

Plant Anatomy Lab 6 - Stems I

This exercise is concerned with the stems of monocot and dicot flowering plants. We will be looking at only primary growth; secondary growth in stems will be considered later.

Materials and Procedures: Two to three week old seedlings of pea and corn are available in the back of the lab. Collect one seedling of each species and keep them in water during the remainder of the lab. Use the toluidine blue stain for sections as used in the previous labs. Stain the tissue for only a minute or two. The thick walls of xylem cells will stain particularly dark and will have a different color than the parenchyma cells. Thick-walled fibers may also be apparent and these may also stain quite differently than the parenchyma cells.

Observations:

A) Start with the dicot pea seedling and obtain transverse sections several points from about 1 cm below the apex to near the base of the stem.

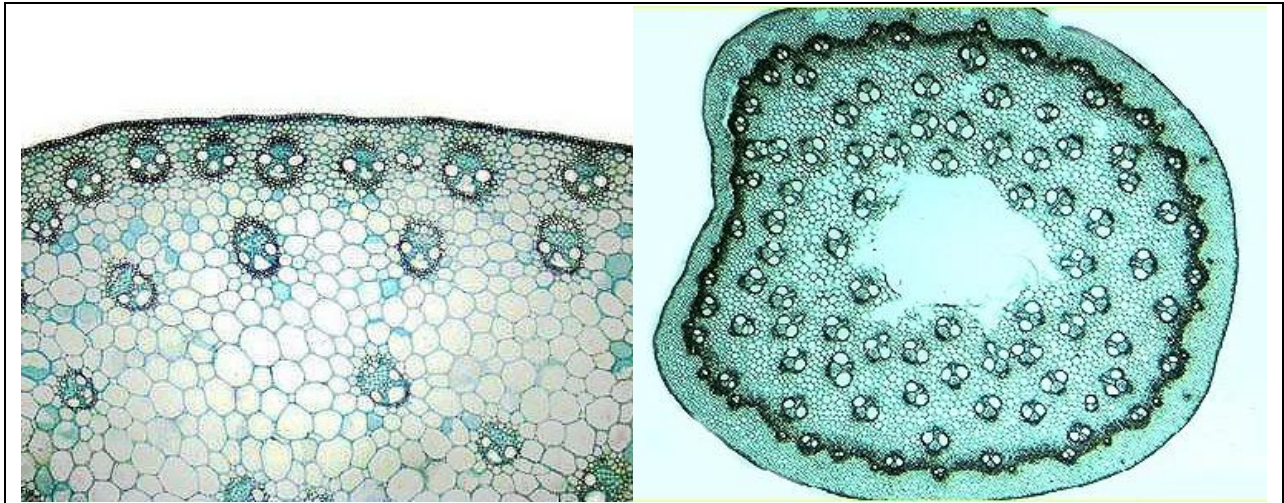
1) Note the occurrence of vascular tissue, particularly the xylem, in discrete bundles. If stems are endarch, you should be able to guess which cells are protoxylem and metaxylem. As you look at sections further from the apex, you should see more xylem development. Remember that stems produce lateral structures like leaves and branches right from the apex, and so you might expect to find vascular bundles which connect these lateral organs.

2) You may see several prominent vascular bundles in the center of the stem, but if you look carefully around the stem sections, you should find other bundles with less development. So may have only a few xylem tracheary cells and some may only appear like a cluster of small, thin-walled undifferentiated procambium cells marking a very early stage in the development of that bundle.

3) Find the pith. Many dicot species will have extensive pith regions.

4) These stems look to be photosynthetic, right? You should be able to see chloroplasts in many of the outer cortex cell layers. What about the epidermis? The cells look very tightly connected. How would CO₂ get into the stem? See if you can find stomata...

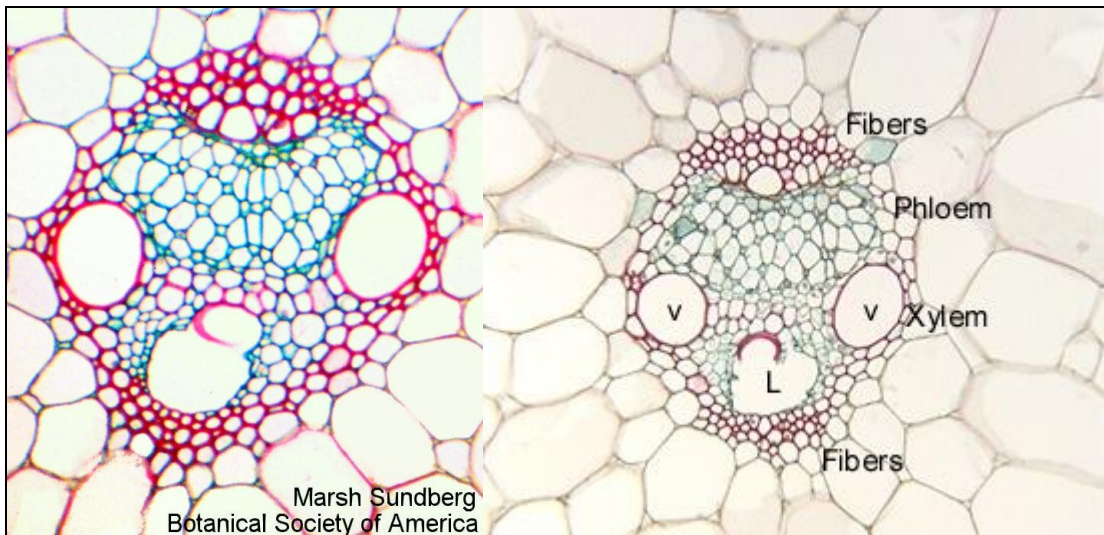
B) Next obtain a series of sections from the corn seedling. Start at the top and proceed toward the root.



Typical monocot stems.

1) Where is the shoot apical meristem in this plant? Think about a typical monocot like turfgrass - When you mow the lawn, are you cutting off the apical meristems?

2) Observe the vascular bundles in the stem. Is this really stem or leaf? Identify the xylem and phloem in the vascular bundle. Also note the presence and location of collenchyma cells. Are there fibers around the bundle? You should be able to see that this is sometimes referred to as a “closed” vascular bundle.



Vascular bundles from corn stems. A large air space (L - lacunae) often occurs in addition to the large xylem vessels (V).

3) Examine a prepared slide of a corn stem. These are from older plants. What type of stele is this? Also study the longitudinal sections and macerations of corn stems - they should help you identify xylem and phloem cells. What differences in secondary thickenings can you see among the different xylem vessels? These differences should help you decide how development is proceeding (exarch or endarch).

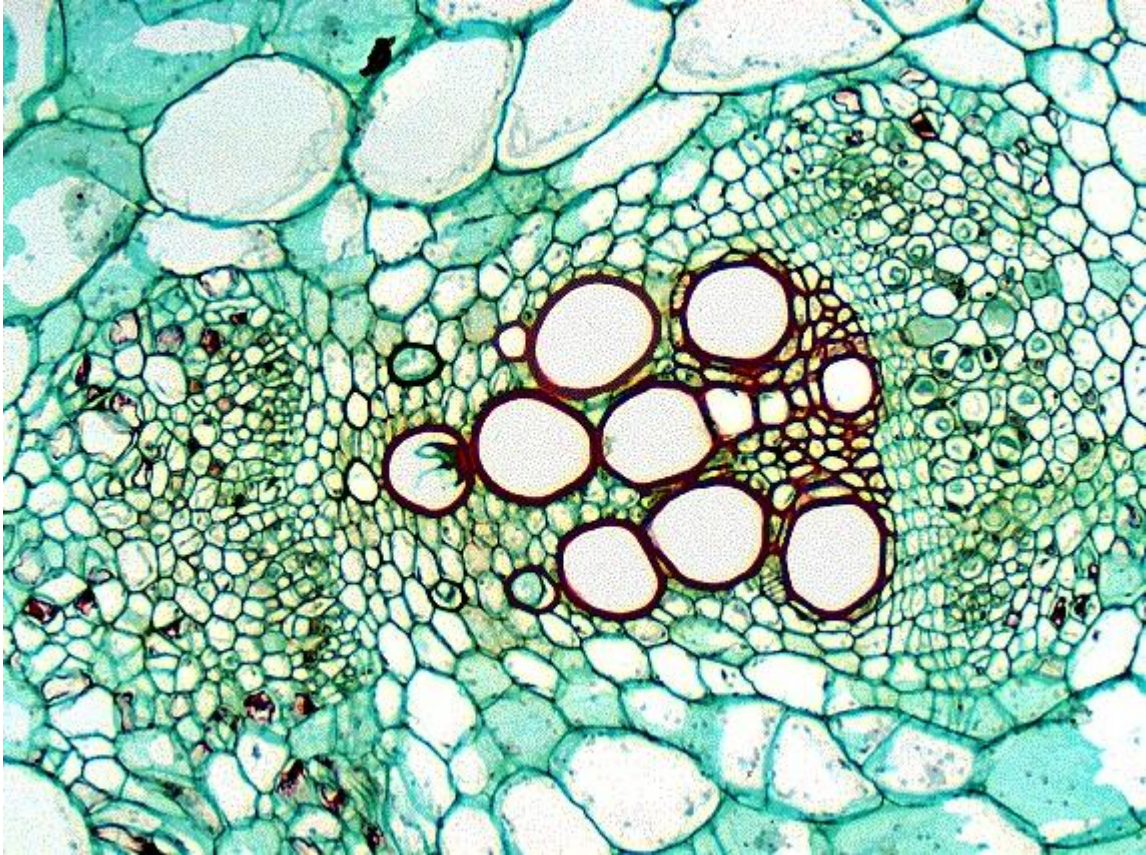
C) Observe the other prepared slides.

1) Look at the *Coleus* stem tip longitudinal section. Compare the meristem structure with pictures that you can find in the text. Find the lateral bud meristems. Trace the vascularization of the leaves. The xylem vessels will have secondary thickenings and the degree of thickening should indicate the relative age of the cells and in which direction the vascular strands are developing. Lastly note the trichomes of the epidermis. Are they single-celled?

2) Observe the transverse section of the *Lilium* stems. Note the presence of the cuticle. Find the xylem and phloem in the vascular bundles. What kind of stele is this? Find the sclerenchyma fibers near the epidermis. Do these seem to be common among monocots? Think about the possible function of such fibers, given that as we will see later monocots do not produce secondary xylem (wood).

3) Lastly, take a look at the stem sections of *Ranunculus*. Identify the xylem and phloem. Also note the cap of sclerenchyma fibers over the phloem.

D) See the *Cucurbita* (squash) stem section below. What seems odd about this vascular bundle? What are all those cells on the left? Where is the phloem? Cucurbits are somewhat unusual in having what is called amphiphloic phloem - there is the usual region of phloem to the exterior of the xylem, but also a region on the other side of the xylem. You should see where the cambium has developed and thus be able to say in which direction you would go to find the epidermis. Also, which xylem cells are likely protoxylem and metaxylem?



E) Lastly, here are a couple of images showing phloem tissues. You should be able to identify sieve tube members and companion cells. The image on the left (*Vitis*, grape) even shows sieve plates with sieve pores in two of the sieve tube members. The image on the right is from a bean stem and the arrows mark pairs of sieve tube members and companion cells.

