**Basic Biochemistry – BIOL 12U**

1. The Importance of Carbon

* Highly important element when teaching biochemistry
* Has 4 valence electrons, therefore can make up to 4 bonds
* Bonding capacity
* Various elements including H, O, S, and P can bond to carbon to form functional groups
* There are many functional groups found in biological molecules
* Using a periodic table to understand valance electrons

2. Anabolic and Catabolic Reactions

**Anabolic reactions:** produce large molecules from smaller subunits

* They include condensation reactions, where water is removed

**Catabolic reactions:** break macromolecules down into their individual subunits

* They include hydrolysis reactions, where water is needed

3. Biological Macromolecules: **Carbohydrates**



3. Biological Macromolecules: **Lipids**

* Hydrophobic molecules (non-polar) composed of C, H, and O
* Most common energy storing molecules
* Most common fats in plants and animals are triglycerides (3 fatty acids + glycerol)
* Saturated fatty acids: All single bonds between C atoms, max amount of H’s
* Unsaturated fatty acids: 1 or more double bonds between C atoms, fewer than max amount of H’s
* Phospholipids: Molecule that consists of 2 fatty acid tails + glycerol + phosphate group
* Make up the cell membrane

3. Biological Macromolecules: **Proteins**

* Most diverse molecules in living organisms
* Cells contain thousands of different proteins with various functions
	+ Enzymes: Biological catalysts, speeding up chemical reactions
	+ Immunoglobulins: Protect animals from foreign microbes
	+ Hemoglobin: Carry oxygen throughout mammals
	+ Keratin: Tough structural protein found in hair and fingernails
* Polymers of amino acids
	+ Held together by peptide bonds
	+ 20 different R groups in living organisms
	+ 8 amino acids are considered essential

3. Biological Macromolecules: **Nucleic Acids**

* Store hereditary information of organisms
* **DNA: (Double stranded)** The digital code that stores the instructions for creating an organism
* **RNA: (Single stranded)** Reads the information in DNA and transports it to the protein-building apparatus of the cell
* Both are polymers of nucleotides
	+ Nitrogenous base, pentose sugar, phosphate group
	+ Phosphodiester bonds

4. STSE

**Real world applications of protein enzymes**

* Natural enzymes are used in many food production processes to speed up chemical reactions,
* Examples:
	+ Rennet, a natural enzyme mixture from the stomach of calves, used in cheese making. Contains a protease enzyme that coagulates milk, causing it to separate into solids (curds) and liquids (whey
	+ Enzymes produced by yeast have been used to ferment grape juice in order to make wine.
* Scientists are designing and producing synthetic enzymes that will be more efficient catalysts and allow new technological applications in medicine and industry.
	+ Enzymes produced through biotechnology are identical to those found in nature.
	+ Genetically modified microorganisms would not survive in nature.