

Carbohydrates

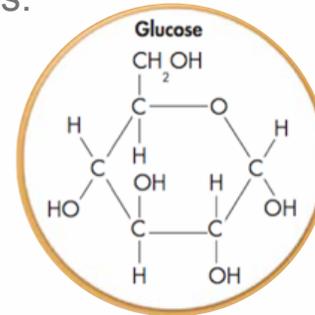
Life Science: Molecular

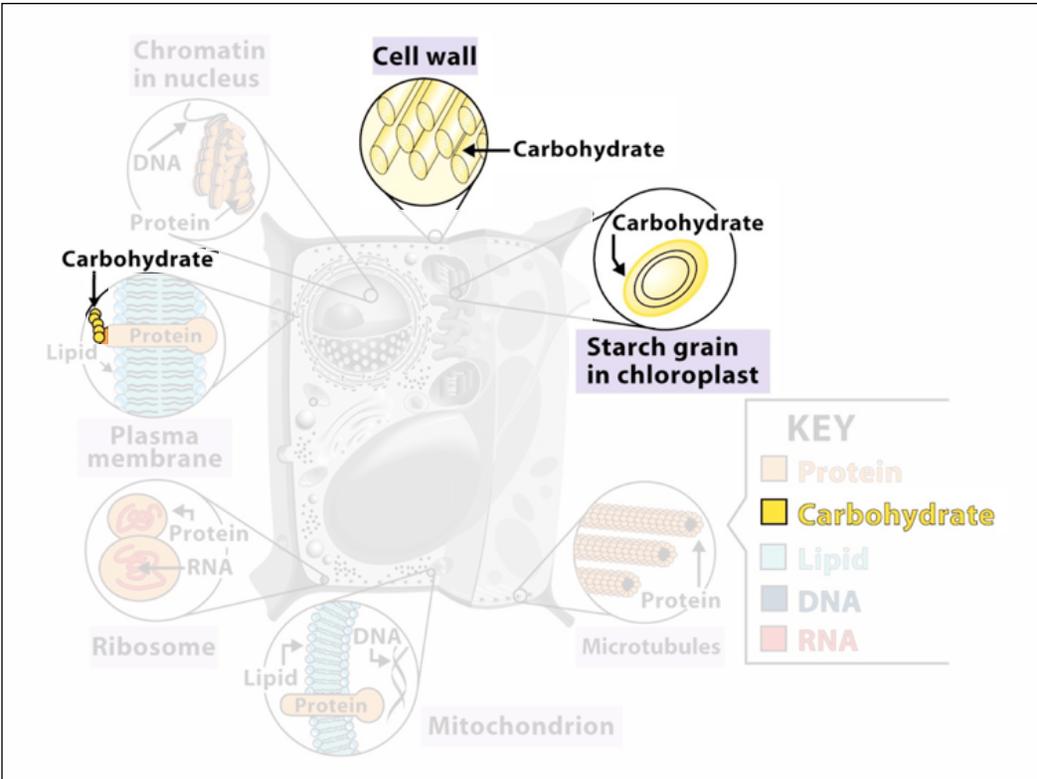
Carbohydrates

- ♦ Carbohydrates are made up of carbon, hydrogen, and oxygen atoms ($C_6H_{12}O_6$).

carbo-hydrate $\rightarrow (C + H_2O)_6$

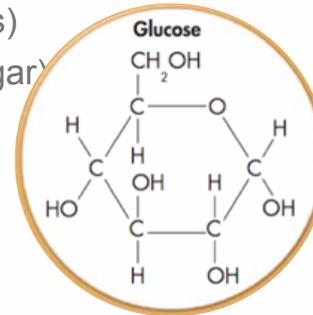
- ♦ Main source of energy for living things.
- ♦ Structure in some organisms.





Monosaccharides

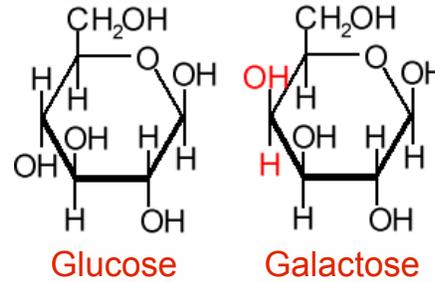
- ♦ Monosaccharides are the building blocks of carbohydrates.
- ♦ Very soluble in water.
- ♦ Three dietary monosaccharides:
 - Glucose (known as grape sugar; found in blood)
 - Fructose (common sugar in plants)
 - Galactose (component of milk sugar)



sacchar is the Greek word for sugar

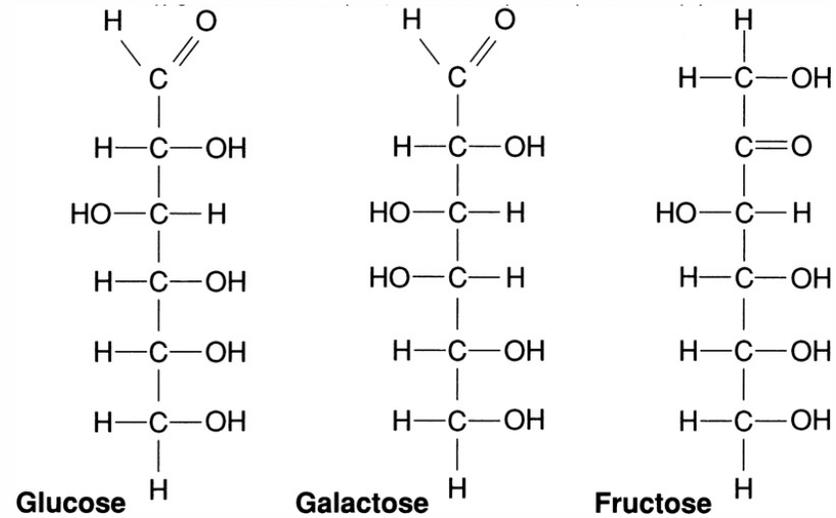
Isomers

- ♦ Isomers are molecules with the same chemical formula, but different molecular structures.
- ♦ Glucose and Galactose have the same molecular formulas, $C_6H_{12}O_6$.



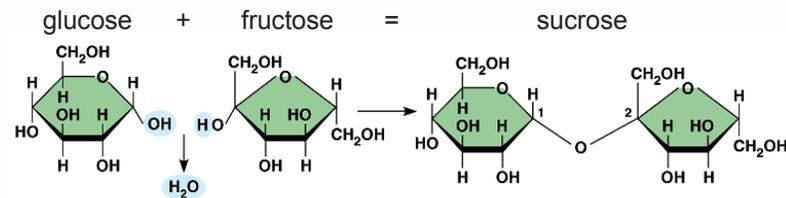
Isomers

- ♦ 5 and 6 carbon sugars form rings in aqueous solutions.



Dehydration Synthesis

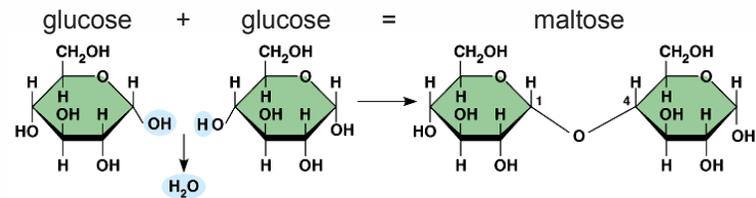
- ♦ Monosaccharides are combined through a process called dehydration synthesis.



Disaccharides

♦ Disaccharides are carbohydrates made from the combination of two simple sugars.

- Maltose = glucose + glucose
- Sucrose = glucose + fructose
- Lactose = glucose + galactose

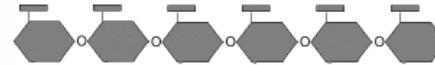


Polysaccharides

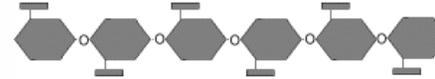
♦ Polysaccharides are complex carbohydrates made from long chains of monosaccharides.

- Amylum (plant starch)
- Cellulose (plant fiber)
- Glycogen (animal starch)
- Chitin (fungi and arthropods)

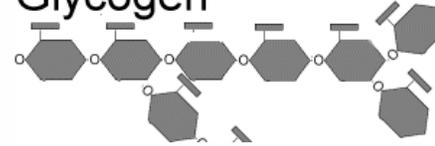
Starch



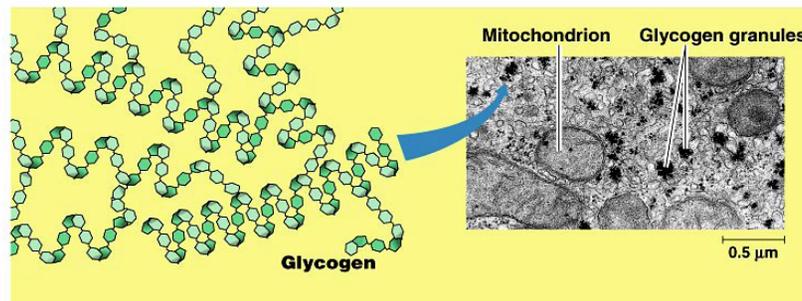
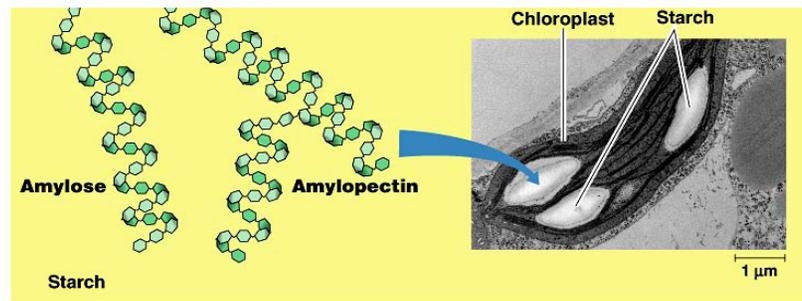
Cellulose



Glycogen

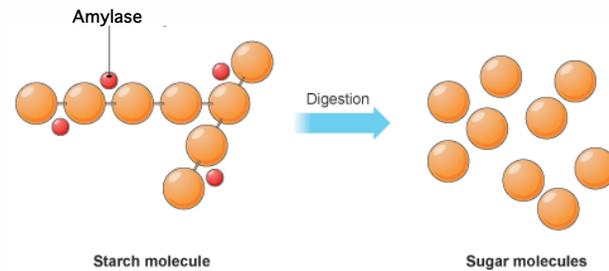


Polysaccharides

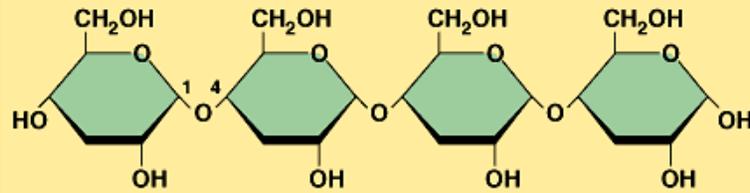


Digestion

- ◆ Polysaccharides are digested through the process called **hydrolysis**.
- ◆ Enzymes aid in the digestion of starches into simple sugar molecules.

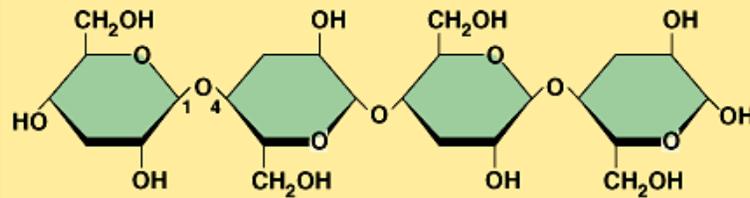


Digesting Starch Vs. Cellulose



(b) Starch: 1-4 linkage of α glucose monomers

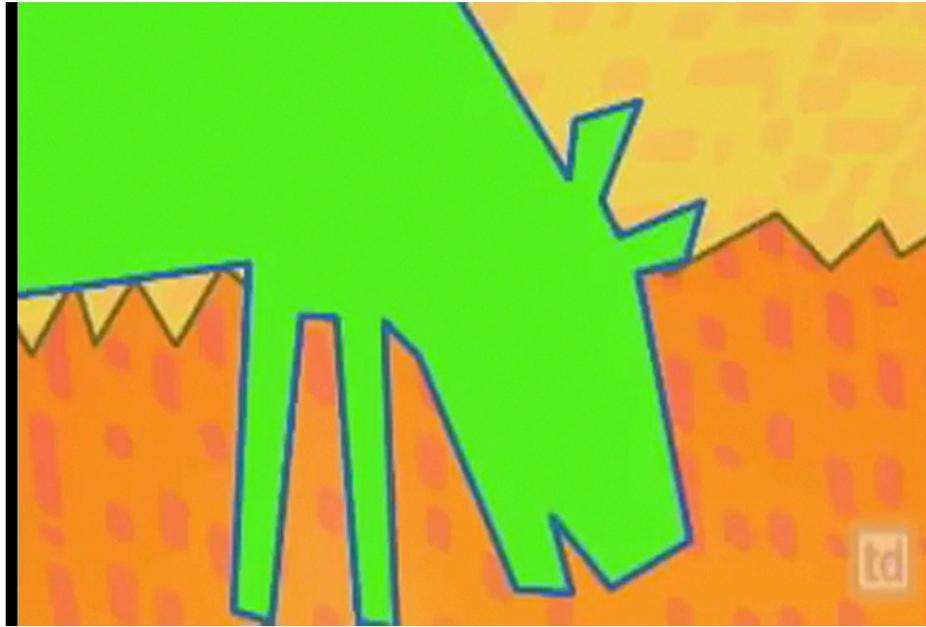
Starch: All the glycosidic linkages are on the same side; molecule lies flat.



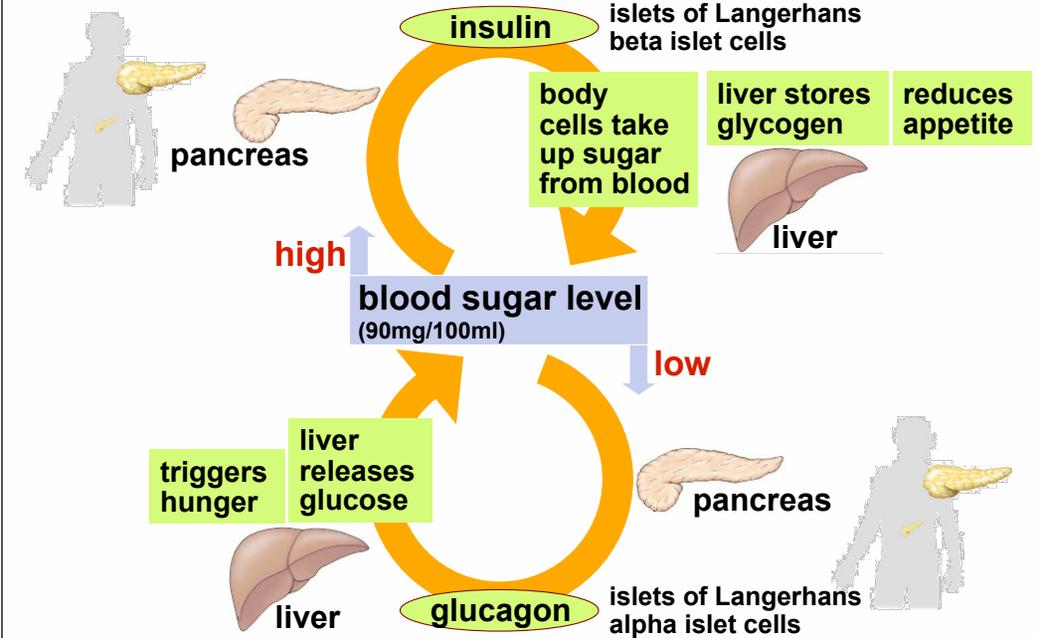
(c) Cellulose: 1-4 linkage of β glucose monomers

Cellulose: Cross linking between monomers results in rigid structure.

Lactose Intolerance

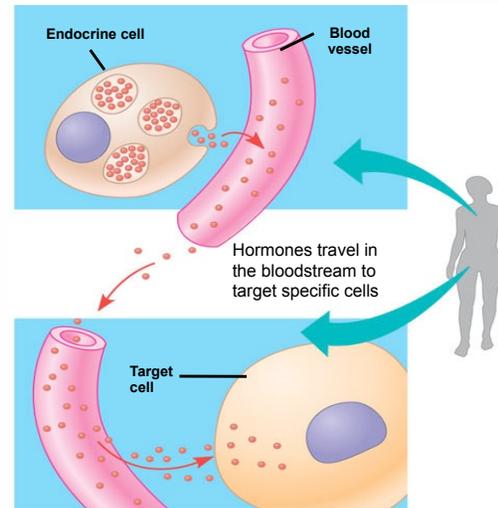


Regulation of Blood Sugar



Endocrine System

- The **endocrine system** involves glands that secrete hormones throughout the body.
- **hormones** are long-range communication molecules distributed through interstitial fluids.



Hormonal signaling. Specialized endocrine cells secrete hormones into body fluids, often the blood. Hormones may reach virtually all body cells.

Carbohydrate Indicators

- ♦ Iodine is a commonly used indicator for polysaccharides. A color change to indigo indicates a positive result for polysaccharides.



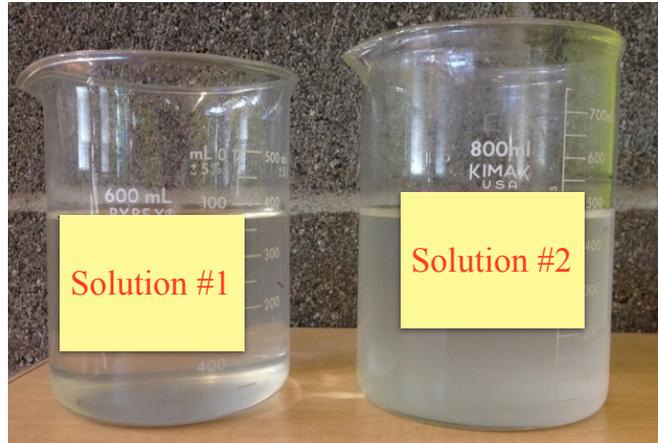
Carbohydrate Indicators

- ◆ Benedict's Solution is a commonly used indicator for monosaccharides. When heated, a color change from blue to green, yellow, orange, or red indicates a positive test.



Increasing Sugar Content →

Testing for Carbohydrates



Is there starch?
Is there sugar?

<http://ed.ted.com/lessons/sugar-hiding-in-plain-sight-robert-lustig>