InsideTrees Module 2: Characteristics of Wood Inside a Tree

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DISCIPLINARY CONTENT

Macroscopic Characteristics

Macroscopic characteristics are properties (in this case of wood) that can be detected by observation *without* the use of a microscope. These observations can be used to determine conditions under which wood has grown, provide an indication of physical properties, and serve as an aid in wood identification.

Bark

Outer bark –
Protects tree from diseases, bugs, and fire

Phloem (inner bark)–
Moves sap (sugar and nutrients) from the crown down to the roots

Vascular Cambium –
Produces new phloem and xylem cells

Xylem

Sapwood –
Active xylem cells
Conducts water and nutrients up from the roots

Heartwood –
Physiologically dead xylem cells
Formed as sapwood ceases to function
Changes in biochemistry not anatomical function
Provides mechanical support

Pith –
physiological center of tree, oldest cells

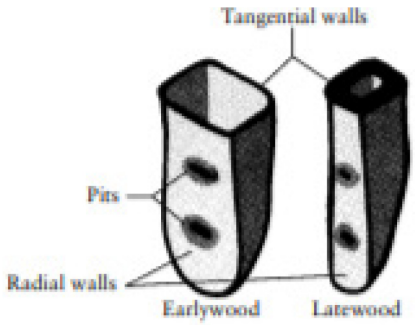
Growth Ring –
Increment of wood formed during a single growth period

Annual ring – One growth period (growth ring) that occurs throughout one year of time

In temperate regions, cell formation in most trees follow a *growing season* (spring and summer) and a *dormant season* (fall and winter)

Composed of *earlywood* and *latewood* longitudinal cells

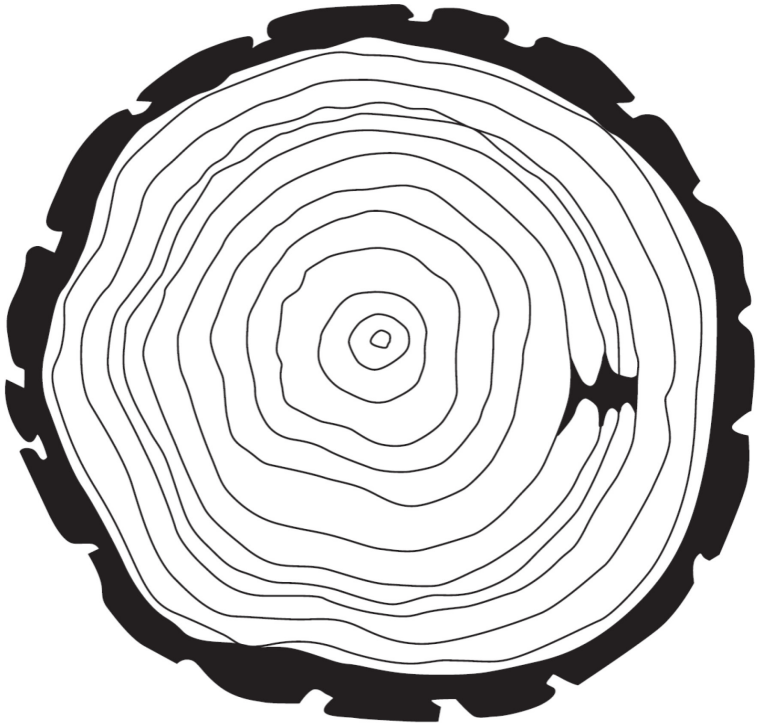
Growth Ring –
Composed of **earlywood** and **latewood** longitudinal cells



Earlywood –
Rapid growth at beginning of growing season
Larger radial cell diameter
Thinner cell wall, lower density

Latewood –
Slower growth toward end of growing season
Smaller radial cell diameter
Thicker cell wall, higher density

LAB ACTIVITY

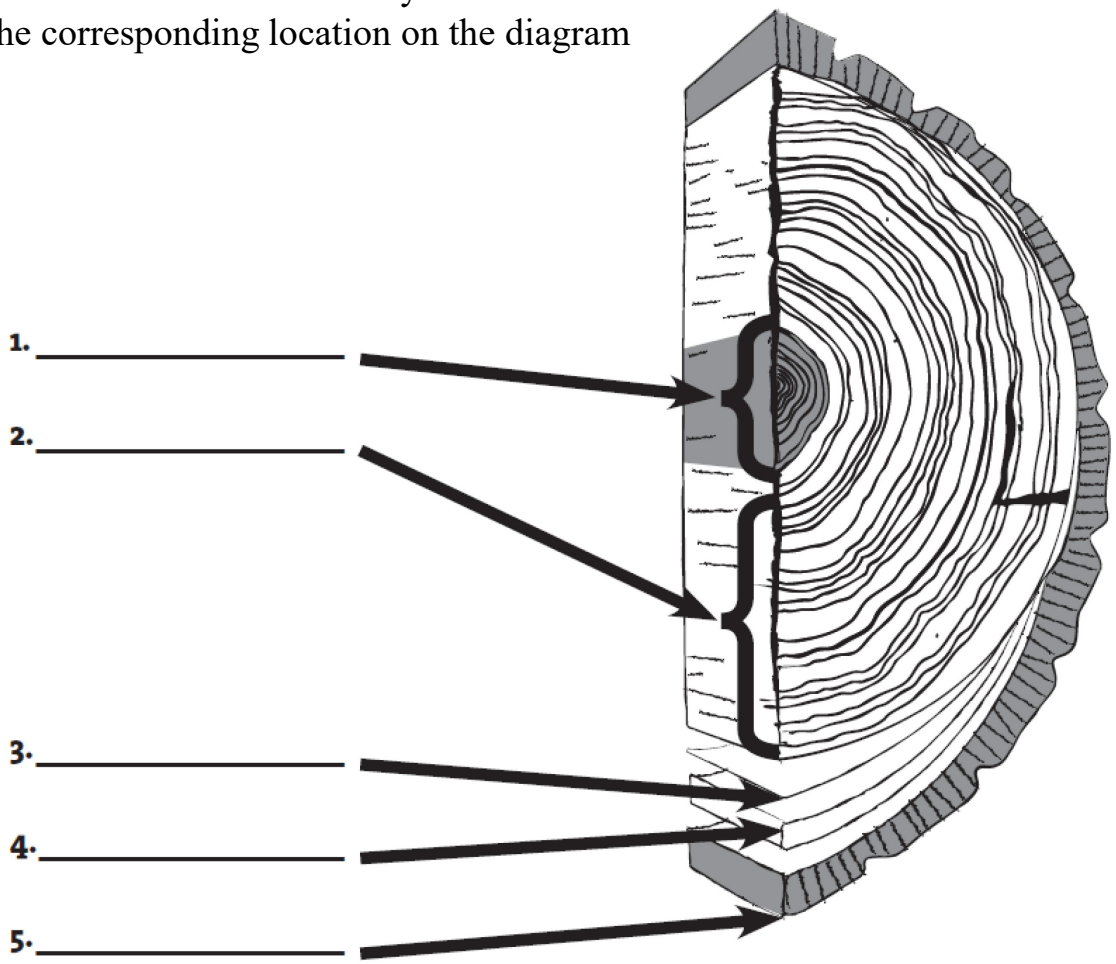


Instructions: Looking at the tree cookie provided, estimate the age of the tree when it was cut down by the tree cookie provided.

AGE OF TREE:

TYPE HERE

Instructions: Match the key terms below to the corresponding location on the diagram

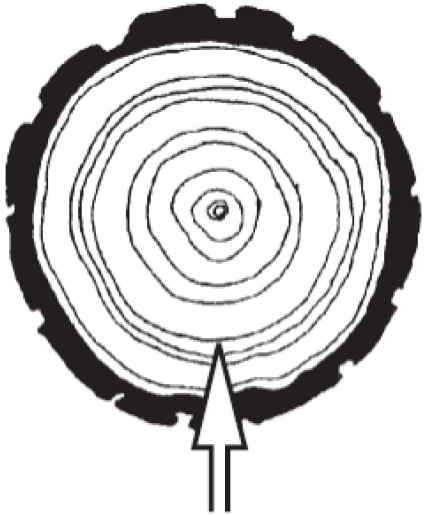


Key Terms

- Outer Bark
- Phloem or Inner Bark
- Cambium
- Sapwood
- Heartwood

Instructions: Looking at the tree cookies provided and the areas indicated by the arrows, estimate what occurred to the tree at those areas:

6. Enter Text Here



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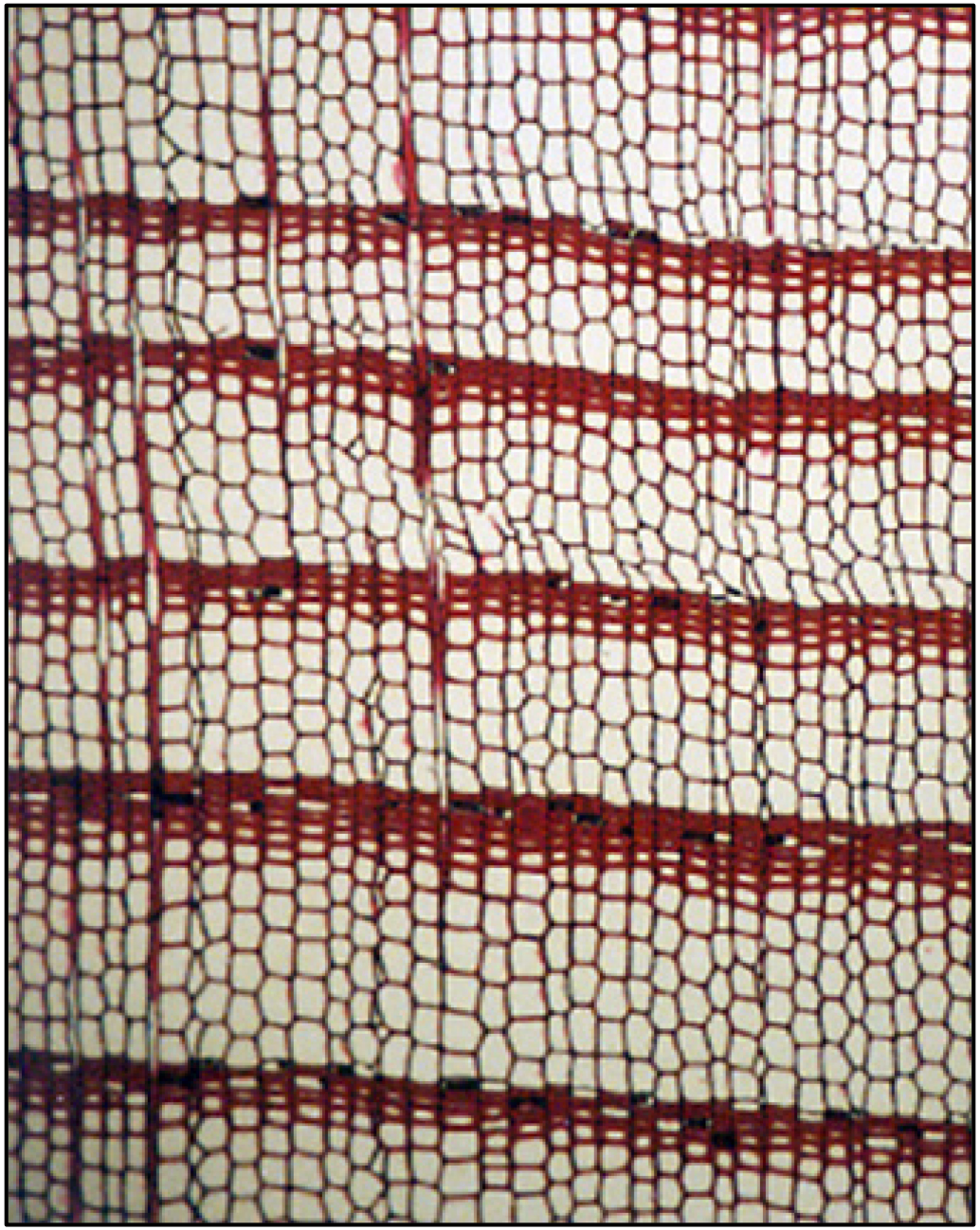
DISCIPLINARY CONTENT

Microscopic Characteristics

Microscopic characteristics are properties that require detection through observation *with* a microscope. These observations can be used to provide an indication of wood quality, the impacts of ecological disturbances, and cambial age. Microscopic characteristics are the principal features used in accurate wood identification.

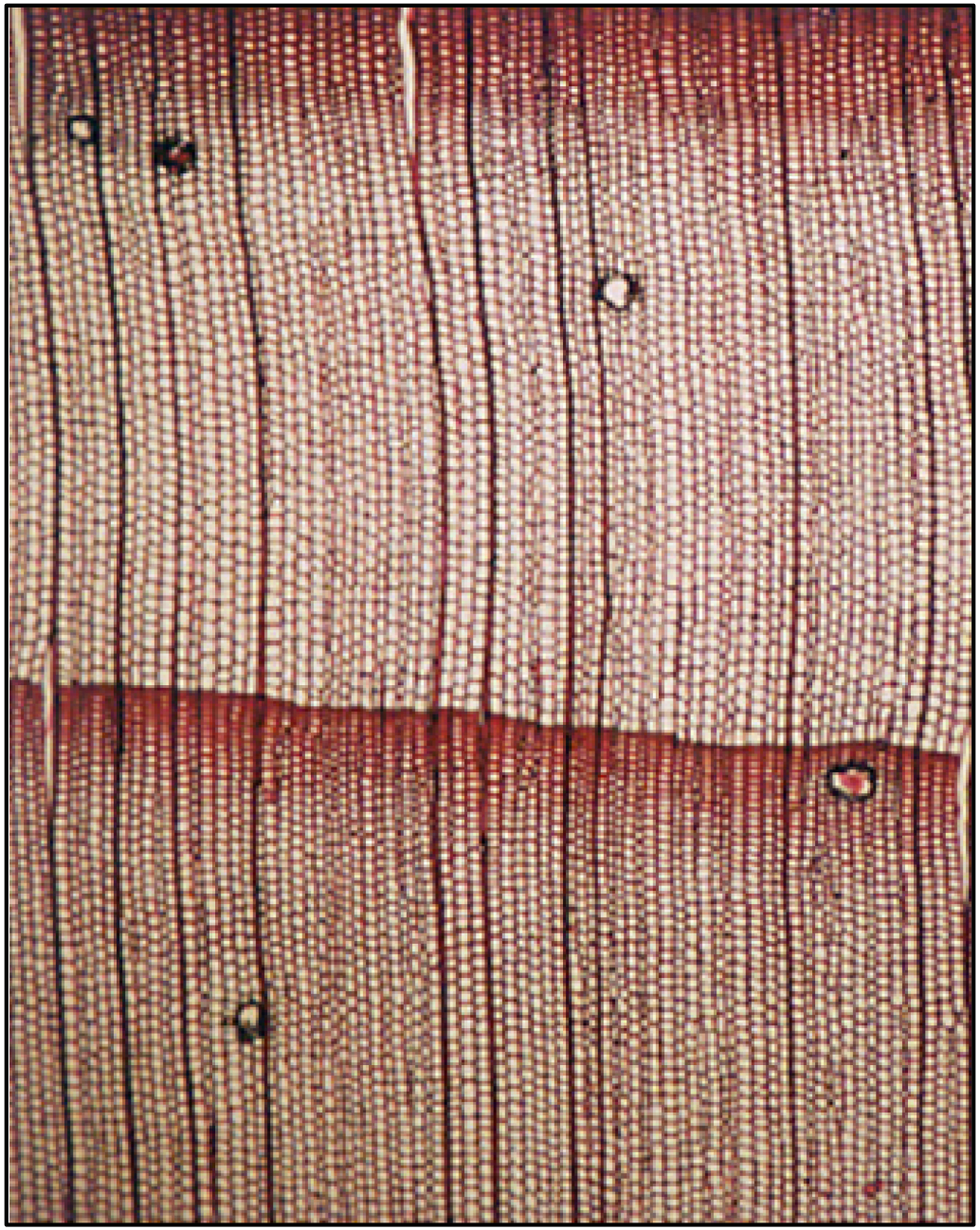
Nonresinous softwood



Latewood cells appear as distinct bands.
Cross section view of *Sequoia sempervirons*, redwood, 50X,

Quantitative Wood Anatomy Lab, Virginia Tech

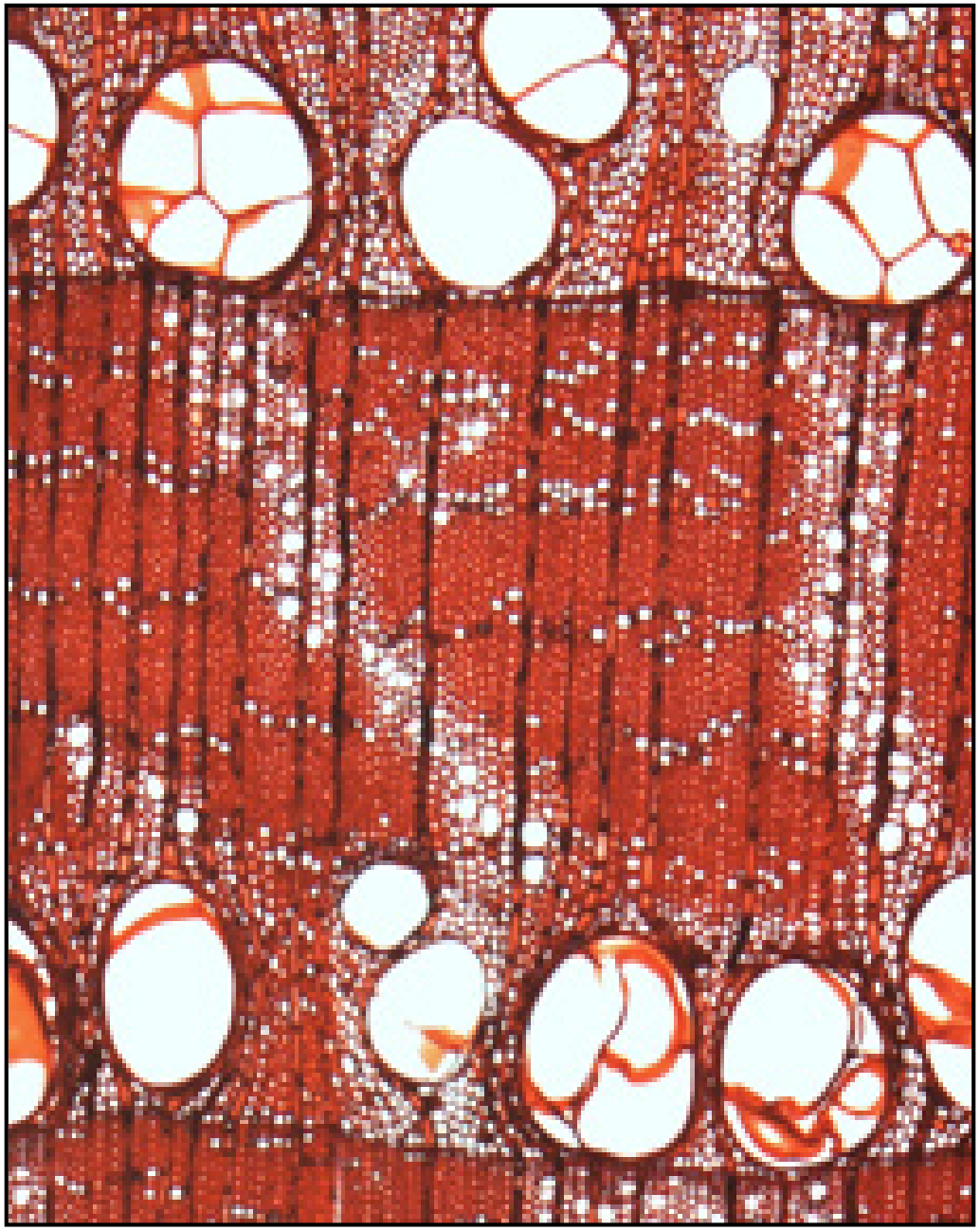
Resinous softwood



Latewood cells appear as distinct bands. Resin canals appear as large circles. Cross section view of *Pinus strobus*, eastern white pine, 50X,

Quantitative Wood Anatomy Lab, Virginia Tech

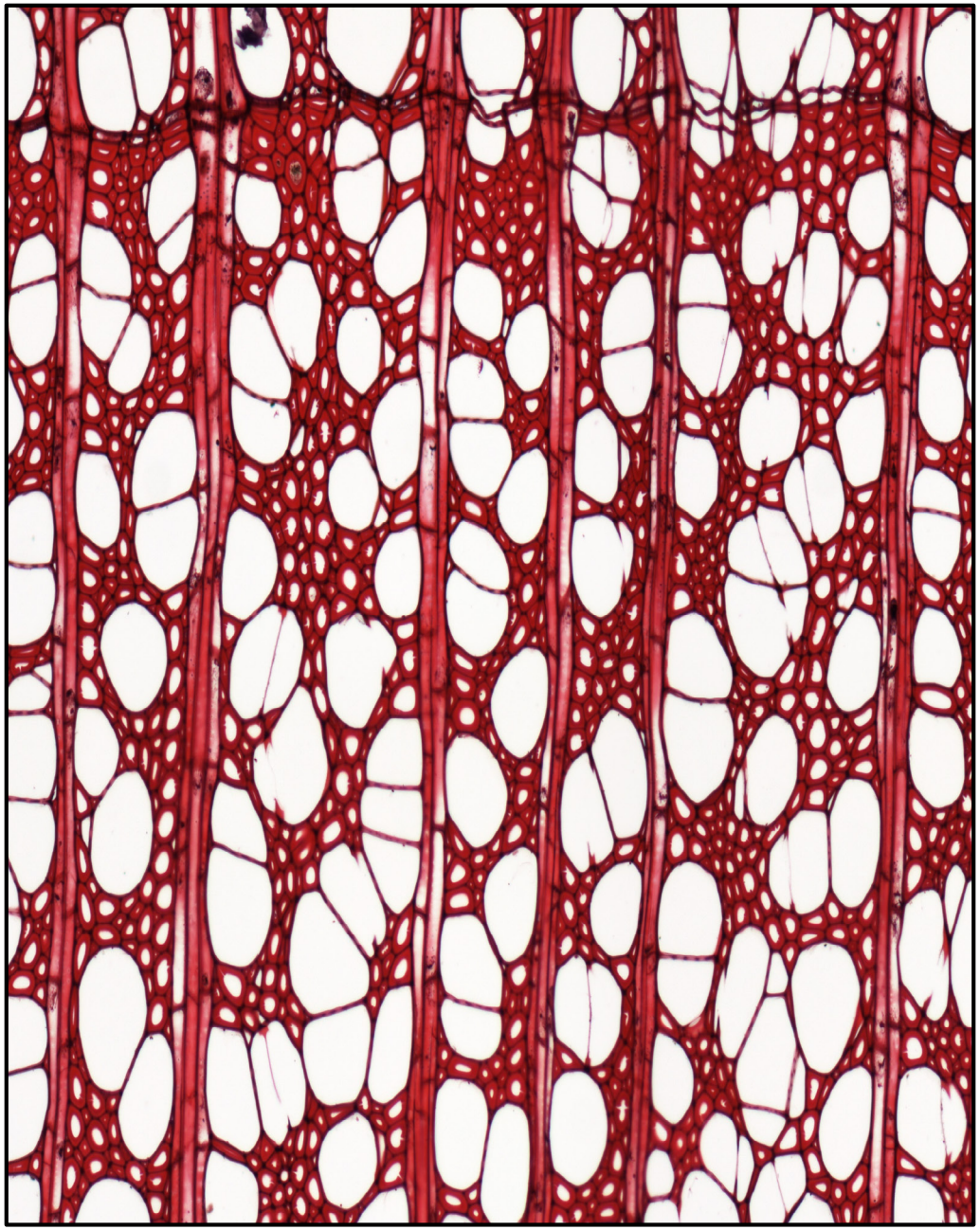
Ring porous hardwood



Ring Porous hardwood. Earlywood cells appear as large openings. Cross section view of *Quercus spp*, 40X,

Quantitative Wood Anatomy Lab, Virginia Tech

Diffuse porous hardwood



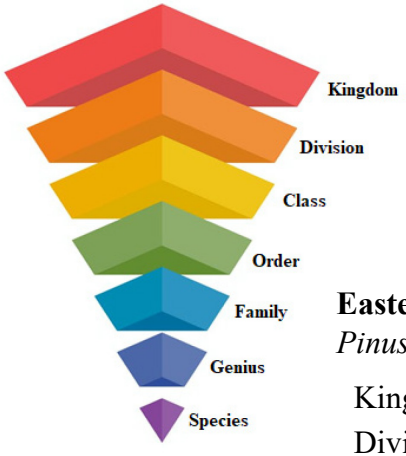
Diffuse porous hardwood. No difference in cell size across the growth ring. Cross section view of *Liriodendron tulipifera*, 40X,

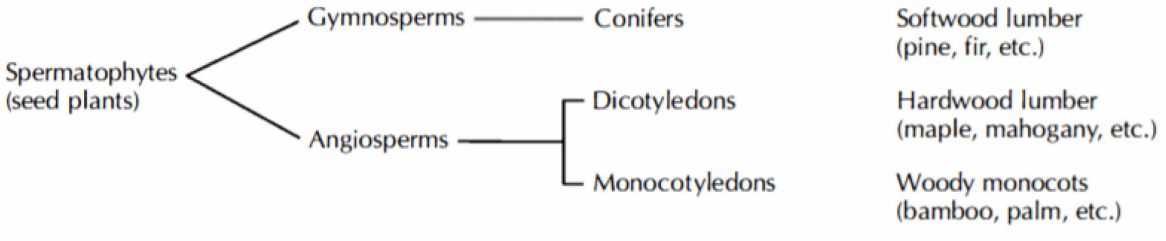
Quantitative Wood Anatomy Lab, Virginia Tech

LAB ACTIVITY

Classification of Wood and Trees

Classification and Naming of Biomaterials

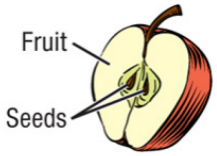




Eastern White Pine
Pinus strobus

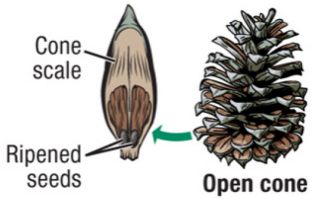
Kingdom: Plant
Division: Spermatophyta
Class: Gymnospermae
Order: Coniferales
Family: Pinaceae
Genus: Pinus
Species: strobus

Angiosperms –
Seeds enclosed in a fruit
Hardwoods



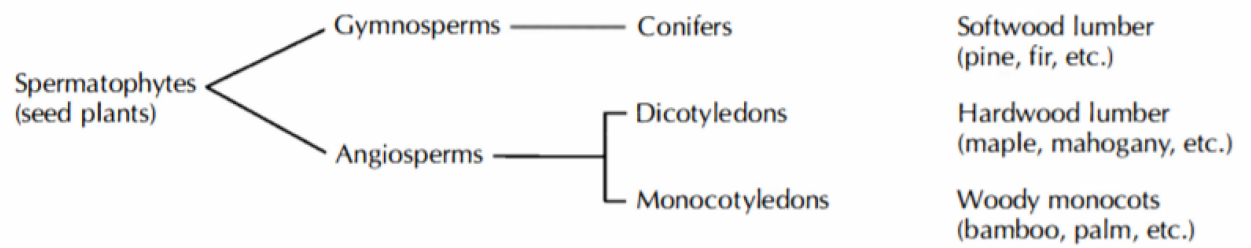
Apple

Gymnosperms –
Seeds naked on cone bract
Softwoods



Open cone

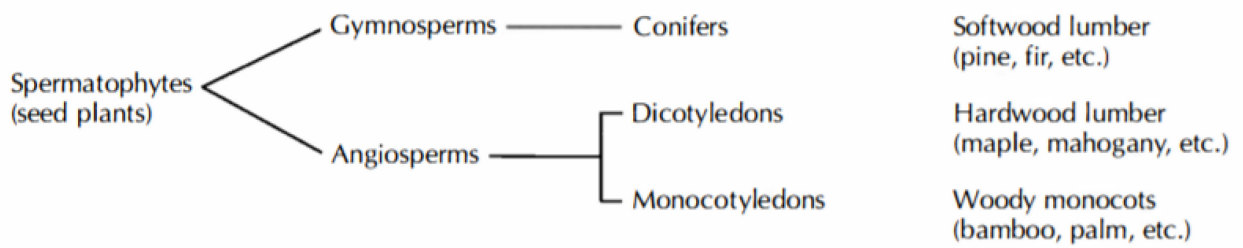
Classification and Naming of Biomaterials



Gymnosperms:
Softwood
Conifers – needle-like or scale-like foliage, usually evergreen
Excurrent form – dominant mainstem with lateral side branches

Angiosperms:
Hardwood
Dicot – two initial seed leaves
Deciduous – losing foliage during winter dormancy
Dendritic form – branching or rebranching of mainstem

Classification and Naming of Biomaterials



Angiosperm:

Woody monocots – one initial seed leaf

Temperate zones – grasses or corn

Warmer Climates – bamboo or palm

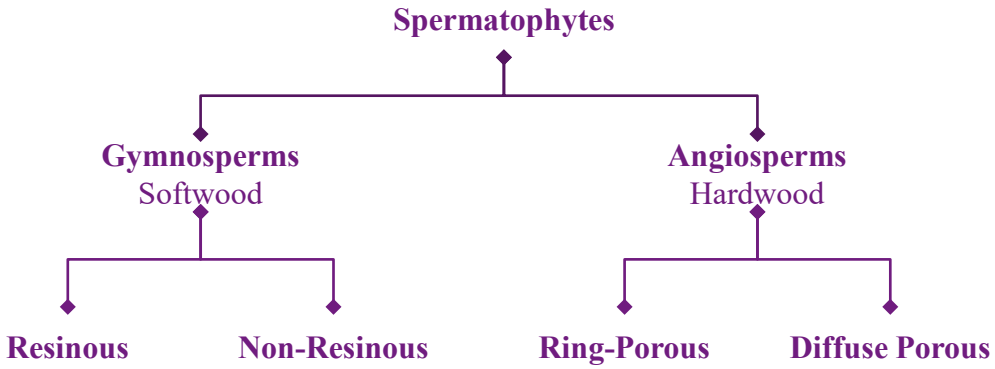
Question:

Considering seasonal growth and physical form,
Do you think the cellular anatomy will differ
between hardwood and softwoods? How?

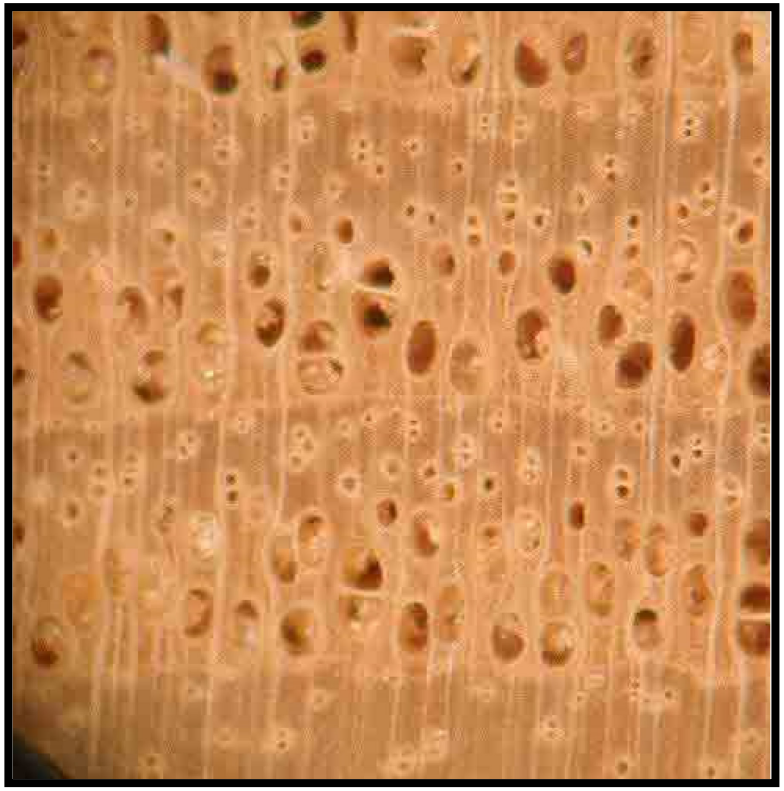
Remember:
Growth is a determinant of preferable environmental conditions and tremendously affects properties (cell size, cell shape, wood density, color)

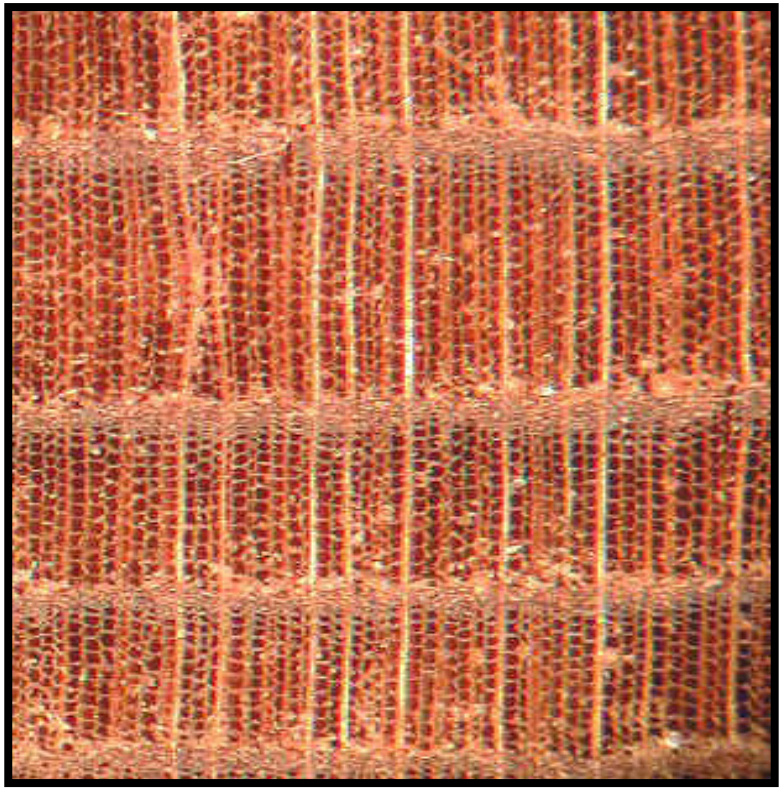
ACTIVITY INSTRUCTIONS:

1. With your partner or team, review the microscopic pictures (look back at slides 12 - 15)
2. Then categorize the following macroscopic slides by gymnosperm (softwood) vs angiosperm (hardwood) using the microscopic template slides
3. Further categorize the gymnosperms into resinous or non-resinous and the angiosperms by ring-porous vs diffuse porous



Determine if the wood in the picture is a softwood or hardwood?
If it is a softwood (gymnosperm), is it resinous or nonresinous?
If it is a hardwood (angiosperm), is it ring porous or diffuse porous?





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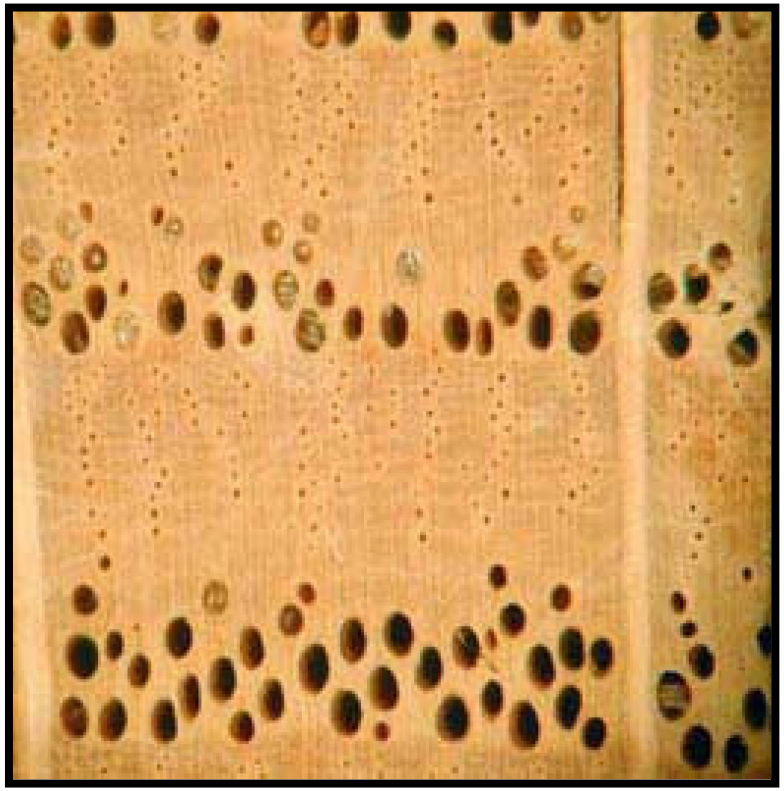
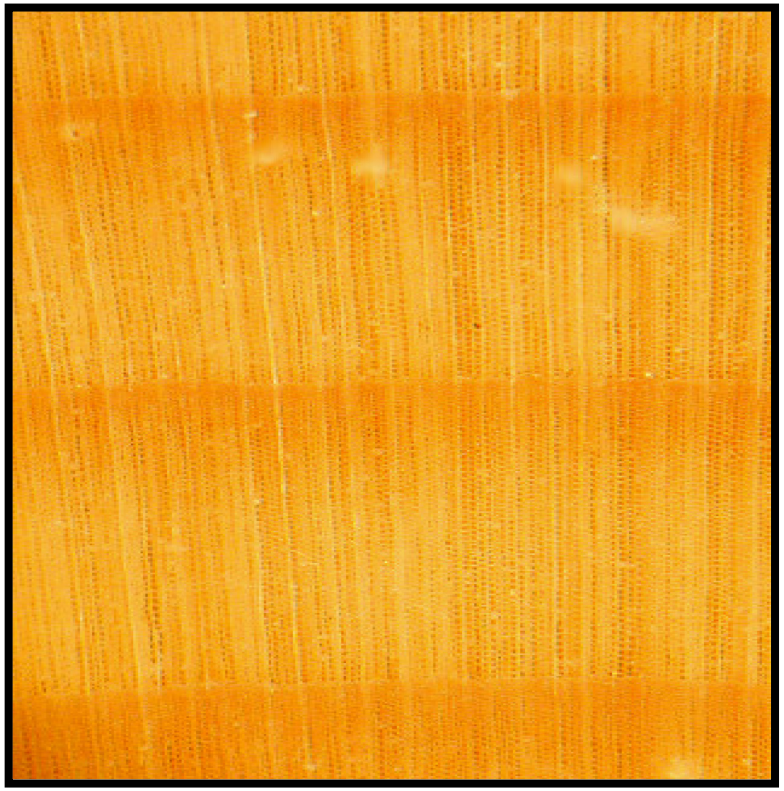
#2





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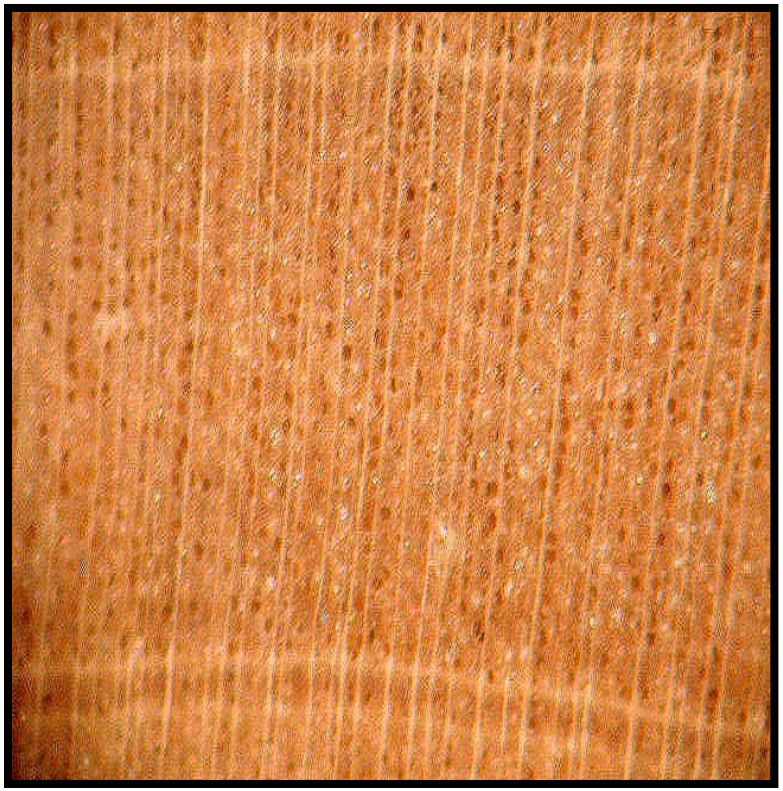

#5

#6

Answer key:

1. RING POROUS HARDWOOD
2. NONRESINOUS SOFTWOOD
3. RING POROUS HARDWOOD
4. RESINOUS SOFTWOOD
5. RESINOUS SOFTWOOD
6. DIFFUSE POROUS HARDWOOD

GROUP ACTIVITY

Click on this link for an interesting story that can be discussed later
some discussion questions could include what did you find most interesting,
what surprised you the most, would you have done anything differently?

Murder Mystery: When the witness is a tree

Wallace, R. (2020, June 11). *Murder Mystery: When the Witness is a Tree Lab Notes*. News from the Forest Products Laboratory. https://www.fpl.fs.fed.us/labnotes/?p=27512

SUMMARY

Wood can be characterized at the macroscopic and microscopic levels.

Macroscopic characteristics are properties that can be detected by observation *without* the use of a microscope. These observations can be used to determine conditions under which wood has grown, provide an indication of physical properties, and serve as an aid in wood identification.

Microscopic characteristics are properties that require detection through observation *with* a microscope. These observations can be used to provide an indication of wood quality, the impacts of ecological disturbances, and cambial age through connection with the dendrochronology field of study. Microscopic characteristics are the principal features used in definitive wood identification.