

Plant Cytology

In this exercise, you may feel insulted by the simplicity of the instructions and the simplicity of the exercises, but some of us need a review at the start of the semester to refocus our science skills in general. Many of us may also need to be reminded of the special differences between plant cells and the cells of other organisms. The plant cell is the unit of plant life and therefore a unit of plant function which means plant physiology! So this is the appropriate place to start a course in plant physiology.

Cell Wall

Obviously any cell has a boundary with the environment. This may involve both a cell wall and a cell membrane. Some twigs are provided to make free-hand sections with a sharp razor blade. Observe them in a wet mount with water first, and then mount in one drop of 5%_(EtOH) Phloroglucinol plus one drop of 9N HCl. This is primarily a stain for lignin. You could repeat this with a bean stem to decide which kinds of tissues and cells have walls containing lignin in plants.

Cell Membrane

Another part of the boundary is a cell membrane which textbooks tell you is made of phospholipid bilayers with integral and peripheral proteins. Since plant cells have a cell wall, the membrane is not visible unless we pull it away from the wall slightly even then you will not see the membrane, only its effect in containing the cytoplasm. Conveniently, the rigid cell wall serves as a marker to show us when the cell membrane has been moved. Make a wet mount of an *Mnium* (moss) "leaf" and observe the cells in distilled water. A saturated solution of NaCl is available for a second mount or to add to the first one. The distilled water will obviously be hypotonic, the salt solution will be hypertonic. Compare the results.

Chloroplasts

You have observed cell membranes and cell walls in plants. One boundary layer is rigid and static, the other flexible and dynamic. A cell is more than its boundaries; it also must have something inside. If you need to, make another wet mount of moss "leaf" in distilled water. The cells contain chloroplasts. You can probably reveal their function by adding a drop of iodine ($I_2KI = 5\% I_2$ and 10% KI) stain to the mount, or making a new mount in the iodine stain. Remember the positive reaction with starch is production of a blue-black speck...not an overall change to brown!

Vacuole

Your instructor will demonstrate how to make a peel of a leaf epidermis from a plant called *Rhoeo discolor*. The upper epidermis of the leaf is essentially transparent but the lower epidermis is quite purple. Make a wet mount of the upper and lower epidermal layers peeled from this leaf and compare them. The kidney-shaped cells common in the purple lower epidermis peels are called guard cells. The other cells of the epidermis are simply common epidermis cells. Where is the purple pigment located specifically? Perhaps a treatment will reveal this by altering the membranes of the cells.

Nucleus

Continue your observation of the upper and lower epidermal cells of *Rhoeo*. With some iris adjustment you should be able to find the nucleus of many cell types. How many per cell?

Proplastids

In *Rhoeo* cells which lack chloroplasts, you should find another member of the plastid family in association with the nucleus. How do such cells obtain chemical energy?

Mitochondria

The mitochondrion in plants is smaller than nuclei or chloroplasts and lacks colorful organic chemicals. It is, of course, the powerhouse of the cell and therefore must have enzymes which release the energy stored in organic molecules. Perhaps we could stain for the special enzymes of the energy pathway. The natural anthocyanin (purple) pigment may have revealed mitochondria already in one epidermal peel. A drop of 0.15%_(aq) methylene blue may work for the other. This dye is known to change color in the presence of electrons and hydrogen ions. The respiration pathway includes enzymes such as succinate dehydrogenase which liberate electrons and hydrogen ions.

Chromoplasts

To reveal these additional members of the plastid family, make free hand sections of red pepper or tomato (depending on what is available) and wet mount them.

What do I hand in?

Next week you should hand in a one-page amplified abstract of this work. The supporting documents for this exercise would be sketches with labels and captions.