

Why are cells small? (activity)

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Why are cells so small?

1. Take 3 blocks of agar of different size (1cm, 2cm, 3cm) ? these are our cell models
2. Measure the length, width and height of each cube using a ruler
3. Calculate the area of each face of the cubes and add all the areas together for a single cube
 - a cube has 6 faces ? the total surface area is the same as the area of one side multiplied by 6
4. Calculate the volume of each cube
5. Report the surface area-to-volume in the table below

Data Table: Calculating Surface Area-to-Volume Ratio

Cell Model (cube)	Length	Width	Height	Total Surface Area	Volume of cell	Surface Area: Volume
1						
2						
3						

Stop and think:

- Which cube has the greatest surface area:volume ratio?
- Which cube has the smallest surface area:volume ratio?
- **Hypothesize:** In an osmosis or diffusion experiment, which cube size would have the

greatest diffusion rate?

Procedures:

1. Each group will cut three agar cubes: A 3cm cube, a 2cm cube, and a 1cm cube. **CUT AS ACCURATELY AS POSSIBLE.** (This may be already completed for you.)
2. Pour 200mL of 0.1M NaOH into your plastic cup.
3. Immerse your 3 cubes in the NaOH, noting the time.
4. Let the cubes soak for approximately 10 minutes.
5. Periodically, gently stir the solution, or turn the cubes over.
6. After 10 minutes, remove the diffusion solution
7. Blot the cubes with a paper towel.
8. Promptly cut each cube in half and measure the depth to which the pink color has penetrated. Sketch each block's cross-section.
9. Record the volume that has remained white in color.
10. Do the following calculations for each cube and complete the following data table:

Data Table: Calculation of Diffusion Area-to-Volume

Cube Size	Cube volume (cm ³) V_{total}	Volume white (cm ³) V_{white}	Sketch of each Cube	Volume of the diffused cube ($V_{total} - V_{white}$) $V_{diffused}$	Percent Diffusion ($\frac{V_{diffused}}{V_{total}} \times 100$)	Surface Area: Volume (from previous table)
1cm						
2cm						
3cm						

Conclude:

- Which cube had the greatest percentage of diffusion?

- Did this meet your expectations with your hypothesis?
- If you designed a large cell, would it be a large sphere or something long and flat?

Tags: [quantitative reasoning](#), [analysis](#), [inquiry](#), [visual communication](#)