Characteristics of Life

1) Living things have cells

2) Living things need energy (ATP)

3) Living things respond to their environment (Stimulus & Response)

4) Living things adapt to their environment (evolution)

5) Living things develop & grow

6) Living things reproduce (sexually and/or asexually)

Divisions of Life

Kingdom

Phylum

Class

Order

Family

Genus

Species

Ordered largest to smallest

Levels of Biological Organization

Atom

Molecule

Cell

Tissue

Organ

Multicellular Organism

Organized smallest to largest

Phylogenetics

Show evolution over time of different animals based on physical and/or genetic similarities

Scientific Method

1) Define problem

2) Collect info on problem

3) Form a hypothesis, null hypothesis = opposite of the hypothesis

4) Design an experiment that includes a control group, dependent variable, and independent variable

5) Preform experiment, observe and record data

6) Draw conclusions, a theory could be developed if hypothesis is proved correct

Scientific Method (cont)

7) Report results

- Scientific method can only answer objective questions based on quantitative facts from experiments
- Experimental design = design an experiment to test a hypothesis and/or answer a question
- Data gathering = Observe and record quantitative and/or qualitative data from experiment
- Data analysis = Make a conclusion as to whether or not the data from the experiment proves the hypothesis incorrect or correct

Science v. Pseudoscience v. Non-Science

Science	Study of natural world
Pseudoscience	Theories about the natural world that appear scientific, but are not
Non-Science	An area of study that is not scientific

Matter & Units of Matter

Matter	Anything that takes up space
Element	Pure substance, cannot be broken down
Atom	Smallest unit of matter
Isotope	An atom with a different number of neutrons
Ion	An atom with more or less electrons than proteins
Molecule	Atoms bonded together

Bonding

Ionic	Giving or losing electrons
Covalent	Sharing electrons

Properties of Water

Universal solvent

High cohesion

High specific heat (= thermal stability)

High heat of vaporization (= cooling mechanism)

Buffer, 7 on pH scale

pH

- Concentration of hydrogen ions
- Basic = 8-13, less hydrogen ion concentration
- Neutral = 7
- Acidic = 0-6, more hydrogen ion concentration
- 7 to 6 = 10x more acidic, 7 to 5 = 100x more acidic and so on

Chemical Rxt

Dehydration Synthesis	Form water that is ultimately removed to form bonds
Hydrolysis	Split compounds/large molecules by adding water

Inorganic v. Organic Compounds

Inorganic Compounds	Any compound that lacks a carbon atom, ex. O2, H2O
Organic Compounds	Compounds from living things, ex. Hydroxyl, Carboxyl Acid, Methyl, Amine

Carbon

Carbon is important to life because it is common in most compounds required for life and can be bonded a variety of ways because it only needs four more electrons to complete an octet.

Biological Molecules

Carbohydrates	Simple sugar used for short term energy, polysaccharides (Starch, glycogen, cellulose) + monosaccarides (glucose)
Lipids	Fats, oils, and waxes used for long term energy storage. Two parts: Glycerol & fatty acids. Two kinds: Saturated & unsaturated (double bonded carbons). Ex. Phospholipid
Proteins	Made up of one or more polypeptides folded and coiled onto each other
Nucleic Acid	Used for storing genetic information, two kinds: RNA & DNA

Proteins

- Polypeptide = Polymer of amino acids
- Amino Acids = Organic molecule with an amino acid group and a carboxyl group
- Proteins work by their shape so change the shape = Destroy the protein (denature)

Structures of a Protein

1) Primary Structure	Chain of amino acids
2) Secondary Structure	Coils and folds of a polypeptide chain, hydrogen bonds determine of pleated or helix
3) Tertiary Structure	Shape caused by interactions between R groups, shape can be determined by ionic bonding, disulfide bonds, hydrogen bonding, and hydrophobic attraction

Structures of a Protein (cont)

4) Quaternary Structure	Overall protein structure, 2+ tertiary structures put together

Functions of Proteins

1) Enzyme/Catalyst = Speeds up reactions by lowering the amount of energy needed, allosteric site = working sites of enzymes

2) Structure = Protein fibers (filaments), cytoskeleton in cells

3) Hormones = Slow communication system, quorum sensing = bacterial cells communicate with each other by releasing hormones

Enzymes

Used to do work in cells such as:

1) Mechanical Work

2) Transport Work

3) Chemical Work (catalysts = lower the amount of energy required)

How does an enzyme work?

1) Induced Fit = Putting two reactants together to lower energy

2) pH = Modifies pH of the system/reaction for a favorable spontaneous reaction

What affects enzyme function?

1) Temperature

2) pH

3) Cofactor = A mineral is needed for an enzyme to work, changes the shape of the allosteric site

4) Inhibitors = Substance that blocks the allosteric site of an enzyme, ex. negative feedback loops, positive feedback loops, penicillin

Other Proteins

Defensive Proteins	Protection against diseases, ex. antigens & antibodies
Receptor Proteins	Located on the phospholipid bilayer of a cell or organelle's membrane, function: response to compounds