

**College of science**

**Department of Biochemistry**

**Second class**

**MSc. Issa Farhan**

**Lecture: Introduction to Organic Chemistry**

**Organic chemistry is a branch of chemistry that deals with the study of carbon-containing compounds. These compounds include a vast array of molecules essential for life, such as proteins, carbohydrates, and lipids, as well as many synthetic materials we use daily, like pharmaceuticals and plastics. Organic chemistry is fundamental to various fields, including biology, medicine, environmental science, and engineering.**

**1 .Definition of Organic Chemistry:**

**Organic chemistry focuses on compounds containing carbon atoms. While carbon can form many types of bonds with itself and other elements, the most common elements it bonds with are hydrogen, oxygen, nitrogen, sulfur, and halogens (fluorine, chlorine, bromine, iodine). These carbon-based molecules are called organic compounds and are central to the study of life and materials.**

**Organic compounds can be classified based on their structure and functional groups. Functional groups are specific groups of atoms within molecules that are responsible for the chemical reactions of those molecules. Some common functional groups include:**

**Hydroxyl group (-OH):** Found in alcohols.

**Carboxyl group (-COOH):** Found in organic acids.

**Amino group (-NH<sub>2</sub>):** Found in amines and amino acids.

## **2 .Importance of Organic Chemistry:**

Organic chemistry plays a crucial role in modern science and industry. It helps scientists understand the structure, properties, and reactions of organic molecules. Here are a few examples of how organic chemistry impacts daily life:

**Pharmaceuticals:** Organic compounds form the basis of most medications. Understanding their structure helps in designing drugs that can treat various diseases.

**Polymers:** Organic chemistry is key to developing materials like plastics, nylon, and polyester.

**Agriculture:** Pesticides, fertilizers, and herbicides are all developed through organic chemistry to enhance crop production.

**Food Chemistry:** Organic compounds determine the flavor, texture, and nutritional content of food.

## **3 .Bonding and Structure in Organic Chemistry:**

The central concept of organic chemistry is how carbon atoms bond to form stable structures. Carbon can form four covalent bonds, allowing it to create chains, rings, and complex three-dimensional structures. This ability is due to carbon's tetrahedral bonding geometry.

There are different types of bonds in organic molecules:

**Single bonds (sigma bonds):** Strong bonds where electrons are shared between two atoms.

**Double bonds and triple bonds (pi bonds):** Bonds where multiple pairs of electrons are shared, allowing for more complex structures.

#### **4 .Major Classes of Organic Compounds:**

Organic compounds can be divided into several categories based on their structure and functional groups:

**Alkanes:** Hydrocarbons with only single bonds between carbon atoms (e.g., methane, ethane).

**Alkenes and Alkynes:** Hydrocarbons with double and triple bonds between carbon atoms (e.g., ethene, ethyne).

**Aromatics:** Compounds that contain a ring of carbon atoms with alternating single and double bonds (e.g., benzene).

**Alcohols, Acids, and Esters:** Compounds containing hydroxyl, carboxyl, and ester groups, respectively.

#### **5 .Reactions in Organic Chemistry:**

The most important aspect of organic chemistry is understanding how organic molecules react. Organic reactions are typically classified into different types:

**Substitution reactions:** One atom or group of atoms in a molecule is replaced by another.

**Addition reactions:** Atoms or groups are added to a molecule, typically across double or triple bonds.

**Elimination reactions:** Atoms or groups are removed from a molecule, often forming double or triple bonds.

**Oxidation and Reduction reactions:** These involve changes in the oxidation state of molecules, often in biological and industrial processes.

