Cell Membranes

The boundary of the cell, sometimes called the plasma membrane, separates internal environment from the external environment and controls the movement of materials into and out of the cell. This membrane is very selective about what it allows to pass through; this characteristic is referred to as "selective permeability." For example, it allows oxygen and nutrients to enter the cell while keeping toxins and waste products out. The plasma membrane is phosolipid bilayer, with the nonpolar hydrophobic (fatty acid) tails pointing toward the inside of the membrane and the polar hydrophilic (phosphate) heads forming the inner and outer surfaces of the membrane.

Protein and Cholesterol

Proteins and cholesterol molecules are scattered throughout the flexible phospholipid membrane. Cholesterol is found within the lipid portion of the membrane and provide support and fluidity to the membrane. Peripheral proteins attach loosely to the inner or outer surface of the plasma membrane. Integral proteins (transmembrane proteins) lie across the membrane, extending from inside to outside. A variety of proteins are scattered throughout the flexible matrix of phospholipid molecules. The phospholipid bilayer is selectively permeable. Only small, uncharged polar molecules can pass freely across the membrane. Some of these molecules are H_2O and CO_2, hydrophobic (nonpolar) molecules like O_2, and lipid soluble molecules such as hydrocarbons. Other molecules need the help of a membrane protein to get across. There are a variety of membrane proteins that serve various functions:

- **Channel proteins**: Proteins that provide passageways through the membranes for certain hydrophilic or water-soluble substances such as polar and charged molecules. No energy is used during transport, hence this type of movement is called facilitated diffusion.
- **Transport proteins**: Proteins that spend energy (ATP) to transfer materials across the membrane. When energy is used to provide passageway for materials, the process is called active transport.
- **Glycoproteins**: These proteins have chains of polysaccharides usually extending out from peripheral proteins. These proteins that distinguish the identity of the cell and neighboring cells.
- **Structural and Adhesion proteins**: Usually peripheral proteins that attach cells to neighboring cells or provide anchors for the internal filaments and tubules that give stability to the cell.
- **Glycolipids**: Saccharide chains that extend from the phospholipid bilayer and are involved in specific cell responses once hormones or other trigger molecules bind to them. They also provide structure to the cell membrane and tissue integrity
- **Electron transfer proteins**: Proteins that are involved in moving electrons from one molecule to another during chemical reactions.

Passive Transport Across the Cell Membrane

Passive transport describes the movement of substances down a concentration gradient and does not require energy use.

- **Simple diffusion**, or diffusion, is the net movement of substances from an area of higher concentration to an area of lower concentration. This movement occurs as a result of the

random and constant motion characteristic of all molecules, (atoms or ions) and is independent from the motion of other molecules. Since, at any one time, some molecules may be moving against the gradient and some molecules may be moving down the gradient, although the motion is random, the word "net" is used to indicate the overall, eventual end result of the movement.

- **Facilitated diffusion** is the diffusion of solutes through channel proteins in the plasma membrane.
- **Osmosis** is the diffusion of water molecules across a selectively permeable membrane.

Active transport is the movement of solutes against a gradient and requires the expenditure of energy, usually in the form of ATP.

Protein Pumps

- The proteins involved with active transport are also known as **ion pumps**.
- The protein binds to a molecule of the substance to be transported on one side of the membrane, then it uses the released energy (ATP) to change its shape, and releases it on the other side.
- The protein pumps are specific, there is a different pump for each molecule to be transported.
- The sodium-potassium pump (also called the Na^+/K^+-ATPase enzyme) actively moves sodium out of the cell and potassium into the cell. These pumps are found in the membrane of virtually every cell, and are essential in transmission of nerve impulses and in muscular contractions.

http://en.wikibooks.org/wiki/Human_Physiology/Cell_physiology

Marieb, Elaine N. and Mallatt, John. Human Anatomy. Benjamin/Cummings Publishing Co., Redwood City, CA, 1992.