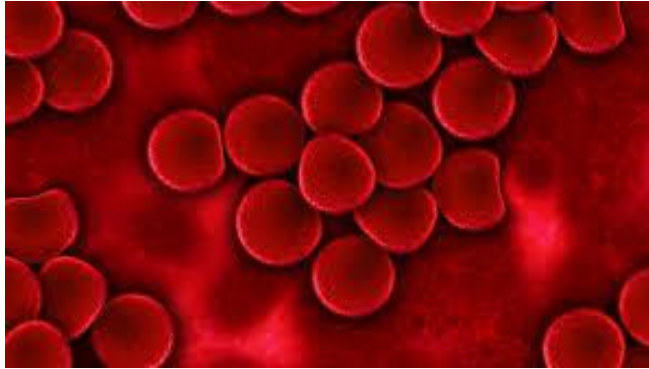


## Why Do Cells Stay Small?

The fact that you have about 100 trillion cells in your body gives us a good indication of the tiny size of most cells. While cells come in a variety of shapes and sizes, they tend to be extremely small. Cells are usually between 2 and 200 millionths of a meter. Red blood cells (pictured below) are only about 8 millionths of a meter in diameter.



**Red blood cells like these are only about 8 millionths of a meter in diameter.**

Substances are moving in and out of the cell continuously. For the cell to thrive, these materials must be able to move back and forth quickly and efficiently. While the cell membrane provides an important barrier that can regulate which materials move in and out, the process of simple diffusion is also super important.

In this case, substances move naturally from where they are more concentrated to where they are less concentrated. Water, carbon dioxide, and oxygen, are three small molecules that move by diffusion into the cell. In a very real sense, cells breathe when oxygen and carbon dioxide move into and out of the cell.

One factor that impacts the speed (rate) of diffusion is the size of the cell. The larger the cell, the lower the rate of diffusion. As a cell grows, it becomes more and more difficult for key substances like oxygen and carbon dioxide to get into and out of cell. The bigger the cell, the more difficult it becomes for it to breathe effectively.

Our research question for this activity is, "Why Do Cells Stay Small?" Since we don't have the equipment needed to work at the nano-level, we are using gelatin models of a cell that is large enough for us to manipulate. The gelatin works well as a model because it allows for materials (in this case vinegar) to diffuse slowly into it. The gelatin also contains some universal indicator solution that gives the cubes a green or blue color. As the vinegar diffuses into the Jello cell, it will turn from green to red. This color change allows us to measure how fast the diffusion occurs. Let's see what the experiment shows about the size limitations of a cell.