1.0: Introduction to Cells and Osmosis

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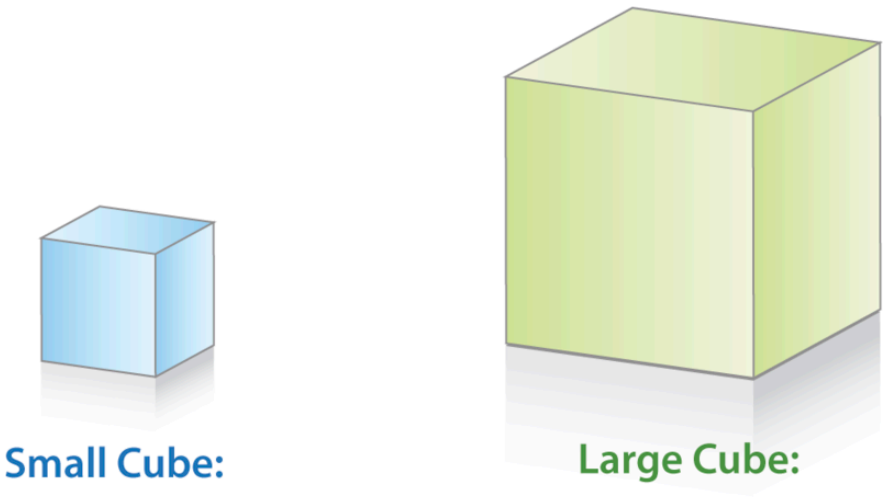
Diversity of Cells

Today, we know that all living cells have certain things in common. For example, all cells share functions such as obtaining and using energy, responding to the environment, and reproducing. We also know that different types of cells—even within the same organism—may have their own unique functions as well. Cells with different functions generally have different shapes that suit them for their particular job. Cells vary in size as well as shape, but all cells are very small. In fact, most cells are much smaller than the period at the end of this sentence. If cells have such an important role in living organisms, why are they so small? Even the largest organisms have microscopic cells. What limits cell size? (THIS IS THE BIGGEST QUESTION OF THIS UNIT)

CELL SIZE

The answer to these questions is clear once you know how a cell functions. To carry out life processes, a cell must be able to quickly pass substances into and out of the cell. For example, it must be able to pass nutrients and oxygen into the cell and waste products out of the cell. Anything that enters or leaves a cell must cross its outer surface. It is this need to pass substances across the surface that limits how large a cell can be. Look at the two cubes in **Figure** below. As this figure shows, a larger cube has less surface area relative to its volume than a smaller cube. This relationship also applies to cells; a larger cell has less surface area relative to its volume than a smaller cell. A cell with a larger volume also needs more nutrients and oxygen and produces more wastes. Because all of these substances must pass through the surface of the cell, a cell with a large volume will not have enough surface area to allow it to meet its needs. The larger the cell is, the smaller its ratio of surface area to volume, and the harder it will be for the cell to get rid of its wastes and take in necessary substances. **This is what limits the size of the cell.**



Surface Area to Volume Comparison. A larger cube has a smaller surface area (SA) to volume (V) ratio than a smaller cube. This also holds true for cells and limits how large they can be.

CELL SHAPE: REMEMBER THE RELATONSHIP BETWEEN FORM AND FUNCTION? (LIKE WE SAW IN THE SHAPE OF THE MITOCHONDRIA'S INNER MEMBRANE, THE WIGGLES THAT INCREASED THE SURFACE AREA TO MAKE MORE ENERGY) HERE IT IS AGAIN!

Cells with different functions often have different shapes. The cells pictured in **Figure** below are just a few examples of the many different shapes that cells may have. Each type of cell in the figure has a shape that helps it do its job. For example, the job of the nerve cell is to carry messages to other cells. The nerve cell has many long extensions that reach out in all directions, allowing it to pass messages to many other cells at once. Do you see the tail-like projections on the algae cells? Algae live in water, and their tails help them swim. Pollen grains have spikes that help them stick to insects such as bees. How do you think the spikes help the pollen grains do their job? (*Hint:* Insects pollinate flowers.)

Although cells are diverse, all cells have certain parts in common. The parts include a plasma membrane, cytoplasm,

ribosomes, and DNA.

a. The **plasma membrane** (also called the cell membrane) is a thin coat of lipids that surrounds a cell. It forms the physical boundary between the cell and its environment, so you can think of it as the “skin” of the cell.
b. **Cytoplasm** refers to all of the cellular material inside the plasma membrane. Cytoplasm is made up of a watery substance called cytosol and contains other cell structures such as ribosomes.
c. **Ribosomes** are structures in the cytoplasm where proteins are made.
d. DNA is a nucleic acid found in cells. It contains the genetic instructions that cells need to make proteins.

These parts are common to all cells, from organisms as different as bacteria and human beings. How did all known organisms come to have such similar cells? The similarities show that all life on Earth has a common evolutionary history.

A nice introduction to the cell is available at http://www.youtube.com/user/khanacademy#p/c/7A9646BC5110CF64/33/Hmwvj9X4GNY (http://www.youtube.com/user/khanacademy#p/c/7A9646BC5110CF64/33/Hmwvj9X4GNY) (21:03).

Lesson Summary

- All cells are very small because they need to pass substances across their surface. Their small size gives them a relatively large ratio of surface area to volume, facilitating the transfer of substances. The shapes of cells may vary, and a cell’s shape generally suits its function.

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