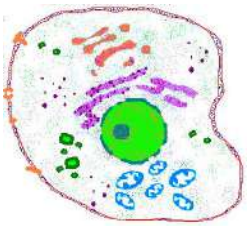

NAME _____

Surface Area to Volume Ratio of Cells Lab

"Bigger isn't always better"

INTRODUCTION

Cell size and shape are important factors in determining the rate of diffusion (movement of certain molecules across a membrane from a high concentration to a low concentration). Cells must move molecule to gain the necessary molecules they need to function. If transport of molecules, both in and out of cells, does not happen at a sufficient rate, cell death will result.

Think about cells with specialized functions, such as epithelial cells that line the small intestine or plant root hairs.

- What is the shape of these cells?
- What size are the cells?
- How do small intestinal epithelial and root hair cells function in obtaining nutrients?

As you proceed through this activity, think about these questions:

- Why are cells so small?
- Why are we not made up of larger cells?

Think of this... if you are in a rush to get your meal prepared fast, would you dice potatoes in large pieces or small ones? Let's investigate!

Gelatin containing red cabbage juice will be cut into appropriate sizes. Red cabbage contains a colored pigment that is sensitive to changes in pH. You will place your gelatin cubes in a cup containing vinegar (a weak acid). Time for 20 minutes then remove cubes from vinegar. Slice open down the middle of the cube and measure how far the vinegar moved into cube (Look for pink!)

TEST THE INDICATOR

Place a small piece (1 X 1 cm^2) of Jello into 2 cups. Add a few drops of 0.1 M KOH to one cup swirl to mix and observe the color. Using the same procedure, add a few drops of vinegar to the other cup. Record your observations.

- Which solution is an acid?
- Which solution is a base?
- What color is the cabbage juice indicator when placed in a base?
- What color is the cabbage juice indicator when placed in an acid?

PROCEDURE

1. Using a knife cut three blocks of Jello of different sizes. These three blocks will be your models for cells. Look on your AP Biology Formula sheet.

What is the equation for surface area of a cube?

What is the equation for volume of a cube?

- Calculate the surface area and volume for cells shown in the table below.

CALCULATE: Surface Area, Volume, and SA/VOL Ratio of Various Sized Cells

Cell Dimensions	Surface Area	Volume	Surface Area to Volume Ratio (SA/VOL)
1x1x1			
2x2x2			
3x3x3			

MAKE A PREDICTION :

If each of the blocks were placed into a solution for the same amount of time, which block would show the greatest amount of diffusion.? EXPLAIN your prediction.

PROCEDURE:

1. Using a knife cut three blocks of Jello of different sizes (shown in the table above). These three blocks will be your models for cells.
2. Place cubes into plastic container filled with enough vinegar to cover the cubes.
3. After 20 minutes. Remove blocks from vinegar and slice in half.
4. Measure the width of the pink stripe surrounding the cube.

POST-LAB CALCULATIONS:

After the experiment has been completed to step 4, calculate the % diffusion in each of the three cubes by following the steps given :

i) volume not penetrated (L X W X H of PURPLE area inside)
ii) volume penetrated = initial volume - volume not penetrated
iii) % Volume with diffusion = $\frac{\text{volume penetrated}}{\text{initial volume}}$ X 100

Comparison of Different Cell Sizes and the % of Volume that Experienced Diffusion

Cell	Measure Volume NOT Penetrated	Calculate Volume Penetrated	% of Volume with Diffusion
1x1x1			
2x2x2			
3x3x3			

ANALYSIS and CONCLUSION:

1. What does the surface area represent in a cell?

2. What does the volume represent in a cell?

3. As a cell grows larger, what happens to its surface area and its volume?

4. As a cell grows larger, what happens to its surface area to volume ratio?

5. Which size cube (cell) showed the highest % diffusion? Why?

6. Compare the surface area and volume of a Jello Cube that is 2 X 2 X 2 cm^3 with one that is 1 X 1 X 8 cm^3. Which do you think would have the greatest diffusion % if tested? WHY?

7. What conclusion can you draw between the cell size (volume), SA/volume ratio, and the % of volume experiencing diffusion? Use data from your experiment to support your conclusion.

8. Explain the connection between a cell's SA/volume ratio and MITOSIS. ☺