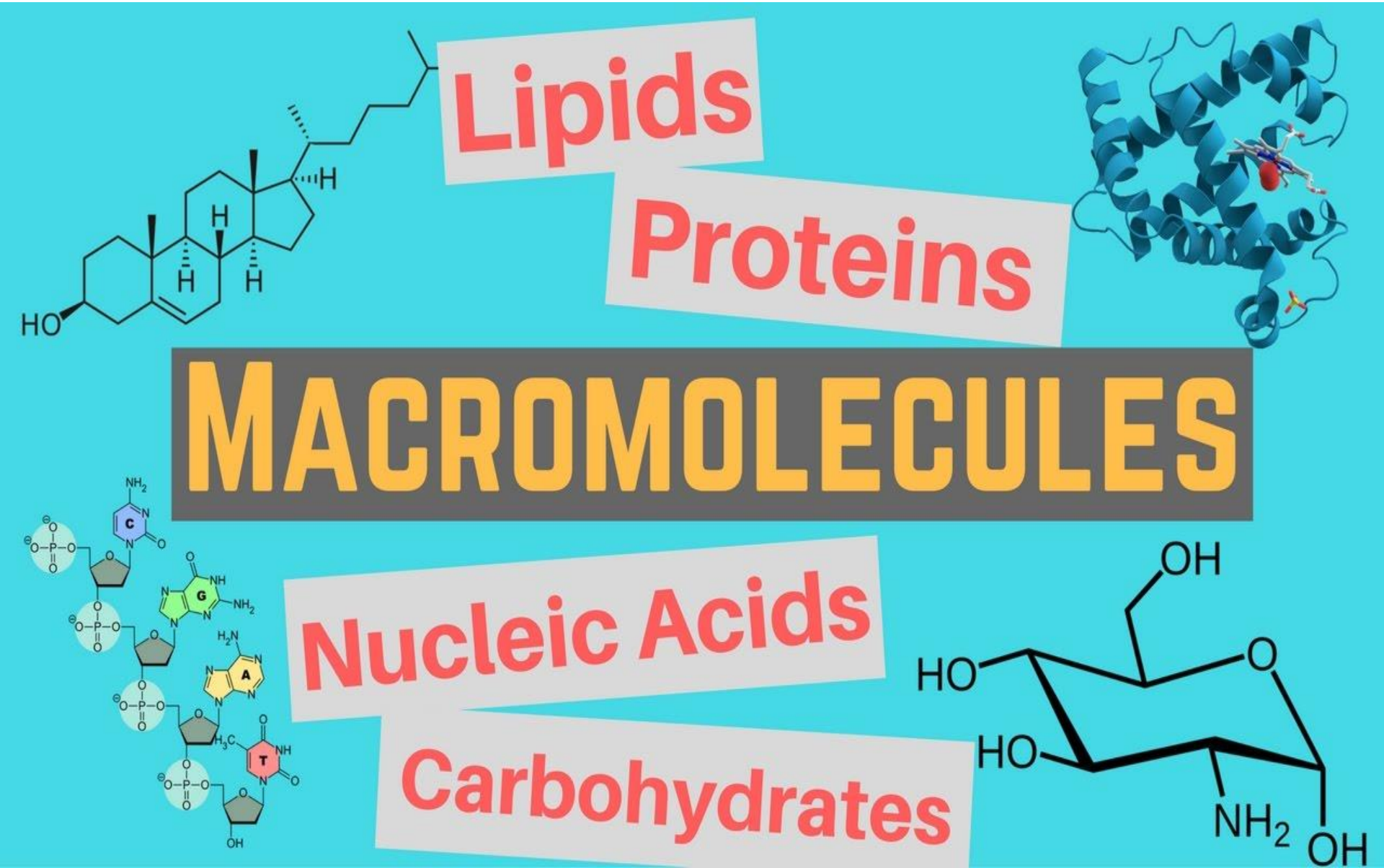
Dr: Saba Al-Abachi



The importance of biochemistry

Biochemistry: sometimes called biological chemistry, is the study of chemical processes within and relating to living organisms. Biochemical processes give rise to the complexity of life.

Biochemistry can be divided in three fields; molecular genetics, protein science and metabolism. Biochemistry has through these (three disciplines fields) become successful at :

1- Explaining living processes.

2- All areas of the life sciences are being uncovered and developed by biochemical methodology and research.

3- Biochemistry focuses on understanding how biological molecules give rise (lead) to the processes that occur within living cells and between cells, which in turn relates greatly to the study and understanding of tissues, organs, and organism structure and function.

4- Biochemistry is related to molecular biology, the study of the molecular mechanisms by which genetic information encoded in DNA is able to result in the processes of life.

5- Much of biochemistry deals with the structures, functions and interactions of biological macromolecules, such as proteins, nucleic acids, carbohydrates and lipids, which provide the structure of cells and perform many of the functions associated with life.

6- The chemistry of the cell also depends on the reactions of smaller molecules and ions. These can be inorganic, for example water and metal ions, or organic, for example the amino acids, which are used to synthesize proteins.

7- The mechanisms by which cells harness energy from their environment via chemical reactions are known as metabolism.

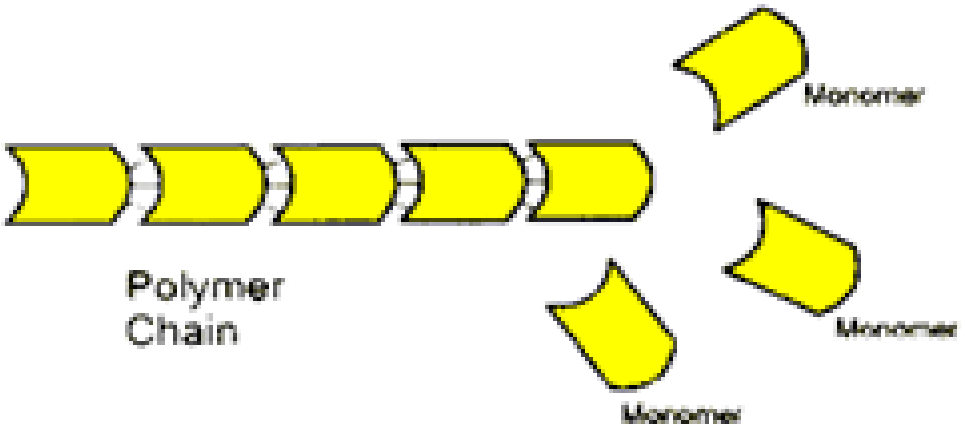
8- The findings of biochemistry are applied primarily in medicine, nutrition, and agriculture. In medicine, biochemists investigate the causes and cures of diseases. In nutrition, they study how to maintain health wellness and study the effects of nutritional deficiencies. In agriculture, biochemists investigate soil and fertilizers, and try to discover ways to improve crop cultivation, crop storage and pest control.

What are Macromolecules?

- Cells and their organelles are made up of smaller building blocks called **macromolecules**.
- There are 4 basic types of macromolecules. They are:
  - Lipids
  - Proteins
  - Carbohydrates
  - Nucleic Acids

Monomers & Polymers

- Macromolecules are actually made up of even smaller subunits. Each subunit of a macromolecule is called a **monomer**.
- The macromolecules themselves are called **polymers**, because they are made up of many of these subunits.



Monomer: one basic unit or subunit

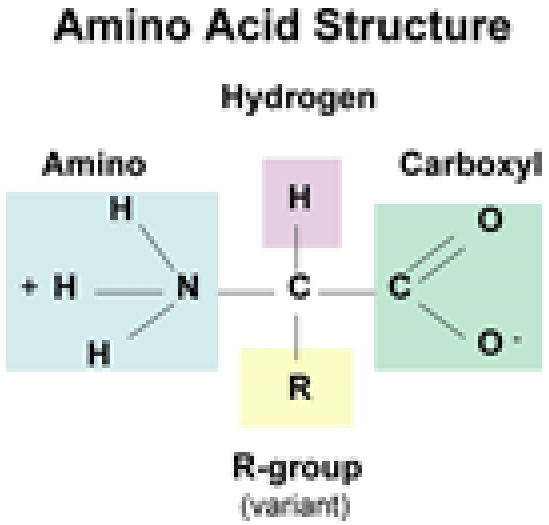
Polymer: a chain of many basic units

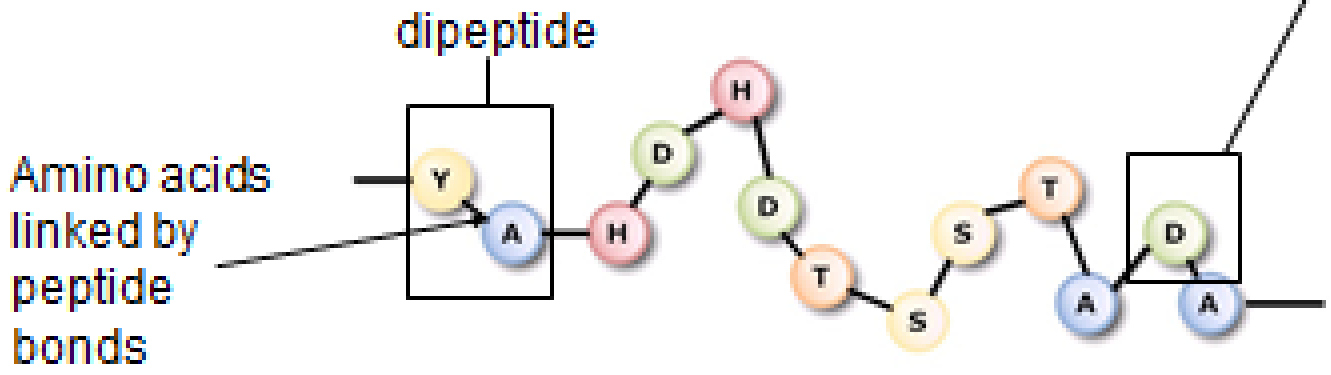
- **A macromolecule is a very large molecule, such as protein, commonly created by the polymerization of smaller subunits (monomers). They are typically composed of thousands of atoms or more.**

- **Synthetic macromolecules include common plastics and synthetic fibers as well as experimental materials such as carbon nanotubes**

Proteins: Structure

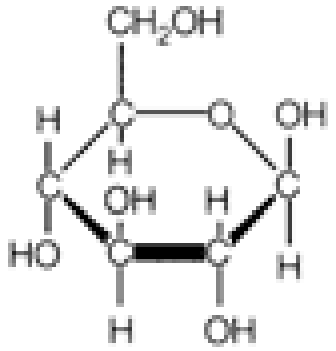
- Proteins are made up of…
  - Monomer (basic unit): **amino acids**
    - 20 different kinds!*
  - Polymer (chain of units): **protein**
    - More specifically- **polypeptides**



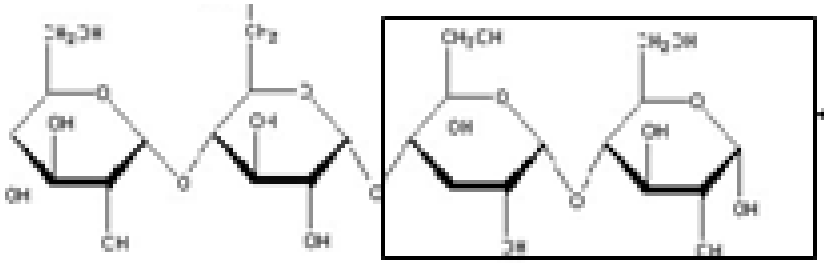


Carbohydrates: Structure

- Carbohydrates are made up of…
  - Monomer (basic unit): **simple sugars** (or **monosaccharides**)
    - Ex.: glucose →



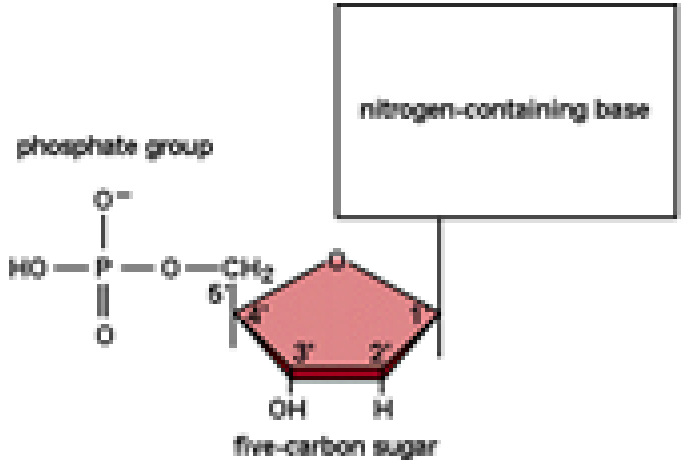
  - Polymer (chain of units): **complex carbohydrates** (or **polysaccharides**)
    - Ex.: starch, cellulose, chitin, glycogen



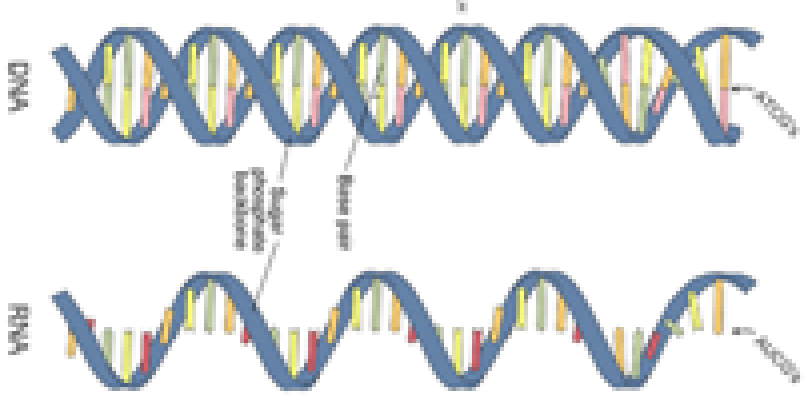
Disaccharide: 2 simple sugars bonded together

Nucleic Acids: Structure

- Nucleic Acids are made up of…
  - Monomers (basic unit): **nucleotides**

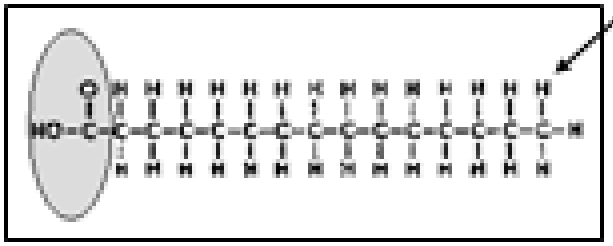


  - Polymers (chain of units): **DNA** or **RNA**

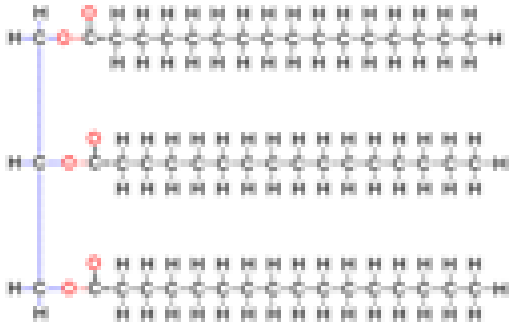


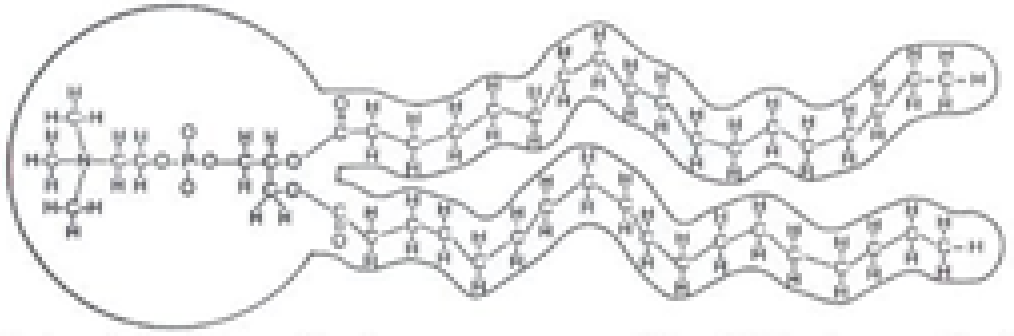
Lipids: Structure

- Lipids are made up of…
  - Monomer (basic unit): **fatty acids**



  - Polymer (chain of units): **lipids**
    - Specific examples: triglycerides, phospholipids



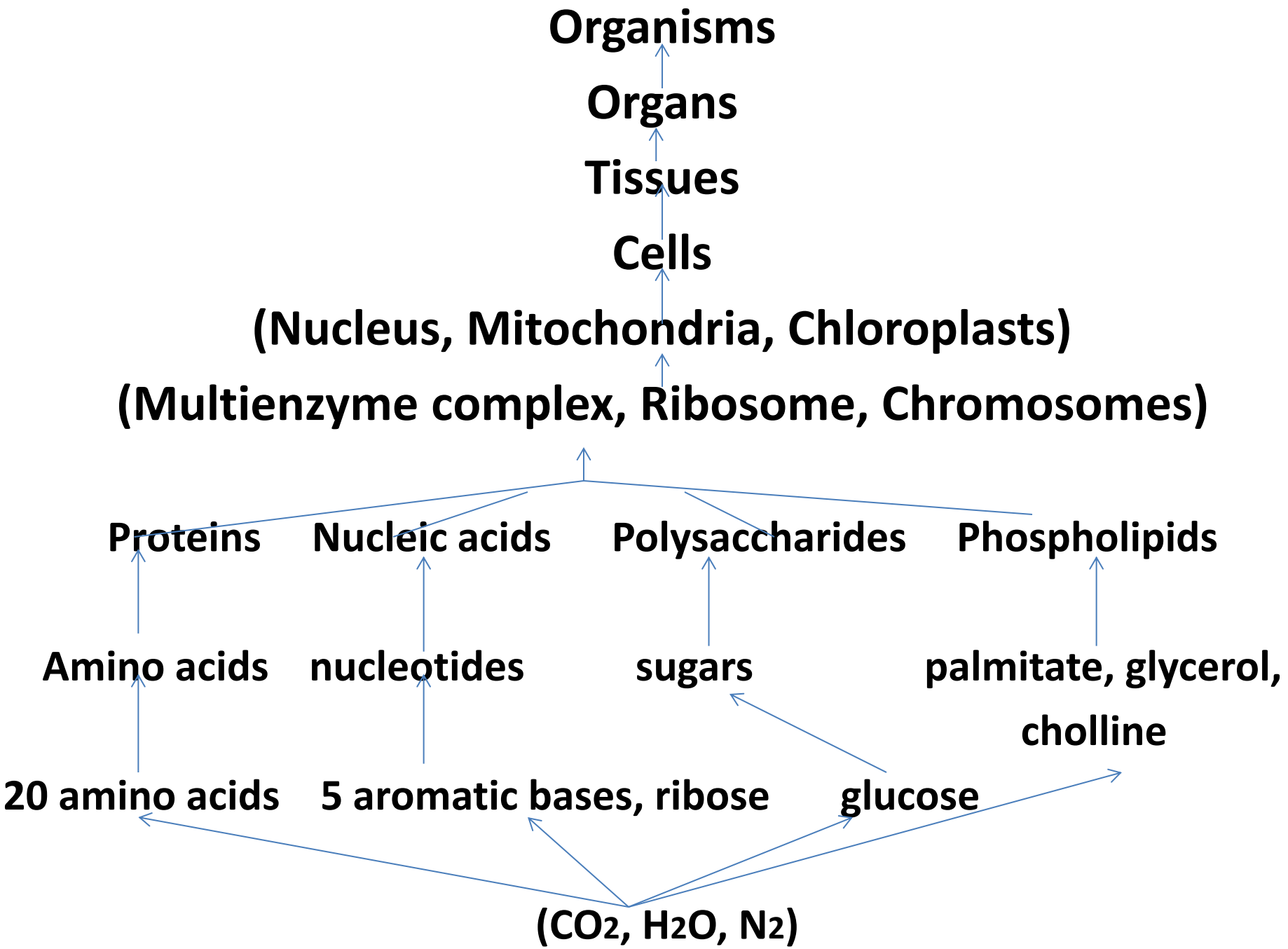


Formation of larger complexes

- **The larger complexes are very high molecular weight as multienzyme complex, ribosomes, chromosomes, membranes and structural elements. The raw materials for building these complex molecules are macromolecules.**

- **The complex molecules aggregate with others to form organelles as nucleus and mitochondria, then form the cells.**

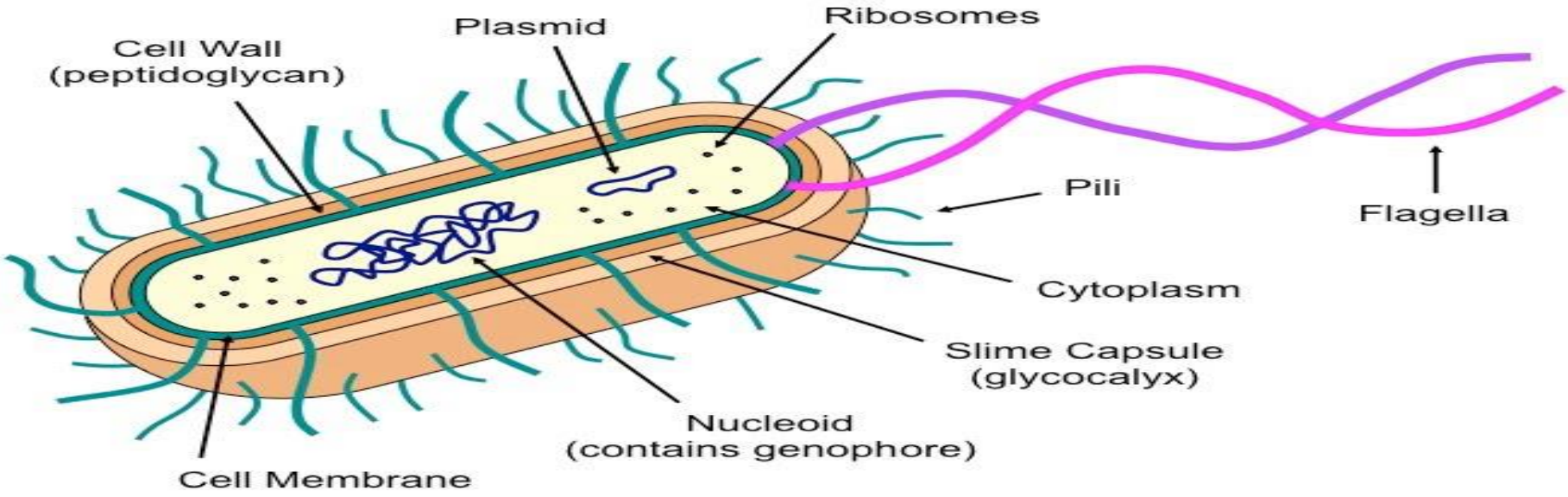
- **The cells form different tissues then they form organs which the organism of.**


Organisms
Organs
Tissues
Cells
(Nucleus, Mitochondria, Chloroplasts)
(Multienzyme complex, Ribosome, Chromosomes)
Proteins
Nucleic acids
Polysaccharides
Phospholipids
Amino acids
nucleotides
sugars
palmitate, glycerol, cholline
20 amino acids
5 aromatic bases, ribose
glucose
(CO2, H2O, N2)

Types of living cells

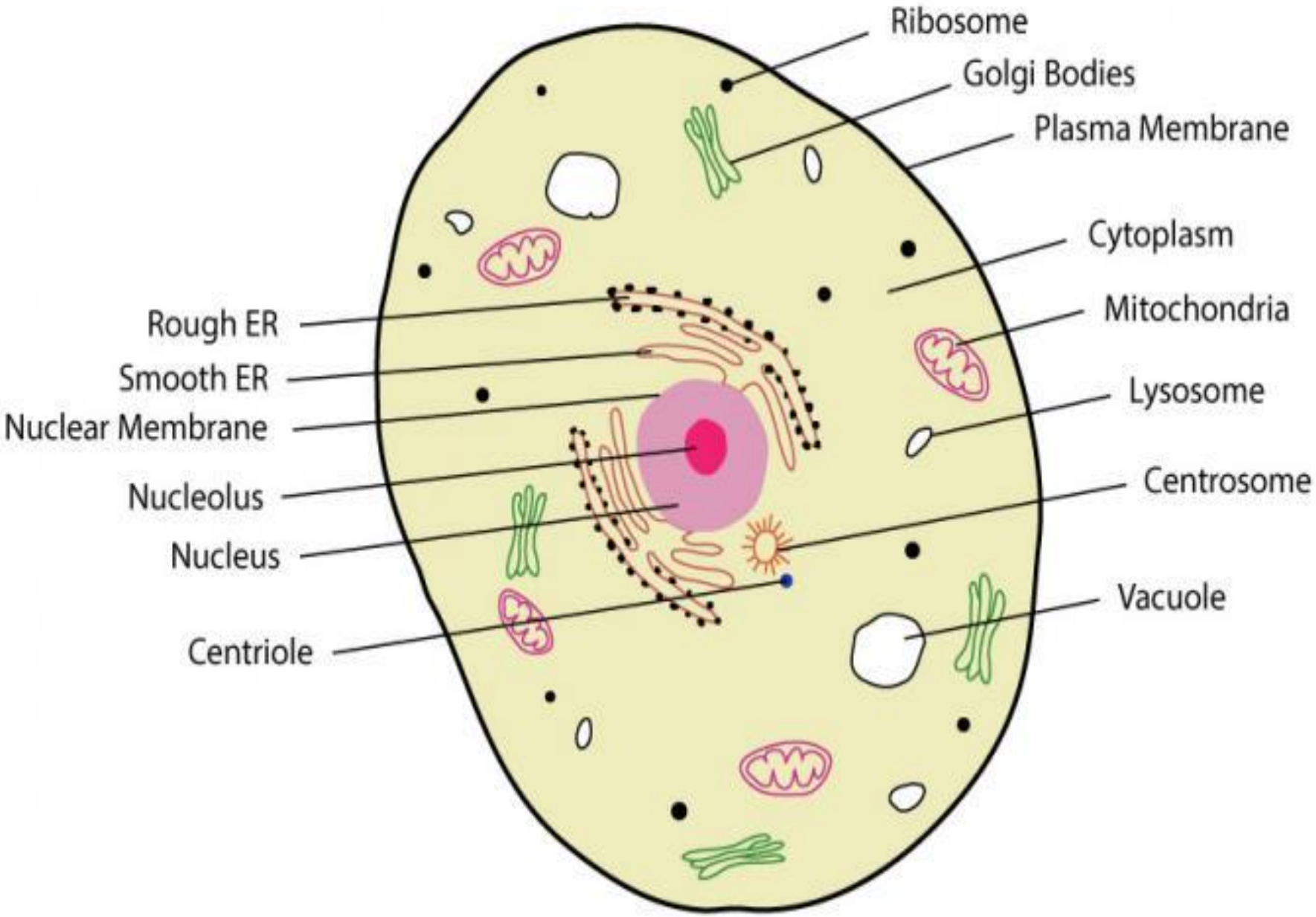
- The cell is the basic structural, functional, and biological unit of all known living organisms. A cell is the smallest unit of life.
- **1- Prokaryotic cells:**

Prokaryotes include bacteria as E- coli and blue-green algae.



2- Eukaryotic cells

- **Eukaryotes are organisms whose cells have a nucleus enclosed within membranes, unlike prokaryotes.**
- **Eukaryotic cells also contain other membrane-bound organelles such as mitochondria and the golgi apparatus, and in addition, some cells of plants and algae contain chloroplasts. Unlike unicellular archaea and bacteria, eukaryotes may also be multicellular and include organisms consisting of many cell types forming different kinds of tissue. Animals and plants are the most familiar eukaryotes.** **H.W**


Ribosome
Golgi Bodies
Plasma Membrane
Cytoplasm
Mitochondria
Lysosome
Centrosome
Vacuole
Rough ER
Smooth ER
Nuclear Membrane
Nucleolus
Nucleus
Centriole