UNDERSTANDING WOOD

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Wood, having been a living structure, is made up of cells. Plant cells form, and leave, outer cell walls. Wood is made up of cell walls of varying size and thickness. The main ingredient is cellulose, but a large variety of other chemicals may be present, accounting for much of the differences between species. Wood is produced in layers known as annual rings. Most cells (walls) present are elongated creating the fibrous nature of wood. The makeup of wood is based on it's functions for the tree. These functions include: support - the strength of wood; Water transport - the porosity and need for drying; food storage - limited only to sapwood.

Hardwood or softwood?

This has nothing to do with the hardness of the wood! If it comes from a flowering tree it is called a hardwood, such as maple, walnut, mahogany, and balsa. If it comes from a cone bearing tree it is a softwood, such as pine, redwood, spruce, and cedar. You might need a magnifying glass to tell the difference.

If it has pores it is a hardwood (flowering tree). (see below)

If it has no pores it is a softwood (cone bearing).

Many can be identified by smell - Pine, Cedar, cypress
Or color - redwood, or a combination of the two.

HARDWOODS

Pores very visible in early (spring) wood but not in late wood:
RING-POROUS WOODS

1. Pores in summer wood in radial branching lines 2
1. Pores of summer wood either not in lines or not radial 3
2. Rays very minute *Chestnut*
2. Rays broad and visible *Oak*
3. Pores of summer wood only slightly smaller - hard and heavy *Hickory*
3. Pores of summer wood very small 4
4. Pores single, in groups, or in short broken lines - never radially oriented 5.
4. Pores of summer wood in concentric, wavy, sometimes branching lines 6
5. Rays minute - not yellowish *Ash*
5. Rays fine, but distinct - yellowish brown *Black Locust*
6. Rays fine, but distinct - yellowish white *Hackberry*
6. Rays indistinct, heartwood reddish brown *Elm*

Pores evenly distributed, usually small:
DIFFUSE-POROUS WOODS

7. Pores varying in size from large to quite small giving somewhat the appearance of ring-porous 8
7. Pores nearly uniform in size 9
8. Heavy, hard, chocolate brown *Black Walnut*
8. Light, soft, light reddish brown *Butter Nut*
9. Rays indistinct even with some magnification *Cottonwood*
9. Rays distinct 10

10. Pores large, plainly visible, filled with gum *Mahogany*
10. Pores minute, more numerous in spring wood resembling ring-porous, reddish *Cherry*
10. Pores minute but evenly distributed 11
11. Rays of 2 thicknesses 12
11. Rays all nearly the same thickness 13
12. Broad rays predominant *Sycamore*
12. Narrow rays predominant *Beech*
13. Rays very small, pores visible only as gray specks on cross section *Birch*
13. Rays somewhat larger, pores distinct 14
14. Wood hard, pinkish white, rays visible as orange-brown flakes in radial section *Maple*
14. Wood soft 15
15. Pores not crowded, occupying not more than one-third of space *Basswood*
15. Pores crowded, occupying nearly all of space between rays 16
16. Yellowish white, often with greenish tinge *Tulip Poplar*
16. Light to dark reddish brown *Sweet Gum*

TERMS EVERY WOODTURNER SHOULD KNOW

Bark - the trunk of a tree outside of the wood, part living and part not.

Bole - the trunk of a tree.

Burl - an abnormal growth on the bole in reaction to canker or physical stress which creates a very figured grain pattern.

Cambium - the living layer beneath the bark which produces the annual layer of new wood.

Cellulose - a strong fibrous molecule made of sugars which is the primary structural molecule of wood

Checking - separation or cracking in wood particular noticeable in the end grain and may be either of two kinds based on direction of cracks:
Radial checking - following the direction of the rays
Ring checking - separating between annual rings

Crotch - the joining point of two boles or branches creating a special figured grain.

Cork - the outer, non living layer of bark serving as protection.

Cork Cambium - The living layer of cells beneath the cork which produces it.

Figure - fancy or unusual patterns in wood, giving it "character".

Grain - the fibrous structure running linearly in wood.

Grain Pattern- the pattern produced by the fibrous nature of wood enhanced by the annual rings and other variations in growth which can be called figure.

Green Wood - any wood still containing water. Water is found in wood in to forms:
Free Water - that within the cavities of pores, and can be easily removed and does not result in any shrinkage.
Bound Water - that which is imbibed in the cell wall structure of wood and when removed causes shrinkage.

Heartwood - older wood toward center of bole that no longer has any living cells and is usually stained with colors unique to the species.

Knot - the remains of a branch leaving a circular pattern crossing or opposing the grain.

Meristem - tissue of a plant specialized for production of new tissue (growth) such as cambium.

Parenchyma - thin walled cells for storage, some of which are found in sapwood.

Phloem - the living, enter part of bark used for carrying food.

Pith - soft center in a bole left from the primary (first) growth.

Ray - Groups of cells scattered in wood that extend radially and were used for carrying food.

Ray Fleck - the splotches showing in wood when the rays are exposed from their side view.

Reaction Wood - Wood which grew other than vertical. Below the pith is called compression wood and above the pith is called tension wood. This may vary in character from the normal.

Sclerenchyma - Fiber cells which give the strength to the wood.

Shrinkage - the decrease in volume as the wood dries. This differs in the three dimensions of wood:
Linear - no appreciable shrinkage
Radial - varies according to species, usually between 4 and 8 %.
Tangential - equal to or greater than that of radial, often twice as much.

Spalt - the activity of fungus while feeding on starch in sapwood parenchyma. This does not degrade the structure as does rot when fungus feeds on cellulose in any wood.

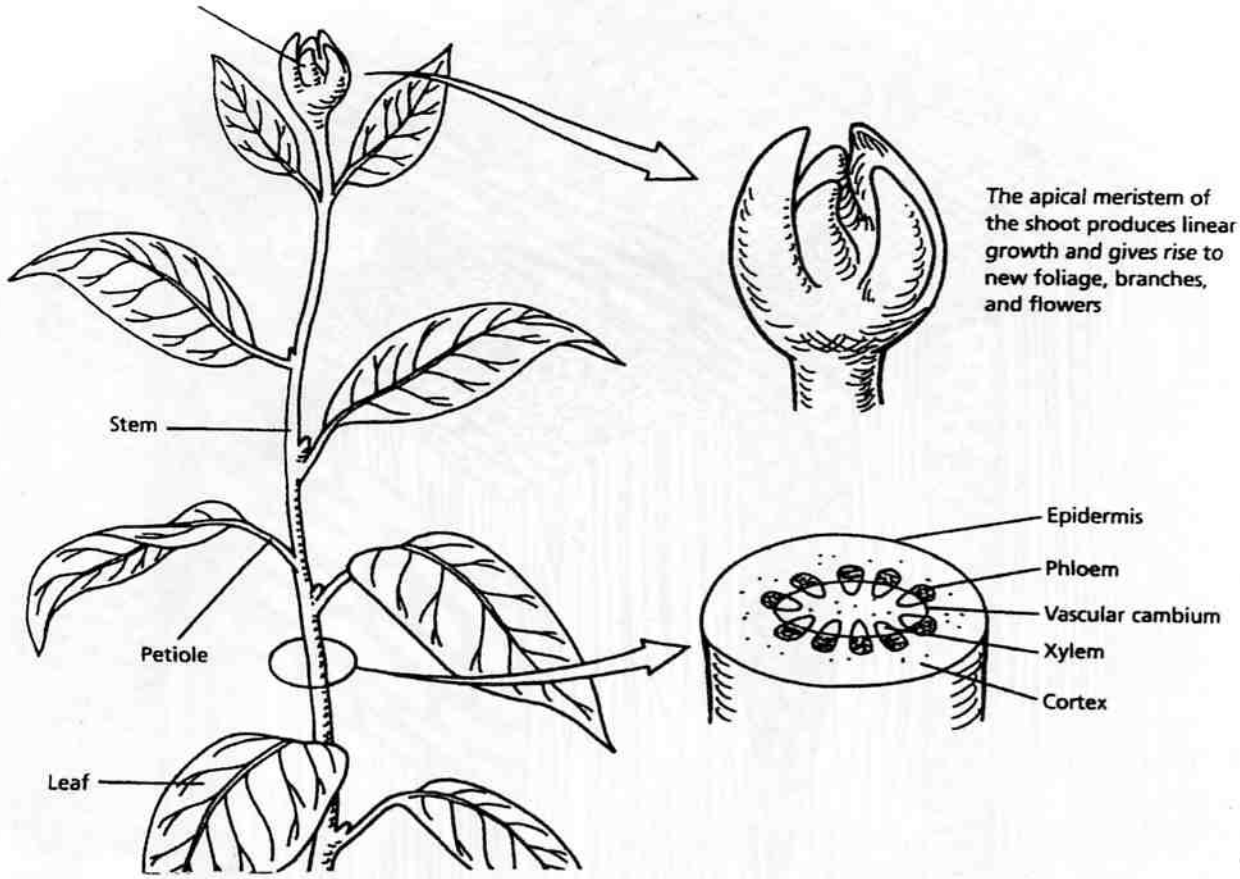
Specific gravity - density of dry wood as a comparison to the density of water (1).

Spring wood - the inner, early portion of an annual ring.

Summer wood - the outer, late portion of an annual ring.

Vessel - the large, tube shaped cells forming pores in hardwood and that carried water in the living tree.

Xylem - that portion of a tree that we call wood, used for support, water transport, and food storage.



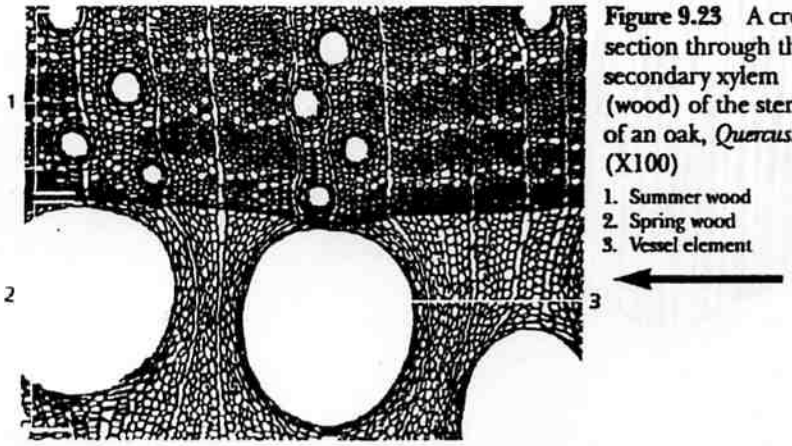


Figure 9.23 A cross section through the secondary xylem (wood) of the stem of an oak, *Quercus*. (X100)

1. Summer wood
2. Spring wood
3. Vessel element

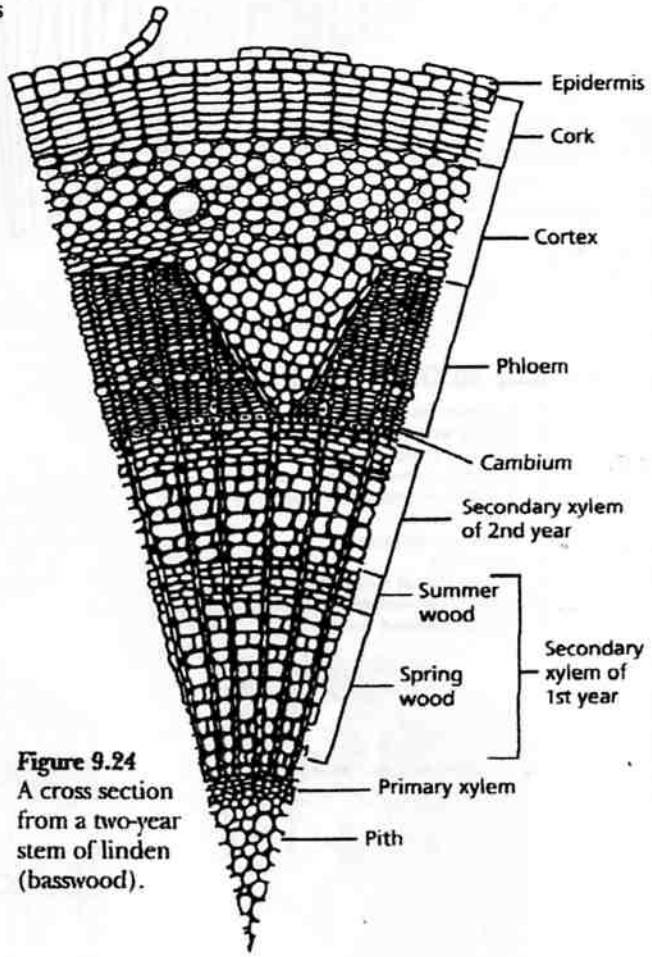


Figure 9.24 A cross section from a two-year stem of linden (basswood).

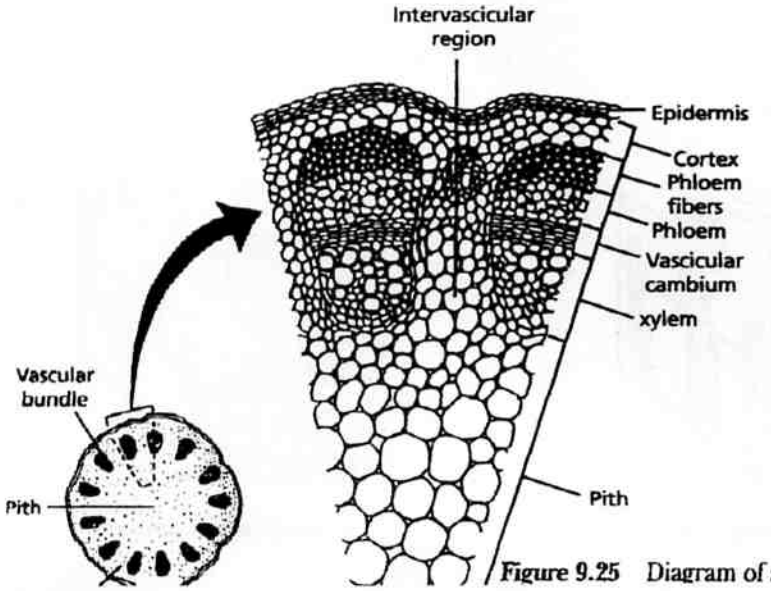
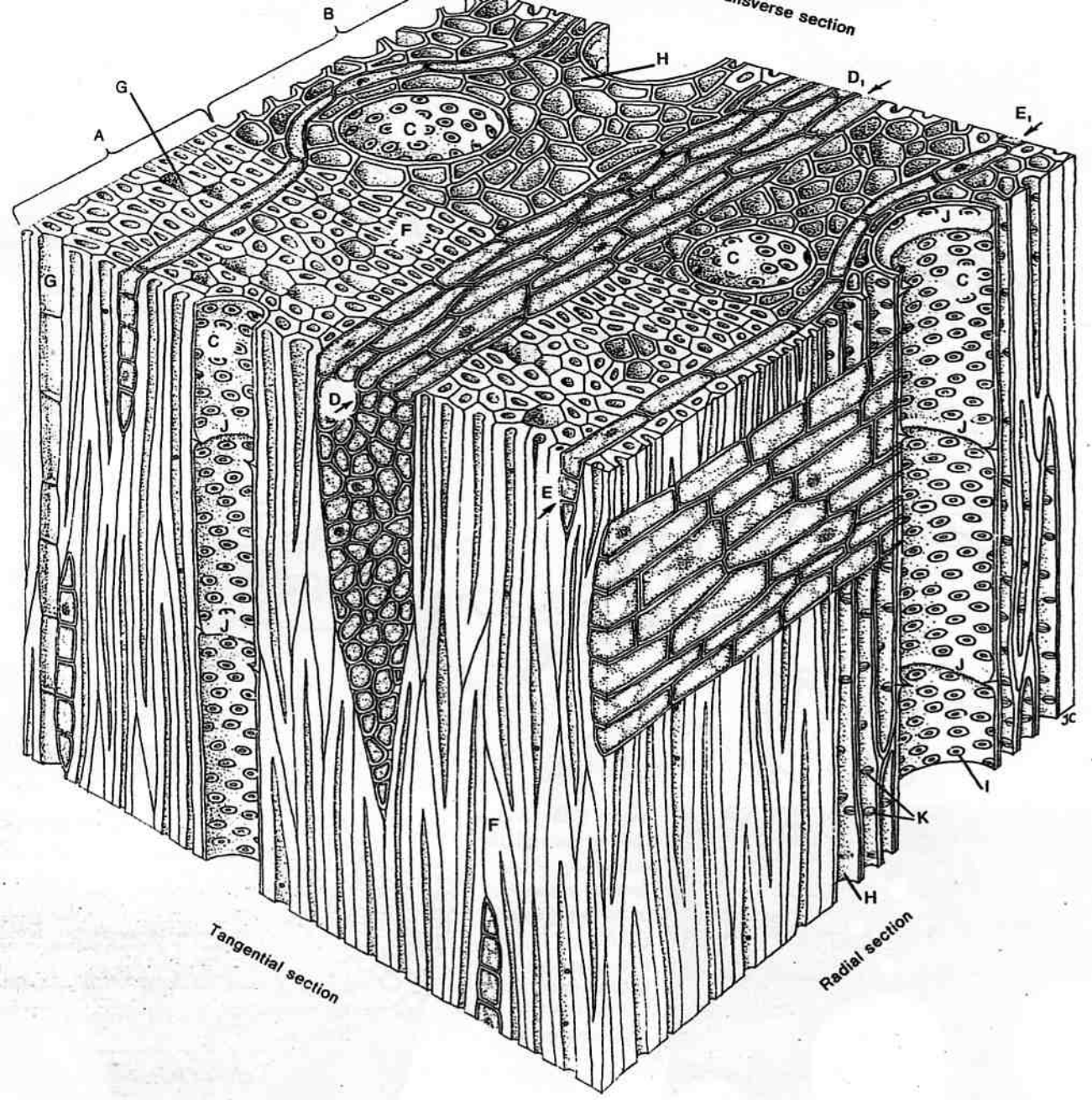
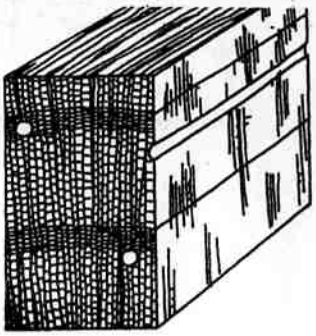


Figure 9.25 Diagram of a dicot stem.

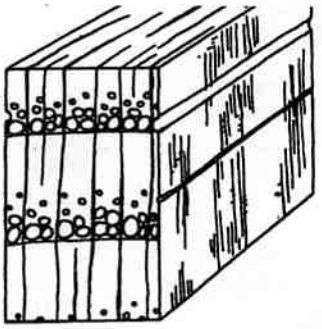


Key to Oak Wood Cube Labels

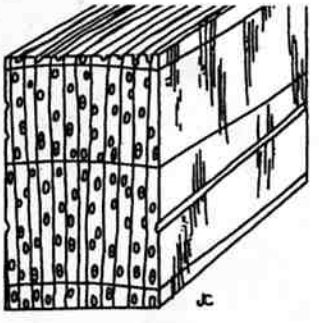
A. Summer wood
B. Spring wood
C. Vessels (tracheae)
D. D and D_1—multiseriate wood ray
E. E and E_1—uniseriate wood ray
F. Wood fibers
G. Wood parenchyma
H. Tracheids
I. Pits in vessel (trachea) walls
J. Junction of vessel elements
K. Pits in tracheid walls



A Coniferous nonporous (pine)



B Ring-porous (oak)



C Diffuse-porous (maple)