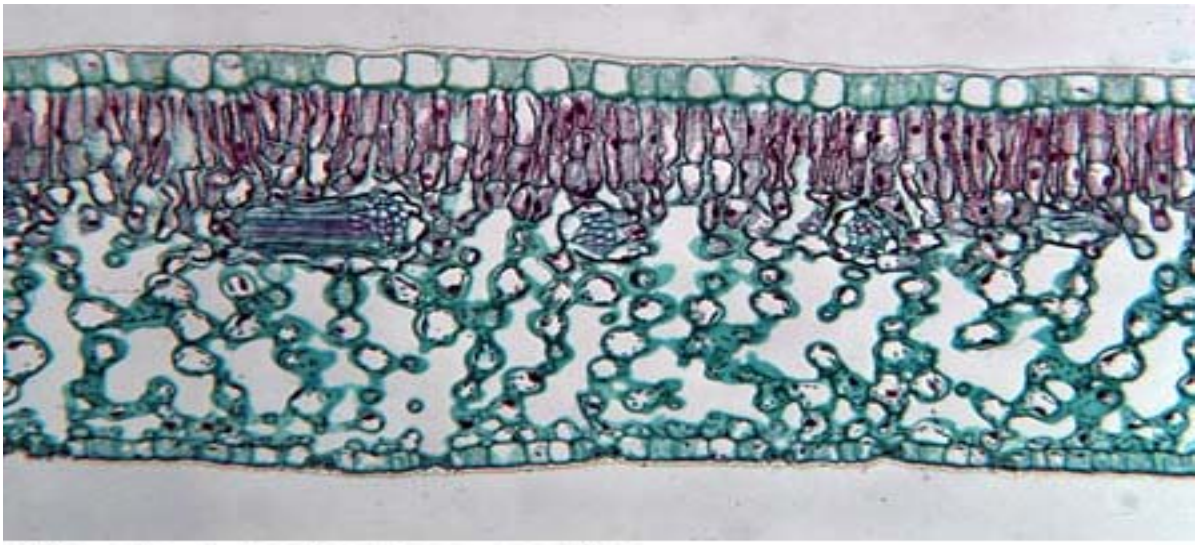
Dicot and Monocot Leaves

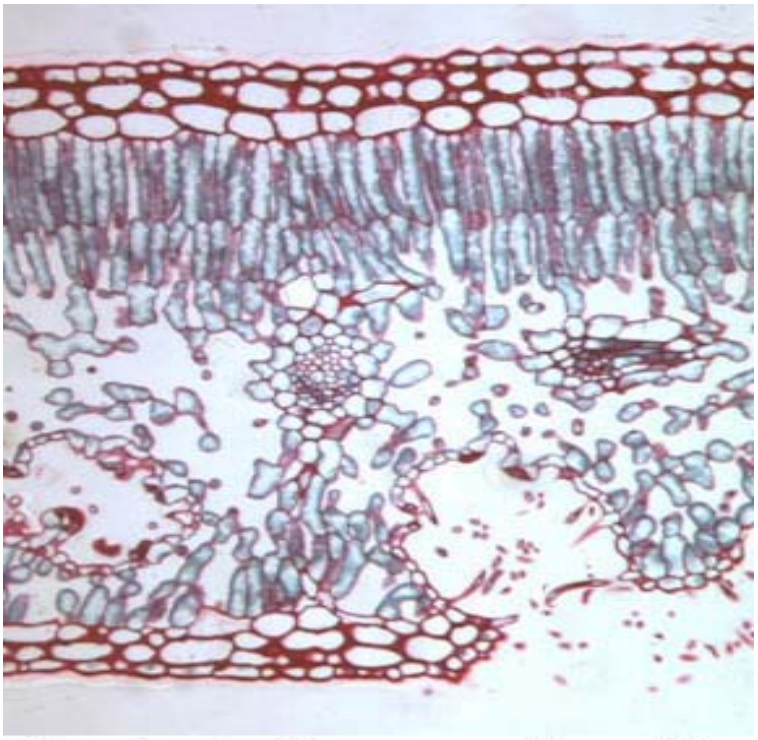
Angiosperm leaves have many shapes and sizes (see Photographic Atlas of Plant Anatomy by Curtis, Lersten and Nowak, *Leaf External Morphology* - http://botweb.uwsp.edu/anatomy/).

In general, dicot leaves exhibit net veination and have a differentiated mesophyll with a **palisade** layer associated with the **adaxial** (generally upper) surface and a **spongy** layer associated with the **abaxial** (generally lower) surface as shown below in the *Ligustrum* leaf.



Ligustrum leaf cross section.

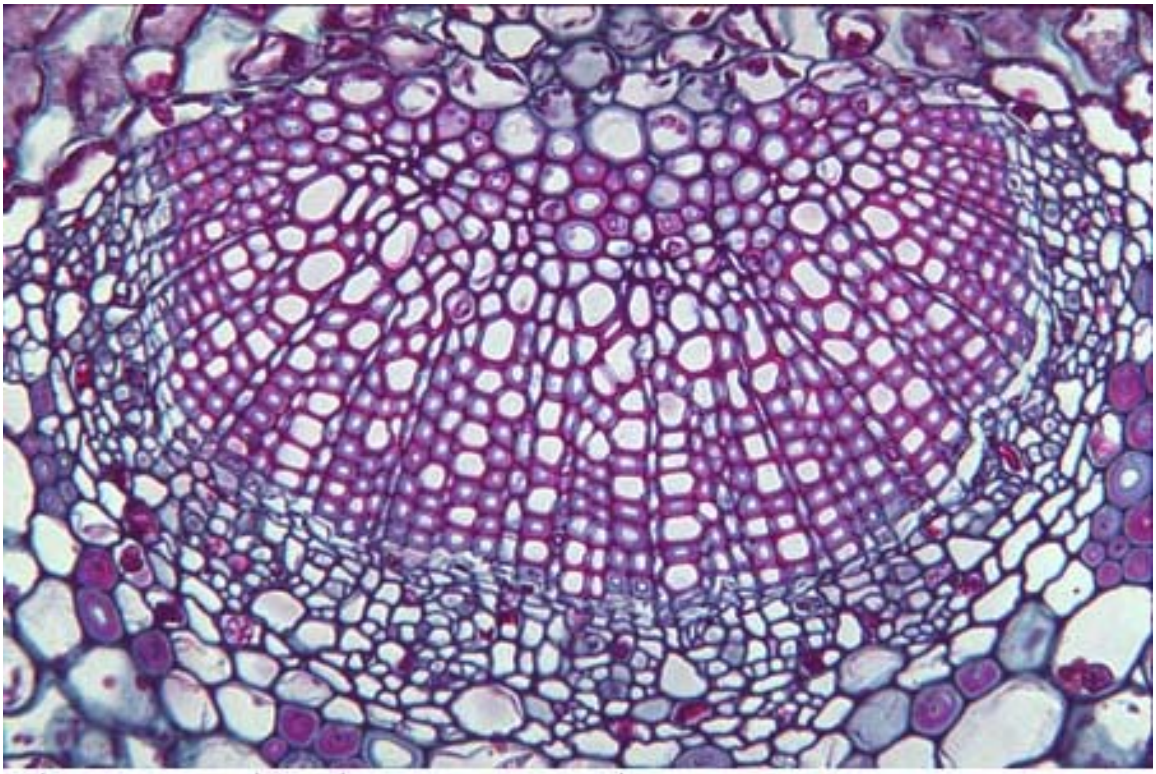
Occasionally the palisade layer is found both top and bottom with a spongy layer in between. The leaf epidermis is typically one cell layer thick but as with most plant characteristics there are exceptions. You can note the multiple epidermal layers in the *Oleander* leaf shown below.



Oleander leaf cross section with stomatal crypt and multiple epidermis.

Stomates are variably located. In some leafs they are found in the abaxial surface only, the adaxial surface only, both surfaces, or as in the *Elodea* leaf and other submerged aquatic leafs, stomata are absent. Often they are located at the surface of the leaf but in the *Oleadnder* leaf shown above, they are in cavities or crypts.

There are additional features of the dicot leaf to consider. Given that dicot leaves generally exhibit net veination, secondary and tertiary veins are seen in all views in a cross section of the leaf, as noted in the *Ligustrum* leaf shown previously. However, the main vein or midvein will always be seen in cross section (see the *Ligustrum* midvein shown below).
The veins of leaves typically lack a vascular cambium but one can be seen quite clearly in the bundle of the midvein. However, even when present cells of the vascular cambium undergo few if any divisions, thus the leaf generally contains only primary tissue. In addition, the bundles may or may not be surrounded by an endodermis.

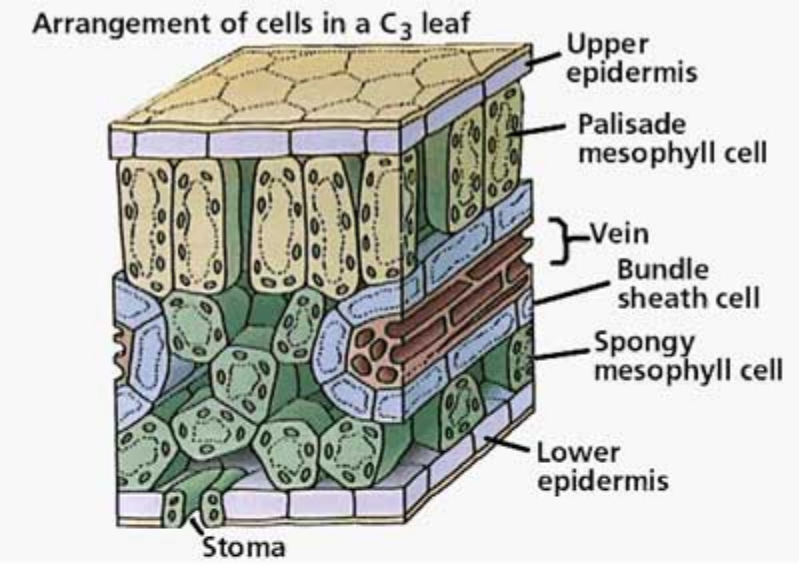


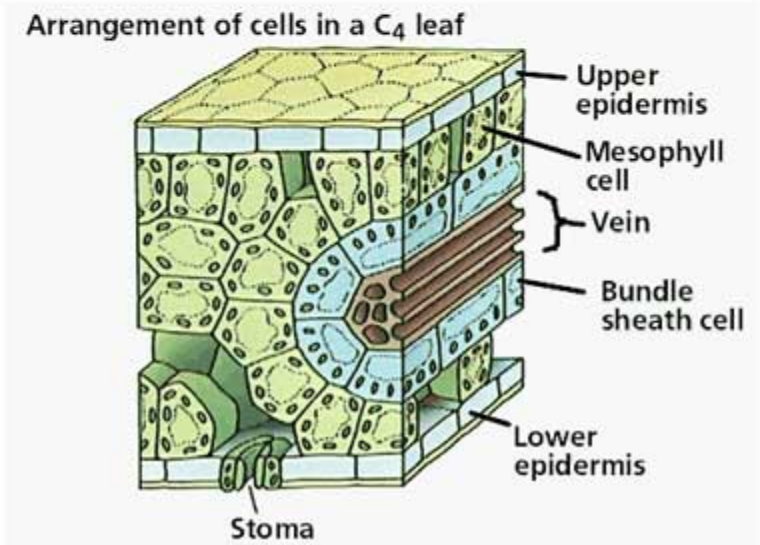
Ligustrum midvein cross section.

Monocot leaves in general differ from the leaves of dicots in several ways.

Zea leaf cross section.

As noted in the *Zea* leaf shown above, the mesophyll is not differentiated but consists solely of spongy mesophyll tissue. As the veins typically all parallel to each other in the blade, all appear in a cross sectional view in a cross section of the leaf. Some monocot leaves also exhibit a type of leaf anatomy shown above. The vascular bundles are surrounded by two bundles sheaths, an inner one called the **mestome** sheath that can be seen here as small thick walled cells. The mestome sheath can be considered to be an endodermis and the cells that comprise it are non-photosynthetic. Surrounding the mestome sheath is an outer sheath of larger thin walled parenchyma cells. In members of the grass family, such as *Zea*, the outer parenchyma sheath is encircled by mesophyll cells. This pattern (**Kranz** anatomy) is associated with C_4 photosynthesis, and while not all C_4 plants exhibit this pattern, all plants that exhibit this pattern have C_4 photosynthesis. A comparison of C_3 and C_4 plants is shown below.





Comparison of leaf anatomy of C_3 and C_4 plants. Reproduced through the courtesy of Dr. Stephen Grace, University of Arkansas.