

Discovering Plant Tissues in a New Dimension – Student Outline

Exercise Activity 1

Submerge three leaves in 10 mL Visikol™ until they become transparent (time will depend on the thickness of the tissues). Students will make a wet mount of leaf and will be instructed to observe the internal anatomy of the leaf and identify different tissue systems (epidermal, ground and vascular tissue systems) of the leaf. Compare and discuss the structure of each tissue in the leaf and relate it to its function in the plant.

1. Obtain a leaf from an aromatic plant (mint, basil or oregano) already cleared in Visikol™ for 12-24 hours.
2. Place one leaf with the top side facing up on the microscope glass slide, add two drops of Visikol and make a wet mount. 3. Add cover slip by placing one edge at one side of the drop of the liquid and then slowly lower the other edge of cover slip on the specimen trying to avoid the formation of air bubbles. Note: if air bubbles are trapped in the mount, gently tap with a pencil on top of the cover to move the bubbles out.
3. First examine the leaf at low power. Examine the epidermis, observe the shape of the cells and if there is or not a space between them.
4. Locate a pair of guard cells (often a kidney-shaped) and a pore between them, also known as stoma (in plural, stomata). These cells are specialized to control the water movement. Are epidermal cells surrounding the stomata, are stomata sunken below the general surface? How is the distribution of stomata (are they scattered or they have a particular arrangement, like in row)?
5. Locate epidermal hairs or trichomes. Observe their shape, size and arrangement. How many cells are forming the trichome? What is a trichome? What are the functions of trichomes?
6. Observe a mushroom-shaped structure, sticking out of the surface, these structures are essential oil glands. Here some chemical compounds responsible of the characteristic aroma are produced and accumulated. There are two types, one small also known as capitate glands and another larger one also known as peltate glands. How many cells are forming each gland?
7. Observe the glands at different power. Do you notice any distribution pattern?
8. Examine the leaf from the upper (adaxial) to the lower (abaxial) part of the leaf using the fine focus knob.
9. First observe the compact layer of photosynthetic cells, this is the palisade parenchyma.
10. Continue using the fine focus knob and observe deeper layers. You will encounter cells arranged differently, this tissue is also known as spongy parenchyma. What is the shape of these cells? Are they tightly arranged or loosely arranged (do you see spaces between the cells)? How are the cell walls (thin, thick)?
11. The palisade parenchyma and spongy parenchyma constitute the mesophyll of ground tissue of the leaf. Can you see the chloroplasts in these cells? How are the cell wall, thick or thin?
12. Locate the midrib and vein system. These are specialized cells which conduct water and minerals (xylem) and transport substances synthesized in the leaf mesophyll to other tissues in the plant (phloem), they are grouped together in stands called vascular bundles. Observe thickening in the cell wall of the xylem. What shape do you see?
13. Observe the vascular system and note the diverse and elaborate patterns of veins and vein endings. This pattern is used for identification such as net like or parallel.
14. Continue using the fine focus knob and you will observe the lower epidermis. Locate the epidermal cells, guard cells, stomata and oil glands. Do you notice any difference between the structure of the upper and the lower epidermis? (For example are more or less guard cells and stomata, different distribution?)

Exercise Activity 2

Students will make a wet mount of 10-day old Arabidopsis plantlet and will be instructed to observe the complete plant body, the primary root and primary shoot. Students will observe that growth in roots is arising from the apical meristems in three dimensions.

1. Obtain a 10-day-old Arabidopsis plantlet cleared with Visikol™ for 12-24 hours.
2. Prepare a wet mount of the plantlet and add a cover slip.
3. Locate the root tip and find the root cap. The cap is between the soft apical meristem and the hard soil particles. What is the function of the root cap? Poster Session: Discovering Plant Tissue in New Dimension © 2016 by Adolfin R. Koroch, Thomas S. Villani and James E. Simon 3
4. Look carefully, just above the root cap, and you will identify the division zone, the source of new cells for the root growth. Using the fine focus knob and you will locate the apical meristem, protoderm (the young epidermis), procambium (young vascular system) and ground meristem (cells between protoderm and procambium). What is the size of these cells? 5. At lower power, in addition to the division zone in the root, identify the cell elongation zone (just above the division zone). Do you notice any difference in these cells?
5. Continue observing and you distinguish a zone rich in root hairs. This is maturation zone in the root. What is the characteristic shape of cells in this zone? What is the function of the root hairs? Are the cell walls thick or thin? How many cells are in a root hair?
6. Observe the vascular tissues, where are they located? Are they in the center of the root or in the surface?
7. Examine the leaves with lower and high power from the upper to the lower part. Can you identify the tissues? Does Arabidopsis have trichomes? What is the shape? Why would plants have or not have trichomes? What could an advantage of trichomes provide to a plant?
8. Locate the shoot meristem, and observe the cell size and shape.

Follow Up Questions

1. Do you see any difference (shape, size) between the superficial layer of cells and the deepest ones in the leaves? Can you relate the structure you see with the function it has? Can you suggest another shape or structure for that function?
2. How many layers of tissues you can to see from one side of the leaf to the other? Would you expect to find many more layers? What would be the limiting factor?
3. In the leaf you have observed, did you see the trichomes on both upper and lower surfaces? What is the function of the trichomes? Plants from which environments would you expect to find them?
4. What is the purpose of having oils glands and trichomes on the surface in the leaf?
5. Why do you think the meristem in the root (or shoot) is located in deeper tissues and not on the surface?
6. Do you expect to find oil glands in the epidermis of the root? Why?