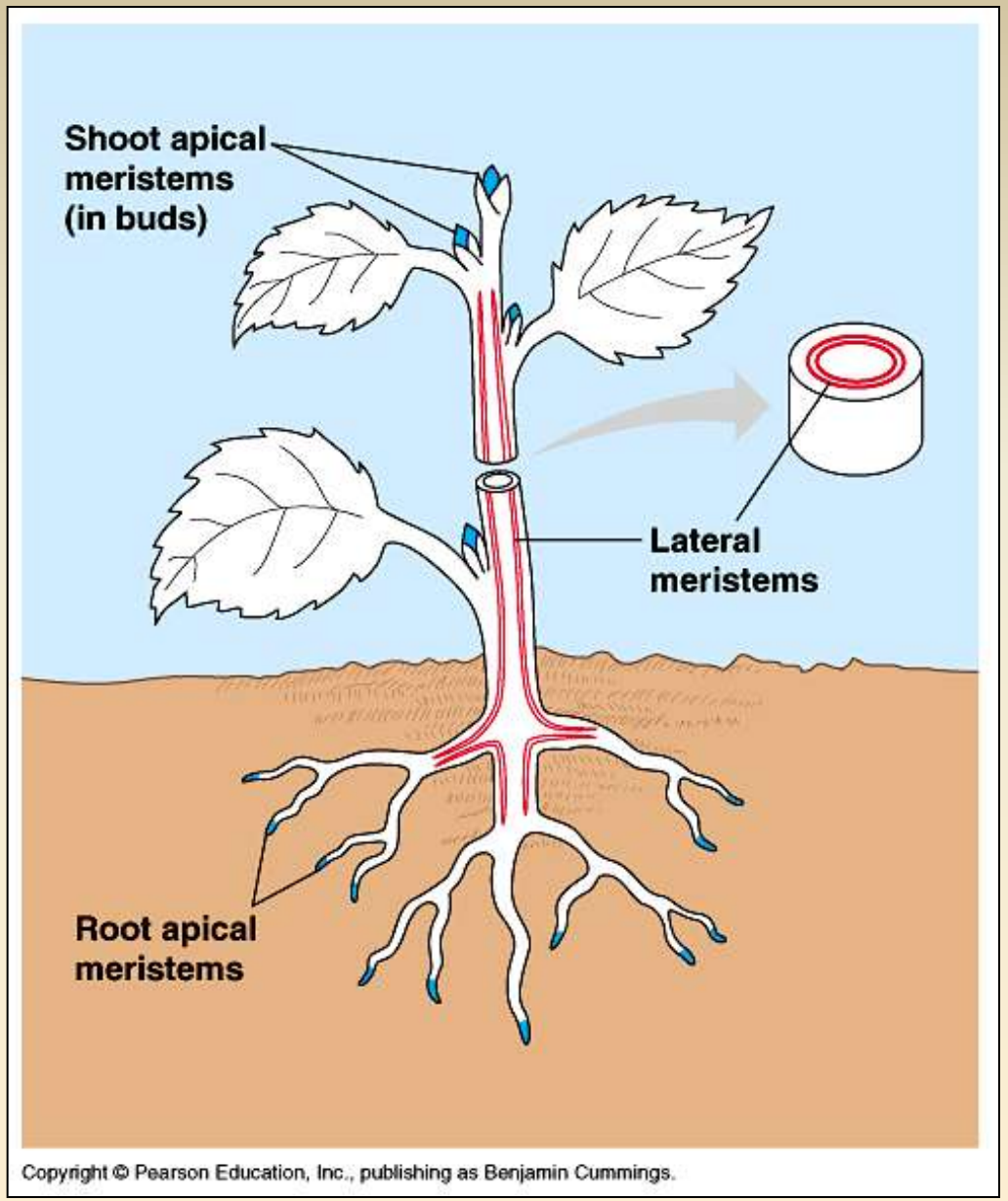
Vascular Bundle – xylem, phloem, fibers



Vascular Bundles

- Water and minerals transported up in xylem
- Sugars transported down to roots or to fruits in phloem





Primary Growth – Apical growth from meristems at the tips

Secondary Growth – Lateral growth in width from vascular cambium meristem

Stems: Secondary growth

- Vascular cambium – meristem for lateral growth
- Vascular tissue (xylem) makes up the bulk of the stem
- Form tree rings

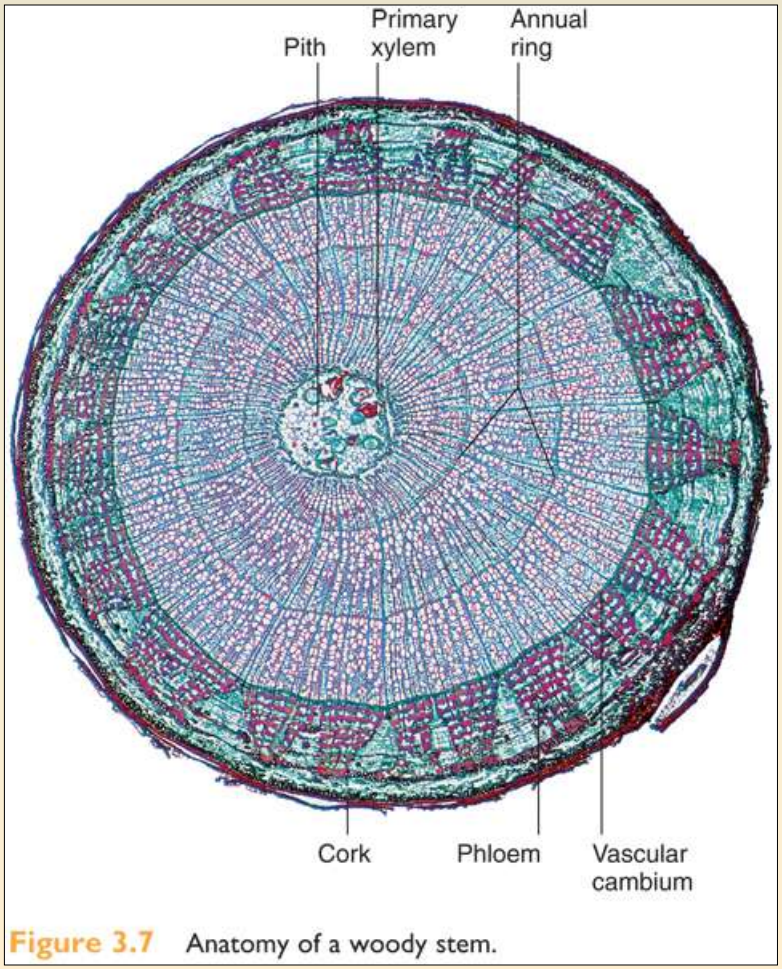
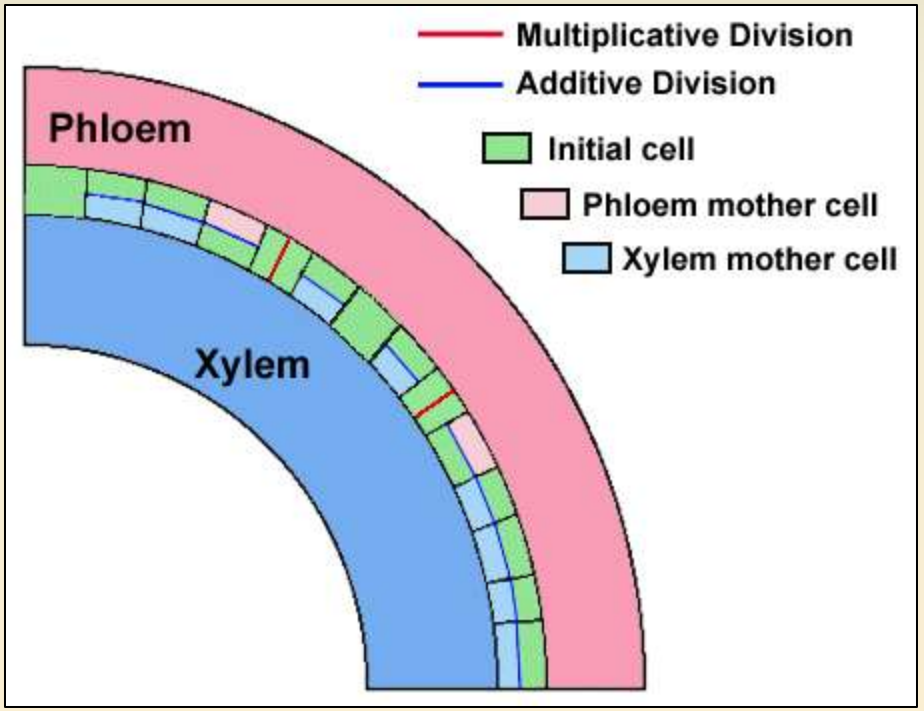
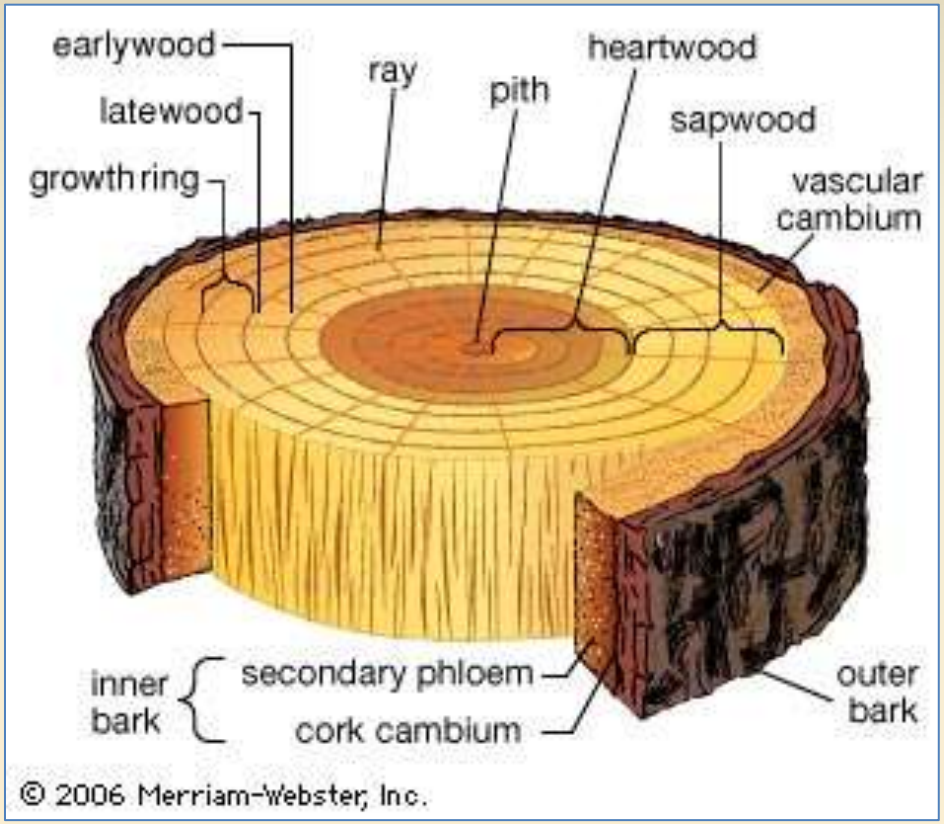


Figure 3.7 Anatomy of a woody stem.

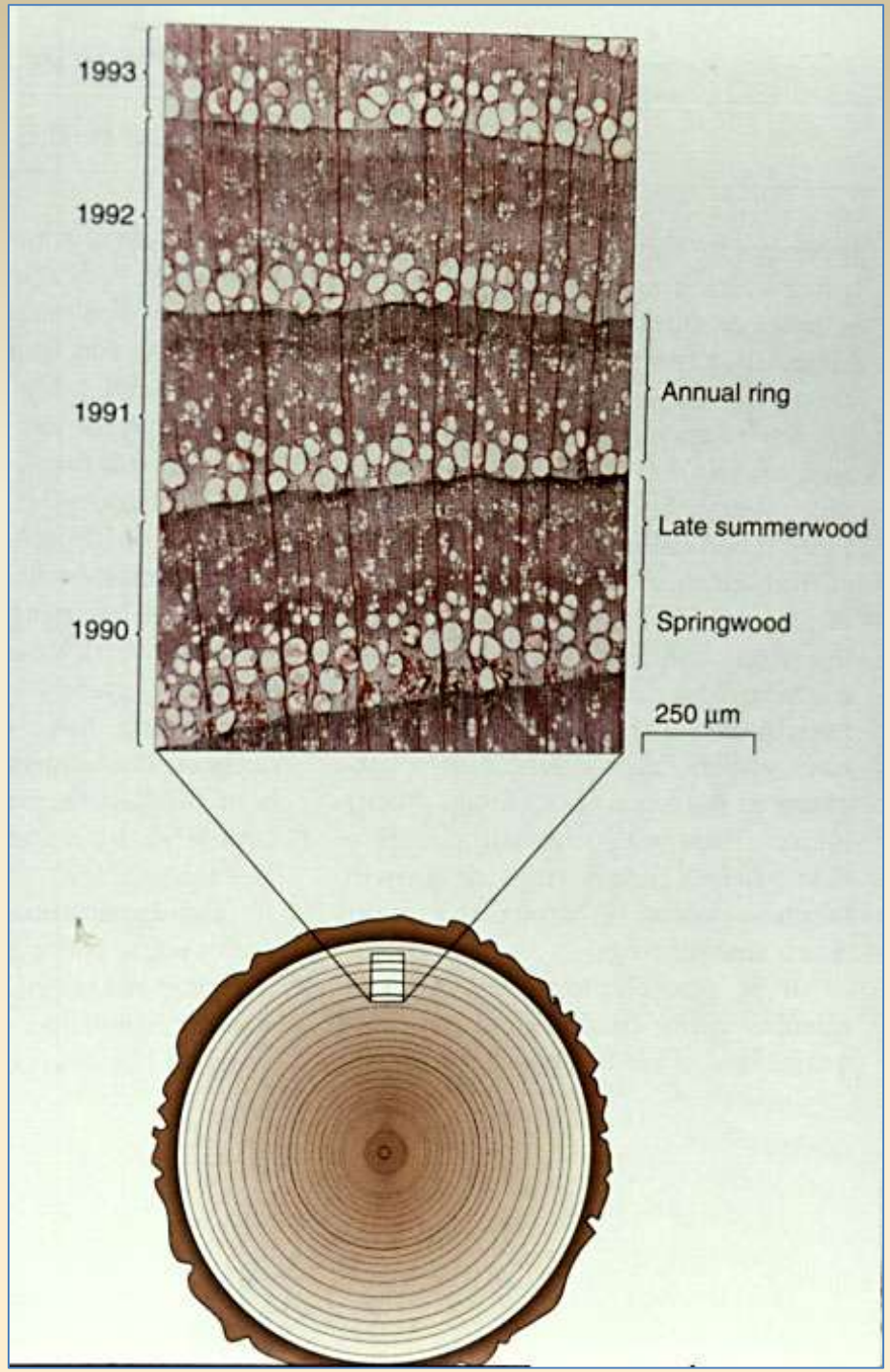


Cambium produces xylem to inside, phloem to outside

Wood


earlywood
latewood
growth ring
ray
pith
heartwood
sapwood
vascular cambium
inner bark
secondary phloem
cork cambium
outer bark
© 2006 Merriam-Webster, Inc.

Growth Rings



1914
When the tree was 6 years old, something pushed against it, making it lean. The rings are now wider on the lower side, as the tree builds "reaction wood" to help support it.

1924
The tree is growing straight again. But its neighbors are growing, too, and their crowns and root systems take much of the water and sunshine the tree needs.

1927
The surrounding trees are harvested. The larger trees are removed and there are once again ample nourishment and sunlight. The tree can grow rapidly again.

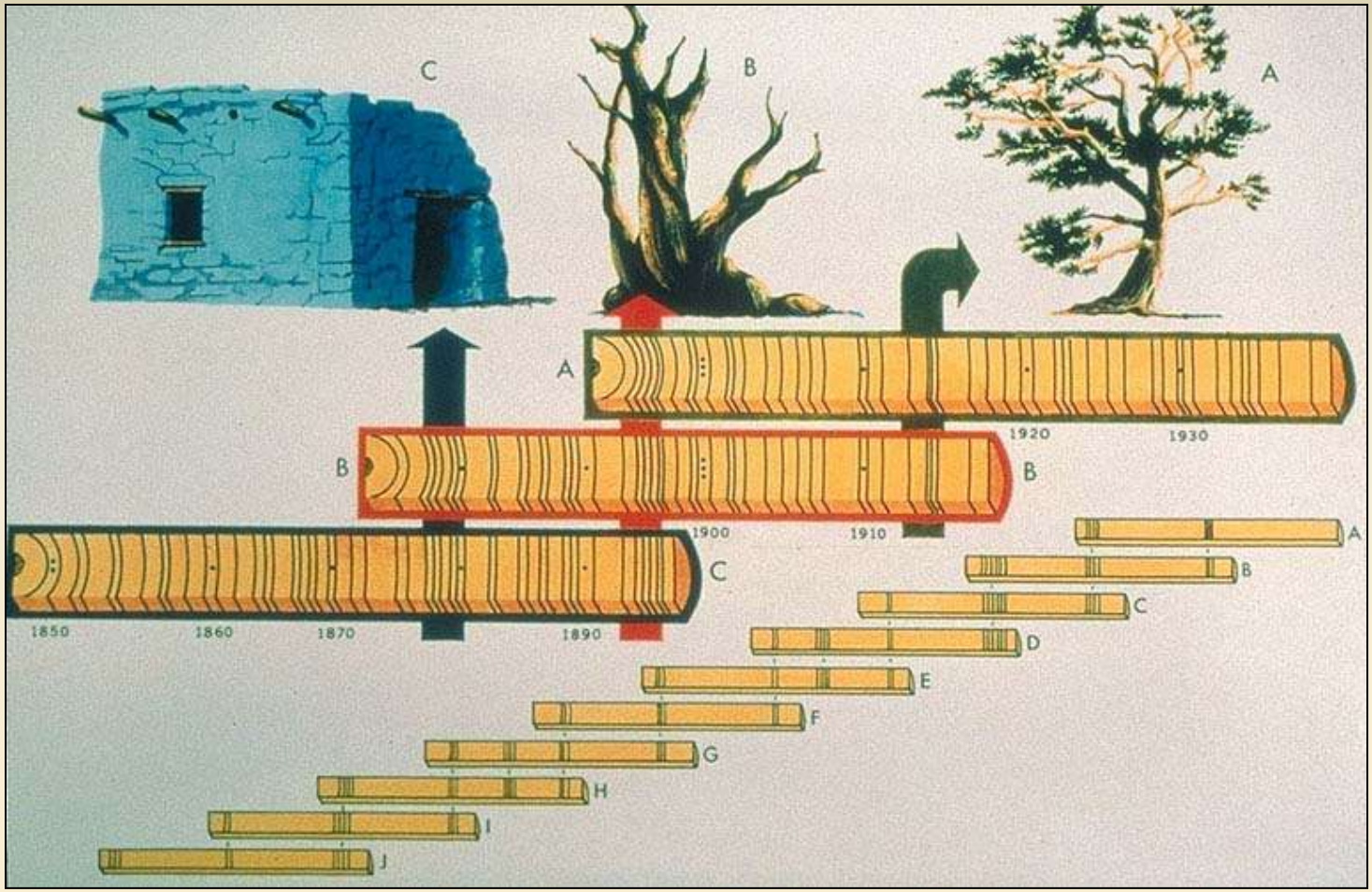
1930
A fire sweeps through the forest. Fortunately, the tree is only scarred, and year by year more and more of the scar is covered over by newly formed wood.

1942
These narrow rings may have been caused by a prolonged dry spell. One or two dry summers would not have dried the ground enough to slow the tree's growth this much.

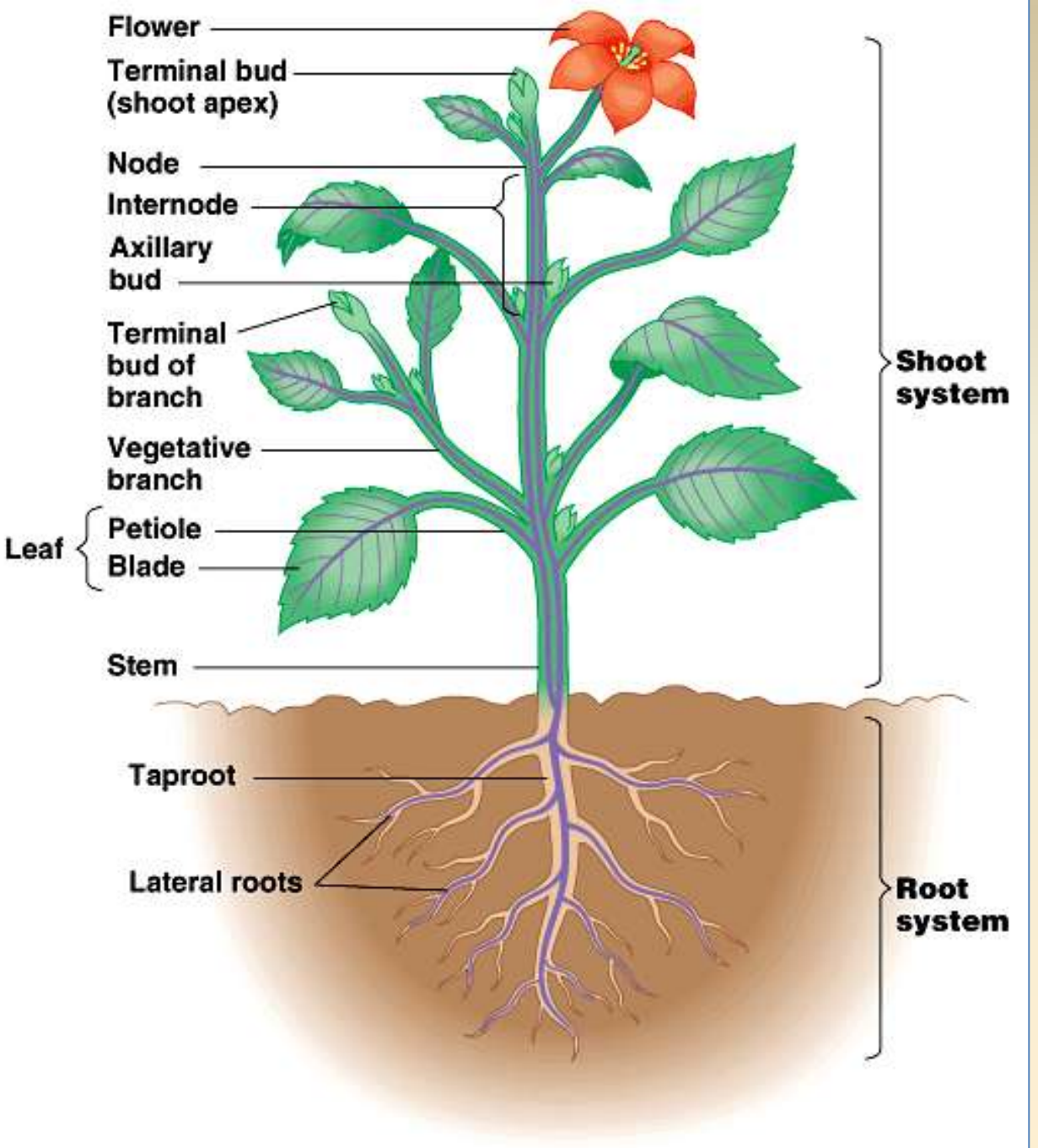
1957
Another series of narrow rings may have been caused by an insect, such as the larva of the sawfly. It eats the leaves and leafbuds of many kinds of coniferous trees.

Box Figure 3.1 The pattern of annual rings is correlated with events in the life of this tree.
Source: St. Regis Paper Company, New York, NY, 1966.

Dendrochronology – Study of Annual Growth Rings

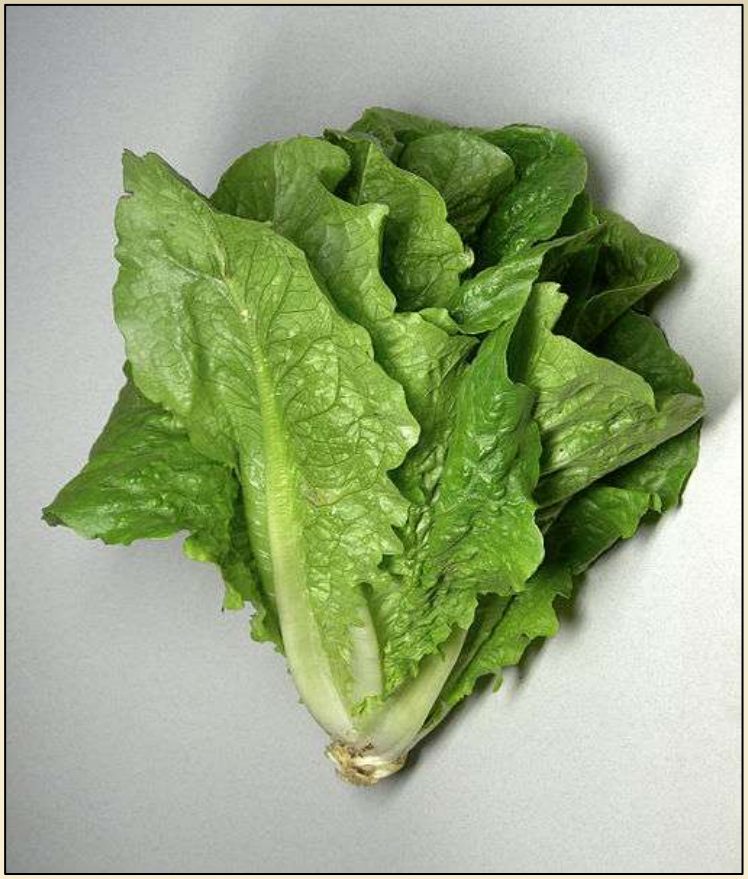


Plant Organs
Leaves
Roots

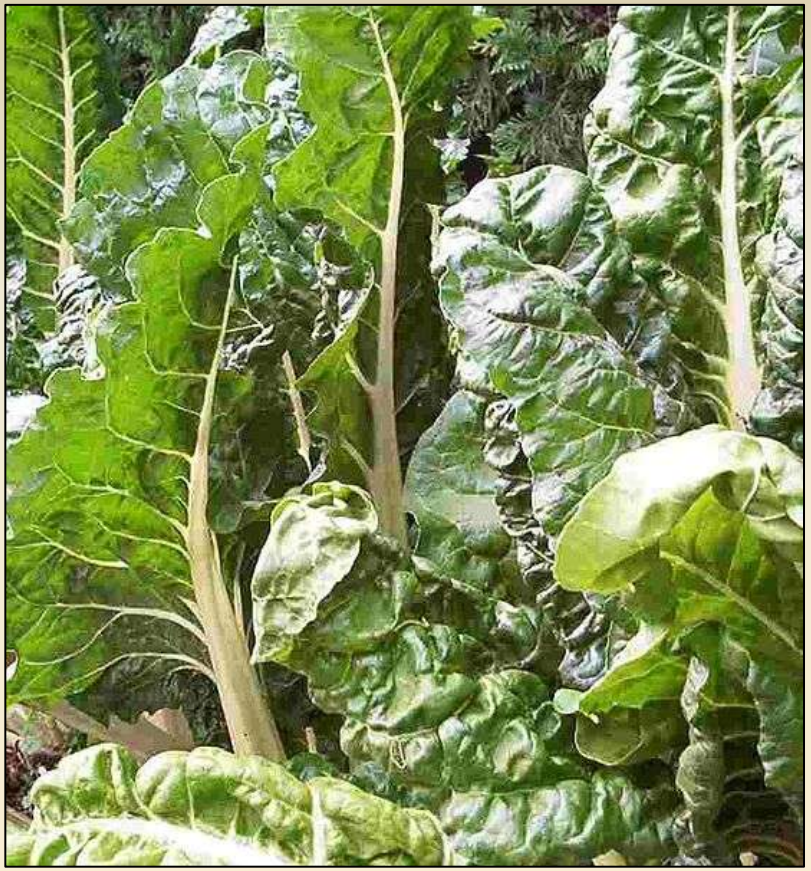


Leaves

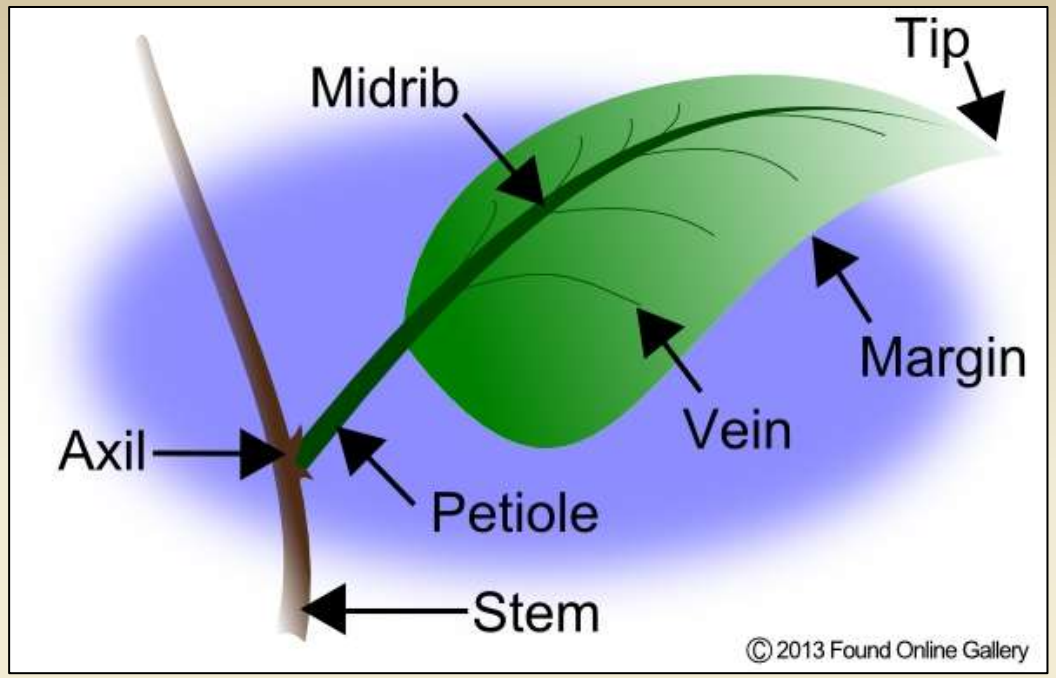
Leaf Crops

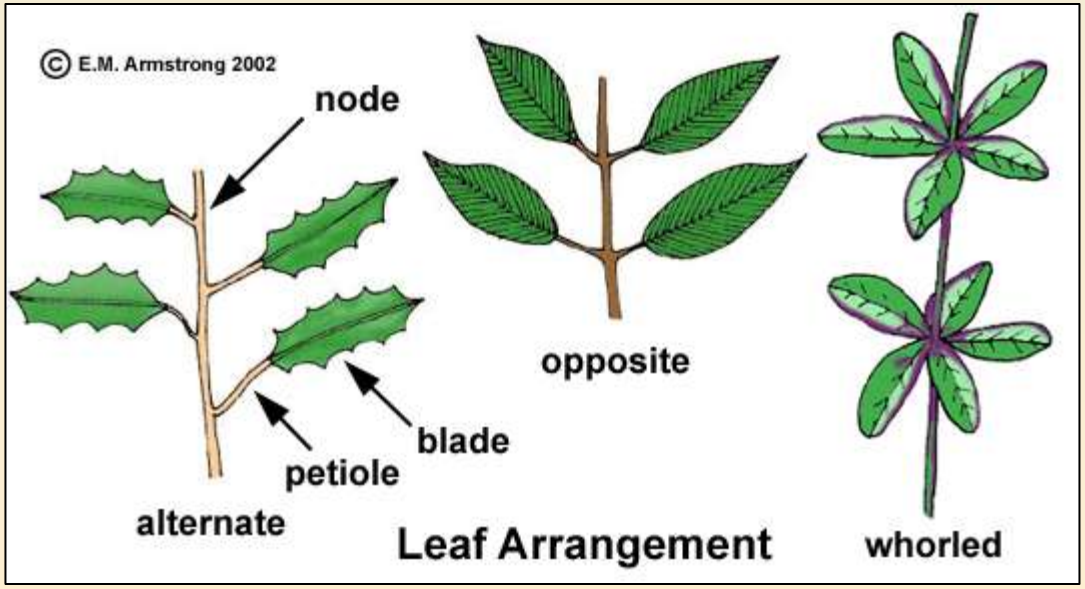


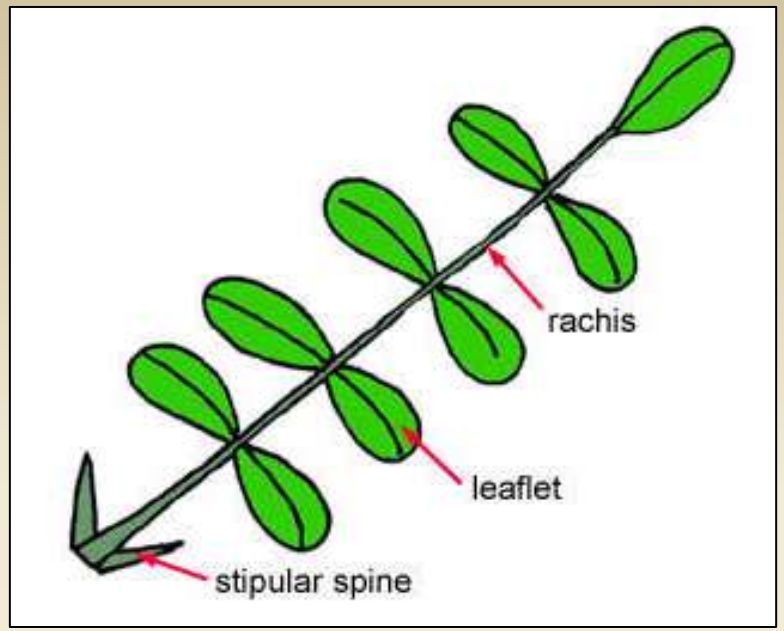
Lettuce (Romaine)



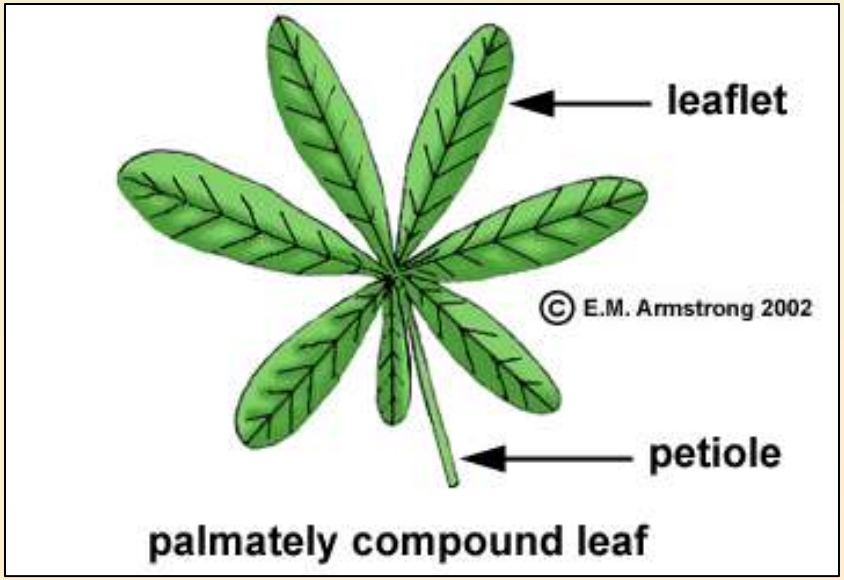
Swiss Chard


Tip
Midrib
Margin
Vein
Axil
Petiole
Stem
© 2013 Found Online Gallery

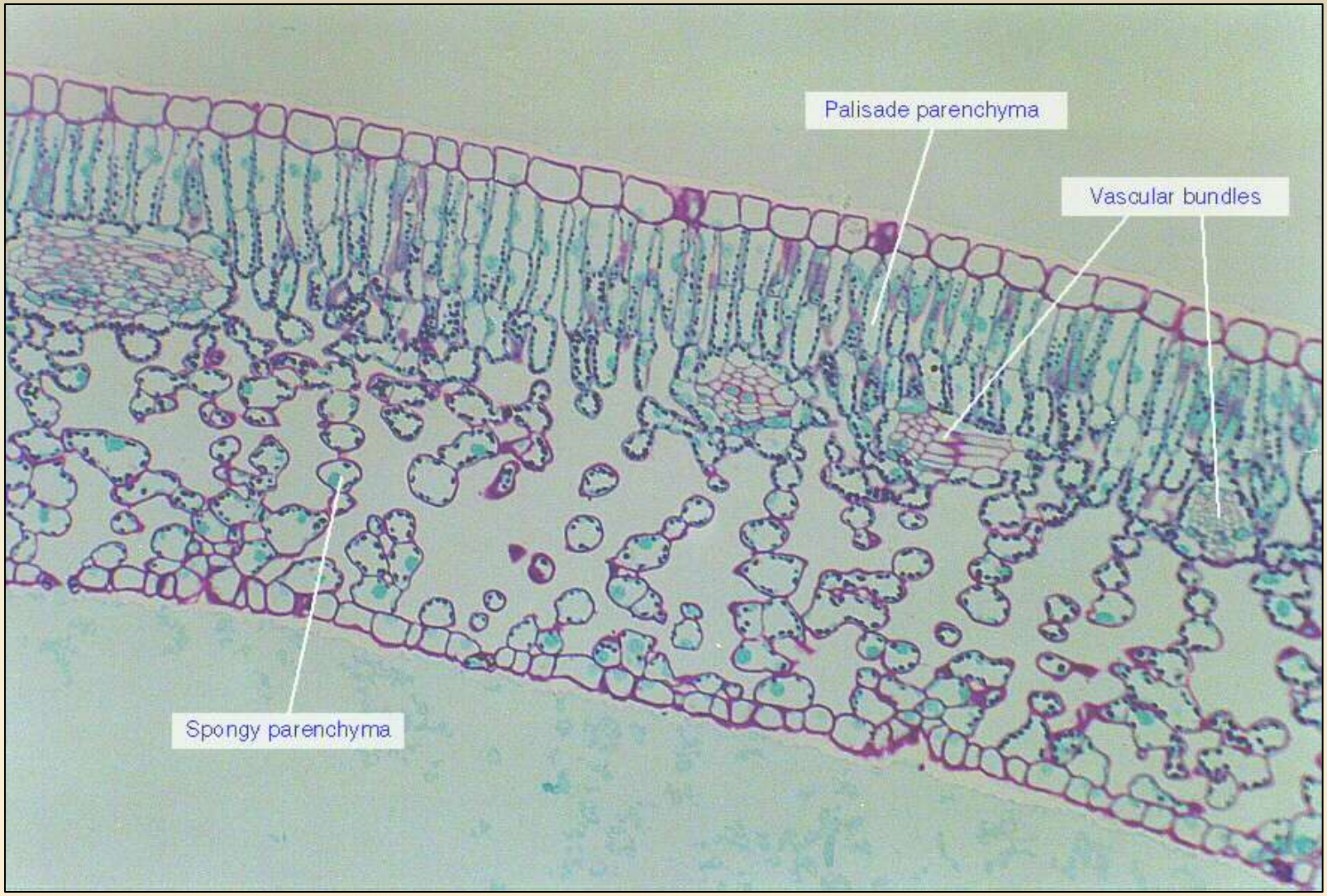

© E.M. Armstrong 2002
node
opposite
blade
petiole
alternate
Leaf Arrangement
whorled



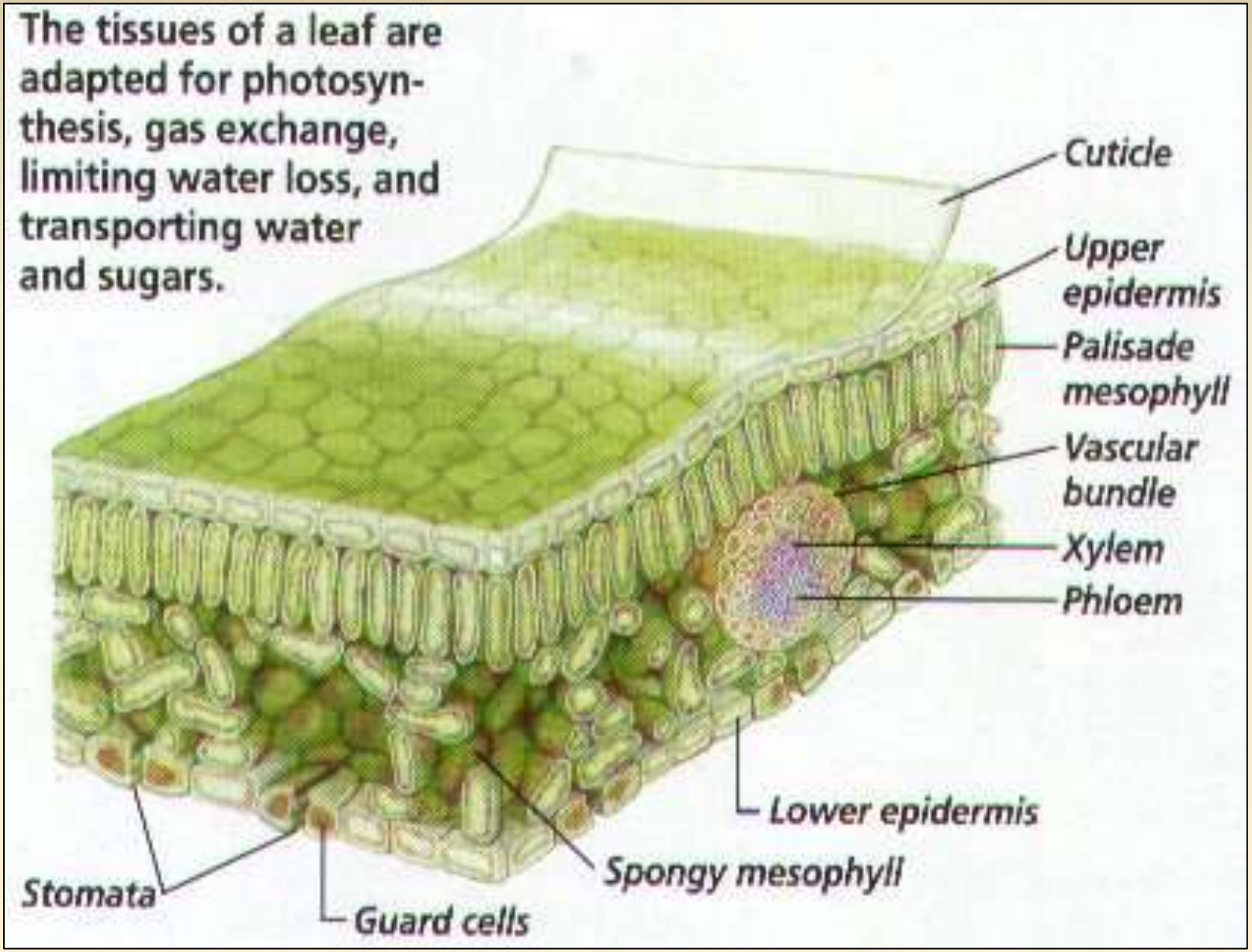
Pinnately compound leaf



Cross section through a leaf



Leaf Structure



Roots

The Roots:

-Anchors the plant in the soil and holds the stem in place

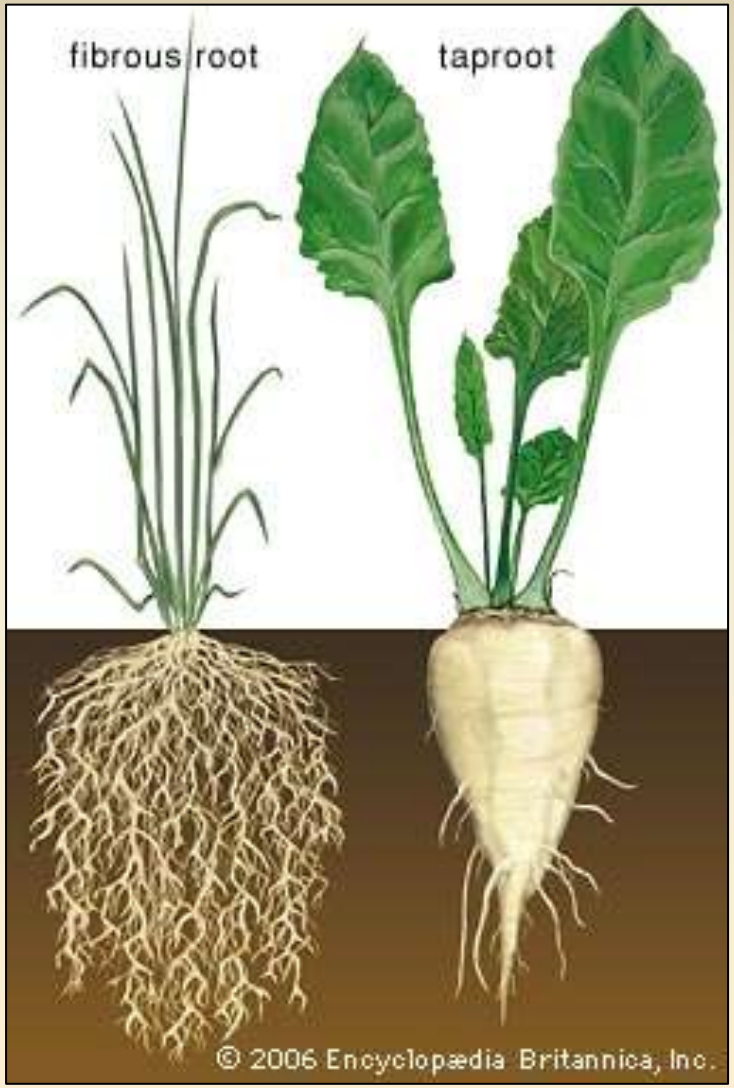
-Prevents erosion

-Roots absorb water required for photosynthesis and replace water loss during transpiration.

-Absorb dissolved minerals

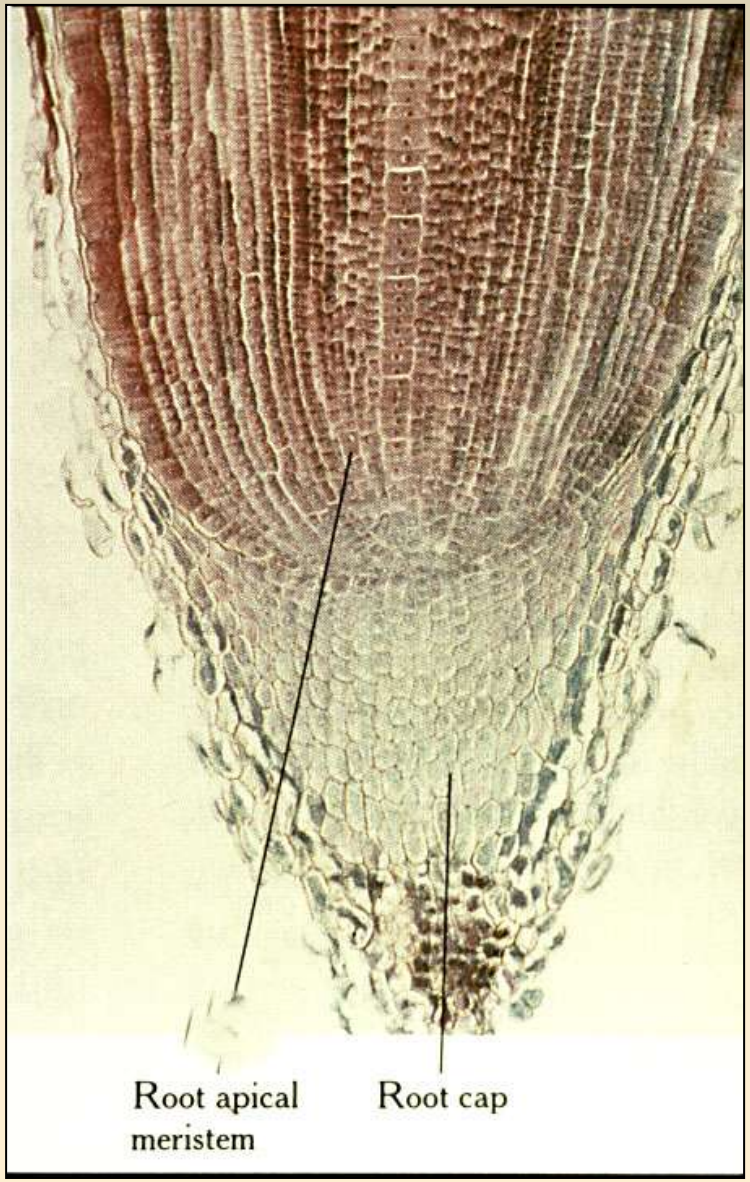
-Store starch that is made by the leaves

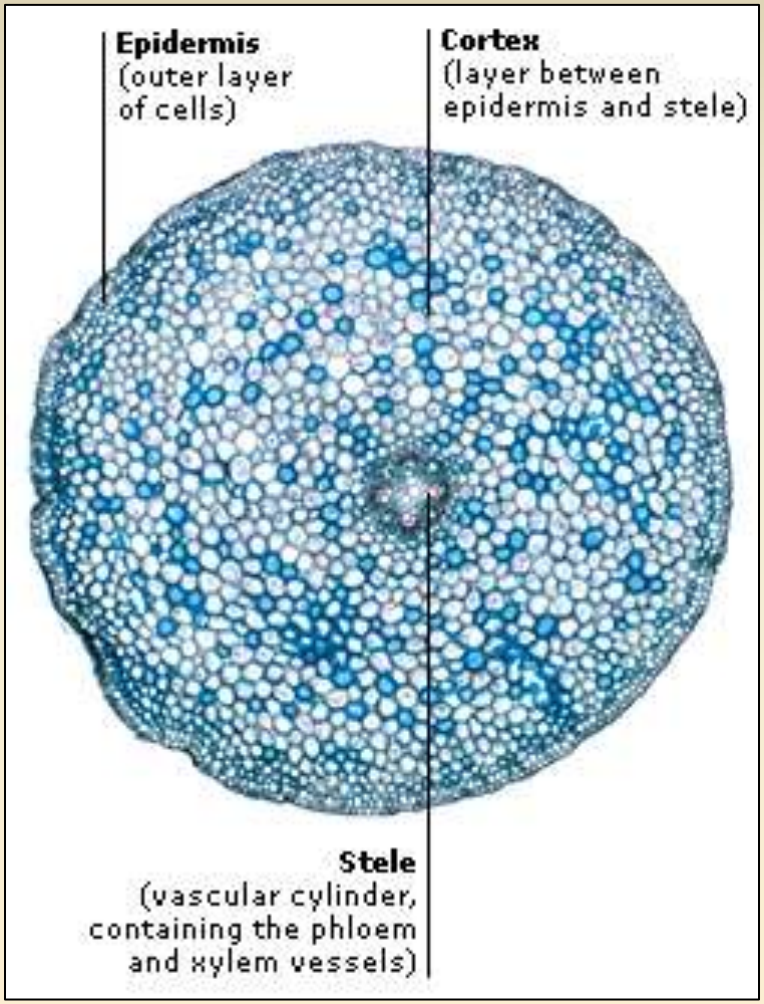
Roots



Root Crops

Root Anatomy





Root Anatomy

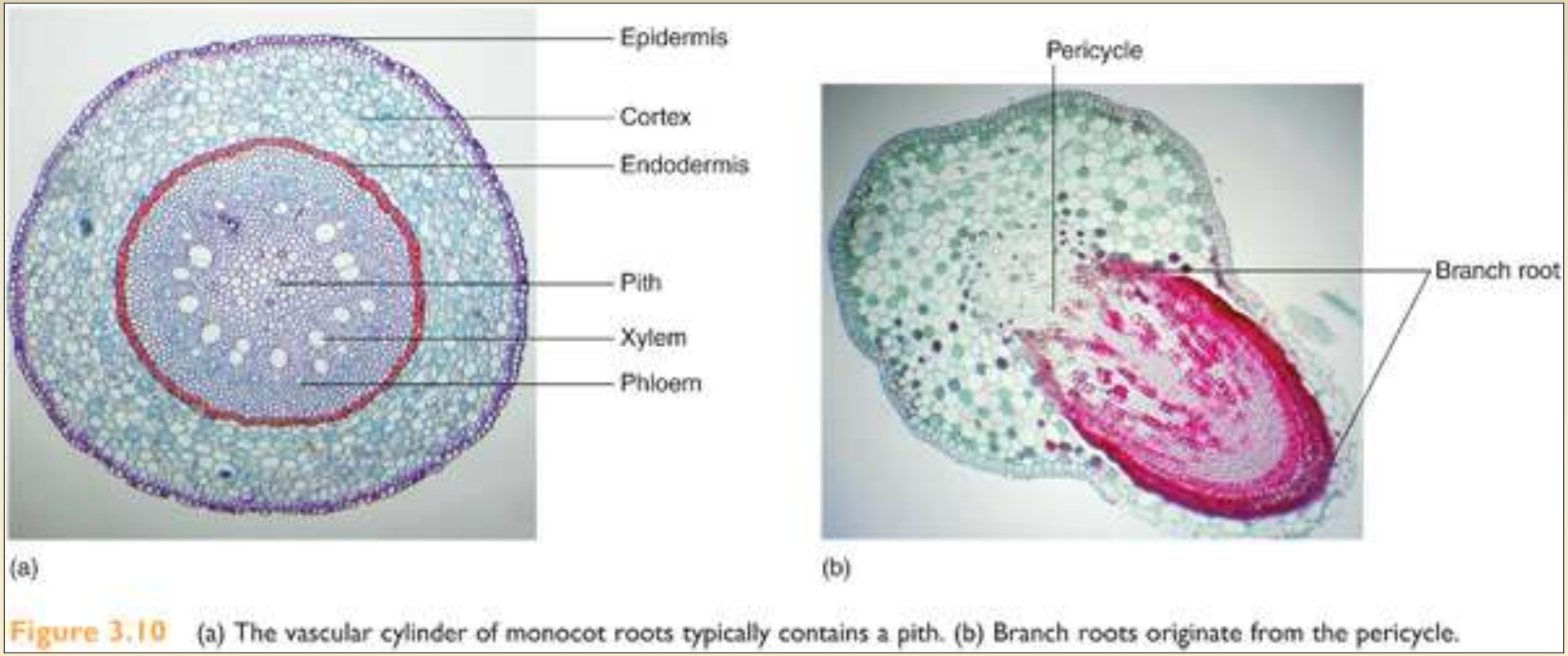


Figure 3.10 (a) The vascular cylinder of monocot roots typically contains a pith. (b) Branch roots originate from the pericycle.

Root Regions

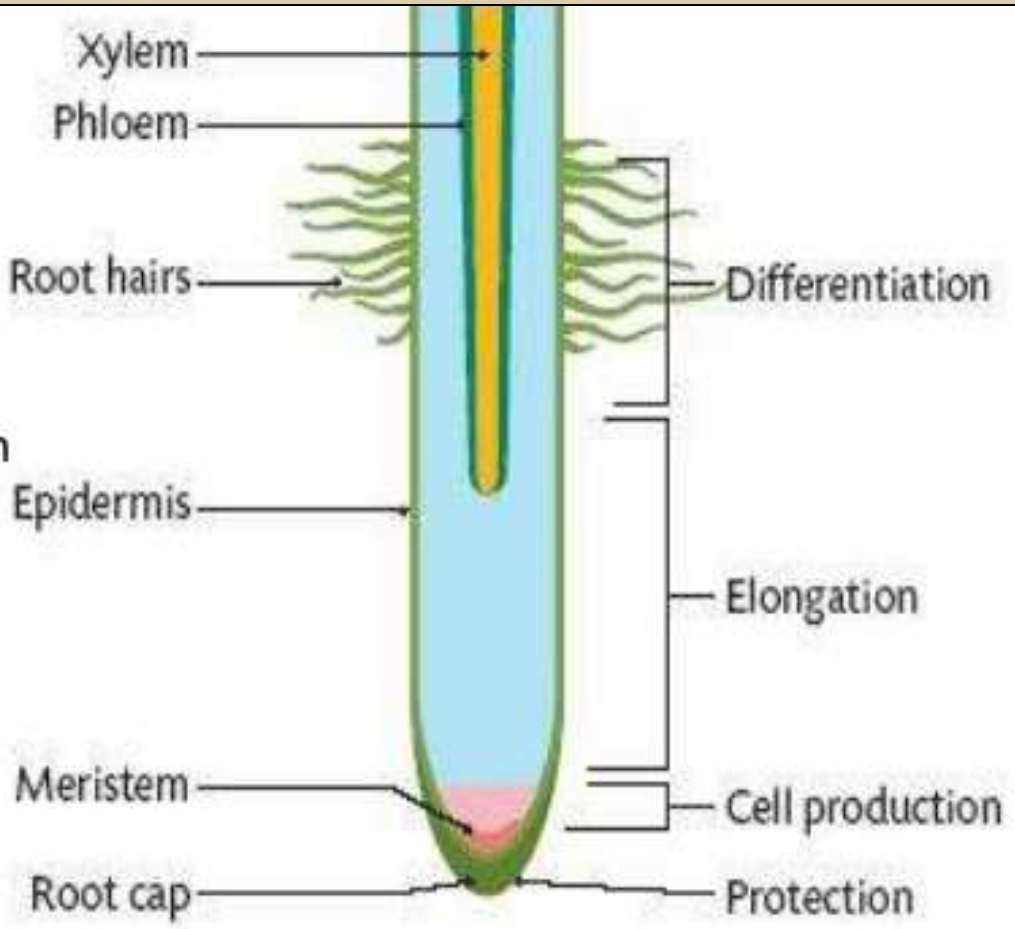
The Roots: 4 zones

-**Zone of maturation:** cells differentiate into different types of cells.

-**Zone of elongation:** allows the root to get deeper within the soil

-**Meristematic region:** rapid mitosis of undifferentiated meristematic cells.

-**Root cap:** protects the meristematic region.



True Root Crops

Radish

Carrots

Beets

Rhizomes - Modified Stems – Root-like crops

Yams

Ginger

Taro

Cassava

End