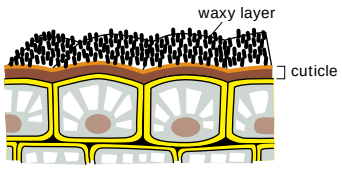
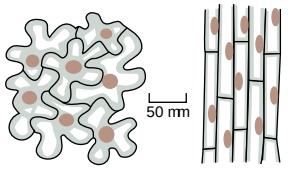
Plant Cells and Tissues, Part 2

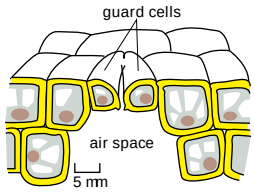
DERMAL TISSUE

The epidermis is the primary outer protective covering of the plant body. Cells of the epidermis are also modified to form stomata and hairs of various kinds.



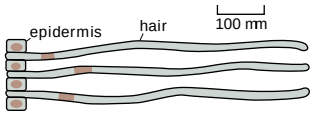
The epidermis (usually one layer of cells deep) covers the entire stem, leaf, and root of the young plant. The cells are living, have thick primary cell walls, and are covered on their outer surface by a special cuticle with an outer waxy layer. The cells are tightly interlocked in different patterns.



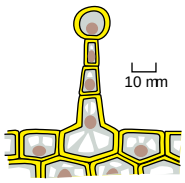


Stomata are openings in the epidermis, mainly on the lower surface of the leaf, that regulate gas exchange in the plant. They are formed by two specialized epidermal cells called *guard cells,* which regulate the diameter of the pore. Stomata are distributed in a distinct species-specific pattern within each epidermis.

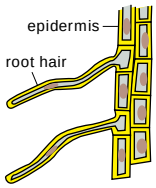
Hairs (or trichomes) are appendages derived from epidermal cells. They exist in a variety of forms and are commonly found in all plant parts. Hairs function in protection, absorption, and secretion; for example,



young, single-celled hairs develop in the epidermis of the cotton seed. When these grow, the walls will be secondarily thickened with cellulose to form cotton fibers.



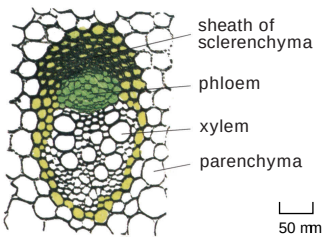
a multicellular secretory hair from a geranium leaf



Single-celled root hairs take up water and ions from the soil.

Vascular bundles

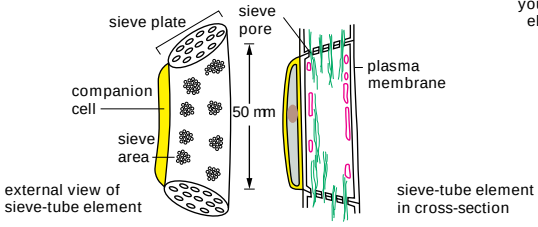
Roots usually have a single vascular bundle, but stems have several bundles. Each bundle is a complex of different types of cells providing pathways for fluid transport.



a typical vascular bundle from the young stem of a buttercup

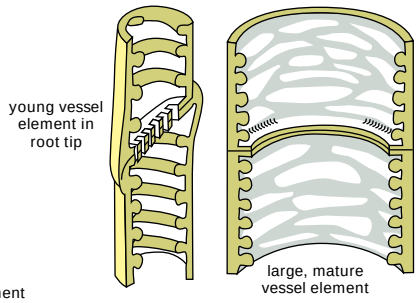
VASCULAR TISSUE

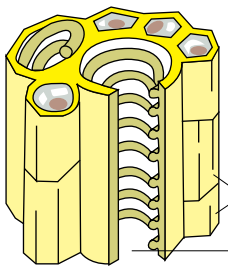
The phloem and the xylem together form a continuous vascular system throughout the plant. In young plants they are usually associated with a variety of other cell types in *vascular bundles*. Both phloem and xylem are complex tissues. Their conducting cells, or *elements,* are associated with parenchyma cells that maintain and exchange materials with the elements. Also, groups of collenchyma and sclerenchyma cells provide mechanical support.



Phloem is involved in the transport of organic solutes in the plant. The main conducting elements are aligned to form tubes called *sieve tubes*. The sieve-tube elements at maturity are living cells, interconnected by perforations in their end walls formed from enlarged and modified plasmodesmata (sieve plates). These cells retain their plasma membrane, but they have lost their nuclei and much of their cytoplasm; they therefore rely on associated *companion cells* for their maintenance. These companion cells have the additional function of actively transporting soluble food molecules into and out of sieve-tube elements through porous sieve areas in the wall.

Xylem carries water and dissolved ions in the plant. The main conducting cells are the vessel elements shown here, which at maturity are dead cells that lack a plasma membrane. The cell wall has been secondarily thickened and heavily lignified. As shown, by maturity, the end wall has largely been removed to form long, continuous tubes.





The vessel elements are closely associated with xylem parenchyma cells, which actively transport selected solutes into and out of the elements across their plasma membrane.