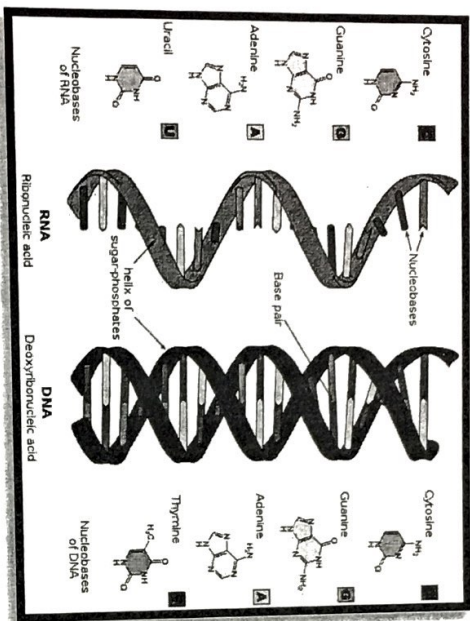


## Why are Macromolecules Essential to Life?

Organic compounds are compounds associated with life processes. Among the numerous types of organic compounds, four major categories are found in all living things. These four categories of organic compounds are often referred to as the Macromolecules of Life: carbohydrates, lipids, protein, and nucleic acids.

### Nucleic Acids

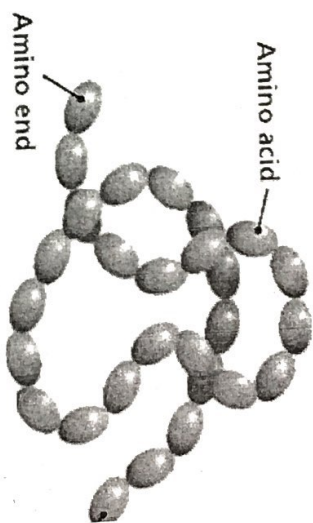
The nucleic acids are composed of smaller units called nucleotides. Each nucleotide contains a sugar molecule, a phosphate group, and a nitrogen base. Living organisms have two important nucleic acids. One type is deoxyribonucleic acid, or DNA. The other is ribonucleic acid, or RNA. DNA is found in the nucleus of the cell, while RNA is found in both the nucleus and the cytoplasm (a gel-like substance that composes the inside of the cell). DNA and RNA differ from one another in a few ways. DNA contains the sugar deoxyribose, while RNA has ribose. In a DNA molecule, the adenine base pairs with thymine, but in RNA the adenine pairs with



1. What are two examples of nucleic acids?
2. What is the monomer that makes up a polymer of nucleic acid?
3. What is the function of nucleic acids to living things?

### Proteins

Proteins, among the most complex of all organic compounds, are composed of amino acids. Many proteins are immense in size and extremely complex. However, all proteins are composed of long chains of relatively simple amino acids. There are 20 kinds of amino acids. The links forged between the amino acids are peptide bonds, and small proteins are often called peptides.



All living things depend on proteins for their existence. Proteins are the major molecules from which living things are constructed. Certain proteins are dissolved or suspended in the watery substance of the cells, while others are incorporated into various structures of the cells. Proteins are also found as supporting and strengthening materials in tissues outside of cells. Bone, cartilage, tendons, and ligaments are all composed of protein.

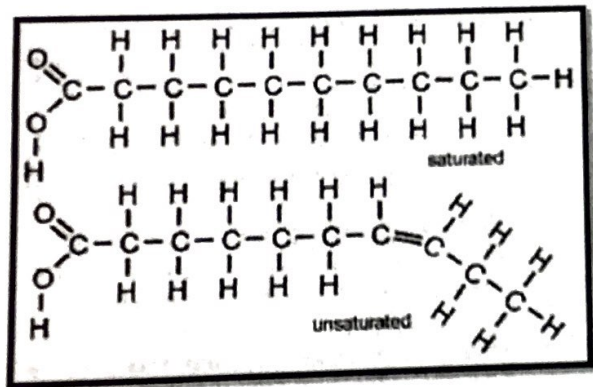
One essential use of proteins is in the construction of enzymes. Enzymes catalyze (speed up) the chemical reactions that take place within cells. The information for synthesizing the unique proteins is located in the nucleus of the cell. This genetic code (DNA) specifies the amino acid sequence in proteins. Hence, the genetic code regulates the chemistry taking place within a cell.

1. What are two examples of proteins?
2. What is the monomer that makes up a polymer of protein?
3. What are two functions that proteins provide for living organisms?
4. What is an enzyme?

## Lipids

Lipids are another organic macromolecule essential to life. Lipids include steroids, waxes, oils, and fats. A fatty acid is the monomer of a lipid. There are two types of fatty acids. Fatty acids that have one or more double bonds in their molecules are unsaturated fats. Fatty acids have no double bonds are saturated fats. In most human health situations, the consumption of unsaturated fats is preferred to the consumption of saturated fats. Consuming large amounts of lipids can cause cardiovascular (heart) disease.

Fats stored in cells usually form clear oil droplets called globules because fats do not dissolve in water. Plants often store fats in their seeds, and animals store fats in large, clear globules in the cells of adipose tissue. The fats in adipose tissue contain much concentrated energy. Hence, they serve as a reserve energy supply to the organism.



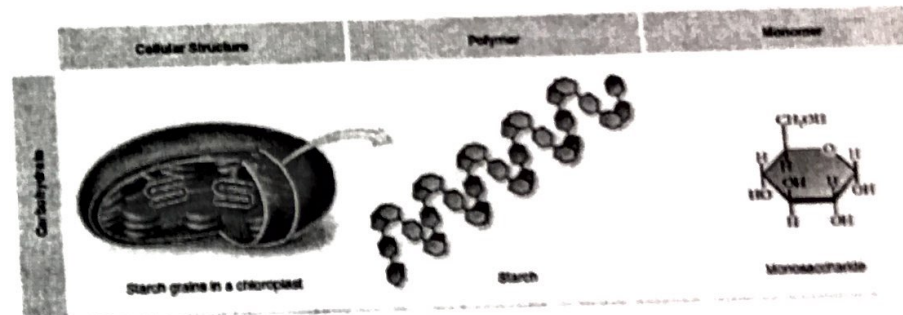
1. What are two examples of lipids?
2. What is the monomer that makes up a lipid polymer?
3. Where can we find lipids in living things?
4. What are two functions of lipids to living things?

## Carbohydrates

Carbohydrates are an organism's main source of energy. The single building block of a carbohydrate molecule is the monosaccharide glucose. Glucose is the basic form of fuel in living things. It is transported by body fluids to all cells, where it is metabolized to release its energy.

Carbohydrates are commonly referred to as sugars, and can be monosaccharides if they are composed of a single glucose molecule, or disaccharides if they are composed of two glucose molecules. Complex carbohydrates are known as polysaccharides. Polysaccharides are formed by linking many glucose molecules. Among the most important polysaccharides are the starches, which are composed of hundreds or thousands of glucose molecules linked to one another.

Another polysaccharide, cellulose, is used primarily as a structural carbohydrate. It is also composed of glucose molecules, but the molecules cannot be released from one another except by a few species of organisms. Plant cell walls are composed primarily of cellulose.



1. What are two examples of carbohydrates?
2. What is the monomer that makes up a carbohydrate polymer?
3. What is the function of carbohydrates to living things?