

Big Picture

Our body is made out of four basic classes of organic compounds: carbohydrates, lipids, proteins, and nucleic acids. Each class performs a unique role and is vital for the function of life.

Key Terms

Organic Compound: A chemical substance created within an organism.

Carbohydrate: An organic compound containing carbon, hydrogen, and oxygen that supply the energy living systems need to survive.

Lipid: An organic compound produced for storing energy.

Protein: An organic compound making up muscles, enzymes, and other organs in the body.

Nucleic Acid: An organic compound used to store genetic information.

Fatty Acid: Molecule in which carbon atoms are bonded to hydrogen atoms or other groups of atoms.

Amino Acid: Small molecule that is a building block of proteins.

Nucleotide: Small molecule containing a sugar, phosphate group, and base that is a building block of nucleic acids.

Complementary Base Pair: Pair of nucleotide bases that bond together.

Four Main Types of Organic Compounds

There are four main types of **organic compound** responsible for cellular functions within cells. These are **carbohydrates, lipids, proteins, and nucleic acids.**

Types of Organic Compounds

Type of Compound	Examples	Functions
carbohydrates	sugars, starches	provides energy to cells, stores energy, forms body structures
lipids	fats, oils	stores energy, forms cell membranes, carries messages
proteins	enzymes, antibodies	helps cells keep their shape, makes up muscles, speeds up chemical reactions, carries messages and materials
nucleic acids	DNA, RNA	contains instructions for proteins, passes instructions from parents to offspring, helps make proteins

Carbohydrates

- The most common type of organic compound.
- Built of small, repeating units (monosaccharides) that can bind to make a larger molecule (polysaccharide)

Lipids

- Made up of **fatty acids**—either saturated (carbon bonded to as many hydrogen atoms as possible) or unsaturated (some carbon bonded to groups other than hydrogen atoms)
- Lipids include:
 - triglycerides: the main form of stored energy in animals
 - phospholipids: the major components of cell membranes
 - steroids: serve as chemical messengers and have other roles

Notes

ORGANIC COMPOUNDS CONT.

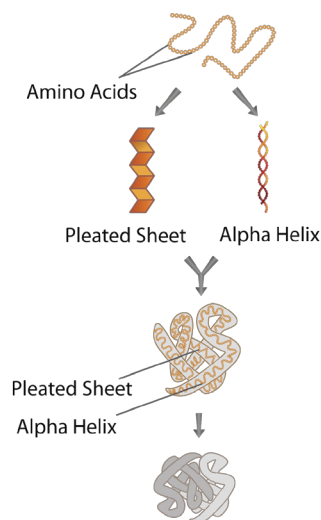
Four Main Types of Organic Compounds (cont.)

Proteins

- Made up of **amino acids** connected with peptide bonds
- There are 20 amino acids, which, like the alphabet, can be arranged in any order and number to form a near-infinite number of polypeptides

Structure of a protein

- The shape of a protein is important for function. There are four different structures that proteins can form in the body.



Primary Protein Structure is sequence of a chain of amino acids.

Secondary Protein Structure occurs when the sequences of amino acids are linked by hydrogen bonds.

Tertiary Protein Structure occurs when certain attractions are present between alpha helices and pleated sheets.

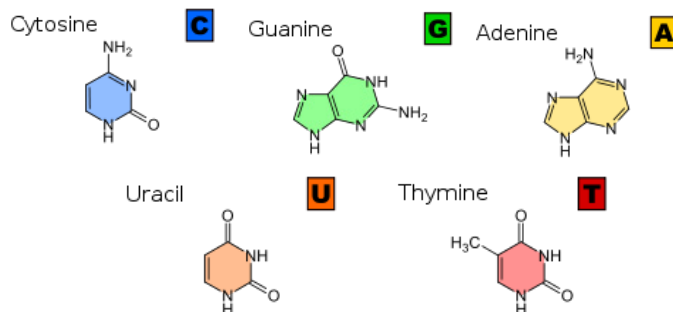
Quaternary Protein Structure is protein consisting of more than one amino acid chain.

Figure: Protein structures.

Image Credit: CK-12 Foundation, CC-BY-NC-SA 3.0

Nucleic Acids

- Nucleic acids include DNA, which is double-stranded, and RNA, which is single-stranded. Nucleic acids are made up of **nucleotides**.
- Nucleotides are made up of:
 - sugar
 - phosphate group
 - nitrogen base
- Chemical bonds between the sugar of one nucleotide and the phosphate group of the next nucleotide hold together the backbone of all nucleic acid molecules.
- There are five different types of nitrogen bases: cytosine, adenine, guanine, and either thymine (present in DNA) or uracil (present in RNA).
- These bases pair up in a specific way, forming **complementary base pairs**. Adenine bonds only with thymine (uracil in RNA), and cytosine only with guanine.
- Hydrogen bonding between base pairs holds together two strands of nucleic acid, forming the double helix in DNA molecules.



To remember DNA base pairing rules try using the mnemonic device: *Grandama's Cookies Taste Awesome.*

Molecule	DNA	RNA
sugar	deoxyribose	ribose
bases	adenosine (A), thymine (T), cytosine (C), guanine (G)	adenosine (A), uracil (U), cytosine (C), guanine (G)
structure	double-stranded, double helix	single-stranded

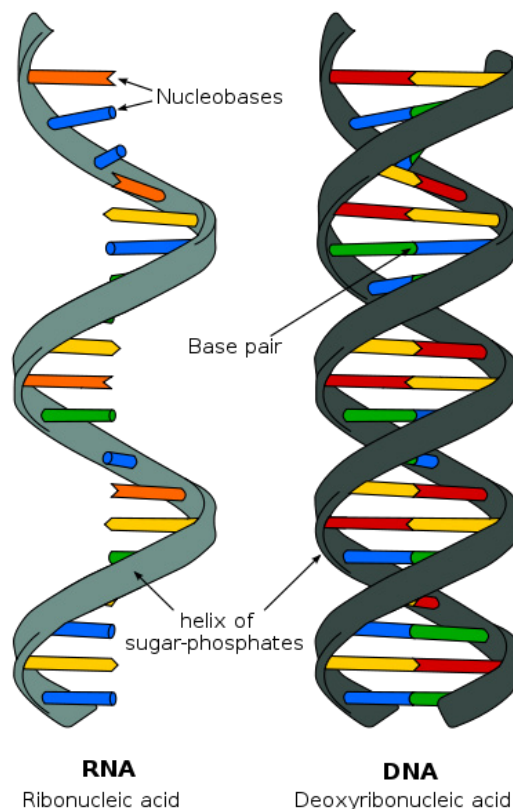


Figure: Comparison of DNA and RNA molecules
Image Credit: Spoink, CC-BY-SA 3.0