SI A&P - Full Discipline Demo - Fetal Pig

Cell Structure and Function

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI A&P - Full Discipline Demo - Fetal Pig
Course	SI A&P - Full Discipline Demo - Fetal Pig
Instructor	Sales SI Demo

Test Your Knowledge

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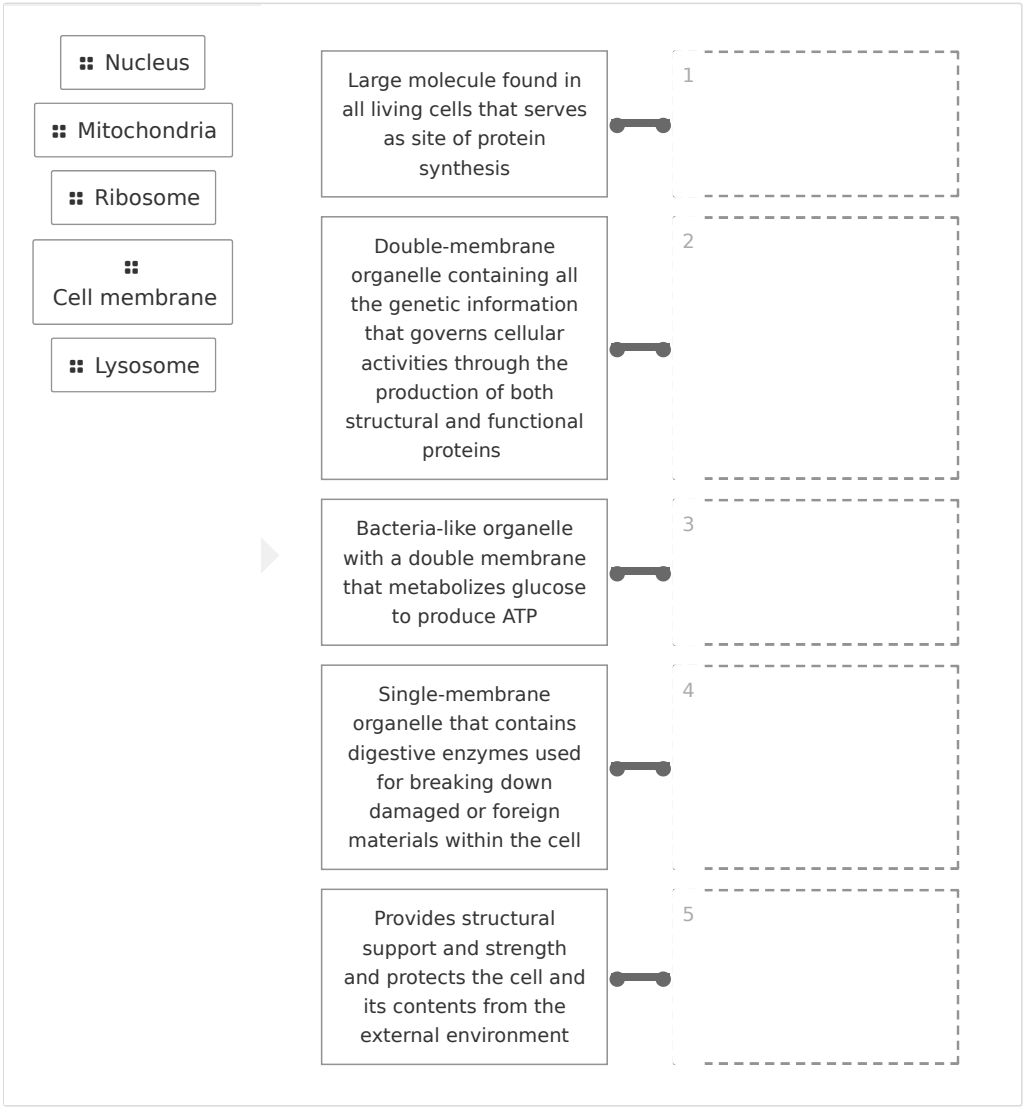
Match each term to the best description.



Correct answers:

1 Ribosome 2 Nucleus 3 Mitochondria 4 Lysosome

5 Cell membrane

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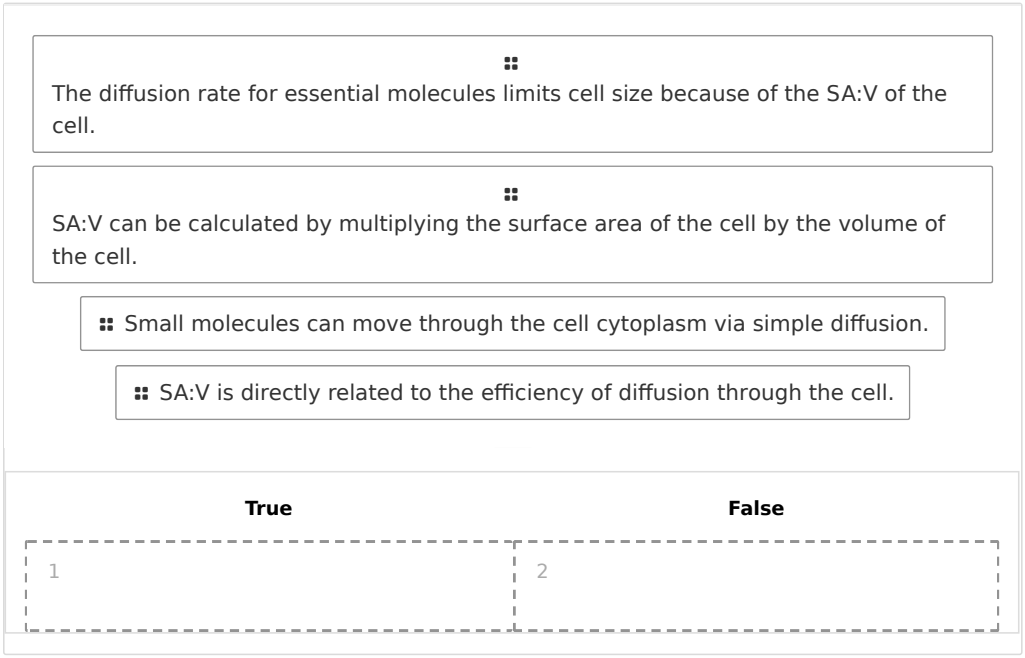
Categorize each statement as true or false.



Correct answers:

1

The diffusion rate for essential molecules limits cell size because of the SA:V of the cell.

Small molecules can move through the cell cytoplasm via simple diffusion.

2

SA:V can be calculated by multiplying the surface area of the cell by the volume of the cell.

SA:V is directly related to the efficiency of diffusion through the cell.

Exploration

Eukaryotic cells can be differentiated from prokaryotic cells through the presence of membrane bound organelles and a nucleus.

- True ✔
- False

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The ribosome functions for _____.

- digestion
- DNA replication
- mobility
- protein synthesis ✔

The SA:V for a cell can be calculated by dividing the surface area by the volume.

- True ✔
- False

Exercise 1

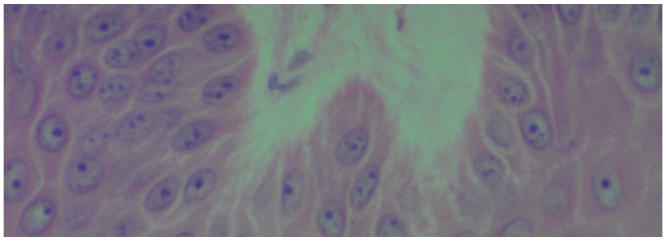
What are the functions of each of the cellular structures labeled in Photo 1?

0 Word(s)

Was the labeled cell in Photo 1 eukaryotic or prokaryotic? Explain your answer by referencing the distinguishing structure(s) labeled in Photo 1.

0 Word(s)

Photo 1: Skin Cell
(SAMPLE ANSWER BELOW)



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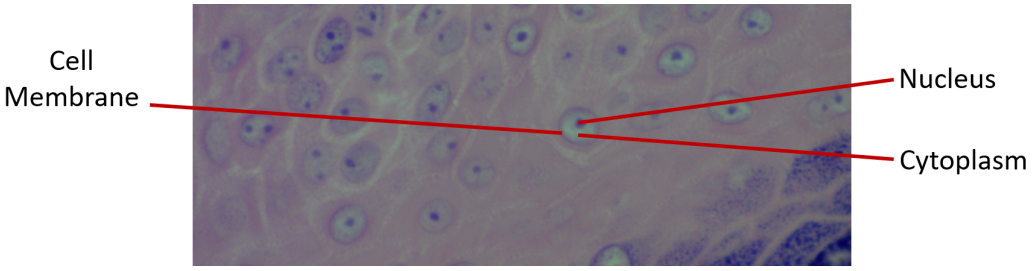

(SAMPLE ANSWER BELOW)

Slide	Total magnification
Human Skin	600

Exercise 2

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How did increasing the cell diameter affect the surface area to volume ratio?

As the diameter increased, the surface area to volume ratio decreased.

What impact did the change in surface area to volume ratio have on diffusion?

0 Word(s)

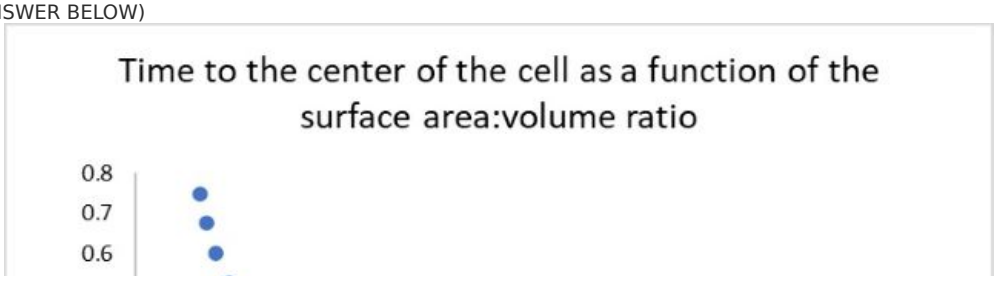
How does this experiment demonstrate the need for cells to maintain a smaller size?

0 Word(s)

Data Table 2: Surface Area and Volume in Relation to Cell Size
(SAMPLE ANSWER BELOW)

Radius (μm)	Surface Area (μm^2)	Volume (μm^3)	SA:V (μm^{-1})	Diffusion Time (s)
15	2827	14137	0.2	0.075
45	25447	382000	0.066	0.225
75	70686	1770000	0.04	0.375
105	139000	4850000	0.029	0.525
135	229000	10300000	0.022	0.675

Graph 1: Time to the Center of the Cell
(SAMPLE ANSWER BELOW)



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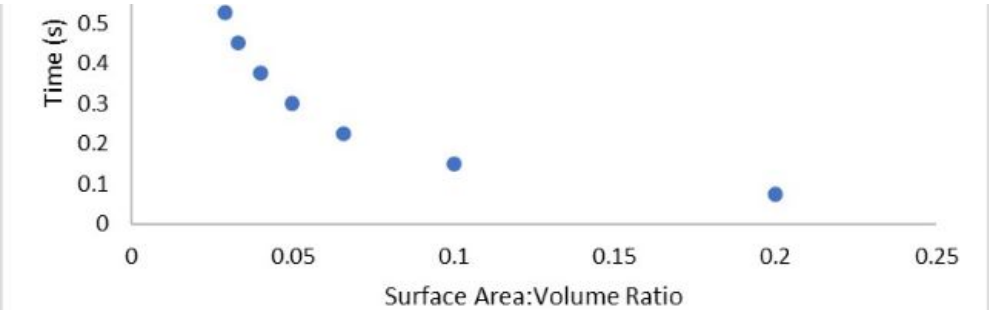

Competency Review

All human cells are eukaryotic.

- True ✔
- False

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The cytoplasm is made up of ____, a water-based solution containing small molecules such as proteins and sugars.

- cytoskeleton
- cytosol ✔
- centrioles
- ribosomes

____ are single-membraned organelles that store water and other small molecules.

- Centrioles
- Ribosomes
- Mitochondria
- Vacuoles ✔

Through simple diffusion, molecules move from areas of high concentration to areas of low concentration.

- True ✔
- False

$4\pi r^2$ is used to calculate cell ____.

- density
- mass
- surface area ✔
- volume

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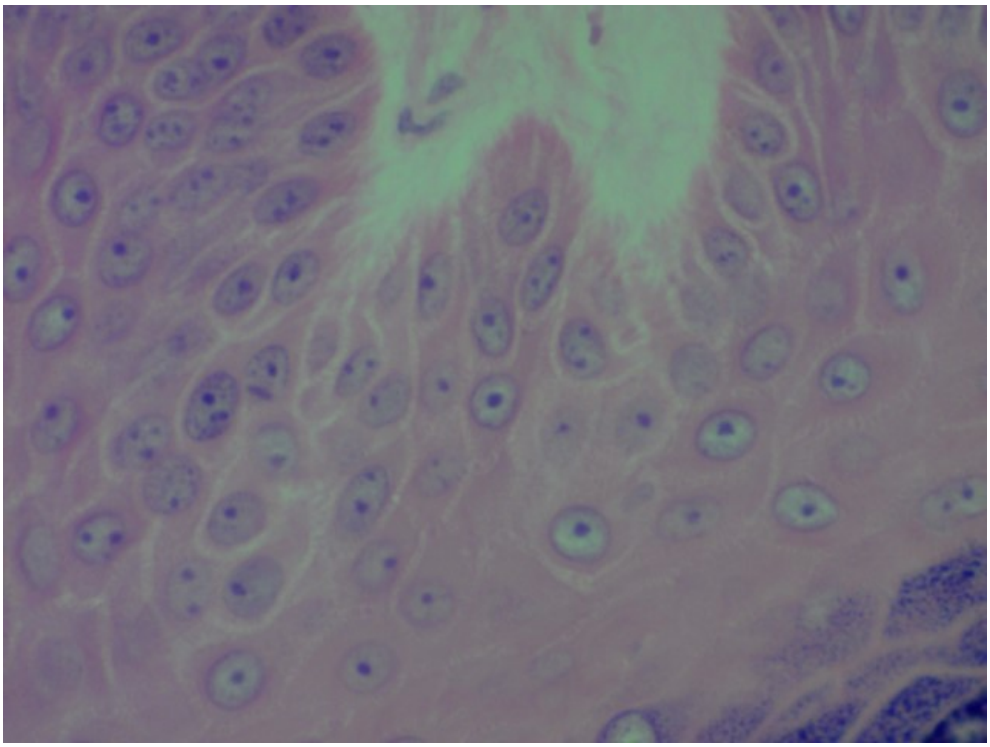
_____ is/are visible in the image of human skin cells below.



- Cell membranes
- Cytoplasm
- Nuclei
- All of the above ✔

A cell has a surface area of 2827 μm^2 and a volume of 14137 μm^3. The SA:V of the cell is _____ μm^{-1}.

- 0.2 ✔
- 5
- 11
- 17

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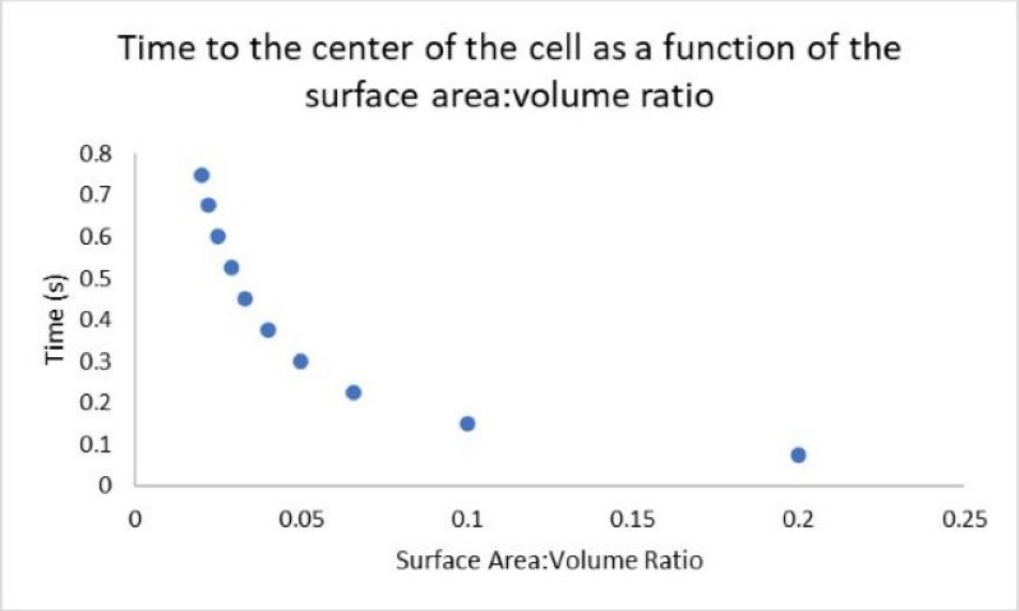
The graph below indicates that diffusion time is inversely related to the surface:volume ratio of the cell.



- True ✔
- False

Extension Questions

Human cells vary in size from 30-4,000,000 μm^3 in volume. Apply your knowledge of cell structure and simple diffusion to predict which cell type in the table below would have the fastest diffusion rate for water molecules to the center of the cell. Explain your prediction by referencing the relationship between cell size and diffusion rate.

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Cell Type	Average Volume (μm^3)
Sperm cell	30
Red blood cell	100
Neutrophil	300
Beta cell	1,000
Fibroblast	2,000
Osteoblast	4,000
Megakaryocyte	30,000
Fat cell	600,000
Oocyte	4,000,000

(SAMPLE ANSWER BELOW)

The sperm cell would have the fastest diffusion rate for water molecules to the center of the cell because the sperm cell has the smallest volume and simple diffusion rates are inversely related to cell size.

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