

2013-2014 Biology Curriculum Proposal Part 1

- I. Introduction to Biology
 - A. 5 shared characteristics
 1. Organized
 2. Reproduce
 3. Grow and develop
 4. Adaptation (response to stimuli)
 5. Homeostasis
 - B. Levels of organization
 1. Atom
 2. Molecule
 3. Organelle
 4. Cell
 5. Tissue
 6. Organ
 7. Organ system
 8. Multicellular organism
 - C. Evolution
 1. Natural selection
 2. Fossil records
 - D. Scientific reasoning
 - E. Taxonomy
 1. Classification
 2. Six kingdoms
 3. Phylogeny
 4. Dichotomous key
 - II. Biochemistry
 - A. Chemistry basics
 1. Atoms
 2. Elements
 3. Bonding and valence electrons
 - B. Properties of water
 1. Polarity
 2. High surface tension
 3. Cohesion and adhesion
 4. Capillary action
 5. Expansion during freezing
 - C. Elements of life (C, H, O, N, P, S)
 - D. Organic macromolecules
 1. Proteins
 2. Lipids
 3. Carbohydrates
 4. Nucleic acids
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- III. The Cell
 - A. Cell theory
 1. All living things are composed of cells.
 2. All cells come from pre-existing cells.
 3. Cells are the basic units of structure and function in living things.
 4. Microscopic evidence
 - B. Prokaryotes vs. eukaryotes
 - C. Cell organelles
 1. Structure
 2. Function
 3. Structure is related to function
 - D. Plasma membranes
 1. Structure
 2. Transport
 - a. Active
 - b. Passive
 - c. Diffusion
 - d. Osmosis
 - e. Facilitated diffusion
 - f. Endocytosis
 - g. Exocytosis
 - h. Phagocytosis
 - i. Pinocytosis

IV. Energy

- A. Adenosine triphosphate
 - 1. Structure
 - 2. Role as an energy currency
 - 3. Recyclable
- B. Enzymes
 - 1. Biological catalyst
 - 2. Factors affecting enzyme activity
 - a. Salinity
 - b. pH
 - c. concentration
 - d. temperature
 - e. inhibitors
 - f. activators
- C. Endergonic vs. Exergonic
- D. Photosynthesis
 - 1. Light reactions
 - 2. Dark reactions
- E. Cellular respiration
 - 1. Aerobic respiration
 - 2. Anaerobic respiration
 - 3. Lactic acid fermentation
 - 4. Alcoholic respiration

V. Nucleic acids

- A. DNA structure
 - 1. Nucleotides
 - 2. Double helix
 - 3. Rosalind Franklin
 - 4. Watson and Crick
- B. DNA replication
- C. RNA
 - 1. Structure compared to DNA
 - a. Single strand
 - b. Uracil instead of thymine
 - 2. Types of RNA
 - a. mRNA
 - b. tRNA
 - c. rRNA
- D. Protein synthesis
 - 1. Transcription
 - 2. Translation
 - 3. Mutations

VI. Cell Division

- A. Cell cycle
 - 1. Nucleotide to chromosome
 - 2. IPMAT
- B. Mitosis
 - 1. PMAT
 - 2. Plant vs. animal
 - a. Cytokinesis
 - b. Cleavage
 - c. Cell plate
- C. Meiosis
 - 1. I and II
 - 2. Somatic cells vs. gametes (egg and sperm)
 - 3. Diploid vs. haploid

VII. Genetics

- A. Introduction
 - 1. Mendel
 - 2. Heredity
 - 3. Self vs. cross fertilization
- B. Mendel's work
 - 1. Garden pea
 - 2. F₁ and F₂ generations
 - 3. Genotype and phenotype
 - 4. Mono- and di-hybrid crosses
 - 5. Punnett squares and probability
 - 6. Human examples
- C. Inheritance patterns
 - 1. Incomplete dominance
 - 2. Co-dominance
 - 3. Sex-linked traits
 - 4. Multiple alleles
- D. Mutations
 - 1. Genetic disorders
 - 2. Environmental influences (i.e., Chernobyl)
 - 3. Nondisjunction in autosomes vs. sex chromosomes

VIII. Ecology

A. Abiotic vs. biotic factors

B. Levels of organization

1. Individual
2. Population
3. Community
4. Ecosystem
5. Biome
6. Biosphere

C. Trophic levels

1. Autotrophs vs. heterotrophs
2. Producers, consumers and decomposers
3. Food chains and food webs
4. Energy pyramids

D. Species interaction

1. Symbiosis
2. Predation
3. Competition
4. Co-evolution

E. Limiting factors

1. Population fluctuation
2. Extinction

F. Nutrient cycles

1. Water
2. Carbon
3. Nitrogen
4. Oxygen

G. Changing ecosystems

1. Natural disturbances
2. Human disturbance