III. Carbohydrates

*Organic compounds made up of C, H, and O (H to O in a 2:1 ratio)

*Carbohydrates include: sugar, starch, cellulose and glycogen

A. Sugars

1. monosaccharides: the simplest type of sugar

a. monosaccharide = one sugar unit

* has 3-7 Carbon atoms

* most familiar are the 6 C monosaccharides: Glucose, Fructose and Galactose

b. Glucose: $C_6H_{12}O_6$, a.k.a. Blood Sugar

*our main energy molecule (4 calories per gram)

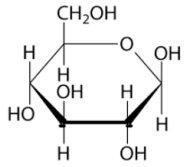
*all sugars and starch are converted into glucose in our bodies

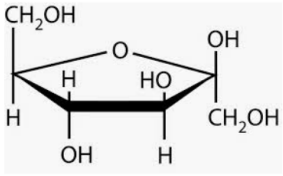
c. Fructose: $C_6H_{12}O_6$, is a sweet-tasting fruit sugar

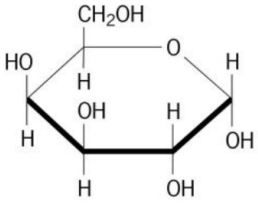
d. Galactose: $C_6H_{12}O_6$, is part of the sugar found in milk

e. Isomers: different compounds with the same chemical formula

* Isomers have different structures







2. Disaccharides: "two-sugar units" or "double sugar"

a. Formed by chemically joining two monosaccharides (dehydration synthesis)

b. The three most common disaccharides: sucrose, lactose and maltose

c. sucrose, lactose and maltose all have the chemical formula $C_{12}H_{22}O_{11}$

they are all Isomers

d. sucrose: table sugar is made by joining glucose and fructose

e. lactose: sugar in milk is made by joining glucose and galactose

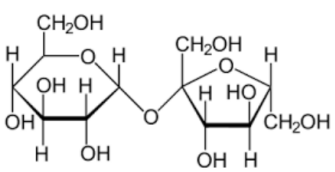
f. maltose: malt sugar is made by joining glucose and glucose

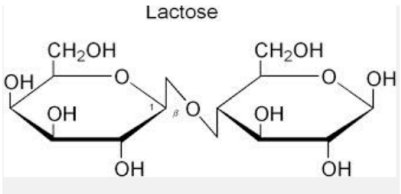
g. To digest one of these sugars, our body must break the disaccharide down and form two monosaccharides.

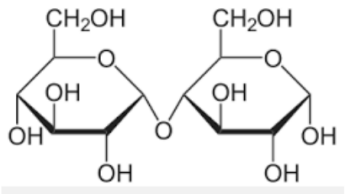
*hydrolysis: the chemical reaction that breaks down macromolecules

h. $C_6H_{12}O_6 + C_6H_{12}O_6 \longrightarrow C_{12}H_{22}O_{11} + H_2O$

i. $C_{12}H_{22}O_{11} + H_2O \longrightarrow C_6H_{12}O_6 + C_6H_{12}O_6$



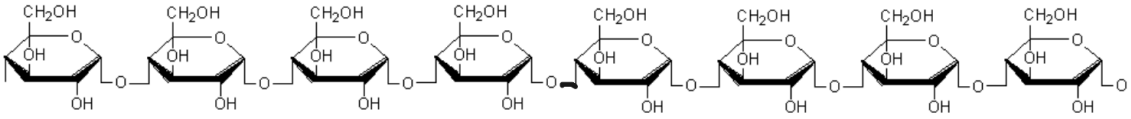




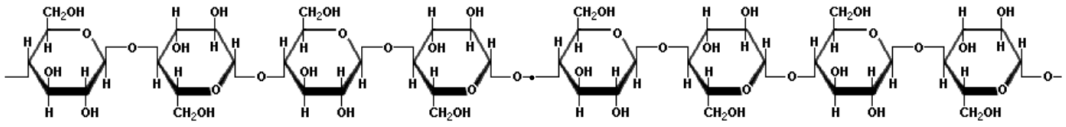
B. Polysaccharides: "many sugar units"
1. Polymer: a large molecule (macromolecule) made up of repeating units
   a. monomer: a small molecule that joins together to form a polymer
2. Polysaccharides are polymers of glucose
   a. glucose is the monomer that makes all polysaccharides
   b. dehydration synthesis builds polymers including polysaccharides
   c. hydrolysis breaks down a polymer into the individual monomers
3. Common Polysaccharides: starch, cellulose, and glycogen
   a. starch: produced by plants to store energy
      *starch serves as a food source for other organisms (4 calories/gram)
   b. cellulose: a structural carbohydrate that makes plant cell walls
      *we cannot digest cellulose for energy; Dietary Fiber
   c. glycogen: produced by humans and other animals to store glucose
      *stored in our liver and muscles
      *provides quick energy source and helps control blood-sugar

C. Functions of Carbohydrates
1. Provide and store energy (4 calories per gram)
2. Build structures like cell walls

Starch



Cellulose



Cellulose Cellulose

Glycogen