

CRLS Science Learning Expectations Biology Grades 11/12

Ecology

Organisms interact with the abiotic environment to form complex ecosystems. Ecosystems can be modified by human influence.

CRLS Learning Expectations	Mass Standard	Topic/Theme	Key Understandings	Assessments/Evidence
	6.1 6.2 6.3	Interdependence among organisms in the biosphere	Students will: Explain how biotic and abiotic factors cycle in an ecosystem (water, carbon, oxygen, and nitrogen). Identify the factors in an ecosystem that influence fluctuations in population size. Explain how symbiotic behavior produces interactions within ecosystems.	Analyze data from a human population to deduce factors that affected changes in the size of the population over time.
	6.4	Decision making in a complex world	Analyze changes in an ecosystem resulting from natural causes, changes in climate, human activity, or introduction of non-native species.	Analyze data from an ecological situation which has been influenced by humans. Discuss the social and political decisions that have been or must be made based on the data analysis.

Homeostasis

All organisms must maintain a controlled internal environment to function well. Systems of cellular transport and integration of organ systems in multicellular organisms are essential to the ability to maintain internal balance in spite of changes in the external environment.

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Learning Expectations	Standard			
	2.1	Internal environment of organisms	Students will: Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).	Design and perform an experiment demonstrating the process of diffusion using a chicken egg.
	2.1	Maintaining balance in organisms	Describe how cells function in a narrow range of physical conditions, such as temperature and pH, to perform life functions that help to maintain homeostasis	Design and perform experiments demonstrating living systems maintaining homeostasis when faced with changes in temperature and pH.
	4.1	Human Homeostasis: Health and disease	Describe how the function of individual systems within humans is integrated to maintain a homeostatic balance in the body.	Write a mock grant proposal for a health related program that includes an analysis of how the health program will work to help unhealthy individuals maintain homeostasis in affected organ systems.

Energy and Matter

The matter of living things is made of carbon-based organic molecules. Energy from sunlight is converted into chemical energy of matter by photosynthesis. Organisms depend on the cycling of matter and the flow of energy through an ecosystem. Matter is processed with the help of enzymes, to obtain energy for activity and growth.

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	1.1	Performance and fitness	Students will: Describe the composition and functions of the four major categories of organic molecules (carbohydrates, lipids,	Using knowledge of cycling of matter and energy flow through ecosystems, analyze the

	1.2		<p>proteins, and nucleic acids).</p> <p>Describe how dehydration synthesis and hydrolysis relate to organic molecules.</p>	<p>impact of various changes in the source of nutrients or amount of energy on the ecosystem.</p>
	1.3	Cellular basis of activity	<p>Explain the significance of carbon in organic molecules.</p>	<p>Design and perform a controlled experiment that analyzes a variable that might affect the action of an enzyme.</p> <p>Analyze the performance of a marathon runner given information on the runner's diet and physiological data.</p>
	1.4		<p>Recognize the six most common elements in organic molecules (C, H, N, O, P, S).</p>	
	1.5		<p>Explain the role of enzymes in biochemical reactions.</p>	
	2.2		<p>Identify the reactants and products in the general reaction of photosynthesis. Describe the use of isotopes in this identification.</p>	

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	2.3	Cellular basis of activity	<p>Students will:</p> <p>Identify how cellular respiration is important for the production of ATP.</p>	
	2.4	Cycling of matter and flow of energy	<p>Provide evidence that the organic compounds produced by plants are the primary source of energy and nutrients for most living things.</p>	<p>Analyze nutritional content of a food product.</p> <p>Write a story explaining how an atom of carbon in carbon dioxide ends up in a molecule of human muscle protein.</p>
	2.5		<p>Explain the interrelated nature of photosynthesis and cellular respiration.</p>	
	6.5		<p>Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels.</p>	

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Continuity

In order for a population to maintain itself, individuals must undergo the process of reproduction in which DNA is passed from parents to offspring. Patterns of DNA determine the variety of traits seen and inherited within a population. Scientists have learned to manipulate the structure of DNA and the process of gene expression in the field of genetic engineering.

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	3.1	Reproduction	Students will: Explain how zygotes are produced in the fertilization process.	Create a reproductive strategy for the Critter.
	3.2 3.3 3.4	Inheritance	Differentiate between dominant, recessive, co-dominant, polygenic, and sex-linked traits. State Mendel's laws of segregation and independent assortment. Use a Punnett Square to determine the genotype and phenotype of monohybrid crosses.	Design and perform an experiment following inheritance of a genetic trait in yeast.
	2.6 3.5	Gene Action	Describe and compare the processes of mitosis and meiosis, and their role in the cell cycle. Describe the structure and function of DNA, and distinguish among replication, transcription, and translation.	Using a manipulative, model the structure of DNA and the process of protein synthesis. Create a concept map explaining the relationships between continuity and gene action.
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	3.6	Gene Action	Students will: Describe the processes of replication, transcription, and translation and how	

	3.7		they relate to each other in molecular biology.	
	3.8		Describe the general pathway by which ribosomes synthesize proteins by using tRNAs to translate genetic information encoded in mRNAs. Explain how mutations in the DNA sequence of a gene may be silent or result in phenotypic change in an organism and in its offspring.	

Evolution

Biological evolution occurs by the selection of naturally occurring genetic variations within a population. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Humans are different from other organisms yet also share many common characteristics.

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		Human Evolution		
	5.1	Evolution: Change across time	Students will: Explain how the fossil record, comparative anatomy, and other	Students will role play various scientists at work analyzing various types of

	5.2		evidence support the theory of evolution. Illustrate how genetic variation is preserved or eliminated from a population through Darwinian natural selection (evolution) resulting in biodiversity.	data that provide evidence for evolution. Perform experiments with bacteria that investigate the problem of antibiotic resistance
	2.7 2.8 2.9 3.9	Products of Evolution: Unity and Diversity	Differentiate between prokaryotic cells and eukaryotic cells, in terms of their general structures and degrees of complexity. Distinguish between plant and animal cells. Recognize that while viruses lack cellular structure, they have the genetic material to invade living cells.	Create an organism (The Critter) and it's environment. Using knowledge of natural selection and evolution, explain how the organism resembles all known forms of life, how the organism is and became adapted to its environment and to which organisms it is most
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	5.3	Products of Evolution: Unity and Diversity	Describe how the taxonomic system classifies living things into domains (eubacteria, archaebacteria, and eukaryotes) and kingdoms (animals, plants, fungi, etc.).	closely related and the evidence that support your claim. Analyze various amphibians and reptiles to deduce the evolutionary relationships among them that have resulted in their current classification.

Development

In organisms that reproduce sexually, life begins with fertilization and continues with growth (mitosis) and differentiation until adulthood, when meiosis takes place to create gametes and the cycle begins again.

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	2.10	Development	Students will: Describe and compare the processes of mitosis and meiosis, and their role in the cell cycle.	
	2.11	Human life span	Relate cell parts/organelles to their functions.	Analyze various amphibians and reptiles to deduce the evolutionary relationships among them that have resulted in their current classification.