A GUIDEBOOK FOR TEACHING BIOLOGY -- OSMOSIS AND DIFFUSION

Chemical Changes: Diffusion and Osmosis
11. In order to elicit the interest of students in the concept of osmosis, discuss with them the following questions: Do all animals obtain needed water by means of drinking through their mouths? How do sponges do in this regard? How do roots in plants take in water? If water can be absorbed through membranes, why don’t animals lose all their body fluids through their skin? How do plants and lower animals prevent unwanted substances, such as dirt, germs, and toxic materials, from entering their bodies? Discuss the advantages of a semipermeable membrane and the principle of osmosis.

The following demonstrations are excellent visual presentations of diffusion and osmosis through a semipermeable membrane.

12. Prepare Lugol's iodine solution by dissolving 10 g of potassium iodide in 100 ml of distilled water; then add 5 g of iodine. Pour diluted Lugol's solution into a large test tube, cover the test tube with a wet goldbeater's membrane, and secure the membrane with a rubber band. Now invert the test tube into a beaker containing a 1 percent starch paste, as shown in Fig. 2.1. Prepare a second setup in the same manner, but this time place the starch paste in the beaker and the iodine solution in the beaker. Have students note that molecules of the iodine solution pass through the membrane, while starch does not, as shown by the characteristic blue-black color that appears in the starch solution and not in the Lugol's solution in the beaker in (a) and in the test tube in (b). The starch is insoluble and therefore needs to be digested to diffuse through a membrane.

13. A similar demonstration to show the diffusion of salt through a membrane may be performed using copper sulfate solution (blue) and distilled water.

14. The following setup demonstrates the principle of osmosis: Pour heavy molasses into the bulb of a thistle tube while covering the tube opening with your finger. Then cover the bulb with a wet semipermeable membrane (goldbeater's) and invert it into a beaker of water. Clamp the tube, as shown in Fig. 2.2, to hold it in place. Water in the beaker will diffuse rapidly through the membrane, causing the level of molasses in the thistle tube to rise. The water is moving from a higher concentration through a membrane to a lower concentration, a process called osmosis.

15. A similar setup using a raw potato may be used to show the passage of water through the semipermeable membranes surrounding the living cells of the potato. Using an apple corer, remove a center cylinder of a raw white potato. Leave about a ½ in. thickness at the bottom of the potato. Fill the cavity with a concentrated sucrose solution and cover the opening with a one-hole rubber stopper through which a piece of glass tubing has been inserted. (See Fig. 2.3.) Place the potato in a beaker of water, as shown in Fig. 2.3, using a clamp to hold the tube upright. Melted paraffin may be used to seal the stopper. Water will diffuse through the membranes of the cells in the potato to the cavity and rise in the tube, carrying some of the sucrose with it.
**Figure 2.1.** Diffusion setup.
Molecules of iodine solution (Lugol’s) pass through the semipermeable membrane, while the starch does not. The black color appears in the starch solution but not in the iodine solution.
Figure 2.2. Osmosis demonstration.
Water in the beaker diffuses through the goldbeater membrane attached to the end of the thistle tube, causing the level of molasses in the tube to rise.

Figure 2.3. Raw potato diffusion setup.
The cavity in the potato is filled with sucrose solution. The water diffuses through the cell membranes of the potato to the cavity and rises in the tube, carrying some of the sucrose solution.