

Nutrients, Enzymes and Digestion: Lesson 1: Chemicals of Life

Curricular connection: describe the chemical nature of carbohydrates, lipids and proteins

- The chemicals that our bodies are composed of can be broken down into the 5 groups seen below:

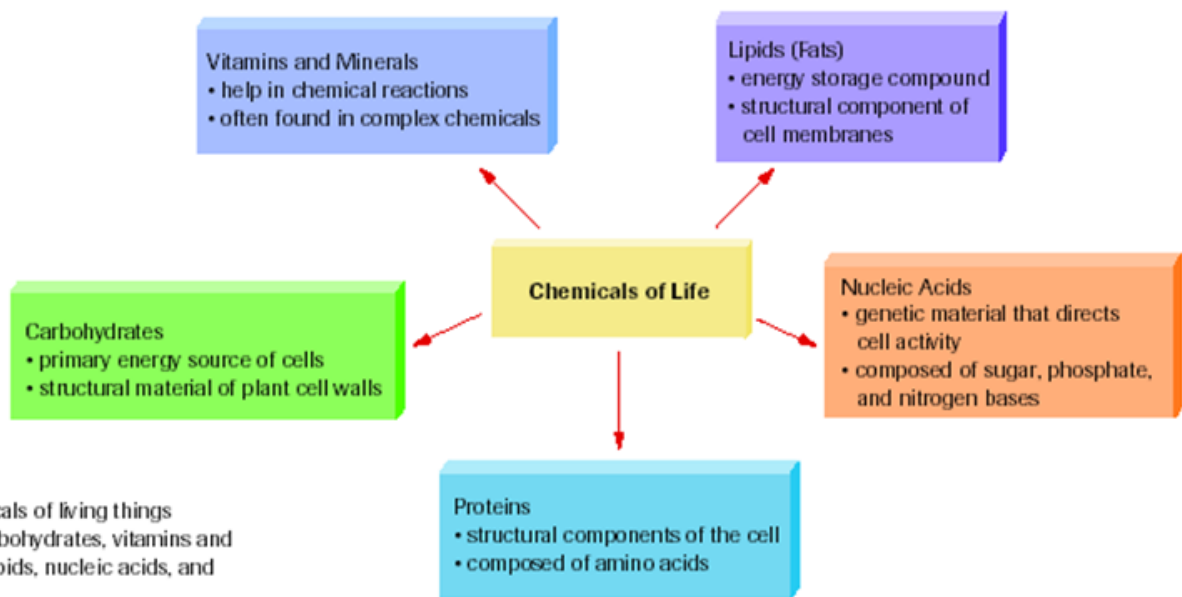


Figure 1

The chemicals of living things include carbohydrates, vitamins and minerals, lipids, nucleic acids, and proteins.

- The food we eat falls into 3 main categories:
 - Carbohydrates
 - Lipids (fat)
 - Proteins
- Vitamins and minerals are also **necessary**, but in much smaller amounts

<http://youtu.be/ISZLTJH5IYg>

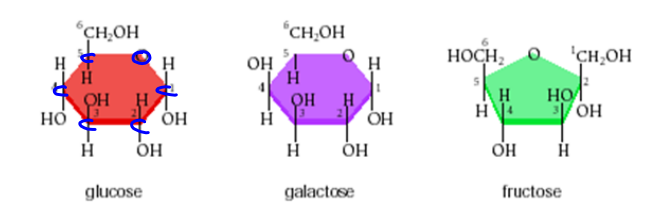
Carbohydrates

Carbohydrate - a molecule composed of sugar subunits that contain carbon, hydrogen, and oxygen in a 1:2:1 ratio $C_6H_{12}O_6$

- Carbohydrates are often described as **energy** nutrients.
- They provide a fast source of energy and make up the largest component in most diets.

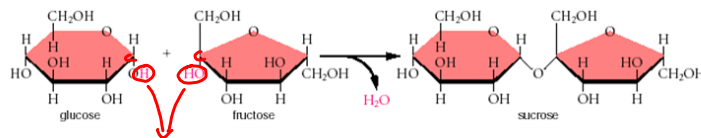
Carbohydrates can also be classified according to the number of sugar units they contain.

- **Monosaccharides** are the simplest sugars, containing a single sugar unit.
 - Glucose, galactose, and fructose are three common monosaccharides.



- **Disaccharides** are the combination of two monosaccharides

- Sucrose, maltose and lactose are common disaccharides
- Are formed from a reaction called **dehydration synthesis**



- These reactions are also called **condensation** reactions
- The reverse of these reactions are called **hydrolysis**

Polysaccharides are carbohydrates formed from the union of many monosaccharides

- **Plants** store carbohydrates in the form of a polysaccharide called **starch**.
- **Animals** store carbohydrates in the form of a polysaccharide called **glycogen**.
- Plant cell walls are made up of the polysaccharide **cellulose**.

http://www.nelson.com/ABbio20-30/teacher/protect/otr/Bio2030OTR/attachments/i_AnimationSimulation/reaction_types.html

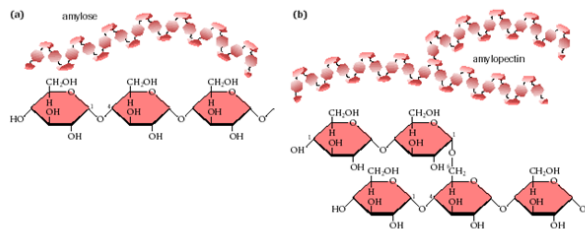
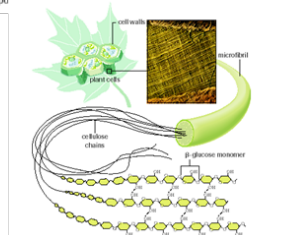


Figure 4
 (a) Amylose is an unbranched polymer of glucose.
 (b) Amylopectin is a branched polymer of glucose.

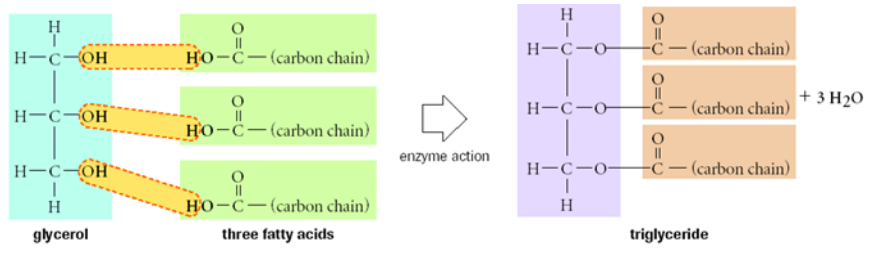
glycogen is the form of carbohydrate storage in animals



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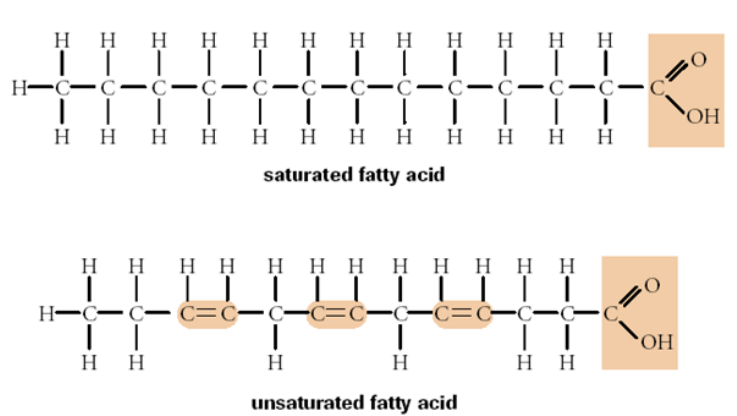
Lipids

- Lipids are molecules made up of a **glycerol** and **fatty acids**
- **Triglycerides** are a common lipid made from one glycerol molecule and 3 fatty acid molecules



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- Fats and oils are two main groups of lipids
 - **Fats** are made up of a glycerol unit and **unsaturated** fatty acids
 - **Oils** are made up of a glycerol unit and **saturated** fatty acids

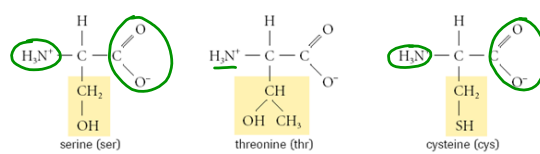


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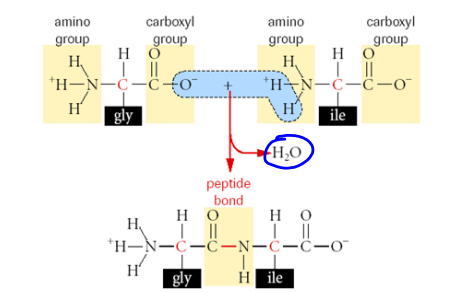
- Lipids are important for
 - longer term energy storage- excess carbohydrates are converted into lipids (fat)
 - key components in cell membranes (phospholipid bilayer)
 - cushion delicate organs of the body (brain)
 - carry vitamins in throughout our body
 - serve as the building blocks for hormones
 - insulation (keep us warm)

Proteins

- o Unlike carbohydrates and fats, proteins are not primarily energy compounds.
- o Proteins are used as structural components of cells
- o Cytoplasmic organelles like the mitochondria and ribosomes are composed largely of protein.
- o The predominant part of muscles, nerves, skin, and hair is protein.
- o **Antibodies** are specialized proteins that help the body defend itself against disease;
- o **Enzymes** are proteins that speed chemical reactions.
- o Like lipids and carbohydrates, proteins are composed of carbon, hydrogen, and oxygen. However, proteins contain nitrogen and, often, sulfur atoms as well.
- o Like sugars and lipids, proteins can supply energy for the tissues, although energy production is not their main function.
- o A protein is a chain ^{of} **amino acids**



- o There are 20 different amino acids
 - The human body can manufacture some amino acids but others must come from proteins in our diet
 - **essential amino acids** are the ones our body cannot make
- o Proteins are made through dehydration synthesis just like lipids and carbohydrates



http://www.nelson.com.au/Bo/20_30/teacher_resource/Bo/20/30/11P/attachments/_AnimationSimulation/peptide_bonding.html

- o When we digest proteins, we break them down into the individual amino acids which are then carried by our blood to where they are needed
- o Strings of amino acids are called **polypeptides**
- o Polypeptides then fold into proteins

