Limits to Cell Size

Almost all cells are so small that they are microscopic and even the largest of cells are difficult to see with the naked eye. An important question is what limits the size of cells to such diminutive dimensions? Why are there almost no cells with a diameter larger than 300 μm? To discover the answer to this question, we will complete the following outline.

A. **Complete the Following Table:** (for this exercise, we will assume that we are measuring cells that are shaped as cubes; this assumption will simplify the calculation while providing a model to understand the pattern.

	Edge Length	Surface Area (SA)	Volume (V)	Ratio: SA ÷ V
	1 μm			
	2 μm			
	3 μm			
	8 μm			

Based on the information from the table above, it is apparent that as cells increase in size, their surface area (SA) increases at a _____rate than their _____.

Therefore, as cells increase in size, their surface area to volume ratio (ie. $\frac{SA}{V}$ ratio) _____.

This means that there is less _____ _____per unit of _____.

It is through the cell's surface (ie. through the cell _____) tht the exchange of _____and _____necessary to keep the cell alive occurs.

Thus, in order to stay alive, a cell must have a fairly latge amount of _____for each unit of _____in order to bring in enough _____and remove enough _____.

Therefore, in order to survive, a cell must have a relatively _____ $\frac{SA}{V}$ ratio.

Since large cells would have a relatively _____ $\frac{SA}{V}$ ratio, they cannot survive. Consequently, cells do not grow very _____; once they reach a certain size they _____which _____the $\frac{SA}{V}$ ratio once again.

B. Questions

1. Complete the following table.

Edge Length	Cell	Surface Area (SA)	Volume (V)	Ratio: SA/V
3 μm	A			
6 μm	B			
9 μm	C			
12 μm	D			

2. As cell increases in size, what increases at a faster rate, the surface area or the volume?

3. What happens to the $\frac{SA}{V}$ ratio as a cell increases in size?

4. Which has more surface area per unit of volume, a large cell or a small cell?

5. Why is the amount of surface area per unit of volume (ie. the $\frac{SA}{V}$ ratio) important to a cell?

6. Explain why large cells cannot exist.

7. a) What do cells usually do before they grow too large?

   b) Name the process by which cells do this.

   c) Briefly describe this process: