University of Jordan
Faculty of Medicine

Medical Committee
The University of Jordan

Introduction to

BIOCHEMISTRY

Lecture #: (.....1.....)

■ Sheet ☐ Slides ☐ Other

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Price: .....

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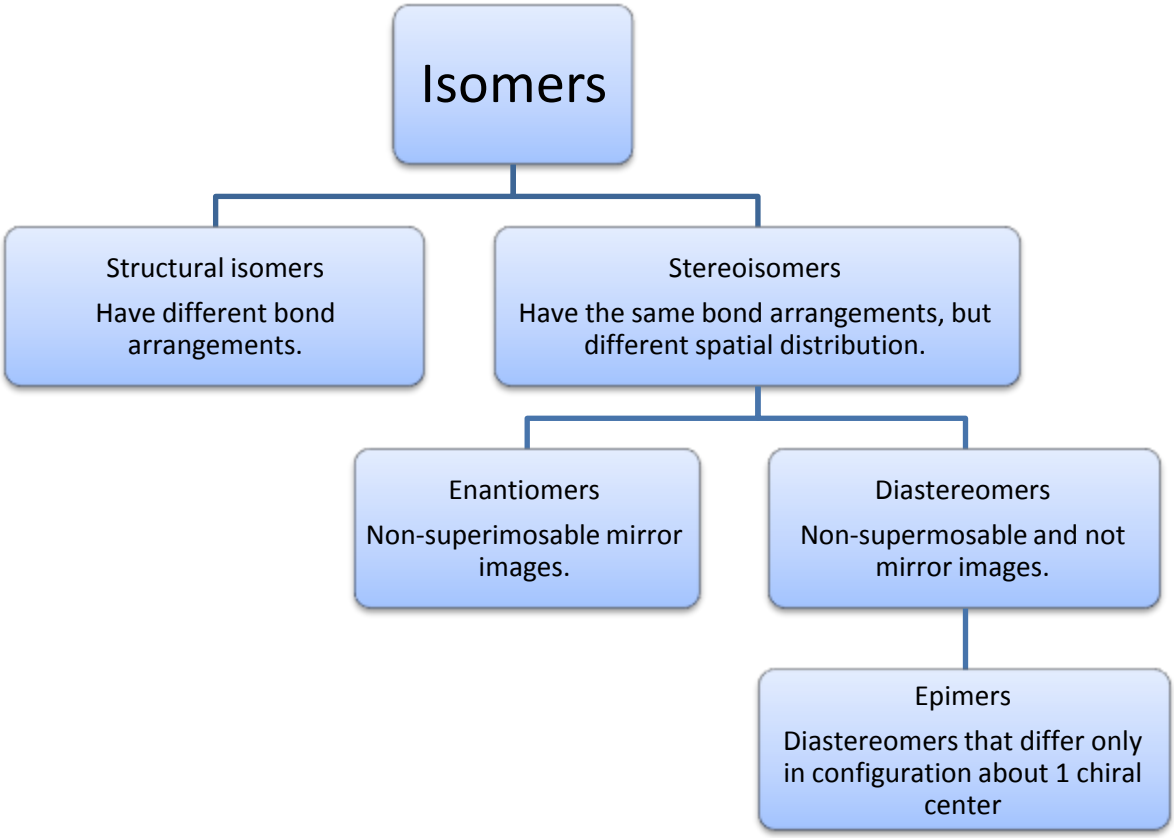
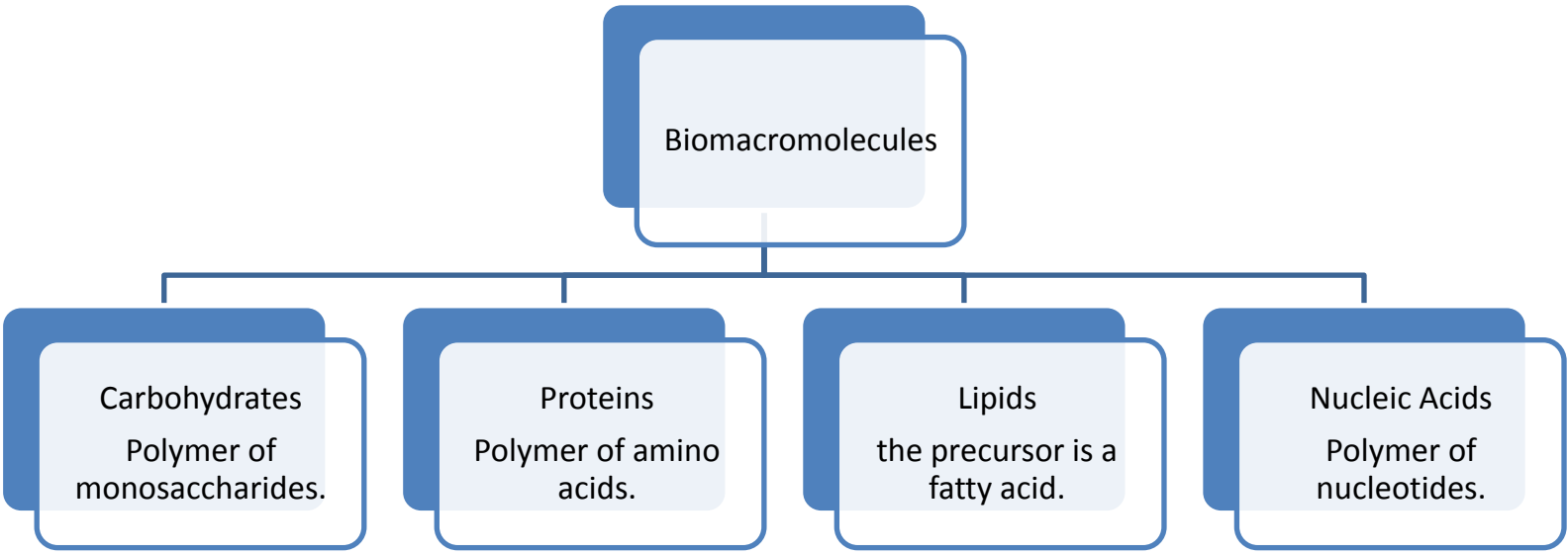
Lecture Outline:

- **Aldoses and Ketoses**
- **Optical isomers**
  -Fischer projection
  -Enantiomers, Diastereomers, and Epimers

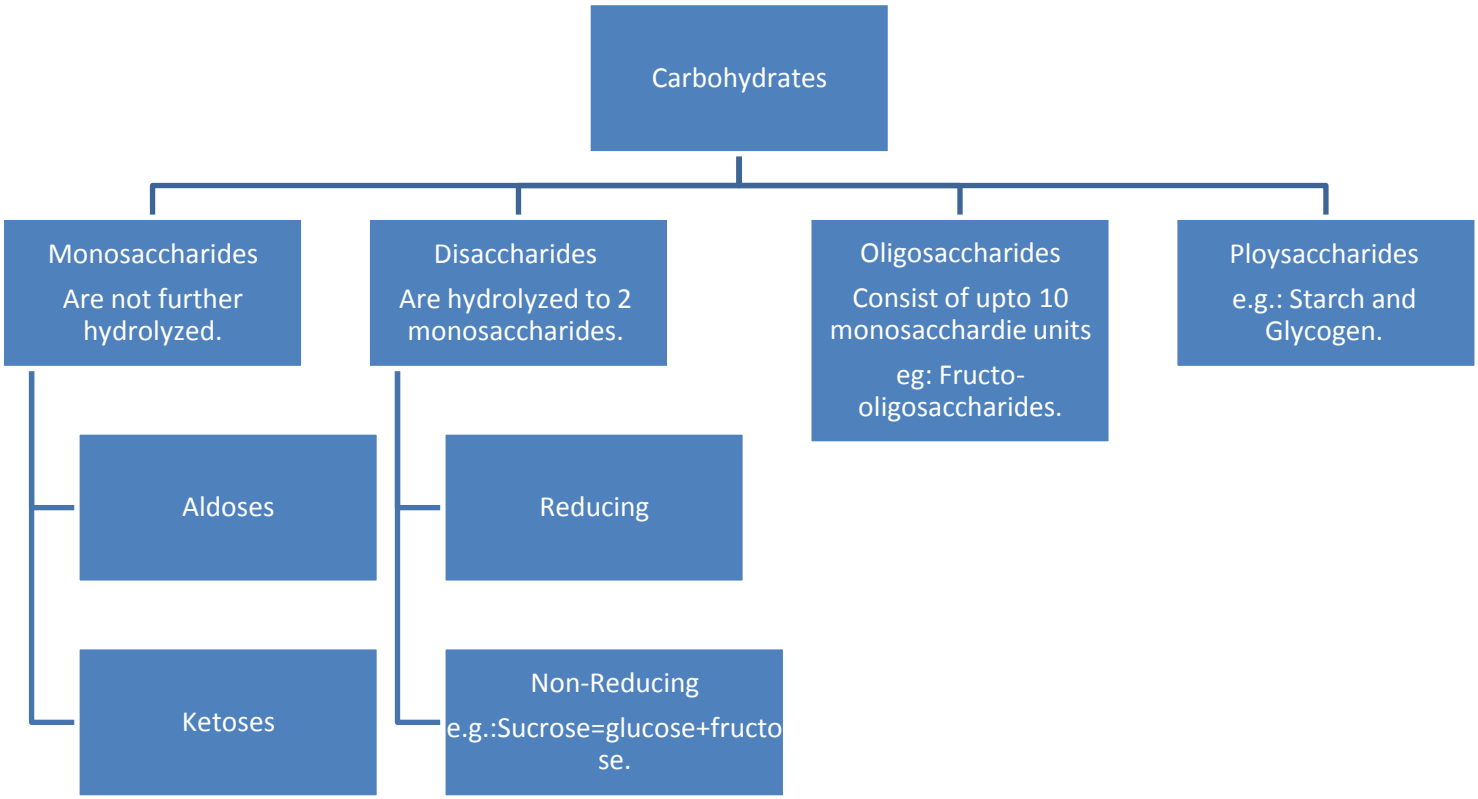
Isomers: Compounds with the same molecular formula, but different structural formulas.



- **Isomers can have similar or different properties. This depends if they have the same or different functional groups.**
- **The presence of a chirality center and lack of plane of symmetry is responsible for the existence of stereoisomers.**
- **A chiral carbon is a carbon atom bonded to 4 different groups, and achiral carbon isn't chiral.**
- **The number of stereoisomers for a compound with "n" stereogenic centers is 2^n.**



- **The monomers of the biomacromolecules share the fact that they possess –H and –OH, so they monomer units can join together in a condensation reaction forming the polymers and water.**
- **While, polymers are broken down-as in digestion taking place in the stomach and intestines-in an enzyme catalyzed hydrolysis reaction.**



Monosaccharides:

- **Are the building blocks of carbohydrates, and have the general formula $C_n(H2O)_n$, where "n" can be between 3-8.**
- **Being the subunits of carbohydrates, this means they can't be hydrolyzed into simpler units.**
- **Monosaccharides can exist as aldose sugars having an aldehyde group (terminal carbonyl group), or as ketose sugars having a ketone group (peripheral carbonyl group).**
- **The simplest carbohydrates are: glyceraldehyde (aldotriose) and dihydroxyacteone (ketotriose).**
- **We classify them according to the number of carbon atoms.**
- **Trisoses are the simplest.**
- **Gylceraldehyde has 1 stereogenic center, thus has 1 pair of enantiomers.**
- **Dihydroxyacteone has no stereogenic centers.**

Functions of carbohydrates:

- **Major energy source, in the process of aerobic respiration glucose is broken down to pyruvate, and then to acetyl-CoA, which enters the Krebs cycle. In Krebs cycle, acetyl-CoA is fully oxidized as electrons are extracted from it and carried by NADH and $FADH_2$ to the electron transport chain to harvest the energy from electrons in order to produce ATP.**
- **Carbohydrates can be used to synthesis lipids and proteins, especially, when they get in excess in the body.**
- **They are associated with vitamins and antibiotics.**
- **Found on cell surfaces aiding in cell-cell recognition, immune recognition and activation of growth factors .**
- **Provide structural support, as cellulose which is present in wood giving it tensile strength and in bacterial cell wall .**

Carbohydrates are rarely found as simple sugars, they are mainly found in complex or bound forms:

- **Polysaccharides (Chitin, cellulose)**
- **Glycoproteins and proteoglycans (hormones and antibodies)**
- **Glycolipids (cerebrosides and gangliosides >> found in CNS)**

- **Mucopolysachharides (Hyaluronic acid, found in joints giving them resilience)**
- **Nucleic acids (DNA and RNA)**
- **Glycosides (a molecule in which a sugar is bound to another functional group via a glycosidic bond)**

Fischer projection:

- **Is a 2 dimensional representation of a 3 dimensional structure.**
- **Horizontal lines represent bonds projecting out of the plane of the paper(toward us)**
- **Vertical lines represent bonds projecting into the plane of paper(away from us)**
- **According to Fischer, D-monosaccharide has –OH on the highest numbered chiral carbon to the right**
- **L-monosaccharide has –OH on the highest numbered chiral carbon to the left.**
  (we numerate according to the highest oxidized carbon)

Pentoses and Hexoses:

- **Pentoses have 3 chiral centers, thus have 2^3 stereoisomers.**
- **Hexoses have 4 chiral centers, thus have 2^4 stereoisomers.**
- **Not all stereoisomers are present in nature with equal amounts. E.g.: D-sugars are more common than L-sugars. In DNA and RNA, only D-deoxyribose and D-ribose are present in their structures.**

Please check the slides ^_^