

BIOLOGY

Surface area to volume ratio

Objective :

Explain that surface area to volume ratio is important in the limitation of cell size .

Resources :

Student book page 8 .

<https://www.youtube.com/watch?v=dn-tFMdsHcE>

https://www.youtube.com/watch?v=qpzFrL_KXYg experiment

Cells are very small, no matter what the size of the organism that they are part of.

Cells do not and cannot grow to be very large and this is important in the way living organisms are built and function.

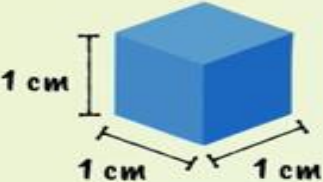
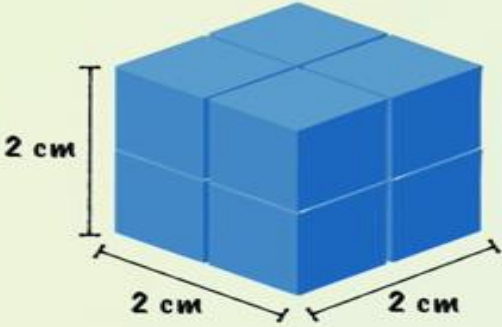
The volume of a cell determines the level of metabolic activity that takes place within it. The surface area of a cell determines the rate of exchange of materials with the outside environment.

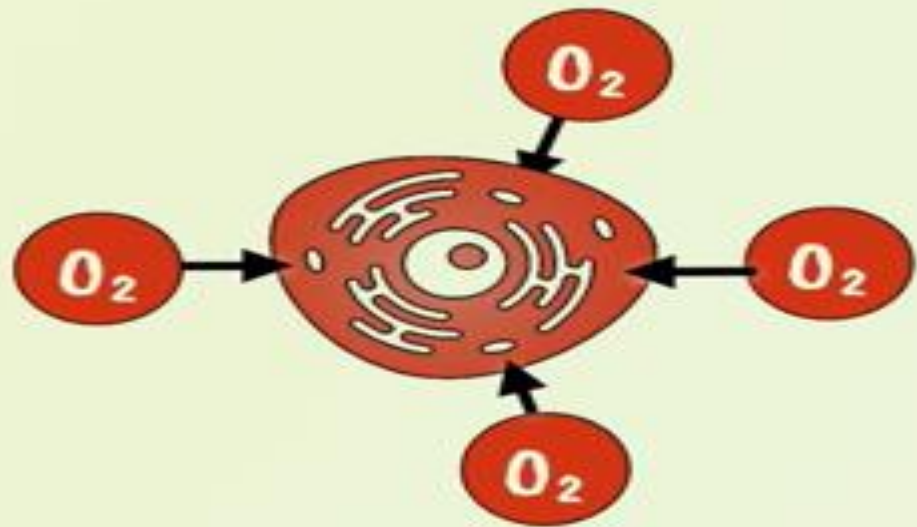
As the volume of a cell increases, so does its surface area, but not in the same proportion, So as a cell grows larger, it has proportionately less surface area to obtain the materials it needs and to dispose of waste.

The rate of exchange of materials across the outer membrane becomes limiting and cannot keep up with the cell's requirements. Some cells have specialized structures, such as folds and **microvilli**, to provide a larger surface area relative to their volume but nevertheless there is a limit to the size of a single cell. Beyond this limit, a cell must divide and an organism must become multicellular.

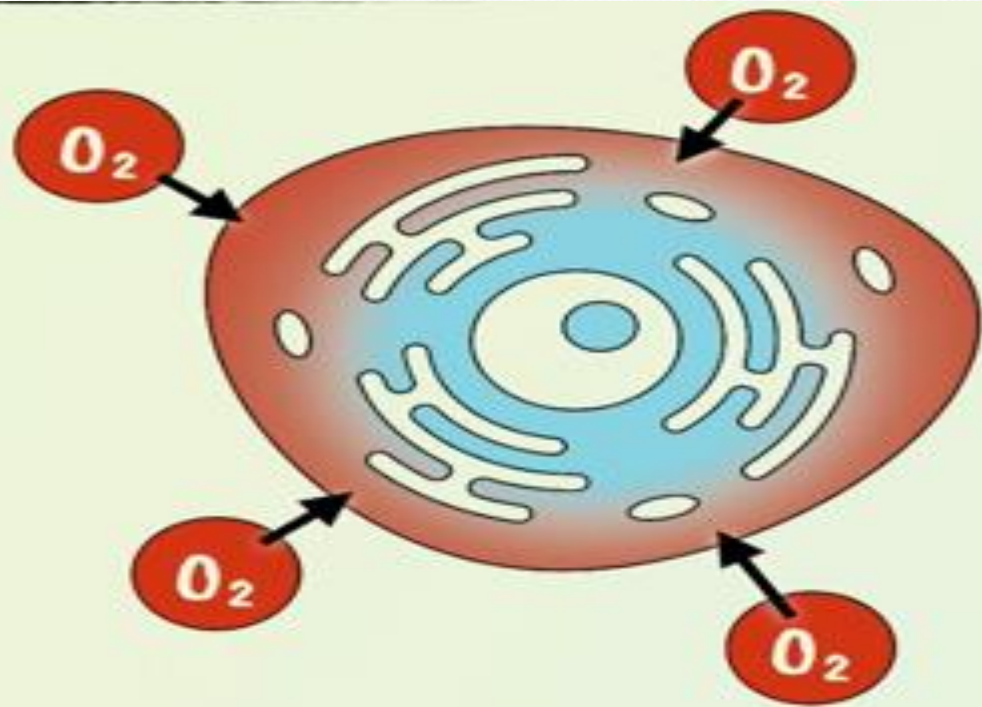
As a cell increases in size, its surface area-to-volume ratio decreases.

When there is insufficient surface area to support a cell's increasing volume, a cell will either divide or die

		
Surface Area (cm ²)	6	24
Volume (cm ³)	1	8
SA:Vol	6 : 1	3 : 1



6 : 1

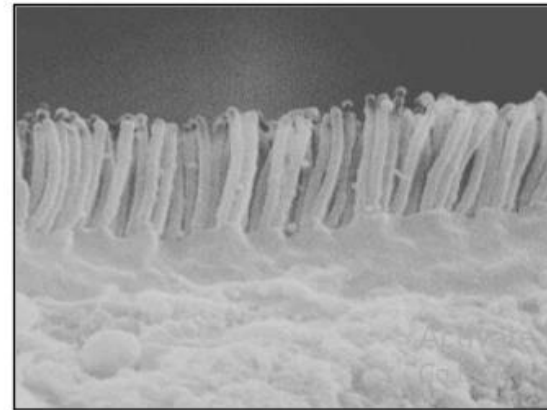


3 : 1

Increasing SA:Vol Ratio

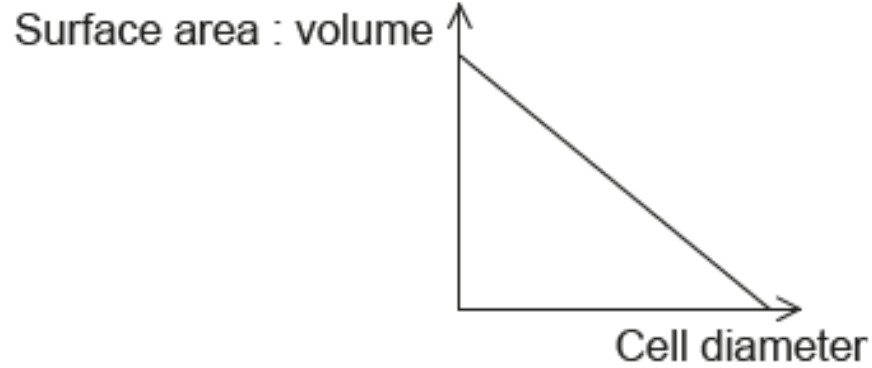
Cells and tissues that are specialized for gas or material exchanges will increase their surface area to optimize material transfer

- ✓ **Intestinal tissue of the digestive tract may form a ruffled structure (villi) to increase the surface area of the inner lining.**
- ✓ **Alveoli within the lungs have membranous extensions called microvilli, which function to increase the total membrane surface.**

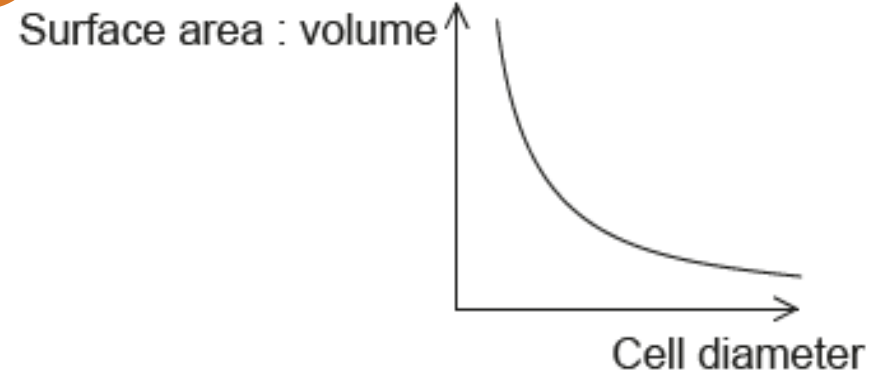


Which graph represents the change in cell surface area to volume ratio with increasing cell diameter?

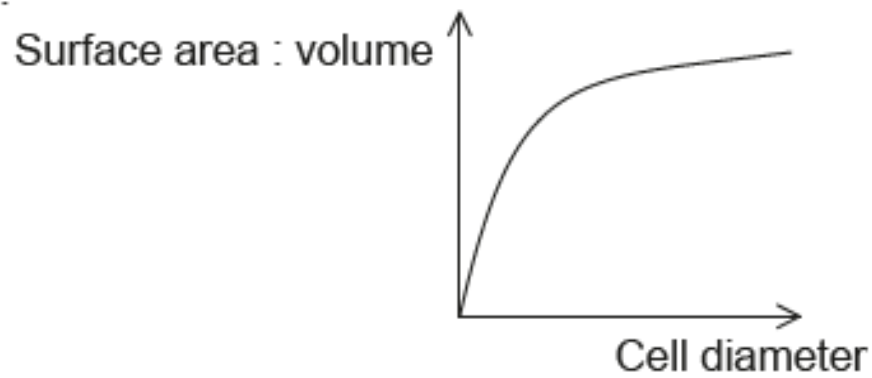
A.



B.



C.



D.

