CELLS

Biochemistry is the chemistry of living organisms. Biochemists study the chemical reactions that occur at the molecular level of organisms.

All living organisms contain cells. A cell is a prison of sorts. The working apparatus of the cell is imprisoned within the "bars" — known as the cell membrane. Just as a prison inmate can still communicate with the outside world, so can the cell contents. The prisoner must be fed, so nutrients must be able to enter every living cell. There is a sanitary system for the elimination of waste. And, just as inmates may work to provide materials for society outside the prison, a cell may produce materials for life outside the cell.

There are two types of cells: **prokaryotes and eukaryotes**. (Viruses also bear some similarities to cells, but these are limited.) Prokaryotic cells are the simplest type of cells. Many **one-celled** organisms are prokaryotes.

The simplest way to distinguish these two types is that a prokaryotic cell contains **no well-defined nucleus**, whereas the opposite is true for a eukaryotic cell.

Prokaryotes are mostly bacteria. Besides the lack of a nucleus, there are few well-defined structures inside a prokaryotic cell. The prison wall has three components: a cell wall, an outer membrane, and a plasma membrane. This wall allows a controlled passage of material into or out of the cell. The materials necessary for proper functioning of the cell float about inside it, in a soup known as the cytoplasm.

Eukaryotes are *animals, plants, fungi, and protists*. **You are a eukaryote**. In addition to having a nucleus, eukaryotic cells have a number of membrane enclosed components known as organelles. Eukaryotic organisms may be **either unicellular or multicellular**. In general, eukaryotic cells contain much more genetic material than prokaryotic cells

The **plasma membrane** separates the material inside the cell from everything outside the cell.

The **plasma or cytoplasm** is the *fluid inside the cell*. It is important for the health of the cell to prevent this fluid from leaking out. However, necessary materials must be able to enter through the membrane, and other materials, including waste, must be able to exit through the membrane. Transport through the membrane may be active or passive.

Active transport requires that a price be paid for a ticket to enter (or leave) the cell. The cost of the ticket is energy.

Passive transport does not require a ticket. Passive transport methods include *diffusion, osmosis, and filtration.*

CELLS (cont)

Centrioles behave as the *"train conductors"* of the cell. They organize microtubules, which help move the parts of the cell during cell division.

The cell can be thought of as a smoothly running factory.

The **endoplasmic reticulum** is the *main part of the cell factory*. There are two basic regions to this structure, known as the rough endoplasmic reticulum and the smooth endoplasmic reticulum. **The rough endoplasmic reticulum contains ribosomes, and the smooth endoplasmic reticulum contains no ribosomes.**

The **rough endoplasmic reticulum**, through the ribosomes, is the assembly line of the factory. The **smooth endoplasmic reticulum** is more like the shipping department, which ships the products of the reactions that occur within the cell, to the Golgi apparatus.

The **Golgi apparatus** serves as the *postal system of the cell*. It looks a bit like a maze, and within it, materials produced by the cell are packaged in vesicles, small membrane-enclosed sacs. The vesicles are then mailed to other organelles or to the cell membrane for export. The cell membrane contains "customs officers" **(called channels),** who allow secretion of the contents from the cell. Secreted substances are then available for other cells or organs.

Lysosomes *are the landfills of the cell*. They contain digestive enzymes that break down substances that may harm the cell (Chapter 6 has a lot more about enzymes). The products of this digestion may then safely reenter the cell. Lysosomes also digest "dead" organelles. This slightly disturbing process, called *autodigestion*, is really part of the cell digesting itself.

The **mitochondria** (singular mitochondrion) are the *cell's power plants*, where the cell produces energy. Mitochondria use food, primarily the carbohydrate glucose, to produce energy, which comes mainly in the form of adenosine triphosphate (ATP)

Each cell has a nucleus and, inside it, a nucleolus. These *serve as the control center of the cell* and are the root from which all future generations originate.

A double layer known as the nuclear membrane surrounds the nucleus. Usually the nucleus contains a mass of material called chromatin. If the cell is entering a stage leading to reproducing itself through cell division, the chromatin separates into chromosomes.

CELLS (cont)

In addition to conveying genetic information to future generations, the *nucleus produces two important molecules for the interpretation of this information*. These molecules are **messenger ribonucleic acid (mRNA) and transfer ribonucleic acid (tRNA).** The nucleolus produces a third type of ribonucleic acid known as **ribosomal ribonucleic acid (rRNA)**.

Ribosomes contain protein and ribonucleic acid subunits. It is in the ribosomes *where the amino acids are assembled into proteins*. Many of these proteins are enzymes, which are part of nearly every process occurring in the organism.

The small vacuoles, or simply **vacuoles**, serve a variety of functions, including *storage and transport of materials*. The stored materials may be for later use or may be waste material no longer needed by the cell.

The **cell wall** is composed of cellulose. **Cellulose**, like starch, is a *polymer of glucose*. The **cell wall provides structure and rigidity**.

The large **vacuole** serves as a *warehouse for large starch molecules*.

Glucose, which is produced by *photosynthesis*, is converted to starch, a polymer of glucose. At some later time, this starch is available as an energy source.

Chloroplasts, present in green plants, are specialized chemical factories. These are the sites of photosynthesis, in which *chlorophyll absorbs sunlight and uses this energy to combine carbon dioxide and water to produce glucose and release oxygen gas.*

The green color of many plant leaves is due to the magnesium-containing compound chlorophyll.

"An investment in knowledge pays the best interest."

ENJOY READING!

-MsCane-