Bemidji Area Schools

Grades 11-12 AP Biology Science Standards

Strand	Substrand	Standard "Understand that ...	Code	Benchmark "The student will . . .	Activities
1. The Nature of Science and Engineering	1. The Practice of Science	1. Science is a way of knowing about the natural world and is characterized by emperical criteria, logical argument and skeptical review.	9.1.1.1.3	Explain how the traditions and norms of science define the bounds of professional scientific practice and reveal instances of scientific error or misconduct. *For example:* The use of peer review, publications and presentations.	Labs: Inquiry Based
	3. Interactions Among Science, Technology, Engineering, Mathematics, and Society	1. Natural and designed systems are made up of components that act within a system and interact with other systems.	9.1.3.1.2	Identify properties of a system that are different from those of its parts but appear because of the interaction of those parts.	Lecture Topics: Discussions of Homeostasis; Immune Response; Osmosis Labs; Ecosystems
			9.1.3.1.3	Describe how positive and/or negative feedback occur in systems. *For example:* The greenhouse effect	
		2. Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	9.1.3.2.1	Provide examples of how diverse cultures, including natives from all of the Americas, have contributed scientific and mathematical ideas and technological inventions. *For example:* Native American understanding of ecology; Lisa Meitner's contribution to understanding radioactivity; Tesla's ideas and inventions relating to electricity; Watson, Crick and Franklin's discovery of the structure of DNA; or how George Washington Carver's ideas changed land use.	Lecture Topics: Popcorn in Genetics Unit; Maize Video Clips on various careers such as: Biotechnology, Genetic Counseling, and Genetic Engineering
		2. Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	9.1.3.2.2	Analyze possible careers in science and engineering in terms of education requirements, working practices and rewards.	

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1. The Nature of Science and Engineering	3. Interactions Among Science, Technology, Engineering, Mathematics, and Society	3. Science and engineering operate in the context of society and both influence and are influenced by this context.	9.1.3.3.1	Describe how values and constraints affect science and engineering. *For example:* Economic, environmental, social, political, ethical, health, safety, and sustainability issues.	Discussion of Inquiry Based Labs
1. The Nature of Science and Engineering	3. Interactions Among Science, Technology, Engineering, Mathematics, and Society	3. Science and engineering operate in the context of society and both influence and are influenced by this context.	9.1.3.3.2	Communicate, justify, and defend the procedures and results of a scientific inquiry or engineering design project using verbal, graphic, quantitative, virtual, or written means.	
1. The Nature of Science and Engineering	3. Interactions Among Science, Technology, Engineering, Mathematics, and Society	3. Science and engineering operate in the context of society and both influence and are influenced by this context.	9.1.3.3.3	Describe how scientific investigations and engineering processes require multi-disciplinary contributions and efforts. *For example:* Nanotechnology, climate change, agriculture, or biotechnology.	

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1. The Nature of Science and Engineering	3. Interactions Among Science, Technology, Engineering, Mathematics, and Society	4. Science, technology, engineering, and mathematics rely on each other to enhance knowledge and understanding.	9.1.3.4.1	Describe how technological problems and advances often create a demand for new scientific knowledge, improved mathematics, and new technologies.	Labs: pGlo; Hardy-Weinberg; Restriction Analysis
			9.1.3.4.2	Determine and use appropriate safety procedures, tools, computers and measurement instruments in science and engineering contexts. *For example:* Consideration of chemical and biological hazards in the lab.	
			9.1.3.4.3	Select and use appropriate numeric, symbolic, pictorial, or graphical representation to communicate scientific ideas, procedures and experimental results.	
			9.1.3.4.4	Relate the reliability of data to consistency of results, identify sources of error, and suggest ways to improve the data collection and analysis. *For example:* Use statistical analysis or error analysis to make judgments about the validity of results	
			9.1.3.4.5	Demonstrate how unit consistency and dimensional analysis can guide the calculation of quantitative solutions and verification of results.	
			9.1.3.4.6	Analyze the strengths and limitations of physical, conceptual, mathematical and computer models used by scientists and engineers.	

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4. Life Science	1. Structure and Function of Living Systems	1. Organisms use the interaction of cellular processes to as well as tissues and organ systems to maintain homeostasis.	9.4.1.1.1	Explain how cell processes are influenced by internal and external factors, such as pH and temperature, and how cells and organisms respond to changes in their environment to maintain homeostasis.	Prerequisite Readings Labs: Enzymes; Diffusion and Osmosis; Construction of organic molecule models. Lecture Topics: What does it mean to be alive? A brief overview of the cell and cell membranes. Terms: Cellular Respiration, Circulation, Homeostasis, Diffusion, Osmosis, Metabolism
			9.4.1.1.2	Describe how the functions of individual organ systems are integrated to maintain homeostasis in an organism.	
		2. Cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	9.4.1.2.1	Recognize that cells are composed primarily of a few elements (carbon, hydrogen, oxygen, nitrogen, phosphorus, and sulfur), and describe the basic molecular structures and the primary functions of carbohydrates, lipids, proteins and nucleic acids.	Lab: Mitosis and Meiosis; Osmosis and Diffusion Terms: Protein Synthesis, Enzymes, Carbohydrates, Protein, Amino Acid, Lipid, Nucleic Acid, Mitochondria, Chloroplast, Ribosome, Nucleus, Cell Membrane, Nuclear Membrane, Cell Wall, Diffusion, Osmosis, Facilitated Diffusion, Prokaryotic, Eukaryotic
			9.4.1.2.2	Recognize that the work of the cell is carried out primarily by proteins, most of which are enzymes, and that protein function depends on the amino acid sequence and the shape it takes as a consequence of the interactions between those amino acids.	
			9.4.1.2.3	Describe how viruses, prokaryotic cells, and eukaryotic cells differ in relative size, complexity and general structure.	
			9.4.1.2.4	Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction.	
			9.4.1.2.5	Compare and contrast passive transport (including osmosis and facilitated transport) with active transport such as endocytosis and exocytosis.	
			9.4.1.2.6	Explain the process of mitosis in the formation of identical new cells and maintaining chromosome number during asexual reproduction.	

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4. Life Science	2. Interdependence Among Living Systems	1. The interrelationship and interdependence of organisms generate dynamic biological communities in ecosystems.	9.4.2.1.1	Describe factors that affect the carrying capacity of an ecosystem and relate these to population growth.	Lab: Energy Dynamics; Photosynthesis; Respiration Terms: Carrying Capacity, Invasive Exotic Species, Predation, Competition
			9.4.2.1.2	Explain how ecosystems can change as a result of the introduction of one of more new species. *For example:* The effect of migration, localized evolution or disease organism.	
		2. Matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways.	9.4.2.2.1	Use words and equations to differentiate between the processes of photosynthesis and respiration in terms of energy flow, beginning reactants and end products.	Lab: Energy Dynamics; Photosynthesis; Respiration Lecture Topics: Photosynthesis; Respiration; Energy Flows; Matter Cycles Terms: Photosynthesis, Respiration, Glucose, Carbon Dioxide, Water, Oxygen, ATP, Equation for Photosynthesis, Producer, Consumer, Decomposer, Food Chain, Food Web, Autotroph, Heterotroph, Energy Pyramid, Trophic Level
			9.4.2.2.2	Explain how matter and energy is transformed and transferred among organisms in an ecosystem, and how energy is dissipated as heat into the environment.	
	3. Evolution in Living Systems	1. Genetic information found in the cell provides information for assembling proteins which dictate expression of traits in an individual.	9.4.3.1.1	Explain the relationships among DNA, genes and chromosomes.	Labs: pGlo; DNA Digest Lecture Topics: Transcription/Translation; Genetic Variation Without Meiosis; Cell Communication Terms: Allele, Dominant Allele, Gene, Genotype, Heterozygous, Homozygous, Monohybrid, Nucleotide, Phenotype, Protein, Punnett Square, Recessive Allele, Replication, transcription, Translation
			9.4.3.1.2	In the context of a monohybrid cross, apply the terms phenotype, genotype, allele, homozygous and heterozygous.	
			9.4.3.1.3	Describe the process of DNA replication and the role of DNA and RNA in assembling protein molecules.	

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4. Life Science	3. Evolution in Living Systems	2. Variation within a species is the natural result of new inheritable characteristics occurring from new combinations of existing genes or from mutations of genes in reproductive cells.	9.4.3.2.1	Use concepts from Mendel's laws of segregation and independent assortment to explain how sorting and recombination (crossing over) of genes during sexual reproduction (meiosis) increases the occurrence of variation in a species.	Lab: Mitosis and Meiosis Activity Lecture Topics: Mitosis/Meiosis Terms: Chromosome, Egg, Fertilization, Gamete, Independent Assortment, Meiosis, Mitosis, Mutation, Recombination, Crossing Over, Segregation, Sperm
			9.4.3.2.2	Use the processes of mitosis and meiosis to explain the advantages and disadvantages of asexual and sexual reproduction.	
			9.4.3.2.3	Explain how mutations like deletions, insertions, rearrangements or substitutions of DNA segments in gametes may have no effect, may harm, or rarely may be beneficial, and can result in genetic variation within a species.	
		3. Evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	9.4.3.3.1	Describe how evidence led Darwin to develop the theory of natural selection and common descent to explain evolution.	Labs: Artificial Selection; hardy Weinberg; BLAST Activity Lecture Topics: Natural Selection and Darwin; Natural Selection; The Mathematical Evidence; Mechanisms of Natural Selection and Speciation; Natural Selection in our Modern World
			9.4.3.3.2	Use scientific evidence, including the fossil record, homologous structures, and genetic and/or biochemical similarities, to show evolutionary relationships among species.	
			9.4.3.3.3	Recognize that artificial selection has led to offspring through successive generations that can be very different in appearance and behavior from their distant ancestors.	
			9.4.3.3.4	Explain why genetic variation within a population is essential for evolution to occur.	
			9.4.3.3.5	Explain how competition for finite resources and the changing environment promotes natural selection on offspring survival, depending on whether the offspring have characteristics that are advantageous or disadvantageous in the new environment.	
			9.4.3.3.6	Explain how genetic variation between two populations of a given species is due, in part, to different selective pressures acting independently on each population and how, over time, these differences can lead to the development of new species.	

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4. Life Science	4. Human Interactions with Living Systems	1. Human activity has consequences on living organisms and ecosystems.	9.4.4.1.1	Describe the social, economic, and ecological risks and benefits of biotechnology in agriculture and medicine. *For example:* Selective breeding, genetic engineering, and antibiotic development and use.	Lab: Artificial Selection; pGlo Lecture Topics: From Cells to the Biosphere; Life on Our Planet; Population Dynamics Terms: Biotechnology, Selective Breeding, Sustainable Development, risk and Benefit Assessment, Genetic Engineering, Antibiotic Development
			9.4.4.1.2	Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity. *For example:* Changing the temperature or composition of water, air or soil; altering the populations and communities, developing artificial ecosystems; or changing the use of land or water.	
			9.4.4.1.3	Describe contributions from diverse cultures, including Minnesota American Indian tribes and communities, to the understanding of interactions among humans and living systems. *For example:* American Indian understanding of sustainable land use practices.	
		2. Personal and community health can be affected by the environment, body functions and human behavior.	9.4.4.2.1	Describe how some diseases can sometimes be predicted by genetic testing and how this affects parental and community decisions.	Labs: Various Genetic Unit Activities Terms: Vaccine, Antibody, Antigen, Immune System, Disease, Pathogen, Allergy
			9.4.4.2.2	Explain how the body produces antibodies to fight disease and how vaccines assist this process.	
			9.4.4.2.3	Describe how the immune system sometimes attacks some of the body's own cells and how some allergic reactions are caused by the body's immune responses to usually harmless environmental substances.	
			9.4.4.2.4	Explain how environmental factors and personal decisions, such as water quality, air quality and smoking affect personal and community health.	
			9.4.4.2.5	Recognize that a gene mutation in a cell can result in uncontrolled cell division called cancer, and how exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.	