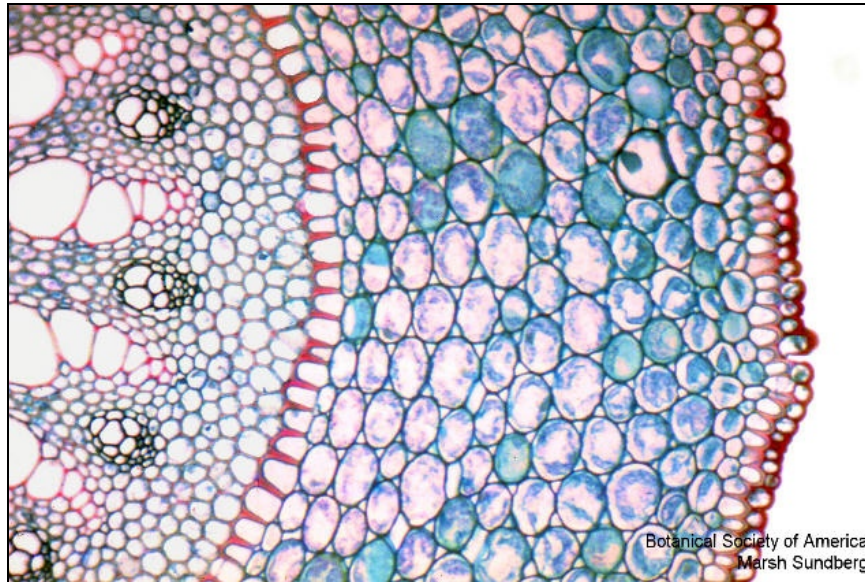


Plant Anatomy Lab 5 - Roots II

This is the second part of our examination of roots. Here we examine root structure for a typical monocot (the monocot *Smilax* sp. is shown below). As for last week, focus on the various cell and tissue types in the root with respect to where they occur and how they develop as the root grows.



Roots II - Roots of the corn plant (*Zea mays*; a monocot)

Corn seedlings have been growing in the flat at the back of the lab for about one week. Obtain a couple of seedlings from the flat - be sure to extract them carefully, so that the root and the root hairs or branches are not damaged. Roots do not have a waxy cuticle and will dry out rapidly, so keep them in water.

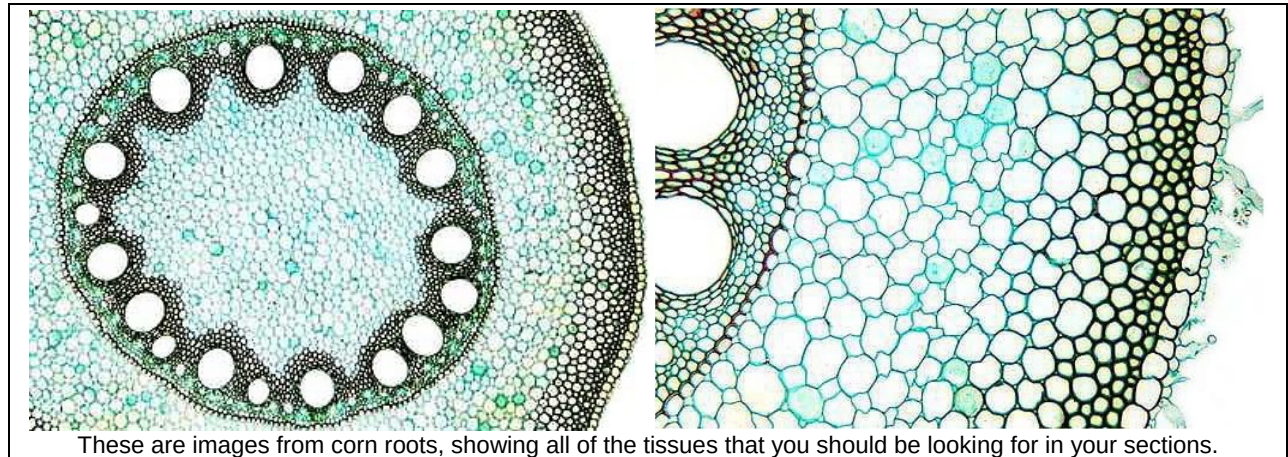
Sectioning: Using a fresh, sharp razor blade, we will be making transverse sections through the root at several points along it starting near the tip. We want to examine the root at 4 or 5 points; make sections about every centimeter or less depending on the available length of the root (if the roots are short, make sections closer together). The tissue is not very rigid, but will cut very easily. At each point, cut at least six sections. Your ability to see clearly will strong depend on how thin you manage to cut the sections. Practice on an extra seedling if you'd like.

Staining: The vascular tissue will stain with toluidine blue, although not as distinctly as with the bean or pea roots. Work with only one set of sections at a time. Place your sections in a milliliter or so of stain in a watch glass. Let them stain for a minute or two. Then rinse the sections by transferring them to another watch glass containing water. You can use dissecting needles to transfer sections - picking them up with forceps will damage the cells. Mount the sections in water on a slide with a cover slip. If you have

a thin section, the xylem cells with thickened walls will stand out. Unfortunately, the phloem cells have very thin walls and do not stain darker than other parenchyma cells.

Observations:

1) Observe a section about 2 cm from the root apex. Note the presence of very wide metaxylem vessels within the stele. Also find the narrower, but thicker walled, protoxylem. How are they arranged? Is the root xylem exarch? What kind of stele is this? How many xylem poles? Is there a pith in the middle of the stele?



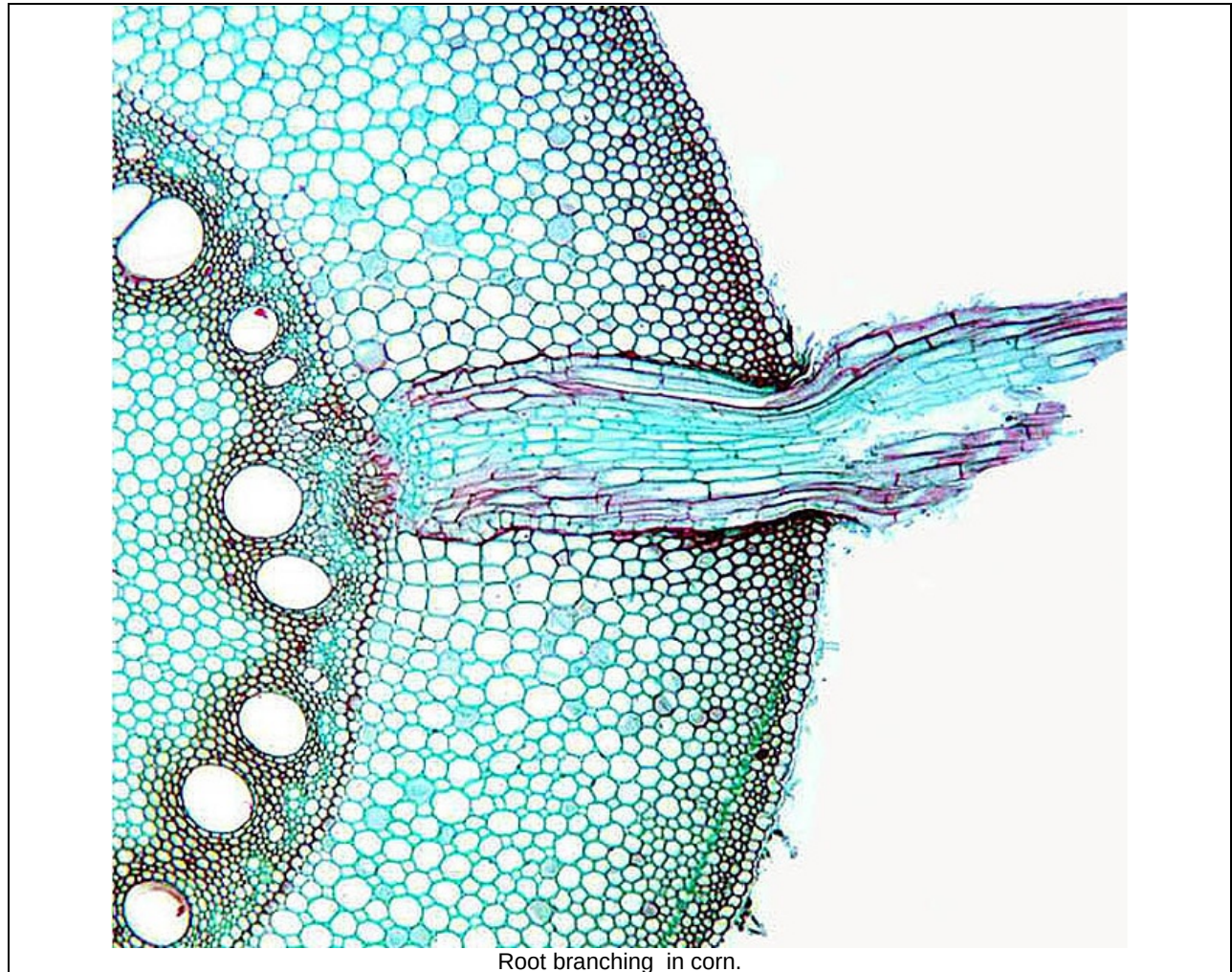
Obtain a section very close to the tip. How early in the stele development do these very wide vessels form? As you observe sections further from the root tip, you should start to see several things:

- a) a greater number of large vessels,
 - b) thicker walls on the vessels,
 - c) the development of thick-walled, narrow vessels or fibers gradually spreading around the wide metaxylem vessels.
- 2) Use the figures in the handout or the atlases in the lab and locate the phloem sieve elements. Where are they found? How many bundles are there compared to the xylem? Why might you not be able to find companion cells?
- 3) Observe the development of the endodermis with distance from the root tip. For a section near the tip, you may even have difficulty locating endodermis separate from the pericycle. Further back from the root tip, endodermal development should be obvious. How does the suberization pattern differ in shape from what you saw with the bean or pea roots?
- 4) Observe the pericycle layer of the stele at various distances from the root tip. Do the cells become thickened (sclerified) far from the root tip? Find sections where root branches are forming. Do they seem to originate from the pericycle? With a good section, you should be able to trace the endodermis around and see how it was broken

and pushed out by the root branch. A thin section may also show how the root branch xylem is connected to the stele of the main root; the protoxylem of the branch connects to the xylem poles of the primary root.

5) Also note the location of root hairs. They appear to be even longer than those you saw with the bean or pea roots.

6) Many of the observations of xylem and phloem cells and the development of root branches would be aided by preparing a few longitudinal sections of the root.



Root branching in corn.

This pair of images below are from *Asparagus* roots. You should be able to find the same tissues that were discussed for the corn roots.

