BIOLOGY
Introduction

BIOLOGY
Science Benchmark

Cells are the basic unit of life. All living things are composed of one or more cells that come from preexisting cells. Cells perform a variety of functions necessary for life. The structure and function of a cell determines the cell's role in an organism. Similarly the functions of an organism are related to the structures. Living cells are composed of chemical elements and molecules that form large complex molecules. These molecules form the basis for the structure and function of cells. Living cells maintain a state of homeostasis.

STANDARD I: Students will understand that all organisms are composed of one or more cells that are; made of molecules, come from preexisting cells, and perform life functions.

Objective 1: Describe the chemical composition and chemical properties exhibited by the chemicals found in cells.

a. List the major chemical elements in cells.
b. Illustrate and explain how large bio-molecules are formed.
c. Explain how the properties of water (e.g., cohesion, adhesion, heat capacity, solvent properties) contribute to maintenance of cells and living organisms.

Objective 2: Explain that cells obtain and store energy, use it to do work and release it to the environment.

a. Distinguish between autotrophic and heterotrophic cells.
b. Diagram and explain how energy from the sun is used in photosynthesis to combine CO_2 and H_2O to produce sugars and oxygen in cells.
c. Diagram how energy in molecules is released through cellular respiration producing CO_2 and H_2O.
d. Illustrate the cycling of matter and the flow of energy through photosynthesis and respiration.

Objective 3: Identify structure and function of cells and cell parts.

a. Explain how cells divide and come from preexisting cells.
b. Illustrate the process of mitosis and describe the significance for life.
c. Trace the history of cell theory and relate to technological developments.
d. Describe how the transport of materials in and out of cells enables cells to maintain homeostasis (i.e., osmosis, diffusion, active transport).
e. Describe the relationship between the organelles in a cell and the functions of that cell.
f. Experiment with microorganisms and plants to investigate growth.

STANDARD II: Students will understand that genetic information passed from parents to offspring is coded in DNA molecules that are replicated and passed on during cell division. The DNA structure is the same for all living things. Changes in DNA may alter genetic expression.

Objective 1: Explain how the structure and replication of DNA are essential to heredity and protein

synthesis.

a. Use a model of DNA to explain its organization.
b. Explain the importance of DNA replication to the cell cycle.
c. Compare the DNA structure in various living organisms. (e.g., single strand, circular strand, chromosomal pairs)
d. Research and report the historical events that led to our present understanding of DNA.
e. Summarize how genetic information encoded in DNA provides instructions for assembling protein molecules.

Objective 2: Cite examples of environmental factors and genetic technologies that may alter DNA sequences in genes and affect their expression.

a. Relate environmental factors to their possible effect on gene and chromosome expression in an organism.
b. Describe how mutations affect genetic expression.
c. Research and report examples of genetic technologies (e.g., genetic engineering, cloning, gene splicing).
d. Analyze bioethical issues related to genetic technologies and consider the role of science in determining public policy.

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Information passed from parent to offspring is coded in DNA (deoxyribonucleic acid) molecules. The fundamental DNA structure is the same for all living things, the sequences of DNA differ between organisms and species. Changes in the DNA sequence (code) may alter genetic expression.
The genetic information in DNA provides the instructions for assembling protein molecules in cells. The code used is virtually the same for all organisms.
Predictable patterns of inheritance can be traced from parent to offspring. Species that reproduce sexually increase the biodiversity of the species. Asexual reproduction provides offspring that have the same genetic code as the parent.
Genes found on DNA within chromosomes, show predictable patterns of inheritance.

STANDARD III: Students will understand that the sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations that show predictable patterns of inheritance. Many organisms, however, may pass on genetic information without genetic recombination.

Objective 1: Compare sexual and asexual reproduction.

a. Explain the significance of meiosis and how it provides for genetic variation.
b. Compare the advantages/disadvantages of sexual and asexual reproduction to survival of species.
c. Relate gamete formation and fertilization to maintaining a species chromosomal complement.
d. Formulate, defend, and support a perspective of a bioethical issue.

Objective 2: Predict and interpret patterns of inheritance in sexually reproducing organisms.

a. Explain Mendel's laws of segregation and independent assortment and their role in genetic inheritance.
b. Demonstrate possible results of recombination in sexually reproducing organisms using one or two

pairs of contrasting traits in the following crosses: dominance/recessive, incomplete dominance, co-dominance, and sex-linked traits.

c. Relate Mendelian Principles to modern day practice of plant and animal breeding.

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Organs and organ systems function together to provide homeostatis in organisms. The functioning of organs depends upon the other organs systems for both the structure and function. Form relates to functions.

STANDARD IV: Students will understand the structure and function of organs and organ systems.

Objective 1: Describe the structure and function of organs.

a. Relate the tissues that make- up organs to the structure and function of the organ.
b. Describe the structure of various organs (e.g., heart, lung, leaf, stem, root, skin, ovaries).
c. Describe the function of various organs.
d. Relate the function of organs to the function of other organs (e.g., function of teeth to function of stomach, function of heart to function of lungs, function of rib cage to the function of lungs).
e. Investigate the components of organs and diagram the relationship of the parts that make up organs (e.g., heart-valve-muscle, leaf-stomata-vein-chloroplast).
f. Compare the structure of organs for various organisms.

Objective 2: Describe structure and function of organ systems in living organisms.

a. Describe the structure and function of various organ systems (i.e., digestion, respiration, reproduction, circulation, protection, excretion).
b. Relate the function of organ systems in an organism (e.g., respiration to circulation,).
c. Compare organs and organ systems of various organisms.
d. Evaluate various systems in terms of a complete organism.
e. Research and report on the technological developments related to the various organ systems (e.g., hormonal modification, organ replacement, antibiotics).
f. Discuss religious/ethical issues (e.g., cloning, stem cell research)

Science Benchmark

Evolution is central to modern science's understanding of the living world. The basic idea of biological evolution is that Earth's present day species developed from earlier species. Evolutionary processes allow some species to survive with little or no change, some to die out altogether, and other species to change giving rise to a greater diversity of species. Science distinguishes itself from other ways of knowing and from other bodies of knowledge through the use of empirical standards, logical arguments, and skepticism, as science strives for explanations of the world.

STANDARD V: Students will understand that biological diversity is a result of evolution.

Objective 1: Relate biological diversity to principles of evolution.

a. Define species and speciation.
b. Explain the roles of variation within species and environmental pressure in natural selection.
c. Describe evolutionary factors that lead to biodiversity.

d. Provide examples that compare how the same niche is filled by different species in different locations (e.g. deer/ kangaroo -browser, shark /tiger -predator, pika /groundhog –burrowing grazer, coyote/golden eagle - scavenger).
e. Compare selective breeding to natural selection and relate the differences to agricultural practices.

Objective 2: Cite evidence for biological evolution and explain how changes in populations may occur over time.

a. Cite evidence that supports biological evolution over time(e.g., fossil and geologic record, molecular, homologous and vestigial structures).
b. Identify the role of mutation and recombination in evolution.
c. Trace the historical development of the theory of evolution.
d. Distinguish between inferences and observations in making interpretations related to evolution *(e.g. Galapogos finch beak bill will provide this).*

Objective 3: Classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships.

a. Classify organisms using a classification tool such as a key or field guide.
b. Generalize criteria used for classification of organisms (e.g., dichotomy, structure, general to specific).
c. Explain the need for classification systems in understanding evolutionary development.
d. Explain the ongoing changes to classification schemes used in biology.

Science Benchmark

Ecosystems are shaped by interactions among living organisms and their physical environment. Ecosystems change constantly either staying in a state of dynamic balance or shifting to a new state of balance. Matter cycles in ecosystems and energy flows from outside sources through the system. Humans are part of ecosystems and can deliberately or inadvertently alter an ecosystem.

STANDARD VI: Students will understand that living organisms interact with one another and their environment.

Objective 1: Summarize how energy flows through an ecosystem.

a. Arrange components of a food chain according to energy flow.
b. Compare the quantity of energy in the steps of an energy pyramid.
c. Compare the energy output of an organism to obtain food to the energy gain in obtaining that food (e.g., hummingbird energy output compared to the amount of energy gained, coyote catching a mouse compared to feeding on carrion, migration of birds to a location with seasonal abundance).
d. Evaluate personal choices (e.g., food choices, feed lot verses range fed cattle) in relation to the flow of energy within an ecosystem.

Objective 2: Explain relationships between matter cycles and organisms.

a. Use diagrams to trace the movement of matter through a cycle (i.e., carbon, oxygen, nitrogen, water) in a variety of biological communities and ecosystems.
b. Explain how water is a limiting factor in various ecosystems.

c. Distinguish between inference and evidence in a newspaper, magazine, journal, or Internet article that addresses and an issue related to humans impact on cycles of matter in an ecosystem and determine the bias in the article.
d. Evaluate personal choices in relation to matter cycles within an ecosystem.

Objective 3: Describe how interactions among organisms and their environment help shape ecosystems.

a. Categorize relationships between organisms according to predator-prey, commensalisms, mutualism, parasitism, and other relationships within an ecosystem.
b. Investigate an ecosystem using methods of science to gather quantitative and qualitative data that describe the ecosystem in detail.
c. Research and evaluate local and global practices that affect ecosystems.