EXERCISE 10 VASCULAR CAMBIUM

Transverse sections reveal the relation of the cambial cells to their derivatives -- secondary xylem and secondary phloem. The young xylem and phloem cells form radial files of cells because of their orderly origin from periclinaly dividing cambial initials. In older xylem the radial seriation is disturbed because of nonuniform enlargement of cells. There is, for example, a striking difference in width between the vessels and the cambial cells. The phloem shows a more orderly arrangement because the cells of this tissue increase in width comparatively little during their differentiation. The cambial cells are relatively undifferentiated. The phloem and xylem derivatives gradually acquire the characteristics of the cells of these tissues.

Vascular Cambium of Tilia (American basswood, slide #32)
It is instructive to follow the radial files of cells from the cambium into the mature tissues and to recognize the process of differentiation in the change in size, wall structure, and contents of the cells. Observe the organization of the vascular cambium of Tilia (slide #32) in transverse and longitudinal section and in demonstration material at the side table. Both the axial and the ray systems originate in the cambium from separate initials. The tangential longitudinal section clearly reveals the difference between the initials of the two systems. The ray initials are relatively small and occur in groups corresponding in width and height with the rays. The initials of the axial system are elongated and pointed. They are usually called fusiform initials, that is, spindle-shaped initials. The organization of the vascular cambium of Tilia is regarded as non-storied cambium because the fusiform initials are not located in distinct bands of equal width.

Vascular Cambium of Robinia (Black Locust, on demonstration)
The cambial initials of Robinia are relatively short compared to those of Tilia and represent a classical example of a storied cambium, where cambial initials occur in discrete tiers. Observe a slide of Robinia cambium present on the demonstration table in transverse and longitudinal section. In tangential section, the fusiform cambial cells occur in horizontal tiers. The most striking developmental consequence of this type of cambial organization is that when anticlinal divisions occur, they are coordinated circumferentially so that each initial divides essentially simultaneously in a given tier to produce derivatives of the same size.

Vascular Cambium of a Conifer - Pinus (Pine, slide #39)
As seen in transverse sections, the relation between the cambial cells and their derivatives, secondary xylem and secondary phloem, is easier to study in Pinus than in Robinia because the structure of the two vascular tissues is simpler and the radial seriation originating in the cambium is maintained in the mature tissues. An important difference between the cambium of Pinus and that of Robinia is seen in tangential longitudinal sections. In Pinus, the ray initials appear in uniseriate vertical files and the fusiform initials are very long and overlap one another. The cambium is, therefore, nonstoried. In dormant cambium, the cell walls may be sufficiently thick to show pits. How do resin ducts appear to originate and what relationship do these bear to the cambium?