EXERCISE 12  CORK, CORK CAMBIA AND ANOMALOUS CAMBIA

Cork and Cork Cambia
After the onset of secondary growth, increases in the girth of the plant render the epidermis and cortex ineffective as protective layers. Although some cell division can occur in these layers, these primary tissues do not keep up with growth of the vascular cambium. Additional protective layers are formed from two sources. 1) Periderm tissues -- generated by phellogen (cork cambium) which produces phellum (cork) to the outside and phelloderm to the inside. 2) Secondary phloem -- which produces quantities of fibers during its development. During later development of a tree, multiple layers of periderm may occur, forming a rhytidome. The distribution of multiple periderm layers in the stem (or root) is responsible for the patterning of bark and accounts for the variability observed in bark structure in different tree species.

An early stage in the development of cork can be seen in the lower stem of the geranium, Pelargonium, and in prepared slides of the same (#19) or of Sambucus (# 15). Identify the periderm of this plant and each of the individual tissue types composing it. Phellum may be distinguished by its suberized cell walls and the internal condition of the cells. The phelloderm is the innermost one or two cell layers of the periderm in this preparation and remains living at maturity. The phellogen is located between the phellum and phelloderm and gives rise to these tissues. If the edge of the stem is examined closely, epidermis may be seen adhering to the outside of the stem. Cortex may be seen to the inside. Observe any lenticels present either in the living plant or on prepared slides. If it is impossible to observe a lenticel on your slide of Pelargonium, observe a prepared slide of the stem of Sambucus (elderberry), slide # 14, and determine the organization and function of the lenticel.

Anomalous Cambia
Anomalous cambia are those which behave in violation of our traditional concepts of cambial function. Only three basic types of anomalous growth are outlined in today's lab, although numerous other patterns exist. An example of supernumerary cambia is given in prepared slides of Rhaphanus, the radish, on demonstration. In the root of this plant, a number of concentric cambia form, one within the other, during development of the plant. In Beta, these form discontinuous rings which are best seen at low magnification. As is evident in the slides, the major product of these cambia is parenchyma, but xylem and phloem are also evident. What evidence is there for a specific function of the root tissues?

An example of anomalous pockets of isolated cambia is evident in the roots of Ipomaea, the sweet potato. In the root of this plant, small circular regions of cambium can be seen isolated within the main mass of the root. These pockets may number in the hundreds even within a single cross section. In these also, xylem and phloem are present. What type of growth accounts for the rest of the ground mass of the root?

Secondary growth in monocots is rare, however, it does occur in isolated species. Cambium division in monocots is entirely unifacial (mitotic divisions only occurring toward the inside of the stem) and results in the formation of entire vascular bundles. Observe a cross section of the stem of either Dracena or Cordyline, on demo. Scan the slide to determine the organization of the vasculature and then locate the vascular cambium and its derivatives. Are any immature vascular bundles present? How is the outside of the stem protected, based on this slide? Details on periderm formation in these types of monocots and palms are available in Esau (pg. 192).