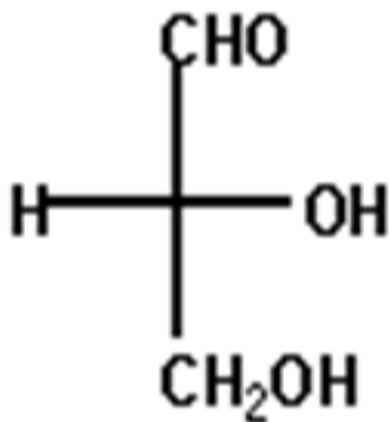


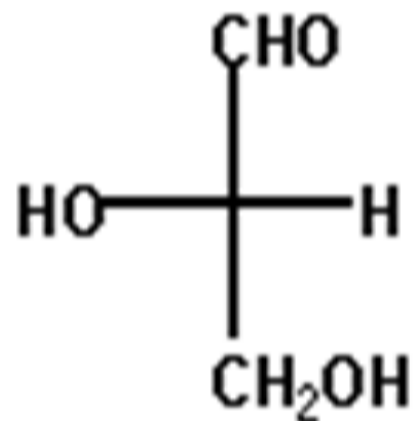
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CHEMISTRY AND BIOLOGICAL ROLE OF CARBOHYDRATES IN THE BODY-1

- **Chiral centers: Asymmetric carbons, i.e carbon atom with four different substituents**
- **Enantiomers : Mirror images Stereoisomers**



D-glyceraldehyde



L-glyceraldehyde



MONOSACCHARIDE DERIVATIVES OF BIOLOGICAL IMPORTANCE

- Oxidation Products (Sugar Acids)**
- Reduction Products (Sugar Alcohols)**
- Amino Sugars**
- Sugar Phosphates**



LECTURE OUTLINE

By the end of the lecture, the student should know:

- ❑ The functions and biological importance of monosaccharides.**
- ❑ The functions and biological importance of disaccharides.**
- ❑ The functions of oligosaccharides.**



IMPORTANCE OF MONOSACCHARIDES:

GLUCOSE

- THE STORAGE FORM OF GLUCOSE IN HUMANS IS GLYCOGEN**
- IN PLANTS IT IS STORED MAINLY IN THE FORM OF STARCH.**
- DIETARY SOURCES: FRUITS, VEGETABLES(IN THE FORM OF STARCH), HONEY**



BIOLOGICAL SIGNIFICANCE

- **BRAIN CELLS, RBCS AND THE GROWING EMBRYO ONLY UTILIZE GLUCOSE AS A SOURCE OF ENERGY.**
- **ENERGY SOURCE FOR CELLS IN THE BODY.**
- **BUILDING BLOCK OF DISACCHARIDES AND POLYSACHHARIDES**
- **IT IS THE SUGAR PRESENT IN BLOOD.**
- **NORMAL VALUES**
 - **FASTING: 70 TO 99MG/DL**
 - **RANDOM:BELOW 140 MG/DL**



DISORDERS ASSOCIATED WITH GLUCOSE

- **DIABETES MELLITUS**

- **GLYCOSURIA**

→ RENAL SUGAR THRESHOLD

**IT IS THE MAXIMUM CAPACITY OF KIDNEYS TO
REABSORB GLUCOSE.**



FRUCTOSE: IMPORTANCE AND BIOLOGICAL SIGNIFICANCE

- **DIETARY SOURCES: FRUIT JUICES, HONEY AND SUGAR CANE.**
- **SWEETEST SUGAR**
- **SEMINAL FLUID IS RICH IN FRUCTOSE.**
- **SPERM UTILIZES FRUCTOSE FOR ENERGY**
- **IN THE SEMINIFEROUS TUBULAR EPITHELIAL CELLS, FRUCTOSE IS FORMED FROM GLUCOSE.**



GALACTOSE: IMPORTANCE AND BIOLOGICAL SIGNIFICANCE

- **DIETARY SOURCE: DIARY PRODUCTS**
- **LESS SWEET THAN GLUCOSE**
- **USED IN THE SYNTHESIS OF MILK SUGAR IN MAMMARY GLANDS**
- **IT IS A CONSTITUENT OF GLYCOLIPIDS AND GLYCOPROTEINS**
- **IT IS REQUIRED FOR THE DEVELOPMENT OF BRAIN AND NERVOUS TISSUE IN INFANTS.**



MANNOSE

- **IT DOES NOT OCCUR FREE IN NATURE**
- **IN THE HUMAN BODY, IT IS FOUND AS A CONSTITUENT OF GLYCOPROTEINS**
- **ITS REDUCTION PRODUCT THAT IS MANNITOL IS IMPORTANT CLINICALLY IN CEREBRAL EDEMA.**



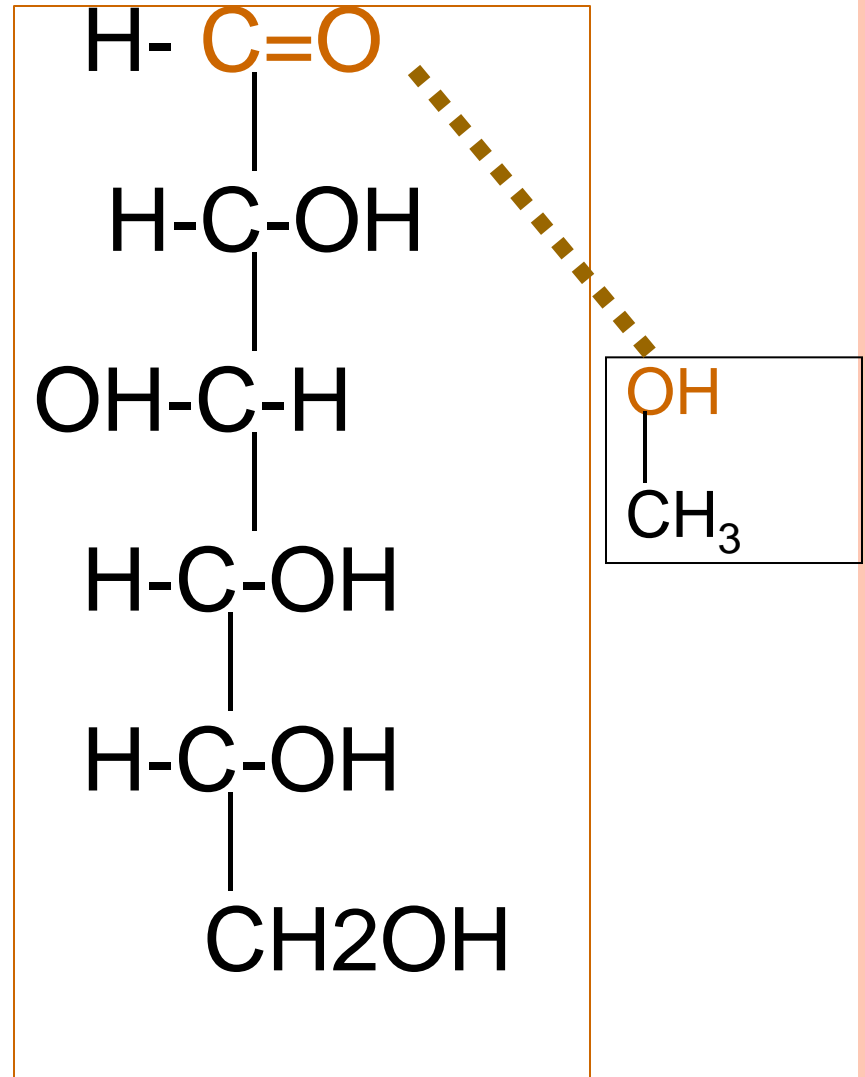
IMPORTANCE OF PENTOSES

- **RIBOSE: IT IS A CONSTITUENT OF NUCLEIC ACID THAT IS RNA**
- **2-DEOXYRIBOSE: IT IS A CONSTITUENT OF DNA**



GLYCOSIDES

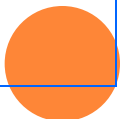
Carbonyl Carbon of a Monosaccharide is attached, by an Acetal linkage, to an Alcoholic group of a second compound. (Acetal is an organic molecule where two separate oxygen atoms are single bonded to a central carbon atom)



Methyl Glucoside

GLYCOSIDES

- **Glycosides are compounds in which:**
 - **A Monosaccharide is attached to an Alcoholic group of a second compound By Glycosidic Linkage.**
- **Glycosidic Linkage is Defined as an:**
 - **Acetal Linkage Between Carbonyl Carbon of a Monosaccharide and Hydroxyl Group of an Another Compound.**

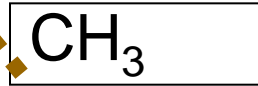
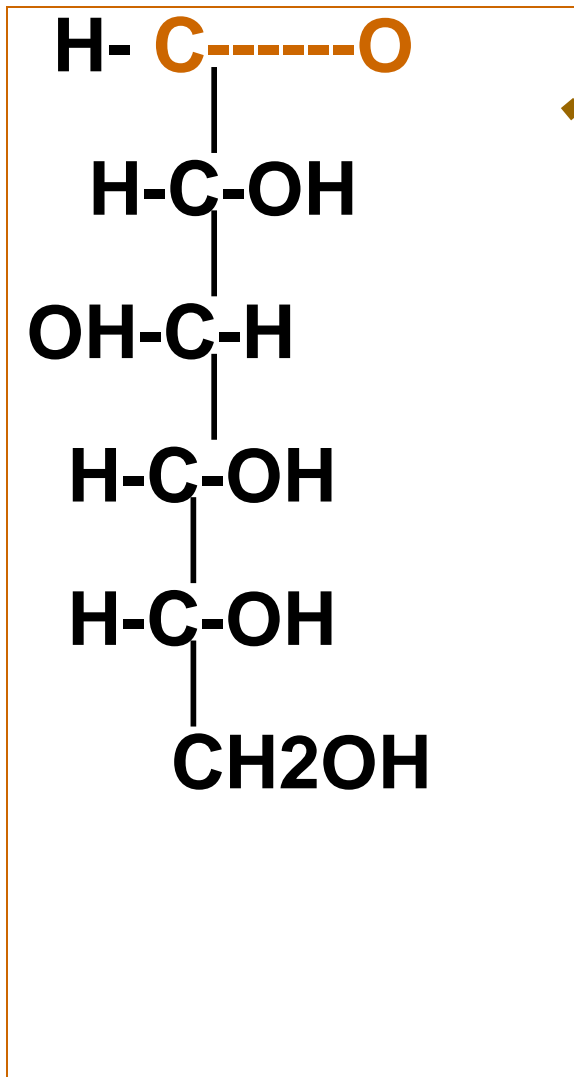


IN GLYCOSIDES OTHER COMPOUND MAY OR MAY NOT BE A MONOSACCHARIDE

- **When the alcoholic compound in a Glycoside is a Non-Carbohydrate it is called Aglycon.**
- **In methyl Glucoside Methyl group is an Aglycon.**



**IN METHYL GLUCOSIDE
METHYL GROUP IS AN
AGLYCON**



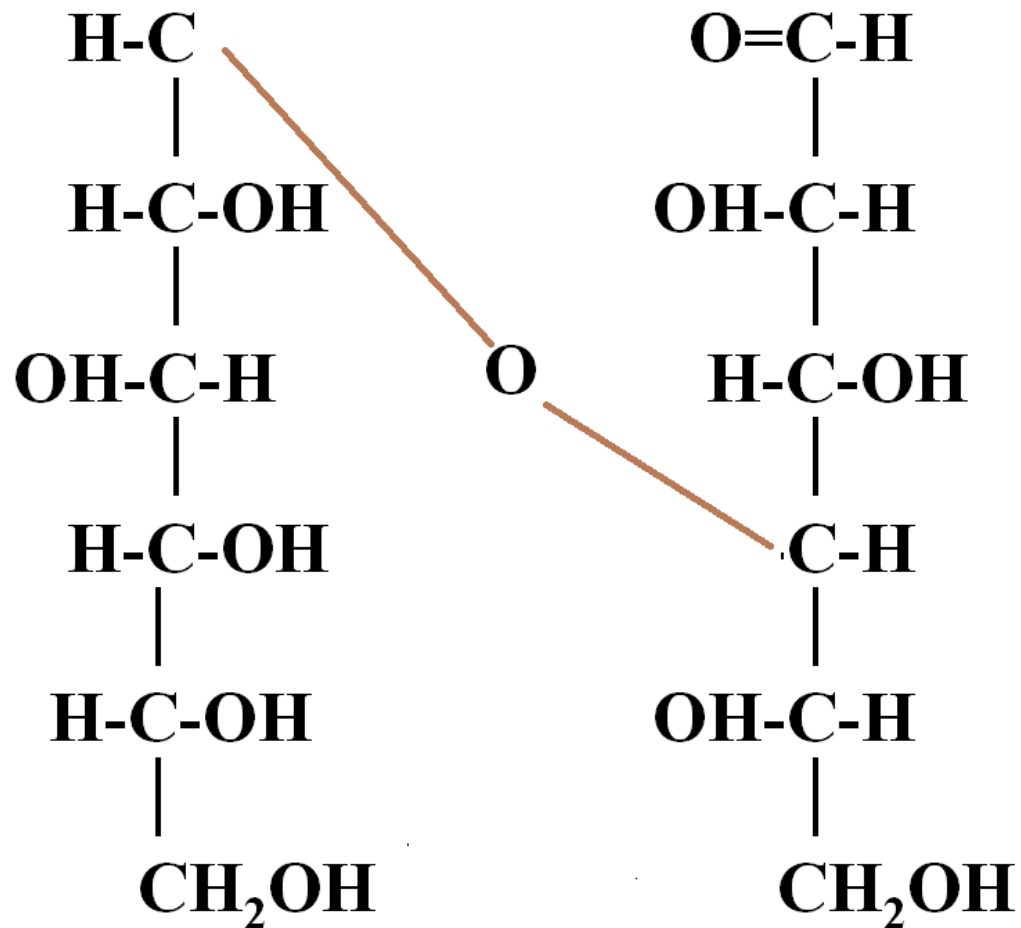
Aglycon

Glycon

Methyl Glucoside



DISACCHARIDES ARE GLYCOSIDES IN WHICH BOTH THE COMPONENTS ARE MONOSACCHARIDES, SUCH AS LACTOSE (GLUCOSE + GALACTOSE)



**GLYCOSIDES ARE NAMED ACCORDING
TO THE MONOSACCHARIDE WHICH CONTRIBUTES
THE CARBONYL CARBON E.G.,**

- **Glucoside**
- **Galactoside**



LACTOSE

- Also called milk sugar because it naturally occurs only in milk.
- On hydrolysis it yields one molecule of glucose and one molecule of galactose which are linked together through 1-4 glycosidic linkage
- Two Monomer Units of Lactose are:-
 - Glucose.
 - Galactose.



BIOLOGICAL SIGNIFICANCE OF LACTOSE

- **Sole source of Carbohydrates in Neonates.**
- **Absorption of Calcium.**
- **Source of Galactose (for developing Brain)**
- **Clinical Aspects.**
 - **Lactosuria (During pregnancy and lactation).**
 - **Lactose intolerance.**



LACTOSE INTOLERANCE:

- **DUE TO THE ABSENCE OF THE ENZYME LACTASE**
- **UNDIGESTED LACTOSE LEADS TO BACTERIAL FERMENTATION IN COLON AND GENERATION OF GASES.**
- **THESE PRODUCTS CAUSE DIARRHEA, BLOATING AND PAIN IN THE GIT.**
- **TREATMENT: FORMULA FEED**



SUCROSE

- It is common table sugar.
- Mainly found in Sugar Cane.
- It has 1,2 glycosidic linkage.
- Two Monomer Units of Sucrose are:-
 - Glucose.
 - Fructose.
- **CLINICAL SIGNIFICANCE:** Small amounts of oral sucrose placed in the infant's mouth reduces procedural pain.



MALTOSE

- **YIELDS UPON THE HYDROLYSIS OF STARCH(AMYLASE)**
- **MADE UP OF TWO MOLECULES OF GLUCOSE**
- **GLYCOSIDIC LINKAGE(1,4)**

CLINICAL SIGNIFICANCE:

- **MALTASE IS DIGESTED BY THE ENZYME MALTASE. BABY FOODS CONTAIN MALTOSE BECAUSE IT IS EASILY DIGESTED.**



OLIGOSACCHARIDES

- **COMPRISED OF THREE TO TEN MONOSACCHARIDES**
- **EXAMPLE: FRUCTOOLIGOSACCHARIDES**
- **CELL MEMBRANE PROTEINS CONTAIN OLIGOSACCHARIDES.**
- **THE OLIGOSACCHARIDE UNITS OF GLYCOPROTEINS ARE RICH IN INFORMATION AND ARE FUNCTIONALLY IMPORTANT.**

