

Lecture #3 - Aug 28th PM lecture

The chemical components of the cell

1. Life is based in chemistry
 - a. Chemical bonds
 - b. Molecules in cells
 - c. Macromolecules
2. The chemistry of life
 - a. Based on carbon compounds (organic chemistry)
 - b. Reactions in aqueous solutions
 - c. Narrow range of temperatures
 - d. Complex structures: lipids, polysaccharides, proteins, DNA, RNA, carbohydrates
 - e. All reactions are tightly regulated by the cell
3. Basic chemistry information
 - a. 3 parts of an atom: neutrons, electrons, protons
 - b. Neutrons+protons=atomic weight of an atom
 - c. The number of protons = the atomic number on the periodic table
 - d. Isotopes are formed when there are added neutrons. EX: Carbon 14 - 6 protons 8 neutrons
 - e. Reactivity depends on the number of electron in the outershell
 - i. 1st shell holds 2 electrons, 2nd - holds 8, 3rd - holds 8
 - ii. If the atoms doesn't have a complete shell it will react with other atoms to try and fill that shell
4. Types of bonds
 - a. Bond to make atoms more stable
 - b. Covalent bond - sharing of electrons to form a molecule
 - i. Nonpolar - equal sharing of electrons
 - ii. Polar - unequal sharing of electrons. Form partial positive and negative charges
 - c. Ionic bond - Transfer of electrons create a positive and negative ion.
5. Partial positive charges and hydrogen bonds
 - a. Unequal electron distribution cause partial + and - charges.
 - b. δ^+ and δ^- of different molecules attract
 - c. Hydrogen bonds only happen when H is involved
 - d. Very weak, but very important bond
 - e. In water H and O form many hydrogen bonds
6. Acids and bases are formed when one water molecule adds or subtracts a H
 - a. H_3O^+ - Hydronium ions
 - b. OH^- - Hydroxyl ions
7. Hydrophilic - Molecules with positive or negative charge or with polar bonds that dissolve well in water
8. Hydrophobic - Molecules with no charge and that form few or no hydrogen bonds. Do not dissolve well in water because they can't interact
9. Van der Waals attraction

- a. Two atoms can show a weak bonding interaction at very short distances due to their fluctuating electrical charges
- b. Electrons can end up all at one side of an atom, creating a fluctuating dipole

10. Sugars

- a. Monosaccharides bonding together by condensation and H₂O molecules are released
- b. The breaking of a disaccharides happen through hydrolysis when water is added

11. Fatty Acids

- a. Hydrophilic carboxylic acid head - polar group, phosphate, glycerol
- b. Hydrophobic hydrocarbon tail - fatty acids
- c. Saturated fats don't have double bonds while unsaturated fats do

12. Amino Acids

- a. Amino group and carboxyl group
- b. Bond together to make a protein by peptide bonds
- c. N-terminus of a polypeptide chain is a head with an amino group
- d. C-terminus is the carboxyl group
- e. As you go from N-terminus to C-terminus the polarity increases

13. Nucleotides

- a. Three components: Base, sugar, and triphosphate
- b. If its DNA the sugar is deoxyribose and if its RNA the sugar is ribose

14. Macromolecules

SUBUNITS	MACROMOLECULE
Sugar	Polysaccharide
Amino Acids	Protein
Nucleotide	Nucleic Acids

- a. Sequential and stepwise polymerization
- b. Covalent bonds hold together polymer subunits
- c. Non covalent bonds specify the shape of macromolecules and make them more stable