CSUSM
STEM Success Center

Macromolecules

Nucleic Acids

RNA
- **Name**: ribonucleic acid
- **Function**: act as a "working copy" of genetic information as mRNA, tRNA, sirna, miRNA, etc.
- **Stranded**: single stranded
- **Bases**: A, T, C, G
- **Sugar**: ribose
- **Location**: everywhere
- RNA folding

DNA
- **Name**: Deoxyribonucleic acid
- **Function**: stores genetic information
- **Stranded**: Double
- **Bases**. A, T, C, G
- **Sugar**: deoxyribose
- **Location**: nucleus (eukaryotes)
- Antiparallel strands

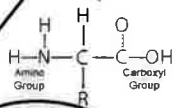
Nucleotide Structure
1. **Nitrogenous Base**
   - proton acceptors:
   - **Pyrimidines** (6 membered ring)
     - cytosine (C)
     - thymine (T, DNA)
     - uracil (U, RNA)
     - -> "CUT a pie"
   - **Purines** (6 membered ring fused w/ 5 membered ring)
     - adenine (A)
     - guanine (G)
2. **Sugar**
   - Ribose (RNA)
   - Deoxyribose (DNA)
3. **Phosphate**
   - Group gives negative charge

Types
- Nucleoside
  - Nitrogenous base + sugar

Monomer: nucleotide
Polymer: polynucleotide/DNA/RNA
Bond: backbone = phosphodiester linkage
btwn bases = hydrogen bond

Proteins

Types
- **Enzymatic**
  - acceleration of chemical rxns
  - ex: digestive enzyme
- **Storage**
  - store amino acids
  - ex: casein
- **Defensive**
  - protection against disease
  - ex: antibodies
- **Transport**
  - transport of substances
  - ex: hemoglobin
- **Hormonal**
  - coordinates organism's activities
  - ex: insulin
- **Receptor**
  - response to chemical stimuli
- **Contractile and Motor**
  - movement
  - ex: actin
- **Structural**
  - support
  - ex: keratin

Amino Acid Structure


Monomer: amino acid
Polymer: polypeptide
Bond: peptide

Quaternary Structure
- one or more polypeptide chains

Tertiary Structure
- Interactions btwn R-groups
- hydrogen bonds
- ionic bonds
- van der waals
- disulfide bridges
- hydrophobic interactions
- 3D conformation

Primary Structure
- sequence of amino acids

Secondary Structure
- coils and folds due to hydrogen bonding
- alpha helicies & beta-pleated sheets
- local structure

Carbohydrates

Monomer: monosaccharide
Polymer: polysaccharide
Bond: glycosidic linkage
-ose, -saccharide = sugar
mono- = one
poly- = many

Function
energy storage and structural support

Monosaccharides
- simple sugars
- ex: Glucose (C6H1206), galactose, fructose, ribose
- molecular formula ratio: CH2O
- → aldose: aldehyde (carbonyl at end of chain)
- → ketose: ketone (carbonyl in middle of chain)
- stable structure is in the ring form

Disaccharides
- Two monomers linked together w/ a glycosidic linkage formed from dehydration synthesis
- - ex: maltose, sucrose, lactose

Polysaccharides

Starch
- function: energy storage
- bonds :α-linkages
- plants (chloroplasts & plastids)
- branched/helical
- simplest: amylose
- humans can digest

Cellulose
- function: structural support
- bonds:β-linkages
- plants (cell wall)
- straight unbranched
- humans cannot digest

Glycogen
- function: energy storage
- bonds: -linkage,
- animals (muscles, liver)
- branched/helical
- hydrolysis releases glucose when the demand for sugar increases

Lipids

Fats & oils
- contain carbon, hydrogen, & oxygen
- overall are hydrophobic/nonpolar
- **Function**: insulation, cell membrane
- structure, hormones, energy storage, protection
- **Bond**: Ester Linkage

Fatty Acids
- glycerol + hydrocarbon chain

Triglycerides
- glycerol + 3 hydrocarbon chains

Phospholipids
- cell membrane
- phosphate head (polar/hydrophilic)
- 2 hydrocarbon tails (nonpolar/ hydrophobic)

Saturated vs. Unsaturated

- solid at room temperature
- no double bonds
- saturated w/ hydrogen
- animal fats
- butters

- liquid at room temperature
- one or more double bond(s)
- has "kinks"
- plant fats (olive oil)
- oils

Biology 210
Handout