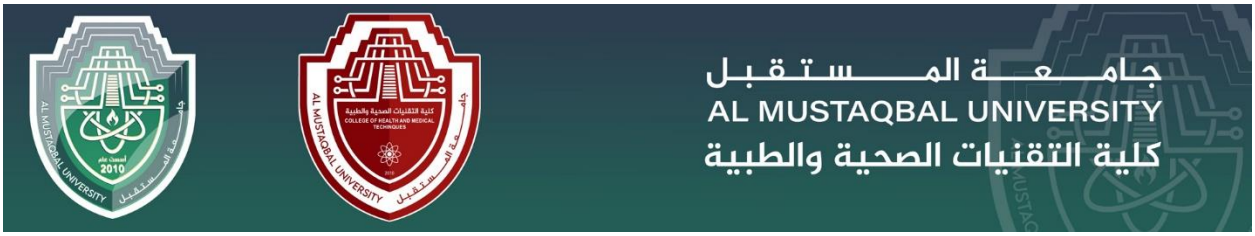

Aesthetic and Laser Techniques Department

First Semester

General Chemistry (2024-2025) lecture (1)

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Scope of biochemistry in health and disease, cell and cell constituents.

1- Biochemistry:-

Biochemistry is a branch of science that uses biological and chemical methods to study the chemical processes that take place inside us, at a molecular level.

In this field help to diagnose and manage disease through the analysis of blood, urine and other body fluids.

Typical activities include:

Carrying out complex analyses on specimens of body fluids and tissues. Assuring the quality of clinical biochemistry investigations

Auditing the diagnostic and clinical use and performance of investigations. Developing new and existing tests, often automated and computer assisted but sometimes requiring considerable manual expertise.Some patient

What is biochemistry?

As the name may suggest, biochemistry is a field of science that combines the two traditional disciplines of biology and chemistry. If chemistry is the science of matter, then biochemistry is the science of living matter.

The biochemistry studies the biochemical reactions that occur at the molecular level within living organisms. In medical biochemistry, biochemical techniques are applied to human health and disease. The typical scope of medical biochemistry can include the following:

The chemical components of the human body, including carbohydrates and lipids; amino acids and proteins; blood and plasma; biological membranes; nucleic acids (DNA and RNA)

The major chemical processes in the human body, such as cell development; enzyme activity; membrane transport mechanisms; homeostasis, blood coagulation, oxygen transport, neuro transmitter function…

Nutrition and mineral metabolism, including the role and function of vitamins in the body , Molecular genetics , Heredity, Genomics .

Much of biochemical inquiry deals with the structures, functions and interactions of biological macromolecules — large and complex molecules (such as proteins) which provide the structure of cells and perform many of the functions associated with life.

Classes of compounds in biochemistry: -

There are four essential classes of biochemical compounds.

1. carbohydrates - composed of monosaccharides & used for energy and cell wall structure

2. proteins - composed of amino acids and used in processes like movement, DNA replication and stimuli sensing.

3. nucleic acids - composed of nucleotides. Function as data storage and transmit genetic information

4. Lipids - includes fats, phospholipids and steroids. Lipids compose cell walls and are used for energy storage.

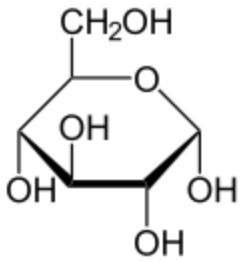
1-Carbohydrates

Carbohydrates are a class of biological compounds composed of carbon, hydrogen and oxygen. The basic chemical composition of carbohydrates is $(CH_2O)n$, where n>=3. 1

Carbohydrates - composed of monosaccharides & used for energy and cell wall structure Simple sugars, known as monosaccharides, form the basic building block of carbohydrates. Glucose ($C_6H_{12}O_6$) is the most common monosaccharide.

Disaccharides are composed of two covalently linked monosaccharides. The monosaccharides fructose and glucose bond to form the disaccharide sucrose, or table sugar. Lactose, or milk sugar, is a disaccharide composed of glucose and galactose.

Polysaccharides are generally larger polymers composed of several thousand covalently linked monosaccharides.



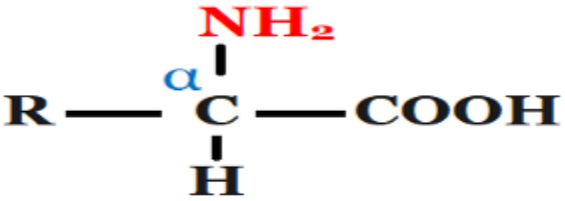
Glucose is a common carbohydrate monomer.

2- Amino acids

Amino acids are organic compounds that contain both amino and carboxylic acid functional groups. Only 22 alpha amino acids appear in the genetic code. Amino acid, is amember of a group of organic molecules that consist of a basic amino group (—NH_2), an acidic carboxyl group (—COOH), and an organic R group (or side chain) that is unique to each amino acid.

The term amino acid is short for α-amino [alpha-amino] carboxylic acid. Each molecule contains a central carbon (C) atom, called the α-carbon, to which both an amino and a carboxyl group are attached. The remaining two bonds of the α-carbon atom are generally satisfied by a hydrogen (H) atom and the R group.

The formula of a general amino acid is:

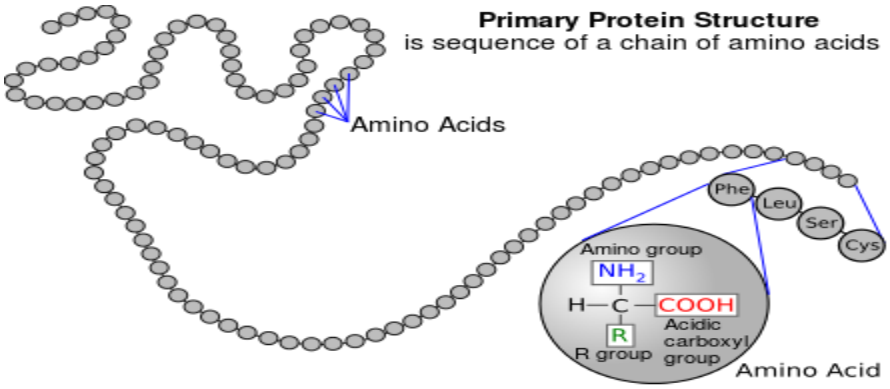


The amino acids differ from each other in the particular chemical structure of the R group.

3-Proteins: -

Proteins are large molecules with many roles in cellular processes, including metabolism, DNA replication, motor function, stimuli sensing and movement of other molecules within an organism.

Despite their multitude of roles and configurations, all proteins are composed from 20 amino acids. Genes within the DNA encode the unique amino acid combination for each protein. These individual amino acids are combined to form polymers known as peptide units. Amino acids can be combined in units of two (dipeptide), three (tripeptide) a few (oligopeptide) or many peptides (polypeptides). Proteins are composed of at least one polypeptide chain and range in length from 40 to over 30,000 amino acids. Based on the standard number of amino acids and the multitude of combinations, a wide variety of proteins can be formed. Each protein folds into a unique shape, or conformation, that optimized for its assigned function.



Analogous to a beads on a string, polypeptide chains are composed of amino acids linked in tandem. This string folds into unique shapes designed for multiple roles in the cell.

4-Lipids:-

Unlike proteins and carbohydrates, lipids are not composed of polymers. This class of biochemical compounds are characterized by their aversion to water, known as hydrophobicity. Lipids are principally composed of hydrogen and carbon. Although lipids are generally smaller than other macromolecules, they display a large variety of form and function.

There are three biologically important types of lipids: fats, phospholipids and steroids. Although not polymers, fats are large biological compounds formed from glycerol and fatty acids.

The importance of biochemistry; -

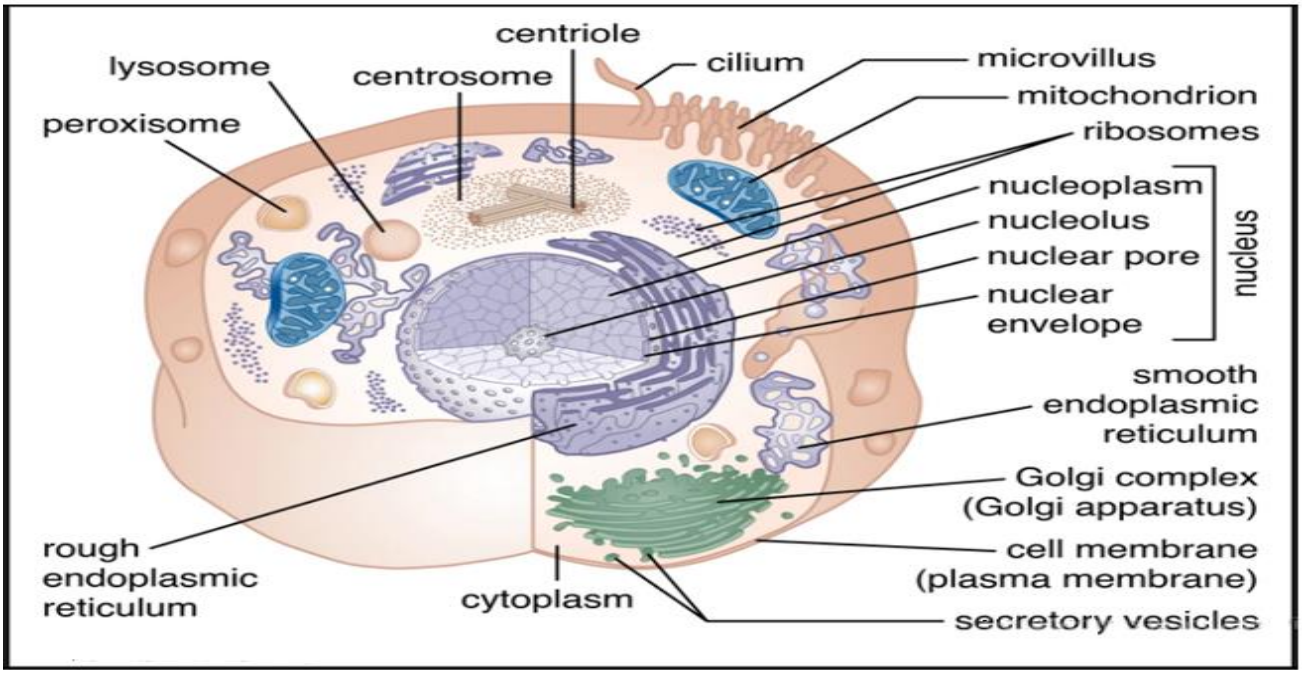
Biochemistry combines biology and chemistry to study living matter. It supports scientific and medical discoveries in areas such as pharmaceuticals, forensics and nutrition. In biochemistry, you will study chemical reactions at the molecular level to better understand the world and develop new ways to harness them.

Functional Biochemistry in Health and Disease:-

The functional biochemistry in health and disease provides a clear and straightforward account of the biochemistry that is necessary to understand the physiological functions of tissues or organs essential to the life of human beings.

Cell and Cell Constituents: -

A cell (latin, cellula- a small compartment) In biology, the smallest unit that can live on its own and that makes up all living organisms and the tissues of the body. A cell has three main parts: the cell membrane, the nucleus, and the cytoplasm. The cell membrane surrounds the cell and controls the substances that go into and out of the cell. The nucleus is a structure inside the cell that contains the nucleolus and most of the cell's DNA. It is also where most RNA is made. The cytoplasm is the fluid inside the cell. It contains other tiny cell parts that have specific functions, including the Golgi complex, the mitochondria, and the endoplasmic reticulum. The cytoplasm is where most chemical reactions take place and where most proteins are made. The human body has more than 30 trillion cells.



What are primary cell constituents?

Primary cell wall : Chemical composition-consists of.

Cellulose (45%), hemicellulose (25%), pectin's (35%) and structural proteins (upto8%) on basis of dry weight. The backbone of the primary wall is formed by

the cellulose fibrils. Any information you enter into a spreadsheet will be stored in a cell. Each cell can contain different types of content, including text, formatting, formulas, and functions. Text. Cells can contain text, such as letters, numbers, and dates.

- ## Properties of cell:

1. **Cells are complex and highly organized structures containing many internal components.**
2. **Cells contain a genetic blueprint.**
3. **Cells arise from the division of other cells pre -existing cells.**
4. **Cells acquire and utilize energy to perform chemical and mechanical activities**

- ## What are the constituents of a cell?

Cells are composed of water, inorganic ions, and carbon-containing (organic) molecules. Water is the most abundant molecule in cells, accounting for 70% or more of total cell mass. Consequently, the interactions between water and the other constituents of cells are of central importance in biological chemistry.