

Botany Lab Unit 1

Plant Tissue

1. Be able to recognize parenchyma, collenchyma and sclerenchyma tissue.
2. Be able to give the role and characteristics of parenchyma, collenchyma and sclerenchyma tissues.
3. Distinguish between tracheids and vessels in xylem tissue.
4. Identify pits in xylem tissue.
5. Be able to identify phloem tissue and distinguish between sieve cell elements and companion cells.
6. Identify the sieve plate of sieve cell elements.
7. Be able to explain the structure and function of the various types of cells in xylem and phloem tissue.
8. Distinguish between meristem and cambium as to the type of growth and tissues produced by each.
9. Be able to identify the location of the apical meristem in roots and stems and of the vascular and cork cambia.
10. Be able to identify epidermal and peridermal tissues.
11. Give the characteristics and functions of both epidermal and peridermal tissue.

Unit 1 Plant Tissues

Plant tissues are divided into four basic types; **ground tissue**, **vascular tissue**, **dermal tissue**, and **meristematic tissues**. Additional tissues are differentiated by their complexity (**simple and complex**) and their origin (**primary and secondary**). Simple tissues are composed of one type of tissue where complex tissues are composed of a combination of several different cell types. Primary and secondary tissues will be discussed in the unit on meristematic tissues. Plants are composed of a few basic types of tissue that show numerous variations for a diverse number of functions.

Ground Tissues:

Ground tissues, parenchyma, collenchyma and sclerenchyma are the basic **simple** tissues that make up much of the plant body. Ground tissues may retain their identity as mature cells, they may differentiate into other cell types or they may function as parts of complex tissues. Parenchyma, collenchyma and sclerenchyma are differentiated from one another by the structure of their cell walls and by whether they are living or non-living at maturity.

Parenchyma cells are large thin walled living cells at maturity. Parenchyma tissue may function in food storage, water storage, lateral transport or in photosynthesis. In non-green plant parts parenchyma tissues are involved in storage or even the lateral transport of water and other materials within roots and stems, while in leaves and other green tissues parenchyma cells, known as **chlorenchyma**, are active in photosynthesis. Chlorenchyma cells make up most of the interior of leaves and other photosynthetic organs.

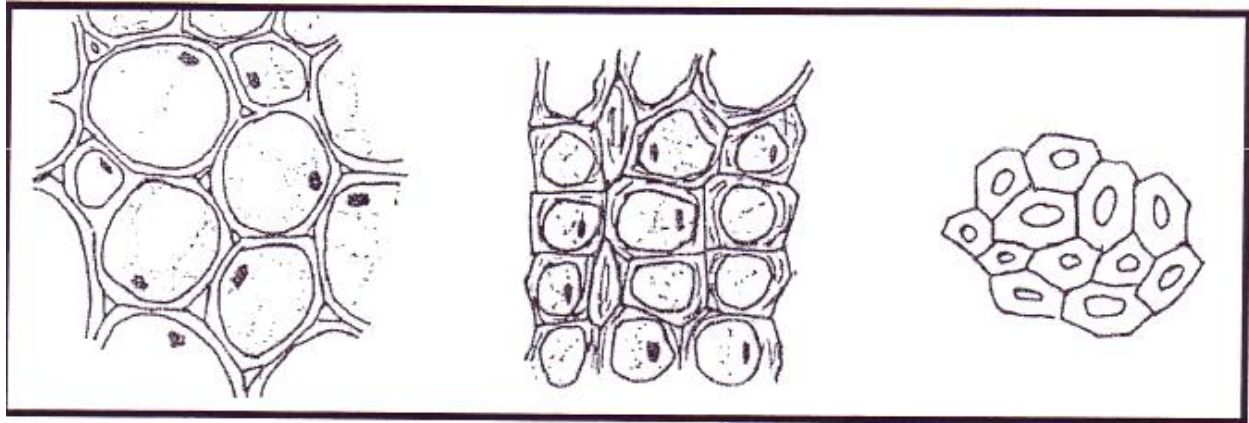
Collenchyma tissue is composed of smaller somewhat angular cells with some secondary cell wall thickening especially in the angles of the cell. These cells have a variety of functions such as food storage, structure, support, protection and even photosynthesis when they are exposed to the sun. Collenchyma cells are living at maturity and are usually found in regions of stress such as just below the outer surface of non-wood stems where they provide physical protection from herbivores and other environmental stresses.

Sclerenchyma cells are usually small in diameter although some fibers may be very long. As the cells mature very thick secondary walls are laid down which eventually result in the death of the cell. Sclerenchyma tissue provides structural strength and protection. Two types of sclerenchyma exist, fibers and **sclerids** or **stone cells**. Fibers may be very long and provide a flexible but strong tissue, while sclerids are small angular cells with very thick cell walls. Sclerids often provide support in soft tissues and are responsible for the gritty texture of pears. Refer to Figure 1A and B for illustrations and photomicrographs of the three basic cell types.

Activity 1

1. Observe prepared slides showing each of the three tissue types.
2. Draw each of the tissue types on the lab report.
3. Answer all questions in Section I of the lab report.

FIGURE 1A



Parenchyma

Note that the cells are large with thin cell walls.

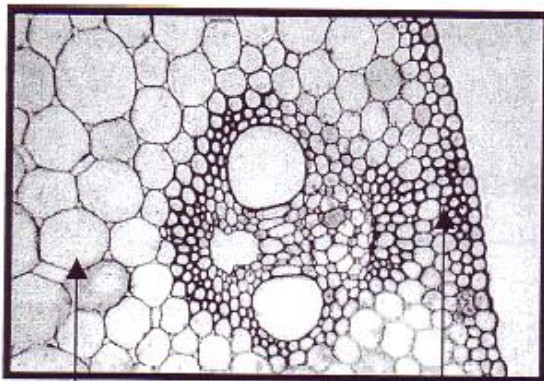
Collenchyma

Collenchyma cells are generally smaller than parenchyma and have some secondary thickening of the cell wall.

Sclerenchyma

Sclerenchyma cells are generally small with very thick secondary cell walls.

FIGURE 1B

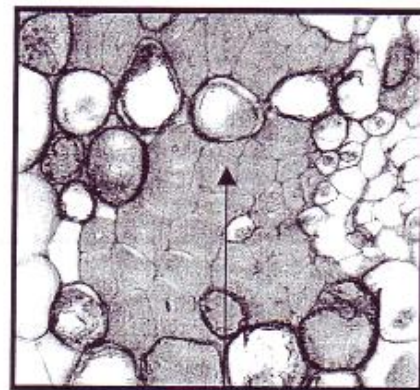


Parenchyma

Note large size and thin walls

Collenchyma

Note the variation in size between parenchyma and collenchyma



Sclerenchyma

Note the very thick secondary cell walls.

Vascular Tissues:

Plants have two basic types of vascular tissue: xylem and phloem. Vascular tissues are complex tissues composed of several different cell types. Xylem cells tend to be large and elongate. They are non-living at maturity, have thick cell walls and are responsible for the transport of water and minerals upward in plants and also function as a major structural and support tissue in most plants. The wood of woody plants is primarily composed of xylem.

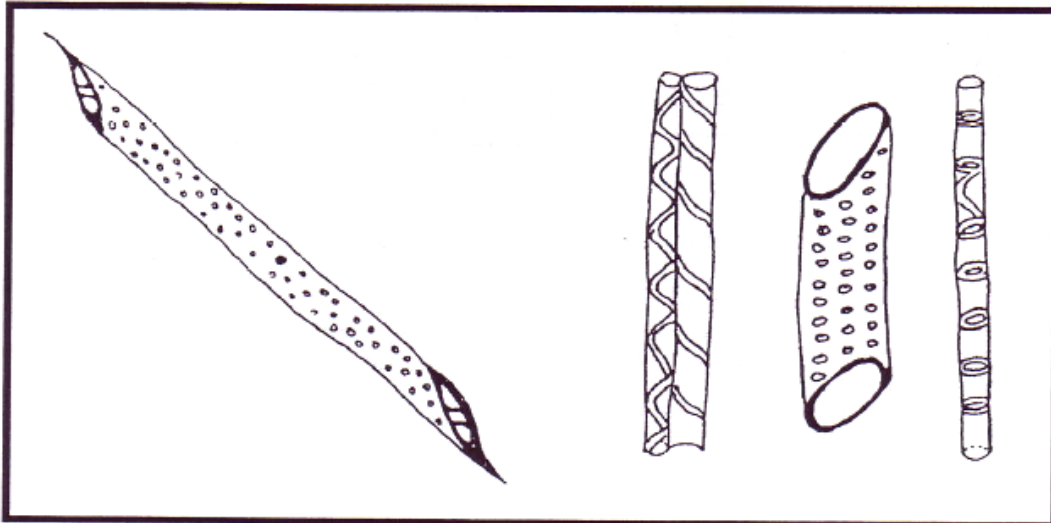
Two major xylem cell types exist, tracheids and vessels. Tracheids are elongate tapering cells that have small round pits for the passage of water from one tracheid to another. Pits are not completely open between adjacent cells but have a thin non-living membrane, the pit membrane separating the cells. Tracheids are the most primitive xylem cells and represent the primary xylem element in non-flowering vascular plants, such as Conifers, and are also the most common type of xylem in primitive flowering plants. More advanced plants have both tracheids and vessels, while the most advanced vascular plants have only vessels as their water conducting tissue.

Vessels are larger, cylinder shaped cells with open or partially open end cell walls. Xylem vessels are stacked end to end forming long tubes for the passage of water. In addition to tracheids and vessels which are the transport elements of xylem, xylem tissue contains sclerenchymous fibers for support and parenchyma cells for lateral transport within the xylem tissue. Parenchyma cells make up the xylem rays seen in woody stems. Observe Figure 2 for illustrations of various types of xylem tissue and 2B for photomicrographs.

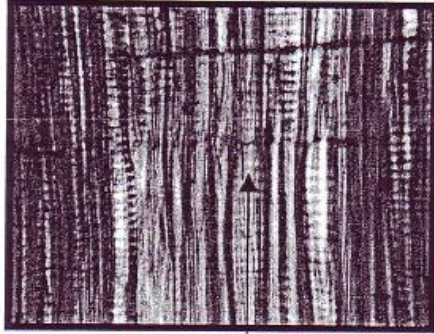
Activity 2

1. Observe prepared slides showing both cross section and longitudinal section views of xylem and phloem tissue.
2. Draw examples of tracheids, vessels, sieve cell elements and companion cells in both cross and longitudinal section.
3. Answer all questions in Section II of the lab report.

Figure 2 – Xylem Types (Tracheids and Vessels)

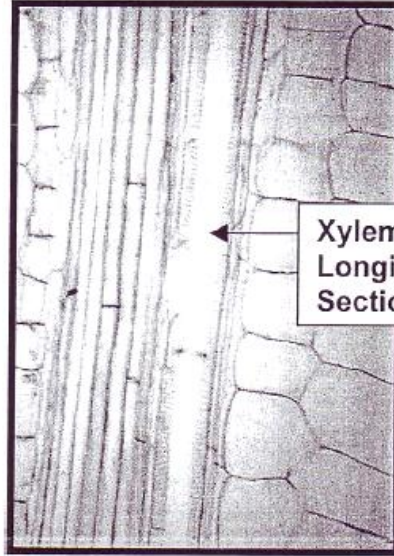


Tracheid

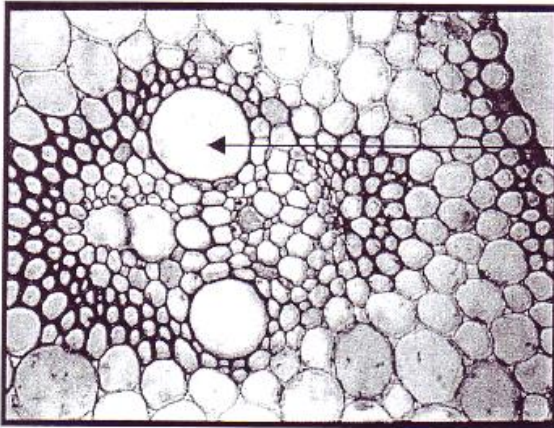


Tracheids are long relatively thin tapering cells with many pits.

Vessels

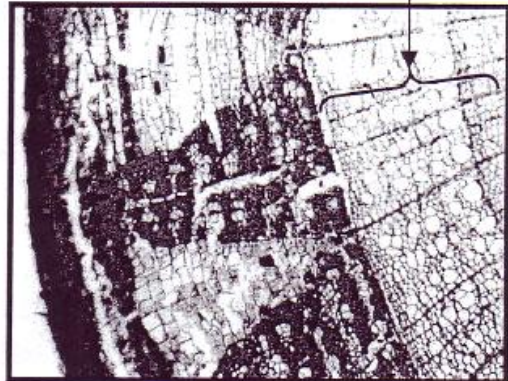


Xylem Vessel Longitudinal Section



Xylem Vessel Cross Section In Zea maies (Corn)

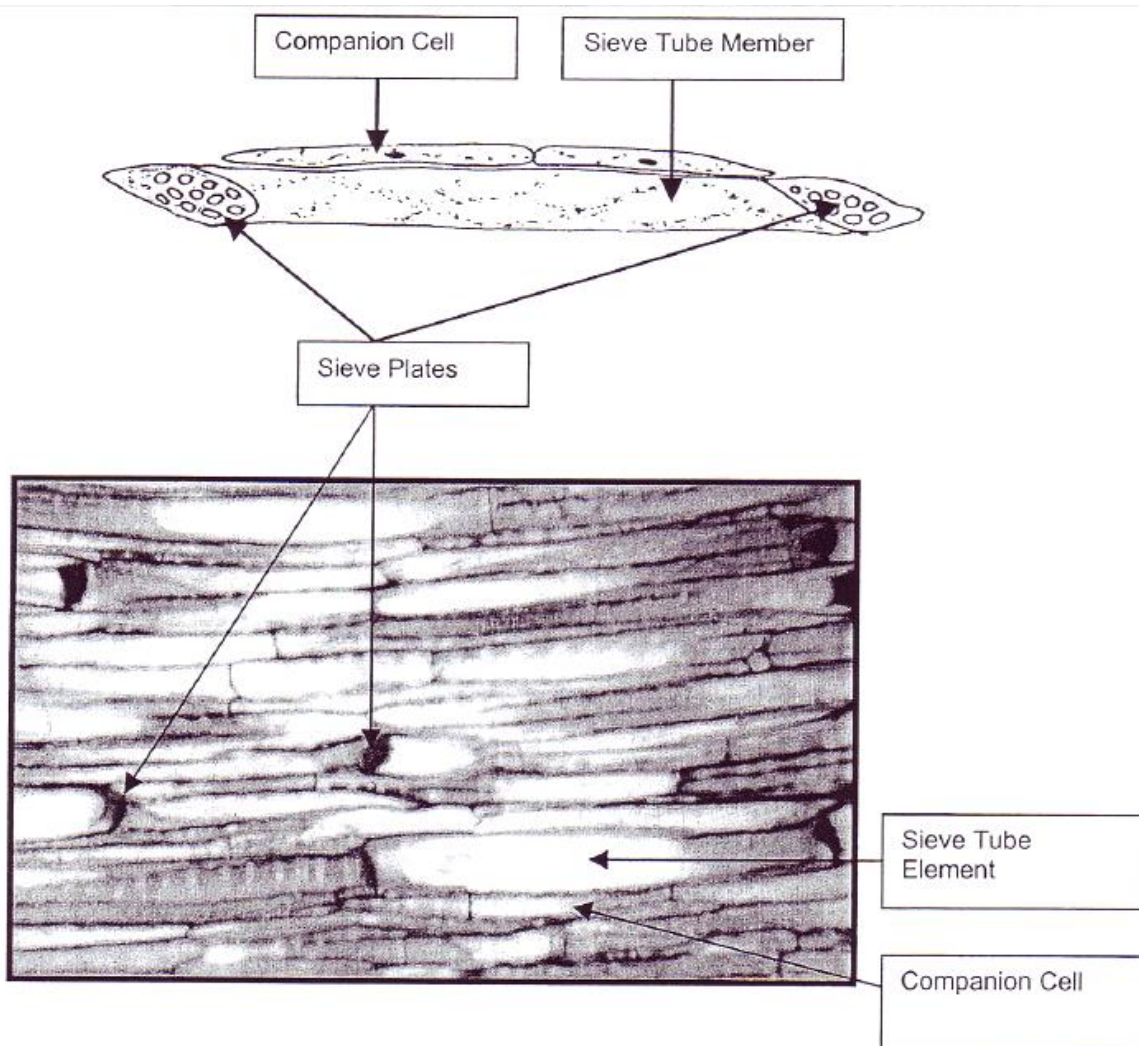
Xylem Woody Dicot Cross Section



Vascular Tissue – Phloem

Phloem is also a complex tissue. Sieve cell elements are the transport cells in phloem. Sieve cell elements are stacked end to end with perforated end cell walls. Unlike xylem, sieve cell elements are living. Dissolved food is transported through the cytoplasm of phloem tissue, and unlike water, food can be transported both up and down. Curiously, sieve cell elements do not have a nucleus, but each sieve cell element is associated with a smaller nucleated companion cell. Numerous cytoplasmic connections exist between the sieve cell element and its companion cell. Like xylem, phloem tissue may also contain fibers and phloem parenchyma. Observe Figure 3 for an illustration of phloem tissue

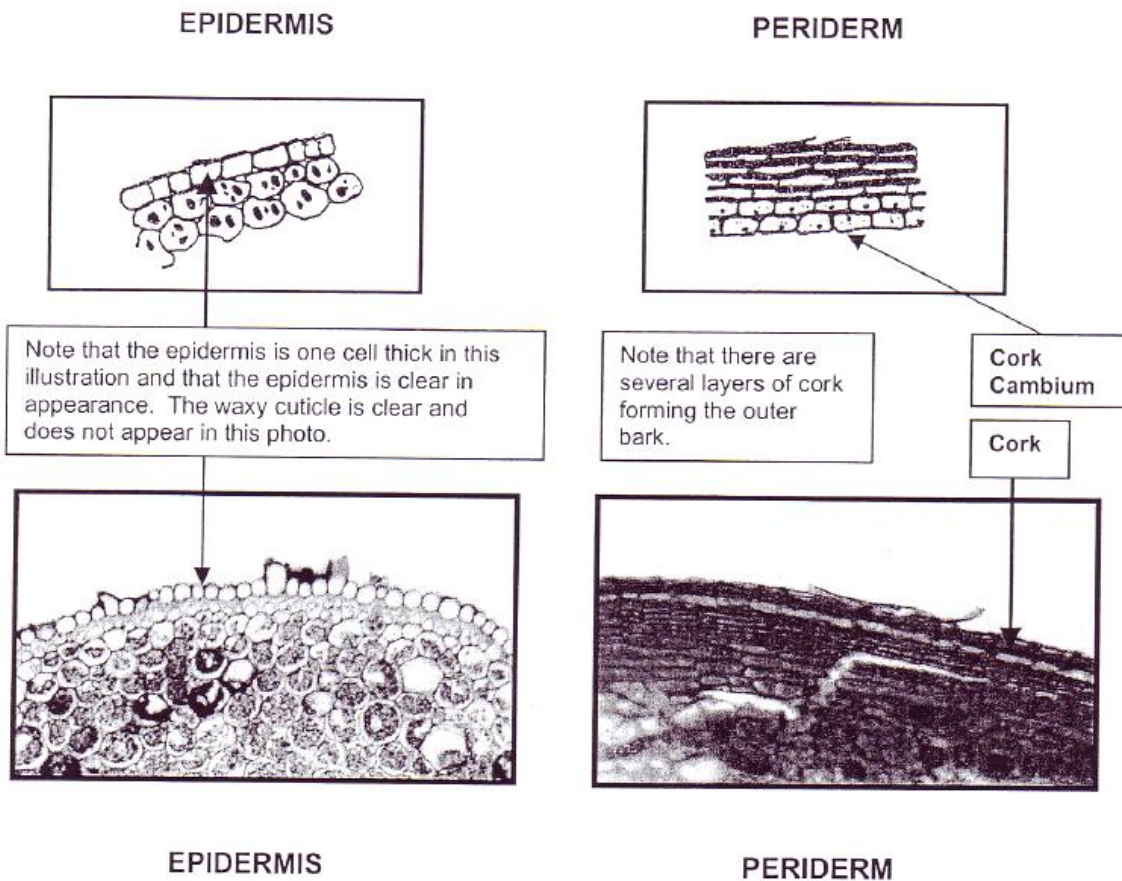
Figure 3 – Phloem



Dermal Tissue

Two types of dermal tissue are common in terrestrial plants. Herbaceous plants or soft organs like leaves, have a single layer of living cells from the outer surface. This is the epidermis, which efficiently protects the plant from desiccation and disease. Epidermal cells exposed to the atmosphere produce a waxy cuticle further reducing desiccation. The periderm or bark of woody plants is a non-living outer covering which may be many cells thick. The cells of the periderm are produced by the cork cambium a layer of mitotically active cells found below the periderm. As these cells mature they develop thick waxy walls becoming non-living but functional cork. Observe examples of epidermal and peridermal tissue in Figure 4.

Figure 4



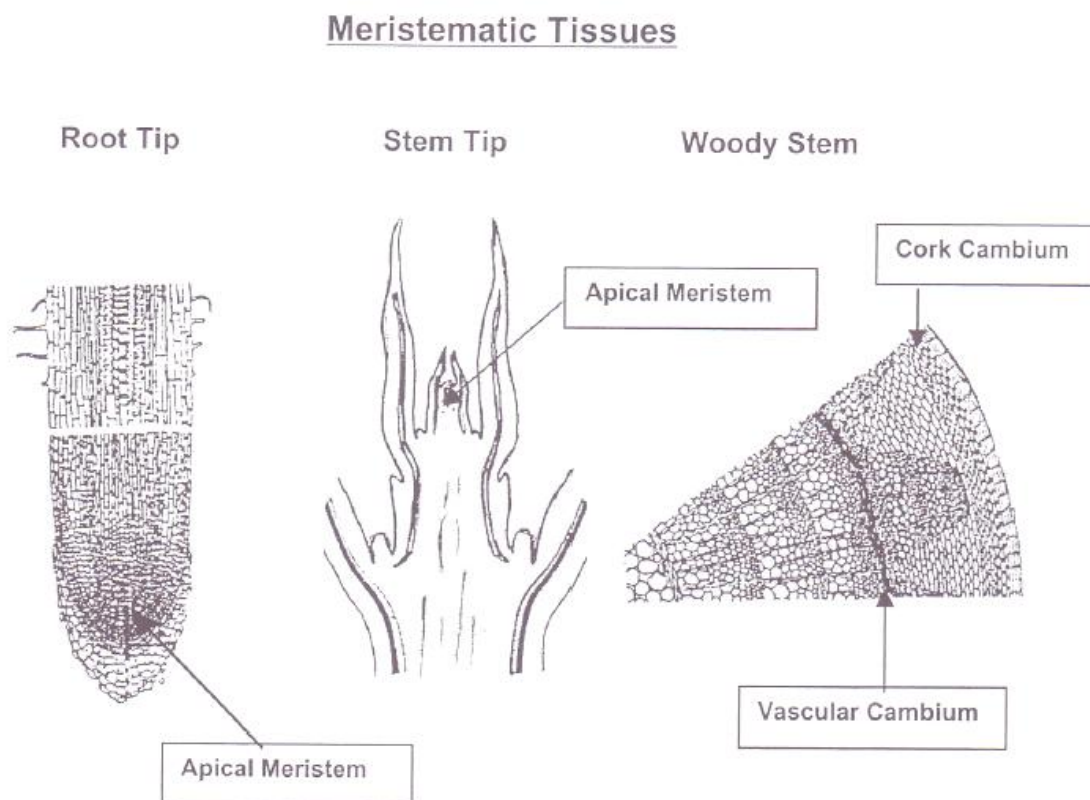
Activity 3

1. Observe prepared slides showing epidermis and periderm.
2. Draw examples of epidermal cells and a section of periderm.
3. Answer all questions in Section III of the lab report.

Meristematic Tissue

Plants have two types of cells that undergo active cell division. Meristems are tissues composed of cells that are active in cell division. These cells are located at the apex of the stem or root or in the lateral buds of the stem. Cells of the meristem produce longitudinal growth and form primary tissues while secondary tissues are produced by another type of mitotic tissue, the cambium. A cambium forms a lateral layer of cells around the stem or root. Cells produced by a cambium result in an increase in diameter. Two types of cambia are commonly identified. The vascular cambium, located between the xylem and phloem, produces secondary xylem and phloem while the cork cambium produces cork cells found in the periderm. Only dicots have a cambium while meristems are found in both dicots and monocots. Observe Figure 5A and 5B to illustrate the location of apical and lateral meristems and the location of the vascular and cork cambium.

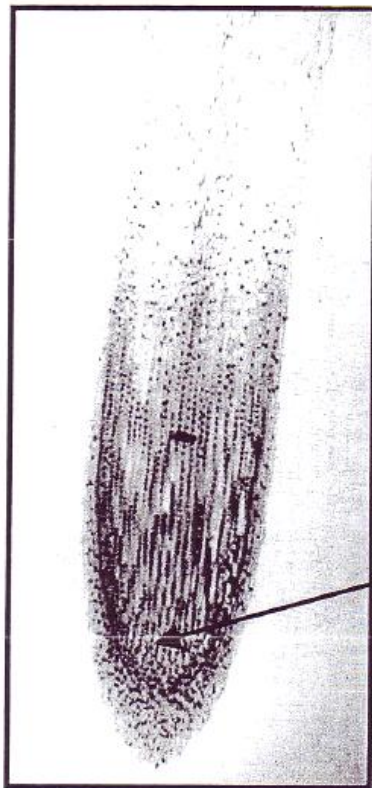
Figure 5A



Be sure to note the location of the apical meristem of the stem tip and root tip and both the vascular and cork cambium on both the drawings and photomicrographs. Figure 5A and 5B

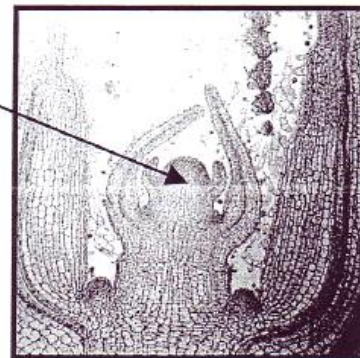
Figure 5B

Meristematic Tissues



Longitudinal Section
of a Root tip

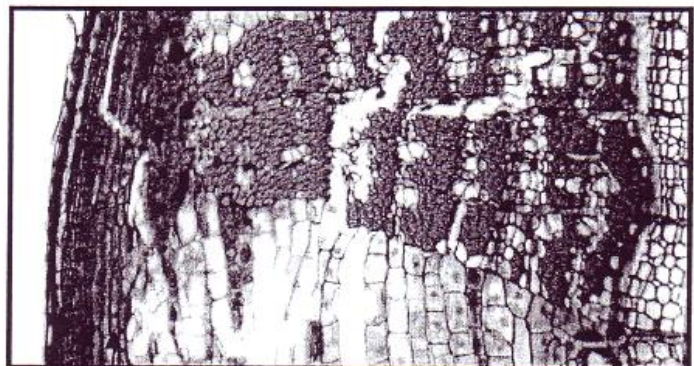
Longitudinal Section of the Stem Tip



Apical Meristem



Vascular Cambium



Cork Cambium

Activity 4

1. Observe slides of root and stem sections that show apical and lateral meristem.
2. Locate the vascular and cork cambium on prepared slides.
3. Answer all question in Section IV of the lab report.