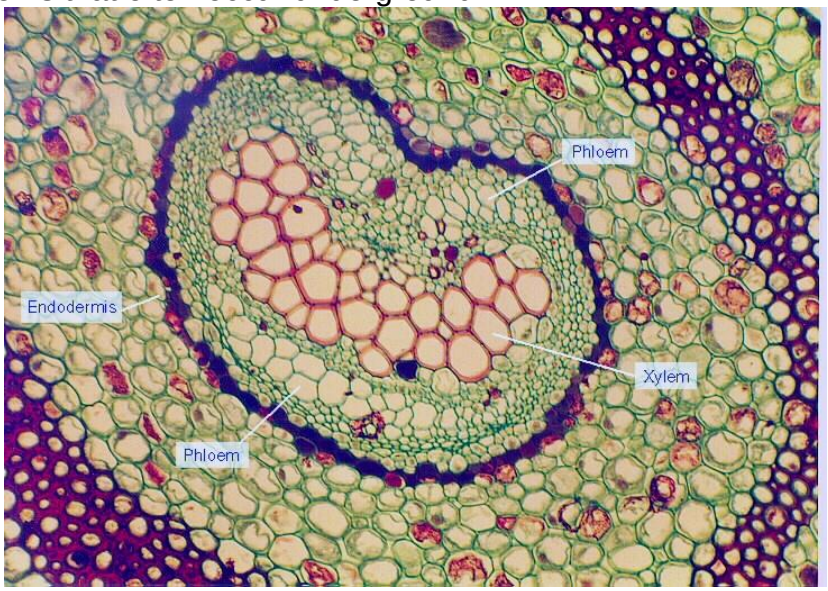
Plant Anatomy Lab 7 - Stems II

This exercise continues the previous lab in studying primary growth in the stem. We will be looking at stems from a number of different plant species, and emphasize (1) the variety of stem tissue patterns, (2) stele types and the location of vascular tissues, (3) the development of the stem from meristem activity, and (4) the production of xylem and phloem by the procambium. All of the species studied are pictured either in your text or the atlases at the front of the lab.

1) Early vascular plants (cryptogams)

A) Obtain a piece of the rachis of the fern (collected in the White Hall atrium). This structure is superficially analogous to a stem, although it has a different origin. Prepare a transverse section of the rachis and stain it in toluidine blue. Note the large amount of cortical tissue and the presence of sclerenchyma cells near the outer cortex. Also note that the stele vascular tissue appears to be amphiphloic. Lastly, you should be able to see readily the endodermal-style thickenings on the cells just outside each vascular bundle.

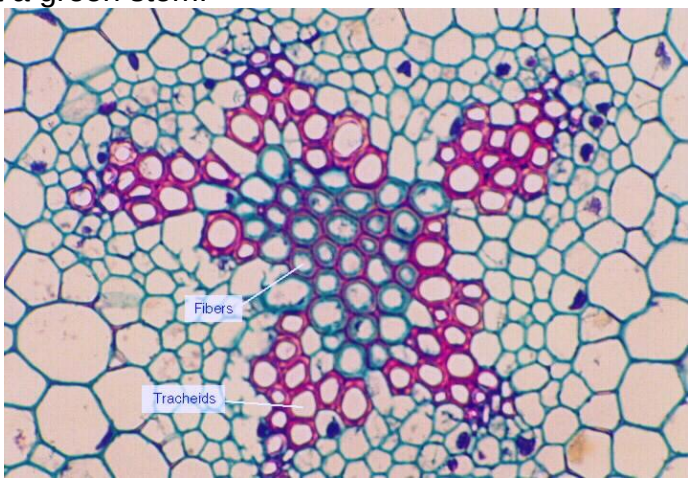
B) Find prepared slides of the *Osmunda* and *Polypodium* (fern) rhizomes. Note the amphiphloic bundles (a protostele?), the presence of sclerenchyma in the cortex, and the thickened walls of the endodermis that you will find is not uncommon among many non-seed plants. Remember that rhizomes are modified stems that often occur underground.



Osmunda fern vascular bundle.

C) Obtain a prepared slide of *Psilotum*. This stele does not have a pith, so it is a protostele (or an actinostele because it has a star-like shape). All the central vascular cylinder cells are not tracheids. The thick-walled cells in the center are sclerenchyma fibers. Look at the longitudinal section and figure out how you can

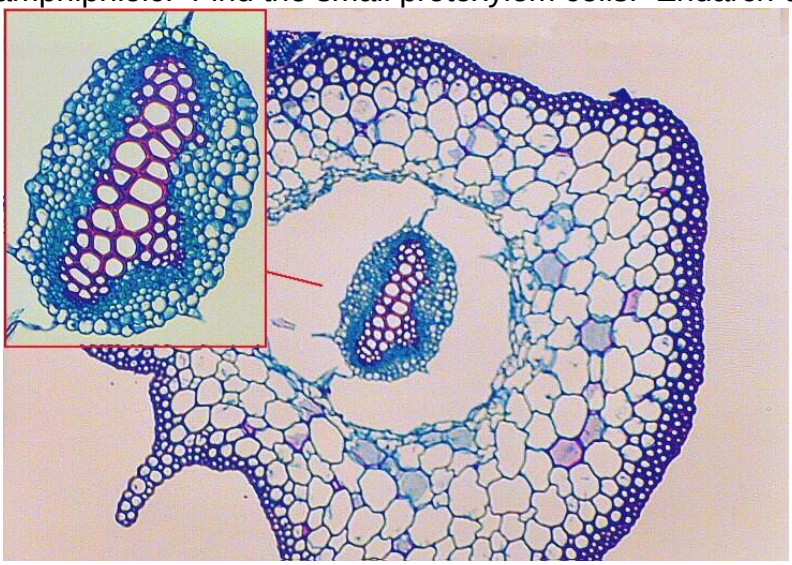
tell that these central cells are not tracheids. Also figure out which xylem tracheids are protoxylem and metaxylem (the longitudinal section should help). Does their direction of development seem odd for a stem (exarch *vs*. endarch)? Returning to the transverse section, note the presence of sclerenchyma fibers in the outer cortex. In the epidermis, you should also find guard cells. This stem is photosynthetic - if you know this plant (commonly called whisk fern), it does not have leaves, but a green stem.



Transverse section of *Psilotum* stem.

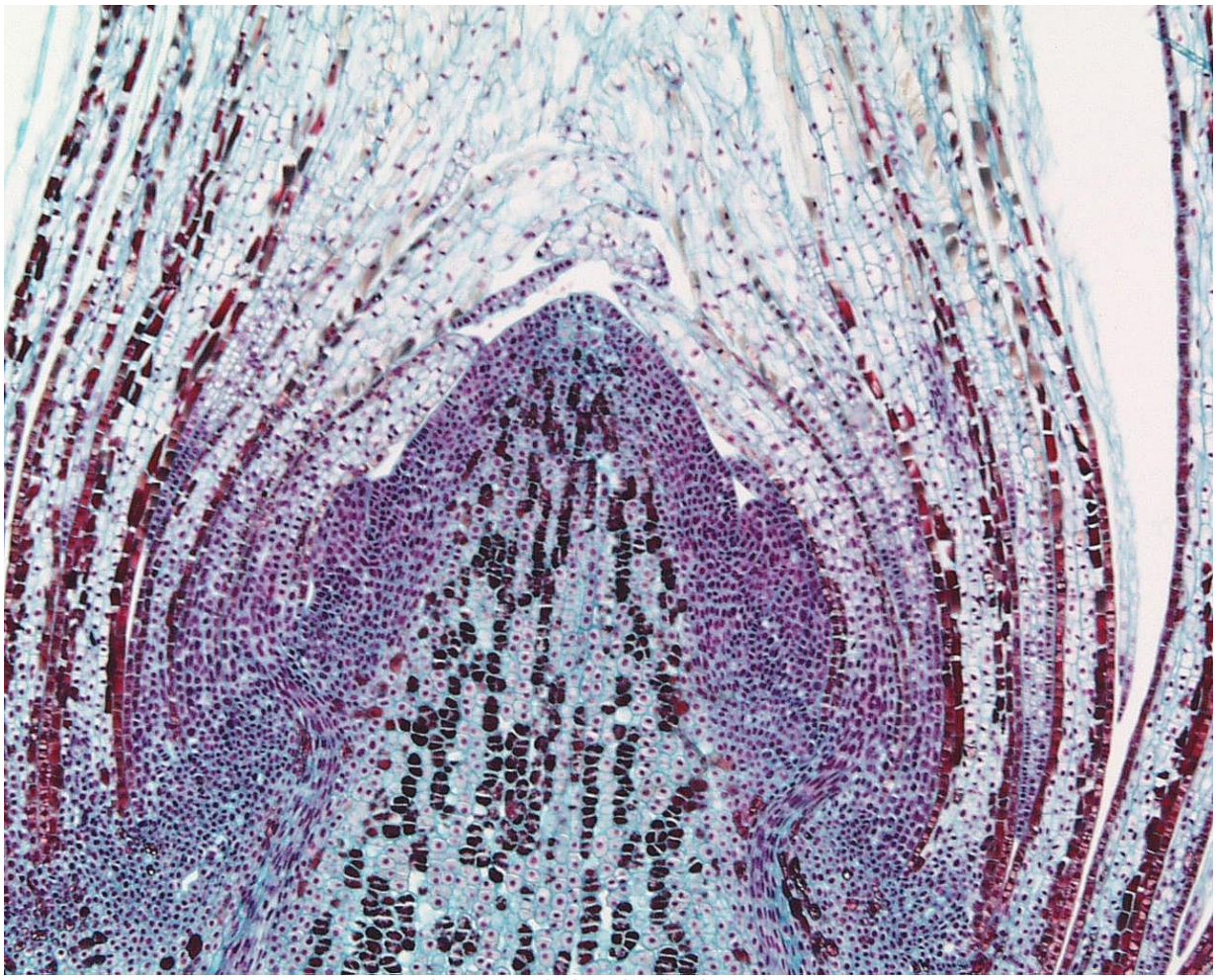
D) Obtain a prepared slide of *Lycopodium*. Both the inner cortex and the outer cortex have sclerenchyma layers. Identify the protoxylem and metaxylem. Is the stem endarch? Also locate the phloem parenchyma and sieve elements. Lastly, note how the cortex has small vascular bundles (leaf traces) that would supply individual leaves.

E) Obtain a slide of *Seliginella*. This species also has sclerenchyma cells in the outer cortex. Think about how that seems to be common in plants that do not produce massive, secondary xylem (like most trees). The vascular bundles are, once again, amphiphloic. Find the small protoxylem cells. Endarch or exarch?

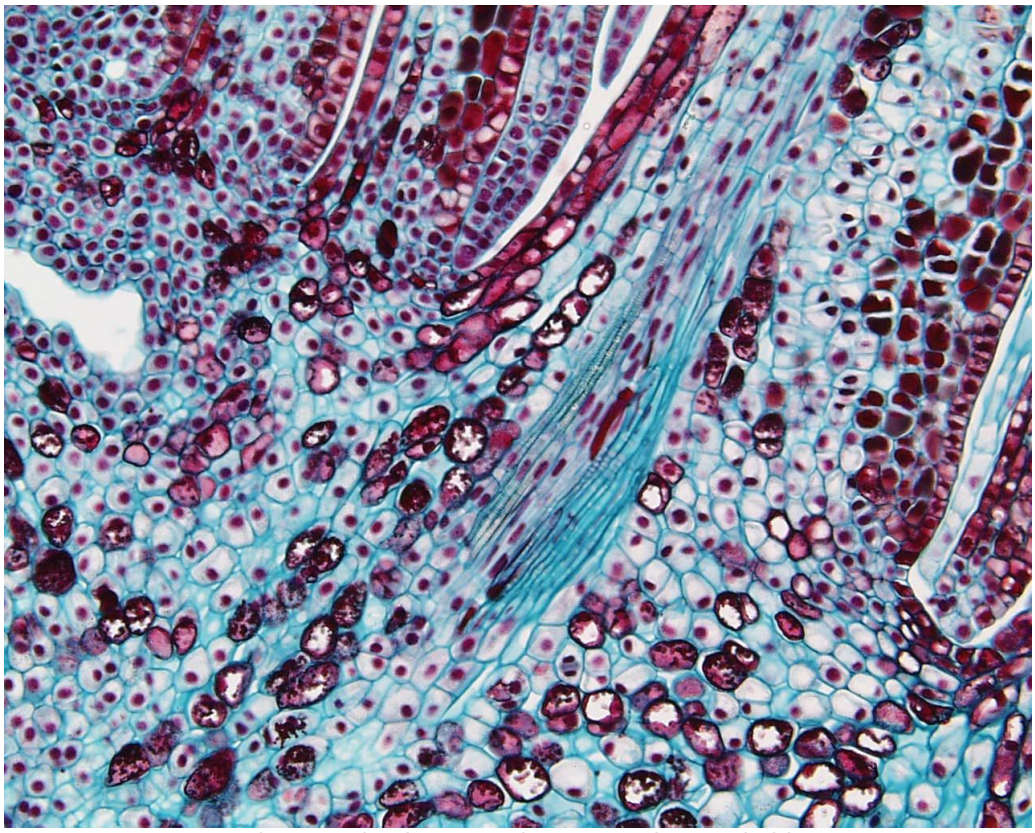

Seleginella stem transverse section.

II) Conifer stems

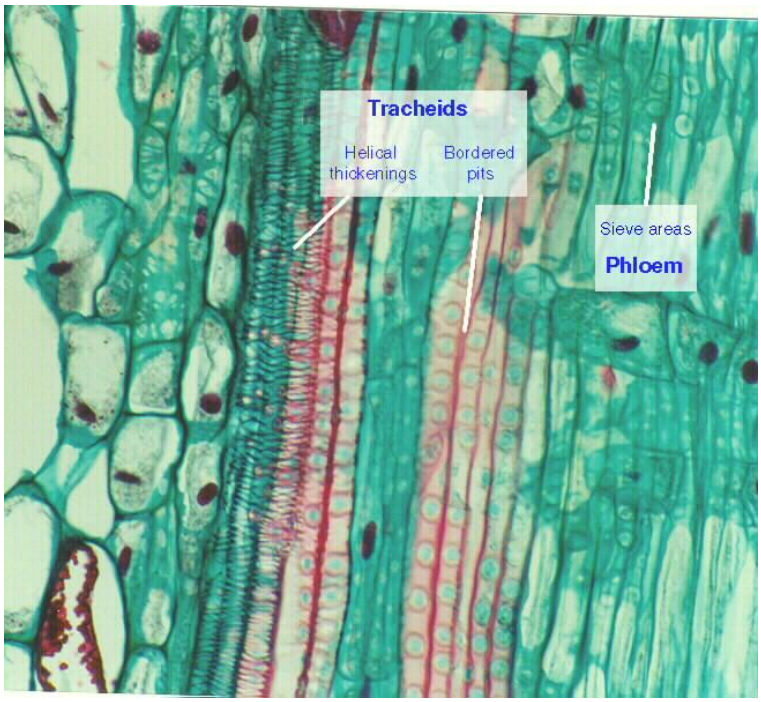
A) Now find slides of the pine bud and the pine stem tip. In the slide of the pine bud, you should be able to find procambial strands feeding the primordia and lateral buds. Where does the protoxylem develop with respect to the procambium? Also locate the rib meristem. From the pine stem tip, find the protoxylem, metaxylem, and secondary xylem. The phloem should also be visible from the presence of sieve areas.



Pine stem tip longitudinal section.



Vascular trace in pine stem tip. Note xylem and phloem.



Pine xylem (primary and secondary) and phloem.

III) Lastly, consider another flowering monocot. Find a slide of the *Yucca* stem. By now, you undoubtedly know this as an atactostele because of the scattered vascular bundles. If you look around, you will find bundles that were cut through on their sides (not a transverse section, for those bundles). Figure out which cells are protoxylem and metaxylem from their diameters and secondary wall thickenings (the protoxylem would have less extensive wall thickenings, like annular rings as opposed to helical thickenings).