

Tree Biology

- This session will cover tree anatomy (structure) and tree physiology (function) including how a tree is put together, how it grows in its environment and
Compartmentalization of Decay in Trees (CODIT)



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(Modified for CMVFS 9/13/16 Donna Davis)



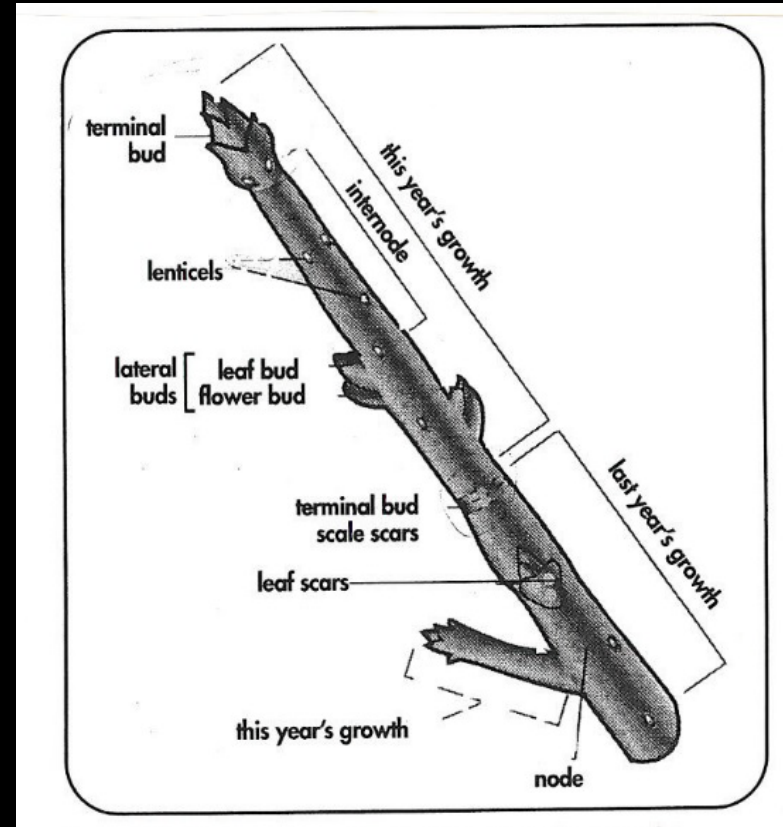
Tree Biology

- **Tree Biology**-the study of structure and function, and the relationship between them
 - **Anatomy**-the study of the component parts of the tree
 - **Physiology**-the study of the biological and chemical processes within these components

Tree Anatomy-Cells and Tissues

- **Apical Meristems**-primary meristems that produce cells that result in elongation of roots and shoots
- **Lateral Meristems**-secondary meristems that produce cells that result in an increase in diameter
 - cambium**-thin, continuous sheath of dividing cells that produces cells that will become the vascular system of the tree
 - xylem**-produced to the inside (H_2O)
 - phloem**-produced to the outside (CHOs)
 - cork cambium**-produces bark

Apical (Primary) Meristem-Shoots



Apical (Primary) Meristem-Roots

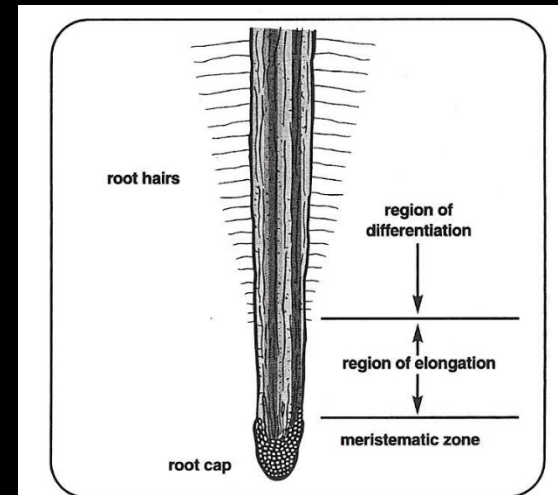
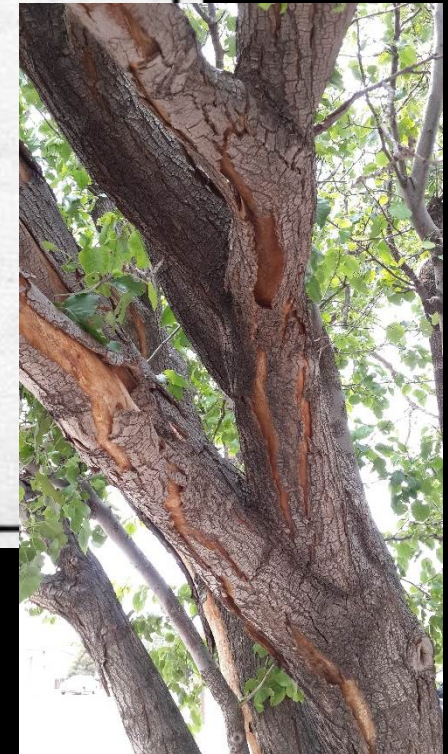
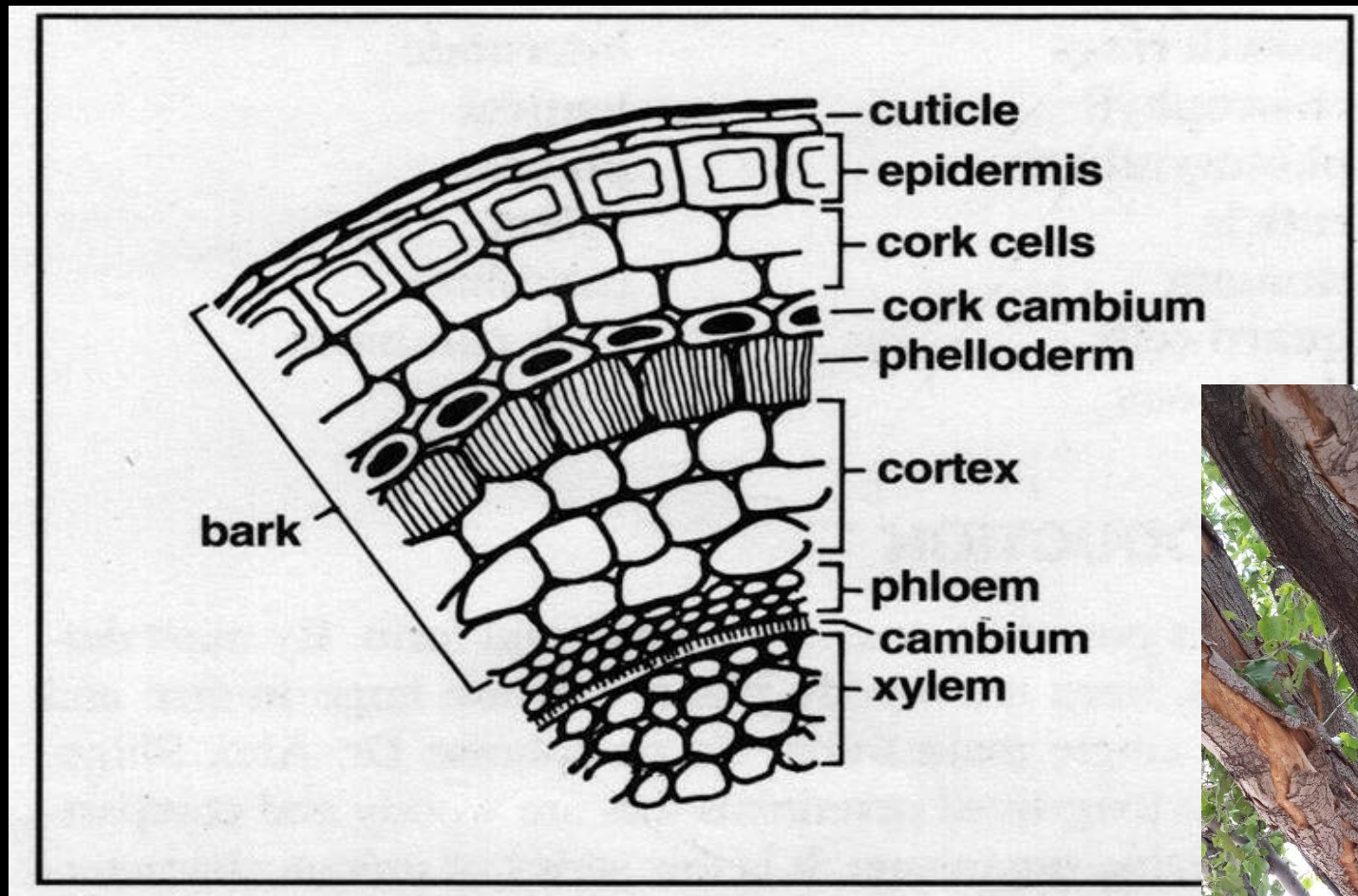


Figure 1.11 Root tip anatomy.

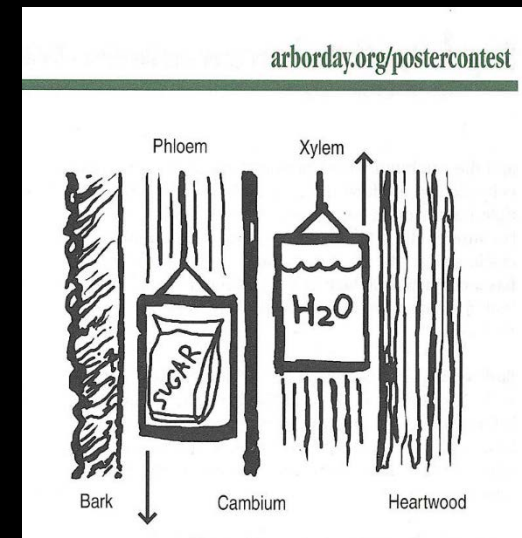
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Lateral (Secondary) Meristems



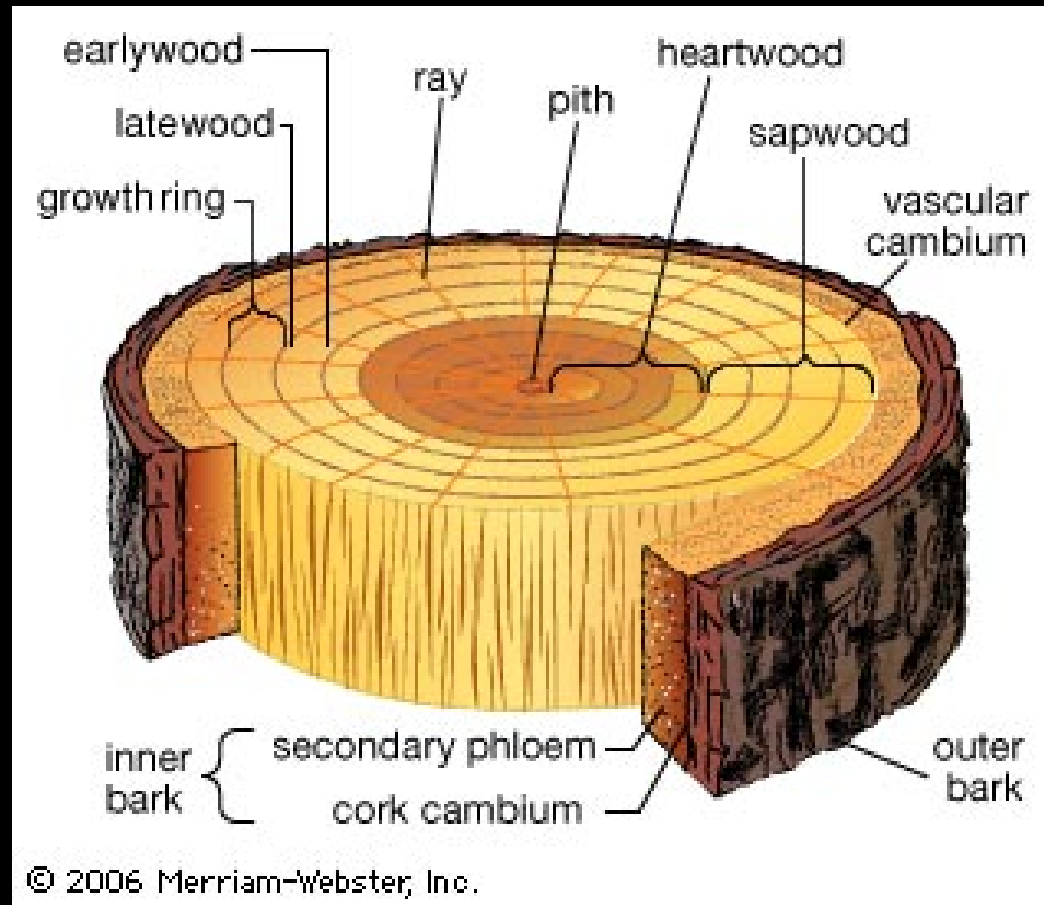
Tree Anatomy-Cells and Tissues

- **Xylem**-wood of the tree, made up of live and dead cells
 - conducts water and mineral elements
 - supports weight of tree
 - storage of resources
 - defends against spread of disease/decay
- **Phloem**-responsible for movement of sugars, produced in the leaves, to roots and throughout the plant for storage and consumption



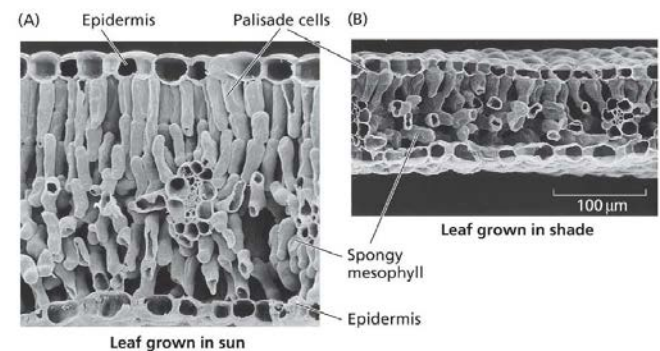
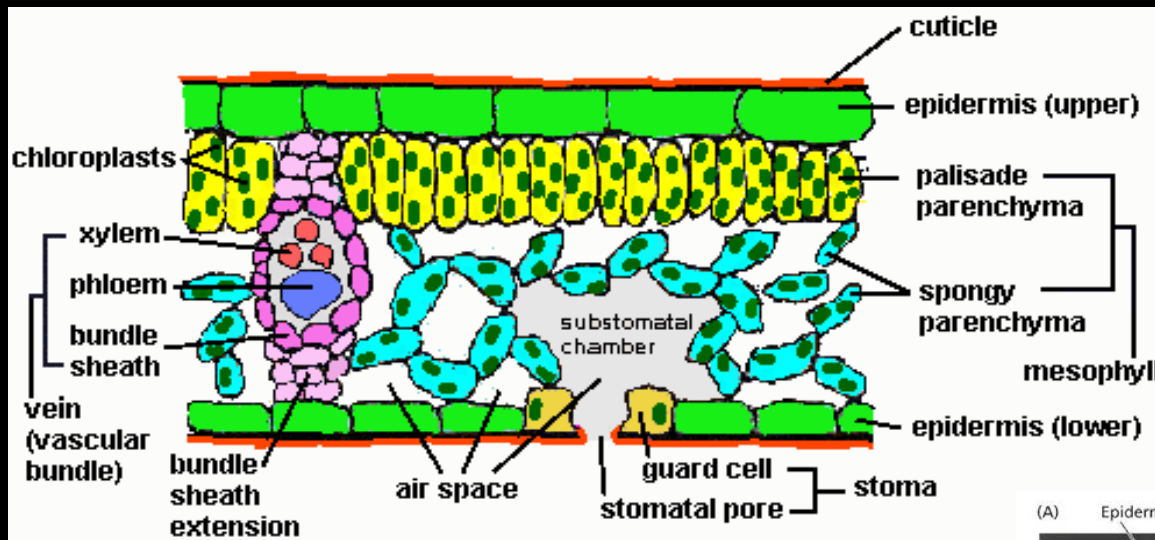
Tree Anatomy-Cells and Tissues

- **Sapwood**-xylem which functions to conduct water
- **Heartwood**-xylem which is non-water conducting tissue - can sometimes be darker in color
- **Earlywood**-xylem (wood) produced in Spring
- **Latewood**-xylem (wood) produced in Summer-growth ring
- **Ray cells**-cells that function to transport sugars and other compounds through the trunk radially



Tree Anatomy-Leaves

- **Leaves**-food producers of the tree
 - chloroplasts**-specialized organelles found in cells that are the site of photosynthesis
 - chlorophyll**-green pigment of plants, found in the chloroplasts
 - cuticle**-waxy layer outside the epidermis of a leaf
 - stomates**-small pores between two guard cells through which gases are exchanged



Tree Anatomy-Roots



Small absorbing roots

Sinker roots

Taproot (walnut, hickory, etc.)

Lateral roots-can extend 2-3 times the crown radius, usually in top 12" of soil

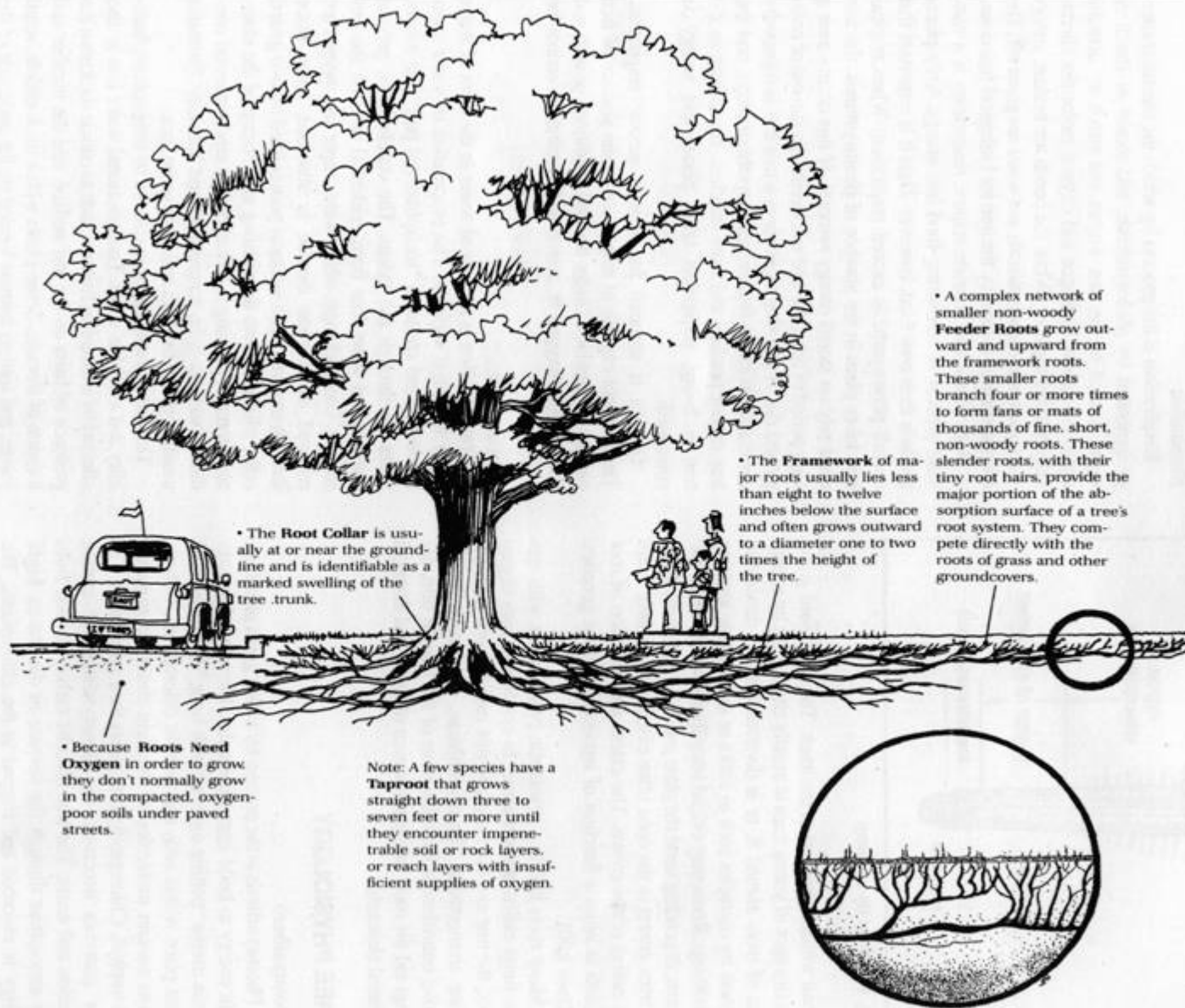


Fig. 1.10 How roots grow.



Critical Root Zone

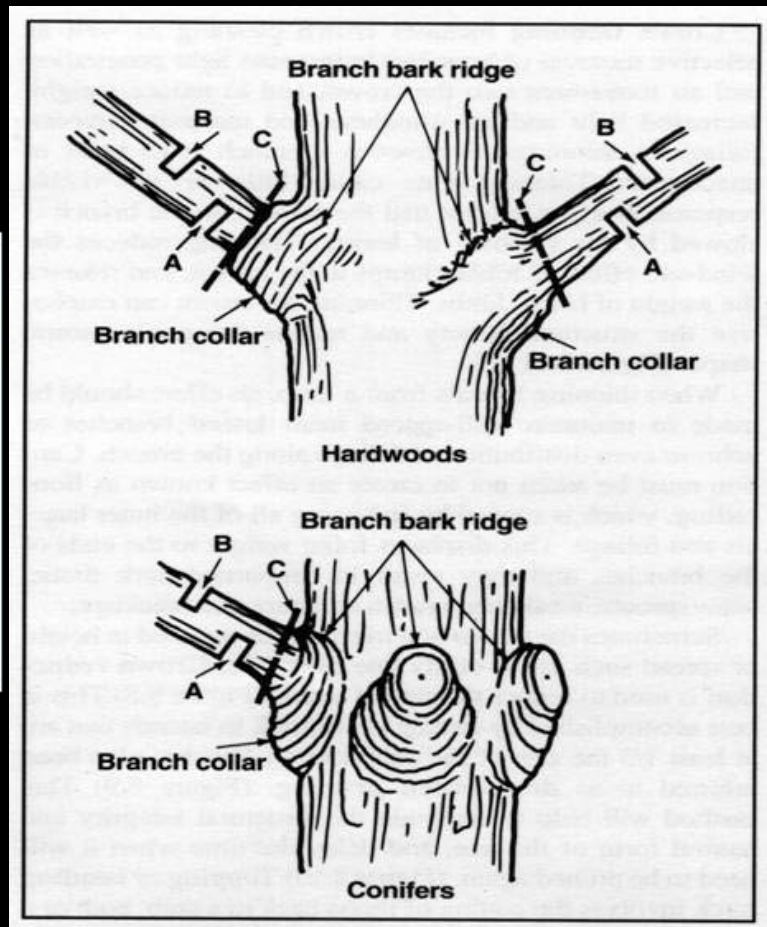
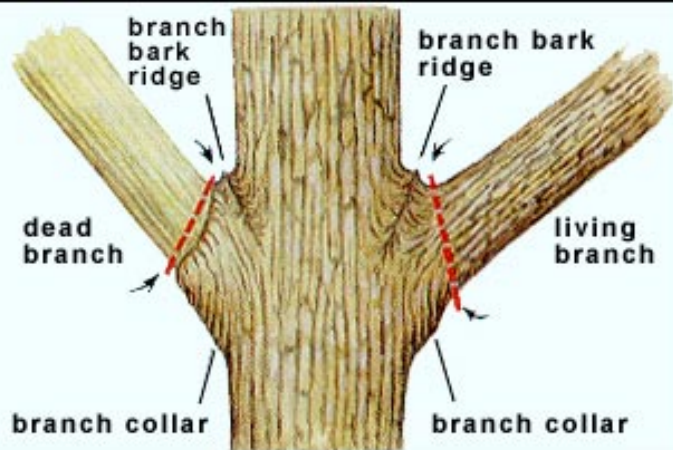
Tree Anatomy-Bark

- **Bark**-outer covering of a tree's branches and stems composed of non-functional phloem and corky cells
 - moderates temperature
 - defense against injury
 - reduces water loss
- **Lenticels**-small openings in bark that allow for gas exchange



Tree Anatomy-Branches

- **Branch collar**-shoulder area where a branch joins another branch or trunk created by the overlapping xylem tissues
- **Branch bark ridge**-area of a tree's crotch where the growth and development of the two adjoining limbs pushes the bark into a ridge



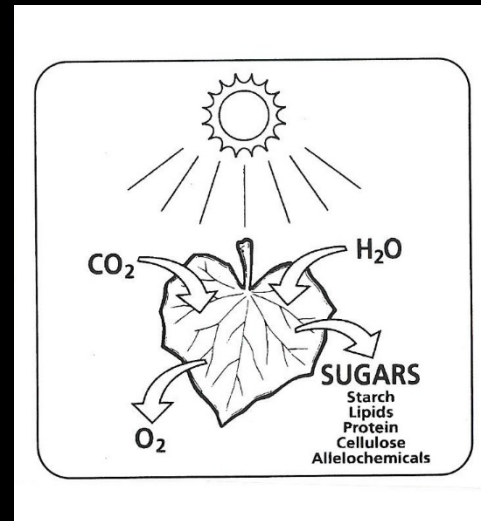
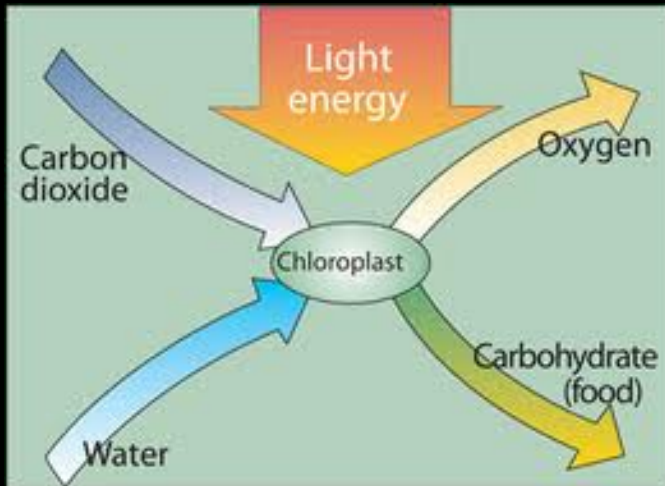
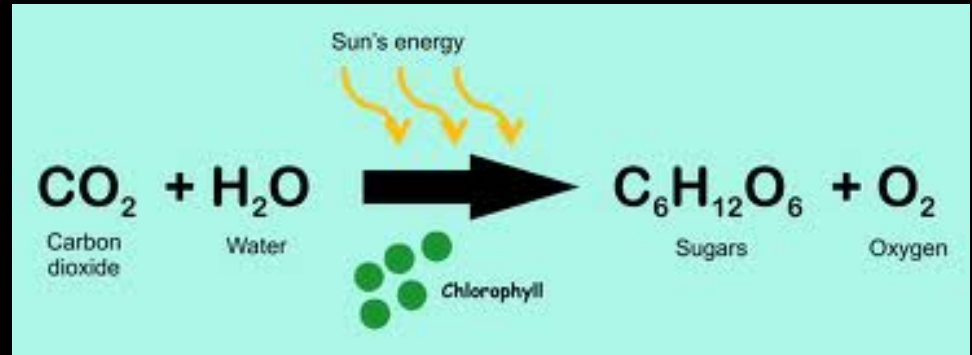
From ISA Arborists' Certification Study Guide, Figure 8.2, 1st edition

Tree Physiology- Photosynthesis

- **Photosynthesis**-process by which green plants use light energy to build carbon molecules from water and carbon dioxide
- **Photosynthate (Food)**-sugar and other products of photosynthesis, much of which is stored for later energy requirements

Tree Physiology-Photosynthesis

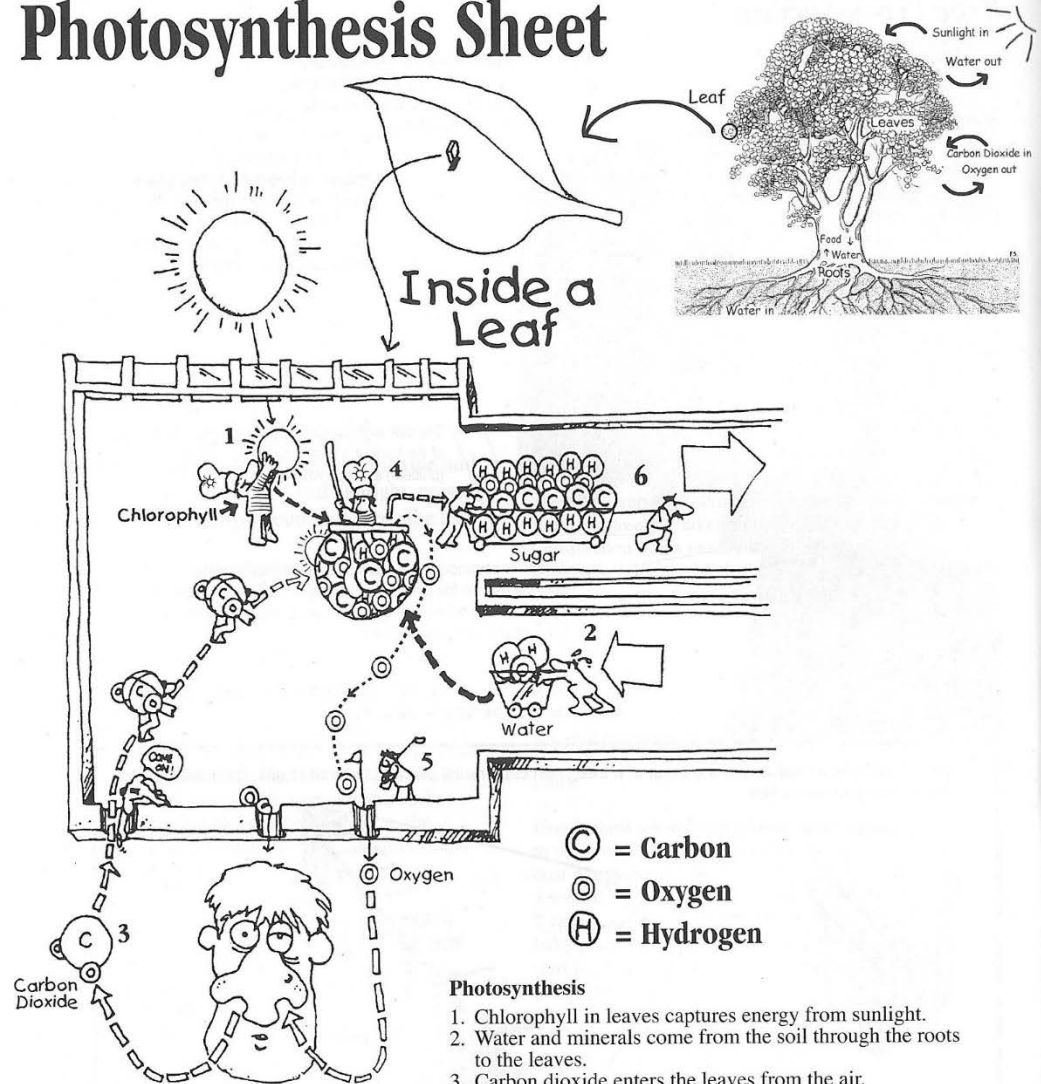
Chlorophyll and Chloroplasts



From ISA Arborists' Certification Study Guide, Figure 1.15, 1st edition

Student Handout #2

Photosynthesis Sheet



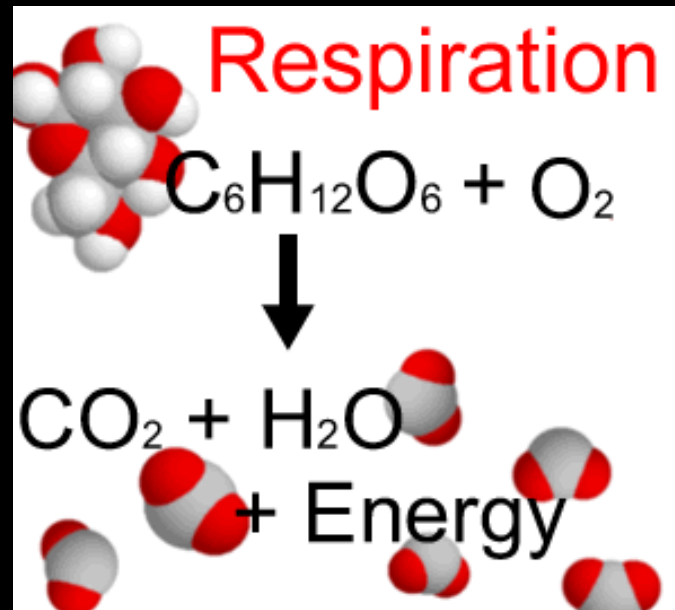
Photosynthesis

1. Chlorophyll in leaves captures energy from sunlight.
2. Water and minerals come from the soil through the roots to the leaves.
3. Carbon dioxide enters the leaves from the air.
4. Chlorophyll uses the sun's energy to combine water and carbon dioxide to make special kinds of sugars which are food for the plant.
5. The leaves give off oxygen into the air.
6. The sugar food moves to other parts of the plant for use or storage.

Tree Physiology-Respiration

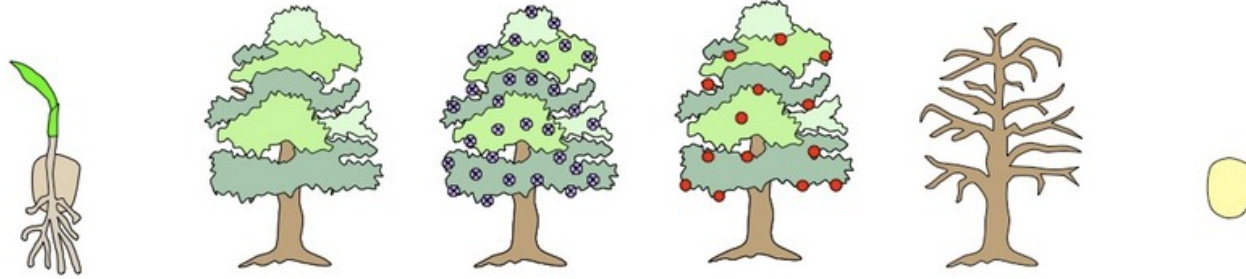
- **Respiration**-process by which carbohydrates produced from photosynthesis are converted to energy by using oxygen

Opposite reaction of photosynthesis



Tree Physiology

Hormones and Growth Regulation



Germination

Growth to Maturity

Flowering

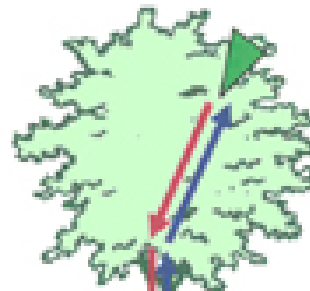
Fruit Development

Abscission

Seed Dormancy

Gibberellin	Yellow	Yellow	Yellow	Yellow		
Auxin		Orange	Orange	Orange		
Cytokinins		Green	Green	Green		
Ethylene				Blue	Blue	Blue
ABA					Pink	Pink

Auxins produced in the canopy growing tips stimulate root growth.



Gibberellins produced in the root growing tips stimulate canopy growth.



Tree Physiology

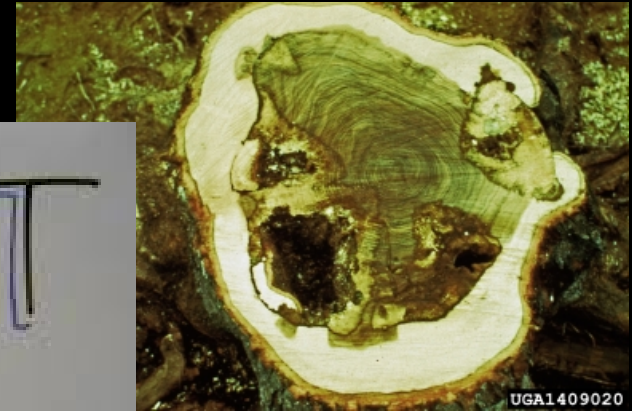
Hormones and Apical Dominance



Humans Heal and Trees Seal



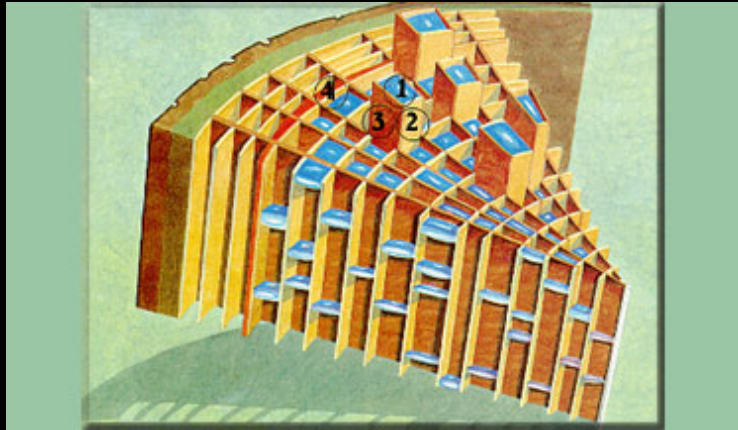
CODIT-Compartmentalization of Decay in Trees



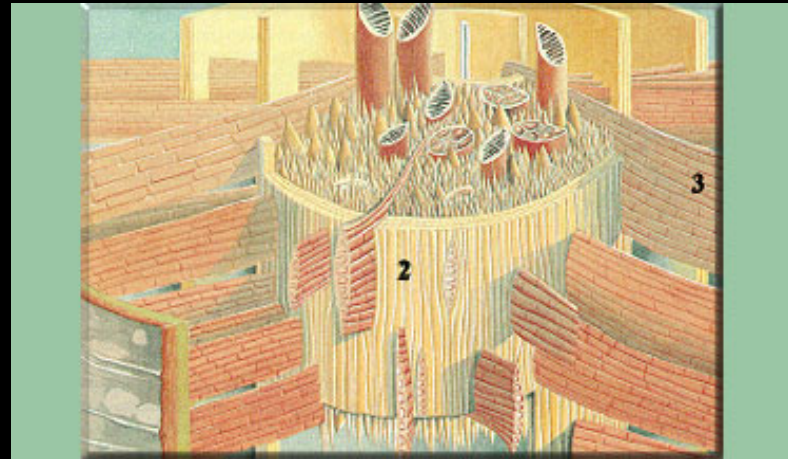
C.O.D.I.T
Compartmentalization
of Decay in Trees.



CODIT-Compartmentalization of Decay in Trees



-**Wall 1**-resists vertical spread of decay-xylem plugging-weakest wall



-**Wall 2**-resists inward spread of decay-compact latewood cells

-**Wall 3**-resists lateral spread-ray cells

-**Wall 4**-resists outward spread into new wood that is formed-strongest wall



Pruned in July 2001



August 2002



October 2003



QUESTIONS?