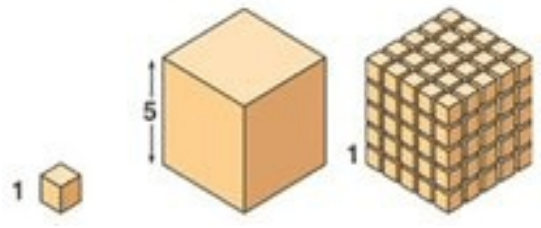
Surface Area to Volume Ratio

Cells need to exchange materials with their environment in order to survive. The volume of a cell is a direct reflection of the amount of exchange that needs to take place, and the surface area available for this exchange is a reflection of how fast it can happen. If the surface area of a cell can't meet the demands of the chemical reactions within the cell, the cell will perish. In this activity, you will acquire and analyze simple quantitative data that supports this principle.

1. Complete the table by calculating the surface area, volume, and surface area to volume ratio for each cube. Be sure that you include the proper units.

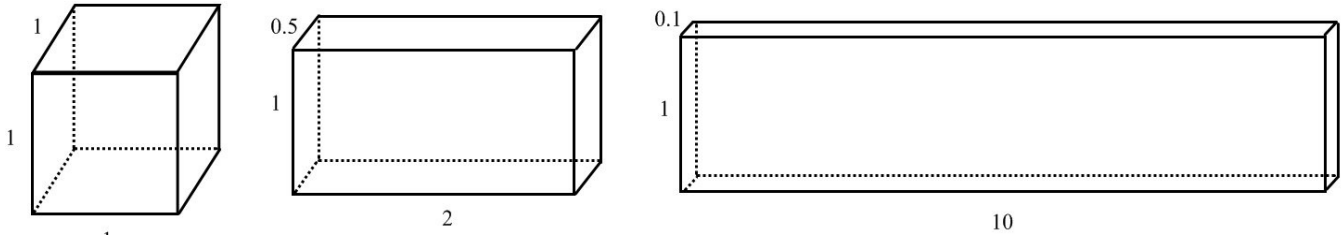
Cube	**Surface area**	**Volume**	**Surface area to volume ratio**
a) micro 1 cm x 1 cm x 1 cm			
b) macro 5 cm x 5 cm x 5 cm			
c) multimicro each side made of 5 micro cubes			



2. When the cube dimensions increase by a factor of 5 (from 1 cm to 5 cm)
a) What is the factor of increase for the surface area?
b) What is the factor of increase for the volume?
3. Cubes (b) and (c) are each 5 cm x 5 cm x 5 cm, and have equal volumes. In other words, they have a 1:1 ratio. Calculate the ratio of surface area for these two cubes.
4. For which two cubes does the ratio between surface area and volume stay the same when the size increases?
5. Why are cells so small? If you're stuck, think about the questions you just answered.

6. Imagine three cells with the dimensions given.

Cell	Length (cm)	Width (cm)	Height (cm)
A	1	1	1
B	2	0.5	1
C	10	0.1	1



a) Using a table like the one in Q.1, calculate the surface area to volume ratio for each.
b) What do you notice happening as the cells elongate?
c) Why do you think we learned about this concept?