

### 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) Perform experiment, observe and record data
- 6) Draw conclusions, a theory could be developed if hypothesis is proved correct
- 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
Pseudo-science	Theories about the natural world that appear scientific, but are not
Non-Science	An area of study that is not scientific



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Published 16th December, 2018.  
Last updated 16th December, 2018.  
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### 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 protons
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. O <sub>2</sub> , H <sub>2</sub> O
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) + monosaccharides (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



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### 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
- 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 |



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Published 16th December, 2018.  
Last updated 16th December, 2018.  
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