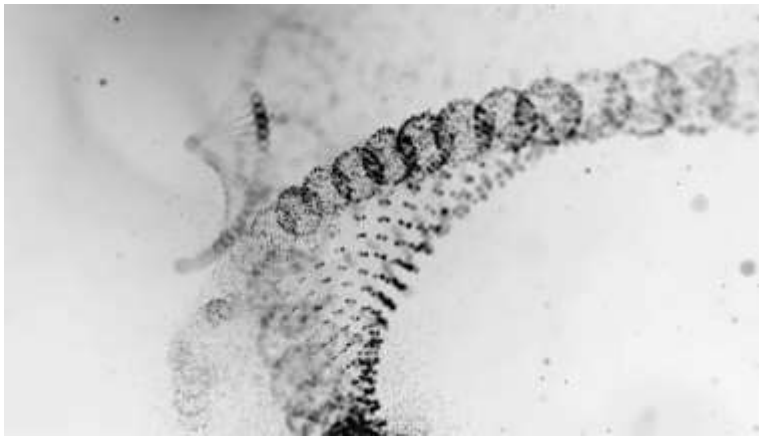
Four Classes of Macromolecules Important to Living Things



Atoms are tiny, tiny building blocks. When you put two or more together, you get a molecule. That might not seem very big, either, but it's all relative. Some molecules are "macromolecules." Made up of thousands of atoms, they are comparatively large. The four major classes of molecules found in living things are giants in the microscopic world. Carbohydrates, proteins, lipids and nucleic acids each have different jobs that help keep organisms performing their life functions. Macromolecules — large structures composed of atoms and smaller molecular structures — play important and sometimes vital roles in creating and sustaining life. While there are many types of macromolecules, those that are fundamental to the existence of life can be organized into four categories: proteins, nucleic acids, carbohydrates, and lipids. That said, macromolecules can be found in plastics, rubber, and diamonds.

Proteins: Keep the Body Running

Proteins, like all macromolecules, form from smaller units that combine and connect together to form one larger molecule. Amino acids — which are smaller, simpler molecules — connect end-to-end to form proteins. Twenty-one different amino acids are essential to all life — there are many different combinations that can form from this set. As such, there are many different possible proteins — this varies depending on the number of sets of amino acids in a protein — each with its own particular function, ranging from attacking antigens in the blood, to regulating metabolism, to digesting particles of food. Proteins are involved in most life processes.

Tough Stuff - Proteins are made up of amino acids. The specific combination of amino acids determines the type of protein. Twenty amino acids exist, and 10 of them can be made by the human body. Plants, on the other hand, can produce all 20. Proteins play many roles in organisms, including helping the immune system, helping cells communicate, speeding up chemical reactions and building tissue, such as muscle.

Nucleic Acids: Blueprints for Life

Nucleic acids — DNA and RNA — contain and describe the genetic code in life. As macromolecules, nucleic acids serve as a detailed instruction manual for the development of the body and the workings of each cell. Nucleic acids form of the sugar 2-deoxyribose, a phosphate group, and one of four base molecules. Different combinations of the four base molecules along the DNA chain encode for certain amino acids, which eventually connect together to form proteins. While DNA contains the raw genetic information for life, RNA passes messages between DNA and the cell.

Carrying the Code - Nucleic acid comes in two forms: ribonucleic acid, RNA, and deoxyribonucleic acid, of DNA. Composed of carbon, hydrogen, oxygen, phosphorus and nitrogen, they are vital to heredity. DNA stores an organism's genetic information, while RNA carries it to where it's needed.

While DNA is highly recognizable in its double helix shape -- like a twisted ladder -- RNA is just a single chain. Some RNA molecules are ribozymes, which speed up the rate of chemical reactions in the body. With the exception of some mammals' red blood cells, the cells of all organisms contain DNA and RNA.

Carbohydrates: Chemical Energy

Found in many energy-providing foods, carbohydrates help the nervous system, muscles, and body in general function. A group of polymers, they contain nothing but carbon, hydrogen, and oxygen. Human bodies break down carbohydrates into their base components, which it then uses to fuel cells and maintain body processes. Plants use carbohydrates, particularly cellulose, to protect their cells and to grow larger. The list of carbohydrates is extensive and includes all sugars and starches.

Get Up and Go - Organisms primarily use carbohydrates for energy, but sometimes use them for support as well. They are made up of various combinations of carbon, hydrogen and oxygen. Simple sugars, such as table sugar and glucose, which provide energy for most cells, are one type of carbohydrate. If many sugars are chained together, starches are formed. Because of their large size, starches serve as storage facilities for sugar. Some types of starches are firm and supportive. The starch cellulose is what gives plants rigidity and keeps them from flopping over.

Energy Source - Both plants and animals use carbohydrates as a source of energy essential to carrying out normal functions such as growth, movement and metabolism. Carbohydrates store energy in the form of starch which, depending on the type of carbohydrate, provide either simple or complex sugars. Complex sugars, known as polysaccharides, give a steady supply of energy while simpler sugars, monosaccharides and disaccharides, supply a quicker jolt before dissolving. Animals receive these starches through foods, especially those made from plant life such as grains and bread. Plants manufacture their own carbohydrates through photosynthesis, using the energy absorbed from light to combine carbon dioxide and water into more complex organic molecules.

Lipids: Long-term Energy

While carbohydrates supply immediate energy for the body, lipids — a class of macromolecule — provide long-term energy storage. Lipids, more commonly known as fats, appear in many foods. There are dozens of lipids, many of which are important for living things. Lipids form the protective membranes around cells, and deliver essential vitamins — to name just a few of their functions. The body stores lipids as reserves of fat, but the reserves will be depleted over time as cells use the stored energy.

Slippery Slope - Lipids are mostly made up of carbon and hydrogen. Lipids that are fats and oils are primarily used to store energy for future use. Phospholipids play an important role in making cell membranes semi-permeable, so not everything can get in or out. Many lipids are "hydrophobic." This doesn't mean they're afraid of water; they just won't dissolve in it. This feature makes them useful as water barriers in cell membranes. Steroids, such as cholesterol, are lipids. Though too much cholesterol damages cells, it's needed to make animal cell membranes, and is vital to brain function.