Biology HS

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Indicators (Tested indicators are bold)	Standards	Instructional Examples/ Additional Specificity	Month/ Concept
The student understands biological evolution, descent with modification, is a scientific explanation for the history of the diversification of organisms from common ancestors.	**S3. B3. I1**	a. The presence of the same materials and processes of heredity (DNA, replication, transcription, translation, etc.) is used as evidence for the common ancestry of modern organisms. b. Patterns of diversification and extinction of organisms are documented in the fossil record. Evidence indicates that simple, bacteria-like life may have existed billions of years ago. c. The distribution of fossil and modern organisms is related to geological and ecological changes (i.e. plate tectonics, migration). There are observable similarities and differences among fossils and living organisms. d. The frequency of heritable traits may change over a period of generations within a population of organisms, usually when resource availability and environmental conditions change as a consequence of extinctions, geologic events, and/or changes in climate.	August, September, October Evolution
The student understands populations of organisms adapt to environmental challenges and changes as a result of natural selection,	S3. B3. I2	a. Genetic changes occur only in individual organisms. b. Natural selection and genetic drift	

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genetic drift, and various mechanisms of genetic change.		occur within populations or organisms. c. Variation among individuals in a population allows individuals to respond differently to environmental challenges.	
The student understands biological evolution is used to explain the earth's present day biodiversity: the number, variety and variability of organisms.	**S3. B3. I3**	a. Separate populations within a species may become sufficiently different enough that new species develop. This process is called speciation. b. Changes in inherited traits accumulate in populations. c. Historically only a small percentage of species have survived to modern times.	
The student understands organisms vary widely within and between populations. Variation allows for natural selection to occur.	**S3. B3. I4**	a. Heritable variation exists in every species. b. New heritable traits results from new combinations of genes and from mutations or changes in the reproductive cells. c. Variation of organisms within and among species increases the likelihood that some members will survive under changes environmental conditions. d. Times, populations, or entire lineages become extinct. One effect of this is to	

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		increase the differences between the surviving lineages.	
The student understands the primary mechanism acting on variation is natural selection.	S3. B3. I5	a. Favorable heritable traits are more advantageous to reproduction and/or survival than others. b. There is a finite supply of resources available for offspring; therefore not all survive. c. Individuals with beneficial traits generally survive to reproduce in greater numbers. d. Favorable heritable traits tend to increase in the population through time if the selective pressure is maintained.	
The students understands biological evolution is used as a broad, unifying theoretical framework for biology.	S3. B3. I6	a. Organisms are classified according to the rules or nomenclature, and are given scientific names. b. The behavioral, physical, and genetic characteristics upon which these classifications are based are used as evidence for common descent. c. Natural selection, genetic drift, genomes, and the mechanisms of genetic change provide a context in which to	

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	S3. B4. I3	ask research questions and help explain observed changes in populations.	
The student understands the distribution and abundance of organisms and populations in ecosystems are limited by the carrying capacity.		a. The carrying capacity is determined by the availability of matter and energy, and the ability of the ecosystem to recycle materials b. Living organisms produce more offspring than environmental resources can support, resulting in a competition for resources.	
The student understands organisms cooperate and compete in complex, interdependent relationships.	S3. B4. I4	These relationships include: a. predator-prey relationships b. symbiotic relationships (parasitism, mutualism, commensalisms).	
The student understands animals have behavioral responses to internal changes and to external stimuli.	**S3. B6. I1**	a. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes. b. These responses can be innate and/or learned.	
The student understands most	S3 B6. I2	c. Animals often live in unpredictable environments, and so their behavior must be flexible enough to deal with uncertainty and change.	

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mulitcellular animals have nervous systems that underlie behavior.	S3. B6. I3	a. Nervous systems are formed from specialized cells that conduct signals rapidly through he long cell extensions that make up nerves. b. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. c. Sense organs, specialized cells that detect light, sound, touch and specific chemicals, enable animals to monitor what is going in the world around them.	
The student understands behaviors are often adaptive when viewed in terms of survival and reproductive success.	S3. B7. I1	a. Common behaviors include seeking food, seeking mates, raising young, avoiding predators, and regulating body temperature. b. Some organisms live in groups and have social behaviors that benefit both the individual and the group.	
The student understands differences in structure and function among organisms and can identify the characteristics of relevant life forms.	S3. B7. I5	a. Major structural differences among organisms include unicellular and multi-cellular, plants and animals, and invertebrates and vertebrates. b. Common functions include digestion, respiration, excretion, locomotion, communication and reproduction.	

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The student understands taxonomy is the systematic way in which organisms are placed into a hierarchical classification system, according to their physical and genetic characteristics and their evolutionary history.		a. All organisms are classified into one of a number of kingdoms, the broadest taxonomic category. b. All organisms are classified into a number of intermediate categories, of which species is the most specific.	
The student understands that homeostasis is the dynamic regulation and balance of an organisms internal environment to maintain conditions suitable to survival.	**S3. B7. I2**	n/a	October, November, December Homeostasis
The student understands that in complex organisms there is a division of labor into specific body systems i.e., respiration, digestion, nervous, endocrine, excretion, circulatory, reproductive, immune, skeletal and muscle.	S3. B7. I4	a. These systems interact with one another to maintain homeostasis. b. Relate the organs and their functions to the body system.	

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The student understands cells are composed of a variety of specialized structures that carry out specific functions.	S3. B1. I1	a. Each cell is surrounded by a membrane that controls the flow of materials into and out of the cell. b. Proteins embedded in the membranes help carry specific life processes such as transport and recognition. c. In eukaryotes, similar membranes compartmentalize various chemical environments of the cell into organelles such as the nucleus ad mitochondria. d Organelles carry out specific life functions for the cell such as protein synthesis, protein processing and packaging, energy transformation, communication, etc...	January, February Energy, Matter, & Organization
The student understands cell functions involve specific chemical reactions.	**S3. B1. I2**	a. Food molecules taken into cells provide the chemicals needed to synthesize other molecules. b. Enzymes catalyze both breakdown and synthesis in the cell.	
The student understands some plant cells contain chloroplasts, which are the sites of photosynthesis.	S3. B1. I4	a. The process of photosynthesis provides a vital connection between the sun and the energy needs of living systems.	
The student understands living	S3. B5. I1		

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systems require a continuous input of energy to maintain their chemical and physical organization.		a. Without the input energy, all matter tends to go toward more disorganized states. With death and the cessation of energy intake, living systems rapidly disintegrate.	
The student understands the sun is the primary source of energy for life through the process of photosynthesis.	**S3. B5. I2**	a. Plants and other photosynthetic organisms use energy to make organic compounds (primarily glucose) from carbon dioxide and water (CO_2 and H_2O) through a series of biochemical reactions. b. The energy in these compounds is used to assemble larger molecules with biological activity, including proteins, DNA, carbohydrates and fats. c. These molecules serve as sources of energy for the plants themselves and for many other organism through food webs. d. Chemosynthetic organisms, unlike photosynthetic organisms, use energy from chemical compounds to maintain life functions.	
The student understands food molecules contain biochemical energy, which is then available for cellular respiration.	**S3. B5. I3**	a. Energy is released when the food molecules are broken down into simpler compounds. b. Energy is transferred to ATP though cellular respiration.	

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The student understands the structure and function of an organisms serves to acquire, transform, transport, release, and eliminate the matter and energy used to sustain the organisms.	S3. B5 I4	c. Most biochemical reactions, furled by ATP, are catalyzed by enzymes. n/a	
The student understands cells can differentiate, thereby enabling complex multi-cellular organisms to form. **The student understands organisms usually have a characteristic number of chromosomes; one pair of these may determine the sex of individuals.**	S3. B1. I5 S3. B2. I2	a. In the development of most multi-cellular organisms, a fertilized cell forms an embryo that differentiates into an adult. a. Most cells in humans contain 23 pairs of chromosomes; the 23rd pair usually contains the XX for female or XY for male.	February, March Continuity

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The student understands cells function and replicate as a result of information stored in DNA and RNA molecules.	S3. B1. I3	a. Gene expression regulates cell functions through the synthesis of proteins. b. This regulation allows cells to respond to their environment and to control and coordinate cell division.	March, April Development
The student understands living organisms contain DNA or RNA as their genetic material, which provides the instructions that specify the characteristics of organisms.	**S3. B2. I1**	a. Nucleotides (adenine, thymine, guanine, cytosine and uracil) make up DNA and RNA molecules. b. Sequences of nucleotides that either determine or contribute to a genetic trait are called genes. c. DNA is replicated by using a template process that usually results in identical copies. d. DNA and associated proteins supercoil during cellular replication to become structured as chromosomes.	
The student understands hereditary information is contained in genes, located in the chromosomes of each cell.	**S3. B2. I3**	a. An inherited trait of an individual can be determined by one gene or by many genes (a polygenic trait), and a single gene can influence more tan one trait. b. The expression of traits is determined by a complex interaction of genes and the environment.	

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The student understands gametes carry the genetic information to the next generation.	S3. B2. I4	c. Alleles, which are different forms of a gene, may be dominant, recessive, or co-dominant. a. Gametes usually contain only one member from each chromosome pair. b. Gametes unite to form a new individual in most organisms.	
The student understands expressed mutations occur in DNA at very low rates.	S3. B2. I5	a. Mutations are genetic changes and can be beneficial, neutral, or deleterious. Many mutations have deleterious effect on the organism's survival and/or reproduction. b. Only mutations in gametes can be passed on to offspring and thus affect future generations.	
The student understands that living things change following a specific pattern of developmental stages called life cycles.	**S3. B7. I3**	c. Mutations in somatic cells can affect the individual organism, but not its offspring. n/a	

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The student understands atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.	**S3. B4. I1**	a. The essential chemical elements for life circulate in the biosphere in characteristic paths known as biogeochemical cycles (e.g., cycles for water, nitrogen, carbon, oxygen, etc.)	April, May Ecology
The student understands energy is received, transformed and expended in ecosystems.	S3. B4. I2	a. Radiant energy that enters the biosphere is balanced by the energy that leaves the earth into space as radiant energy, primarily heat. b. Transfer of energy through a series of organisms in an ecosystem is known as a food web. c. Organisms and ecosystems expend energy, much of which is released as heat, to maintain a high state of internal order.	
The student understands human beings live within and impact ecosystems.	S3. B4. I5	a. Humans modify ecosystems as a result of population growth, technology,and consumption. b. Human modifications of habitats through direct harvesting, pollution, atmospheric changes, and other factors affect ecosystem stability.	