

# Wood Identification

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**For:** Win With Wood Training

**Pictures take by:** Terry Conners & Bobby Ammerman

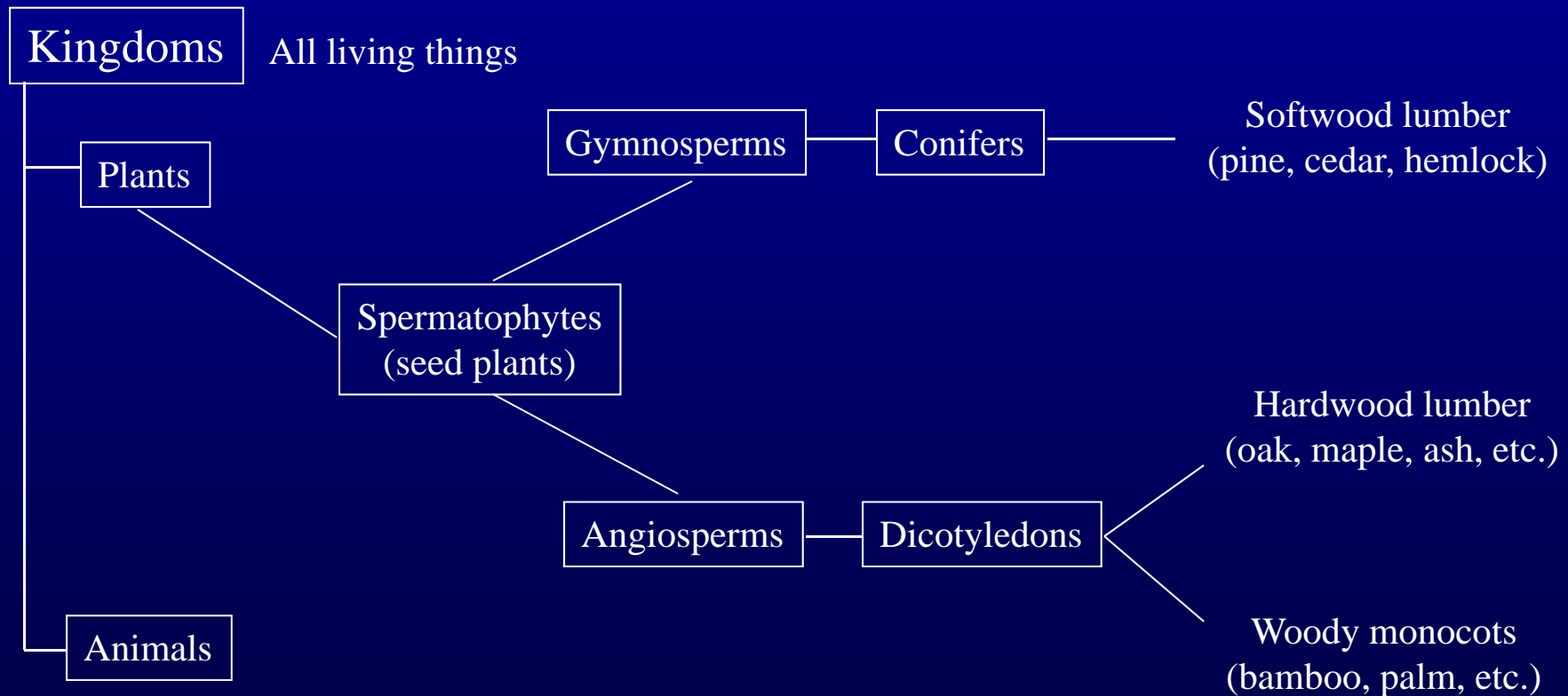
**Special thanks:** to Terry Conners and the staff at the University of Kentucky's Wood Utilization Center for preparation work on the wood samples used in the training.

# Wood Identification Tools



Wood Identification Key

# Woody material (Tree) classification



## Hardwoods:

- Deciduous (they lose their leaves during the winter)
- Usually have broad leaf foliage
- Normally are dendritic (branching and rebranching of the main stem, stem generally will not go all the way to the top of tree)

## Softwoods:

- Coniferous (they keep their leaves during the winter)
- Leaves are shaped like needles and are normally evergreen
- They have an excurrent form (dominant main stem all the way to the top of the tree with smaller branching directly off the main stem)



# There are three types or groupings of names used to identify trees or wood.

- **Common names:** in many cases are names given by local or regional people. They can be very unreliable because the same species of trees can have multiple common names.
- **Trade names:** are names used in a commercial application. Many times the common name is used but the name may be shortened such as black walnut may just be called walnut or yellow poplar may just be called poplar.
- **Scientific names:** there is only one scientific name for a single plant specie. First name designates the genus name and the second name denotes the species.

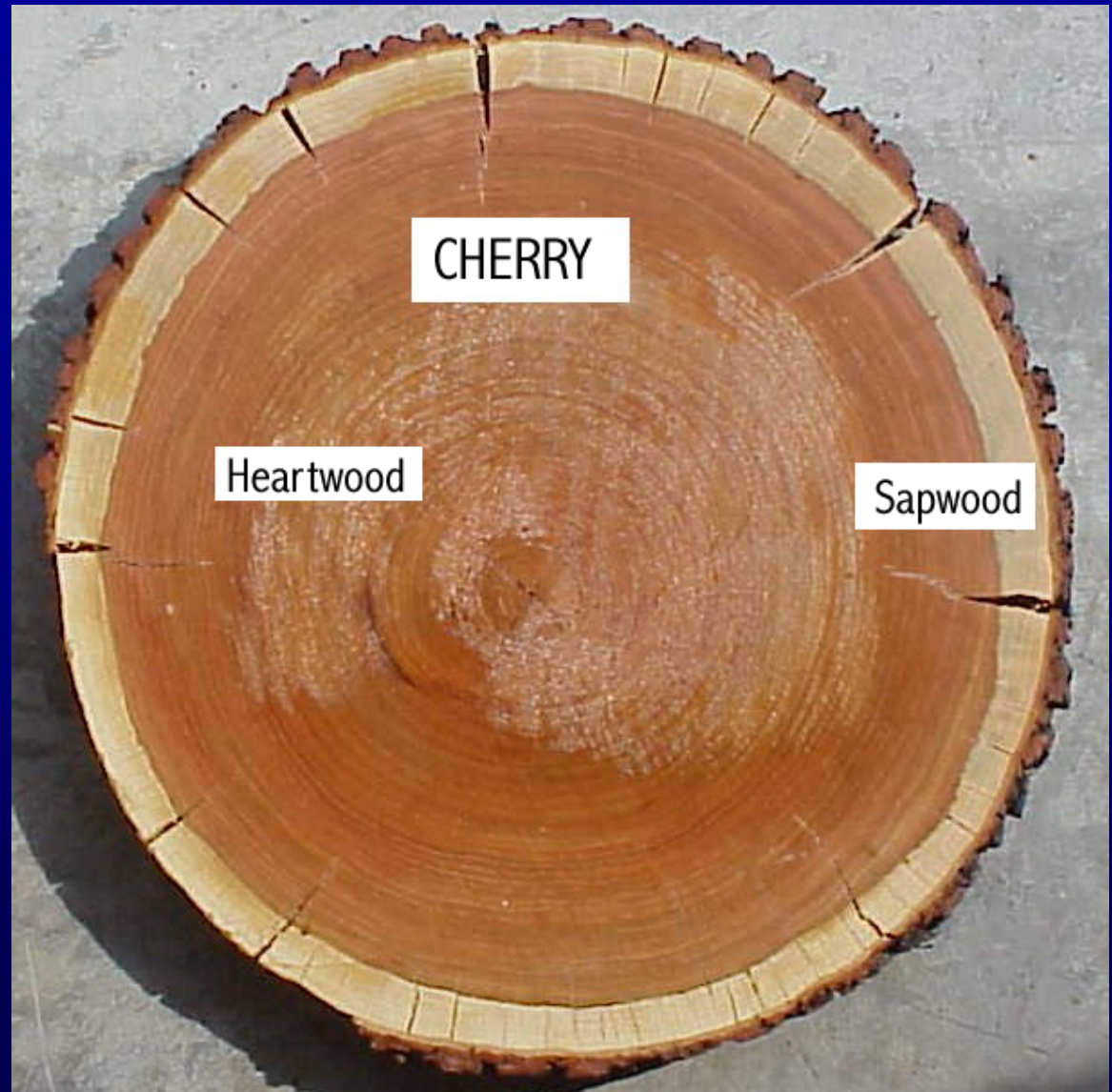
# Key Wood Structure Used for Wood Identification.

- Rays
- Density
- Pores
  - Pore arrangement
- Resin canals
- Heartwood
- Sapwood
- Annual growth rings
  - Earlywood
  - Latewood
- Color
- Odor
- Parenchyma
- Tyloses



**Heartwood:** is usually darker than the sapwood and has materials deposited in this portion of the tree stem that are called extractives. These extractive materials in some cases gives the wood smell and the ability to resist decay.

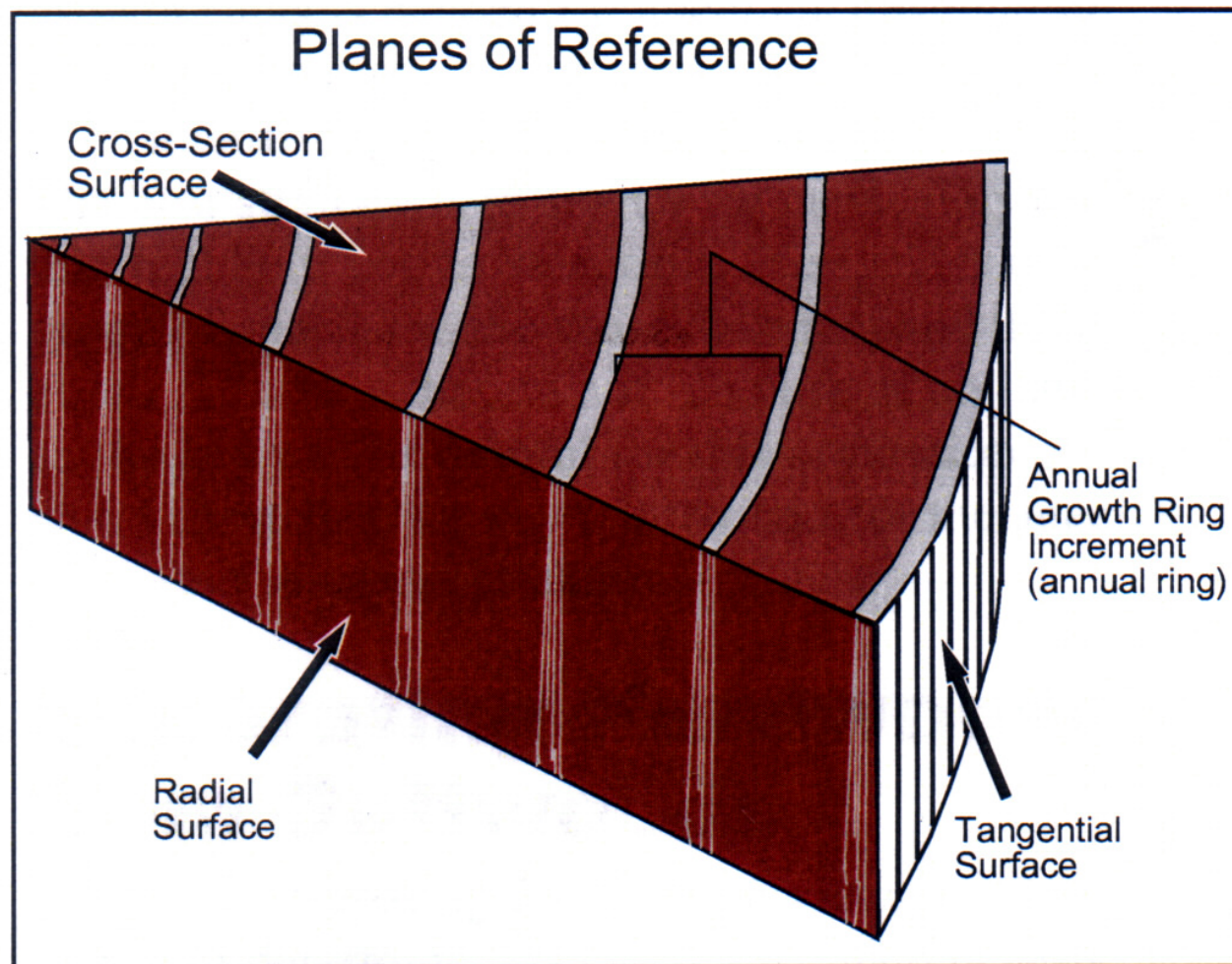
**Sapwood:** is the living portion of the tree stem and does have many of the properties like smell and decay resistance that heartwood has due to lack of the extractive materials but, does retain the same strength properties as heartwood.



# Annual Growth Rings

- Is generally characterized by alternating light and dark lines.
- From one dark line to the next is one year of growth.
- These lines are created from the difference in the way the tree forms cells in spring (earlywood growth) and the way cells are formed in the late summer or fall (latewood growth).

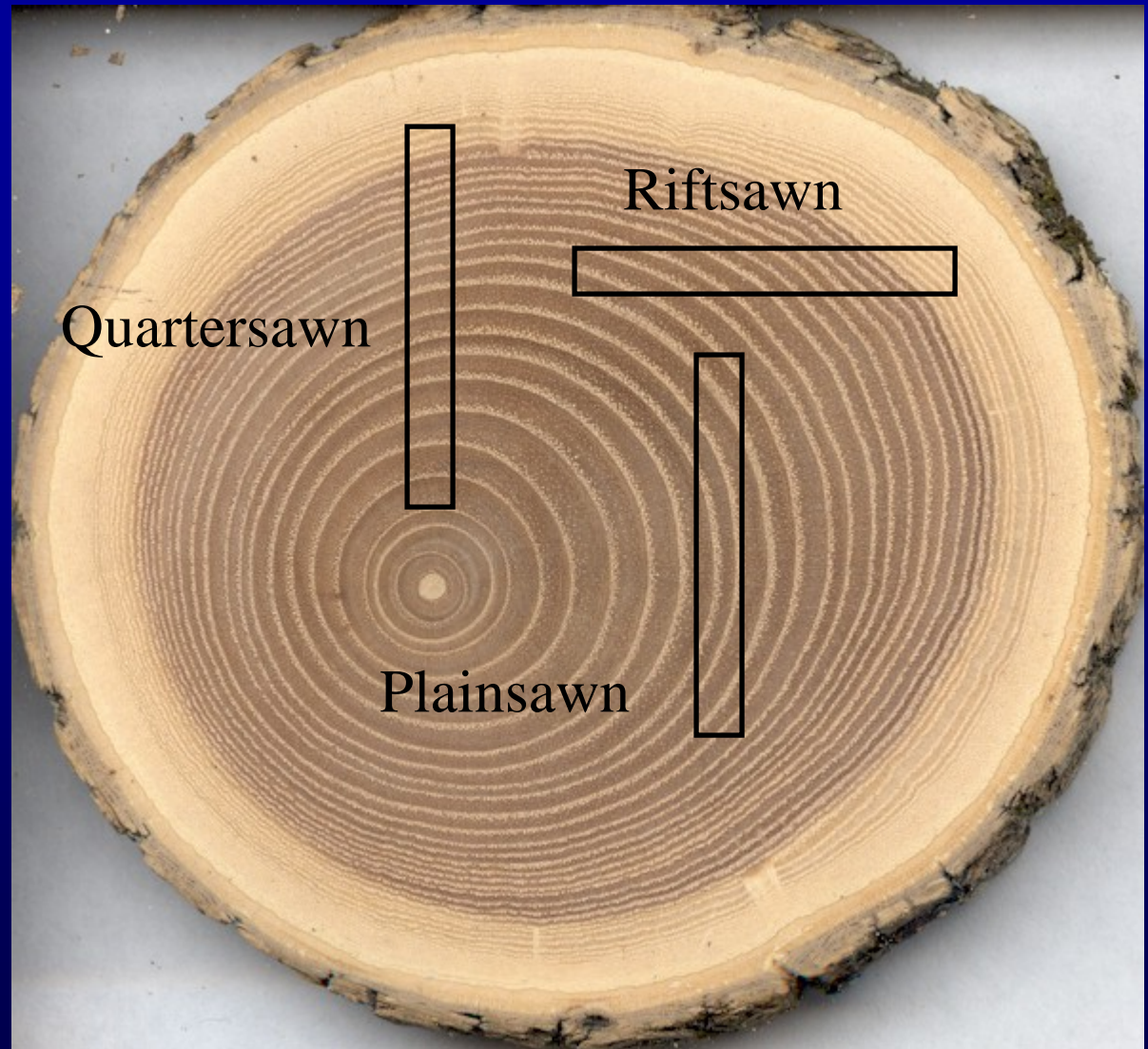




*Figure 1. Three-dimensional orientation of wood material.*

## How Lumber Is Sawn Determines the Orientation of the Planes of Reference

- **Plainsawn:** The lumber is sawed tangent to the annual growth rings.
- **Quartersawn:** The lumber is sawed so the annual rings are oriented at angles of 45 to 90 degrees to the surfaces.
- **Riftsawn:** The lumber is sawed something in between Plainsawn and Quartersawn.

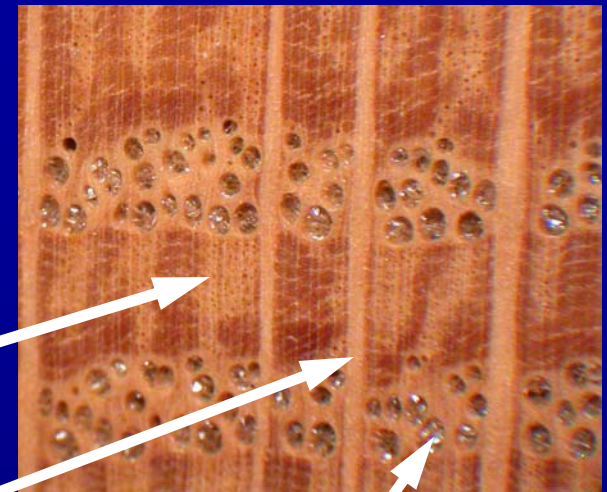
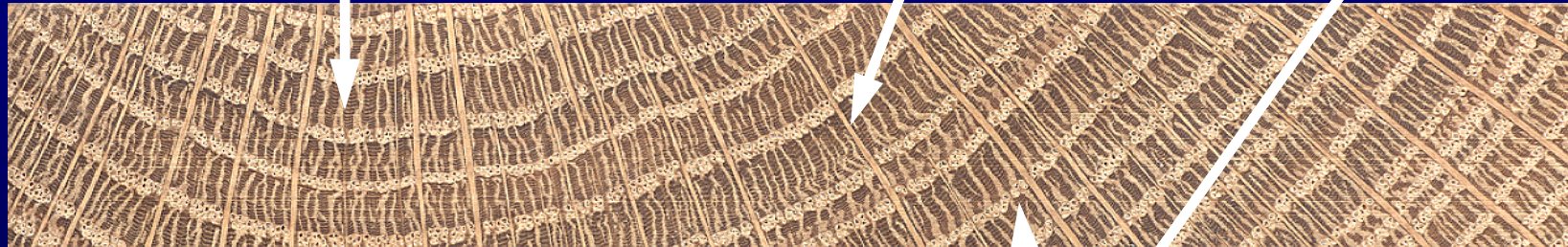


# Cross Section Surface

Summerwood/Latewood

Rays

15X magnification



\*\*\* Rays are cells used like a highway to conduct materials from the cambium layer to the pith of the tree.

# Tangential Surface



← Rays

# Radial Surface



Rays or Ray Fleck



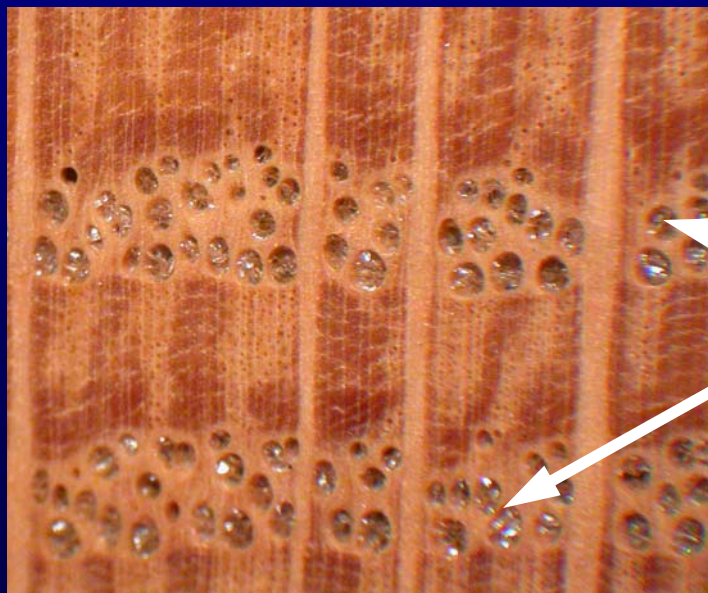
# **The First Step in Wood Identification is to Determine if The Sample is a Hardwood or Softwood.**

- Hardwoods have pores
- Softwoods are void of pores and have tracheids which are very hard to see even with a hand lens

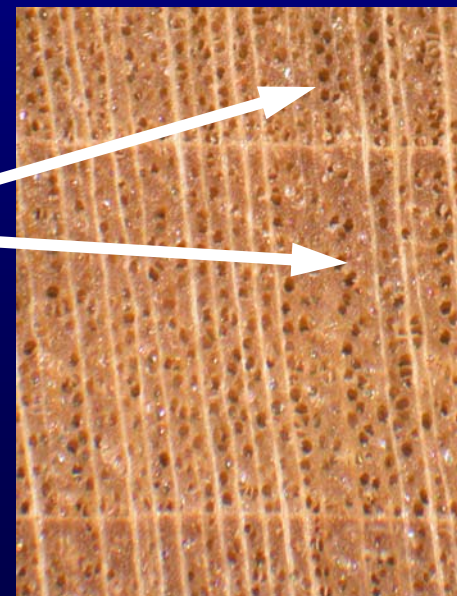


# All Hardwoods Have Pores.

- Pores are normally visible with hand lens, in some species can be seen without hand lens
- They are only present in hardwoods
- Pores will be present in many different shapes and sizes



Pores or  
vessel elements

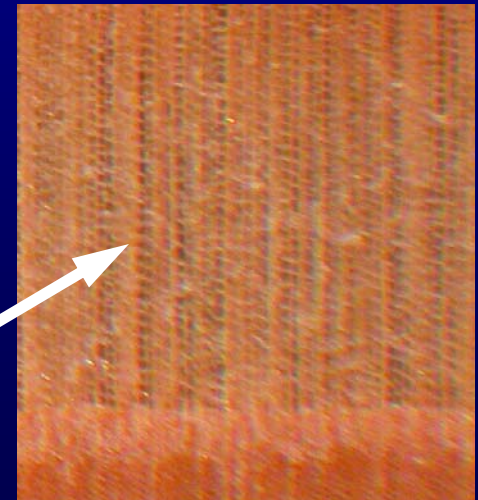


# All Softwoods Have Tracheids and No Pores.

- Normally the tracheids are not visible in the cross-section even with a hand lens
- The cross-section surface will look void of holes or cavities at low magnification
- Tracheids in softwoods are normally in a very uniform in size and aligned in uniform rows



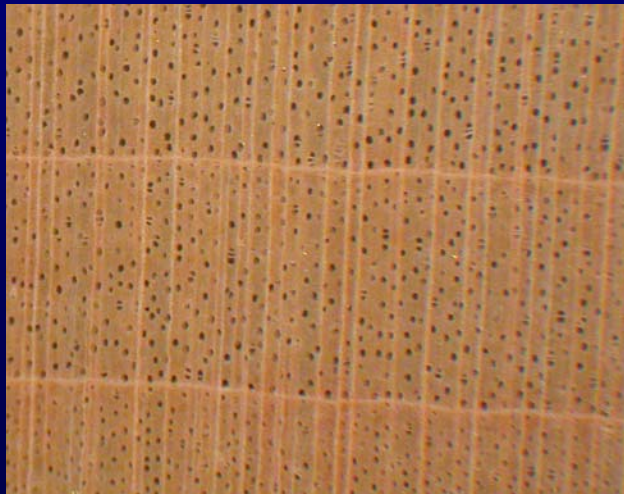
Tracheids not visible  
at 15x magnification



Tracheids viewed with  
heavy magnification

# Lets see if we can separate all of the samples by hardwoods and softwoods

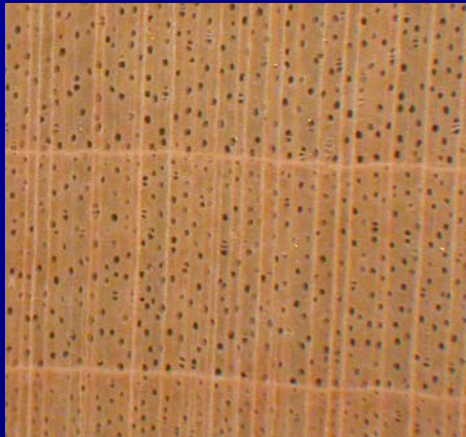
Hardwoods have pores



Softwoods do not have pores

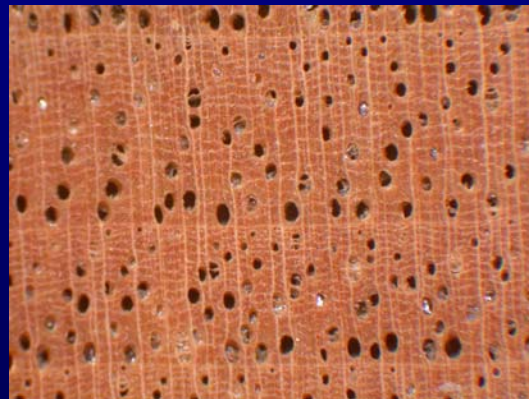


# There Are Three Types of Pore Arrangements

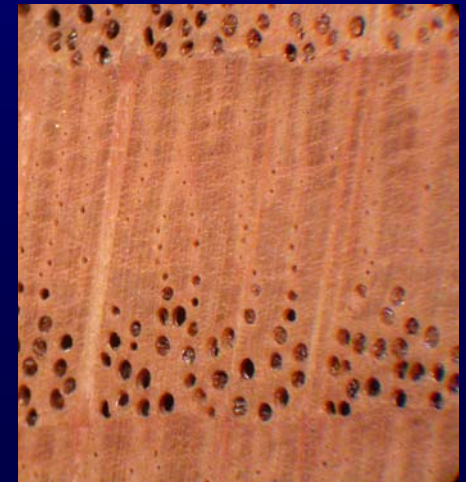


Diffuse porous

Semi-ring porous



Ring porous



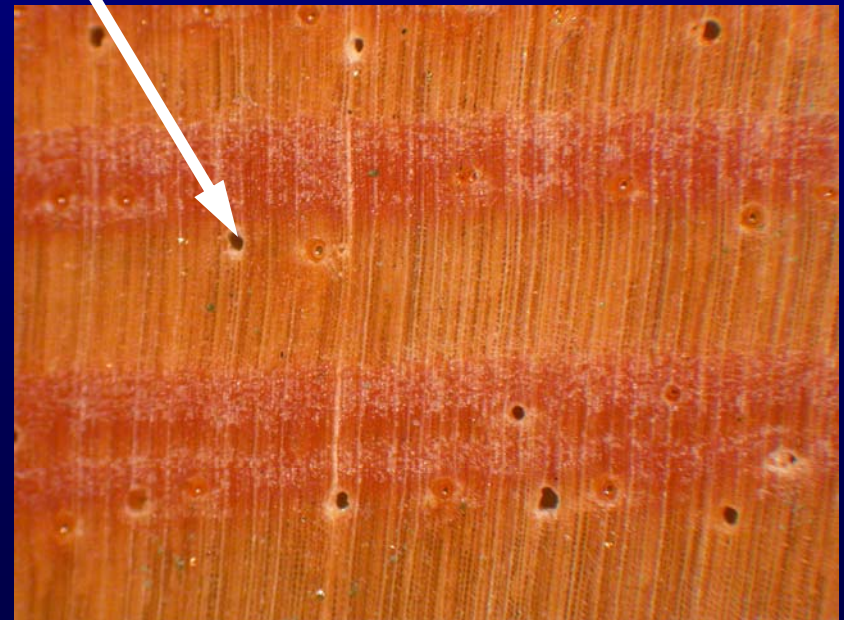
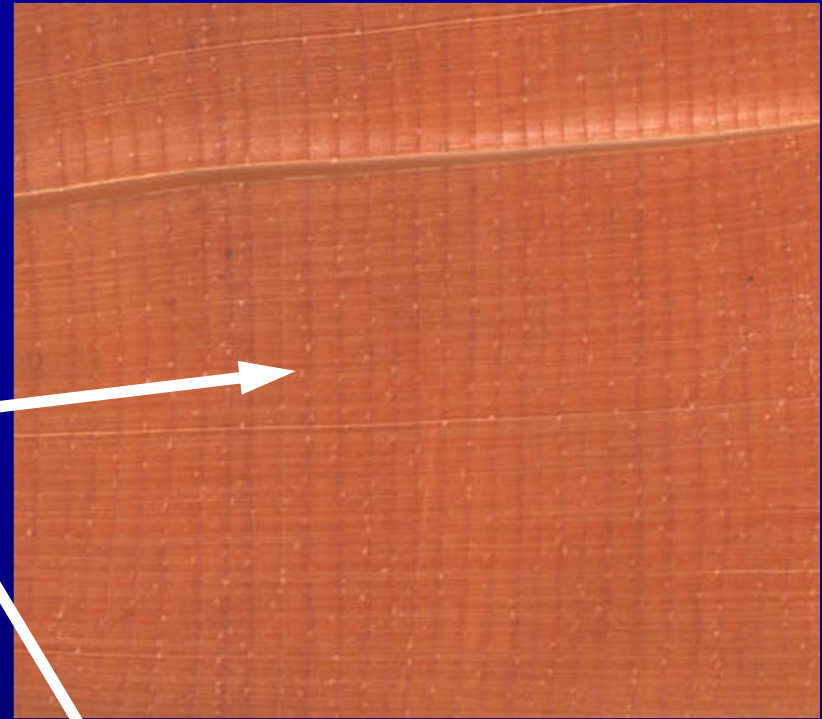
# Now let's see if we can separate all of the hardwood samples into one of these pore arrangements

- Diffuse porous
- Semi-ring porous
- Ring porous

# Resin Canals

- Resin canals are found in softwoods
- Resin canals are only found in all species of the four genera within the *Pinaceae* family
  - Larches (*Larix* spp.)
  - Pines (*Pinus* spp.)
  - Douglas firs (*Pseudotsuga menziesii*)
  - Spruces (*Picea* spp.)

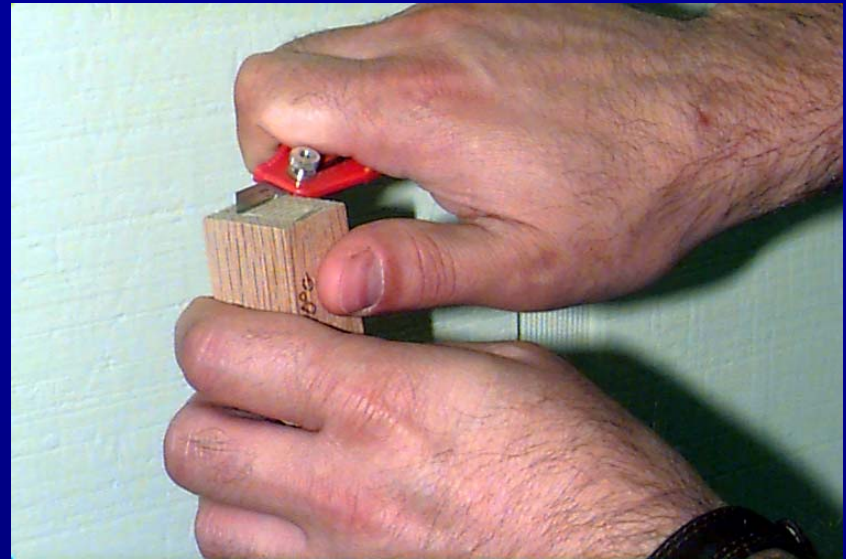
Resin canals



**Now let's see if we can separate all of  
the softwood samples that contain  
resin canals**

# Density

- Density is calculated as a ratio of the weight of wood dried (0% moisture content) to the weight of water.
- Density has a direct relationship to hardness.
- The more dense or hard wood is the more difficult it is to cut with a knife or scratch with your thumbnail.





# Odor

Some have a distinctive smell.

Eastern Red Cedar has an odor that smells like a cedar chest.

Can you find the Eastern Red Cedar??????



# Color

The color of walnut for example is very dark chocolate brown.

Can you find the Walnut??????

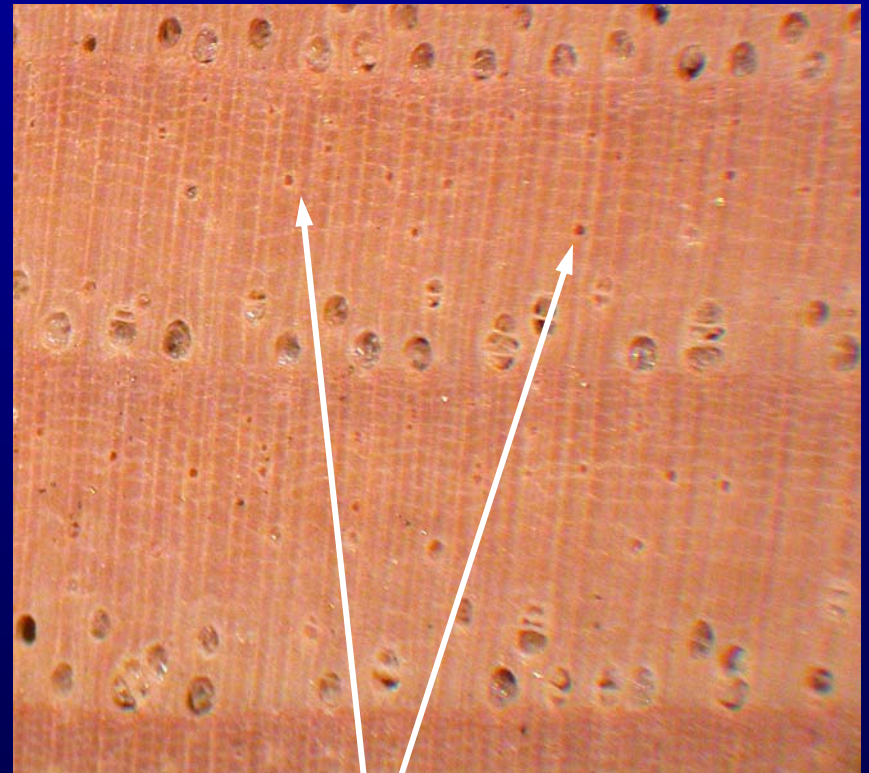


# Parenchyma

These cells are usually light in color.

Hickory for example has little light colored wiggly bands of parenchyma cells that are arranged perpendicular to the rays. They are easily seen using a hand lens in the cross section plane.

Can you find the Hickory??????



Fish in a net

Tyloses are crystal-like substances that can be present in the opening of pores in some species.

## Tyloses

It is this substance that prevents White Oak whiskey barrels from leaking their contents. Tyloses are normally very abundant in white oak and are one of the key features separating White Oak from Red Oak.



Can you find the White Oak??????

**Now let's look at each species  
individually**

# Red Oak

*Quercus rubra, coccinea, palustris, velutina*

**Hardwood:** pores present easily seen without hand lens on the cross-section

**Rays:** are extremely visible without hand lens on the tangential, radial, and cross-section surfaces. Rays appear on the tangential surface as long (normally shorter than 3/4") wide brown lines.

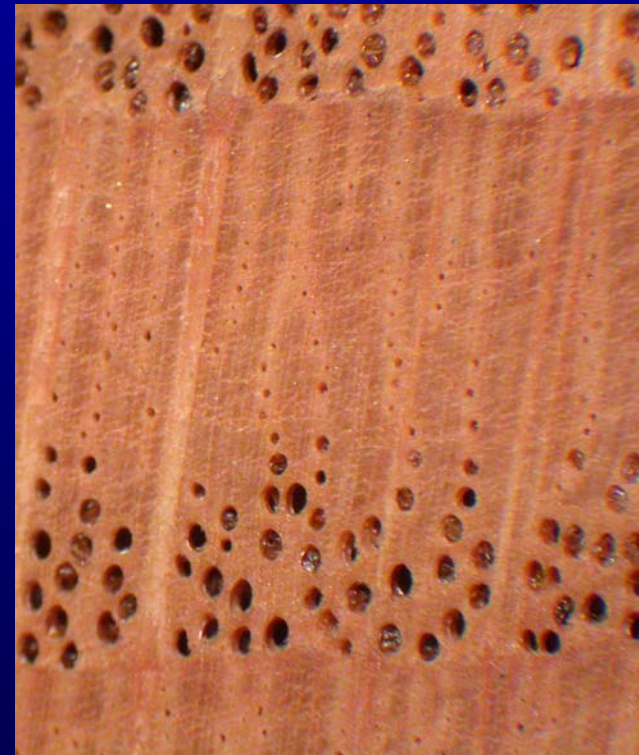
**Pore orientation:** ring porous

**Heartwood color:** medium to dark brown. Can have a pinkish cast

**Sapwood color:** much lighter in color than the heartwood can be almost white

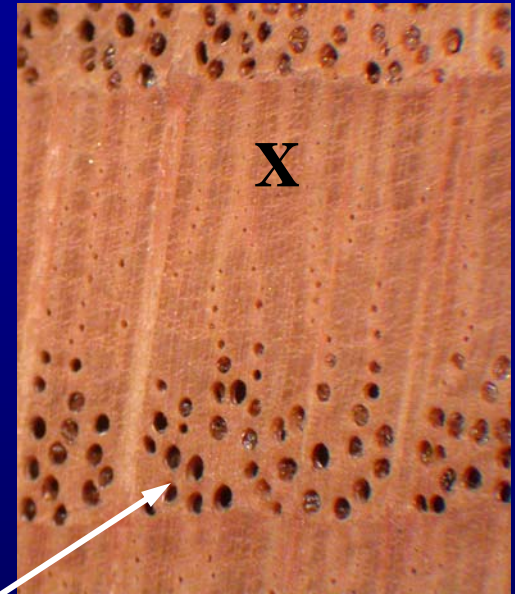
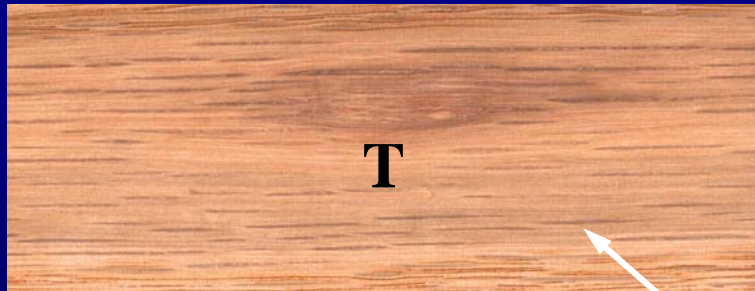
**Density:** very hard (not easily scratched with thumbnail)

**Other features:** Tyloses normally not present or in small amounts



# Red Oak

*Quercus rubra, coccinea, palustris, velutina*



**Key Features:** hardwood, ring porous,  
majority of rays in the tangential surface  
less than 3/4" in length, limited amount of  
tyloses in the pores

Sample # 9

# White Oak

*Quercus alba, macrocarpa, prinus, stellata*

**Hardwood:** pores present easily seen without hand lens on the cross-section

**Rays:** are extremely visible without hand lens on the tangential, radial, and cross-section surfaces. Rays appear on the tangential surface as long (normally greater than 3/4") wide brown lines

**Pore orientation:** ring porous

**Heartwood color:** medium to dark brown

**Sapwood color:** much lighter in color than the heartwood can be almost white

**Density:** very hard (not easily scratched with thumbnail)

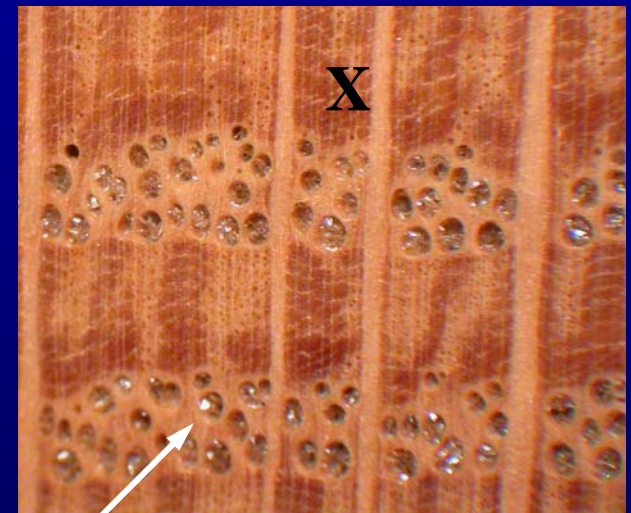
**Other features:** Tyloses normally present





# White Oak

*Quercus alba, macrocarpa, prinus, stellata*



**Key Features:** hardwood, ring porous, majority of rays in the tangential surface greater than 3/4" in length, normally pores filled with tyloses, very large ray fleck in the radial plane can be present.

Sample # 8

# Sycamore

*Platanus occidentalis*

**Hardwood:** pores present, need hand lens to see on the cross-section surface

**Rays:** are extremely visible without hand lens on the tangential, radial, and cross-section surfaces. They appear as very numerous short fat lines on the tangential surface and numerous ray fleck on the radial surface.

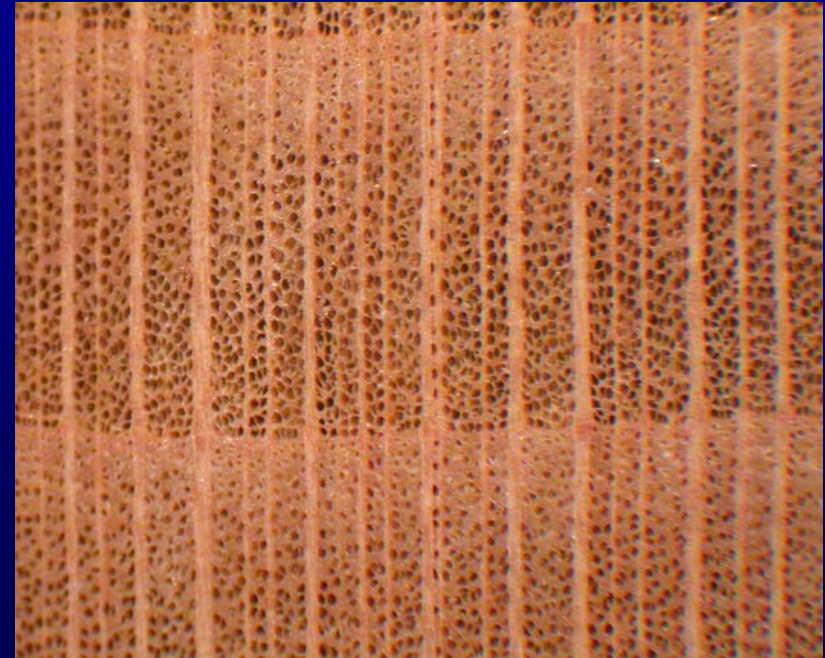
**Pore orientation:** diffuse porous

**Heartwood color:** light in color, can have reddish cast

**Sapwood color:** can be lighter in color than the heartwood

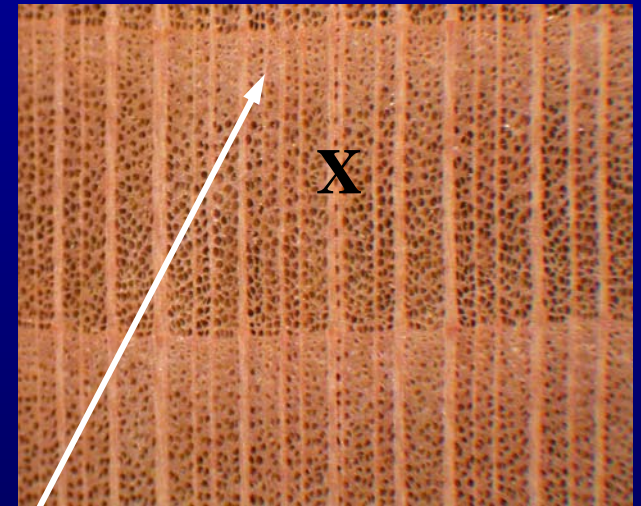
**Density:** medium

**Other features:** in the latewood growth of the annual growth ring the cells are lighter in color than spring wood



# Sycamore

*Platanus occidentalis*



**Key Features:** hardwood, diffuse porous, rays very distinct on the tangential surface, usually has distinct ray fleck on the radial surface, latewood tissue lighter than the earlywood tissue.

**Sample # 12**

# American Basswood

*Tilia americana*

**Hardwood:** pores present, need hand lens to see on the cross-section surface

**Rays:** need hand lens to see rays even on the cross-section surface

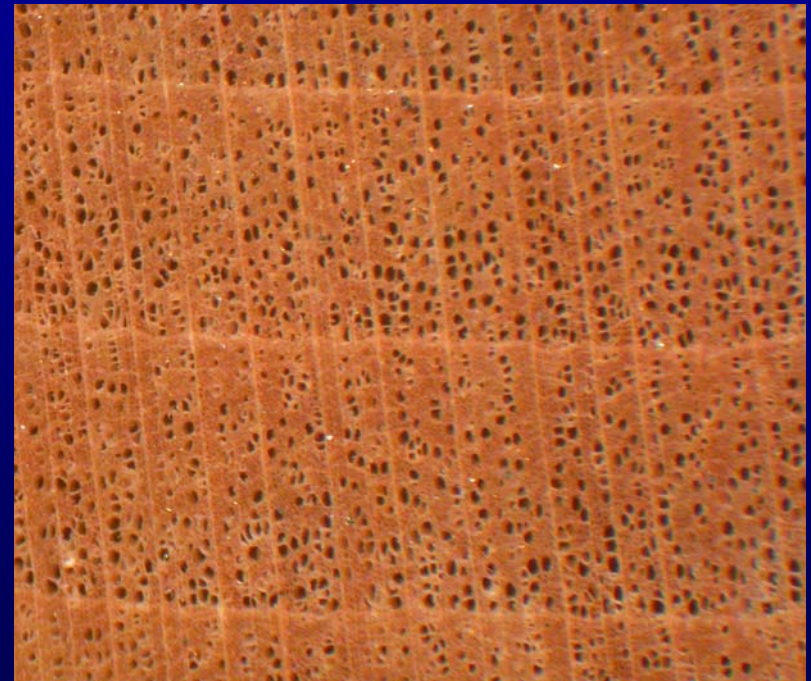
**Pore orientation:** diffuse porous

**Heartwood color:** orange tinge to pale brown

**Sapwood color:** may be slightly lighter in color than the heartwood

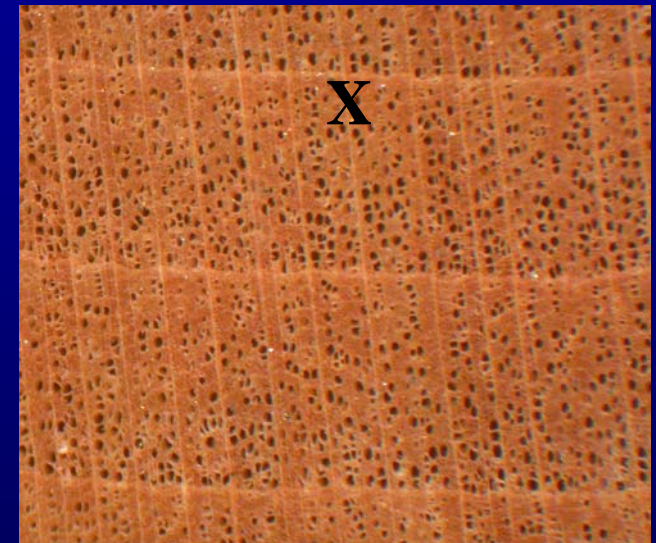
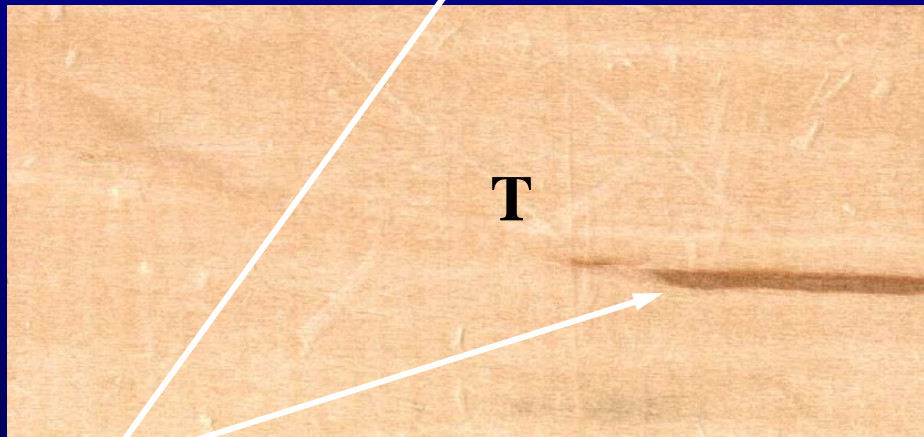
**Density:** very soft (very easily scratched with thumbnail). Has a velvety feel when cut on the cross-section surface

**Other features:** can have a musty odor, usually will have brown streaks, may have white spots along the annual growth ring.



# American Basswood

*Tilia americana*



**Key Features:** a very soft hardwood, diffuse porous, a smooth cut in the cross-section feels like velvet, brown streaks often present.

**Sample # 11**

# Black Walnut

*Juglans nigra*

**Hardwood:** pores present easily seen without hand lens on the cross-section surface. Pores slowly get smaller across the annual growth ring.

**Rays:** need hand lens to see rays even on the cross-section surface

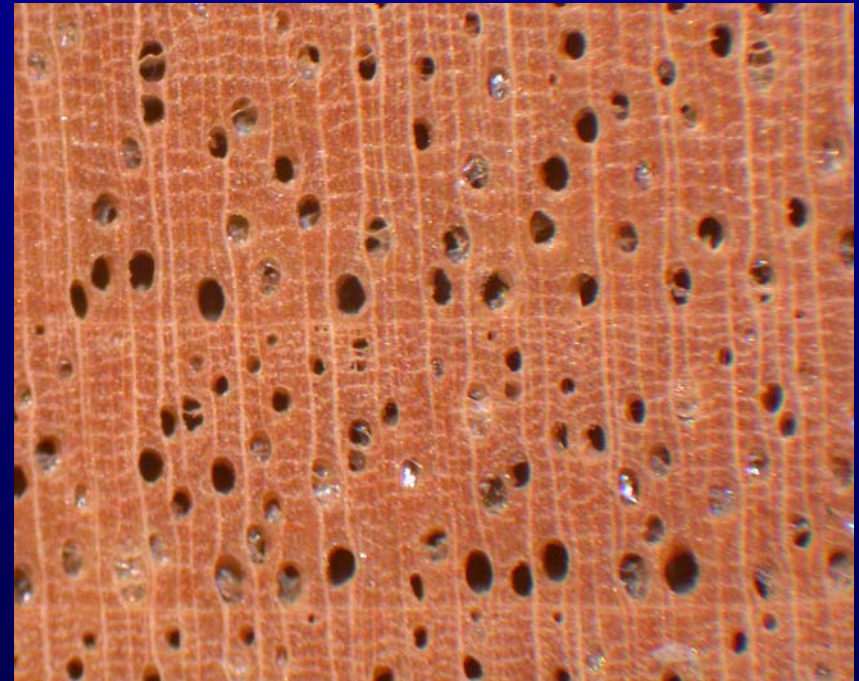
**Pore orientation:** semi-ring porous

**Heartwood color:** very dark chocolate brown

**Sapwood color:** white

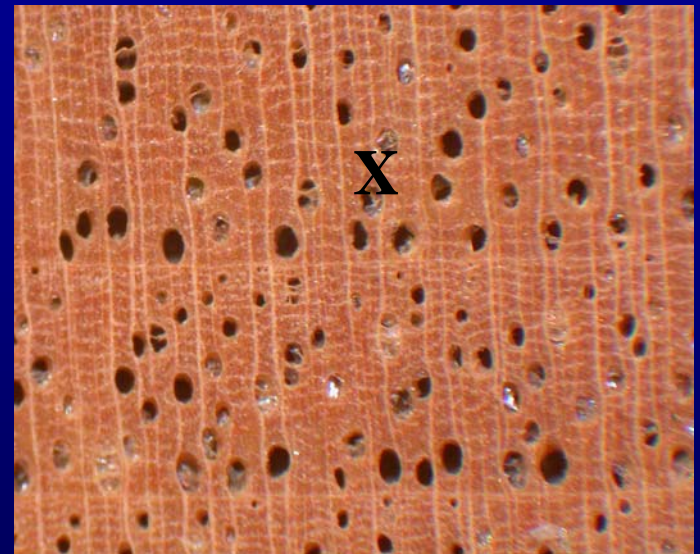
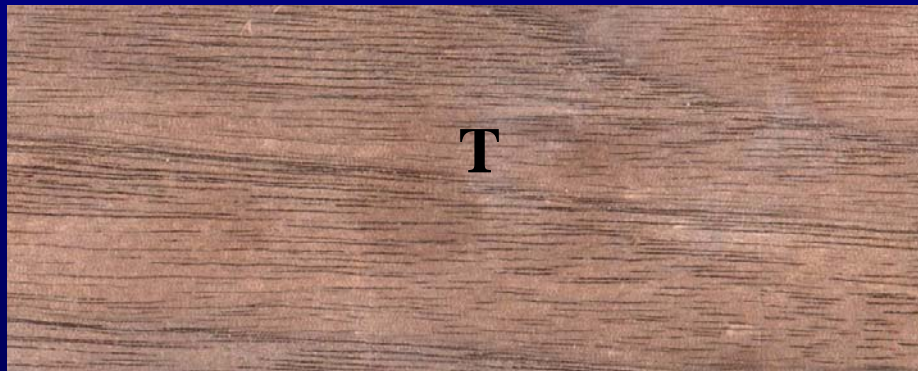
**Density:** medium to hard (not easily scratched with thumbnail)

**Other features:** some tyloses normally present



# Black Walnut

*Juglans nigra*



**Key Features:** hardwood, semi-ring porous,  
very distinctive chocolate brown color.

Sample # 2

# Ash

*Fraxinus spp.*

**Hardwood:** pores present easily seen without hand lens on the transverse surface. Ring porous. In White Ash latewood pores are often connected like a chain

**Rays:** need hand lens to see rays even on the transverse surface

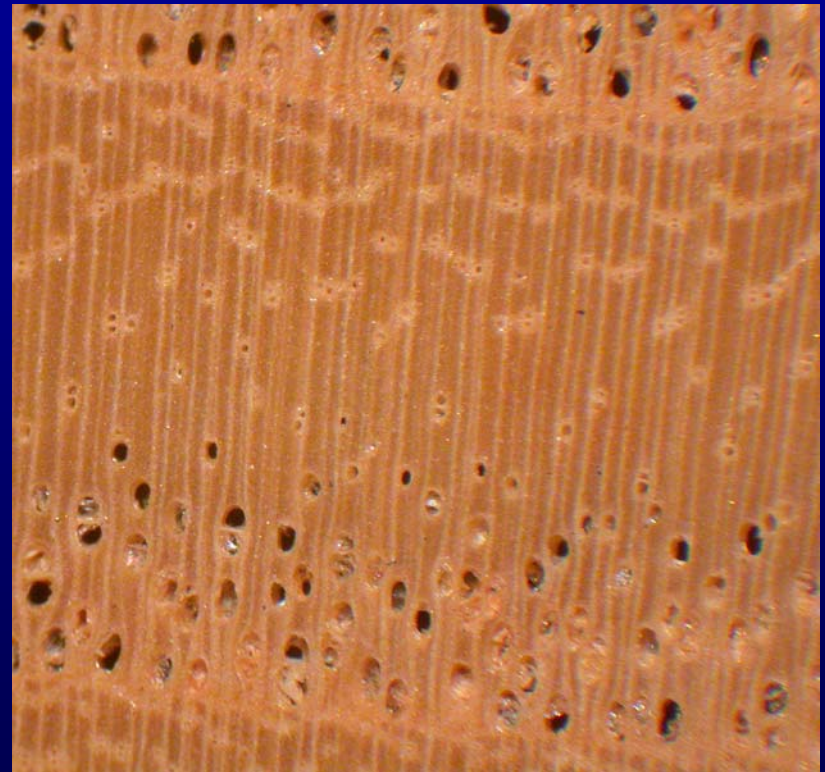
**Pore orientation:** ring porous

**Heartwood color:** very light to medium brown

**Sapwood color:** much lighter in color than the heartwood can be almost white

**Density:** fairly hard (not easily scratched with thumbnail)

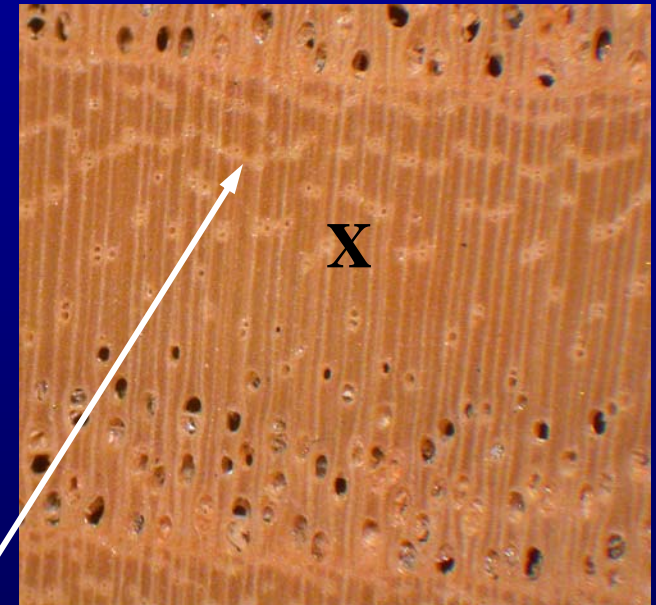
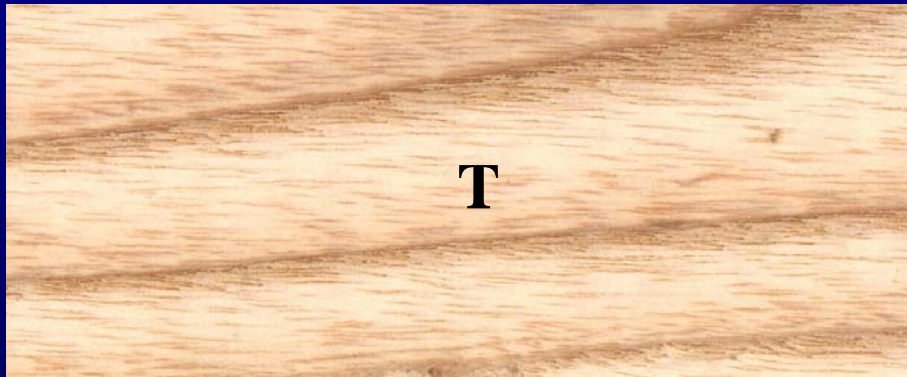
**Other features:** tyloses fairly abundant, latewood pores connected in chain





# Ash

*Fraxinus spp.*



**Key Features:** hardwood, ring porous, looks like oak without visible rays in the tangential or radial surfaces, latewood pores connected in a chain.

**Sample # 1**

# American Chestnut

*Castanea dentata*

**Hardwood:** pores present easily seen without hand lens on the transverse surface. Pores are oval in shape

**Rays:** not visible without hand lens on the tangential, radial, or cross-section surfaces. Rays can be seen, but not easily, on the cross-section surface when using a hand lens

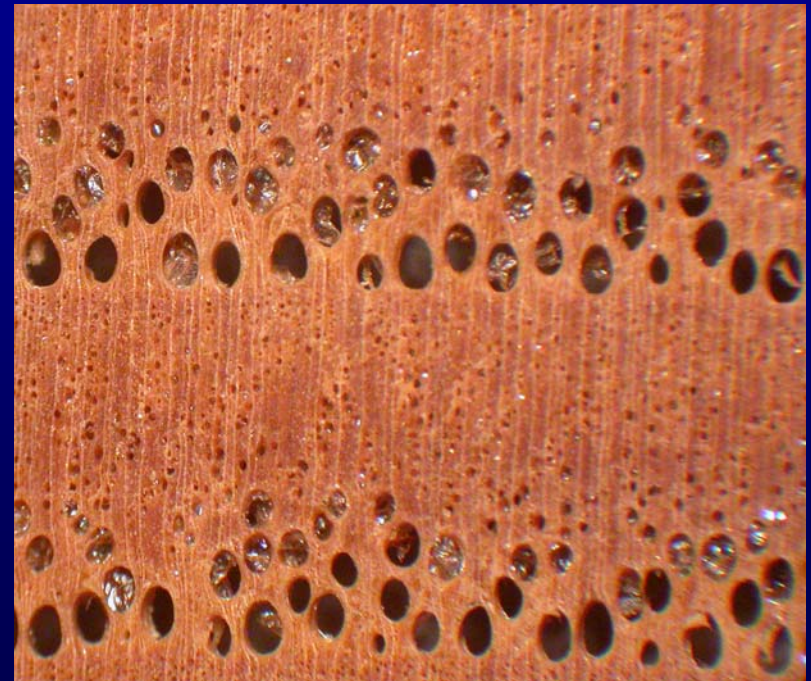
**Pore orientation:** ring porous

**Heartwood color:** Reddish to grayish medium to dark brown

**Sapwood color:** much lighter in color than the heartwood

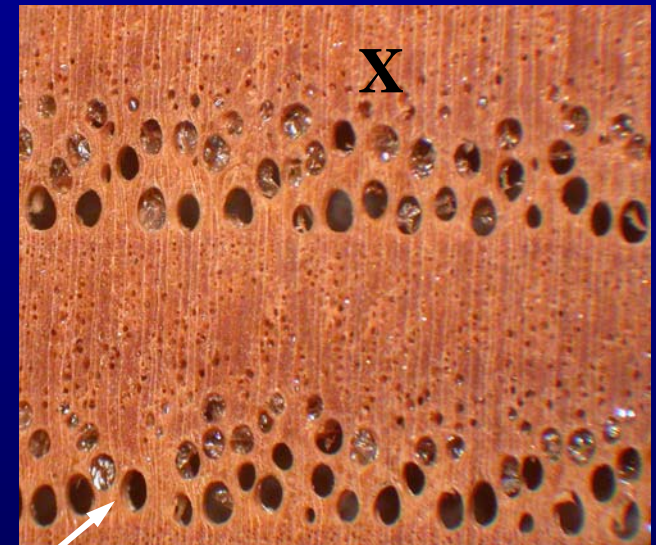
**Density:** medium to soft

**Other features:** Tyloses maybe present, usually will have wormholes, earlywood pores oval shaped



# American Chestnut

*Castanea dentata*



**Key Features:** hardwood, ring porous, usually will have wormholes, earlywood pores oval shaped.

Sample # 4

# Black Cherry

*Prunus serotina*

**Hardwood:** pores present very difficult to see, need hand lens

**Rays:** are not visible without hand lens on the tangential surface. Can be seen on the cross-section surface. Very easy to see on the cross-section surface when using a hand lens. Rays appear as white lines

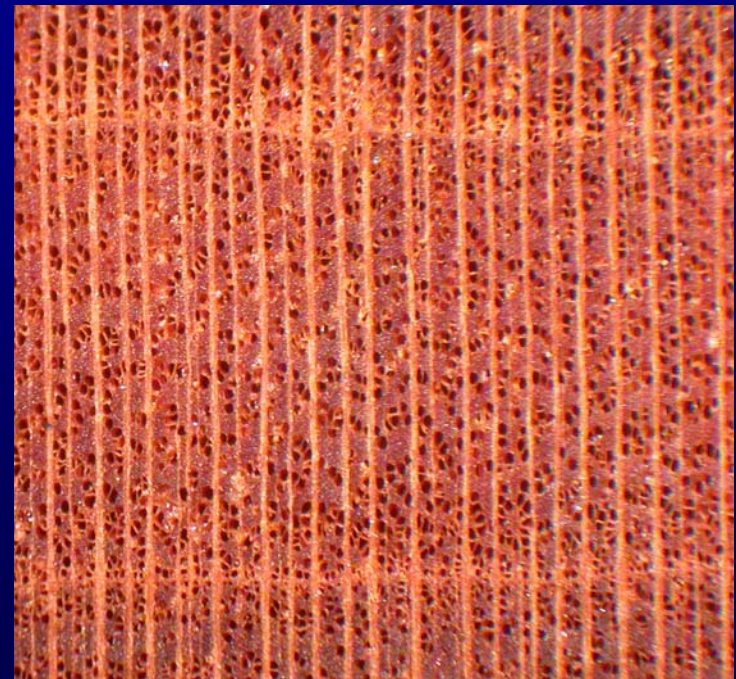
**Pore orientation:** diffuse porous

**Heartwood color:** dark orange to maroon.

**Sapwood color:** much lighter in color than the heartwood, can be almost white.

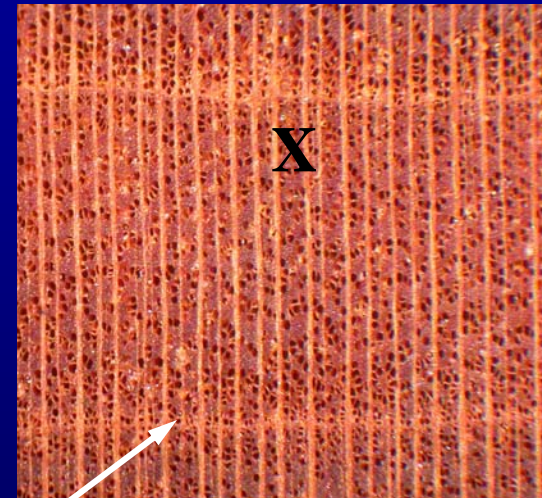
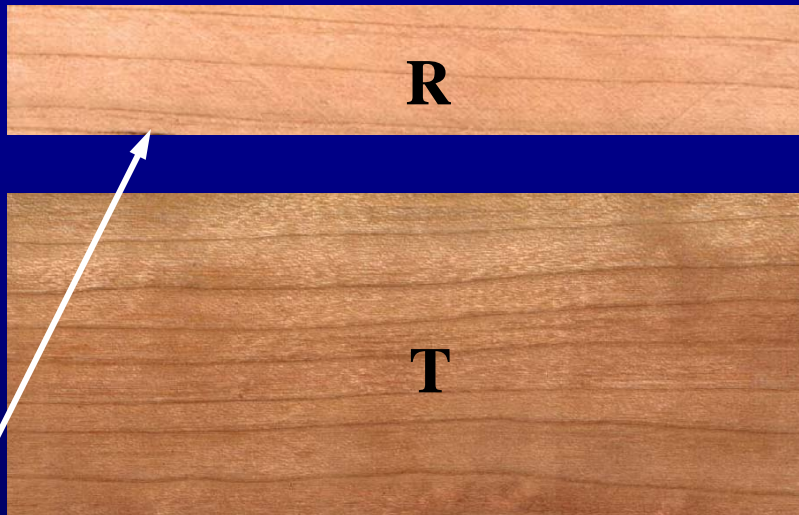
**Density:** medium (fairly easy to scratch with thumbnail)

**Other features:** often has gum pockets



# Black Cherry

*Prunus serotina*



**Key Features:** hardwood, diffuse porous, sapwood very light color, first row of pores in the earlywood may be larger than rest, heartwood distinctive orange to maroon color, gum pockets may be present.

Sample # 3

# Hard Maple

*Acer saccharum*

**Hardwood:** pores present very difficult to see, need hand lens

**Rays:** Usually visible with naked eye in the radial and tangential planes as very small evenly distributed red lines. Can appear as small ray fleck in the radial plane. Can be seen with hand lens on the cross-section surface.

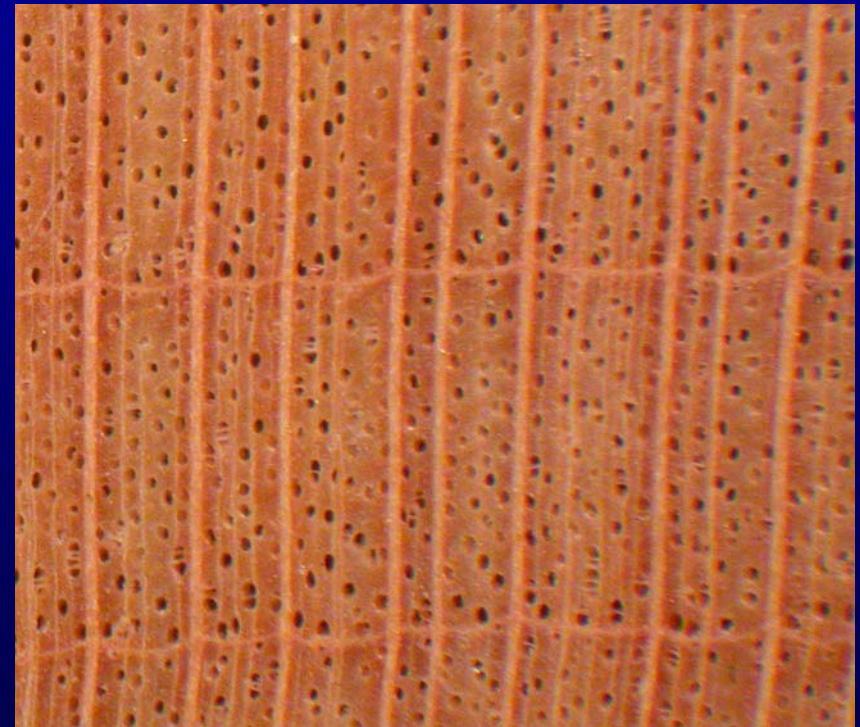
**Pore orientation:** diffuse porous

**Heartwood color:** creamy white to light reddish brown.

**Sapwood color:** generally the same color tint as the heartwood

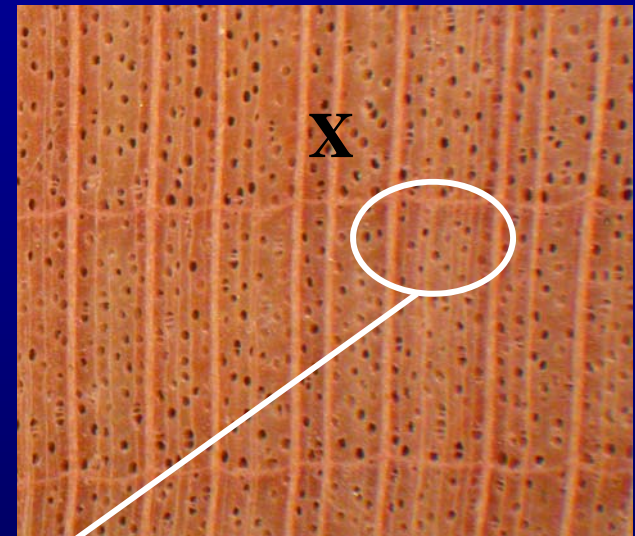
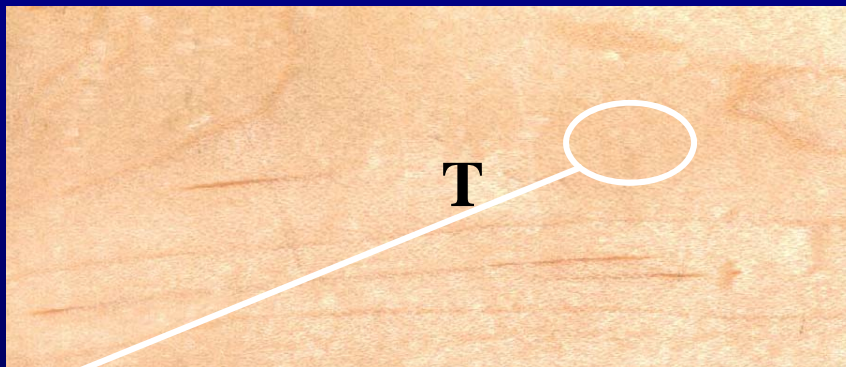
**Density:** hard (fairly difficult to scratch with thumbnail)

**Other features:** large rays with several thin rays in between, the widest rays are about as wide as the diameter of the largest pores



# Hard Maple

*Acer saccharum*



**Key Features:** hardwood, diffuse porous, large rays with several thin rays in between, very hard, difficult to scratch with thumbnail, rays appear on the tangential surface as little red lines and difficult to see

Sample # 6

# Hickory

*Carya spp.*

**Hardwood:** pores present

**Rays:** not visible with naked eye, can be seen with hand lens on the cross-section surface. They appear as small thin lines.

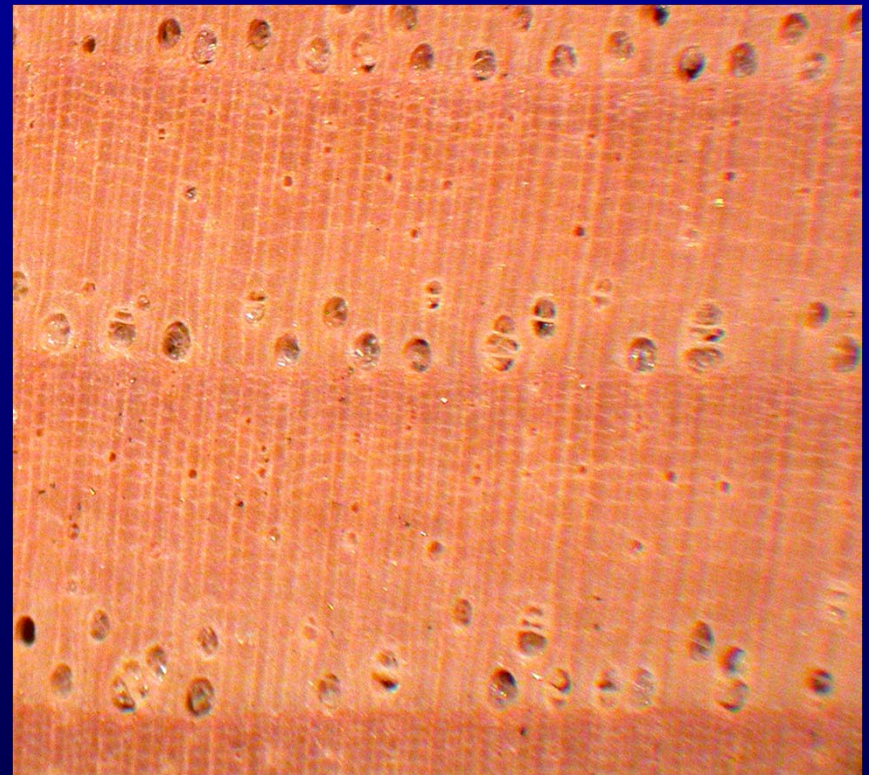
**Pore orientation:** semi-ring porous. Pores generally confined to a single row along the annual growth ring, latewood pores not numerous

**Heartwood color:** light colored brown in some cases almost white to a reddish brown. Purple streaks can be present.

**Sapwood color:** generally lighter than the heartwood

**Density:** extremely hard (not easily scratched with thumbnail)

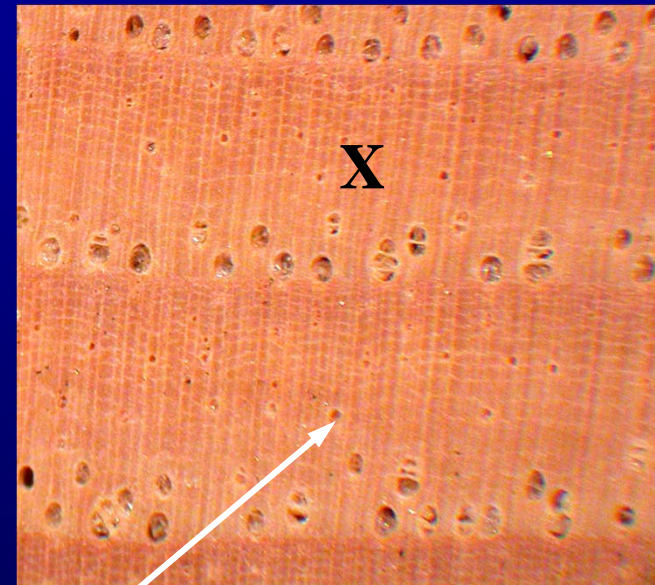
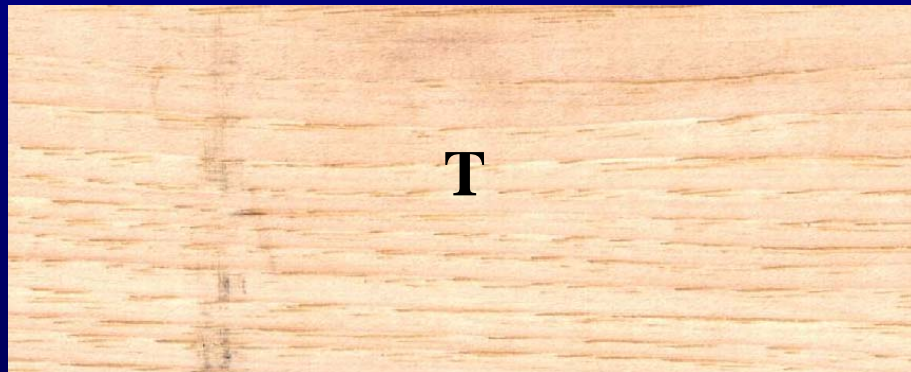
**Other features:** tyloses are fairly abundant, using a hand lens parenchyma cells appear as little white squiggly lines perpendicular to the rays on the cross-section.





# Hickory

*Carya spp.*



**Key Features:** hardwood, semi-ring porous, parenchyma cells appear as little white squiggly lines perpendicular to the rays on the cross-section surface, fish in a net.

Sample # 14

# Soft Maple

*Acer rubrum*

**Hardwood:** pores present very difficult to see, need hand lens

**Rays:** usually visible with naked eye in the radial and tangential planes as very small evenly distributed dark lines. Can appear as small ray fleck in the radial plane. can be seen with hand lens in the cross-section

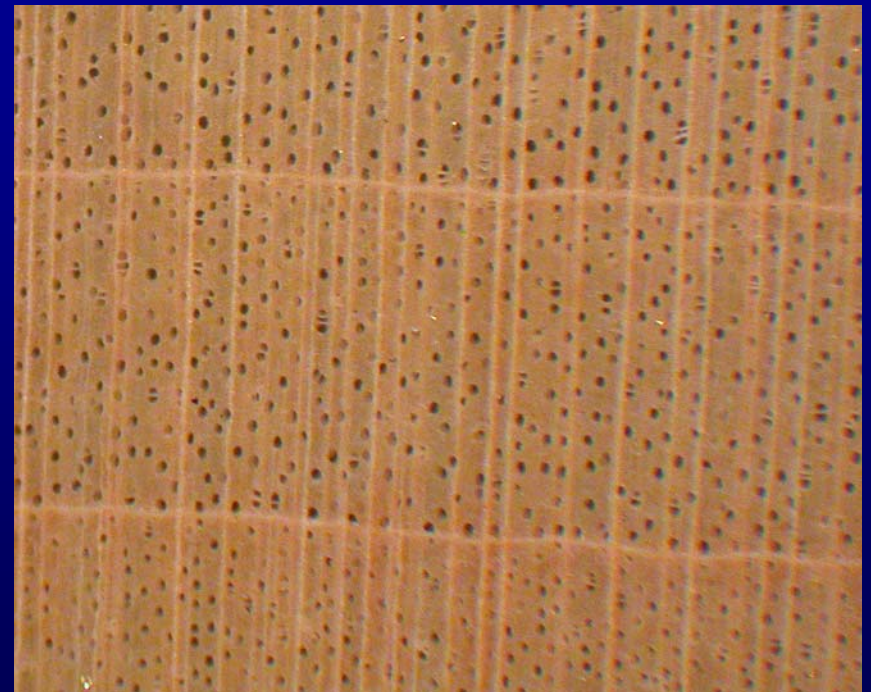
**Pore orientation:** diffuse porous

**Heartwood color:** creamy white to light reddish brown, common in soft maple to have a grayish cast or grayish streaks

**Sapwood color:** generally lighter than the heartwood

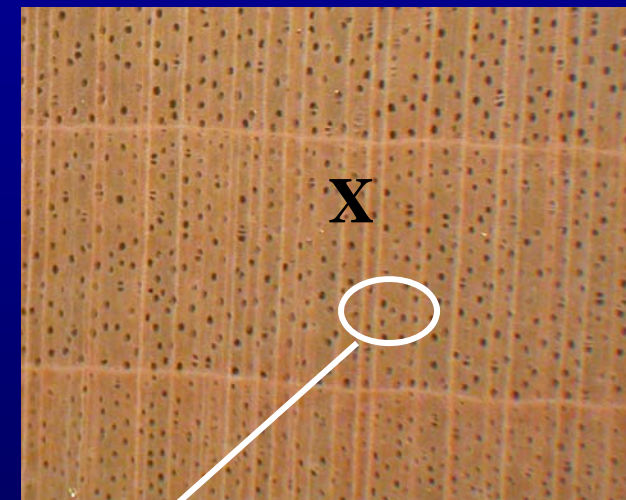
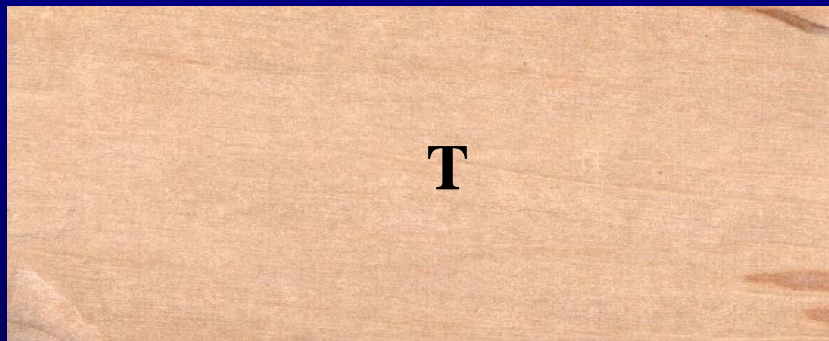
**Density:** medium (fairly easy to scratch with thumbnail)

**Other features:** the largest pores are about as wide as the largest rays



# Soft Maple

*Acer rubrum*



**Key Features:** hardwood, diffuse porous, the largest pores are the same diameter as the largest rays are wide, softer than Hard Maple, easier to scratch with thumbnail.

**Sample # 5**

# Birch

*Betula spp.*

**Hardwood:** pores present, need hand lens to see on the cross-section surface

**Rays:** need hand lens to see rays even on the cross-section surface

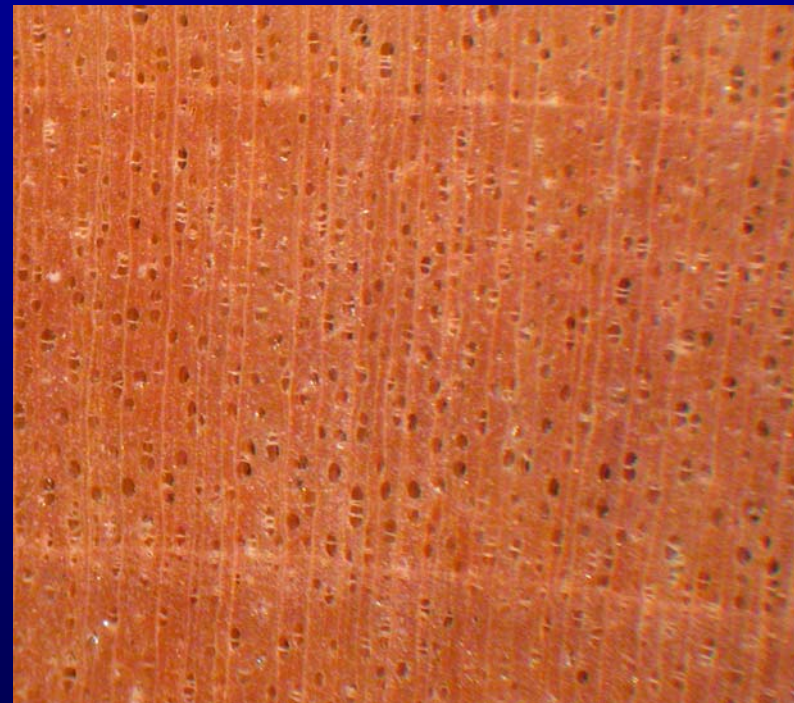
**Pore orientation:** diffuse porous

**Heartwood color:** light to reddish dark brown

**Sapwood color:** can be lighter in color than the heartwood almost white to yellow

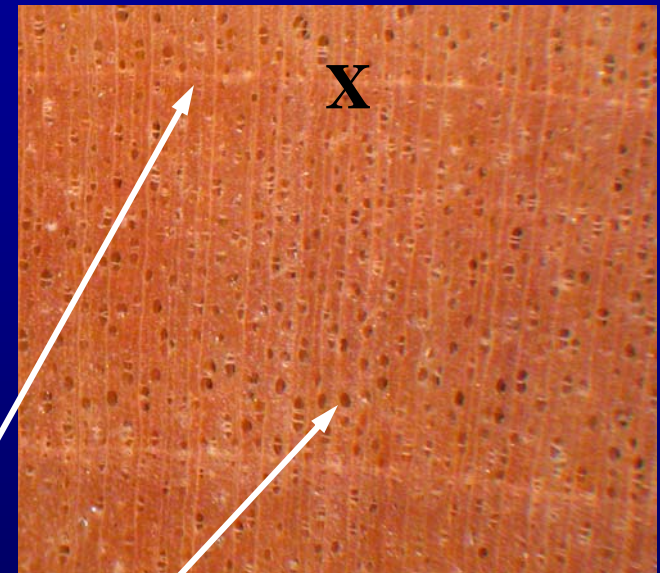
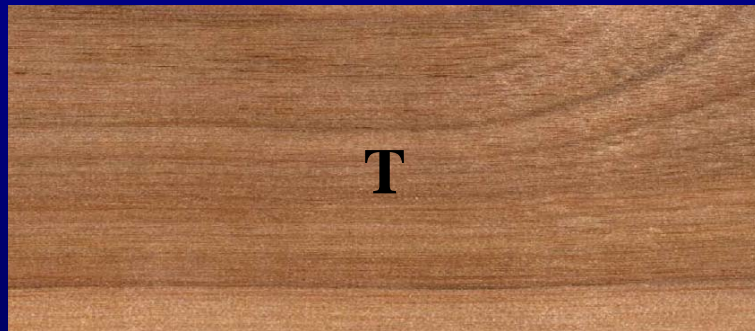
**Density:** hard (not easily scratched with thumbnail)

**Other features:** Annual growth rings may not be distinct. Pore diameters are larger than the ray widths and well separated from each other



# Birch

*Betula spp.*



**Key Features:** hardwood, diffuse porous, annual growth rings not very distinct, pores much larger in size than ray widths.

Sample # 10

# Sweetgum

*Liquidambar styraciflua*

**Hardwood:** pores present, need hand lens to see

**Rays:** not easily visible with naked eye can be seen with hand lens on cross-section surface. They appear as extremely small thin lines.

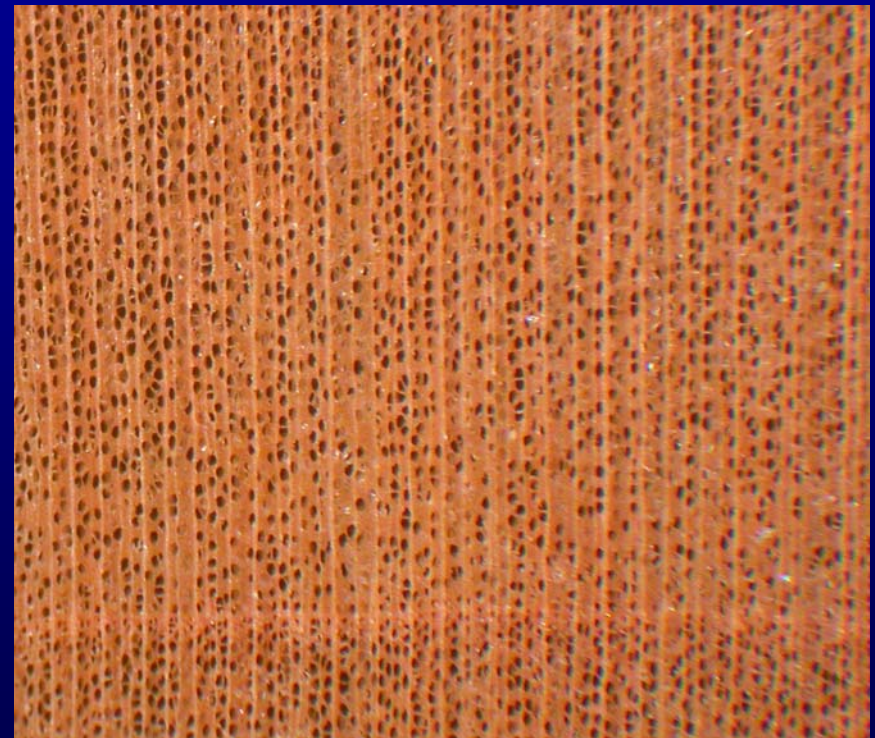
**Pore orientation:** diffuse porous

**Heartwood color:** shades of gray to a reddish brown

**Sapwood color:** nearly white may have a pink cast

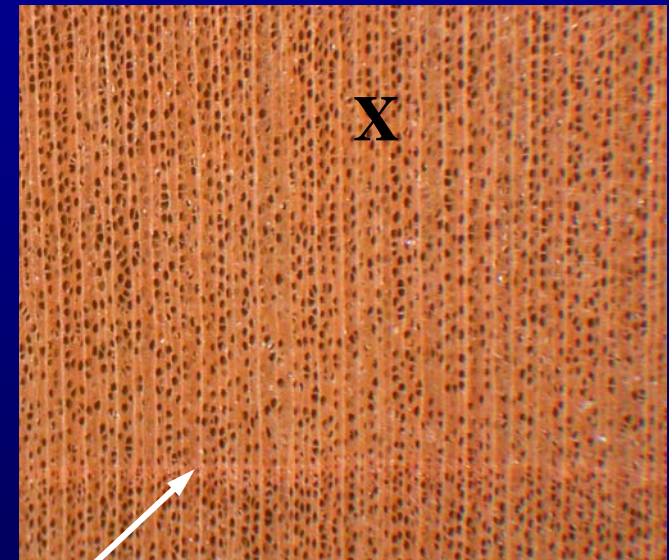
**Density:** medium to hard, difficult to cut and not easily scratched with thumbnail

**Other features:** normally has interlocking grain, growth rings are not distinct without hand lens



# Sweetgum

*Liquidambar styraciflua*



**Key Features:** hardwood, diffuse porous, often has interlocking grain, growth rings are not distinct, several thin tiny rays on the cross-section surface.

**Sample # 13**

# American Beech

*Fagus grandifolia*

**Hardwood:** pores present, need hand lens to see

**Rays:** easily visible with naked eye in the tangential and cross-section surfaces. They appear as short wide dark lines uniformly scattered across the tangential surface.

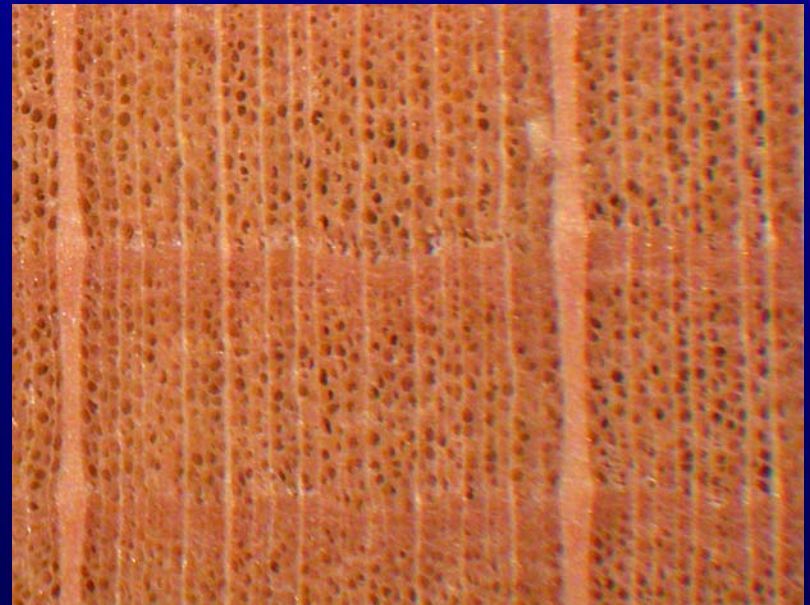
**Pore orientation:** diffuse porous

**Heartwood color:** shades of gray to a reddish brown

**Sapwood color:** nearly white may have a pink cast

**Density:** medium to hard, difficult to cut and not easily scratched with thumbnail

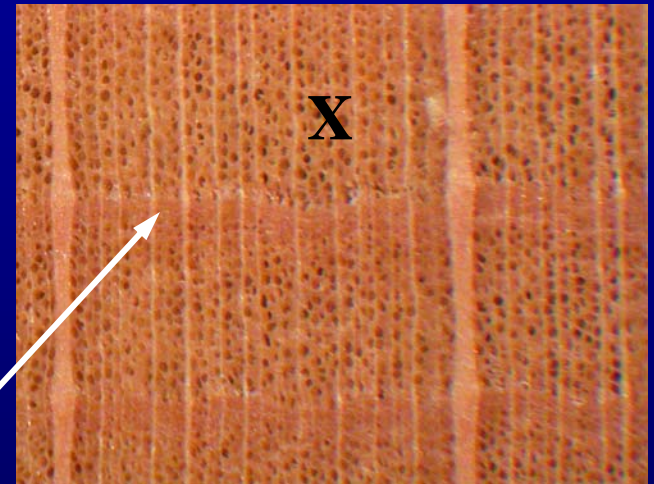
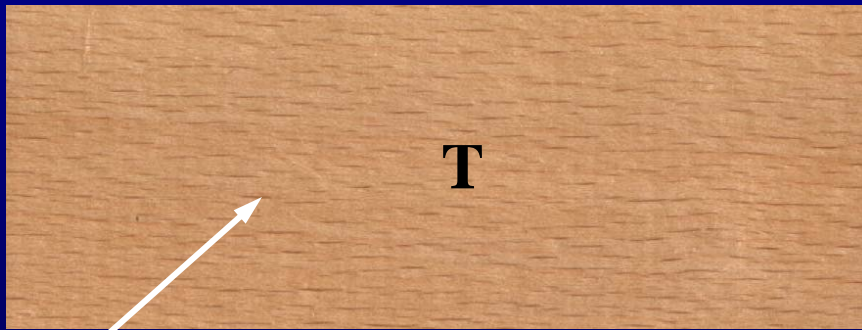
**Other features:** a zone of dense material in the latewood of the annual growth ring





# American Beech

*Fagus grandifolia*



**Key Features:** hardwood, diffuse porous, a zone of dense material in the latewood of the annual growth ring, rays on the tangential surface appear as short wide dark lines uniformly scattered across the surface.

Sample # 15

# Yellow Poplar

*Liriodendron tulipifera*

**Hardwood:** pores present

**Rays:** not visible with naked eye, can easily see with hand lens

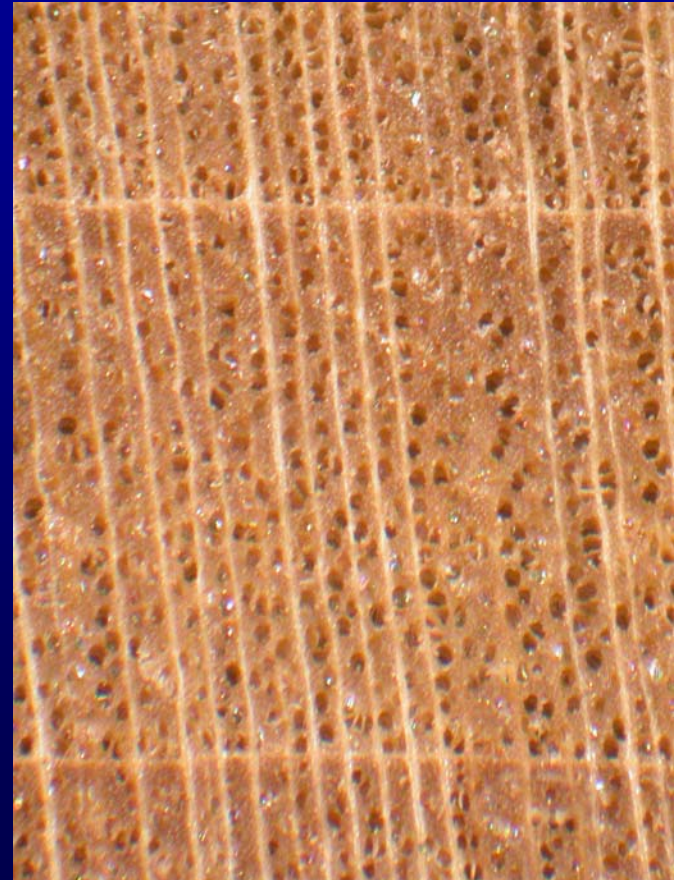
**Pore orientation:** diffuse porous

**Heartwood color:** light green or light brown may have dark black, purple, and green streaks

**Sapwood color:** white or cream

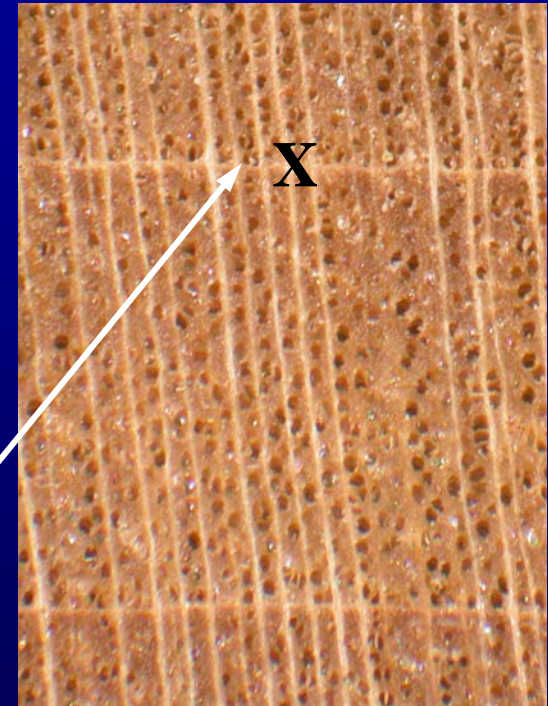
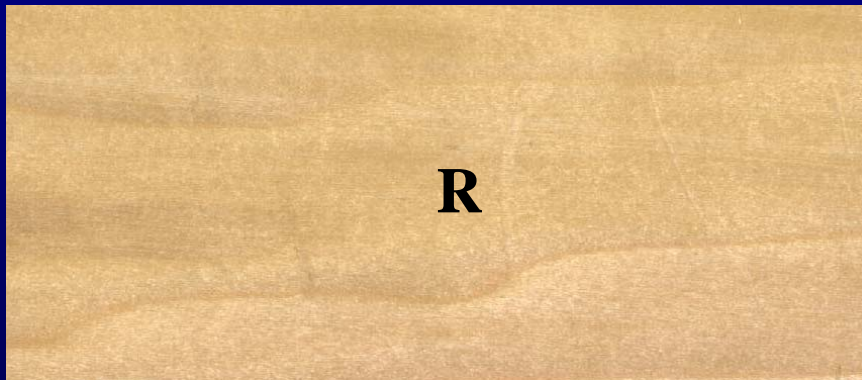
**Density:** fairly soft (can be easily scratched with thumbnail)

**Other features:** marginal parenchyma at the annual growth appears white in the cross-section surface



# Yellow Poplar

*Liriodendron tulipifera*



**Key Features:** hardwood, diffuse porous, marginal parenchyma at the annual growth ring appears white in the cross-section surface, heartwood is green and can have streaks of purple and black.

**Sample # 7**

# Baldcypress

*Taxodium distichum*

**Softwood:** no pores

**Resin canals:** none

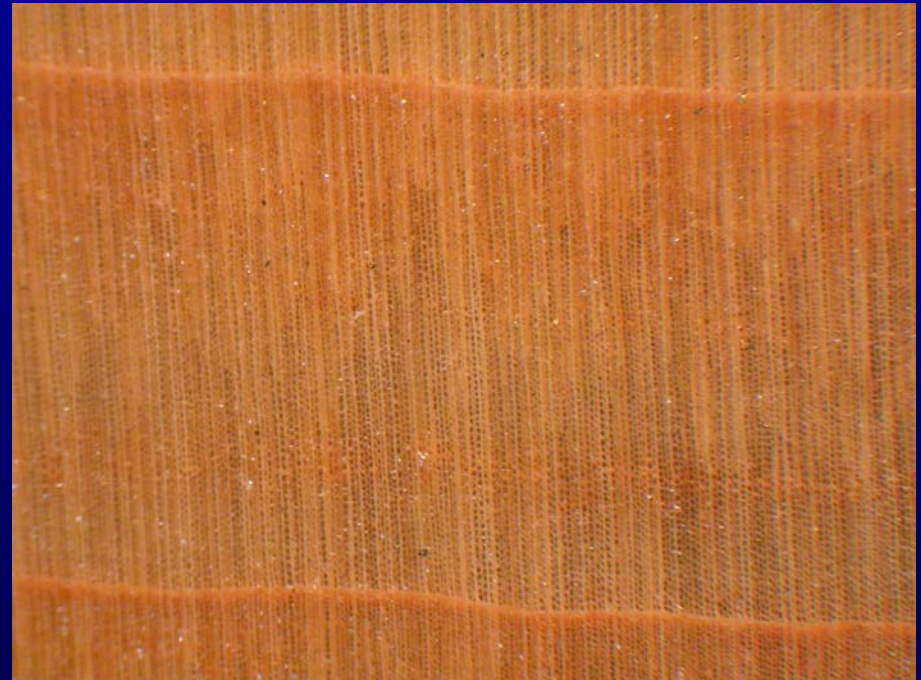
**Odor:** slight distinctive smell

**Heartwood:** usually distinct

**Earlywood/latewood:** transition is abrupt;  
earlywood medium yellow brown,  
latewood amber to dark brown.

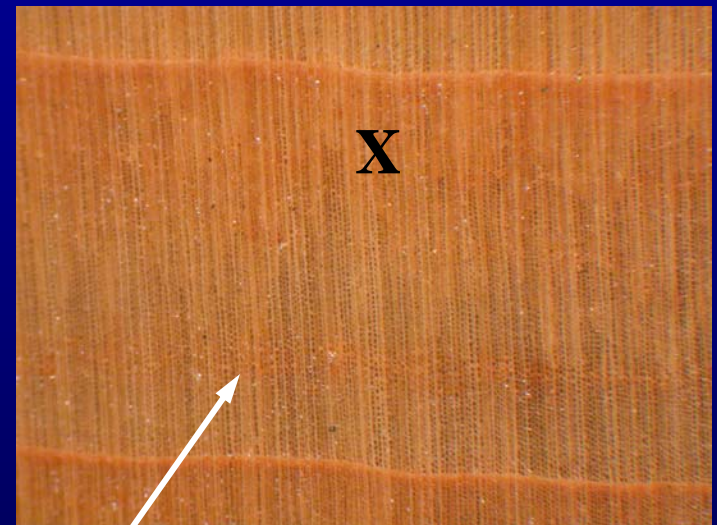
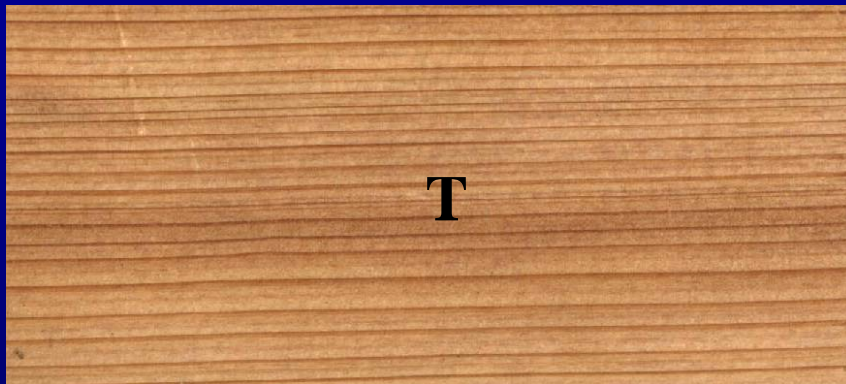
**Density:** medium to soft

**Texture:** coarse



# Baldcypress

*Taxodium distichum*



**Key Features:** softwood, no resin canals, false growth rings, waxy feel on tangential surface.

Sample # 20

# Eastern Redcedar

*Juniperus virginiana*

**Softwood:** no pores

**Resin Canals:** none

**Odor:** cedar chest

**Heartwood:** deep purple to red aging to reddish brown

**Earlywood/latewood:** transition is gradual

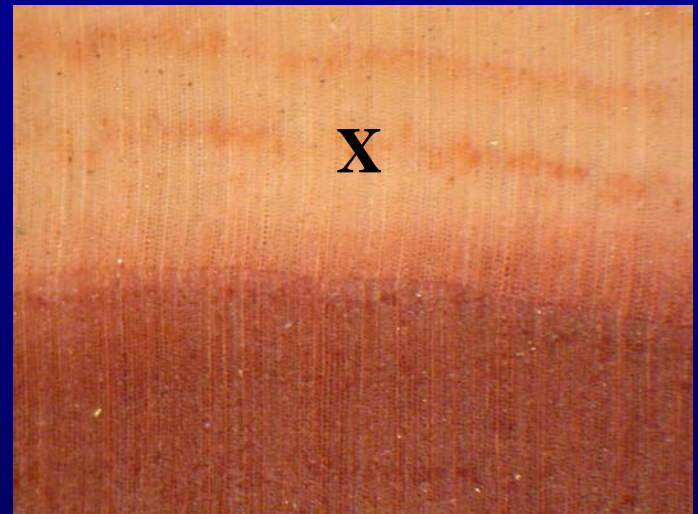
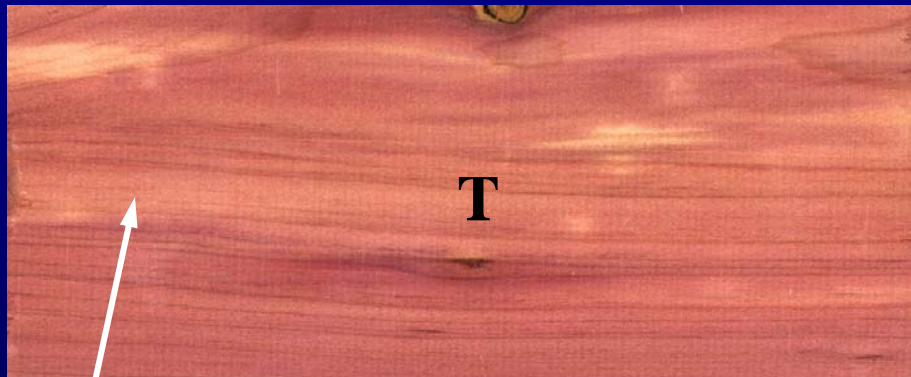
**Density:** medium to soft

**Texture:** very fine, smooth



# Eastern Redcedar

*Juniperus virginiana*



**Key Features:** softwood, no resin canals,  
heartwood deep purple color, distinctive  
cedar chest smell.

Sample # 16

# Eastern White Pine

*Pinus strobus*

**Softwood:** no pores

**Resin Canals:** large and numerous, evenly distributed

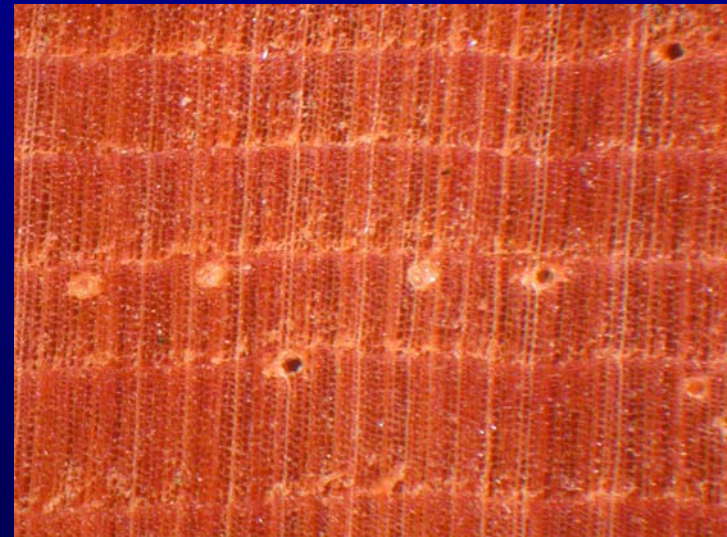
**Odor:** pine smell

**Heartwood:** is distinct and darkens with age

**Earlywood/latewood:** transition is gradual

**Density:** soft

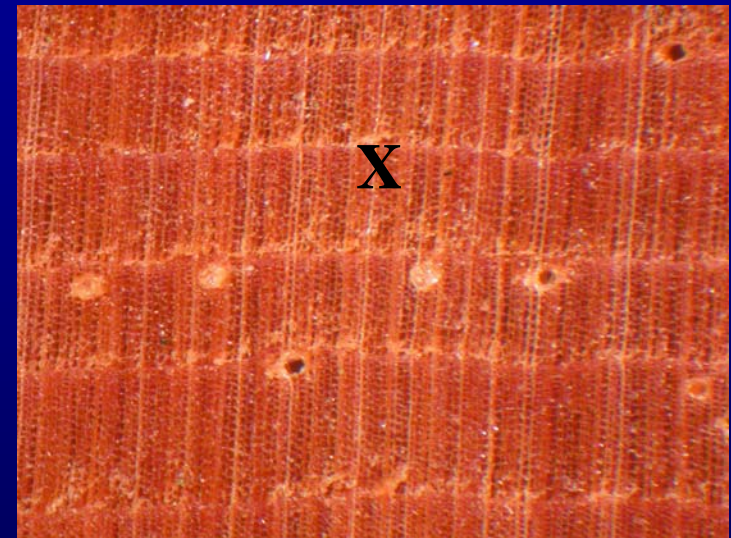
**Texture:** very fine, smooth





# Eastern White Pine

*Pinus strobus*



**Key Features:** softwood, has resin canals, earlywood to latewood transition is gradual, pine smell, much softer than Southern Yellow Pine fairly easy to scratch with thumbnail.

Sample # 17

# Southern Yellow Pine

*Pinus spp.*

**Softwood:** no pores

**Resin Canals:** large and numerous evenly distributed

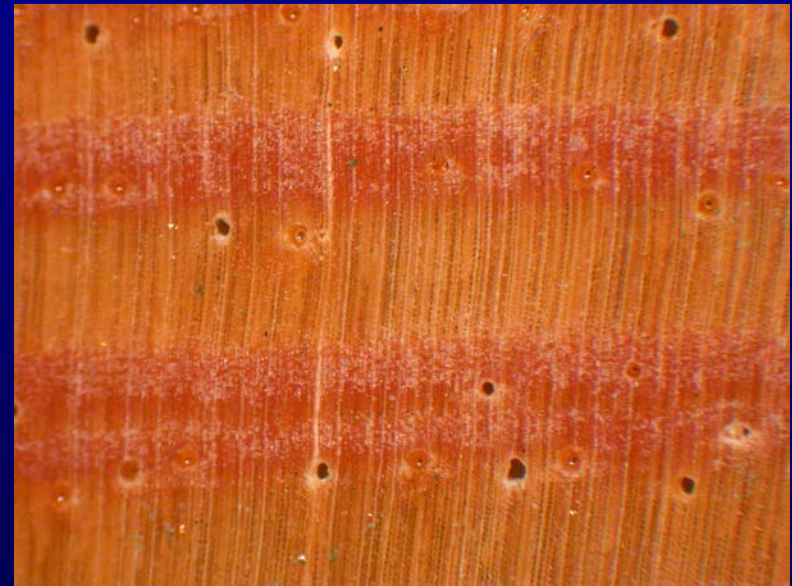
**Odor:** strong pine smell

**Heartwood:** is distinct

**Earlywood/latewood:** transition is abrupt

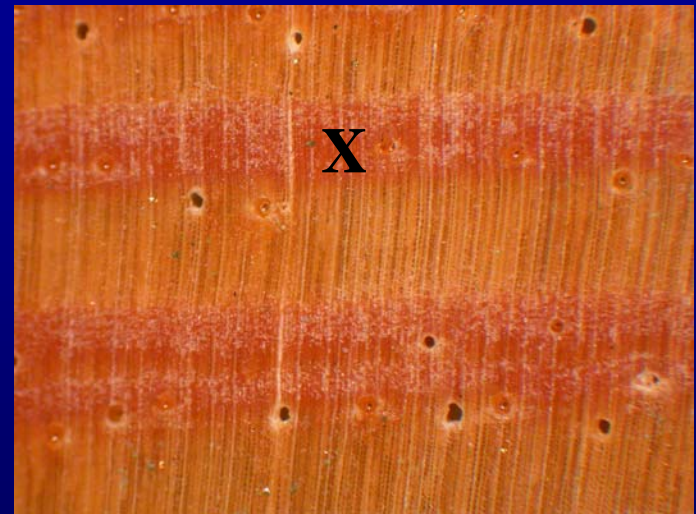
**Density:** Medium to hard

**Texture:** very fine, smooth



# Southern Yellow Pine

*Pinus spp.*



**Key Features:** softwood, has resin canals, earlywood to latewood transition is abrupt, pine smell, much harder than White Pine, fairly difficult to scratch with thumbnail, latewood growth very dense.

**Sample # 18**

# Eastern Hemlock

*Tsuga canadensis*

**Softwood:** no pores

**Resin Canals:** no resin canals

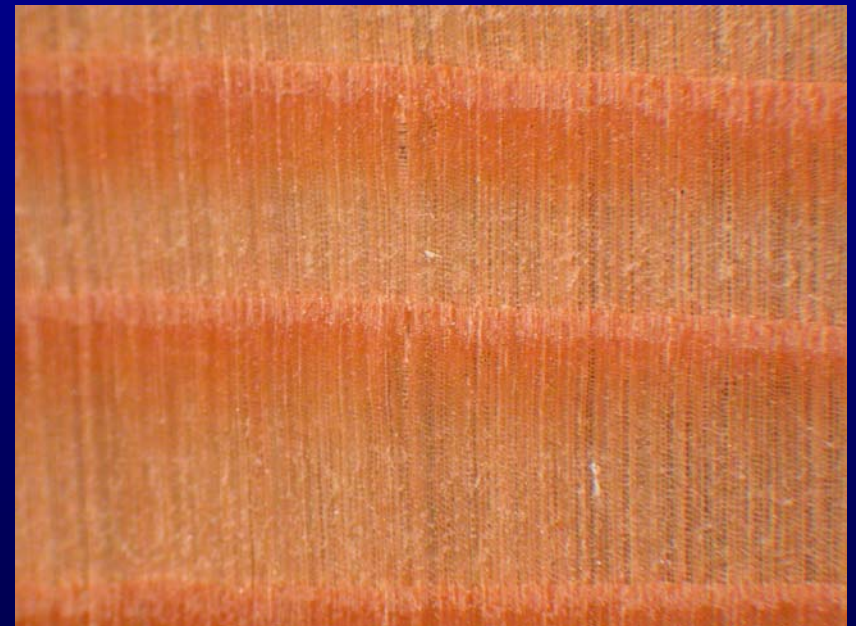
**Odor:** no odor

**Heartwood:** not distinct, light in color

**Earlywood/latewood:** transition is fairly abrupt to gradual

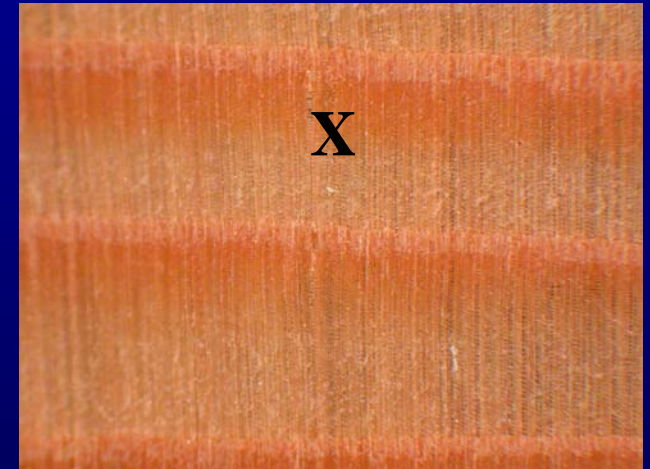
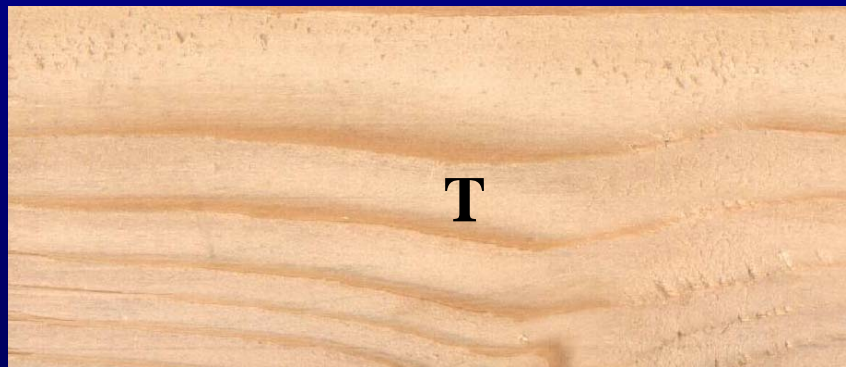
**Density:** soft to medium

**Texture:** medium



# Eastern Hemlock

*Tsuga canadensis*



**Key Features:** softwood, no resin canals,  
earlywood to latewood transition is abrupt,  
no other real distinctive feature.

Sample # 19