Name:_____

Diffusion and Osmosis

Pre-Lab

OBJECTIVES

1. To explore how different molecules move by diffusion and osmosis through semi-permeable membranes.
2. To understand how concentration affects the movement of substances through semi-permeable membranes.
3. To understand how albumin works as an osmotic regulator.

BACKGROUND MATERIAL

All cells are separated from their external environment by a lipid membrane. Cell membranes regulate the molecular traffic in and out of the cell. As a result of their supra-molecular structure (many molecules ordered into a higher level or organization), these membranes exhibit the property of *selective permeability*. Selective permeability refers to the ability of certain molecules to pass through the membrane while other molecules are blocked by the membrane, or must use special protein pores to pass through the membrane. In this lab, we will examine the property of selective permeability, utilizing dialysis tubing and a set of solutions designed to model the osmotic situations cells handle. NOTE: Since these processes only operate efficiently over short distances, the basic living thing – a cell, is limited in the size it can attain. This is a basic consideration in the evolution of life.

[Additional Background Materials include handouts and notes from class. Links on shsanatomy.weebly.com website and textbook]

TERMS

Albumin: An insoluble protein that can be found in the cell and/or in the blood stream that affects the rate of osmosis.

Dehydration: The process of a cell losing water by a hypertonic solution (blood/interstitial fluid) the result is a concentration of electrolytes in the cell initially as urine output increases, followed by concentration of electrolytes in the urine as urine output slows overtime. Thirst would increase as urine would become increasingly yellow to brown.

Diffusion: The random movement of molecules or particles, resulting in the net movement of a substance from a region of high concentration to a region of low concentration.

Edema: The process of a cell gaining water by a hypotonic solution (blood/interstitial fluid) the result is a displacement of electrolytes in the cell initially as water rushes into the cell. This would decrease urine output and thirst; however the electrolyte imbalance would trigger craving that would introduce more electrolytes in the blood, causing electrolytes to go into the cell again and water to move back into the blood.

Osmosis: The diffusion of water across a semi-permeable membrane.

Solute: A substance that is dissolved in a solution.

Solution: A homogeneous, liquid mixture of two or more substances.

Semi-permeable Membrane: A membrane that allows some molecules, but not others, to pass through it.

Homeostasis: The inherent tendency in an organism to maintain physiological balance**.**

FORMING HYPOTHESES

Hypothesis questions—Experiment #1

How does an increase in simple carbohydrate concentration affect the rate of osmosis?
Can the a simple carbohydrate move through the semi-permeable membrane?

Experimental Design—Experiment #1

Dialysis tubing filled with 0%, 25% and 50% simple sugar solution is placed in a cup of pure water.
[You will need to determine how much of each solution will be used in your dialysis tubing]
[You will need to determine how long your dialysis tubing should sit in the solution before final measurement]

Hypothesis Statement—Experiment #1

Make a hypothesis about what you expect your results should look like in Experiment #1 below:

Teacher Stamp: _____

Hypothesis questions—Experiment #2

How does an albumin affect the rate of osmosis?
Does albumin work as an osmotic regulator from in or outside the cell?

Experimental Design—Experiment #2

Dialysis tubing filled with 25% and 50% Albumin placed in 100% water.
Dialysis tubing filled with 100% water placed in cups with 25% and 50% Albumin.
[You will need to determine how much of each solution will be used in your dialysis tubing]
[You will need to determine if experiment #2 should have the same amount of time or a different amount of time as experiment #1]

Hypothesis Statement—Experiment #2

Make a hypothesis about what you expect your results should look like in Experiment #2 below:

Teacher Stamp: _____

METHODS

Procedure and Materials

[You will need to create a procedure for experiment 1 and experiment 2]
[You will need to identify your control group, experimental group, independent and dependent variables]
[Write a step by step instruction for how to conduct your lab]
[You will be provided 7 dialysis tubes (15 cm long) and 14 pieces of string (25 cm long), clear cups, deionized water, all simple carbohydrate solutions, all albumin solutions, a hot plate, pipettes, graduated cylinders, test tubes, Benedicts solution—if you identify any additional materials needed, list in your materials section]
[You do not need to explain how to prepare the dialysis tubing or solutions in your procedure]
[Due to slight variations in dialysis tubing and string—you will need to calculate and compare percent mass changes in each of your 7 treatments]

You will not be allowed to start the lab until your procedure and materials have been approved.

Teacher Stamp: _____

DATA

Data Table

[You will need to create a table for experiment 1 and experiment 2]
[Your table will need a clear title and have columns that clearly show what you are measuring and a place to put your results]

You will not be allowed to start the lab until your data tables have been approved.

Teacher Stamp: _____

We will have 1 hour in class on Tuesday November 1st, dedicated to pre-lab work. If you do not have all 4 stamps necessary to start the lab on Wednesday November 2nd, you should work at home to bring your completed pre-lab to school so you can use the entire hour to conduct your experiment.

*If you do not complete your lab in class, you may work on the lab **after school** Wednesday or Thursday in Mr. Pinkstaff's room. No exceptions!*

You will be turning in this pre-lab when you start your experiment, so please make sure you transfer your hypothesis for your own paperwork! A copy of this pre-lab is available online @ shsanatomy.weebly.com.