Class Set Lab Procedures

**Selective Permeability: Osmosis, Diffusion, and Dialysis**

Introduction

Life depends upon the cell(s) of an organism being able to maintain homeostasis. **Homeostasis** means that the conditions (water concentration, concentration of dissolved substances, temperature, acid-base levels, etc.) remain uniform. In addition, cells require a source of energy in the form of nutrients to perform life functions. These nutrients must be able to enter the cell and wastes must be able to leave the cell. The membrane of all cells is a bilayer of phosolipids. The membrane has protein molecules that pass all the way through the **phosolipid bilayer**. These proteins serve as channels (pores) for small molecules and ions to pass in our out of the cell. By controlling which substances can enter or leave the cell, the **cell membrane** is **selectively permeable**. This means only some things can go through the membrane. Therefore, the membrane plays a big part in the homeostasis of the cell.

The cell membrane is freely permeable to water. The membrane cannot prevent water from entering or leaving the cell. Water diffuses through the membrane by a process we call **osmosis**. Osmosis is the movement of water through a membrane from high to low concentration. Whether water goes in or out of a cell depends upon the water concentration inside and outside the cell.

Some dissolved substances can diffuse through a cell membrane too. **Diffusion** of dissolved substances is called **dialysis**. Small molecules and ions can pass through the membrane by dialysis while medium and large molecules (macromolecules) cannot. Dialysis, like osmosis, is a form of passive transport. This means the diffusing particles can only move away from the area of higher concentration. **Passive transport** never requires energy from the cell.

Plant cells have a cellulose cell wall surrounding their membrane. Animal cells have no wall outside their membrane. When the water concentration outside an animal cell is greater than the water concentration inside, too much water can enter by osmosis that the cell can burst. When plant cells are surrounded by water with a higher water concentration, they gain water too. As the plan cell fills with more water, pressure builds up because the cell wall cannot stretch. This pressure prevents more water from moving in and is called **turgor pressure**.

Pre-Lab: Complete before receiving lab supplies

**Read and annotate pre lab**

1. Write a summary of the introduction
2. How do substances diffuse across a cell membrane?
3. Why is a cell membrane considered semi permeable?
4. What is the difference between diffusion and osmosis?

**Dialysis Tubing** is a type of [semi-permeable membrane](http://en.wikipedia.org/wiki/Semipermeable_membrane) [tubing](http://en.wikipedia.org/wiki/Tubing_(material))made from regenerated [cellulose](http://en.wikipedia.org/wiki/Cellulose) or [cellophane](http://en.wikipedia.org/wiki/Cellophane). It can be used for [diffusion](http://en.wikipedia.org/wiki/Diffusion) with solutes or [osmosis](http://en.wikipedia.org/wiki/Osmosis) if used with water only. Dialysis tubing is used in medical settings to ensure a filtered flow of molecules, preventing the flow of larger solute molecules (kidney dialysis).

Procedure Part 1

1. Today a starch/glucose solution will be used to fill the inside of “cells” made using dialysis tubing. Given what you already know about the relative sizes of starch, and glucose, predict their movement into/out of a cell. Record predictions on your lab record sheet.
2. Obtain a pc of dialysis tubing. Tie a knot near one end or use a piece of string to tie off the end of the tubing.
3. Fill a small beaker full of starch/glucose solution.
4. Holding the tubing open over your bin, pour the starch/glucose solution into the tubing until about half full.
5. Tie the upper end of the tubing closed using a knot (or string).
6. Rinse off the outside of the tubing with water. Pat dry carefully with a paper towel.
7. Carefully measure the mass of the “cell” to the nearest .00 g. Record your data.
8. Make a prediction about if the “cell” will increase or decrease in mass over the length of the experiment. Record predictions.
9. Place the tubing in a beaker containing enough water to cover the bag.
10. Place Iodine into the water surrounding the “cell.”
11. WAIT 30 MINUTES.

Procedure Part 2

1. After 30 minutes is up pull the “cell” out of the beaker water and make a visual observation for the positive/negative presence of starch. Iodine turns blue/black in the presence of starch.
2. Record results for presence or absence of starch in the “cell.”
3. Record results for presence or absence of starch in the beaker water.
4. Next use Diastix to test for glucose. If there is a color change (yellow/orange/brown) glucose is present. No color change indicates the absence of glucose in the beaker water. Record the results.
5. Gently pat off the “cell” to dry it. Carefully measure the mass of the “cell” to the nearest .00 g. Record the data.
6. CLEAN UP. Rinse out and dry everything you used and throw away your “cell.”
7. Double check that all data has been recorded then complete “Analysis & Conclusion” questions.

Procedure Part 3

1. Pour the hypertonic, isotonic, and hypotonic stock solutions into a small beaker for your group.
2. Create a wet mount slide of a leaf for each three solution.
   1. Place a leaf into the hypertonic solution
   2. Let it sit for 5 minutes
   3. Observe under the microscope
   4. Repeat for the other two solutions. Use a new leaf for each solution.

Procedure Part 4

1. Carrots have been placed in a hypertonic, isotonic, and hypotonic solution.
2. Predict what will happen to each carrot in the solution.
3. Observe the characteristics of each one.