Biochemistry Chemistry of Life





Living things are made up of relatively large percentages of four elements:

- 1. Hydrogen (chemical symbol H)
- 2. Carbon (chemical symbol C)
- 3. Oxygen (chemical symbol O)
- 4. Nitrogen (chemical symbol N)

Compounds: substances made up of two or more different elements.

Examples of compounds:

- Water H₂O
- Carbon dioxide CO₂
- Ammonia NH₃
- Glucose $C_6H_{12}O_6$

Compounds interact during chemical reactions.

- Chemical reactions are constantly occurring in our bodies. If these chemical reactions stopped, we could die.
- Cellular respiration: cellular respiration occurs in the mitochondria.

It uses **glucose** and **oxygen** molecules to make **ATP** (energy) and **carbon dioxide** and **water**(waste products).



Photosynthesis

Photosynthesis occurs in the chloroplasts of plant cells.

 During photosynthesis carbon dioxide and water molecules are used to make glucose and oxygen (waste product).



Producers and Consumers are linked through photosynthesis and respiration in the Carbon cycle.



Biological Catalysts

- <u>Catalyst:</u> a substance that initiates or accelerates a chemical reaction without itself being affected.
- Enzyme: a biological catalyst; a protein that speeds up or starts a chemical reaction.

Lock and Key Model

- Enzymes are specific. They fit the substrates that they act upon just as a key fits a lock.
- **Substrate:** the substance that is acted upon by an enzyme.
- <u>Active site</u>: the location on the enzyme where the chemical reaction takes place.



Factors that affect enzyme function:

- Temperature
- pH (acid or base)
- Concentration of substrate.
- Let's see more!

Acid v Base: pH

- pH: pH is a term that refers to the relative concentration of hydrogen ions (H+) in a solution*. pH tells you whether a solution is an acid or a base.
- The <u>pH scale</u> measures how acidic or basic a substance is. The pH scale ranges from 0 to 14.
- A pH of 7 is neutral.



http://upload.wikimedia.org/wikipedia/commons/thumb/4/46/PH_scale.png/639px-PH_scale.png

Bases pH 8-14

Base: a substance with a pH value of greater than 7. Bases break down to yield hydroxide ions (OH-) in water.





Acids pH 1-6

Acid: a substance with a pH value less than 7. Acids break down to yield hydrogen ions (H+) in water.





There are two main categories of compounds

- Organic: compounds that contain carbon and hydrogen.
- Inorganic: compounds that contain any of the other elements but not carbon and hydrogen together.

Examples of Organic Compounds
Carbohydrates: Glucose $C_6H_{12}O_6$
Lipids /fatty acids ex: Oleic Acid (olive oil) C ₁₈ H ₃₄ O ₂
Proteins / amino acids Glycine C2H5NO2 Nucleic acids/DNA Very complex but contains Oxygen, Hydrogen, Nitrogen,

There are four major kinds of Organic Compounds:

- 1. Carbohydrates
- 2. Proteins
- 3. Lipids
- 4. Nucleic acids

<u>Carbohydrates:</u> organic compounds that contain carbon, hydrogen, and oxygen atoms in a 1:2:1 ratio.

 Carbohydrates serve as a source of energy for organisms.



Types of carbohydrates

- Monosaccharides: simple sugars made of one unit of carbon, hydrogen and oxygen. Ex: glucose
- Polysaccharides: chains of three or more monosaccharides.
 - Polysaccharides are used to store the energy contained in sugars.







Proteins

Proteins: complex macromolecules containing carbon, hydrogen, oxygen, nitrogen and usually sulfur.





Proteins are used to make **enzymes**, **hormones**, **antibodies** and other substance essential for the proper functioning of organisms.



- <u>Amino acids:</u> tiny subunits of proteins.
- Amino acids are held together by peptide bonds.

DIFFERENT AMINO ACIDS JOIN TOGETHER

This is the basic process by which protein are assembled.



 valine
 leucine
 tyrosine

 Single amino acids with different side chains...





http://www.horleys.com/Shared/images/editor/Amino-acids-&-peptide-forma.jpg

Lipids

- Lipids: a class of compounds including fats and oils.
- Lipids are used for storing energy in the body..





Examples of lipids include animal fats, plant oils, and waxes



http://www.biologyreference.com/images/biol_03_img0267.jpg

Nucleic Acids

<u>Nucleic Acids:</u>

compounds found in all living things that control cellular function and contain genetic information; DNA and RNA.

