

Carbohydrates, Lipids, and Proteins

3.2

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Organic vs. Inorganic compounds

- Organic compounds
 - contain carbon and are found in living organisms
 - Exceptions: hydrocarbonates, carbonates, oxides of carbon. CO_2
- Inorganic compounds
 - Do not contain carbon

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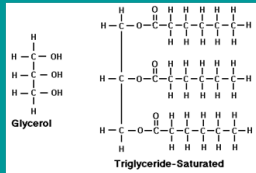
Basic types of organic biological molecules:

Category	Subcategory	Example Molecules
carbohydrates	monosaccharides	glucose, galactose, fructose
	disaccharides	maltose, lactose, sucrose
	polysaccharides	starch, glycogen, cellulose
proteins		enzymes, antibodies, hormones
lipids		triglycerides, phospholipids
nucleic acids		DNA, RNA

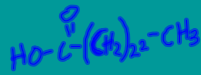
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Fatty acids

- basis of the phospholipid bilayer of the cell membrane (phospholipids = fatty acids + phosphate group)
- Triglycerides, a very common organic molecule consist of 3 fatty acids + glycerol

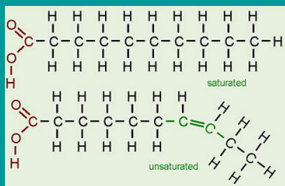


fatty acid
example:



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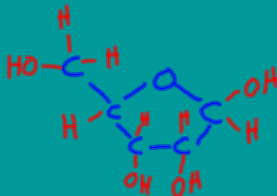
- If there are no double bonds between carbon atoms on the fatty acid (as many hydrogens as possible are attached) it is called a *saturated fatty acid*
- If there are double bonds the fatty acid is considered *unsaturated*



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Ribose

- Sugar found in RNA (type of nucleic acid)
- One of the most important molecules in photosynthesis (ribulose biphosphate binds carbon dioxide in the Calvin Cycle)
- 5 carbon ring structure

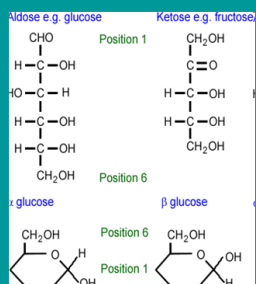


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Carbohydrates can be divided into three groups based on their structure:

Monosaccharides

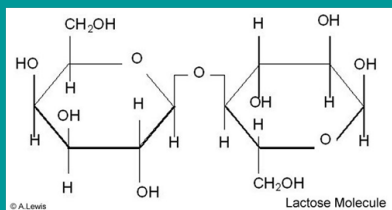
- Simple sugars
- e.g. glucose, galactose, and fructose



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Disaccharides

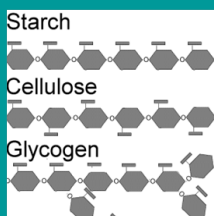
- Two simple sugars put together
- e.g. maltose, lactose, and sucrose



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Polysaccharides

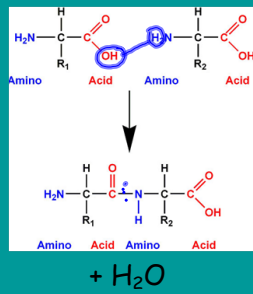
- More complex; composed of multiple types of sugars
- e.g. starch, glycogen, and cellulose



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Condensation and Hydrolysis

- Condensation = the removal of water from monomers during the synthesis of polymers
 - e.g. removing water so that amino acids may bond together to form proteins



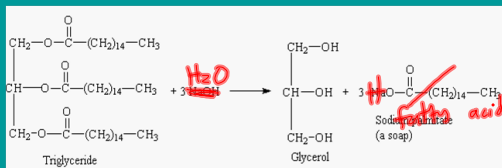
Anabolic reaction

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Hydrolysis = the addition of water to polymers to break them down into monomers

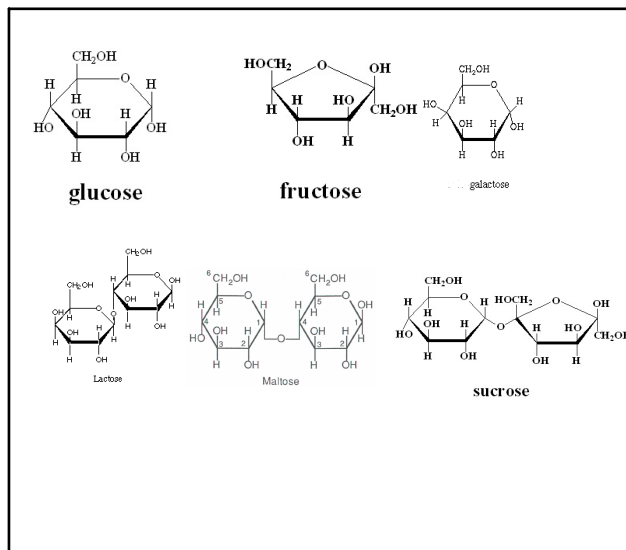
- e.g. breaking triglycerides down into glycerol and 3 fatty acids.

Catabolic reaction



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Functions of lipids

- Energy Storage (long term)
 - solid triglycerides = fat (animals)
 - liquid triglycerides = oil (plants)

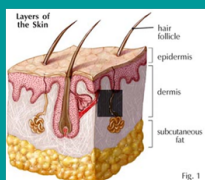


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Thermal insulation

- A layer of fat beneath the skin (called subcutaneous fat) insulates against heat loss
- blubber is essential for many cold weather animals.



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Buoyancy

- Lipids are less dense than water and therefore help animals to float



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Carbohydrates vs. lipids for energy storage

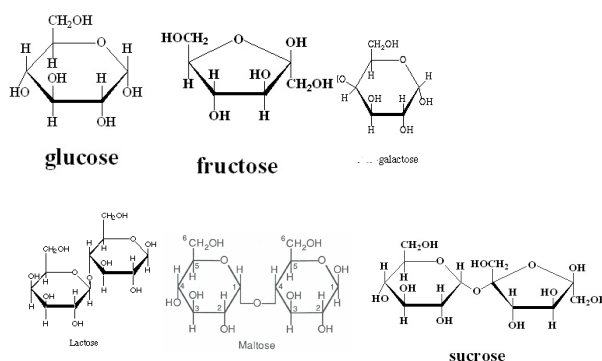
Carbohydrates

- Store less energy per mass
- More accessible (easier to break down)
- More soluble in water and therefore easier to transport in the blood stream

Lipids

- More energy per unit of mass (2x)
- Insoluble in water

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