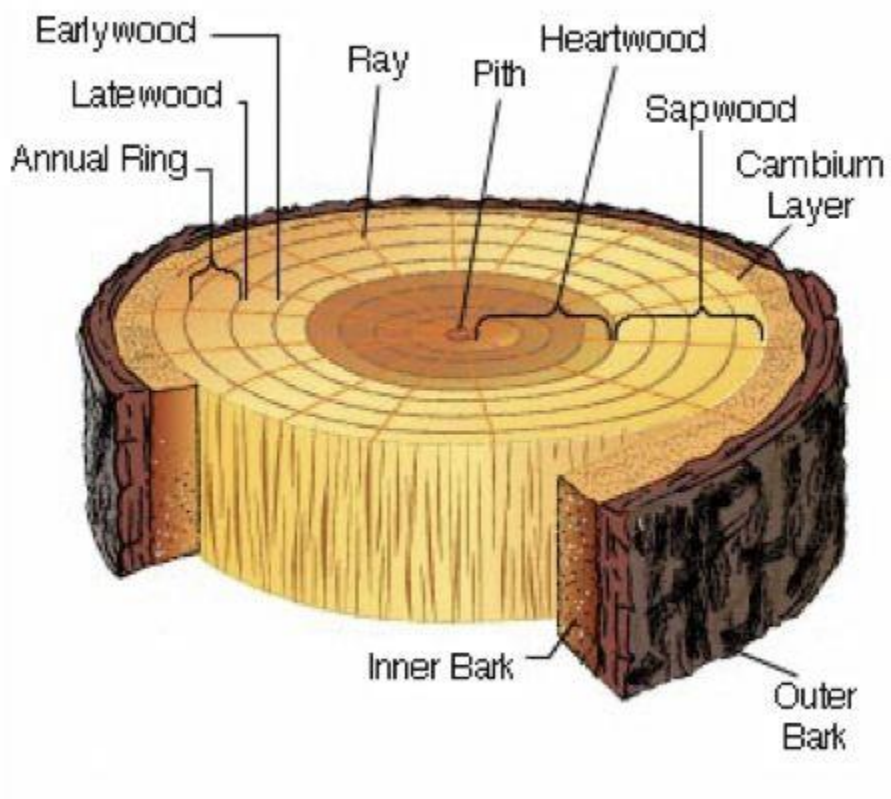
Lab: Tree Cookies

(modified from National Center for Atmospheric Research)

Background: They're round. They're full of fiber. But unless you are a termite, you can't eat tree cookies! Tree cookies are cross sections of tree trunks that are used to illustrate how trees grow. Tree cookies reveal the many different layers that make up a tree. Each layer can tell you something about the tree's life and the climate in which it grew. The study of the growth of tree rings is called dendrochronology.



The **cambium** is a very thin layer of growing tissue that produces new cells that become either xylem, phloem or more cambium. Every growing season, a tree's cambium adds a new layer of xylem to its trunk, producing a visible growth ring in most trees. The cambium is what makes the trunk, branches and roots grow larger in diameter.

The **xylem**, or **sapwood**, comprises the youngest layers of wood. Its network of thick-walled cells brings water and nutrients up from the roots through tubes inside of the trunk to the leaves and other parts of the tree. As the tree grows, xylem cells in the central portion of the tree become inactive and die. These dead xylem cells form the tree's heartwood.

As a tree grows, older xylem cells in the center of the tree become inactive and die, forming **heartwood**. Because it is filled with stored sugar, dyes and oils, heartwood is usually darker than sapwood. The main function of the heartwood is to support the tree.

The **phloem** or **inner bark**, which is found between the cambium and the outer bark, acts as a food supply line by carrying sap (sugar and nutrients dissolved in water) from the leaves to the rest of the tree.

The **outer bark**, which originates from phloem cells that have worn out, died and been shed outward, acts as a suit of armor against the world by protecting the tree from insects, disease, storms and extreme temperatures. In certain species, the outer bark also protects the tree from fire. (source: nc forestry association)

Research from Dr. Glenn Juday at the University of Alaska Fairbanks has determined the relationship temperature and precipitation have with white spruce tree growth. His formula states that the growth in one year is determined 60% by this year's precipitation, 30% by last year's precipitation and 10% by precipitation from year before last. For temperature, the growth in one year is determined 80% by this year's temperature and 20% by last year's temperature. With this, you can see that precipitation and temperature over several years impact a single year of tree growth.

Prelab Questions:

1. What is a tree cookie?
2. What is the role of the cambrium in tree growth?
3. How are xylem and heartwood related?
4. Describe the difference between inner bark and outer bark.
5. What are the two main factors that determine tree growth rate?

Tree Cookie Analysis

a. Draw a picture of your tree cookie and label the five major components listed above.
b. Label any identifying characteristics, including overall shape, differences in ring width, wounds, etc.
c. Count the number of tree rings on your sample and label the age on your drawing.
d. Measure the width of each ring (in mm) for last ten years of tree growth and record your data in Table A as "sample 1". Then calculate percent growth (in %, duh) of each ring and record your data in Table B.
e. Share your data with other groups and record their data in Table A and Table B.

Table A: Ring Widths for the Past Ten Years (mm)

Sample #	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	Total
1											
2											
3											
4											
5											
6											
7											
8											
9											

Table B: Percentage Growth for the Past Ten Years (%)

Sample #	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	Total
1											
2											
3											
4											
5											
6											
7											
8											
9											

Postlab Questions

6. Based on your ring thickness data, which year had the most tree growth? The least tree growth?
7. Why might some trees show different ring thicknesses during the same year?
8. What factors could be affecting tree growth other than local climate?
9. Why do climatologists need at least 30 years of data to describe the climate of a region?
10. Describe how dendrochronologists determine climate patterns for time frames longer than the lifespan of a single tree. Be specific. (hint: overlap)