Biology

IST sec.

Lesson 1

Carbohydrates

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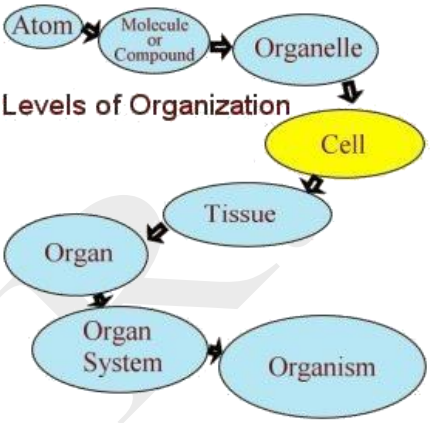
Lesson: 1

Chemical structure of living organism



- The human body

consists of a group of **systems**,

each system consists of a group of **organs** (The organ level)

each organ consists of group of **tissues** (The tissue level)

each tissue consists of a group of **cells** (The cell level)

each cell consists of a group of **organelles** (The organelle level) each organelle consists of a group of **molecules** (The chemical level)

each tissue consists of a group of **atoms**.

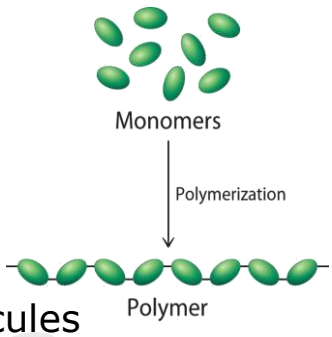
The living cell consists of two types of mplecules

- **Organic compounds (such as biological macromolecules)**
- **Inorganic compounds (Such as water and minerals s NaCl)**

Compare between the organic and inorganic molecules in the cell.

Organic compounds	Inorganic compounds
- They are large molecules. - Mainly contain carbon (C) and hydrogen (H) atoms. - May contain other elements, such as oxygen (O) and nitrogen (N). - They are called biological macro-molecules. Examples: Carbohydrates, lipids, proteins and nucleic acids.	They are molecules that don't contain carbon (atoms) Examples: Water (H2O) and mineral salts (e.g. NaCl)

Biological macro-molecules (Polymers)



Definition:

They are large-sized compounds formed by smaller molecules (monomers) combined together through **polymerization process.**

Polymerization:

It is the process by which the monomers are combined together to form the polymers.

Monomers —**polymerization**→ Polymers

Importance:

They are extremely necessary for the life of the living organisms. **Classification inside the living cell:**

- **They are classified into 4 groups according to their:**
- molecular structure. - functions
- **These 4 groups are**:
- Carbohydrates, Lipids, Proteins, Nucleic Acids.

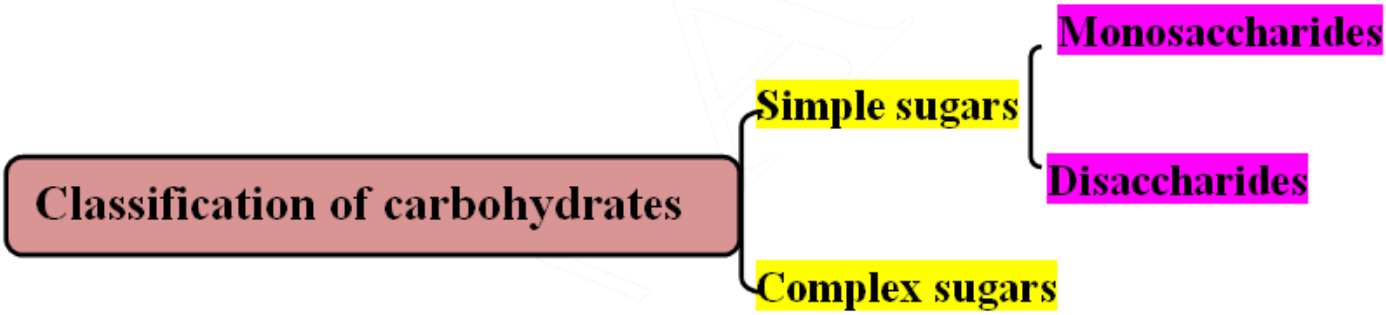
First **CARBOHYDRATES**

- **Definition:**

They are biological macromolecules (polymers) that are made up of many smaller molecules (monomers) called **monosaccharides.**

Monomers	Monosaccharides (such as Glucose, Fructose, Ribose and Galactose)
They include	Sugars, starches and fibers.
General formula	(CH_2O) n e.g. Glucose ($C_6H_{12}O_6$)
Atoms	Carbon (C), Hydrogen (H) and Oxygen (O) atoms in ratio **1:2:1**
Classification	They are classified according to their molecular structure into: Simple Sugars and Complex Sugars

- **Classification of carbohydrates:**



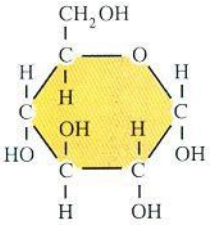
Simple Sugars	Complex Sugars
1- Water soluble 1- Insoluble in water.	
2- Having a law molecular weight 2- Have a high molecular weight.	
3- Having a sweet taste 3- Do not have a sweet taste.	
4- They are two types: Monosaccharides and Disaccharides	

Monosaccharides	Disaccharides
- No. of carbon atoms 3 to 6, made each atom is connected to molecules of oxygen and hydrogen atoms monosaccharides linked in a certain way. together. - The simplest type of sugars (G.R). - Formed of one molecule. Examples : - **Glucose** (grape sugar) - **Fructose** (fruit sugar) - **Ribose** (pentose sugar)(5 C atoms)	- Each molecule is up of two Examples : - **Maltose (malt sugar) :-** Formed of glucose + glucose. - **Lactose (milk sugar) :-** Formed of glucose + galactose - **Sucrose (cane sugar) :-**

SUMMARY

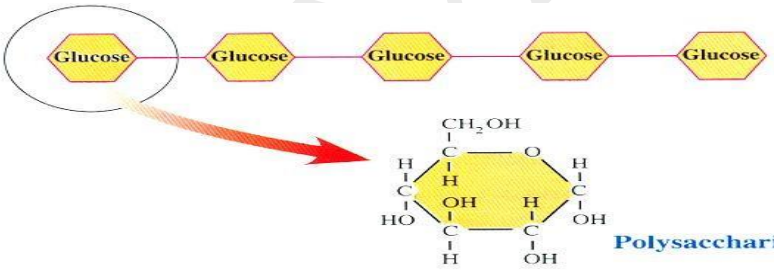
- Monosaccharides, the simplest sugars, number of C atoms = 3:6
- Monosaccharide + Monosaccharide ⟶ Disaccharide. - Glucose + Glucose ⟶ Maltose
- 3 ⟶ Monosaccharides or more Complex Sugars. ⟶
- Glucose + Glucose + Glucose Complex Sugar (Starch, Cellulose, Glycogen)

- **Galactose**. (made in the Formed by glucose + glands that produce milk) fructose



Glucose molecule

- They are made up of many monosaccharides linked together.



Starch molecule (Polysaccharide) is made up of several molecules of monosaccharides (glucose)

Examples - Starch

- Cellulose
- Glycogen
- Each of these molecules conists of glucose molecules linked together.

$(C_6H_{12}O_6)_n$

Role of monosaccharides in energy transferring processes inside the cells: -
Oxidation of glucose occurs inside mitochondria.

- The energy that is stored in chemical bonds of glucose is released to be stored in a ATP molecule (compound called adenosine triphosphate).
- ATP is then transferred to other places in the cell to use the stored energy in it for performing all vital processes inside the cell.

Importance of carbohydrates:

Obtaining energy	They are one of the basic and fast resources for obtaining energy
Storing energy	They are used for storing energy in organisms until be needed, as: 1- **Plants** store carbohydrates in the form of **starch**. 2- **Human and animals** store carbohydrates in the form of **glycogen** in cells of liver and muscles.
Building cells	They are basic component of some parts of the cell, as: - **Cellulose, enters** in the structure of **cell walls of plant cells**. - **Carbohydrates enters** in the structure of in **cell membranes and protoplasm**.

Practical activity:

Detection of simple sugars

- By using **Benedict' reagent** where: color turns from **blue** into **orange**.
- Benedict' reagent is used to detect mono- and di-saccharides.
- Benedict' reagent is used to detect simple sugars in urine and blood.
- Benedict' reagent is used to detect simple sugars in foods.

Detection of starch:

- By using **iodine solution** where: its colour turns from **orange** into **dark blue**.
- Iodine solution is used to detect starch in food samples.
- The degree of the colour of iodine solution depends on the amount of starch in the food samples.

N.B) Diabetic (مرض السكر) and obese patients (مرض السمنه) must keep themselves away from taking sugary and starchy substances.