**Cell Size Lab**

**Background:**   
When cells reach a certain size, their rate of growth slows down. They will eventually stop growing. Each of these cells divides into two smaller cells, which begin to grow. What causes this? An easy way to investigate such questions is to build models. A model is often thought of as a small copy of something larger. Here we will be making a larger model of something small.

When a cell becomes too large, it is no longer as efficient as it used to be. It now has a greater volume and it takes much longer for materials that enter the cell to reach the center of the cell. This concept will be demonstrated in the lab.

**Purpose:**   
To build a model of a cell to understand why when cells reach a certain size they stop growing.

**Materials:**

* Piece of potato
* razor blade or knife
* 250 mL 3% potassium permanganate solution (KMnO4)
* plastic spoon
* 250mL beaker
* millimeter ruler
* paper towel

**Procedure:**

1. With the razor blade, cut the block of potato into cubes. The first cube should be 3 cm on each side; the second, 2 cm on each side; and the third, 1 cm on each side. Measure carefully and trim away the waste. Examine the cubes. Think of them as giant models of tiny cells.

*Which of your three different-sized cells do you think would be most likely to survive?*

*Why do you think so?*

*Materials used during cell activity and growth enter the cell from the outside and must travel through the cell to their destination. Waste products go through the cell surface to the outside. Do you think the cell with the greatest total surface area will do the best job of moving materials in and out of the cell? Why or why not?*

1. Calculate the total surface area of each of your three models using the following formula: Surface area = 6 x (length x width), that is, the total surface area is 6 times the surface area of one side. Record the total surface area for each cube in Table 1.

*Which cell has the greatest surface area?*

1. The cells have different surface areas and they have different volumes (amounts of materials inside). Calculate the volume of each cube. Volume = length x width x height. Record the volume of each cube in data Table 1.

*Look back at the prediction you make in #1. Do these new calculations change any of your earlier ideas? Why or why not?*

1. Place the cubes in the beaker. Pour enough potassium permanganate solution to cover them. Record your starting time. Use the plastic spoon to turn the cubes often for the next 4 minutes. Be careful not to cut or scratch the surface of the cubes. Blot them dry.
2. Slice each cube in half with the knife.

*What differences do you see? Draw a 3cm, 2cm and 1cm square below and draw what you see. Measure the distance from the edge that the sodium hydroxide traveled and color code that on your drawings.*

**Potato Cube Drawings**

|  |  |  |
| --- | --- | --- |
|  |  |  |
| *3 cm cube* | 1. *cm cube* | *1 cm cube* |

1. Calculate the ratio of surface area to volume for each cube. To do this, for each cube size, divide its surface area by its volume. The number obtained can be expressed as a ratio. For example, a surface area of 24cm2 divided by a volume of 3 cm3 = 24/3 = 8/1 = 8:1. Record this ratio on data Table 1.

*Which cell model is the most efficient? Why?*

*How does this demonstrate why larger cells would want to divide?*

**Results:**

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Potato Cubes** | | | |
| **Side of cube (cm)** |  |  |  |
| **Total Surface Area (cm2)** |  |  |  |
| **Volume (cm3)** |  |  |  |
| **Surface area to Volume Ratio** |  |  |  |

**Questions:**

1. What surrounds a cell and controls what enters or leaves?
2. Materials move into and out of a cell by what process?
3. Is diffusion more efficient over short or long distances?
4. The size of a cell is limited by the ratio of what TWO characteristics of the cell?
5. Which increases faster --- surface area or volume of a cell?
6. Why is the surface area of a cell so important to life of a cell?
7. Did the potassium permanganate diffuse into each cube in the same amount? Why or why not?
8. When a cell’s volume becomes too large for its surface area, what do the cells do?