

WHY ARE CELLS SO TINY?



Introduction: Cells are often quite small, much smaller than one millimeter. Here's one explanation for why cells are so small and why the body of a plant or an animal is multi-cellular: nutrients enter a cell and wastes exit a cell at its surface! This surface area must be adequate for a cell to exchange materials with its environment. Yet, as cells get larger in volume, the proportionate amount of surface area actually decreases. This lab will show that there is a limit to how large a cell can become based upon diffusion at its surface.

Objective: You should be able to:

- Relate the concept of surface area - to - volume ratio to the cell
- Show how that ratio limits cell size and function

Materials:

3 of 3% phenolphthalein-agar cubes (sizes = 1cm, 2cm, and 3 cm on a side)	Razor Blade
100 ml of 4% NaOH	Ruler
Paper Towel	Plastic spoon
	Beaker

Safety:

- NaOH is corrosive.
- Goggles must be worn
- Wash hands immediately following lab.

Procedure:

1. Create a data table for all measurements, calculations, sketches, and observations for each of the three cubes.
2. Find the surface area/volume ratio of the 3 cubes. PLEASE show all your work below your data table (even if you can do it in your smart, little head ☺) This is how you do it:
 - a. find the surface area (S.A.) of each of the 3 cubes
 - b. find the volume of each of the three cubes
 - c. divide the surface area by the volume for each cube
3. Put the 3 agar cubes into a beaker. Cover them with NaOH until submerged. Record the time and occasionally turn them with a plastic spoon for the next 5 minutes. DON'T puncture the cubes!
4. After 5 minutes, remove the cubes and blot dry. Slice each block in thirds. Observe the "middle" section.
5. Record your observations: how far in does the dark stain go? Measure the diameter of the uncolored areas to 0.1 cm. Sketch a picture. How do the three cubes compare?

Questions: (to be answered on the back of the page with your data and calculations)

1. What is the relationship between size and surface area ?
2. What is the surface area of the 1cm cube?
3. What happens to S.A./volume ratio as a cell grows in size?
4. When a cube-shaped cell divides into 2 equal parts, how does the volume of each cell compare to one large cell? Does the S.A. change in the same proportion? Explain.
5. Why does the growth rate of a cell slow down as it becomes larger?
6. How does division affect a cell's ability to absorb material for growth?

LAB REPORT MUST INCLUDE:

1. DATA TABLE (SA, V, SA:V Ratio, diagrams (sketches) of Cube cross sections (Calculations shown below)
2. GRAPH OF DATA (Independent variable – Relative size of Cube, Dependent variable – SA:VOL Ratio)
3. ALL QUESTIONS answered Thoroughly and Scientifically.

FOR A Mastery Rating in 1B