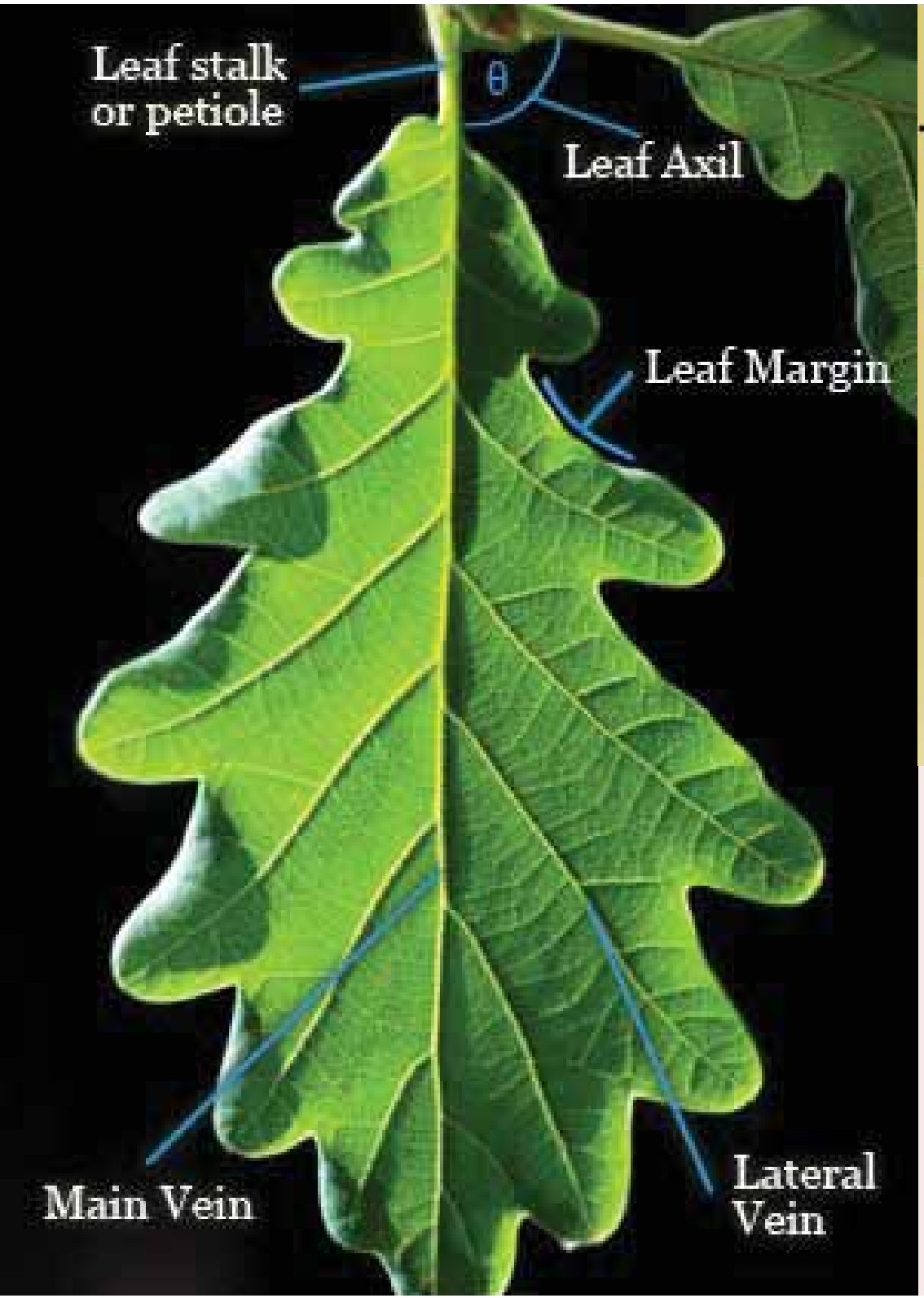
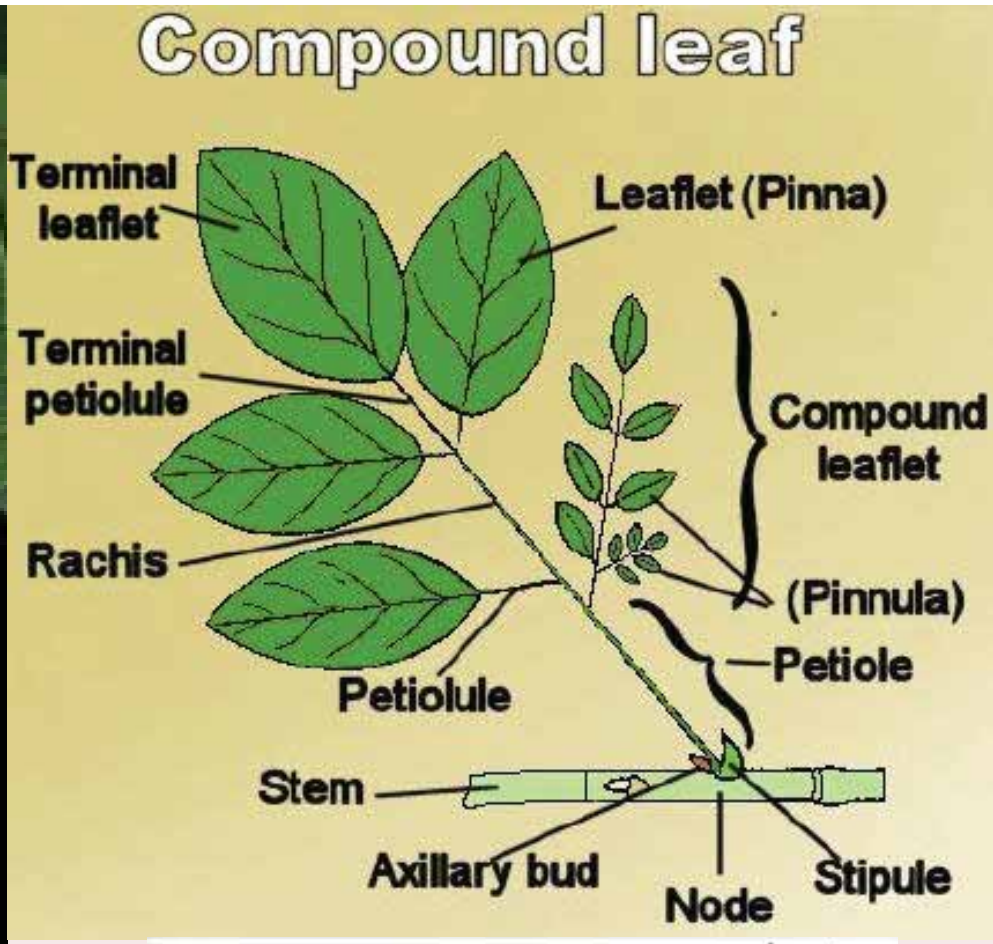
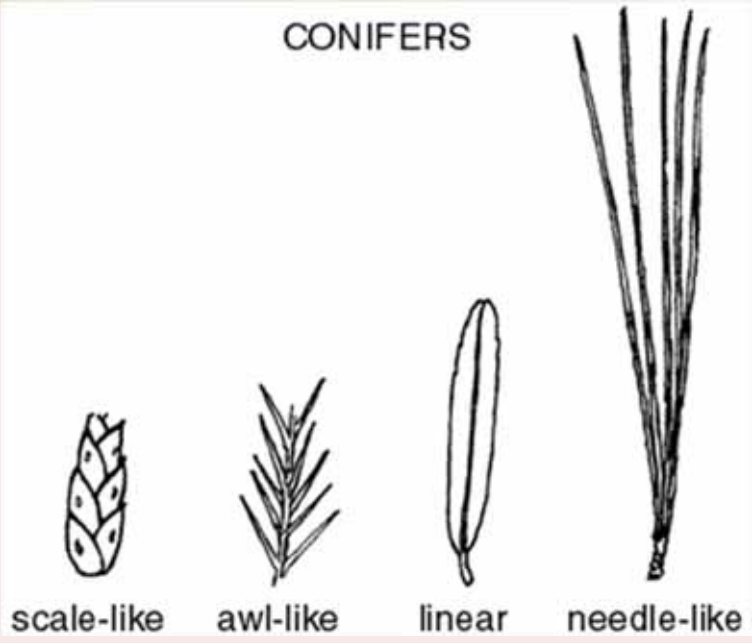
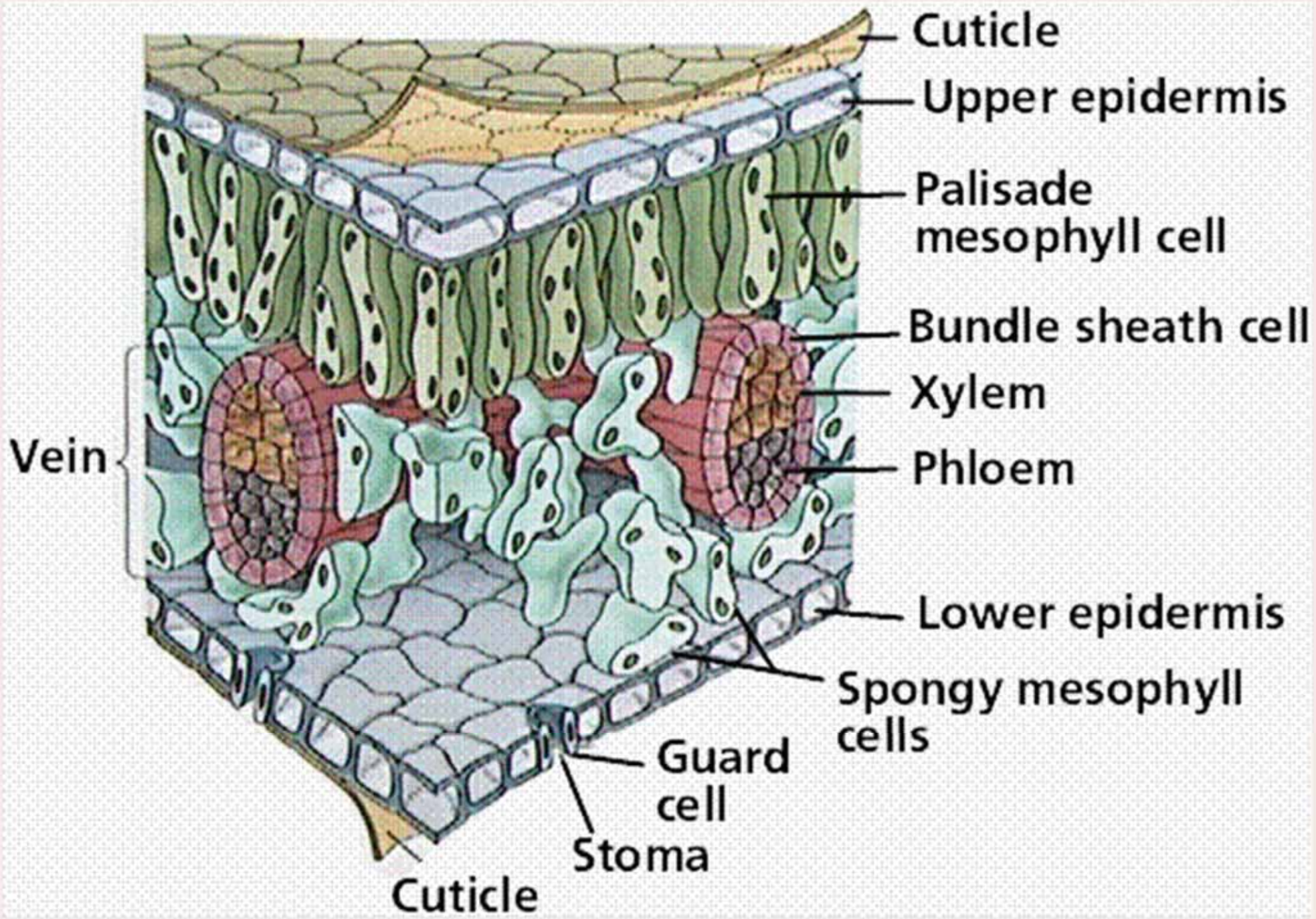
Part Two: Tree Anatomy

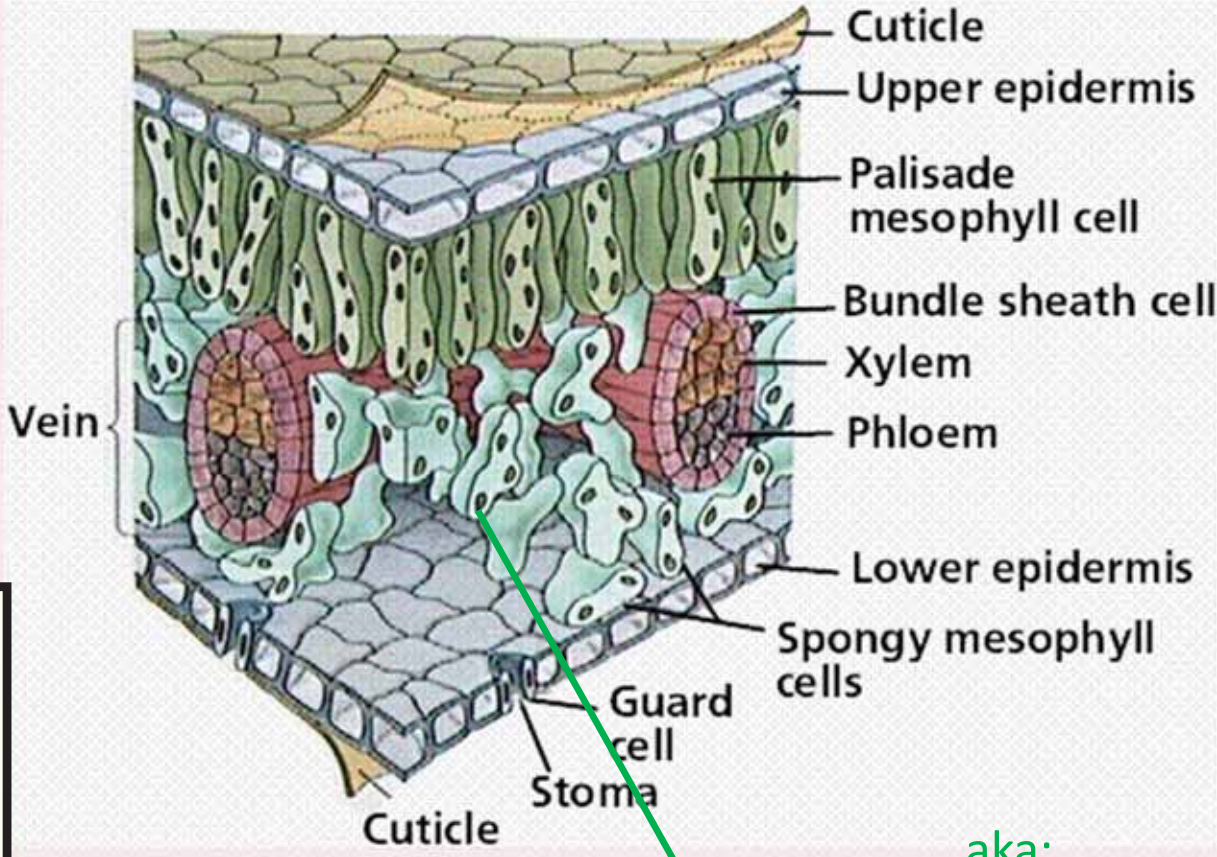

Leaf stalk or petiole
Leaf Axil
Leaf Margin
Main Vein
Lateral Vein

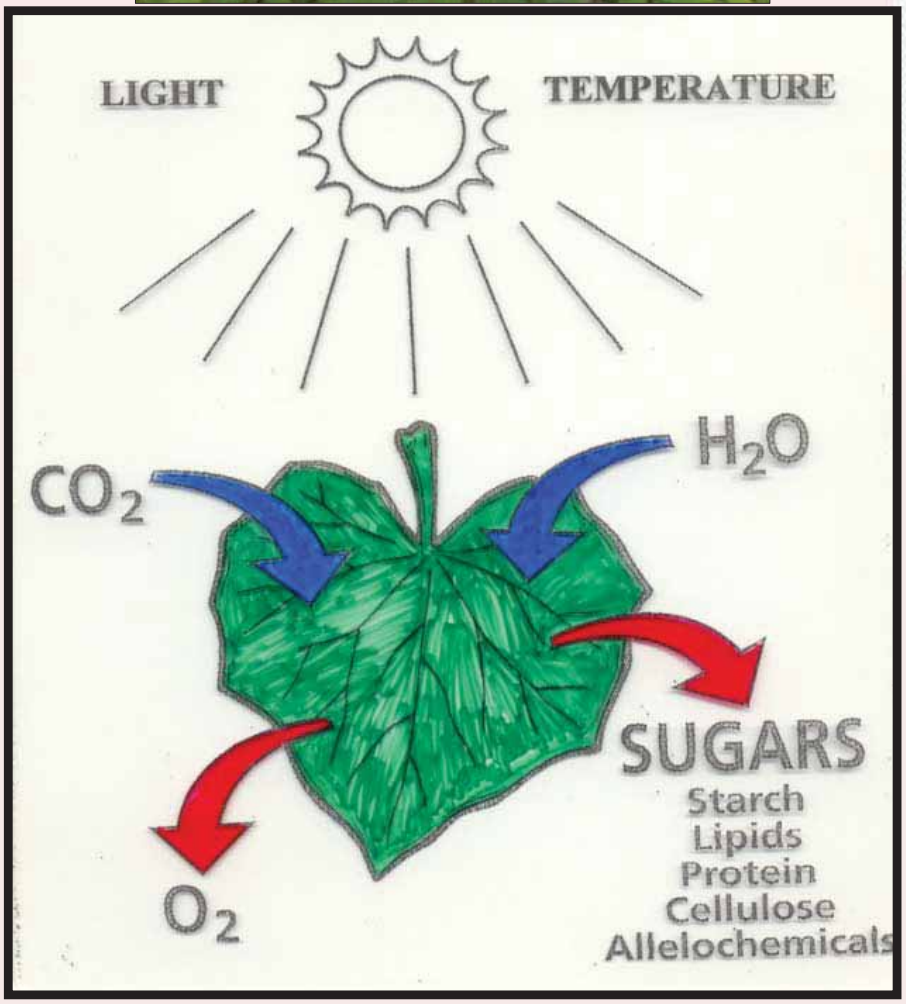

Compound leaf
Terminal leaflet
Leaflet (Pinna)
Terminal petiolule
Compound leaflet
Rachis
(Pinnula)
Petiole
Petiolule
Stem
Axillary bud
Node
Stipule


CONIFERS
scale-like
awl-like
linear
needle-like

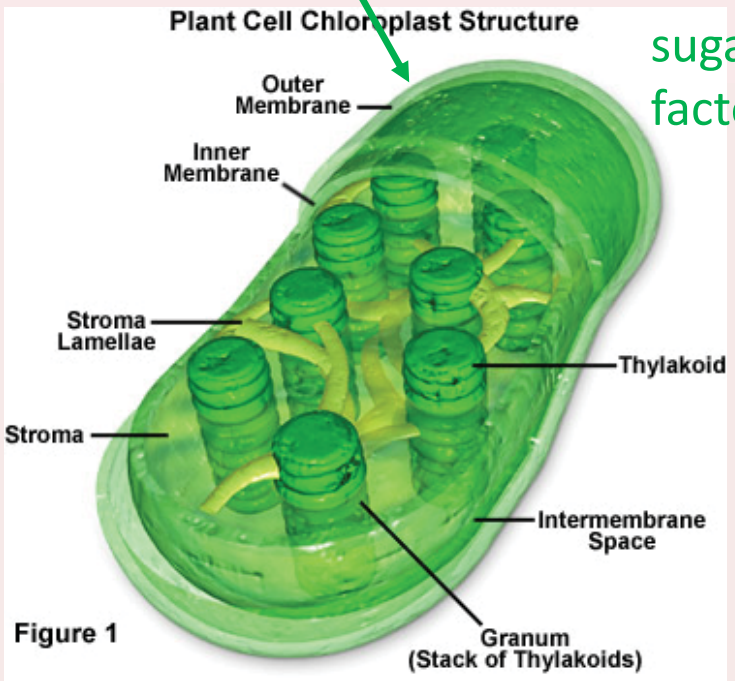
Leaf Cross Section

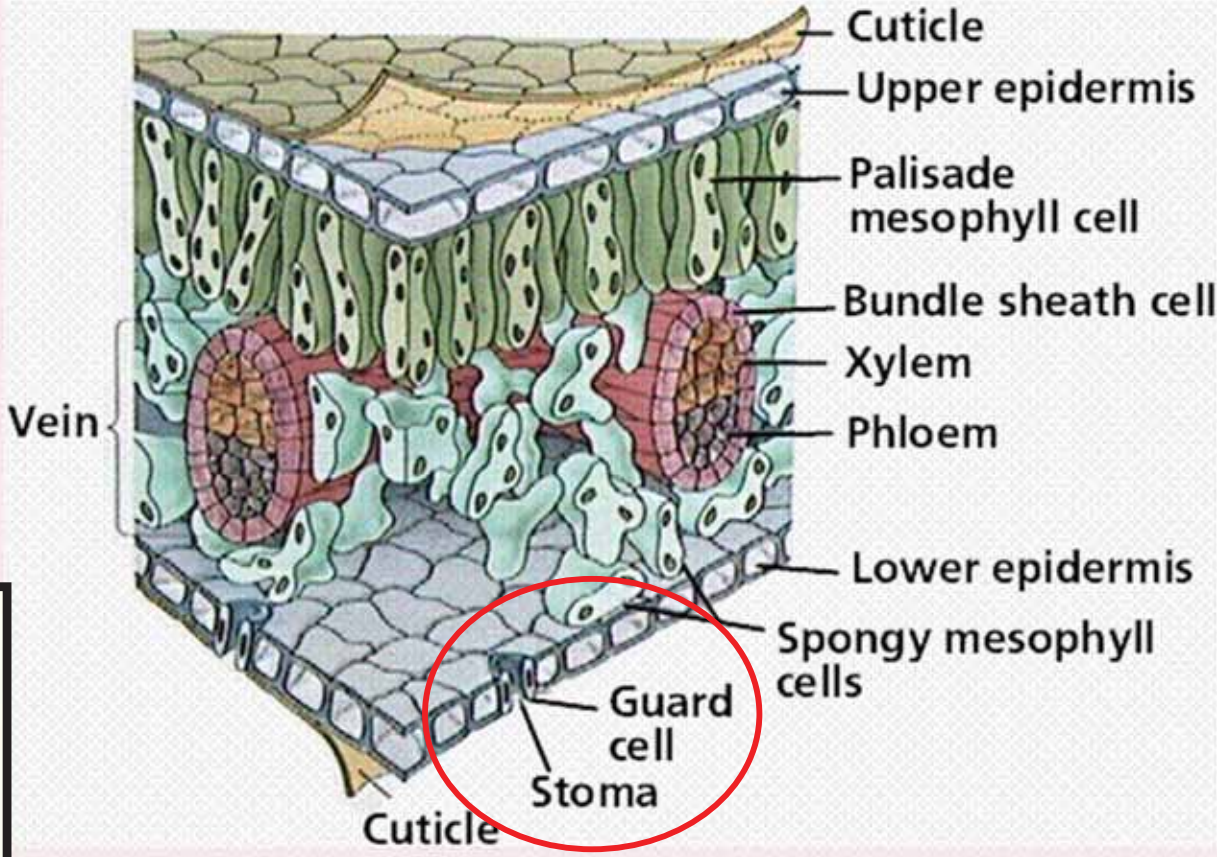


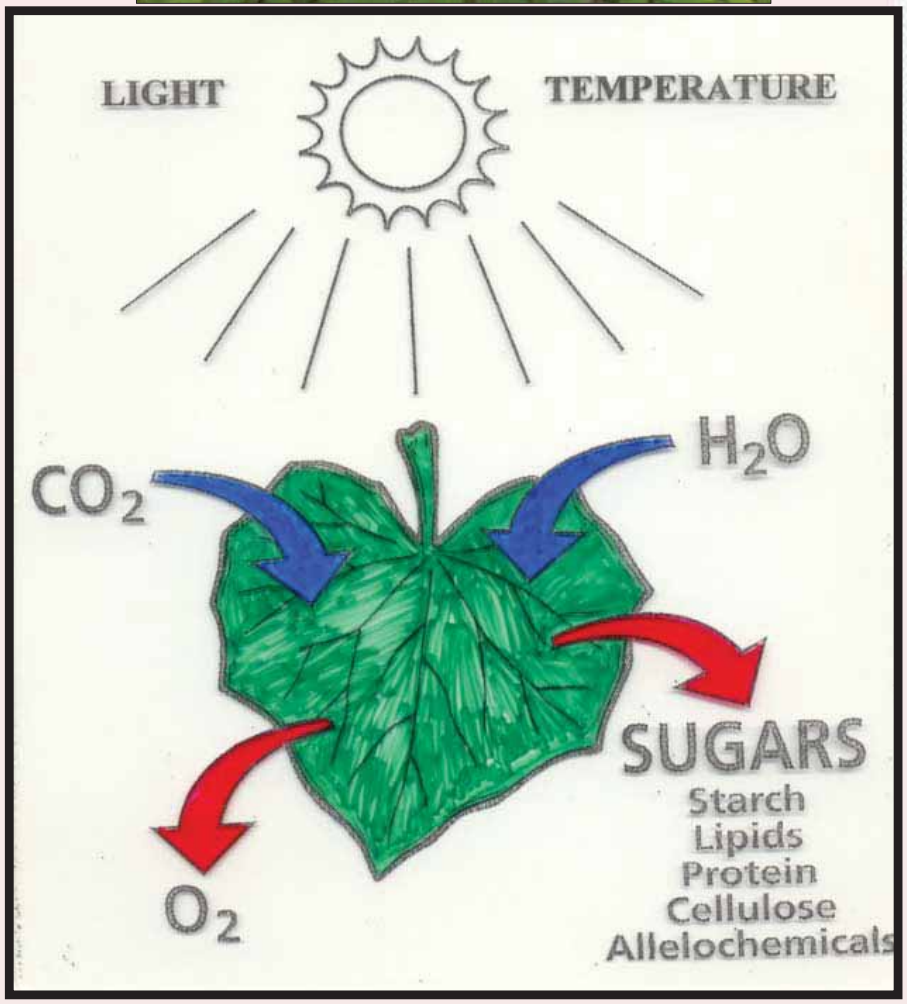


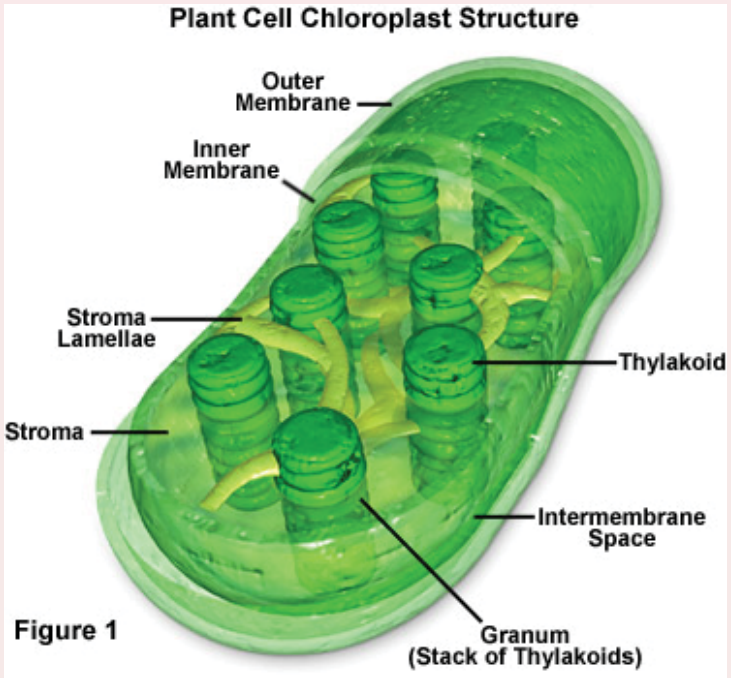


aka:
sugar
factory




Cuticle
Upper epidermis
Palisade mesophyll cell
Bundle sheath cell
Xylem
Phloem
Vein
Lower epidermis
Spongy mesophyll cells
Guard cell
Stoma
Cuticle


LIGHT
TEMPERATURE
CO_2
H_2O
O_2
SUGARS
Starch
Lipids
Protein
Cellulose
Allelochemicals


Plant Cell Chloroplast Structure
Outer Membrane
Inner Membrane
Stroma Lamellae
Thylakoid
Stroma
Intermembrane Space
Granum (Stack of Thylakoids)
Figure 1

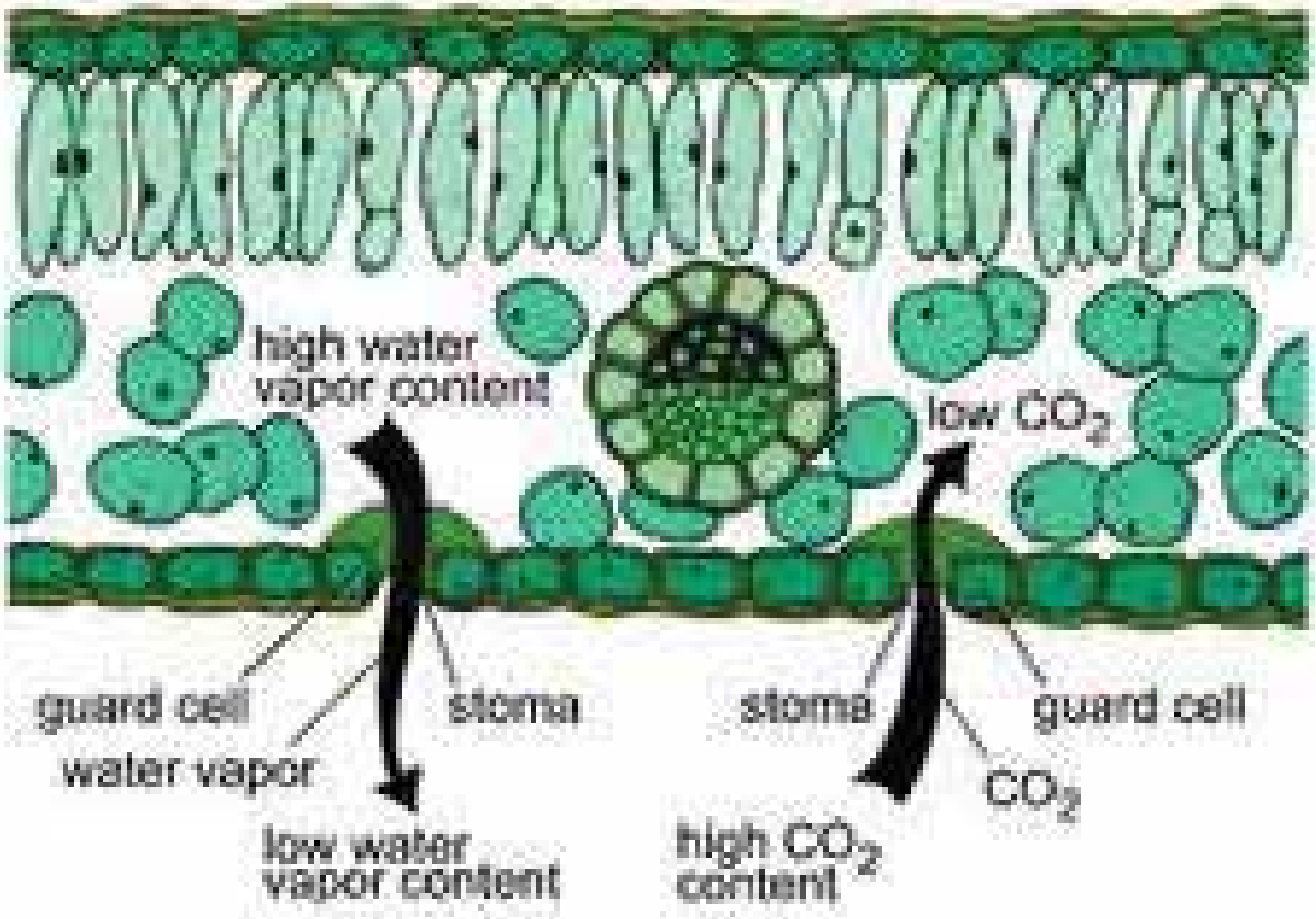
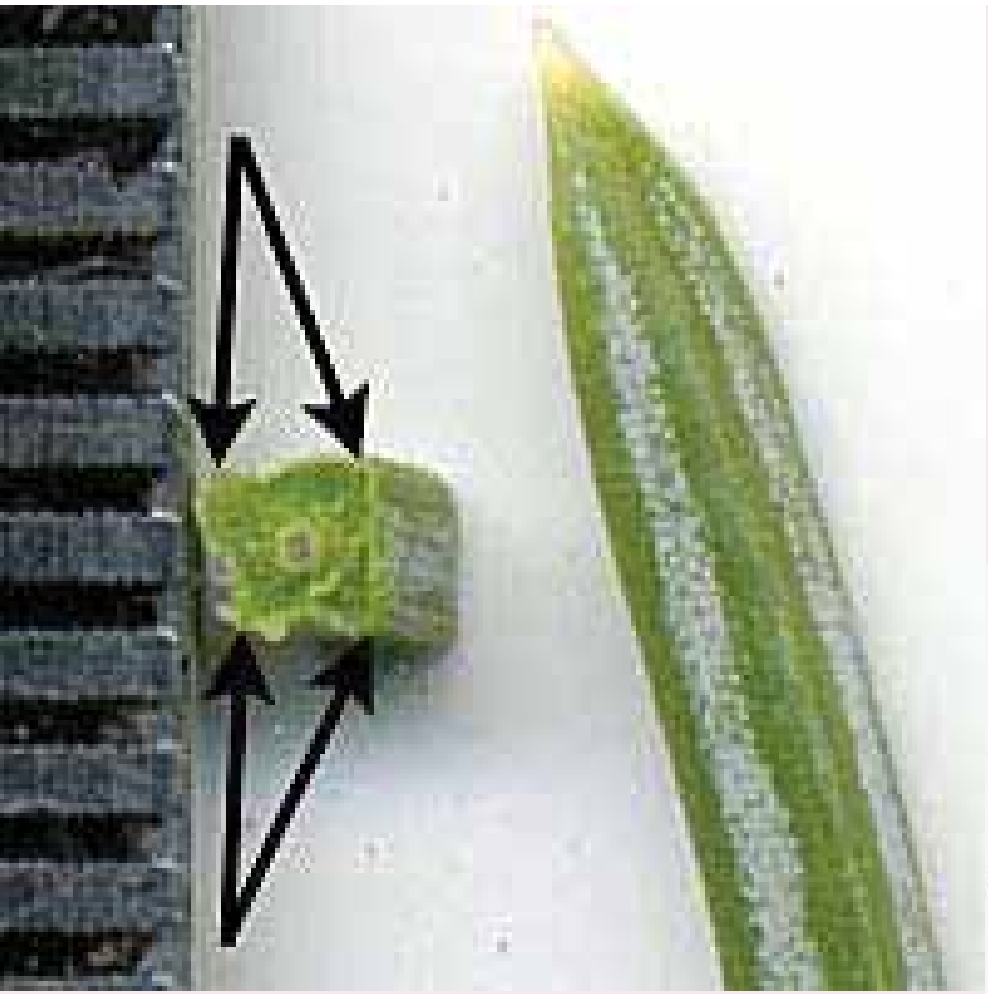
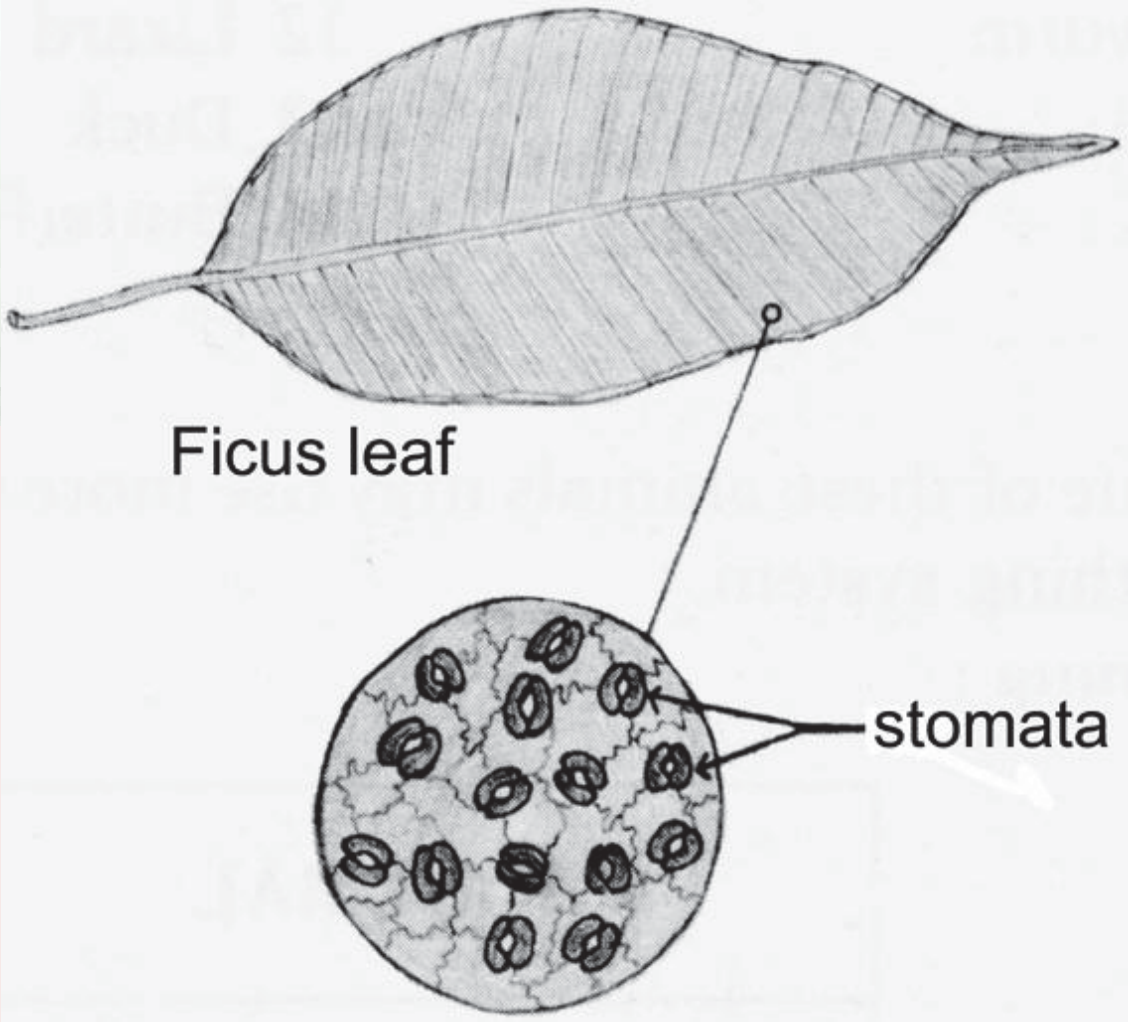


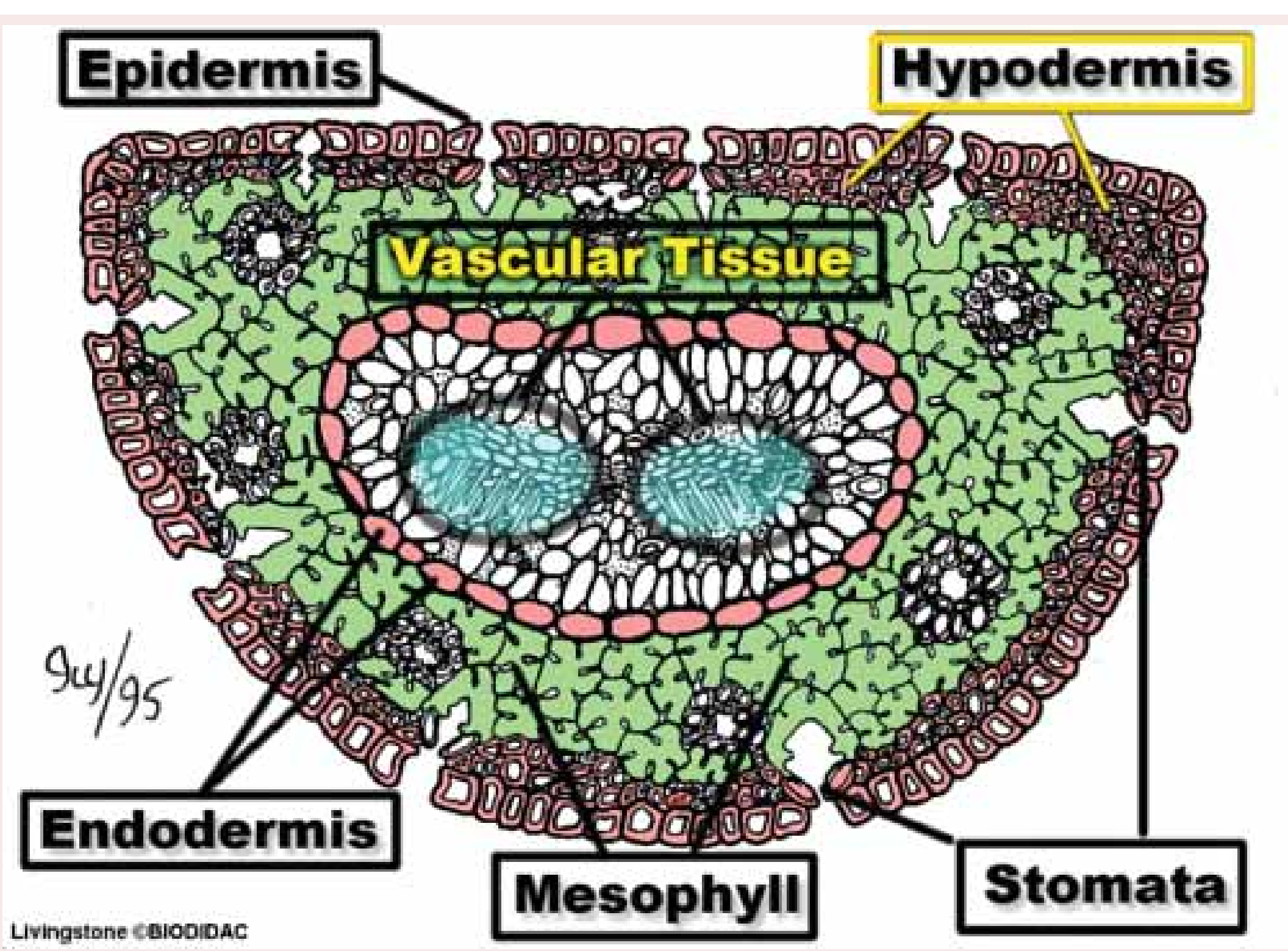
Figure 25. Stomata open to allow carbon dioxide (CO_2) to enter a leaf and water vapor to leave.



Strictly speaking, the stomates (aka, stomata or stoma) are the openings and the two cells around the openings are called the guard cells. Often, though, the word ‘stomates’ (or stoma or stomata) is used to refer to both together – the stomate and the pair of guard cells.



Leaf stomates often shut down on a hot day to avoid moisture stress.
It is one reason why a tree has leaves in the interior of its crown


Epidermis
Hypodermis
Vascular Tissue
9/4/95
Endodermis
Mesophyll
Stomata
Livingstone ©BIODIDAC

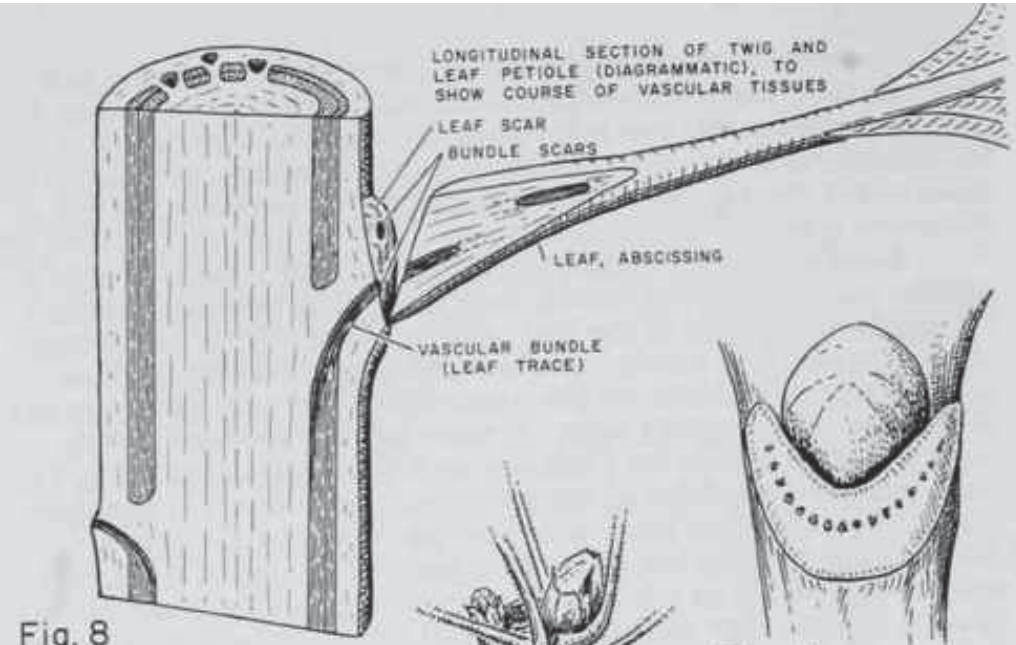


Fig. 8

Fig. 11
LEAF SCAR OF ASH

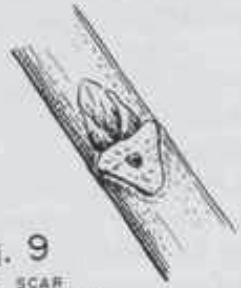


Fig. 9
LEAF SCAR OF PRIVET

Fig. 14
SPUR SHOOT OF APPLE

Fig. 12
LEAF SCAR OF OAK

Fig. 10
LEAF SCAR OF MAPLE

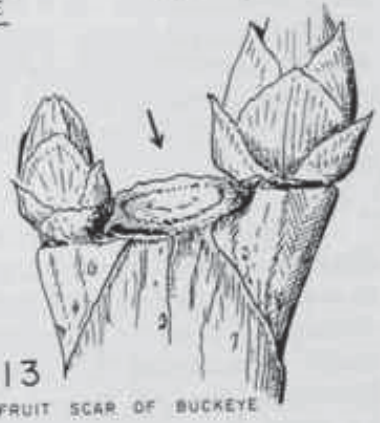
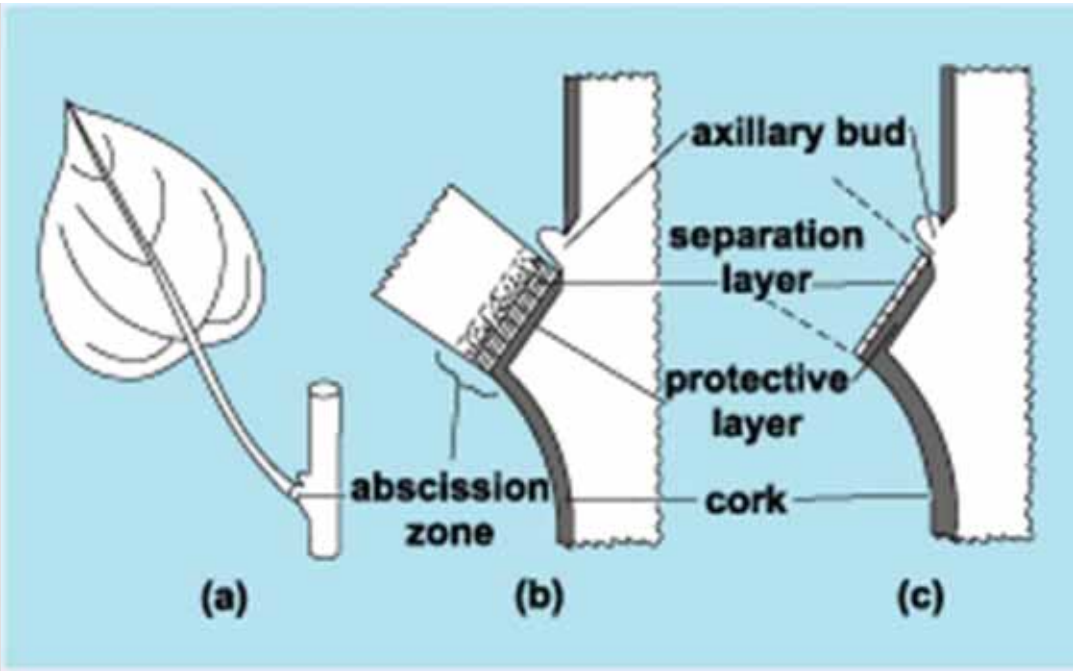
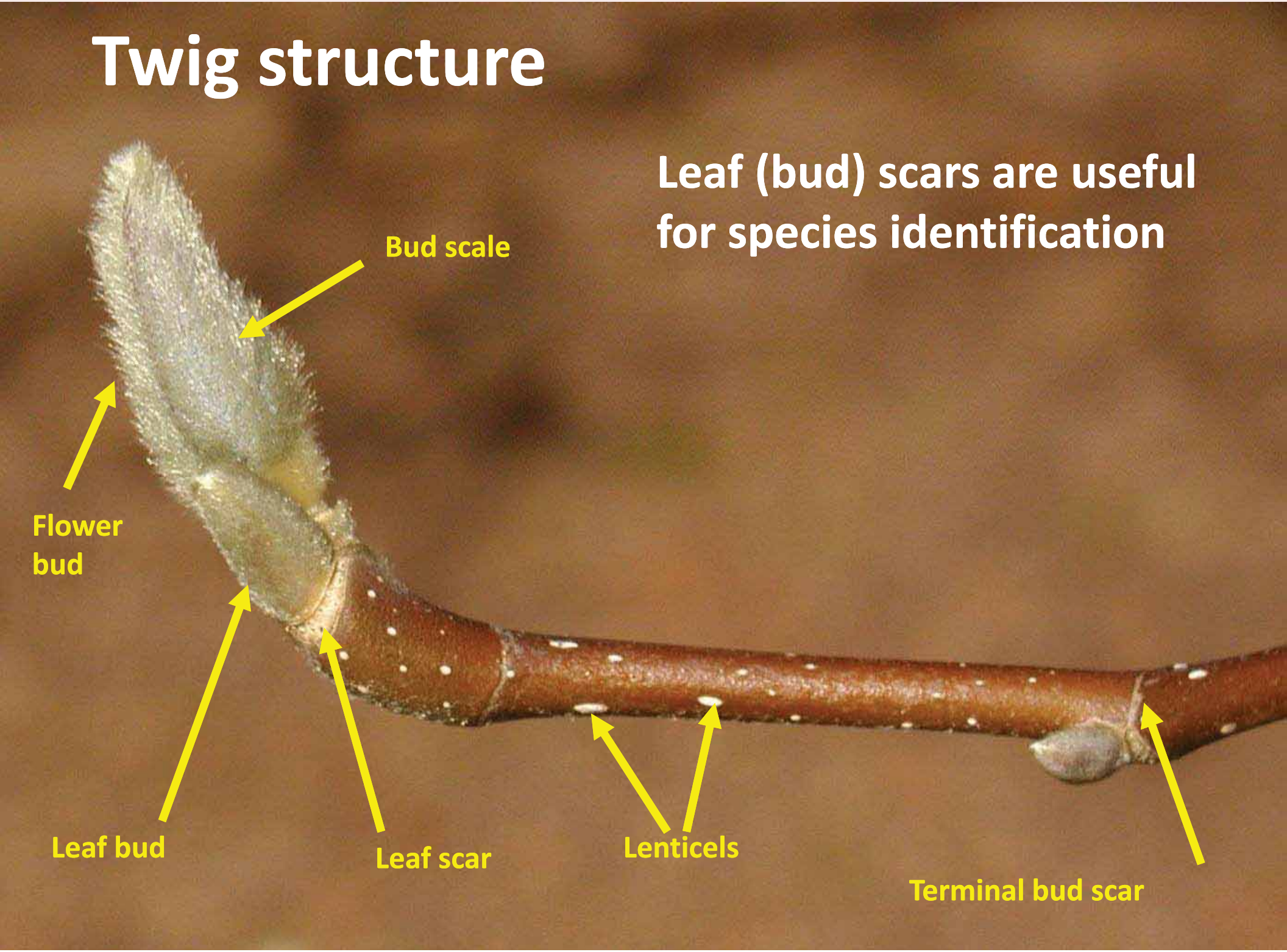
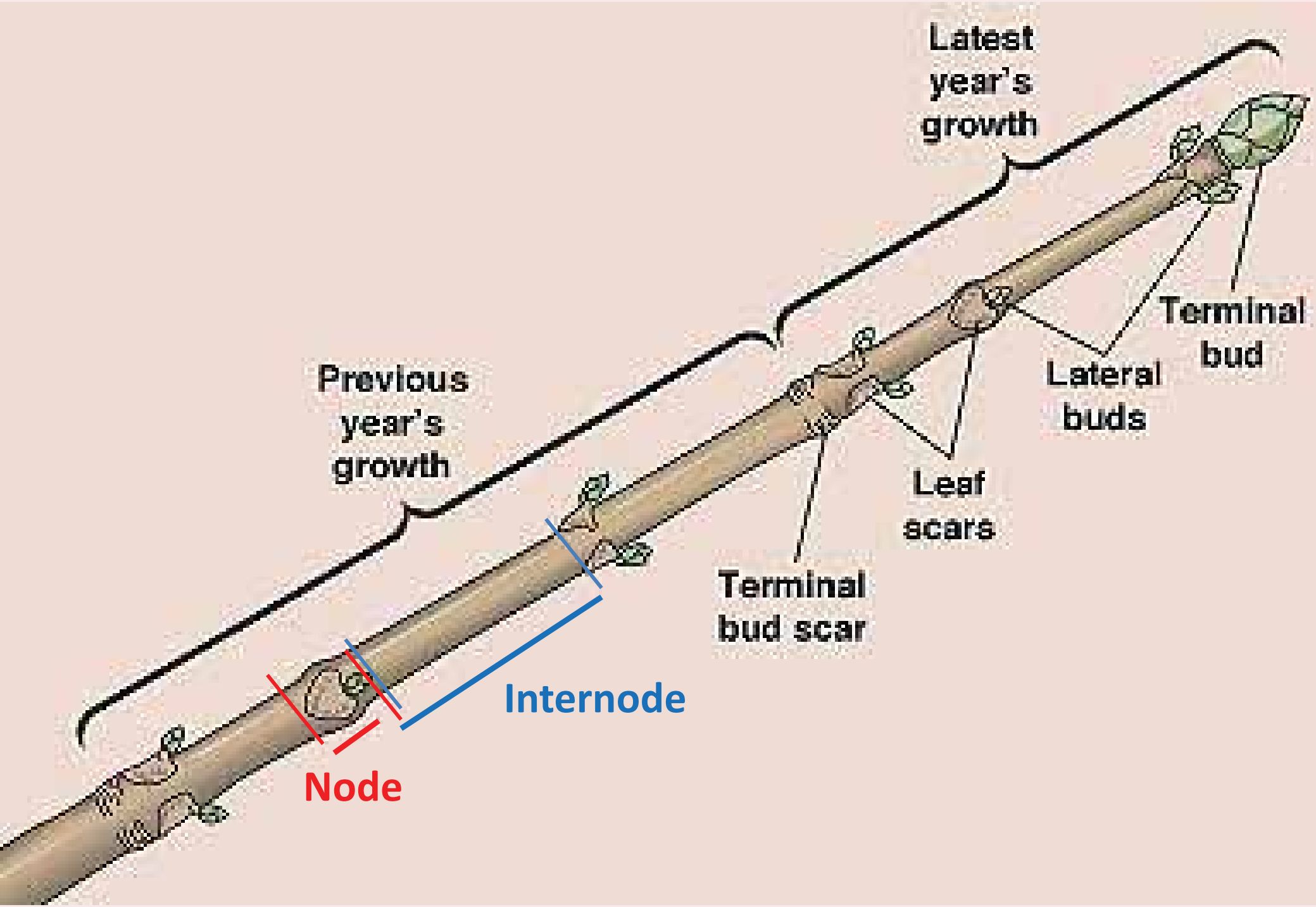


Fig. 13
FRUIT SCAR OF BUCKEYE

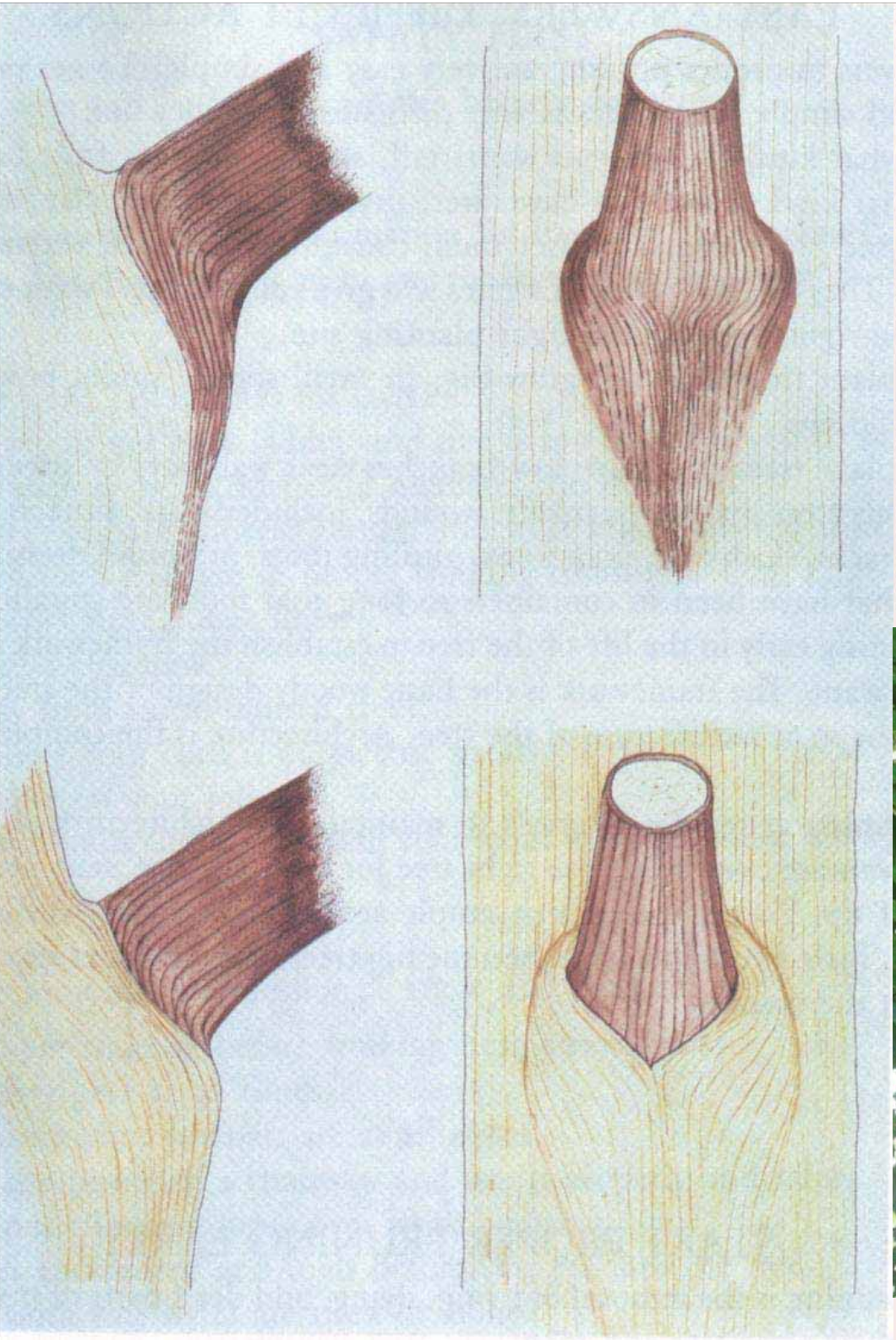


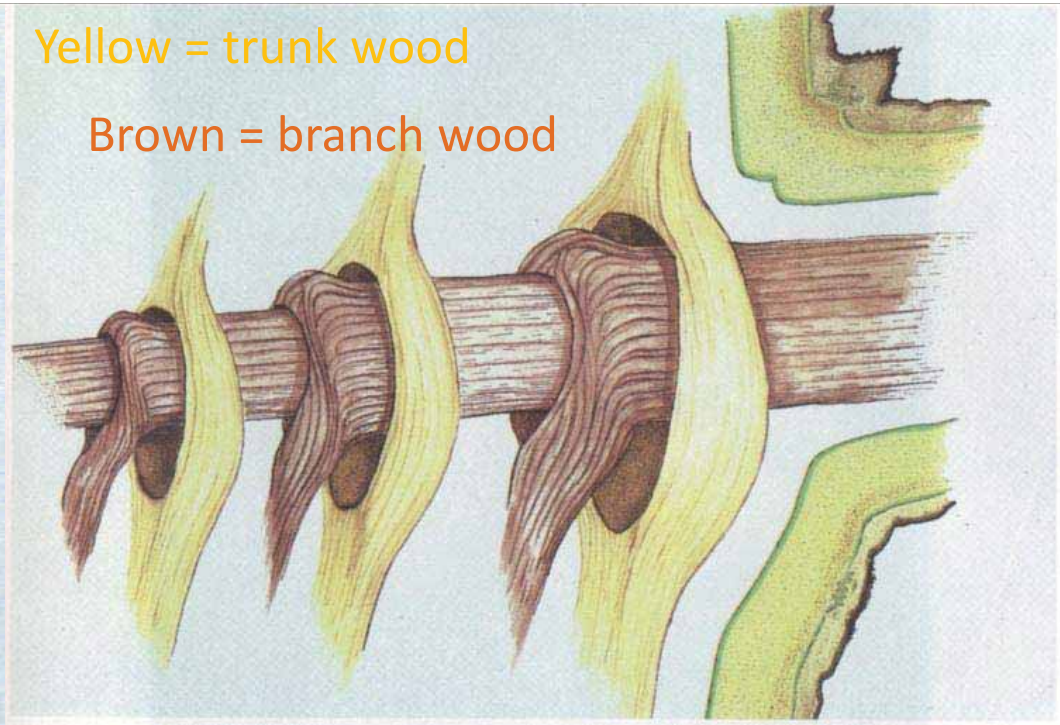
Twig structure

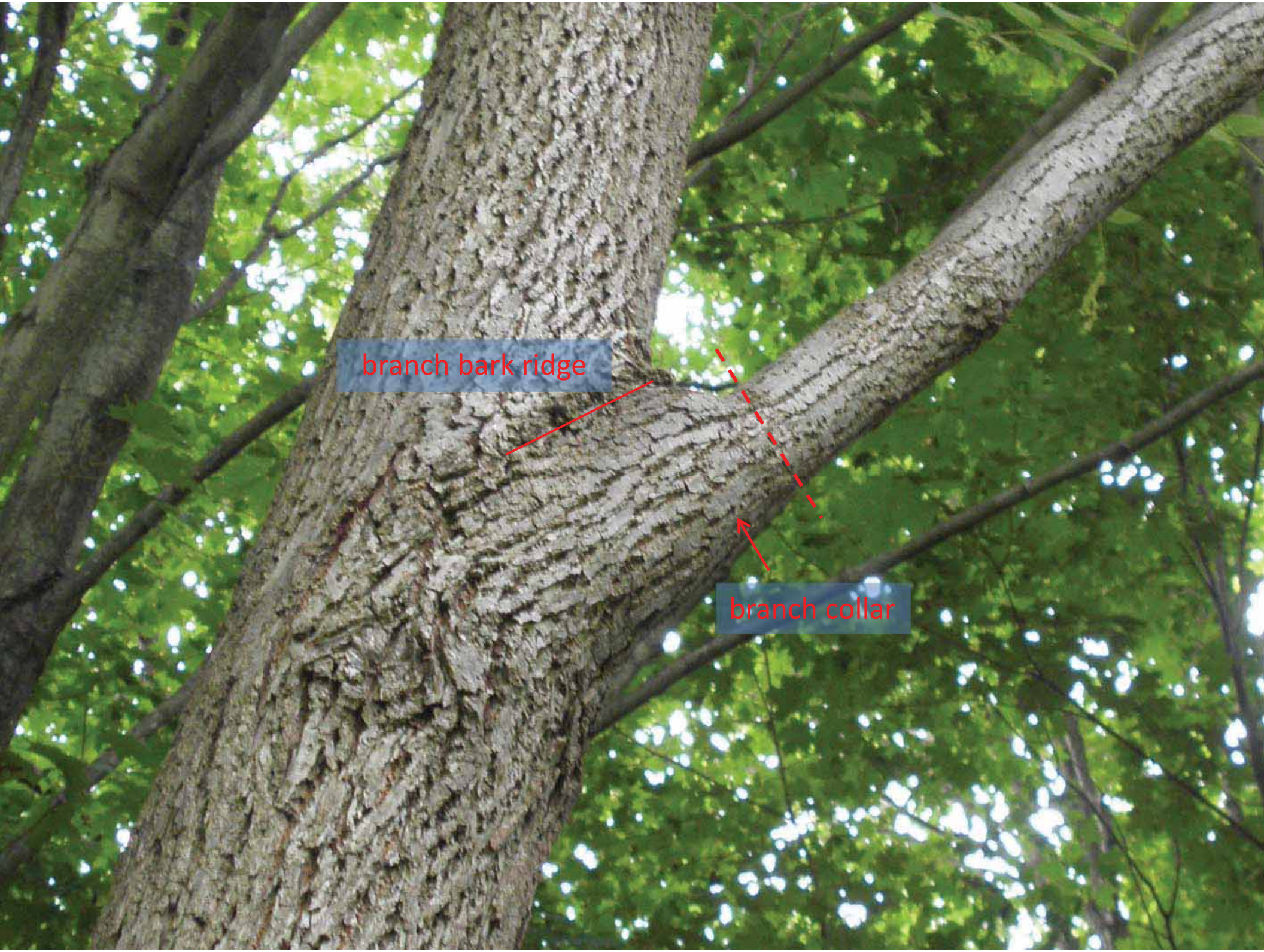



Latest year's growth
Terminal bud
Lateral buds
Leaf scars
Terminal bud scar
Previous year's growth
Internode
Node

Sculpture by Artist Giuseppe Penone

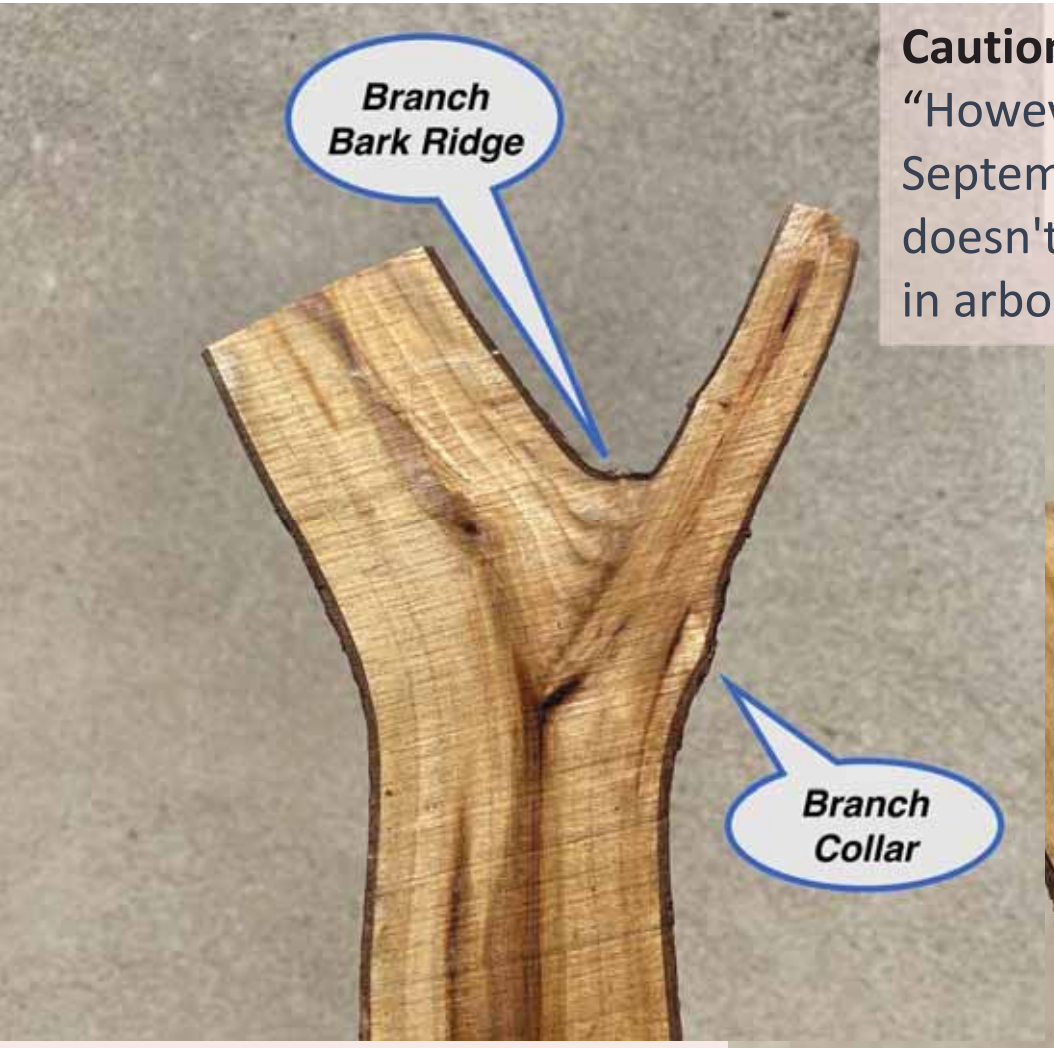



Yellow = trunk wood
Brown = branch wood

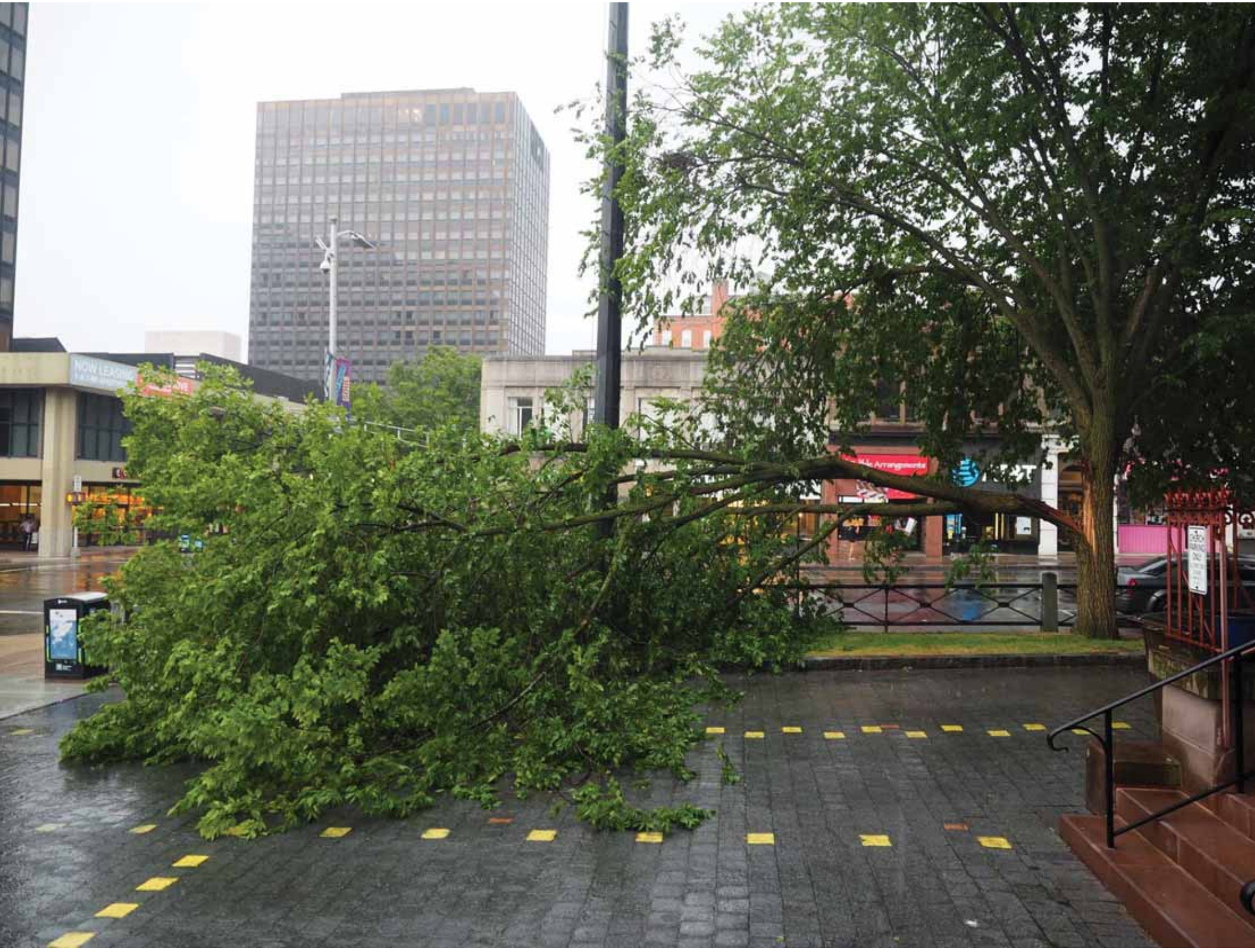

branch bark ridge
branch collar

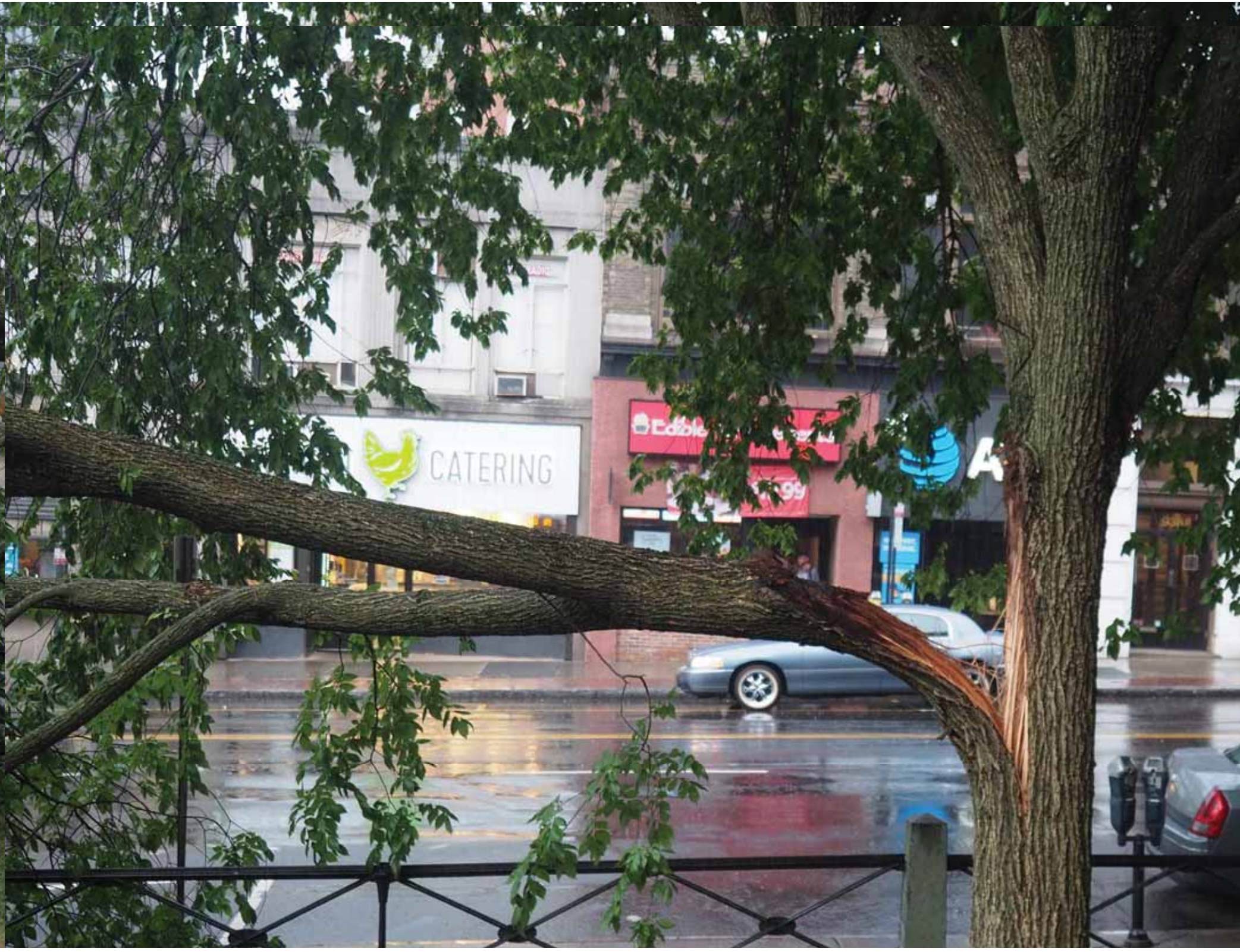
Caution – from Chat GPT:

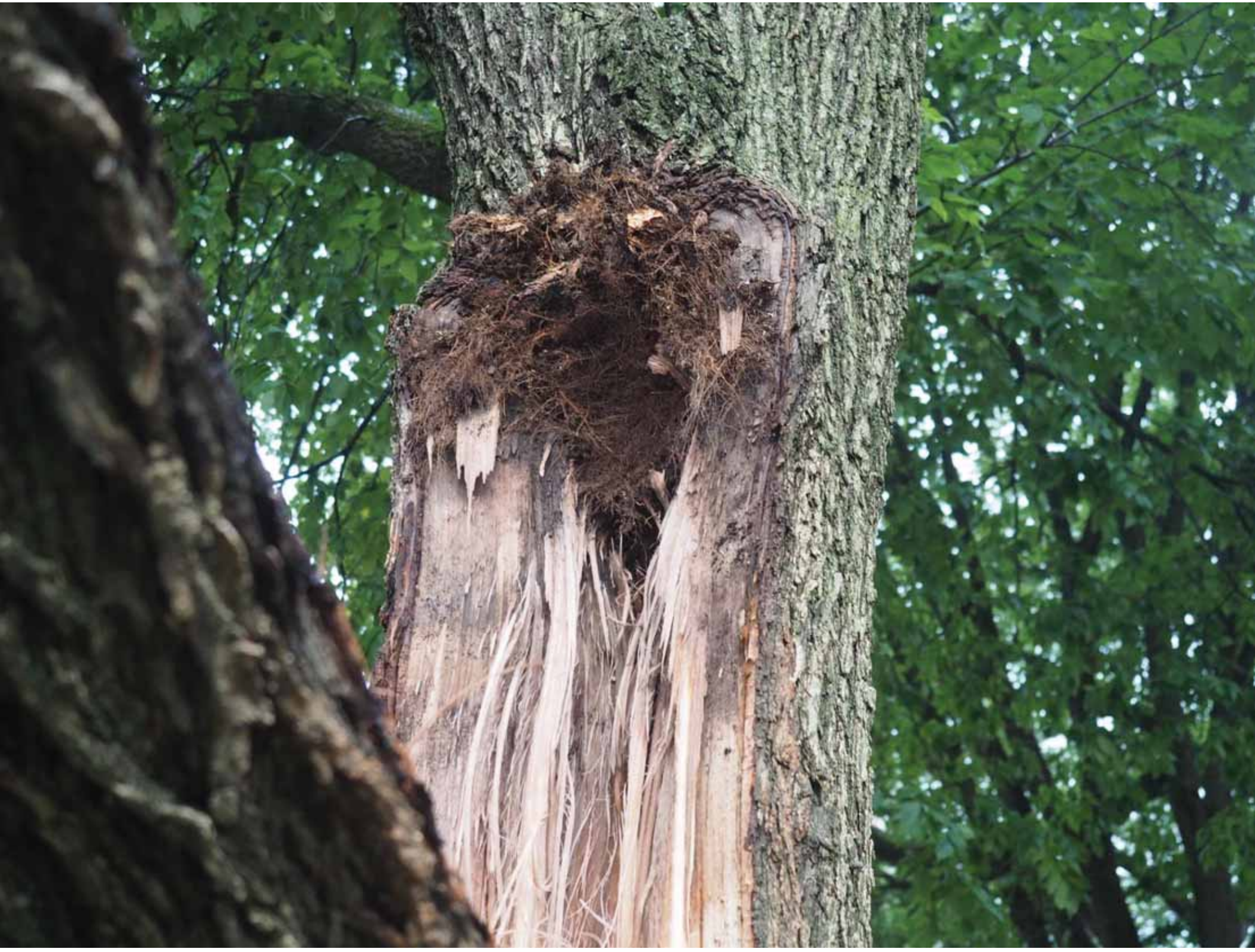
"However, as of my last knowledge update in September 2021, the term "branch protection zone" doesn't have a standard or widely recognized meaning in arboriculture or tree biology."



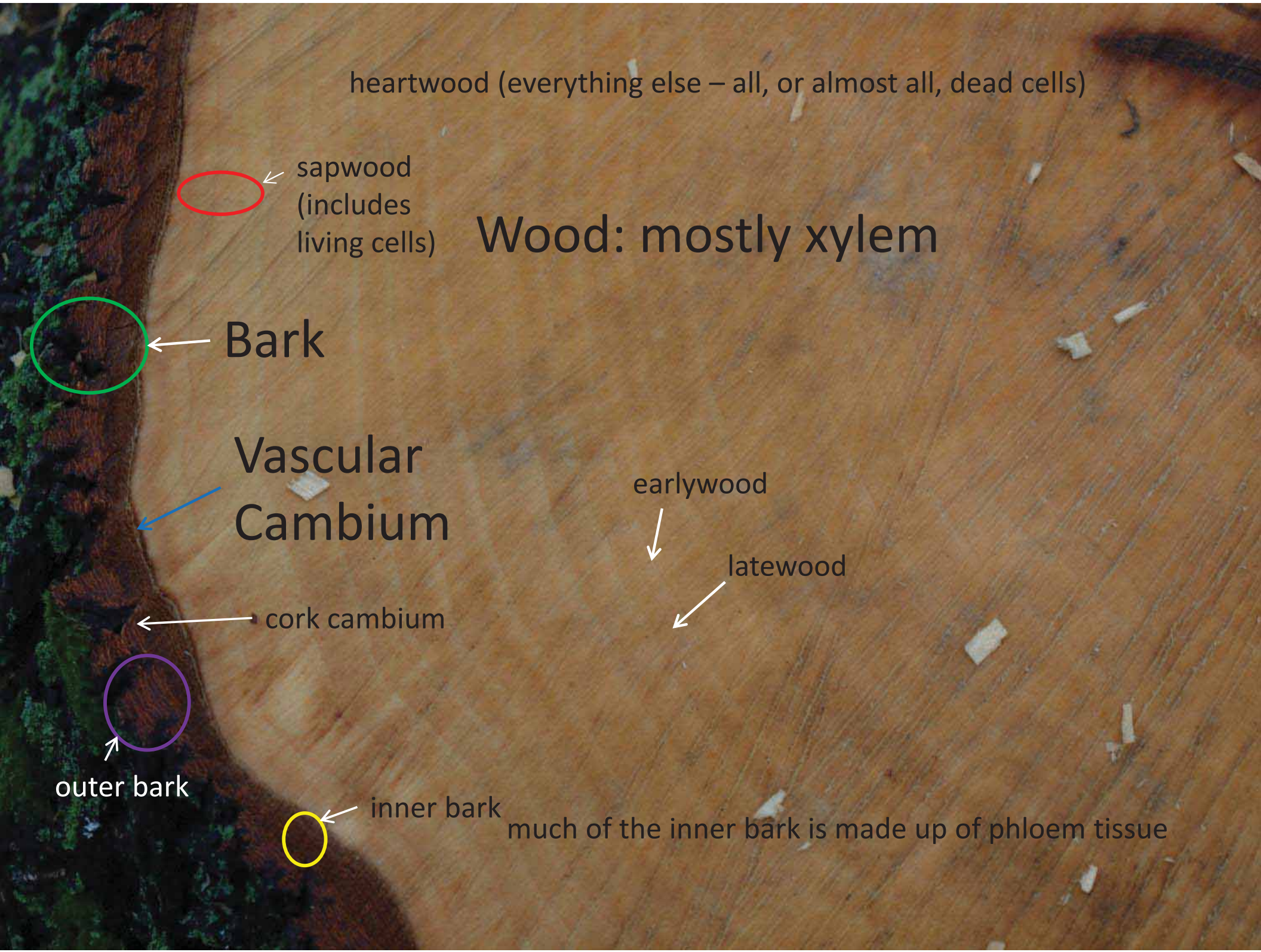
The **Branch Protection Zone** is described as a mixture of structural and chemical elements that serve as barriers to the spread of decay into the tree. This zone is better developed in situations in which the branch is small relative to the trunk.

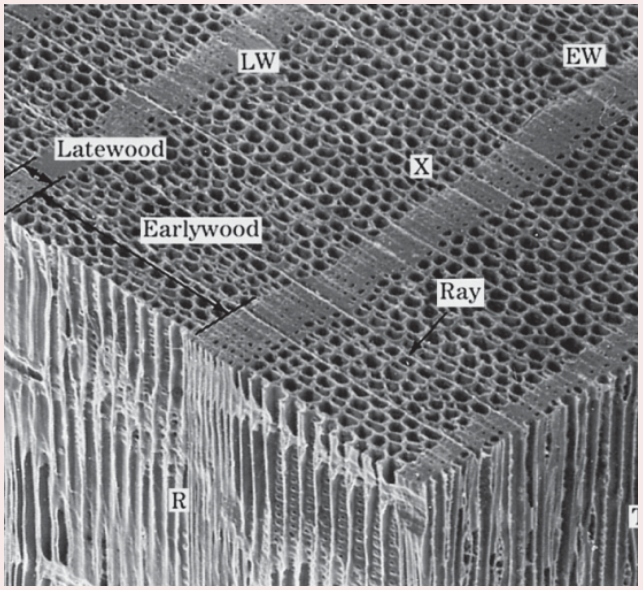


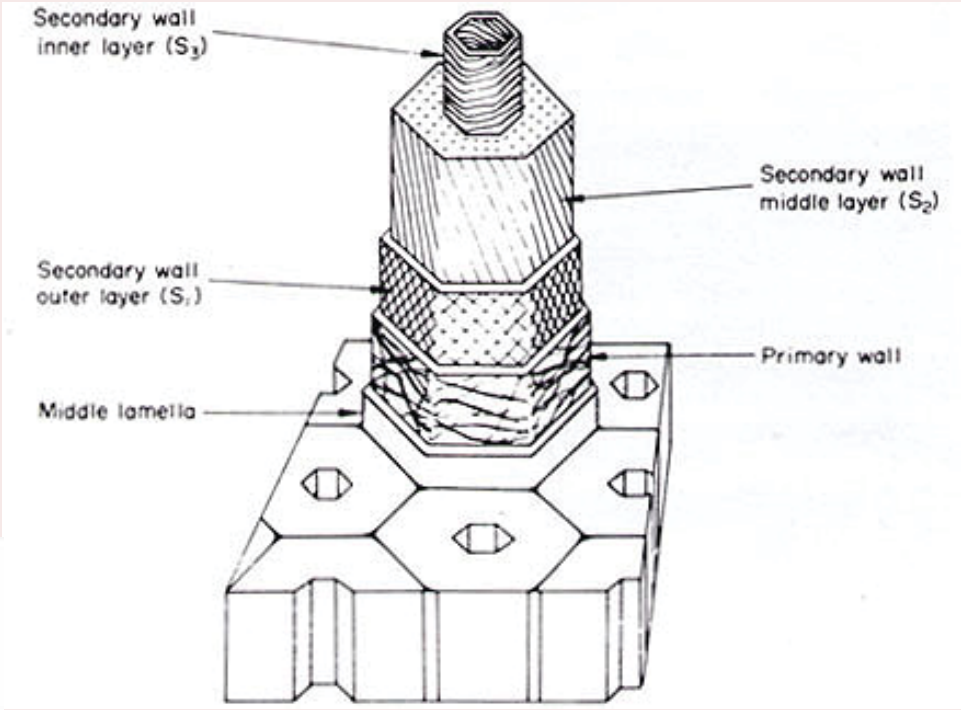

CATERING







heartwood (everything else – all, or almost all, dead cells)
sapwood (includes living cells)
Wood: mostly xylem
Bark
Vascular Cambium
earlywood
latewood
cork cambium
outer bark
inner bark
much of the inner bark is made up of phloem tissue





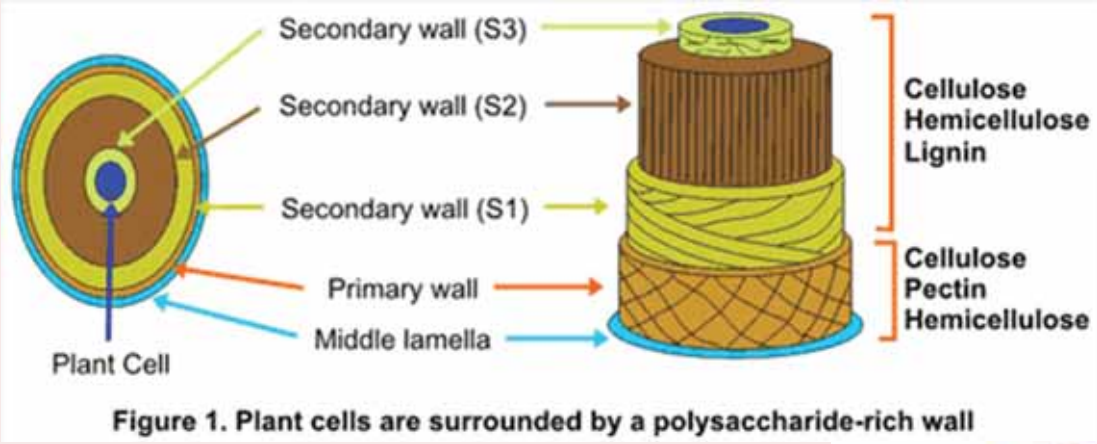
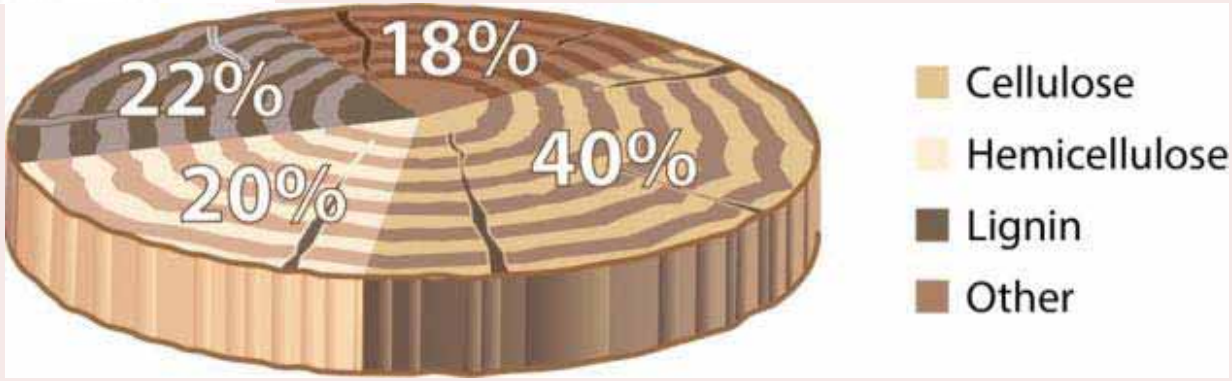
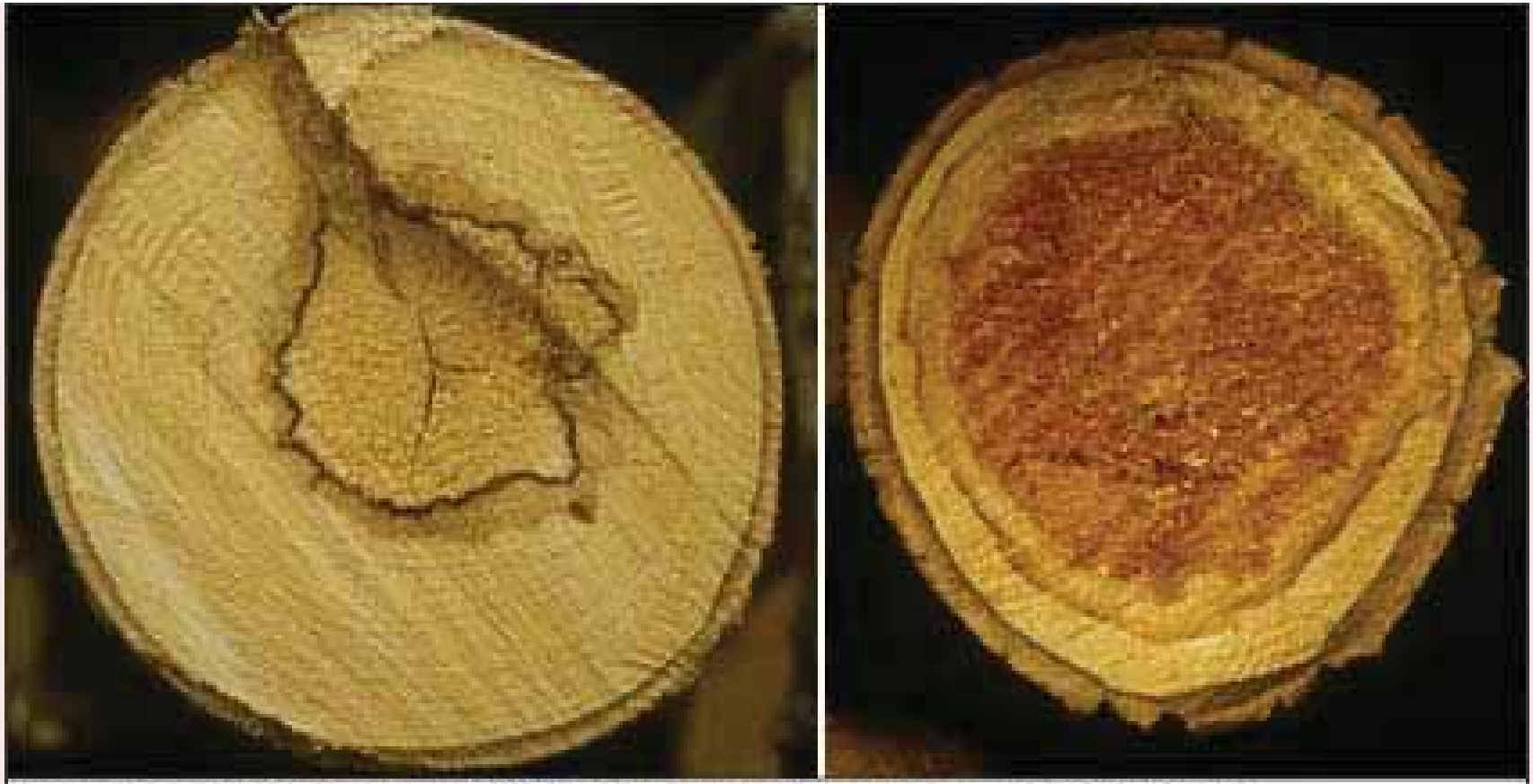


Figure 1. Plant cells are surrounded by a polysaccharide-rich wall

Lignin = stack of bricks
Cellulose = length of rope
Hemicellulose and Pectins = glue





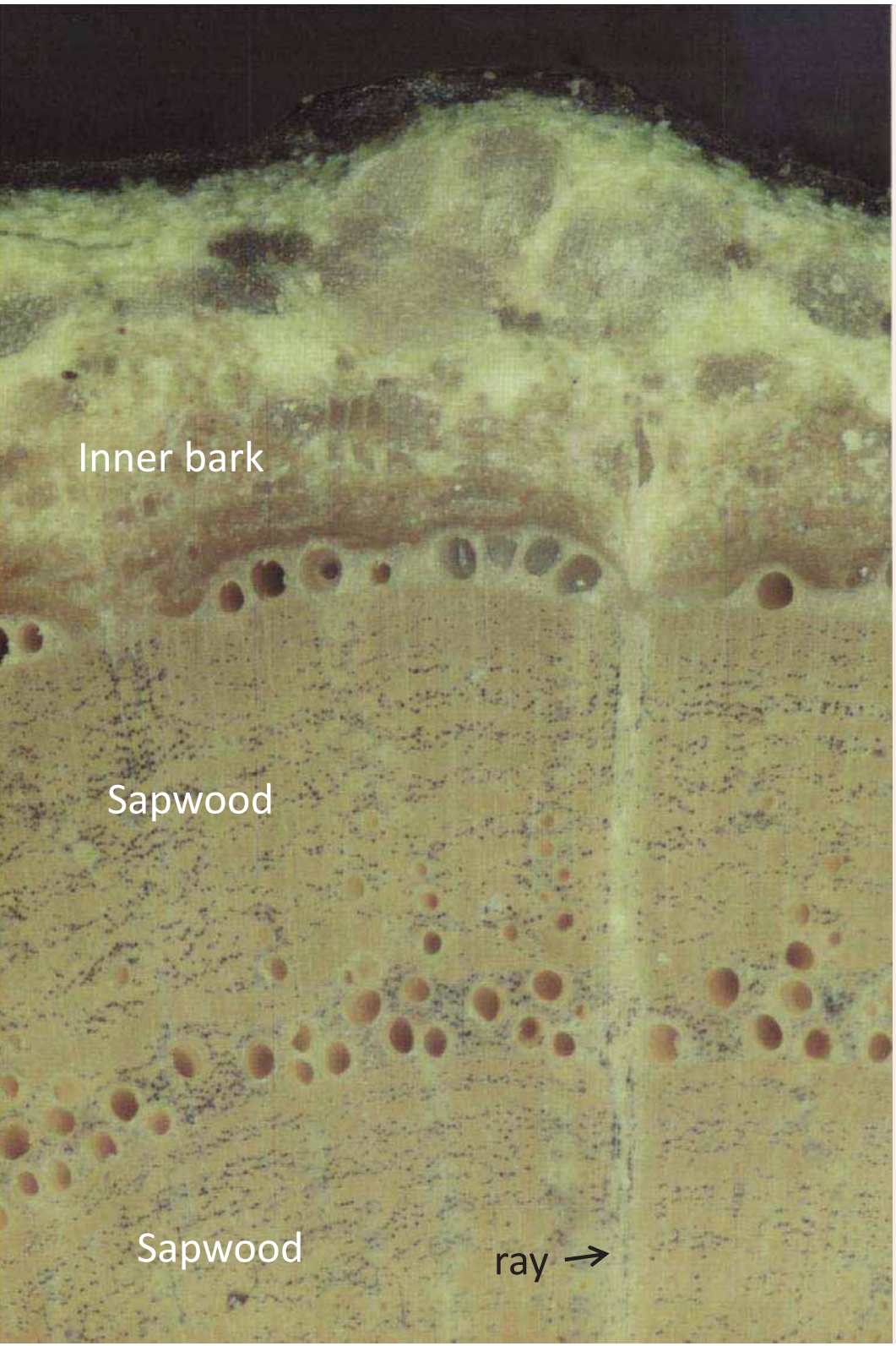
White rot in aspen (left) and brown rot in oak (right)

Photo © Mel Baughman

White rots degrade lignins or lignins and cellulose and leave light-colored, stringy decayed wood.

Brown rots degrade cellulose and tend to leave brown, blocky cubes behind.

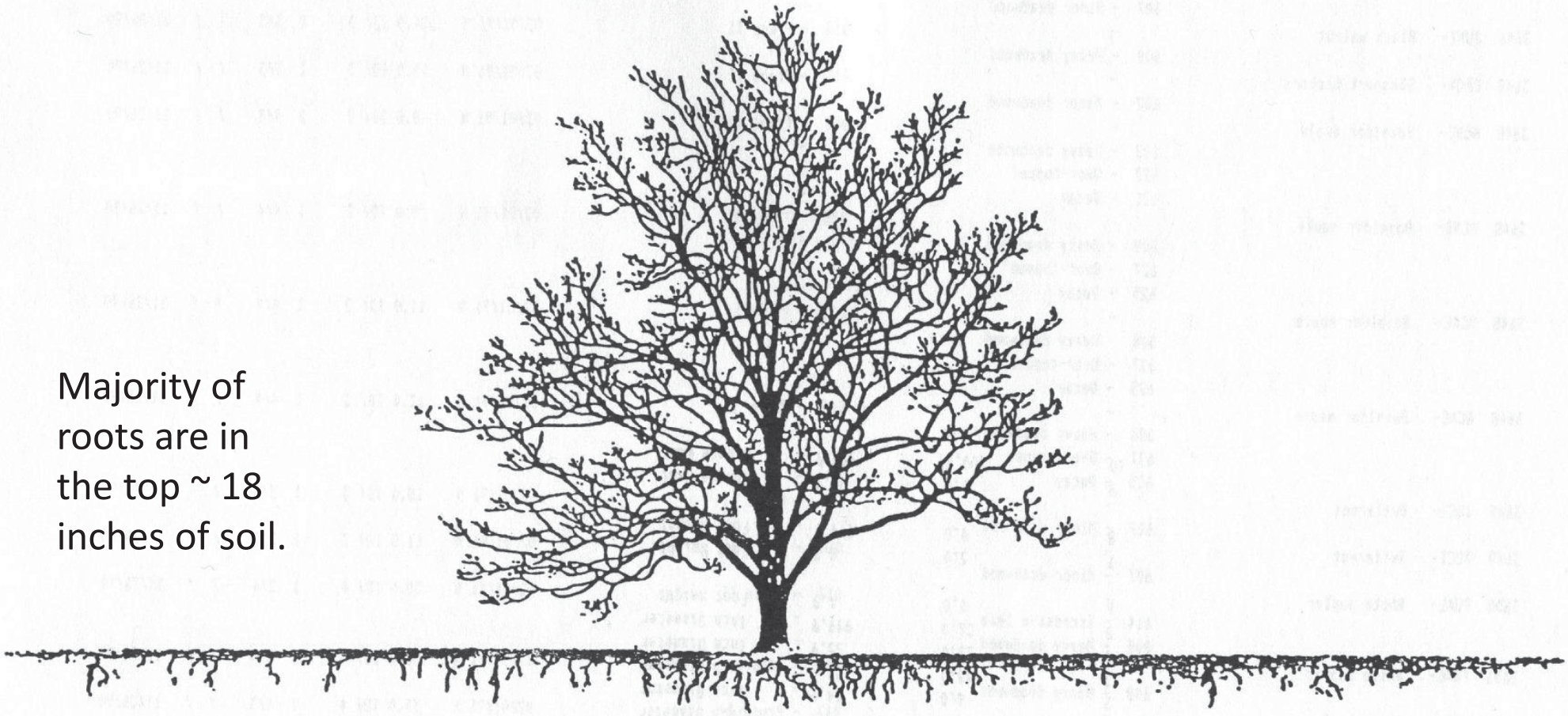

rays



This photo by Alex Shigo shows a section of red oak that has been treated with iodine. The black specks that you see throughout the wood are starches – iodine turns starches black or dark blue.

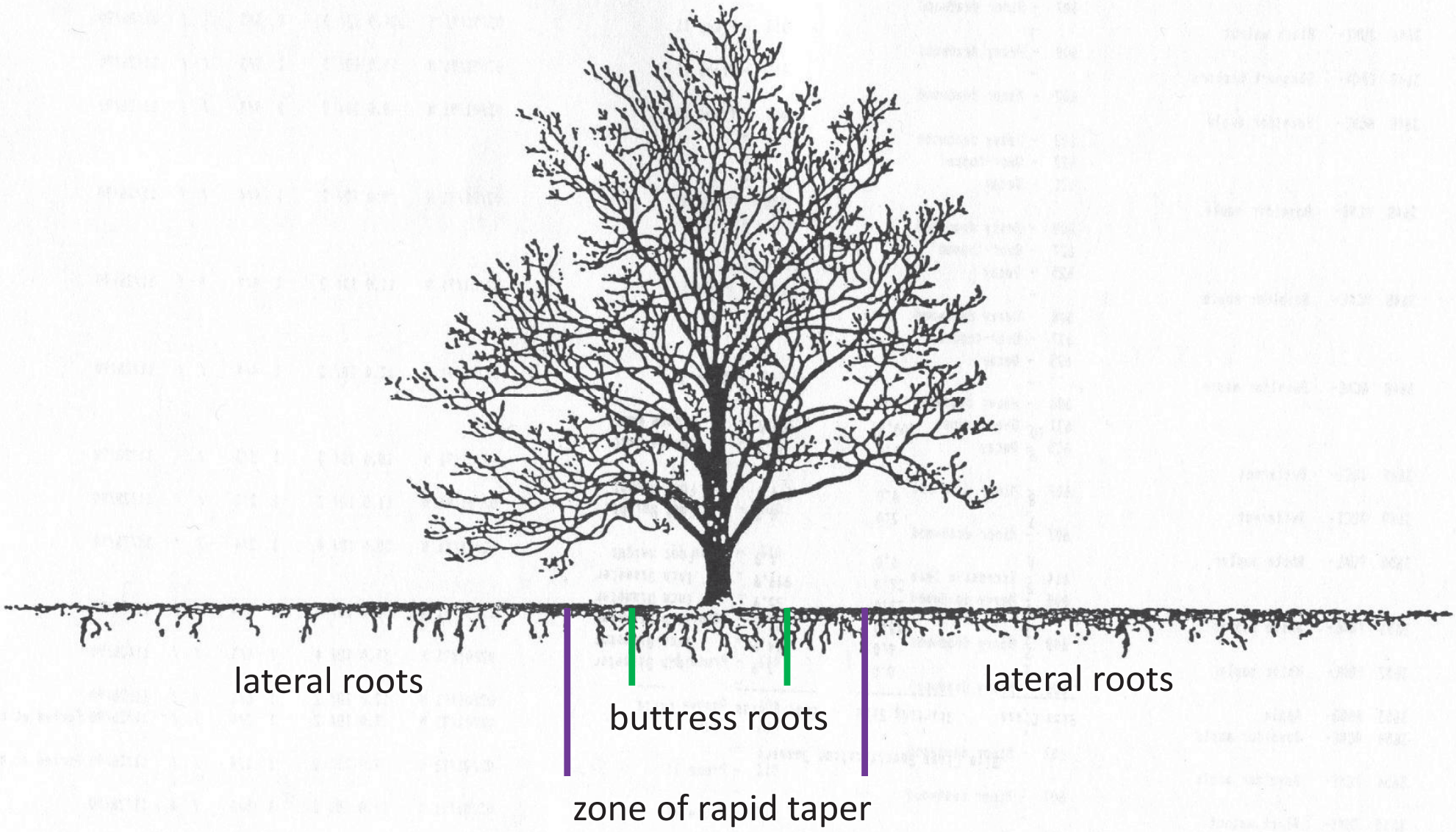
This is another major function of wood – it helps store the food supply of the tree – starches and fats (oils). The ray cells aid with transportation within the living part of the wood.

Majority of roots are in the top ~ 18 inches of soil.

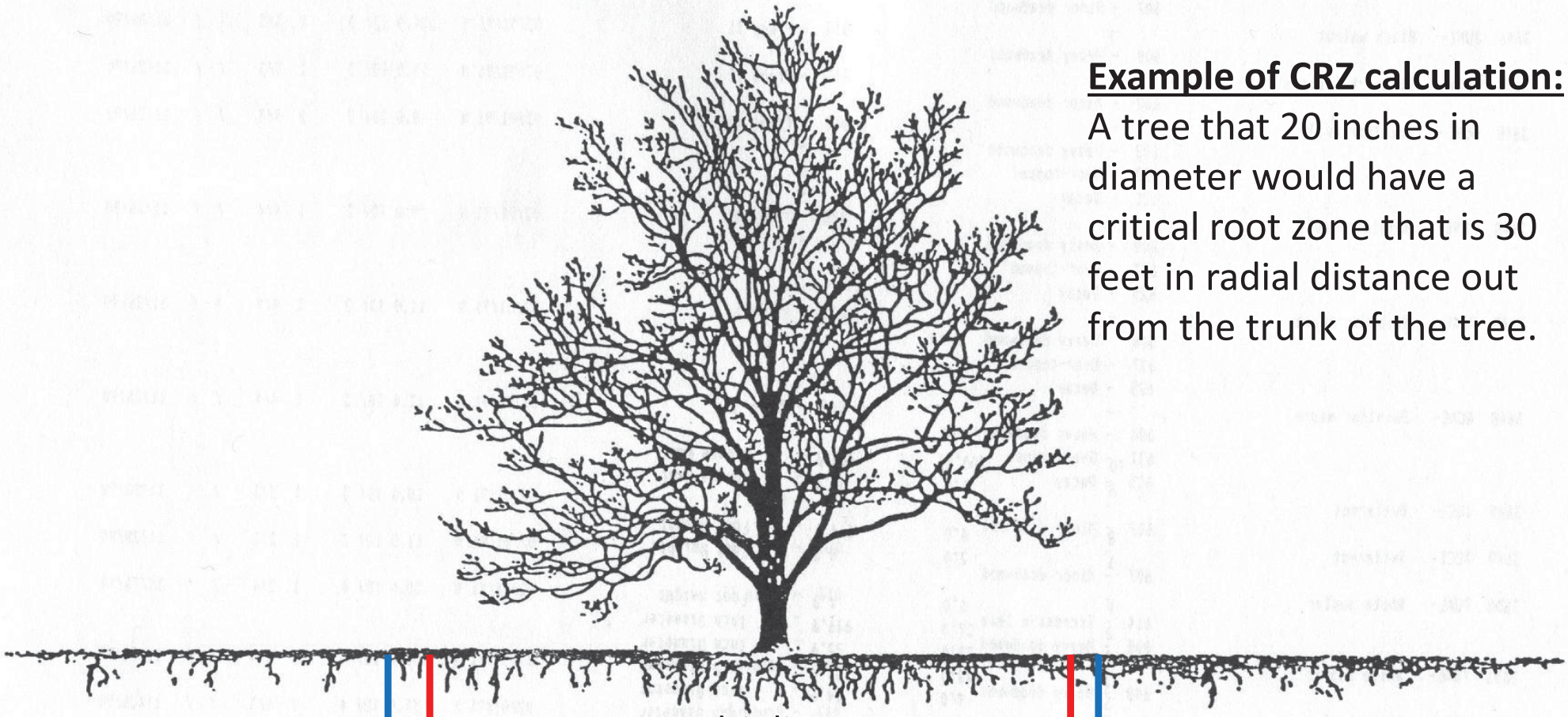


Occasional “sinker roots” penetrate deeper into the soil

The Root Plate



The Root Plate



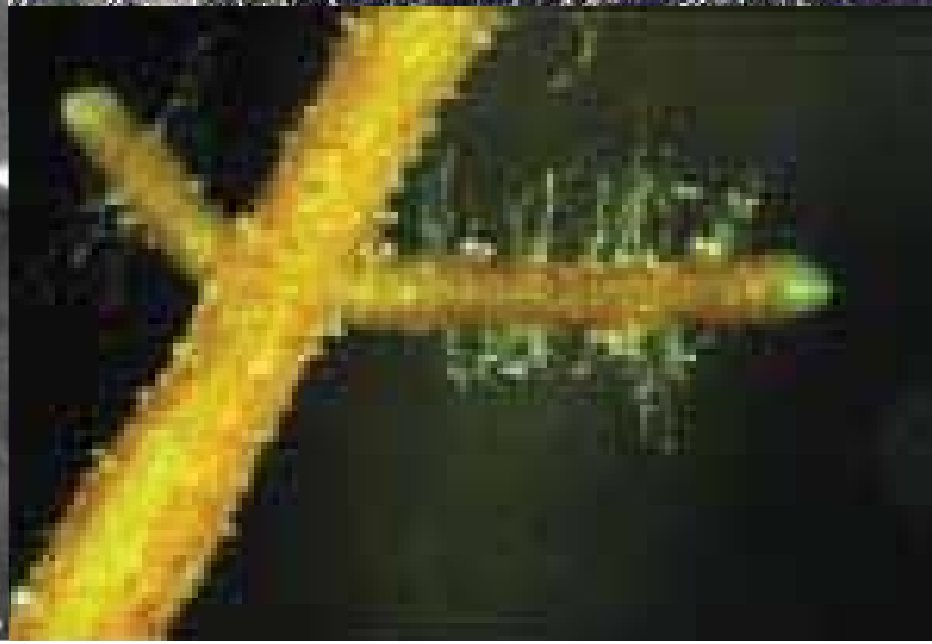
Example of CRZ calculation:

A tree that 20 inches in diameter would have a critical root zone that is 30 feet in radial distance out from the trunk of the tree.

dripline

critical root zone:
1.5 times the dbh, but dbh as if it were feet and not inches and is in radial distance..

The Root Plate



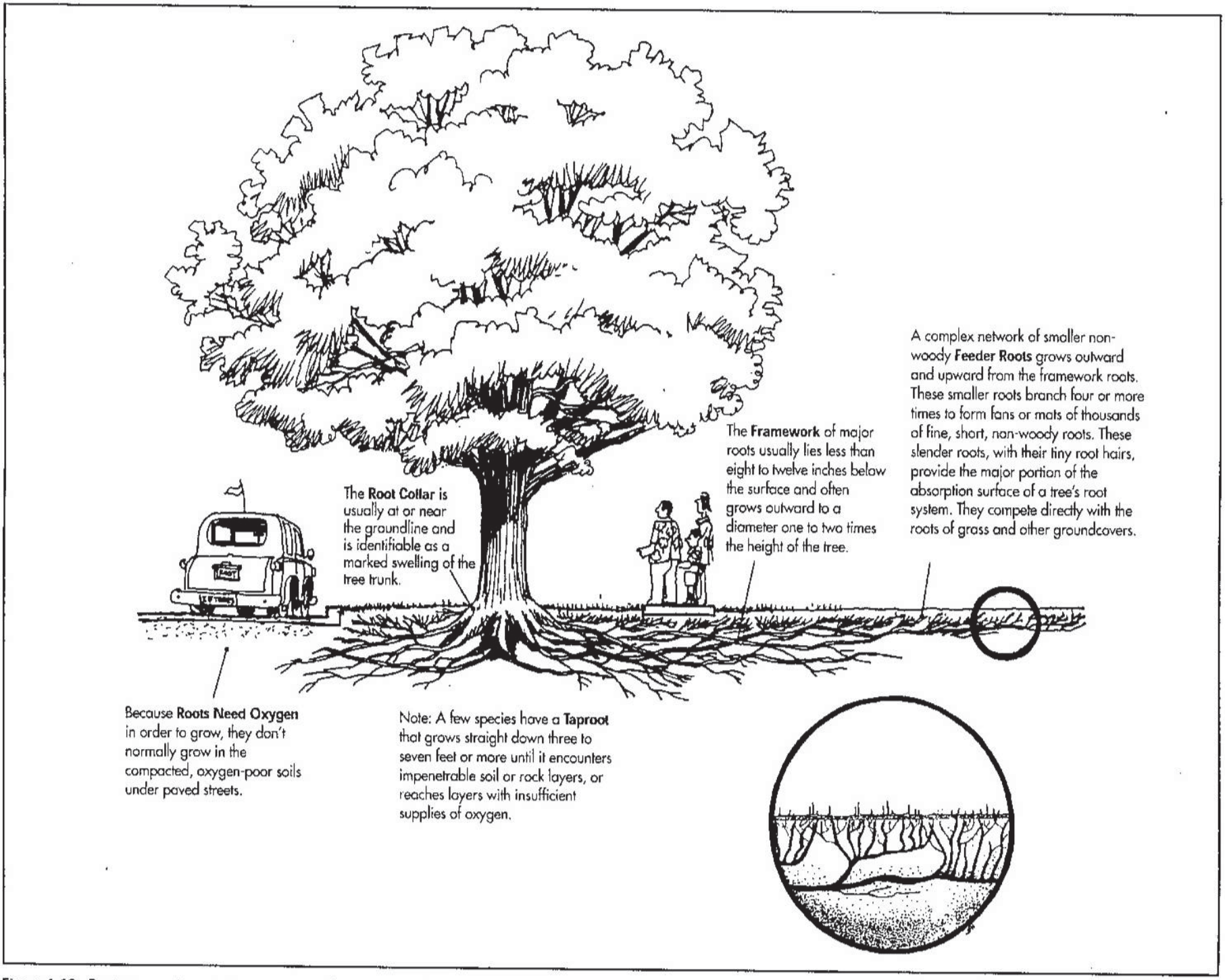
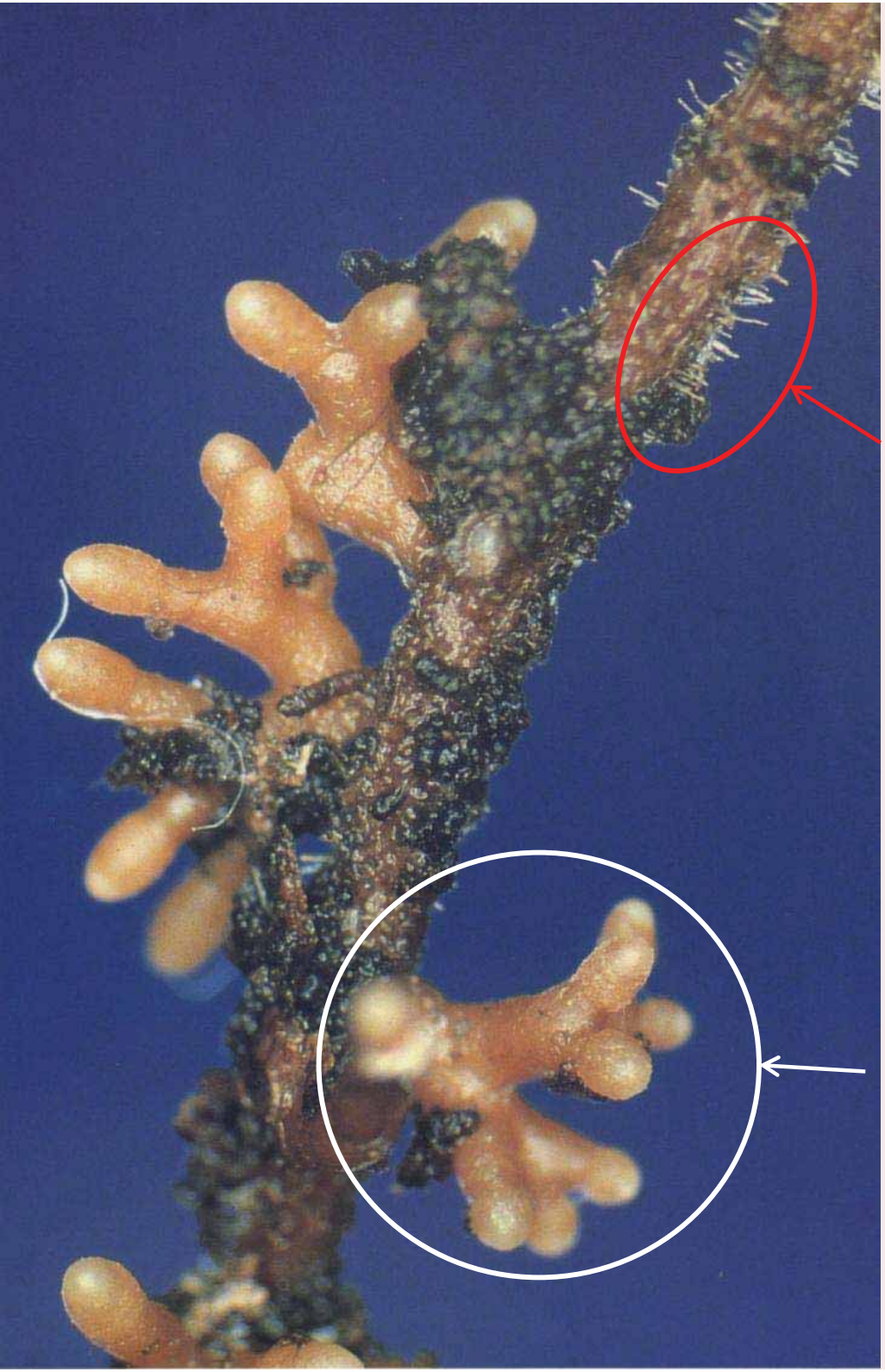


Figure 1.12 Roots grow where water, oxygen, and space are available.



Alex Shigo
Photo Micrograph
of a non-woody root
(sometimes called a
fine root or a feeder
root)

Mycorrhiza is the name given to the mutually beneficial relationship between plant roots and fungi. The structure is a combination of both – in this case, tree and fungus. The fungus helps the tree find soil nutrients and, in turn, gets food (sugars) from the tree.
Plural: mycorrhizae

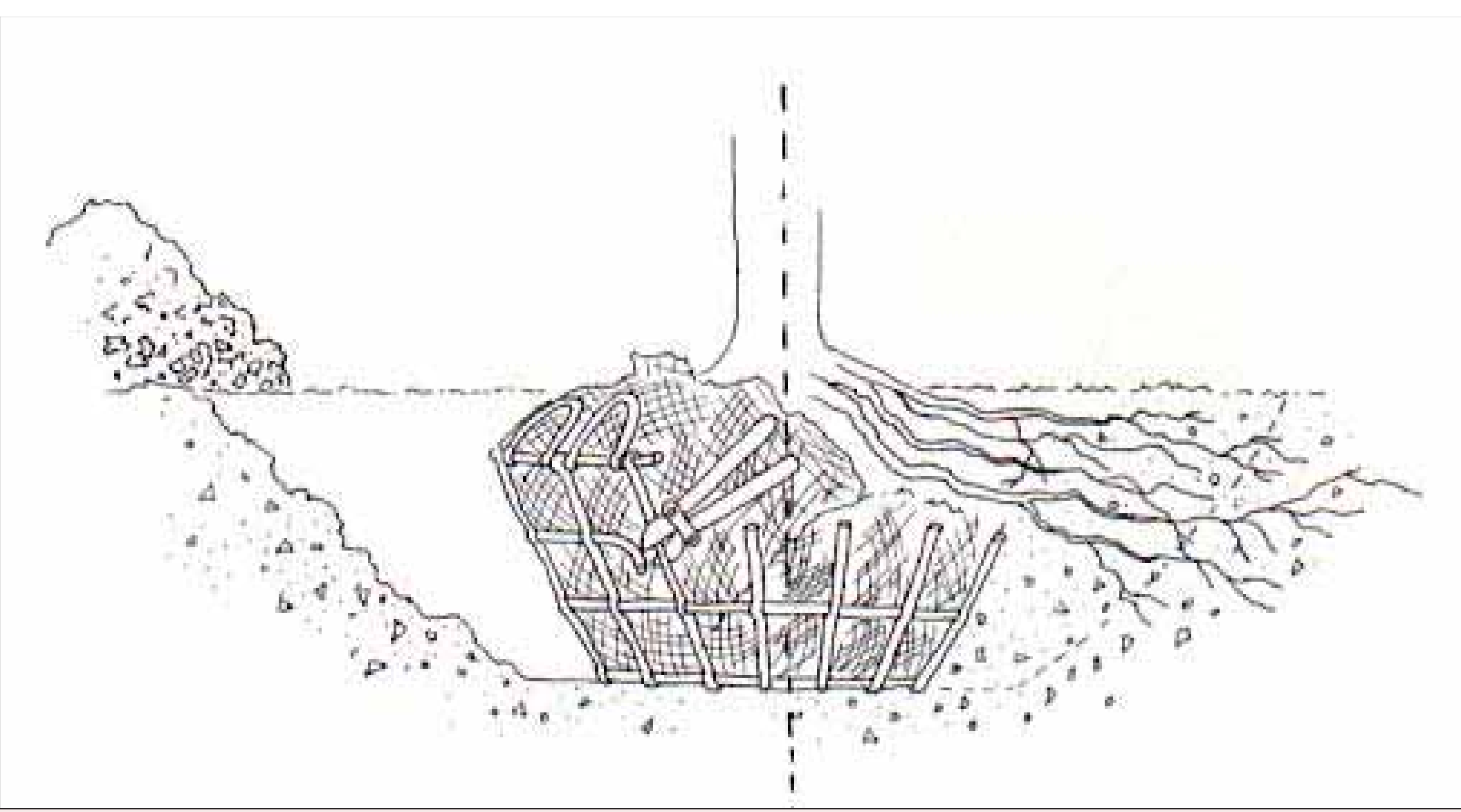
Soil nutrients

Macro - nitrogen, phosphorus, potassium

Minor – calcium, iron, sulfur, magnesium

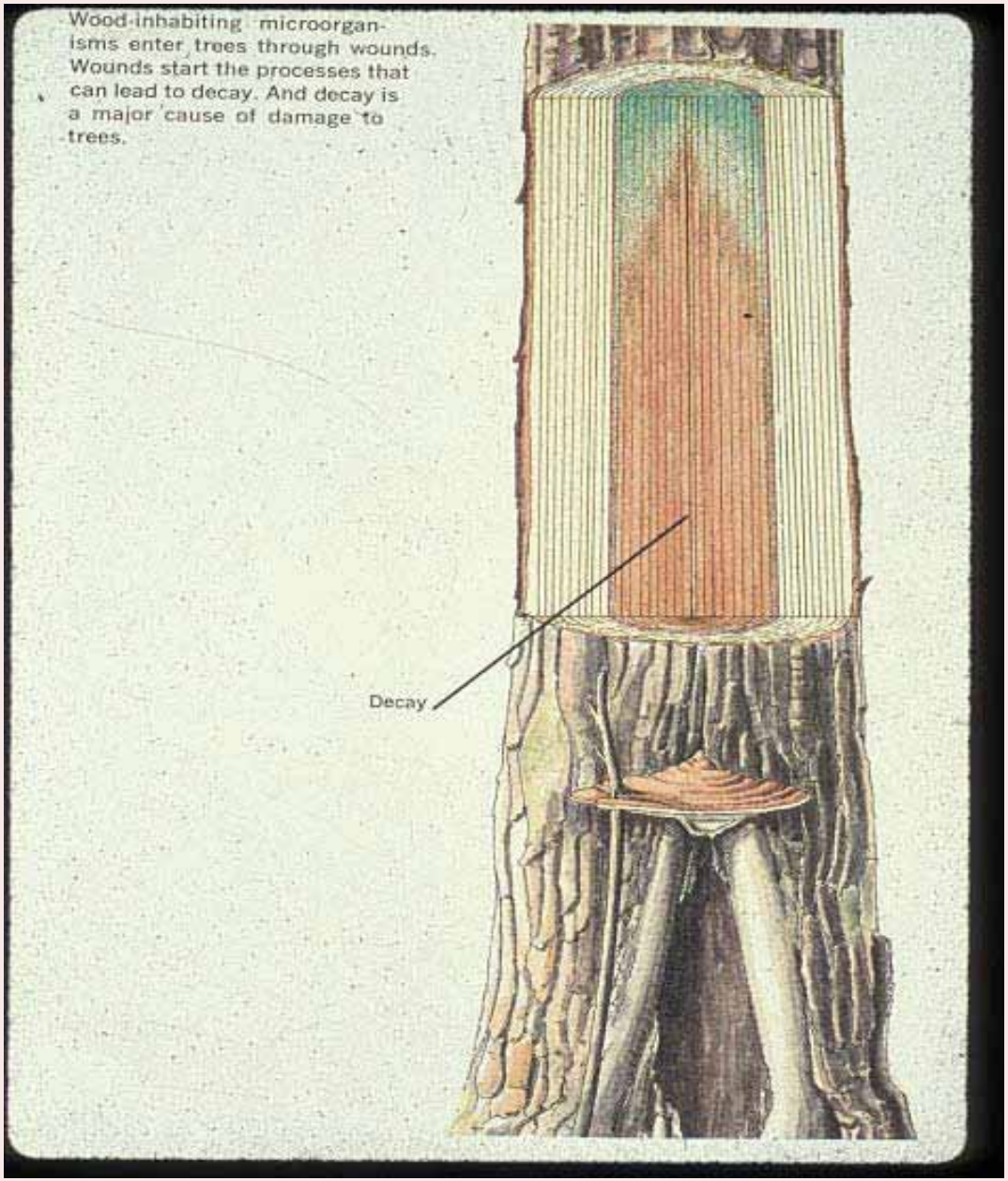
Trace minerals

C HOPKN’S CaFe Mg B Mn CuZn Mo

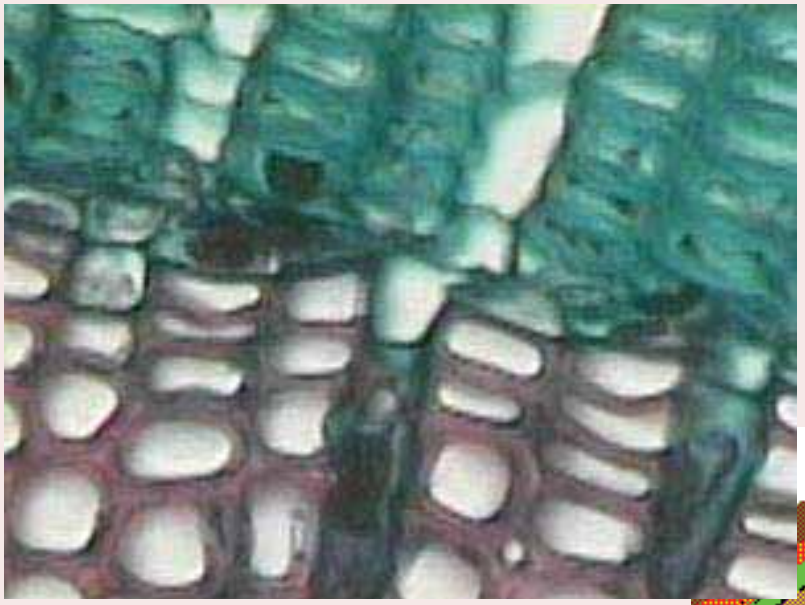


Tree roots grow from the tips, in the top 18 inches or so of the soil. When planting a tree, it is important to remove the burlap and wire from the root ball from the upper 18 inches of the root ball, after the root ball has been placed in the hole!

COMPARTMENTALIZATION OF DECAY

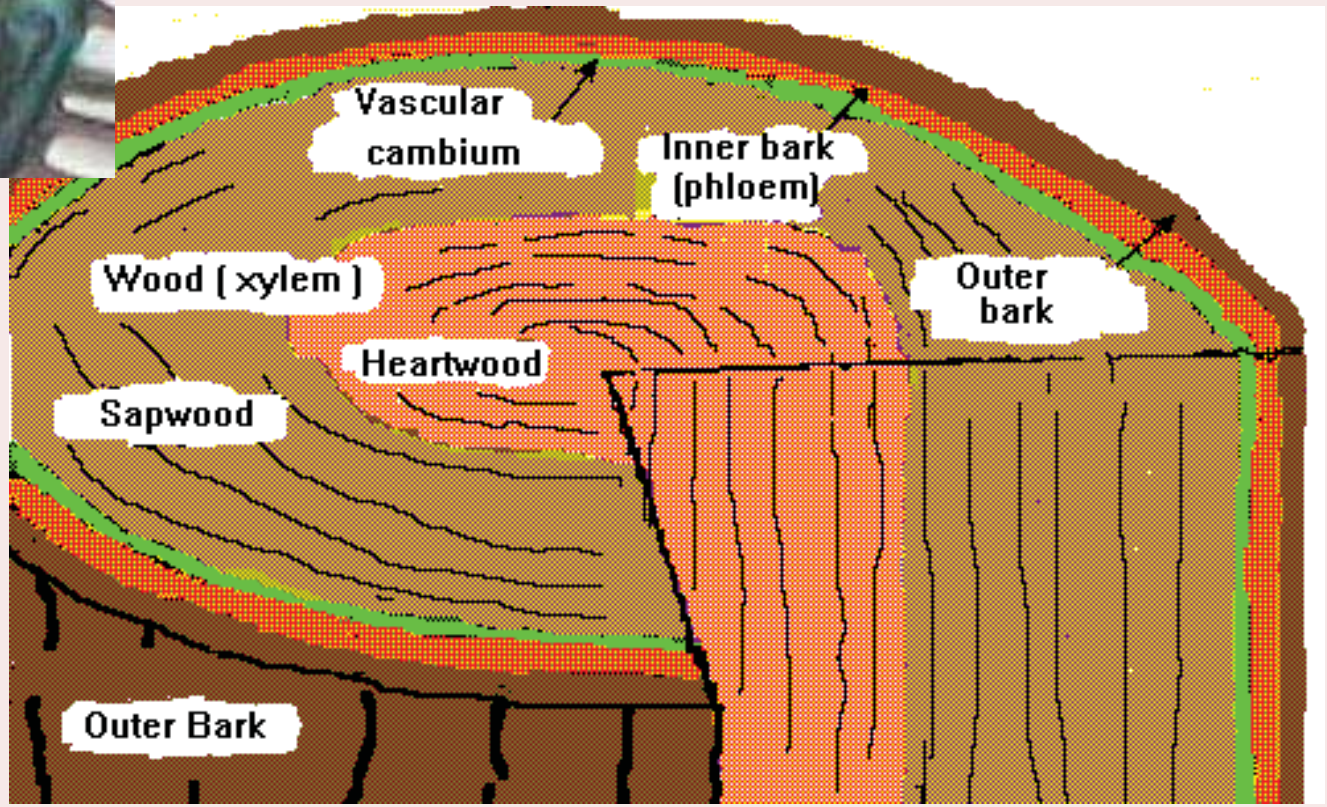


Stem Anatomy



Phloem

Xylem



Compartmentalization Of Decay In Trees - CODIT

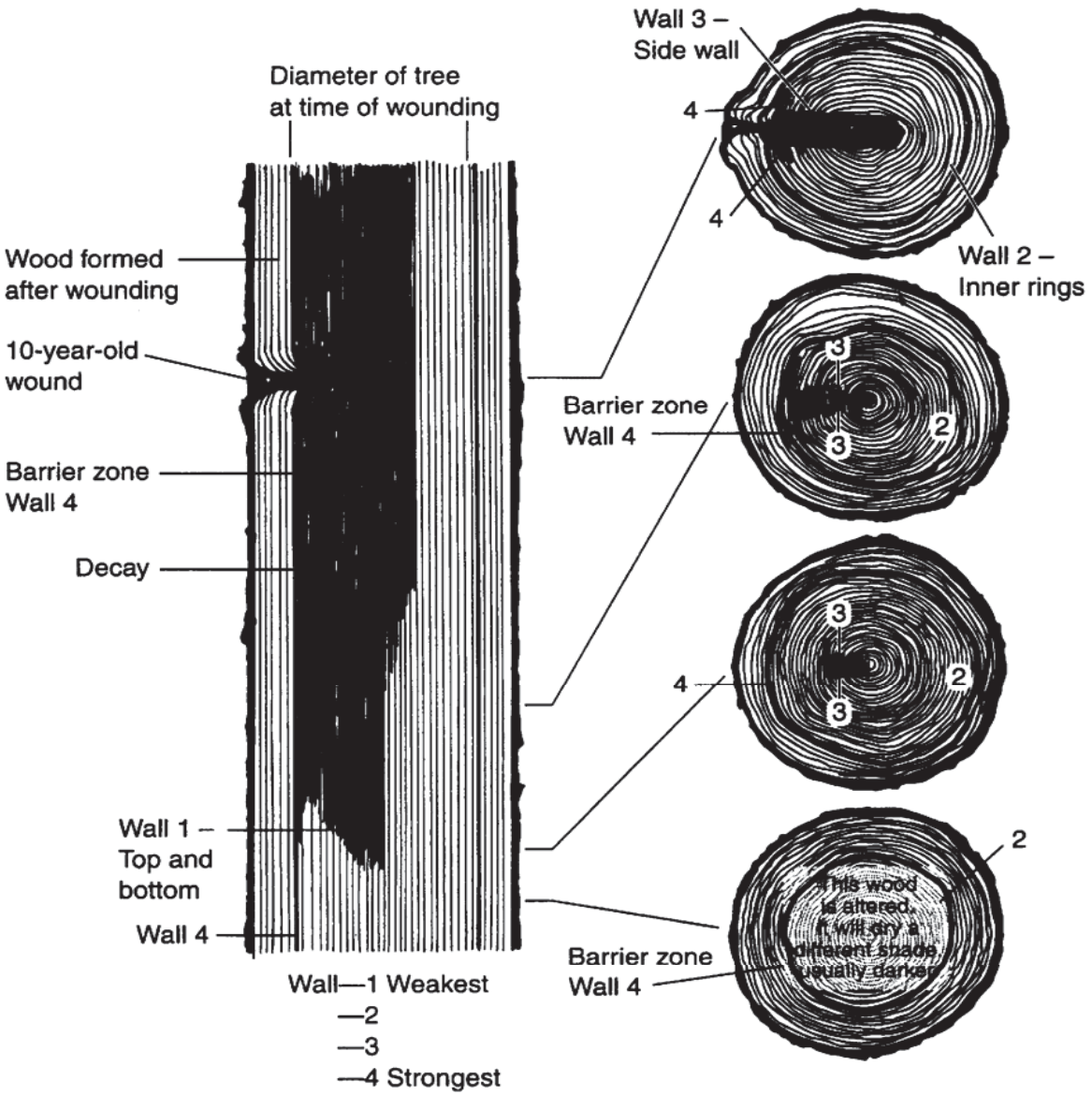
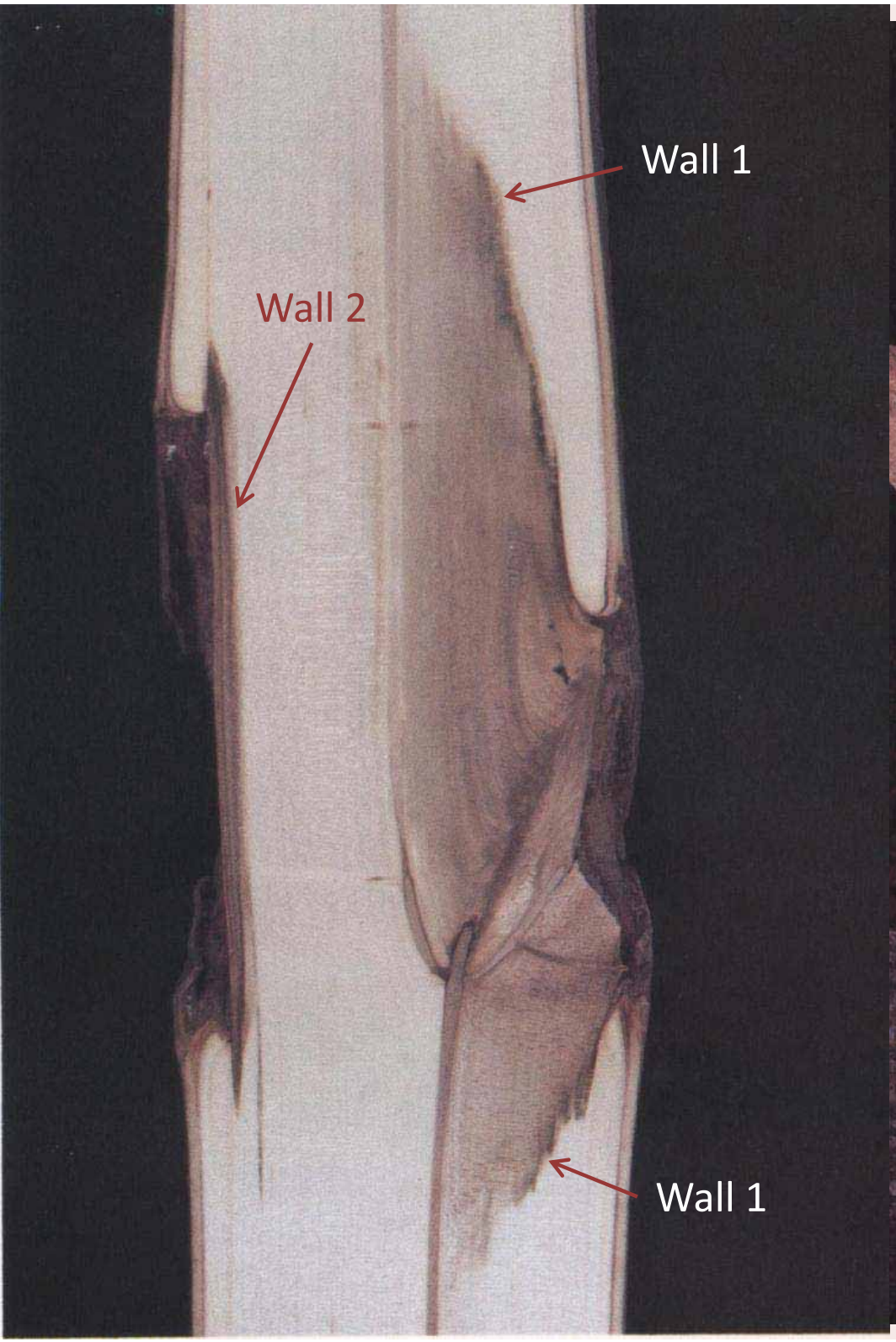
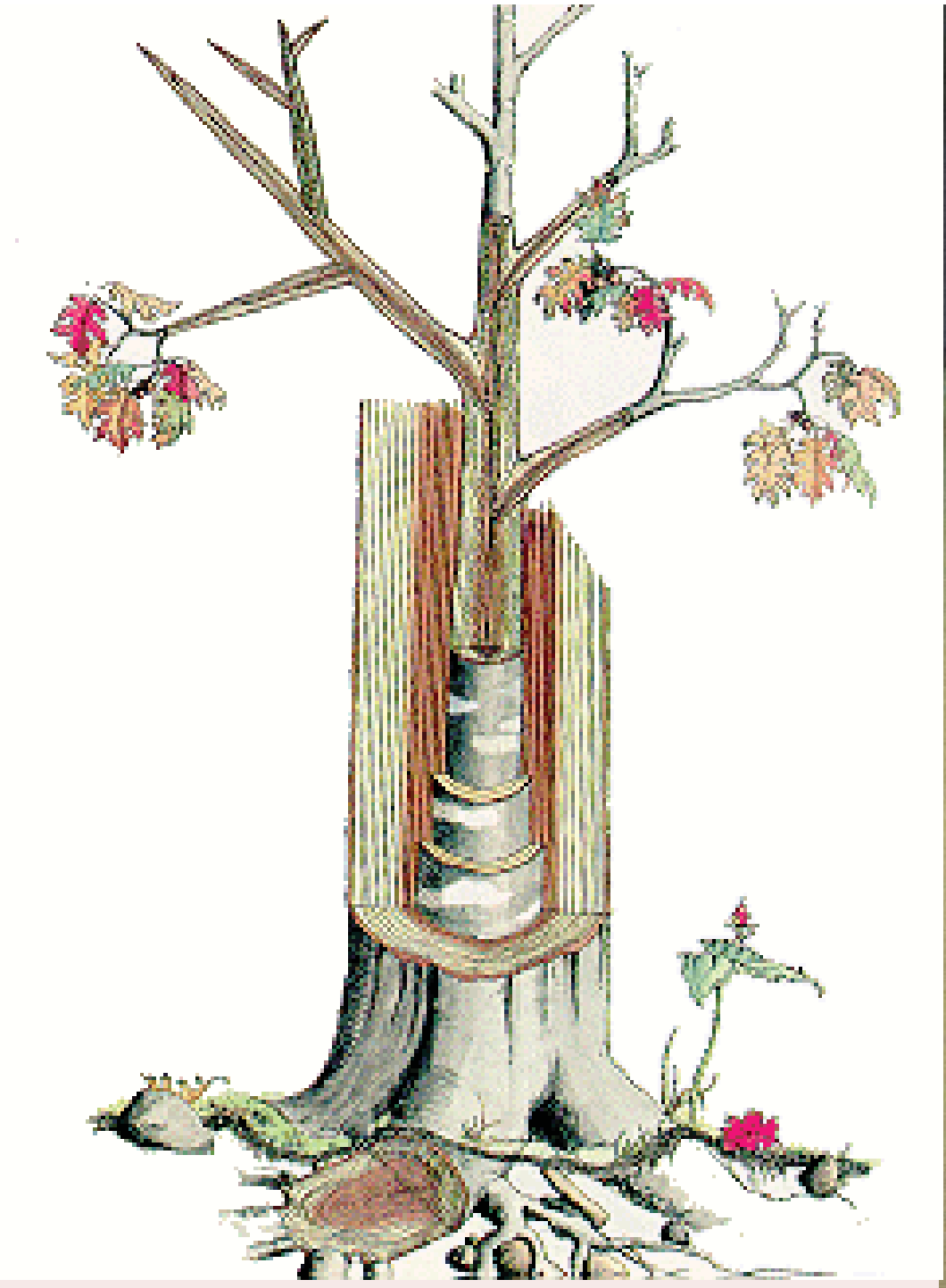


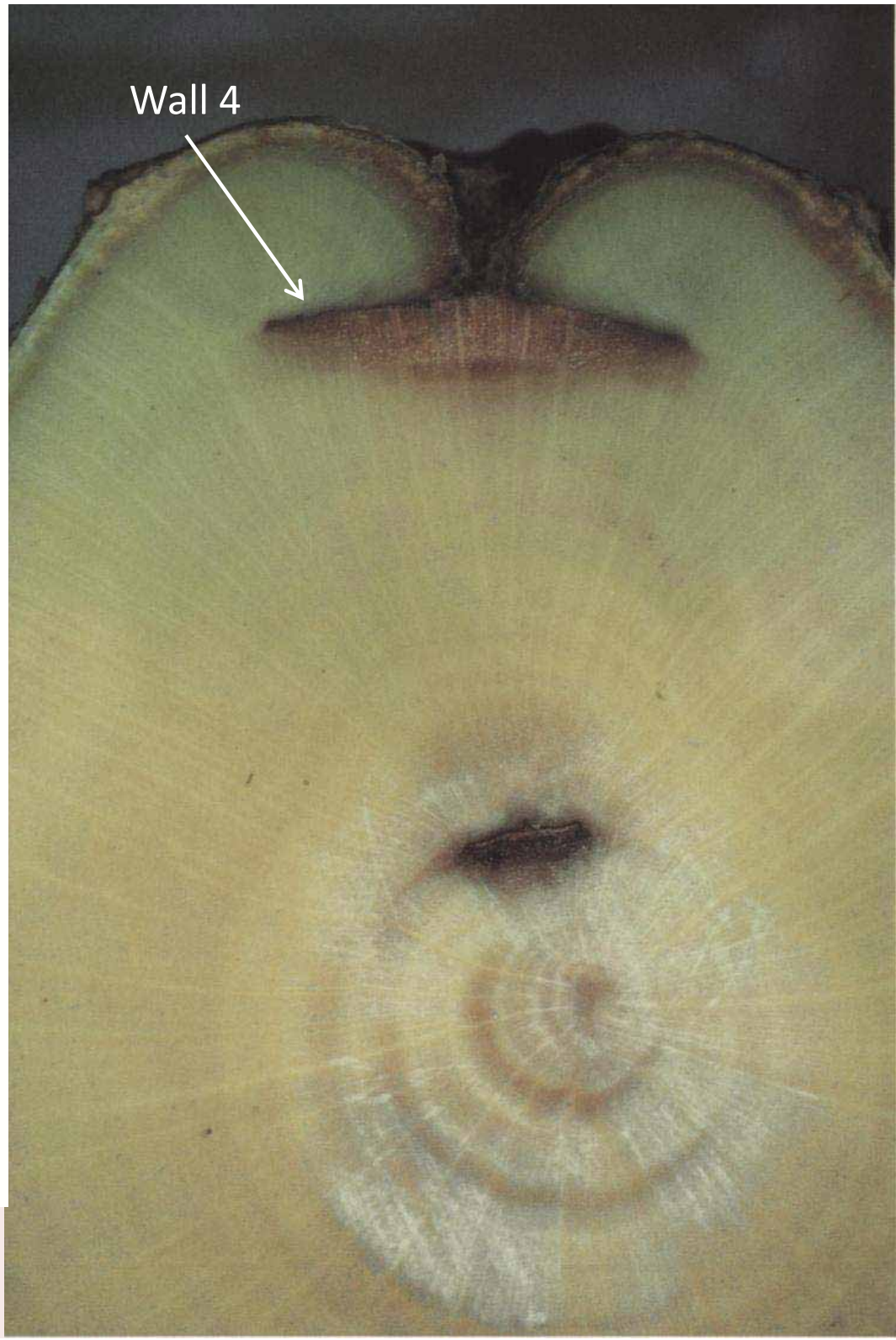
Figure 14.13
The concept of compartmentalization in trees.
(Source: From Shigo and Marx 1977.)


Wall 1
Wall 2
Wall 1


rays
The rays are wall 3



Wall 4



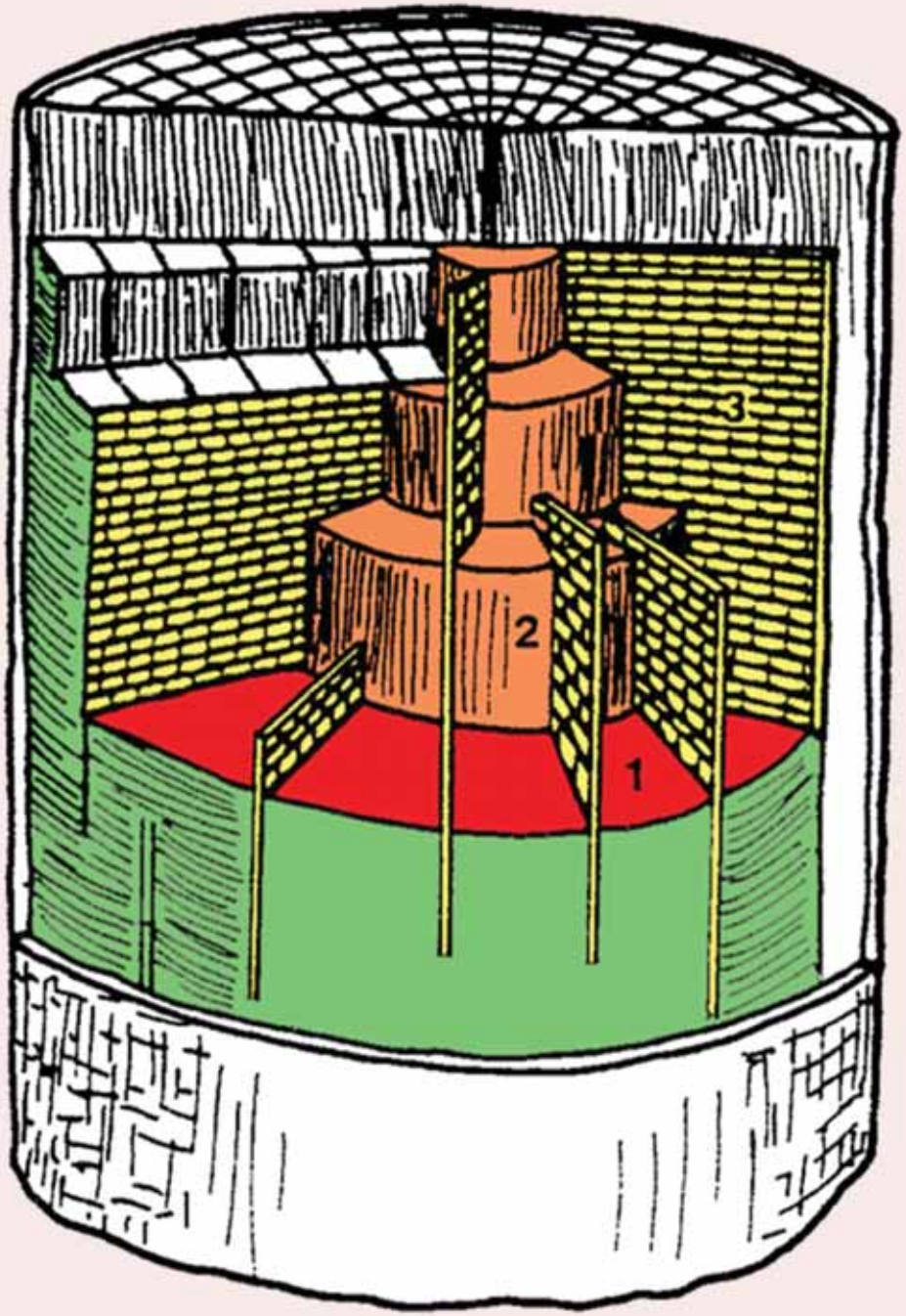


Illustration from Lilly et al. 1991.

Tree Decay

- Wall 1 – up and down
  (plugged vessels)
- Wall 2 – back wall
  (annual rings)
- Wall 3 – side to side
  (ray cells)
- Wall 4 – outside wall
  (new growth)

Trees will respond to wounds differently depending upon size and type of wound, vigor and health of the tree, species and genetics of the individual tree.


May you find your own pot of gold in arboriculture!
Questions?