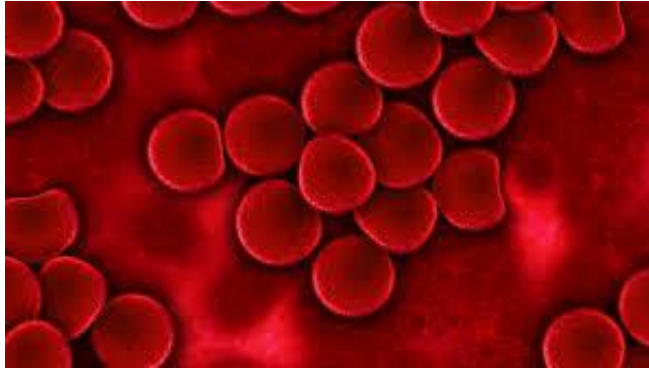


Why Do Cells Stay Small?

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. One process that may serve to limit cell size is the process of diffusion. Diffusion is the movement of materials from an area of greater concentration to an area of lesser concentration. We know that diffusion occurs passively (meaning that it does not require energy) through the cell membrane. Cells obtain needed materials through diffusion into the cell and they remove unneeded materials and waste through diffusion out of the cell.



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

Two important factors that impact the rate of diffusion are the surface area of the cell and the volume of the cell. The surface area of the cell represents the space where diffusion can occur since it serves the boundary between the inside and the outside of the cell. The volume of the cell represents the space that must receive needed materials and nutrients and remove the unneeded materials. If the cell doesn't receive and remove needed and unneeded materials at a fast enough rate, it will quickly die.

The experiment that we have been working on allows us to investigate the changing relationship between the surface area and volume of a growing cell. 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 agar cell, it will turn from green to red. This color change allows us to measure how fast the diffusion occurs.

While the gelatin cells serve as a useful model for studying diffusion and limitations in cell size, we should realize that these are, in fact, just models and that real living cells are much more complex and intricate. We should always consider how the models that we are studying are limited in how they represent real things and actual systems. But limited or not, it is cool to see how diffusion happens.