

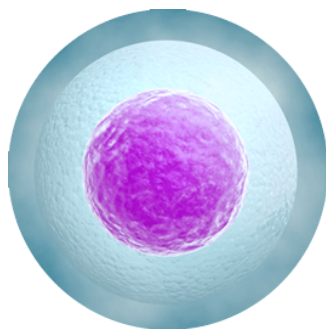
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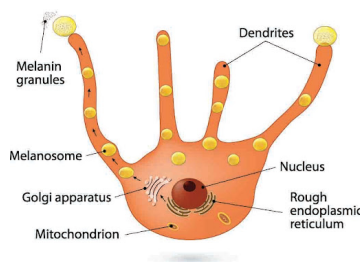
Cell Size and Shape Laboratory Exercises

Questions to Investigate: How do the sizes and shapes of cells impact their functions?
Specifically, diffusion.

Below are different types of cells that are found in the body. How might their size and shape influence their ability to diffuse substances?



Human Egg Cell
115 μm (micrometers) width



Melanocyte (Pigment Producing Cell)
7 μm (micrometers) width



Enterocyte (Intestinal Cell)
1 μm (micrometers) width

Your task in this laboratory exercise is to investigate the impact of cell size and shape on a cell's ability to diffuse substances into and out of itself.

In your mini report (write up is detailed later in this document), you will need to make claims regarding the impact of cell size and shape on diffusion rates. Then provide evidence from an experiment designed and conducted by your group. Evidence should include quantitative data communicated with some sort of visual display (chart, graph, etc...) Along with the evidence, give the rationale for how the evidence supports your claim.

Task #1. Design and conduct your own experiment on “cell” **size** and diffusion using the bromothymol blue agar cubes and .5 M HCl solution. Use at least three different sizes in your experimentation. What will you control?

Task #2. Design and conduct your own experiment on “cell” shape and diffusion using the BTB agar and .5 M HCl solution to investigate the effect of agar **shape** on rate of diffusion. Use at least three different shapes in your experiment. What will you control?

Task #3. Using the **surface area and volume mathematical formulas** (copied from the AP formulas sheet) on the next page, determine which shape (sphere, rectangular solid, cylinder, or cube) is most effective at supporting diffusion if the volume is $2\mu\text{m}^3$. Which is second most effective? Third? Least effective?

Show your work on separate paper and staple it to this assignment. If you are unsure how to do the calculations, here is a [key to get you started](#). Note, for the rectangular solid and cylinder the sides may vary depending on the dimensions you choose.

Surface Area and Volume

Surface Area of a Sphere

$$SA = 4\pi r^2$$

Surface Area of a Rectangular Solid

$$SA = 2lh + 2lw + 2wh$$

Surface Area of a Cylinder

$$SA = 2\pi rh + 2\pi r^2$$

Surface Area of a Cube

$$SA = 6s^2$$

Volume of a Sphere

$$V = \frac{4}{3}\pi r^3$$

Volume of a Rectangular Solid

$$V = lwh$$

Volume of a Cylinder

$$V = \pi r^2 h$$

Volume of a Cube

$$V = s^3$$

r = radius

l = length

h = height

w = width

s = length of one
side of a cube

SA = surface area

V = volume

Mini Report (to be typed and submitted in Canvas). Include the following:

-Your predictions (alternative hypothesis and null hypothesis) regarding size and shape impact on diffusion rates..

-Brief outline of your methods.

-Visual representation of your data (results). Use appropriately labeled charts, graphs, etc... Include titles, label axis, and give units. Briefly describe your results in words.

-Analyze your results using a claim, evidence, and reasoning format. Make claims regarding the impact of cell size and shape on ability to diffuse substances in and out. Give evidence from your experiments. Give rationale (reasoning) regarding how the experimental evidence supports your claims.

Scoring Guide:

- All aspects of the laboratory report are present and complete. 3 pts
- Your experimental design is deliberate and consistent. 4 pts
- Your data is communicated in a clear manner that uses appropriate graphics. 4pts
- Analysis is logical and shows connections between evidence and claims. 4pts

Total = 15 pts