

Osmosis Demonstration Lab

Objectives

The student will:

- 1) Observe the effects of different concentrations of salt solutions on potato cores.
- 2) Infer the relationship between weight loss and rate of osmosis.
- 3) Use a line graph to display data and draw conclusions.
- 4) Observe plasmolysis in *Elodea*.

Background

Osmosis is the process whereby water moves across a cell membrane by diffusion. Diffusion takes place when the molecules of a substance tend to move from areas of higher concentration to areas of lower concentration. The process of osmosis must be tightly controlled by cells, otherwise they will die. For example, if you place a red blood cell in pure (distilled) water, it will quickly take up water until it bursts. That is why plasma, the liquid portion of our blood is made of water with proteins and salts dissolved in it, preventing the unnecessary gain of water by our blood cells.

In plants, osmosis is just as important. Plants with too little water will wilt. This happens when water moves out of the cells by osmosis. Without this water there is little pressure inside the cells and the plant can no longer support itself against the pull of gravity. However, after watering the plant, the cells become reinflated with water and the plant stands upright. The effect of water loss on plant cells is shown in the diagram below.

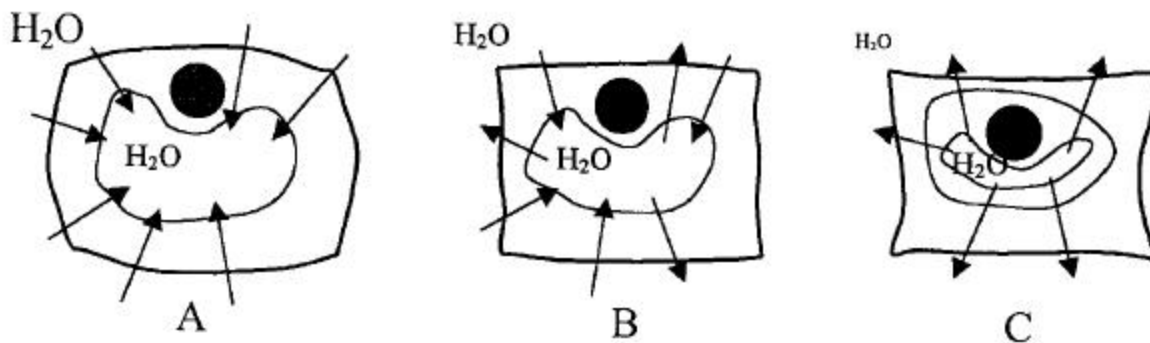


Figure 1. A. Plant cell placed in pure water. This cell will become inflated because the water outside the cell is at a higher concentration than the water inside the cell. As water moves in by osmosis the vacuole fills up and presses out against the cell wall. B. The same cell in water equal to the concentration inside the cell. This cell has no overall gain or loss of water because whatever moves out will be replaced by water moving in. C. A cell placed in a salt solution. This cell will lose water as the water moves by diffusion from higher to lower concentration. The cytoplasm of this cell has shrunk in a process called plasmolysis. (The size of the symbols for water represent the relative concentration: larger symbol = more water.)

In this lab activity you will observe the effects of osmosis on plant cells. In the first part, you will use the weight of pieces of potato to see how much water moves in and out of cells in different salt solutions. In the second part, you will observe plasmolysis in an aquatic plant, *Elodea*.

Materials (for each group)

Part 1

- potato
- cork borer
- knife or razor blade
- beakers, baby food jars, or plastic cups
- salt solutions (1%, 3%, 5%)
- distilled water
- balance
- ruler

Part 2

- *Elodea* leaves
- microscope
- microscope slide and coverslip
- dropper
- salt solution (5%)
- distilled water

Part 1 – Observing Osmosis in Potato Cells

Procedure

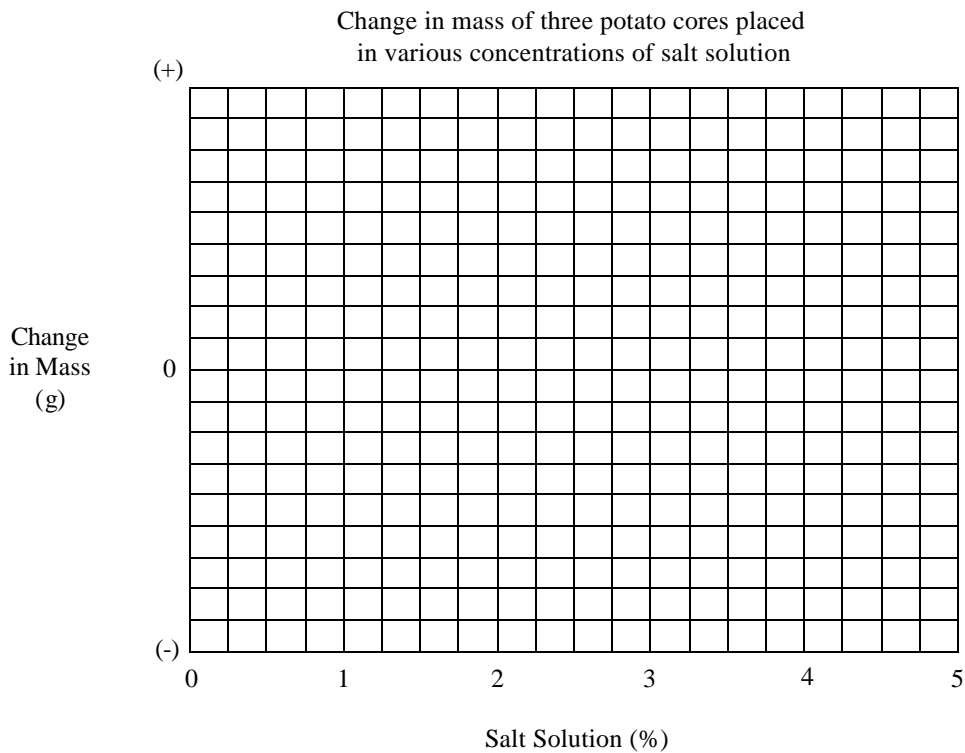
1. Label 4 containers with your name and the following: distilled water, 1% salt, 3% salt, and 5% salt.
2. Using the cork borer, make 12 cylinders from your potato. Trim them with a knife until they are 3 cm long. **Caution: be very careful with the cork borer and knife. Always cut away from yourself.** Make sure there is no peel left on the core. (If a cork borer is not available, you may also cut strips of potato using a knife. Try to make them all the same width.)
3. Place three cores in each of the containers and cover them temporarily. When you are ready, remove the cores and find the mass of each group of three using the balance. Mass all three of them together, not separately. You should mass them to the nearest 0.1 g. Record your data in the data table.
4. Immediately return the cores to the correct container and cover them with the correct solution. Place a lid on each container and set them aside for 24 hours.
5. After 24 hours, remove each set of three cores from their containers. Briefly blot them with a paper towel to remove excess water. Quickly find the mass of each group of 3 and record the mass in the data table.
6. Make observations of the texture, color and flexibility of the cores. Record these observations in the data table.
7. Determine the change in mass by subtracting. If the mass increased over the 24 hours, place a (+) in the data table next to the amount changed. If the mass decreased, place a (-) in the space.

8. Make a line graph of your data. The concentration of the salt solution is on the bottom because that is the variable you changed in the experiment. (Note: distilled water is 0% salt solution).

Data Table

Solution	Beginning Mass (g) (3 cores)	Ending Mass (g) (3 cores)	Change in Mass (g) (give # and + or -)	Observations
Distilled water				
1% salt				
3% salt				
5% salt				

Graph



Questions

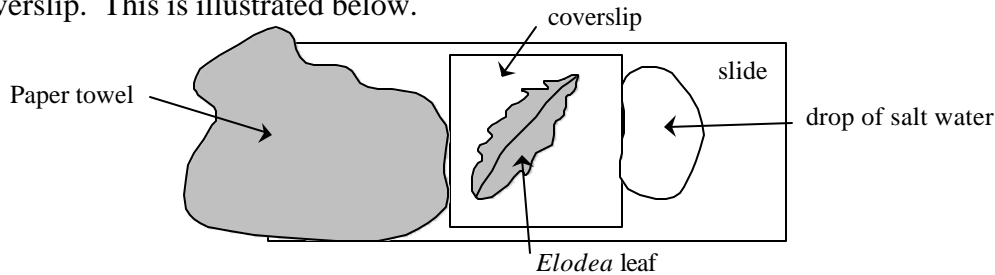
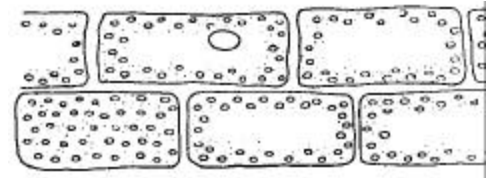
1. Which solution caused the potato cores to gain the most weight?
2. Was water moving into the potato cells or out of the cells in this case? How can you tell?

3. Which solution caused the cores to lose the most weight? Which way was the water moving in these?
4. Look on your line graph. Find the point where your line crosses the 0 line. This is the point where the cores do not lose or gain any mass. Follow down to the bottom axis to see the concentration of salt at this point. What is it?
5. Why do you think the workers at the grocery store spray water on the vegetables? Explain this using the term “osmosis.”

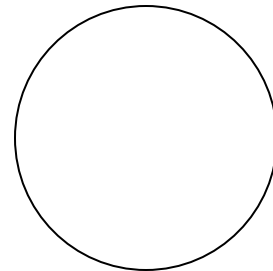
Part 2 – Observing Plasmolysis in *Elodea* Leaves

Procedure

1. Remove a single leaf from an *Elodea* plant and place it on a microscope slide. Use a dropper to place a drop of aquarium water on the leaf. Cover the leaf with a coverslip and place the slide under a microscope.
2. Focus on the leaf under high power. Move the slide around to find an area where you can clearly see single cells. They will appear rectangular and look like green bricks in a wall. The illustration at right shows how they look. The green ovals inside the cells are chloroplasts. After awhile you may see them start to move around the cell.
3. Leave the slide on the microscope. Using the dropper, place a drop of 5% salt solution on the right edge of the coverslip. Place a small piece of paper towel on the left edge of the coverslip. As the fresh water soaks into the paper towel it will draw the salt water under the coverslip. This is illustrated below.



4. Observe the same cells you were looking at before adding the salt solution. You will notice that the cell contents have shrunk down, leaving a space between the cytoplasm and the cell wall. This is called plasmolysis. Make a sketch of the appearance of a few of the cells in the space at right.



5. Repeat Step 3 using distilled water. It may take a number of tries to remove all of the salt water. When successful, the cells will appear as normal.
6. Clean up the slide and coverslip and return the microscope to its proper place.

Questions

1. In which direction was the water moving (into or out of the cell) during plasmolysis?
2. What prevents the *Elodea* cells from completely collapsing?