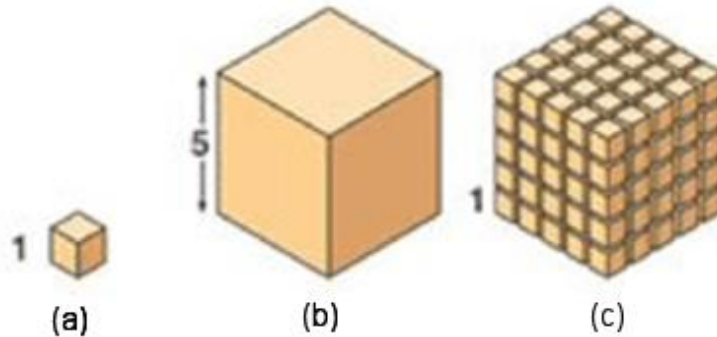## Surface Area to Volume Ratio

Cells need to exchange materials with their environment in order to survive. The size (or volume) of a cell is an important factor in determining the amount of exchange that needs to take place, and the surface area available for this exchange determines how quickly it can happen. If the surface area is too small, the cell will be unable to acquire everything it needs from its environment. In this activity, you will consider the surface area and volume of a variety of cells to learn more about the importance of both of them.

1. Complete the table by calculating the surface area, volume, and surface area to volume ratio for each of the three cubes. Be sure that you include the proper units. Remember that A = L x W and V = L x W x H.

(a)   (b)   (c)

2. When the cube dimensions increase by a factor of 5 (from 1 cm to 5 cm)
a) How many times greater is the surface area?
b) How many times greater is the volume?

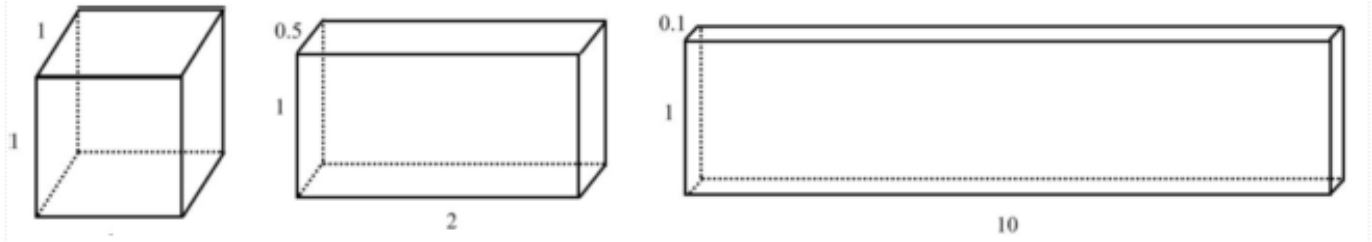| Cube	Surface area	Volume	Surface area to volume ratio
a) micro cube (1 cm x 1 cm x 1 cm)			
b) macro cube (5 cm x 5 cm x 5 cm)			
c) multimicro cube (5 cm x 5 cm x 5 cm) but made of many micro cubes			

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. a) For which two cubes does the ratio between surface area and volume stay the same when the size increases?
b) You would expect large animals to be made of large cells while small animals are made of small cells. What does your answer to (a) teach us about this idea?

5. a) Write an explanation of what happens to the surface area and volume when a cell gets larger.
b) Why is this concept important for cells? 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.

Cube	Surface area	Volume	Surface area to volume ratio
A			
B			
C			

b) What do you notice happening as the cells elongate?