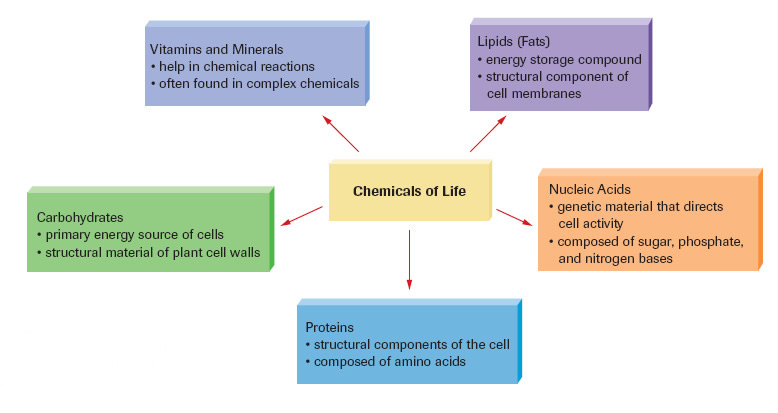
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**Chapter 8: Nutrients, Enzymes and the Digestive System**

**8.1 : Essential Nutrients (page 242-253)**

Essential Nutrients



**Carbohydrates**

* The human body is not able to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* We rely on plants to produce carbohydrates through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Carbohydrates are in foods such as potatoes, pasta, rice, bread, corn, and fruit etc.
* Carbohydrates provide our bodies with a with a fast source of \_\_\_\_\_\_\_\_\_\_\_\_but excess amounts of carbohydrates turn into \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Carbohydrate Chemistry

* Carbohydrates are made up of simple sugar units containing\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_ in the ratio of 1:2:1
* eg. triose C3H6O3, glucose (in human blood) fructose C6H12O6 (plant sugar in fruits)
* Carbohydrates are classified according to the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_units they contain

Types of Carbohydrates

**A**.   **Monosaccharide**: \_\_\_\_\_\_\_\_\_\_\_\_\_simple sugar unit (monomer), with a 1:2:1 ratio

example – glucose, fructose, ribulose, and glactose

* **Glucose (C6H12O6)**
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* our primary energy source
* excess is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and muscles as **glycogen** (a polymer of glucose)
* amount in blood is influenced by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which is a hormone produced by the pancreas
* **2. Fructose**
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* very sweet, added to cereals for flavour
* an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of glucose

**3. Ribulose**

- part of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecule and forms part of our \_\_\_\_\_\_\_\_\_\_\_\_\_\_

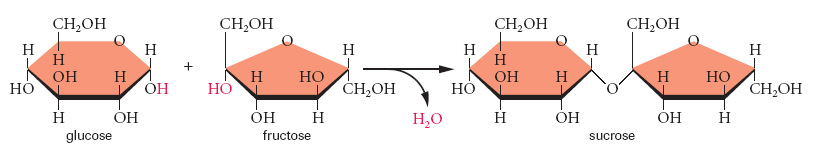
**4. Galactose**

- The sugar found in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of glucose

**B. Disaccharides**

* **Disaccharide**: are made up of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ sugar units
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are bound together by a process called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: in which a water molecule is removed from two monosaccharide molecules. (glucose + glucose = maltose + **water**)
* The opposite reaction (splitting disaccharides) releases water and is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



1.Maltose (brown sugar):

- composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ glucose molecules

- glucose + glucose → maltose + H2O

2. Sucrose (table sugar):

- composed of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

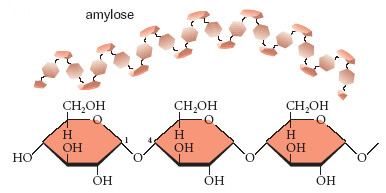
- glucose + fructose → sucrose + H2O

3. Lactose (milk):

- composed of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_and a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- glucose + galactose → lactose + H2O

C) Polysaccharide

* **Polysaccharide**: a carbohydrate consisting \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (100’s to 1000’s) bonded together.

1.Starch: a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the main storage unit of glucose in plants (potatoes, grains)

- Two types of starch:

- **amylose**: contains up to 1000 or more glucose molecules

- **amylopectin**: 1000-6000 glucose molecules, branched like a tree with 24-36 glucose units long branches

2. Glycogen: an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ similar to starch

* Tasteless
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Easily converted back into glucose if needed

3. Cellulose: 50% off all organic matter is cellulose

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- More tightly bound than starch

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ without the assistance of micro-organisms that can convert cellulose into glucose.

**Lipids**

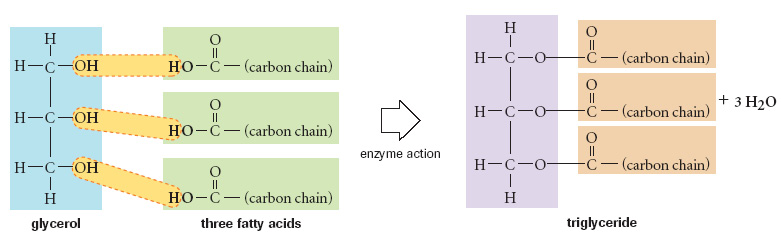
Characteristics:

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** compounds that are insoluble in polar solvents like water (they float!)
* lipids are made up of two structural units
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

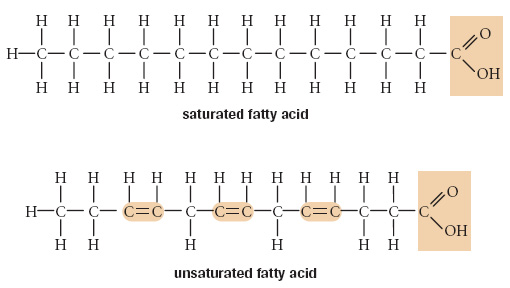
glycerol - is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

fatty acid - molecules are long \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chains

* Lipids are formed through **dehydrolysis synthesis.**



**Use of Lipids**

* Lipids are used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (excess sugars are converted to fats, very compact) Lipids provide twice as many calories as carbohydrates.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (love handles protect kidneys, second chin protects carotid artery)
* Important part of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Carry \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A, D, E, and K.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (blubber, subcutaneous fat). Eskimos eat the blubber of whales which also contains vitamin C. You will never see an Eskimo with scurvy.

**Types of Lipid Molecules**

1) Triglycerides – glycerol and three fatty acids

- two main types of triglycerides

– \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**a) Saturated**: a molecule that \_\_\_\_\_\_\_\_\_\_\_\_\_\_ take in more hydrogen or other atoms.

- most of the fatty acids in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are saturated.

- very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_bonding structure (single covalent bonds: C-C-C-C-…)

- No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_bonds.

- this stability makes saturated fats \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to break down

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at 20oC; this leads to clogging of arteries

b) **Unsaturated**: a molecule that can take in some \_\_\_\_\_\_\_\_\_\_\_\_hydrogen atoms.

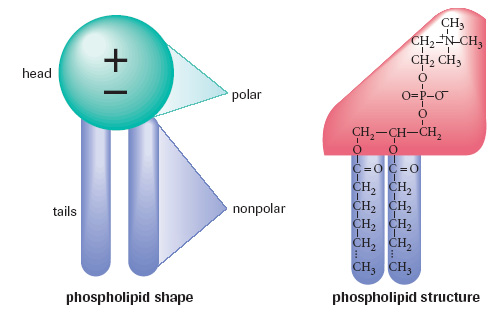
- described as either monounsaturated or polyunsaturated

- most \_\_\_\_\_\_\_\_\_\_\_\_ oils are unsaturated

- characterized as having a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bond within the carbon chain

- are generally \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, therefore can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_broken down

- most are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_at room temperature



2) Phospholipids – have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ group bound to a glycerol backbone

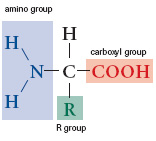
-the main component in cell membranes

3) Waxes – long chain fatty acids are joined to long chain alcohols or to carbon rings

- wax is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, making it well suited as a water proof coating

**Practice questions** : page 247- Questions 7 - 10

**Proteins**

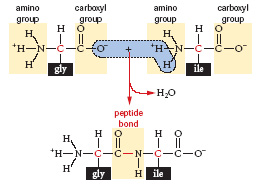
* Proteins are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** they are used to make cell structures and to repair any damages.
* Made up of 100’s to 1000’s of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Amino acids are composed of nitrogen, carbon, hydrogen, and oxygen atoms. The order, sequence, and number of amino acids determine the type of protein.

**Amino Acids**

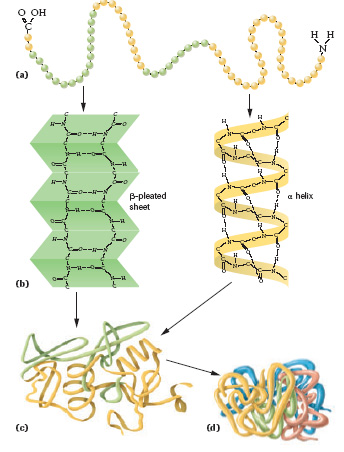
* There are \_\_\_\_\_\_\_\_\_\_\_\_different kinds of amino acids. The body can only make some of these. The others **must** be supplied by the diet; these are called the essential amino acids.

**Use of Proteins**

* Essential for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of body tissues.
* Are needed to make enzymes, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and hormones.
* Maintain the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the body
* Can supply body with energy if no other resources are present.
* Just like carbohydrates and lipids, proteins are also formed through **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
* The bonds that are formed are called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: covalent bonds between the acid group of one amino acid and the amino group of the joining amino acid.
* Proteins are also called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** because of the peptide bonds.



**Structure of Proteins**

* A proteins shape or structure determines its function
* There are four levels of protein structures;

a) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Primary – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_sequence of amino acids
2. Secondary – depends on the primary structure, hydrogen bonds cause the protein to bend in a pleated shape or a helix
3. Tertiary – more folding and twisting due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ interactions
4. Quaternary – large globular proteins (hemoglobin)

**Denaturation** – a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change in the structure of the proteins as a result of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Coagulation** – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change in the structure of the protein as a result of heat, radiation or changes in pH.