## Properties of Life

| |
|---|
| order |
| reproduction |
| growth and development |
| energy processing |
| regulation |
| response to the environment |
| evolutionary adaptation |

## Prokaryotic vs. Eukaryotic Cell

| | | |
|---|---|---|
| DNA | ✔ | ✔ |
| nucleus | | ✔ |
| cell membrane | ✔ | ✔ |
| cell wall | ✔ | |
| cytoplasm | ✔ | ✔ |
| ribosomes | ✔ | ✔ |
| mitoch-ondria | | ✔ |
| organisms | bacteria | plants, animals, fungi, protists |

## Formation of Macromolecules

| | |
|---|---|
| monomer | beads |
| polymers | necklace |
| dehydr-ation | create necklace, water produced |
| hydrolysis | take necklace apart, water consumed |

## Carbohydrates

| | |
|---|---|
| monomer | monosaccharide |
| polymer | polysaccharide |
| bonded by | covalent bonds |
| purpose | energy and storage |
| ETC | hydrophilic |

## Carbohydrate (-saccharides)

| | | |
|---|---|---|
| mono | di | poly |
| glucose | lactose | starch |
| fructose | sucrose | glycogen |
| galactose | maltose | cellulose |
| | | chitin |

## Storage and Energy

| | plants | animals |
|---|---|---|
| energy storage | starch | glycogen |
| structure | cellulose | chitin |

## Polysaccharides

| | |
|---|---|
| maltose | glucose + glucose |
| sucrose | glucose + fructose |
| lactose | glucose + galactose |
| cellulose | glucose |
| starch | glucose |

Starch is a chain of glucose. Cellulose is made of multiple chains of glucose with hydrogen bonding to connect the chains.

## The G Things

| | |
|---|---|
| glycerol (lipids) | ALL fatty acids |
| glycogen (polys-accharide) | Jenna needs energy, made of glucose |
| glucagon (protein) | sugar in the blood is GONE |

## Endosymbiont theory

Mitochondria and chloroplasts were formerly small prokaryotes that began living within larger cells, may have gained entry as undigested prey or parasites. In a world that was increasingly aerobic, host benefited from endosymbiont that could use oxygen to create energy. This led to the formation of a eukaryotic cell with a mitoch-ondria. Plant cells were developed from eukaryotic cells with photosynthetic prokar-yote.

## Structural Protein

What structural protein is secreted outside of cells making up 40% of the protein in your body?

> collagen

## Diabetes

| | |
|---|---|
| Type 1 | insulin isn't produced, beta pancreatic cells damaged |
| Type 2 | insulin/glucose receptors not working |

Hyperglycemia (high blood sugar), hypogl-ycemia (low blood sugar). Antagonist to insulin is glucagon.

## Tonic Solutions

Convert all %s to describe solvent, think about concentration gradient of solvent.

Hypertonic - full of things
Hypotonic - empty of things

## Membrane Transport

What kind of materials can travel through membrane passively?

> Non-polar molecules and water.

## Steroid Hormones

Why can steroid hormones pass through membranes?

> non-polar

## Phosphorylation

Phosphorylation is the transfer of a phosphate from ATP to another molecule.

## Hierarchy of Organization

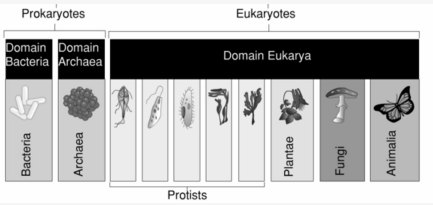
| | |
|---|---|
| atom | organ system |
| molecule | organism |
| organelle | population |
| cell | community |
| tissue | ecosystem |

## Hierarchy of Organization (cont)

| | |
|---|---|
| organ | biosphere |

Community is a bunch of populations, ecosystem is those populations and abiotic factors.

## Domains and Kingdoms




## Lipids

| | |
|---|---|
| monomer | fatty acids, glycerol |
| polymer | none |
| purpose | long-term energy storage |
| ETC | hydrophobic |

Saturated fats are found in animals, unsaturated found in plants and is healthier. Trans fat is structured like a unsaturated fat, but straightened like a saturated fat.
Head of phospholipid is hydrophilic, tail hydrophilic. Fats are more concentrated amounts of energy than carbohydrates.

## Proteins

| | |
|---|---|
| monomer | amino acids (different R groups) |
| polymer | polypeptide, enzyme |
| bonded by | peptide bonds |
| ETC | shape determines function |

Destroyed via denaturation. Must be in specific temp and pH.

## Protein Structure

| | |
|---|---|
| primary | chain (covalent bonds) |
| secondary | alpha helix, beta sheet (hydrogen bonds) |
| tertiary | 3D shape |
| quarte-rnary | multiple chains |

## Lysosomes

Digestion, disposal and recycling of material. Malfunction can result in Tay-Sachs disease.

## Chloroplasts

| | |
|---|---|
| stroma | thick fluid |
| thylakoid | chips |
| granum | stack |

## Cytoskeleton

| | microt-ubules | microfila-ments | interm-ediate filaments |
|---|---|---|---|
| structure | straight, hollow tubes | solid rods | superc-oiled cables |
| protein subunit | tubulin | actin | fibrous proteins |
| | thickest | thinnest | |
| function | shape and support cell tracks along which organelles with motor proteins move, flagella and cilia | form 3D network inside plasma membrane, supporting cell shape | reinforce cell shape, anchor organelles |

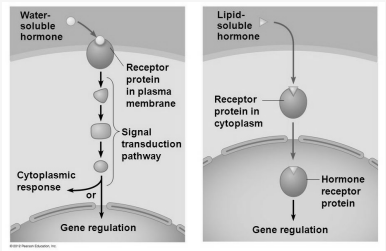
## Cytoskeleton (cont)

| | |
|---|---|
| rapidly disassemble | permanent |

## Stages of Hormone Signaling

1. Reception
2. Signal transduction
3. Response

## Water/Lipid-Soluble Hormone Signaling




## Enzyme

Enzymes are selective in the reaction it catalyzes. It can be a protein or RNA. The specific reactant it acts on is the substrate, which fits into the active site on the enzyme. Cofactors are helps that bind to the active site and function in catalysis. Coenzymes are organic cofactors. This speeds up reactions.

Competitive inhibitors block the active site whereas noncompetitive inhibitors reshape the enzyme.

## Cellular Respiration

| | |
|---|---|
| glycolysis | cytoplasm, 2 net ATP |
| pyruvate oxidation | 0 ATP |
| citric acid cycle | matrix, 2 ATP |
| oxidative phosphory-lation | inner mitochondrial membrane, ~28 ATP |

## Major Themes of Biology

emergent properties of life's hierarchy & systems that arise

structure and function

exchange of matter and energy

evolution

## Theory, Hypothesis, Law

Theory - widely accepted explanatory idea that is supported by a body of evidence

Hypothesis - testable explanation for a set of observations based on the available data

Law - statement based on repeated experimental observations that describes some aspect of the universe

Law describes, theory and hypothesis explain.

## Reasoning

Deductive: general --> specific

Inductive: specific --> general

Sherlock utilizes inductive reasoning. He's in the "in" and knows the details.

## Nucleic Acids

| | |
|---|---|
| monomer | nucleotides |
| polymer | nucleic acids, DNA, RNA |
| bonded by | hydrogen bonds (form helix), covalent bonds (form backbone) |
| purpose | genetic info |

## Nucleus

contains genetic information, DNA

direct protein synthesis, controlling cell's acticities

chromatin - complex of proteins and DNA

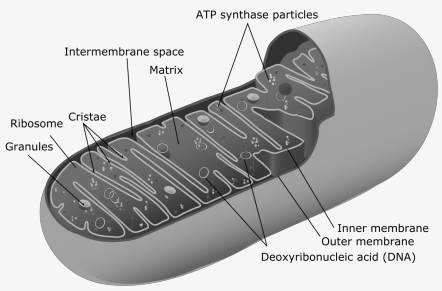
nuclear envelope - double membrane enclosing nucleus

nucleolus - where rRNA is synthesized

## Ribosomes

| | |
|---|---|
| free ribosome | proteins that function w/in cytosol |
| bound ribosome | proteins that are inserted into membranes, packaged in certain organelles, exported from cell |

## Mitochondria Diagram




## Endomembrane System

nuclear envelope

endoplasmic reticulum

Golgi apparatus

lysosome

vacuole

plasma membrane

## Smooth & Rough ER

| | |
|---|---|
| smooth ER | variety of metabolic processes, synthesis of lipids, process harmful substances, storage of calcium ions |
| rough ER | secrete proteins, makes membranes |

## Functions of Cell Structures

genetic

manufacture, distribution

energy

structural support, movement, communication

## Aquaporins

What if a cell has too many aquaporins?

> Too much water will be absorbed, body tissues will swell.

## Exocytosis & Endocytosis

## Types of Endocytosis

Phagocytosis takes in large molecules, taking them to lysosome via vacuole. Receptor-mediated endocytosis takes in specific solutes, forming a vacuole and then releasing the solute into cytoplasm.