Unit 1: Biochemistry

Carbohydrates

Polarity: Polar, Hydrophilic

Polymer: Polysaccharides

Monomer: Monosaccharides

Bond Type: Glycosidic Linkage - strong stable covalent bond, always goes from a carbon bonded to an oxygen bonded to a carbon

Formula: $C_nH_{2n}O_n$

Functions: Energy Storage (Starch/Glycogen); Structural (Cellulose/Chitin)

Lipids

Polarity: Non-Polar, Hydrophobic

Polymer: No Polymers or Monomers

Types: Triglycerides, Phospholipids (hydrophilic), Steroids

Bond Type: Ester Bond -

Formula: Contains many C's & H's and has uneven C:O ratio

Functions: Energy Storage (Starch/Glycogen); Structural (Cellulose/Chitin)

Proteins

Polarity: Non-Polar or Polar Side Chains

Polymer: Polypeptide

Monomer: Amino Acid

Unit 1: Biochemistry (cont)

Bond Type: Peptide Bonds - strong stable covalent bond, carbon in carboxyl group bonds to nitrogen in amine group, OH (carboxyl) & H (amine) forms H2O

Formula: Includes Nitrogen, not Phosphorus !

Functions: So Many (ex. Enzymes, Structural Support)

Nucleic Acids

Polarity: Polar, Hydrophilic

Polymer: Nucleic Acids

Monomer: Nucleotide

Bond Type: Phosphodiester - strong covalent bond, hydroxyl group (sugar) bonds to phosphate of next nucleotide

Formula: Includes Nitrogen and Phosphorus

Functions: Coding Information (DNA, RNA)

Properties of Water

Polarity - H_2O is "Polar" because it's uneven distribution of electrons gives it a charge()

Unit 1: Biochemistry (cont)

Cohesion - Attraction of molecules to other molecules of the same kind. H_2O has strong cohesive forces due to the H-Bonds they form with one another.

Adhesion - Attraction of molecules to other types of molecules. H_2O "sticks/adheres" to substances that are more positive or negative than itself

Surface Tension - Liquid's resistance to spreading out due to the cohesive nature of its molecules. H_2O = high surface tension when cohesive forces are stronger than adhesive ones.

High Specific Heat - H_2O has the highest specific heat of any liquid due to its H-Bonds. specific heat - the amount of heat required totemp. of 1g of a substance by1C

H-Bonding - weak bonds from the electrostatic attraction (δ– portion to δ+ portion). Oxygen is δ– and Hydrogens are δ+ in water.

Carbon Based Life

Carbon is stable and forms four covalent bonds

Fluid Mosaic Model

Unit 1: Biochemistry (cont)

Phospholipids - not bound to each other; form structure due to water interactions; lipids ≠ bound → bilayer = fluid

Phospholipids: saturated tails take up less space, unsaturated (kinked) take up more space, long tails = thick membrane, short tails = thing membrane, cholesterol buffers fluidity

Enzymes and Regulation

Competitive Inhibitors - Compete with substrate for the active site; slow down the reaction

Noncompetitive Inhibitors - its attachment (not at active site), Δ active site shape → stop/slow down reaction

Enzyme Structure - (Protein Structure) Synthesis Rxn-2 enzymes catalyze one reaction

Induced fit - Enzyme ↓ the activation energy of a rxn and makes it happen quicker

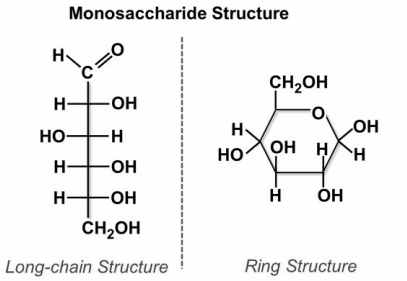
Enzyme Activity versus PH is a bell curve because their optimal pH for the reaction

Unit 1: Biochemistry (cont)

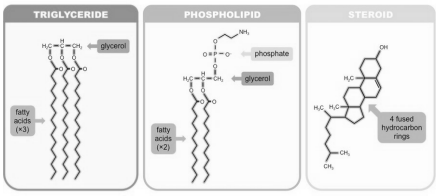
Enzyme Activity versus [Substrate] is a linear relation until saturated and reaction rate platoes

Enzyme Activity versus Time is linear until the protein is denatured at a certain temperature

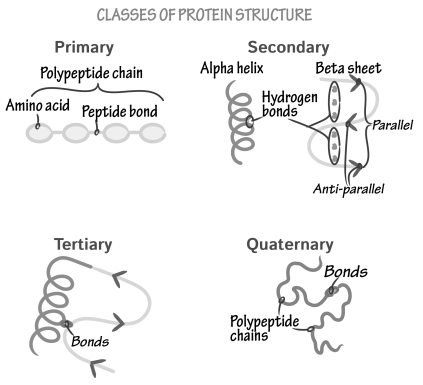
Carbohydrate Structure



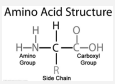
Lipid Structure



Protein Structure



Amino Acid Structure



Unit 2: Cell Biology

Essential Cell Structure

1. Plasma Membrane - Separates internal environment from external (maintains homeostasis); shows cell came from a common ancestor

2. DNA - Information Store/-instruction to pass on to the next generation

3. Ribosomes - Be able to build proteins from DNA instructions

4. Cytoplasm/Cytosol - Conduct the chemical processes of life (water based gel allows for diffusion)

Prok. compared to Eukaryotes

Prokaryotes

Simple, Small, Cheap No Nucleus, Has Nucleoid Circular DNA No Internal Membrane Organelles do one job

Eukaryotes

Complex, Bigger, Expensive Has Nucleus Linear DNA Many Internal Membranes Organelles have many specific compartmentalized functions

Endomembrane System

Unit 2: Cell Biology (cont)

System - Another characteristic of eukaryotes that provides advantage to the cell due to different compartments (organelles) → fine tuned to be the best environment for their job

Idea - System of internal membranes nucleus (has code for making all the proteins) → continuous membrane with the ER (pro. factory) → smooth and rough (vesicles exit the right after and go to the golgi body) → the golgi body (place for modifying cellular products) buds off more vesicles that could fuse with the membrane and dump out the contents, could involve other organelles

Endosymbiotic Theory

Endosymbiosis - one organism living inside of another

Theory: a cell absorbed mitochondria/chloroplast & displayed the combined ability of both

Evidence

1. Mitochondria & Chloroplasts multiply like ancient protists

Unit 2: Cell Biology (cont)

2. M & C have their own DNA (circular) + ribosomes similar to ancient bacteria

3. M & C have inner and outer membranes (inner is their own w/ lipids from ancient bacteria; outer is the cell that they acquired when engulfed)

Membrane Structure

A phospholipid bilayer with embedded proteins that is selectively permeable (ambiphilic: polar cannot penetrate; non polar passes right through ex. steroid hormone)

Passive Transport

Diffusion - (↑ to ↓ concentration) uses concentration gradients

Factors Affecting Diffusion: Amount of gradient, Mass of molecules, Temp, Solvent Density, Solubility, Surface Area & Membrane Thickness, Distance Traveled

Osmosis - movement of H_2O to balance solute concentration (H_2O moves from high H_2O potential (less negative) to low H_2O potential (more negative) :: pure H_2O = w.p.)

Unit 2: Cell Biology (cont)

total w.p.= solute potential + physical pressure

Facilitated Diffusion - (↑ to ↓ with help) type of diffusion guided by the presence of another integral membrane protein forming a pore or channel

Active Transport

Active Transport - uses free energy to move against concentration gradient

Primary Active Transport - ATP dependent

Secondary Active Transport - Primary dependent

Pumps - work against electr-omagnetic gradient

Bulk Transport

Endocytosis - entering the cell (loss of membrane)

Types - *Phagocytosis* (cell eating); *Phinocytosis* (cell drinking)

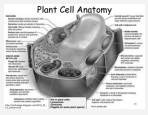
Photocytosis - uses caveolin & is receptor mediated

Exocytosis - exiting the cell (membrane gain)

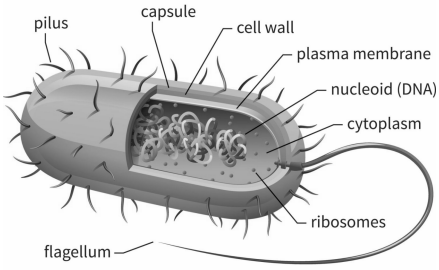
Transcytosis - in one side, out the other

Eukaryotic Cell Structure/Function (Animal)

Eukaryotic Cell Structure/Function (Plant)



Prokaryote Cell Structure



Unit 3: Cell Respiration & PhotoSynthesis

Photosynthesis (Concept)

Light Energy → Chemical Compounds (Glucose)

2 Electron Transport Chains: 1 makes ATP, 1 makes NADPH

Cellular Respiration

Glucose → Usable Energy

1 Electron Transport Chain: makes ATP

Compare

Depend on each other <-> Chemical Eqs

Unit 3: Cell Respiration & PhotoSynthesis (cont)

Both help ATP synthase: Both have H+ pumps (One pumps in, other out)

Alternative Photosynthesis Pathways

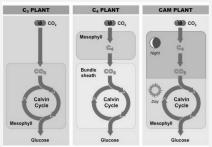
C3 - Concept (Normal Plant); Flaw (H_2O Loss); Where (Cell: Mezophill)(World: Everyw-here)

C4 - Concept ("Air Lock": extra step before Calvin Cycle); Flaw (Costs Extra Energy); Where Cell (Mezophill & Calvin Cycle); Where World (↑Light; ↓ Nutrients)

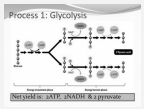
CAM - Concept ("Night Closed": extra step before Calvin Cycle); Flaw (Costs Extra Energy); Where Cell (Mezophill & Calvin Cycle during day); Where World (dry, arid places)

Rubisco - Concept (Enzyme s CO_2 from inorganic → organic); Flaw (Not selective → causes Photorespiration); Where Cell (Calvin Cycle)

Alternative Photosynthesis Pathways



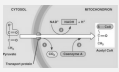
Glycolysis



Imput: 1 Glucose; 2 ATP; 2 NAD+
Output: 2 Pyruvate; 2 ATP (net); 2 NADH
Where: Cytoplasm

Explanation:
1. use ATP to trap & breakdown glucose
2. Continue with oxidative phosphorylation to make 2 pyruvate

Pyruvate Decarboxylation



Input: 2 Pyruvate; 2 NAD+
Output: 2 AcetylCoA; 2 NADH; 2 CO_2
Where: Mitochondria Matrix

Explination:
1. Remove Carboxyl Group
2. Oxidise Acetyl Group
3. Attach CoA