**Diffusion and Cell Size and Shape**[[1]](#footnote-1)

Diffusion is very important for moving substances into and out of cells and within cells. Two important limitations of diffusion are:

* Although diffusion is relatively rapid over short distances, diffusion is extremely slow over long distances.
* The rate of diffusion of substances (e.g. O2) across the plasma membrane into a cell is proportional to the surface area of the plasma membrane, but the rate of using substances (e.g. O2) is proportional to the cell volume. Therefore, cells can only survive if the surface-area-to-volume ratio is large enough.

1. To understand how these limitations of diffusion apply to cells of different sizes and shapes, complete the following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hypothetical Cells | Surface area |  Volume  | Surface-area-to-volume ratio | Distance from center of cell to nearest cell surface  |
|  10 µm |  |  |  |  |
|  100 µm |  |  |  |  |
|   10 µm  10,000 µm 10 µm  |  |  |  |  |

2. What are the disadvantages for the larger cube-shaped cell compared to the smaller cell?

3. Some cells have very long, slender extensions. For example, your body has nerve cells that extend from the bottom of your spine all the way down your leg to your foot. Based on your calculations, explain how diffusion can supply enough O2 to this very long slender extension of the nerve cell.

1. This activity, teacher notes, and other activities for teaching biology are available at <http://serendipstudio.org/exchange/bioactivities>. [↑](#footnote-ref-1)