

Plant Anatomy Lab 8 – Secondary Growth I

This exercise will start our look at secondary growth in terms of how these tissues develop, the cells found in secondary tissues, and the structure of those cells. We will look at the vascular cambium from shoots of different ages. We will also focus on the secondary xylem with its axial and radial components. A few things to consider in all of the species we will look at:

Consider how old the stems are and how you can tell their age from simply looking at the shoot by eye and from microscope views of the xylem.

Think about cambial activity and its relationship to the timing of leaf and bud growth.

For each of these species, observe the cambial region and try to decide which cells are part of this region. Which cells near the cambium are xylem (wall thickness) and which are phloem?

You may notice many parenchyma cells that are really packed with starch grains, although this may be even more common in spring before growth resumes.

Sectioning and Staining: Sharp razor blades are particularly necessary for sectioning woody stems. We will be making transverse sections of these stems. The toluidine blue stain will be useful for highlighting the cell secondary walls.

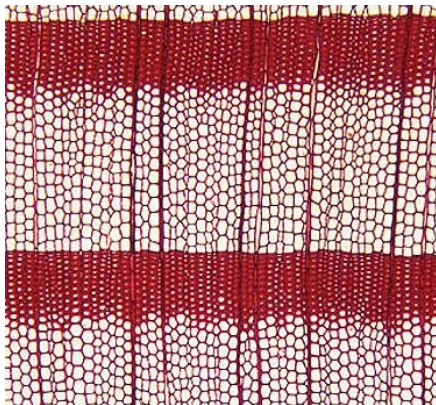
Pine

Prepare a transverse section of the older woody stem.

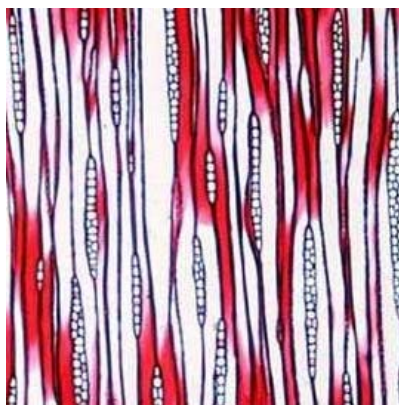
Note the annual growth rings in the secondary xylem.

Observe the rays. How many cells wide are the rays?

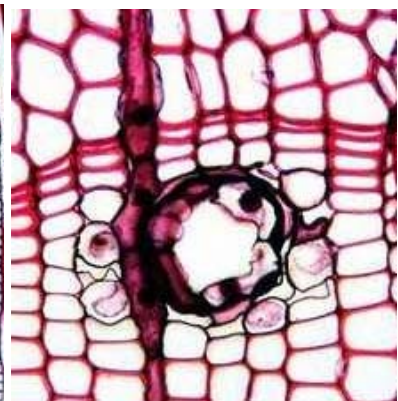
Observe the large resin ducts scattered around the secondary xylem.



Larch xylem (transverse section)



Redwood xylem (tang. long. section)



Pine resin duct

Sycamore

Prepare a transverse section of the older woody stem.

Note the annual growth rings and determine the age of the stem at that point.

Are the rays uniseriate or multiseriate?

Do the ray cells have starch grains? Would this mean that they are parenchyma cells or tracheids?

Observe the distribution of vessels – ring or diffuse porous?

Also note the distribution of xylem fibers (libriform fibers) and how their wall thickness varies across the growth ring.

Can you find perforation plates in the vessels? Sycamores are “supposed” to have simple perforation plates

Mulberry

Prepare a transverse section of the older woody stem.

Note that this species is ring-porous and has very obvious annual rings.

Are the rays in this species different from other dicots we are looking at?

Age the stem.

Cottonwood

Prepare a transverse section of the older woody stem.

Is this a diffuse porous or ring porous species?

The rays are especially narrow – uniseriate?

Look carefully for the primary xylem. Where would it be located? You may be able to identify primary xylem because the helical thickenings sometimes get pulled out of the cells during sectioning.

White Oak

Take a look at a prepared slide of white oak (*Quercus alba*) with the three different orientations for wood sections. Notice the ring-porous xylem with wide vessels in the earlywood and narrower vessels later in each annual growth ring.

Also observe the different types of rays in terms of their widths.

Notice the very thick-walled libriform fibers as observable from the transverse and also longitudinal sections. You should also be able to find the shorter xylem parenchyma cells.

Live Oak

Prepare a transverse section of the older woody stem.

Figure out the age of the stem by looking at the shoot and your section of the stem.

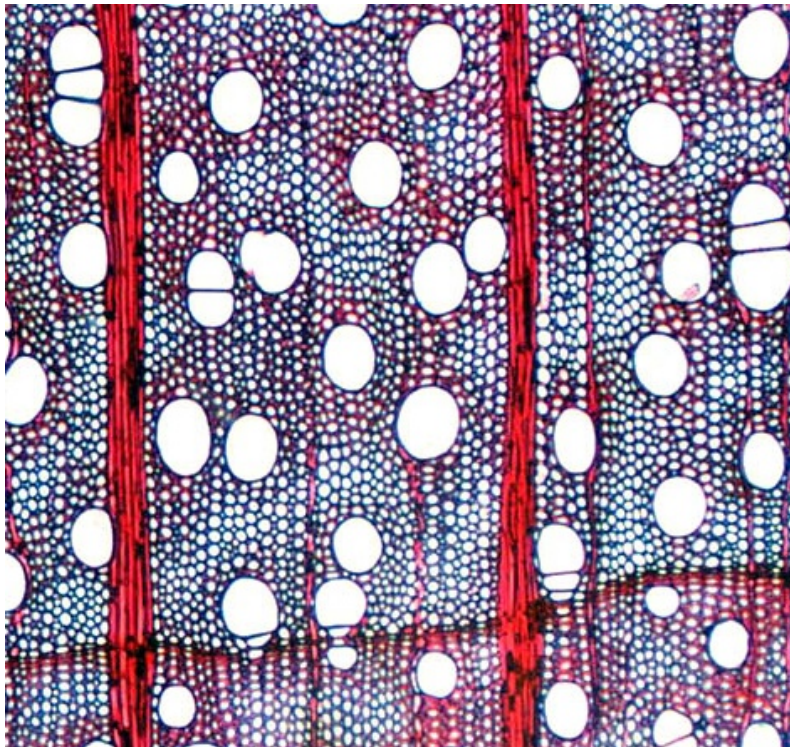
Unlike other oaks, this species is diffuse porous and the vessels often appear to occur in radially oriented chains.

Growth rings are harder to discern compared to the ring-porous oaks – why?

Various parenchyma cells are present in the pith and in the xylem. They may be loaded with starch. Aside from the ray parenchyma, observe the axial parenchyma that occur in bands tangential to the surface of the stem.



Transverse section of wood from white oak.



Transverse section from wood of sugar maple.