Biomolecules: The Chemistry of Life

- ✓ Amino acid
- ✓ Biomolecules
- ✓ Carbohydrate
- ✓ Enzyme
- ✓ Fatty acid
- ✓ Glycerol
- ✓ Lipid
- ✓ Molecule
- ✓ Monomer
- ✓ Monosaccharide
- ✓ Nucleic acid
- ✓ Nucleotide
- ✓ Polymer

Vocab List:

Copy this list (1st page for our new unit).

As we move through the unit, update the page number of these vocabulary words to help you prepare and study!

Introduction to Biomolecules

On the following slides, the yellow sections are the main points; summarize the slides in your notebooks.

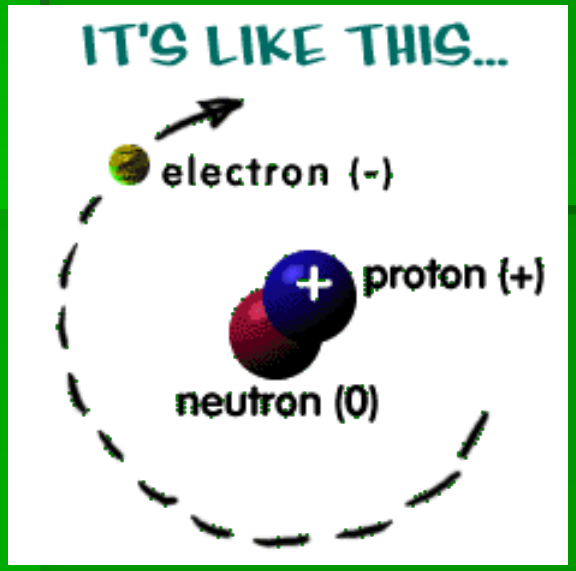
Underlined words = vocabulary!

All life depends on chemistry to function. During breathing and eating, the body uses oxygen and other nutrients in chemical reactions to keep you alive.

In this unit WE will understand that various molecules are involved in processes within living things.

Review: Atoms & Compounds

- ✓ Everything in the world is made of atoms, including you! Atoms = Building Blocks of Life
- ✓ An atom is the smallest particle of an element and they join together to make compounds & molecules within the body and those compounds are necessary for life.

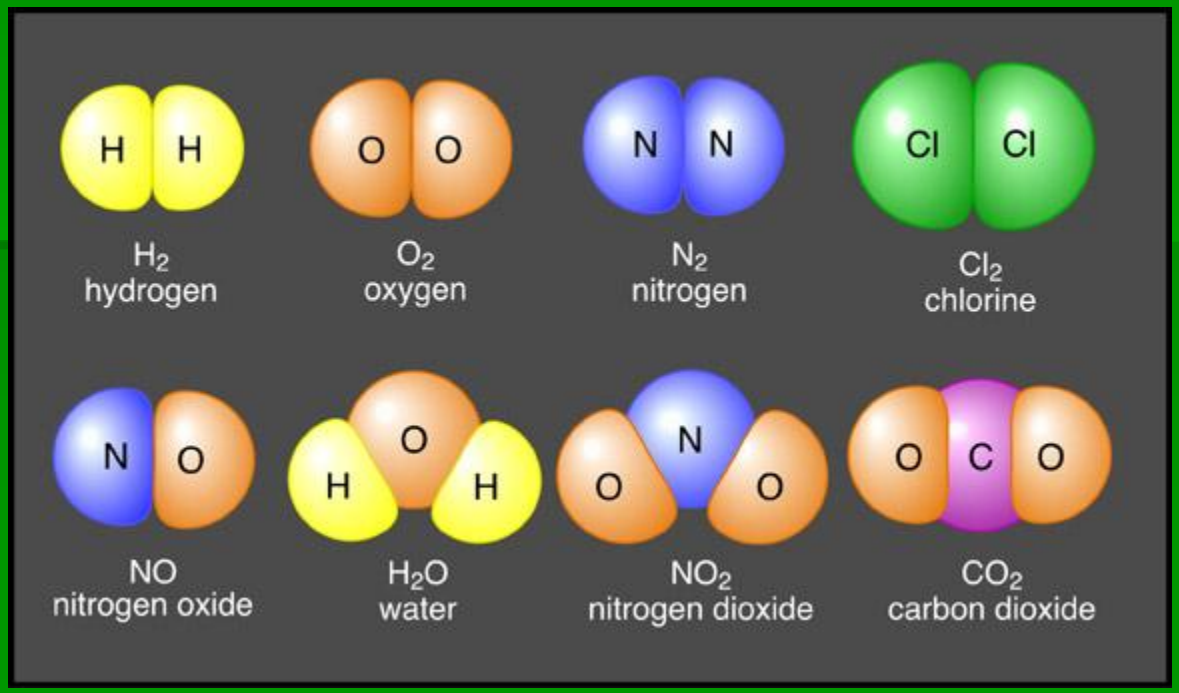


- ✓ The subatomic (smaller) particles are:
  - Protons (+); Neutrons (N^0); Electrons (-)
- ✓ The protons and neutrons are always in the center of the atom = the nucleus.
- ✓ The electrons whiz around the center.

From www.chem4kids.com

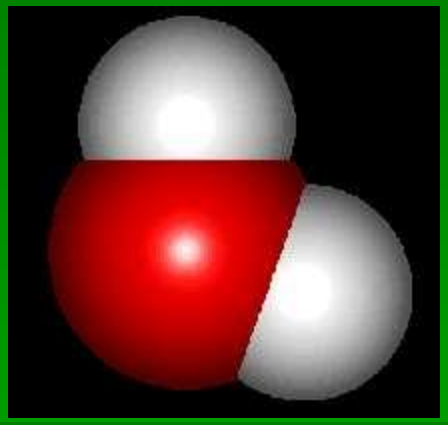
Types of Compounds

- ✓ Organic compounds contain carbon and are found in living things.
- ✓ Inorganic compounds do not contain carbon and are associated with non-living things.



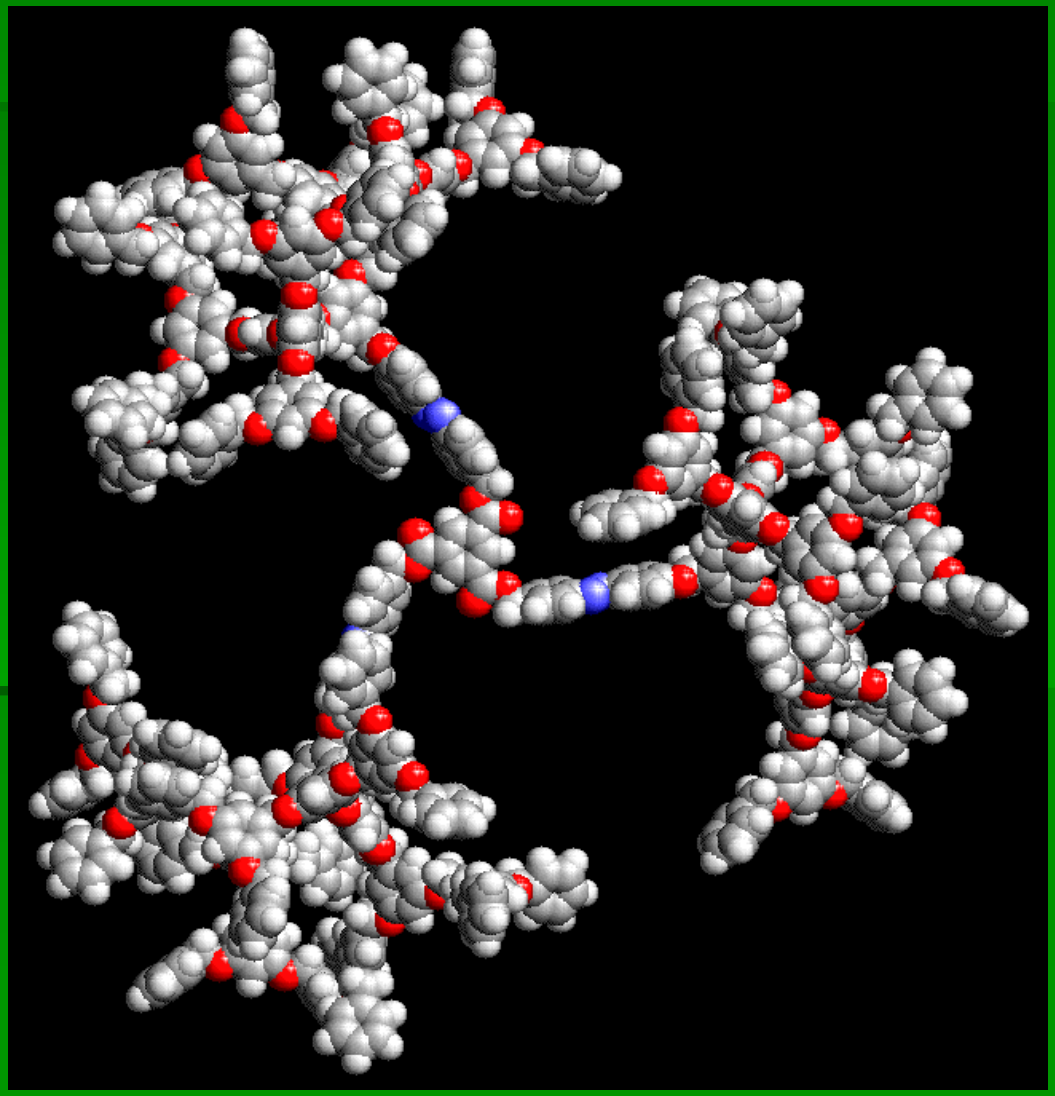
http://www.physicalgeography.net/fundamentals/images/compounds_molecules.jpg

Macromolecules are Huge!



http://www.matchrockets.com/images/h2omol.jpg

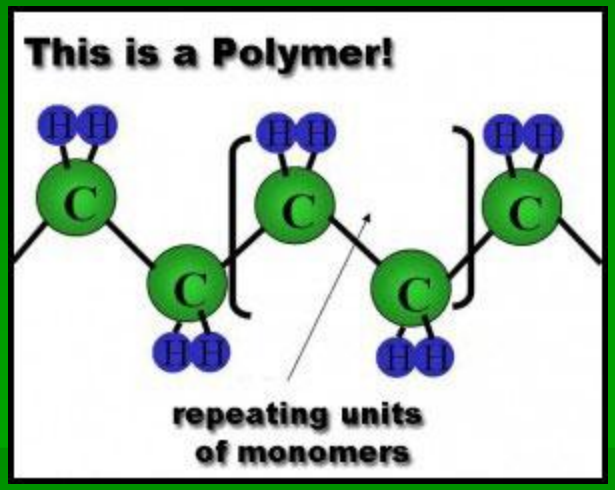
- ✓ 1 molecule of water (above).
- ✓ 1 macromolecule to the right.



http://www.chem.arizona.edu/faculty/mcgr/triazo.GIF

Monomer vs Polymer

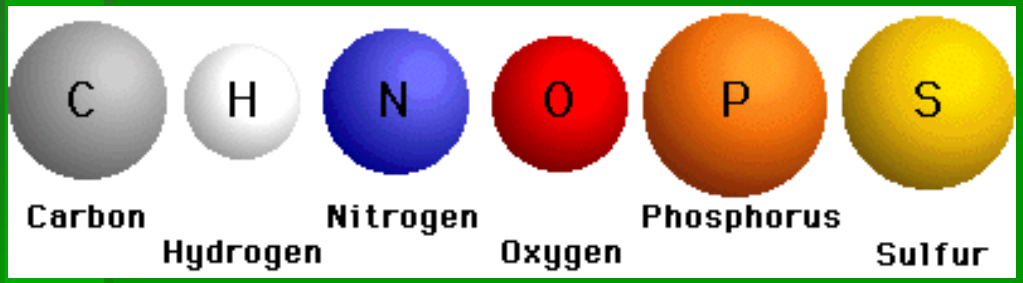
- ✓ Biomolecules are built by combining various atoms in to various groups.
- ✓ Monomers are smaller units (or building blocks) of a larger, more complex molecule.
- ✓ Polymers are large, organic molecules made up of smaller units called monomers.
- ✓ Each biomolecule for this unit is composed of various monomers and polymers which we will review on the following slides.



http://www.recycledplastic.com/wp-content/uploads/2011/02/what-is-a-polymer-300x239.jpg

Biomolecules

- ✓ Everything that is living is composed of molecules with carbon atoms.
- ✓ Carbon (w/ 4 valence electrons) forms many compounds with other elements.
- ✓ Living cells are composed of HUGE molecules (macro-molecules) made of thousands of atoms.
- ✓ The four biomolecules found in living things are:
  - Lipids; Proteins; Carbohydrates; Nucleic acids

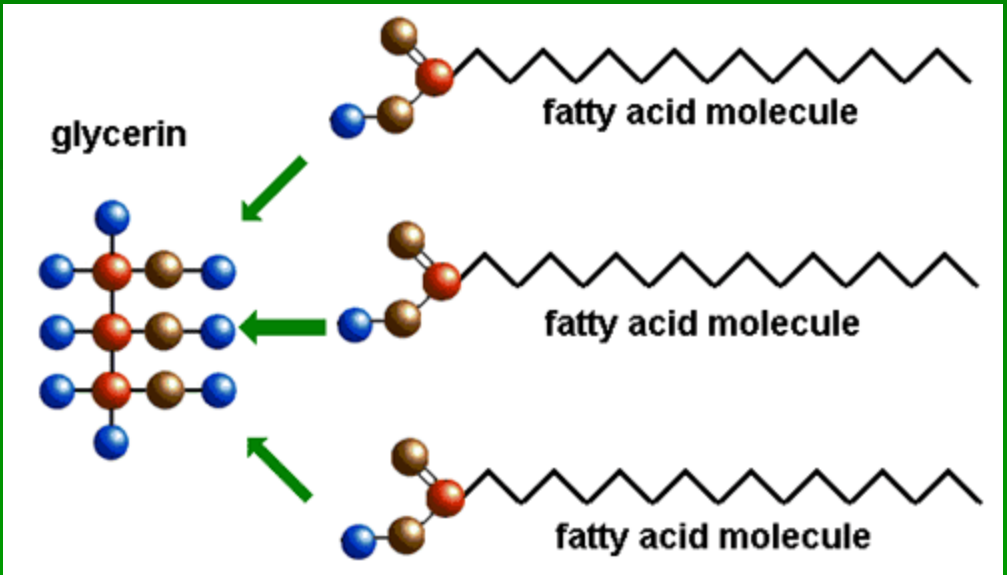


Although more than 25 types of elements can be found in biomolecules, six elements are most common. These are called the CHNOPS elements; the letters stand for the chemical abbreviations of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. From PHSchool

Lipids

- ✓ Lipids (commonly known as fats, oils, and waxes) are made from C, O, and H atoms.
- ✓ Monomers: glycerol & fatty acids (think tons of C and H!!!!!!)

http://www.green-planet-solar-energy.com/images/glycerine.gif



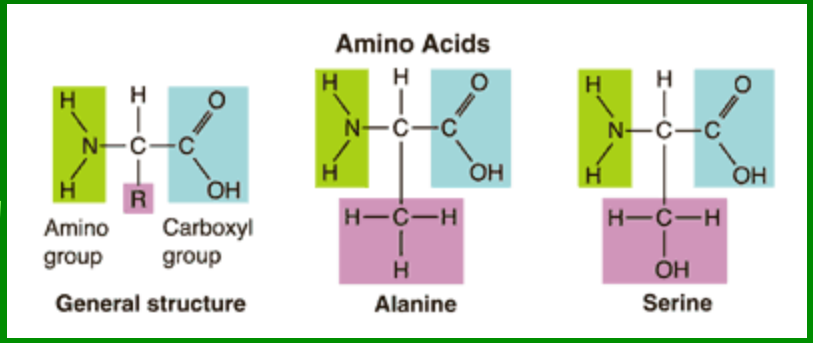
- ✓ Lipids are generally do not mix in water (hydrophobic).
- ✓ They can be used to store energy and are found in cell membranes and help are skin keep from drying out.

Lipids Cont.

- ✓ Lipids can be saturated with only single bonds between atoms; solid @ room temperature and are unhealthy (EX butter, bacon fat, manteca).
- ✓ Unsaturated fats have single and double bonds; are liquid @ room temperature are considered the healthiest (EX vegetable oils)
- ✓ Polyunsaturated fats have more than one double bond.

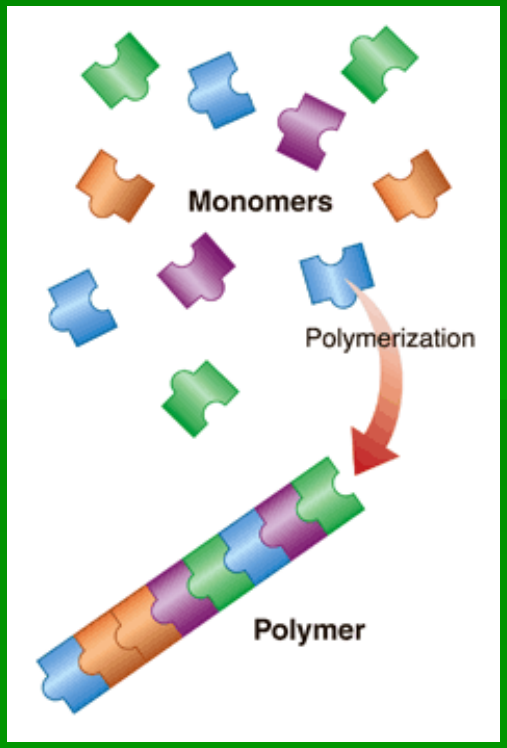
http://www.wholefoodsmarket.com/products/oil/images/oils300w.jpg

Proteins

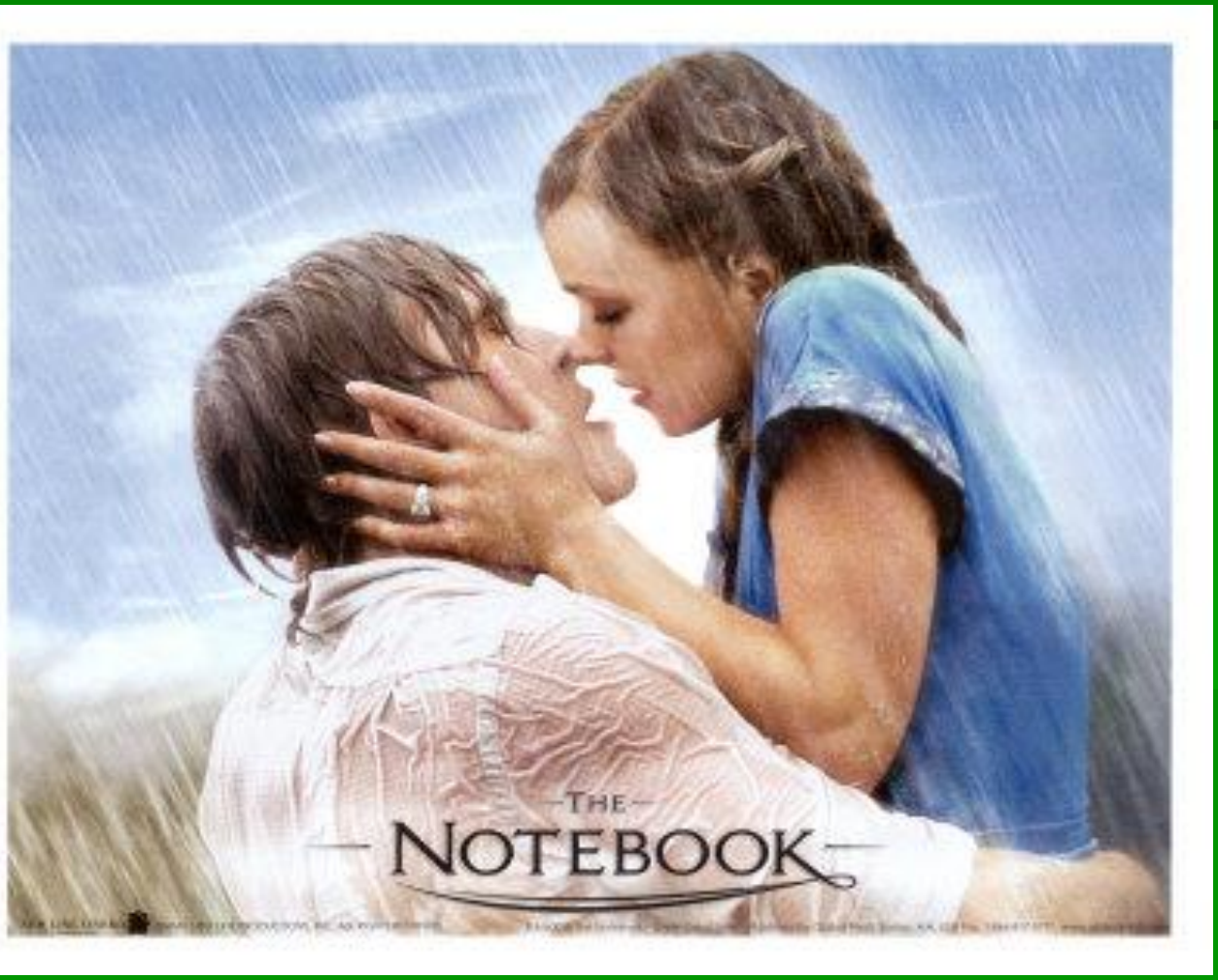


Textbook 2-3

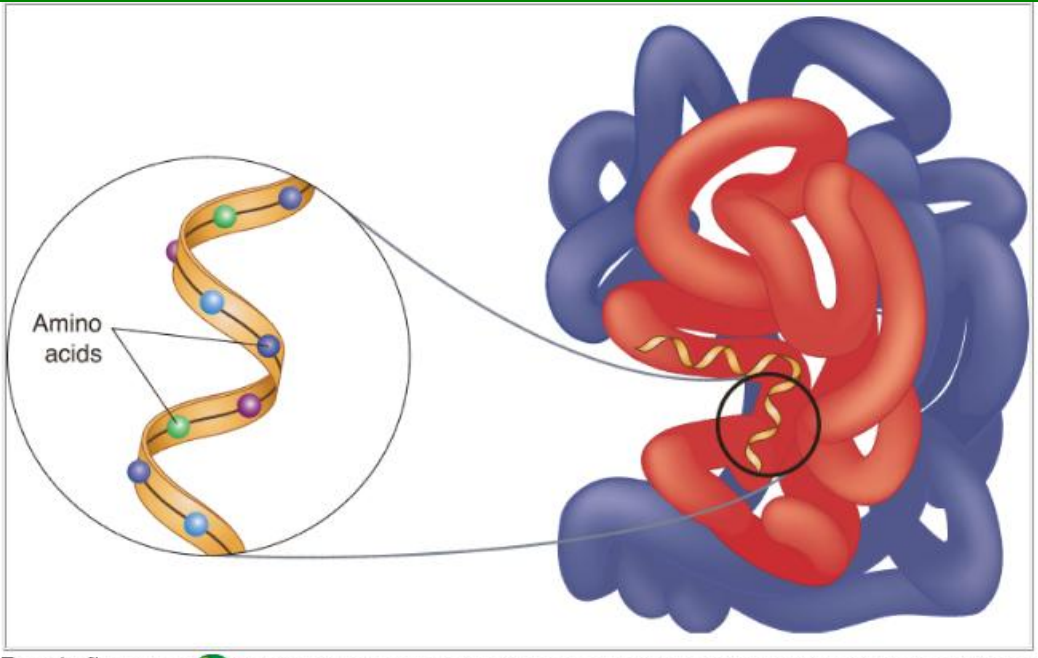
- ✓ Protein is our next macromolecule and contains the elements C, H, O, and N.
- ✓ Monomers: strings of amino acids.
- ✓ There are more than 20 different amino acids found in nature.
- ✓ Some proteins help to control cell processes and they are used to form muscles and bones.
- ✓ They also help to fight disease and are used to transport substances in the body. Video



Textbook 2-3

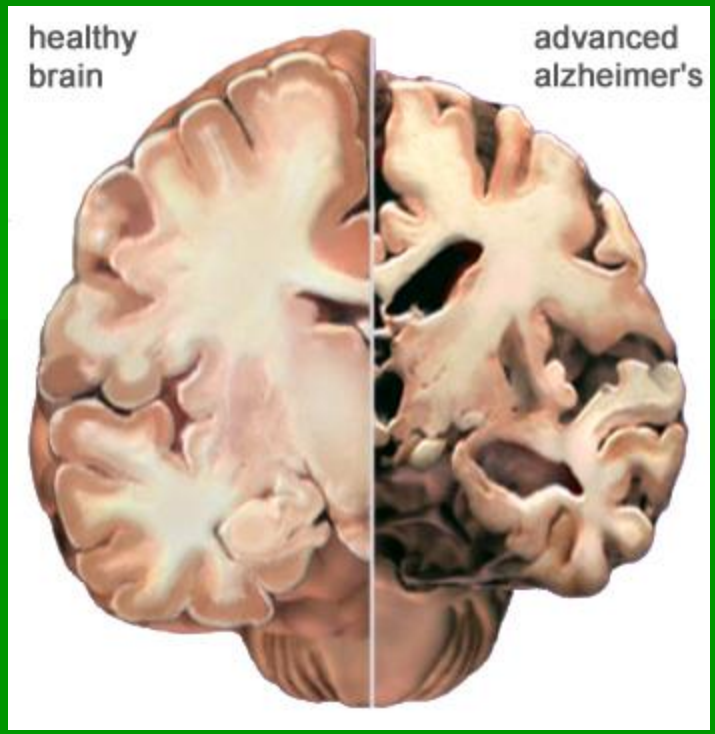


http://hookedonhouses.net/wp-content/uploads/2009/08/the-notebook-movie-poster.jpg



Protein Structure **Proteins help to carry out chemical reactions, transport small molecules in and out of cells, and fight diseases.** Proteins are made up of chains of amino acids folded into complex structures.

Textbook 2-3

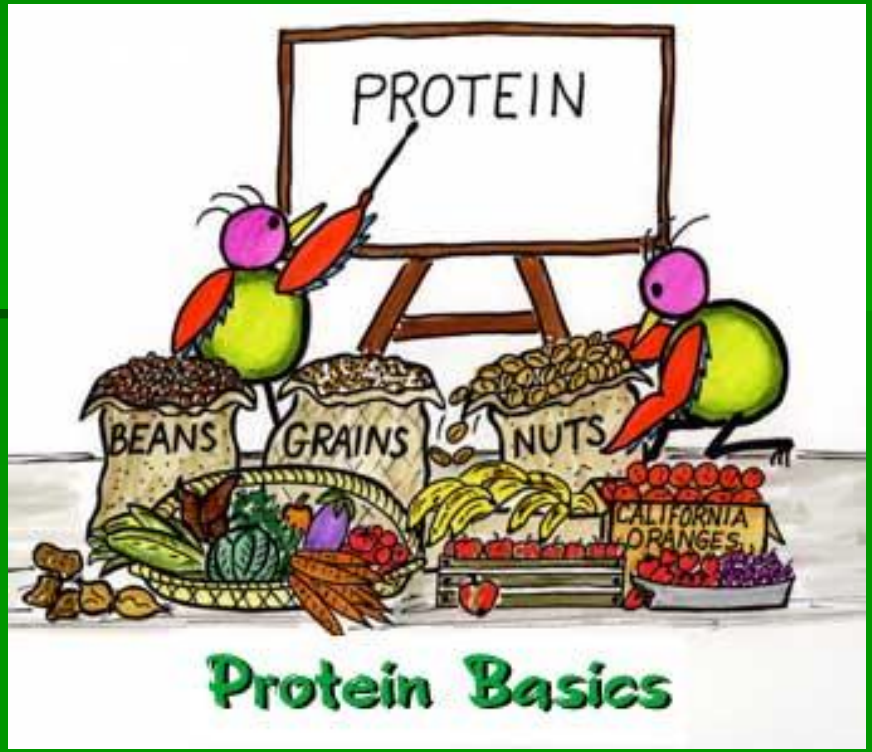


http://www.alz.org/braintour/images/alzheimer_brain.jpg

Proteins Cont.

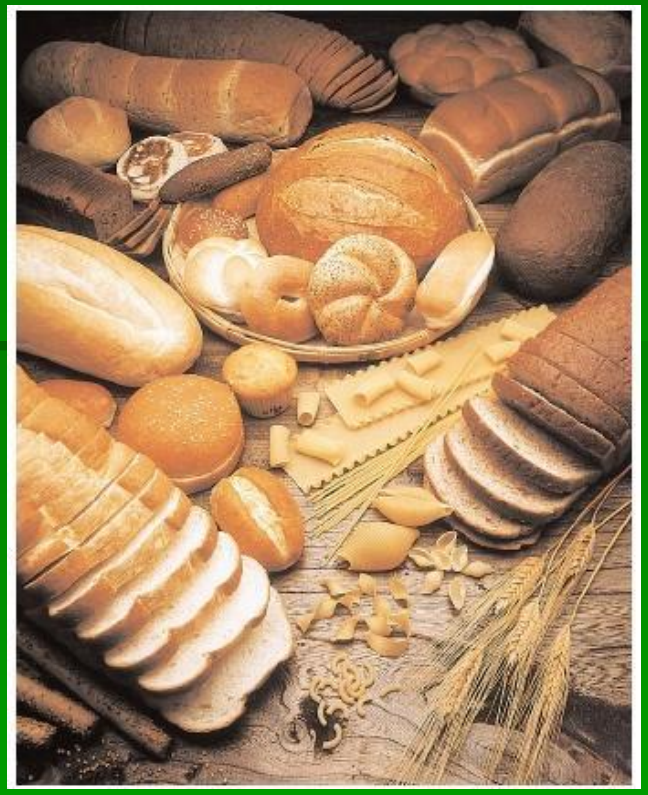
- ✓ Did you know there are over 100,000 different proteins in your body!
- ✓ Each one has a different structure and function!
- ✓ The amino acids to build those proteins comes mainly from your diet!

http://www.vegparadise.com/images/protein.jpg



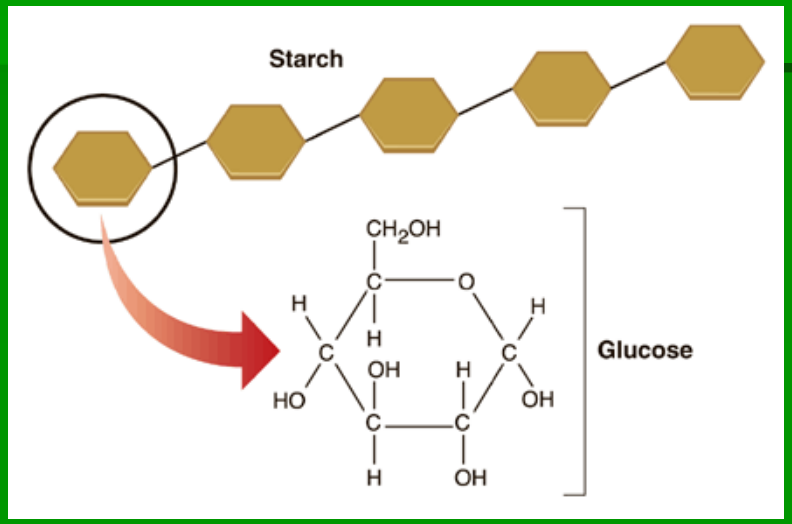
Carbohydrates

- ✓ Carbohydrates are made up of C, H, and O atoms in a ratio of 1:2:1.
- ✓ Carbohydrates are used as a main source of energy for living things.
- ✓ Monomers: monosaccharides (or simple sugars). Video



http://www.faqs.org/nutrition/images/nwaz_01_img0048.jpg

Textbook 2-3



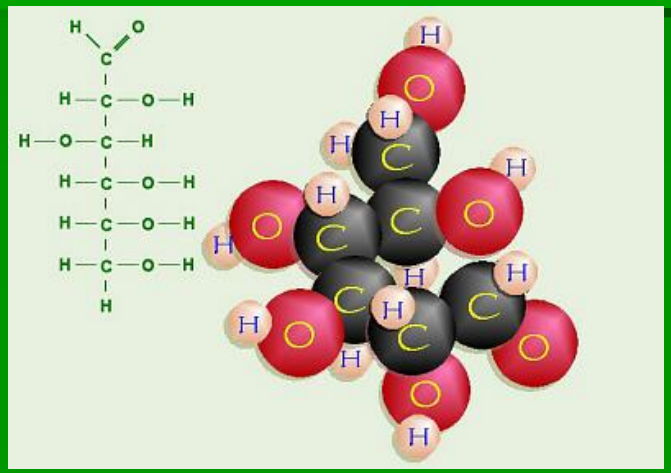
http://newsletter.wsu.edu/eplay/user_pics/375x250_veggies.jpg

ATTENTION!!!

Pick a partner at your table and give them a summary of what you have just learned in less than 15 seconds.
I will RANDOMLY call on someone's partner to repeat back to me what you said so pay attention….GO!

Carbohydrates Cont.

- ✓ Simple carbohydrates are often called sugars (EX glucose, fructose (in fruits) and galactose (in milk)).
- ✓ Simple sugars are known as monosaccharides (meaning "1 + sugar").

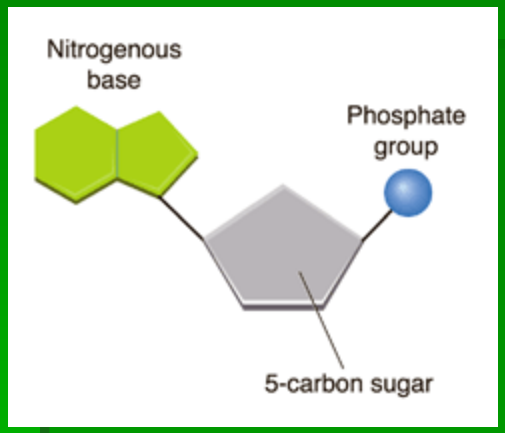


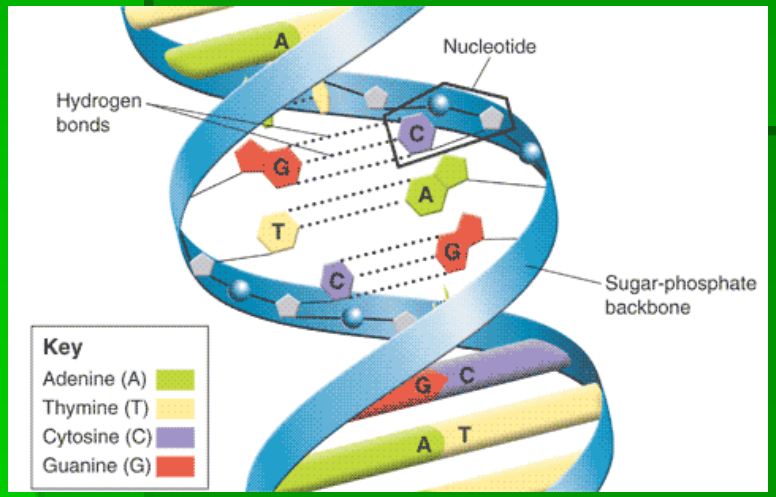
http://biology.clc.uc.edu/graphics/bio104/glucose1.jpg

- ✓ Large carbohydrates are called polysaccharides (meaning "many + sugars"); they are made of strings of monosaccharides.
- ✓ Animals convert carbs and store the energy in the form of glycogen found in cells (often muscle cells).
- ✓ Plants store their carb energy in the form of starch and use cellulose for structure (think tough and fibrous like celery!).

Nucleic Acids

Textbook 2-3



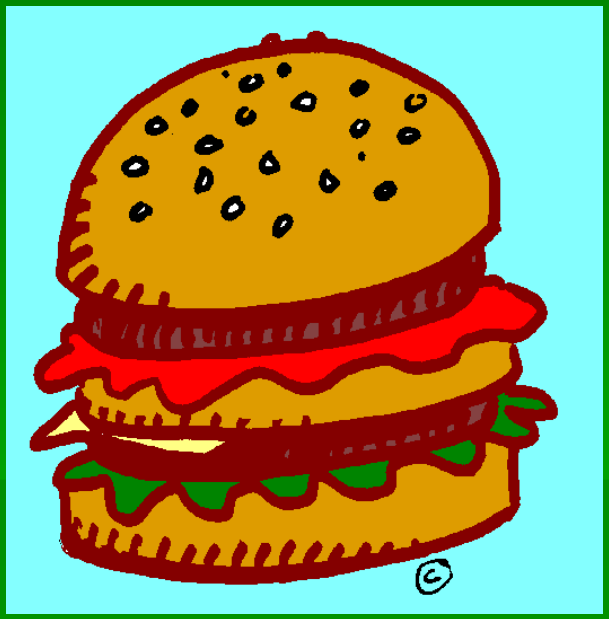


Textbook 2-3

- ✓ Nucleic acids are macromolecules containing H, O, C, N, and P.
- ✓ Monomers: nucleotides
  - Phosphate
  - Sugar
  - Nitrogenous Base
- ✓ Nucleic acids makeup our DNA and RNA!
- ✓ Their function is genetics; the DNA in your cells gives you the specific characteristics that make you you!

Chemical Reactions

- ✓ A chemical reaction is a process that changes one set of chemicals into another set.
- ✓ When you eat a burger, your body has to process and change that into parts the body can use.
- ✓ Reactants are the items that you begin with.
- ✓ Products are the items you end up with.



http://eprentice.sdsu.edu/S03X2/guerra/burger2.gif

Chemical Reactions Cont.

- ✓ As it enters the blood, carbon dioxide reacts with water to produce a highly soluble compound called carbonic acid, H_2CO_3.

Reactants **Product**

$$CO_2 + H_2O \longrightarrow H_2CO_3$$

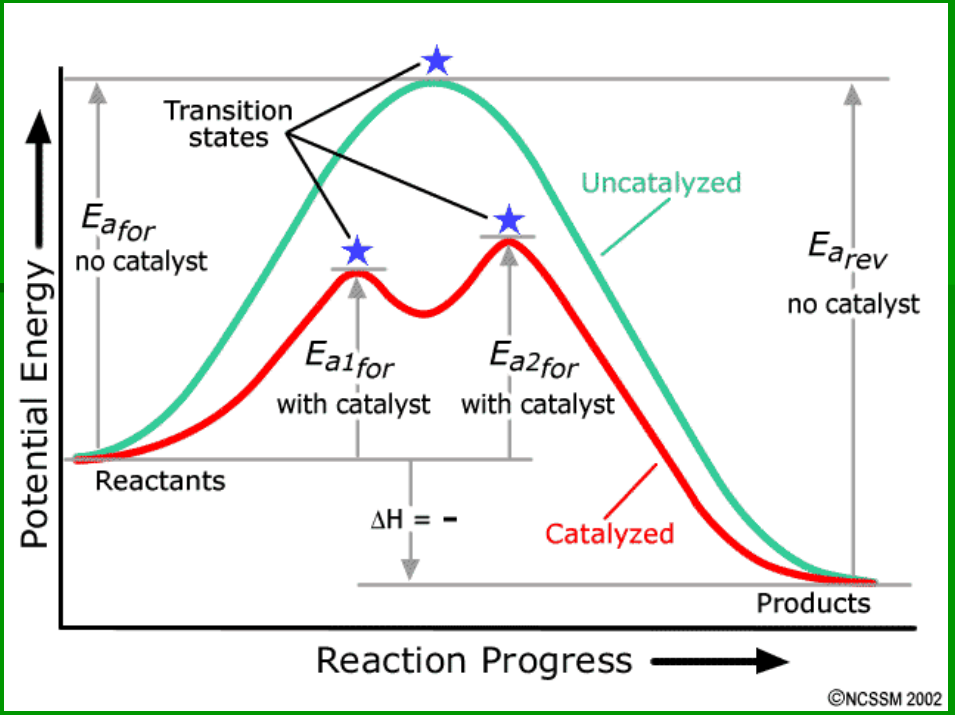
- ✓ The reaction shown above enables the bloodstream to carry carbon dioxide to the lungs. In the lungs, the reaction is reversed.
- ✓ This reverse reaction produces carbon dioxide gas, which is released as you exhale.

Reactant **Products**

$$H_2CO_3 \longrightarrow CO_2 + H_2O$$

Energy Reactions

- ✓ Chemical reactions that release energy happen in our body at all times.
- ✓ Some reactions occur very slowly and sometimes, they need a catalyst to speed it up the reaction.

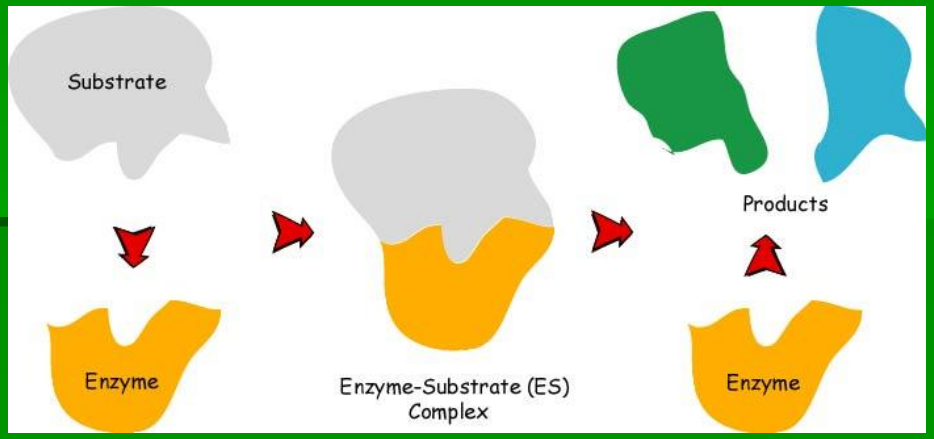


http://www.dlt.ncssm.edu/TIGER/diagrams/kinetics/Catalyst.gif

Enzymes

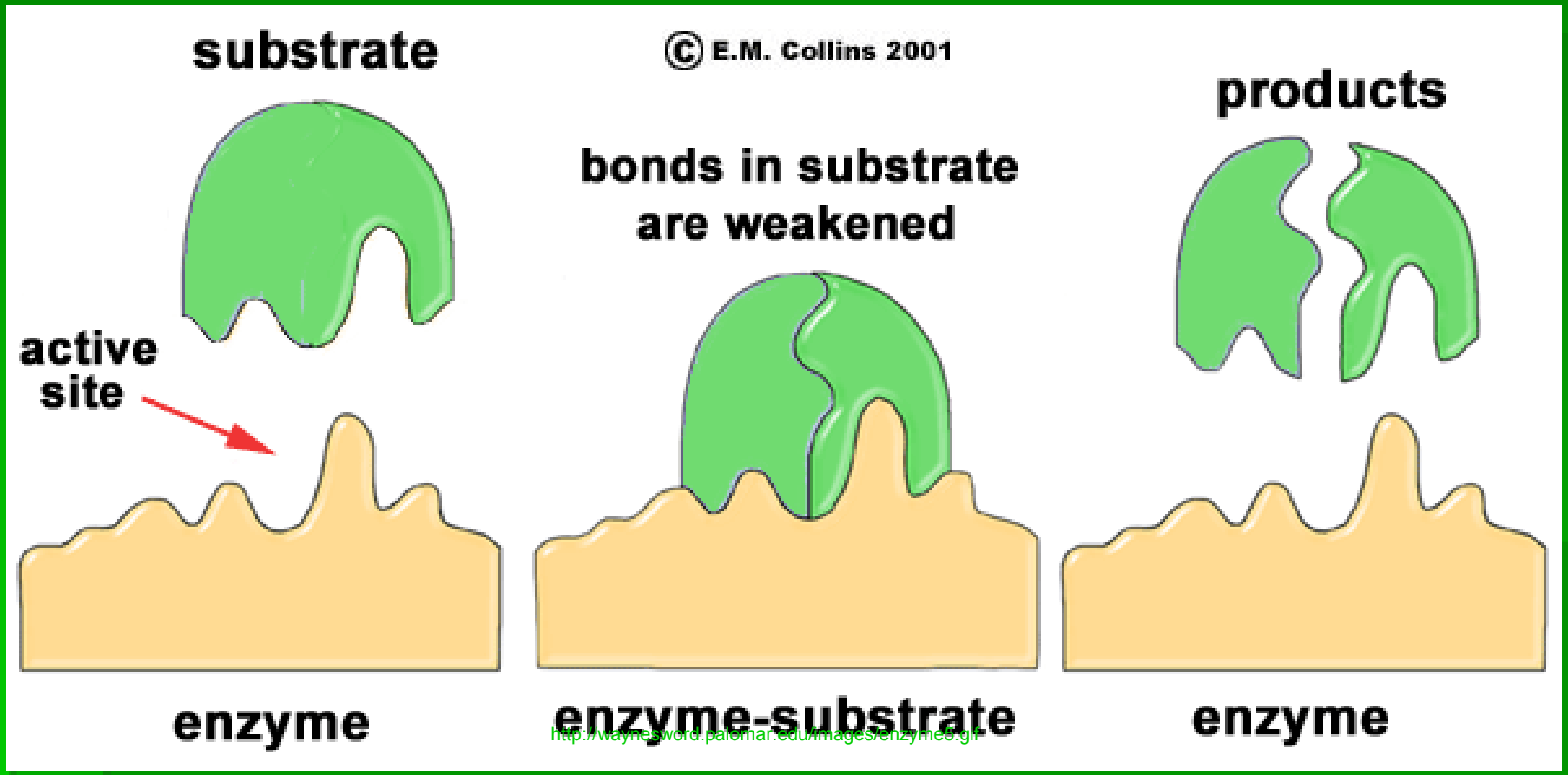
- ✓ An **enzyme** is a protein that acts as a biological catalyst; it increases the efficiencey of chemical reactions w/in an organisms.
- ✓ The enzyme attaches to the **substrate** that it works with (the reactants).
- ✓ Now that the enzyme is connected to the substrates, they will react and produce products.

- ✓ This is called the lock and key model because specific enzymes will only work on specific substrates.



http://stezlab1.unl.edu/reu1999/dputn226/ChemHelp/RET_Web_Pages/Enzymes/lock_key1.gif

Enzymes &
The Lock & Key Model



Conclusion

- ✓ In this unit we reviewed the structure of atoms.
- ✓ We investigated four biomolecules needed for life
  - Carbohydrates
  - Lipids
  - Proteins
  - Nucleic acids
- ✓ We learned that enzymes help to speed up reactions in body cells.
- ✓ Understand that chemical reactions are needed for life's processes, from the food you eat, to the air you breathe, to what occurs in every cell of your body.