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

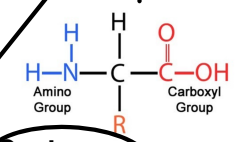
Hormonal
- coordinates organism's activities
- ex: insulin

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

Primary Structure

- sequence of amino acids

Secondary Structure

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

Tertiary Structure

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

Quaternary Structure

- one or more polypeptide chains

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