BSCS Biology
A Human Approach

Correlation to the Next Generation Science Standards

High School Science Content Standards
Grades 9-12

Compiled by Kevin Lindauer, Denver Public Schools

HS-LS1 Ecosystems: Interactions Energy, and Dynamics

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS1-a. Critically read scientific literature and produce scientific writing and/or oral presentations that communicate how the structure and function of systems of specialized cells within organisms help perform the essential functions of life. **Clarification Statement:** Emphasis is on identifying systems of specialized cells or tissues (e.g., nervous, muscular, connective, epithelial) and specialized structures that these cells possess that are vital to their functioning in carrying out essential life processes (e.g., transmission of neural impulses, muscle contraction, maintenance of blood glucose levels). Students should be able to determine information that is relevant to how the structure and function of these systems are related to chemical reactions that take place between different types of molecules (e.g., water, proteins, carbohydrates, lipids, nucleic acids). **Assessment Boundary:** The assessment should measure students' understanding of the hierarchical and structural organization of cells. Emphasis is not on whole body systems or biochemistry.	Cells in Action* ..... Chapter 4 A Cell Model* ..... Chapter 4 Regulating the Internal Environment* ..... Chapter 4 Keep a Body Running* ..... Chapter 8 Using Light Energy to Build Matter ..... Chapter 8 Building Living Systems ..... Chapter 8 Expression of Genetic Information ..... Chapter 11 A Cellular View of Inheritance ..... Chapter 12 Generating Specialized Cells ..... Chapter 13 Microorganisms ..... Appendix F The Body's Organization ..... Appendix F
HS-LS1-b. Critically read scientific literature and produce scientific writing and/or oral presentations that communicate how DNA sequences determine the structure and function of proteins, which carry out most of the work of the cell. **Clarification Statement:** Emphasis is on the conceptual understanding that DNA sequences determine the amino acid sequence; thus, protein structure and function. **Assessment Boundary:** The assessment should provide evidence of students' abilities to read critically and identify key ideas and major conceptual ideas of the relationship between structure and the processes that lead to protein synthesis. The specific steps of transcription and translation or actual protein structure are not assessed.	Expression of Genetic Information ..... Chapter 11 Generating Specialized Cells. ..... Chapter 13 Decoding the Message ..... Chapter 11 The Stuff of Life ..... Chapter 11 Modeling DNA ..... Chapter 11 Genetic Technology ..... Chapter 11 Patterns of Inheritance ..... Chapter 12 A Cellular View of Inheritance. ..... Chapter 12 Yeast Genetics Lab Section ..... 5, TR

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Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS1-c. Develop and use a model to support explanations about the hierarchical organization of interacting systems working together to provide specific functions within multicellular organisms. **Clarification Statement:** Emphasis is on the levels of organization including cells, tissues, organs, and systems of an organism. **Assessment Boundary:** The assessment should provide evidence of students' abilities to develop and use models to explain how each level is dependent on the next to operate as a system carrying out specific functions necessary for life,	Regulating the Internal Environment* .....Chapter 4 You Are What You Eat .....Chapter 7 Structures and Functions*.....Chapter 7 Keep a Body Running!.....Chapter 8 Using Light Energy to Build Matter .....Chapter 8 Building Living Systems .....Chapter 8 Regulating Human Reproduction.....Chapter 10 The Body's Organization* .....Appendix F
HS-LS1-d. Design and conduct an investigation to gather evidence in supporting explanations for the function of feedback mechanisms to maintain homeostasis. **Clarification Statement:** The emphasis is on investigations (e.g., heart rate response to exercise, blood vessels response to temperature changes) that students use to provide evidence to support explanations of types of feedback. **Assessment Boundary:** The assessment should provide evidence that students can distinguish between evidence supporting the feedback mechanism and evidence that does not include a feedback mechanism. Additionally, students should be able to determine whether or not an investigation is safe and ethical. The assessment should provide evidence of students' abilities to distinguish between supporting and irrelevant data. Cellular operations involved in the feedback mechanism are not assessed.	Cells in Action .....Chapter 4 Regulating the Internal Environment .....Chapter 4 Self Defense!*.....Chapter 6 Keep a Body Running!*.....Chapter 8 Using Light Energy to Build Matter .....Chapter 8 Tracing Matter and Energy .....Chapter 8 A Matter of Trash.....Chapter 9 Matter Goes Round and Round.....Chapter 9 Spinning the Web of Life .....Chapter 9
HS-LS1-e. Use a model to support the explanation of how mitotic cell division results in daughter cells with identical patterns of genetic material essential for producing and maintaining a complex organism. **Clarification Statement:** Emphasis is on conceptual understanding that mitosis passes on genetically identical materials via replication, not on the phases of mitosis. **Assessment Boundary:** The assessment should provide evidence of students' abilities to explain from a model (e.g., diagrams, computer simulations) how cells may have differentiated within an organism but are genetically identical.	Expression of Genetic Information*.....Chapter 11 A Cellular View of Inheritance*.....Chapter 12 A Start in Development* .....Chapter 13 Generating Specialized Cells.....Chapter 13 Mystery on Easter Island.....Chapter 15 Islands in the Sky.....Chapter 15 The Body's Organization .....Appendix F

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Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS1-f. Construct an explanation using evidence for how cell differentiation is the result of activation or inactivation of specific genes and small differences in the immediate environment of the cells; relate these concepts to potential solutions in biomedical engineering and research.* **Clarification Statement:** Emphasis is limited to the concept that a single cell develops into a variety of differentiated cells and thus, a complex organism. **Assessment Boundary:** The assessment should provide evidence of students' abilities to construct an explanation about the conditions necessary for cell differentiation as well as the applications for biomedical research (e.g., cancer treatment, replacing damaged organs, engineering tissues to test drugs).	A Start in Development* . . . . . Chapter 13 Generating Specialized Cells . . . . . Chapter 13 Development Gone Awry* . . . . . Chapter 13 Development in Your Critter . . . . . Chapter 13 Looking Inside Black Boxes . . . . . Section 5, TR
HS-LS1-g. Develop and revise a model to support explanations about the role of cellular division and differentiation in producing and maintaining complex organisms composed of systems of tissues and organs that work together to meet the needs of the entire organism. **Clarification Statement:** Emphasis is on the concept that genetically identical cells produced from a single cell during embryological development differentiate and become tissues that make up organs within organ systems working together to meet the needs of the organism. **Assessment Boundary:** The assessment should provide evidence of students' abilities to show strengths and/or limitations of a model to demonstrate the development of differentiated cells with specific functions necessary for the organism to survive. Assessments could use a computer simulation. Emphasis is not on recalling the steps of mitosis or specific gene control mechanisms.	A Start in Development* . . . . . Chapter 13 Generating Specialized Cells* . . . . . Chapter 13 Development Gone Awry . . . . . Chapter 13 Development in Your Critter* . . . . . Chapter 13 Looking Inside Black Boxes . . . . . Section 5, TR
HS-LS1-h. Develop a model to support explanations for how photosynthesis transforms light energy into stored chemical energy. **Clarification Statement:** Emphasis is on model development within the context of explaining the process of photosynthesis. Models may include diagrams and chemical equations. The focus should be on the flow of matter and energy through plants and other photosynthesizing organisms. **Assessment Boundary:** The assessment should provide evidence of students' abilities to describe the inputs and outputs of photosynthesis, not the specific biochemical steps.	Using Light Energy to Build Matter* . . . . . Chapter 8 Building Living Systems* . . . . . Chapter 8 Plants. . . . . Appendix F

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Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS1-i. Construct an explanation that carbon, hydrogen, and oxygen from sugar molecules produced through photosynthesis may combine with other elements to form amino acids and other large carbon-based molecules. **Clarification Statement:** Emphasis is on students constructing explanations for how sugar molecules are formed through photosynthesis and the components of the reaction (i.e., carbon, hydrogen, oxygen). This hydrocarbon backbone is used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA). **Assessment Boundary:** The assessment should provide evidence of students' abilities to explain the relationship between the products of photosynthesis and their role as building blocks for the formation of macromolecules. Limited to the conceptual understanding of how the products of photosynthesis are utilized to build macromolecules. The details of the various chemical reactions are not assessed.	What Is in the Food You Eat?.....Chapter 7 You Are What You Eat* .....Chapter 7 Structures and Functions * .....Chapter 7 Marathon .....Chapter 7 Keep a Body Running! .....Chapter 8 Using Light Energy to Build Matter * .....Chapter 8 Building Living Systems .....Chapter 8 Tracing Matter and Energy .....Chapter 8 A Matter of Trash.....Chapter 9 Matter Goes Round and Round .....Chapter 9 Spinning the Web of Life .....Chapter 9
HS-LS1-j. Use a model to represent and support the explanation that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. **Clarification Statement:** Emphasis is on the conceptual understanding of the inputs and outputs of metabolism, not the specific steps. **Assessment Boundary:** The assessment should provide evidence of students' abilities to use conceptual models or diagrams to explain the inputs and outputs of metabolism. Students are not expected to identify the steps in cellular respiration.	What Is in the Food You Eat?.....Chapter 7 You Are What You Eat .....Chapter 7 Structures and Functions*.....Chapter 7 Marathon*.....Chapter 7 Keep a Body Running!.....Chapter 8 Building Living Systems .....Chapter 8 Tracing Matter and Energy* .....Chapter 8
HS-LS1-k. Produce technical writing to communicate information about the evidence from technologies that supports explanations for the integrated functioning of various regions of the brain.* **Clarification Statement:** Emphasis is on evaluating evidence about the integrated functioning of various regions of the brain and the technologies (e.g., MRI, CAT scan) used to gather the evidence about how the brain functions. **Assessment Boundary:** The assessment should provide evidence of students' abilities to determine which explanations are supported by valid and reliable data and the sources of the data. Emphasis is on physiological function, not the value of the behavior to the organism.	Primates Exploring Primates*.....Chapter 1 Stepping Up the Pace* .....Chapter 5

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HS-LS1 Ecosystems: Interactions Energy, and Dynamics - Continued

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS1-l. Ask questions to establish the strength of evidence supporting scientific arguments for the patterns of behavior in organisms related seeking rewards, avoiding punishments, and/or forming attachments to members of their own species and, in some cases, to members of other species. **Clarification Statement:** Emphasis is on the strength of arguments explaining the relationship between brain circuits and motivation of behaviors. Emphasis is on the strength of evidence used to support an argument. **Assessment Boundary:** The assessment should provide evidence of students' abilities to recognize patterns of behaviors and relate those patterns to information processing regions of the brain.	How Different Are We? . . . . . Chapter 1 Primates Exploring Primates* . . . . . Chapter 1 Explaining Humankind . . . . . Chapter 1 A Long Childhood* . . . . . Chapter 1 Explaining Adaptation . . . . . Chapter 2 Tony's Brain* . . . . . Chapter 6 Life Span Development: Examining the Contexts . . . . . Chapter 14 Making Sense of Reproductive Strategies . . . Chapter 10 The Body Responds . . . . . Chapter 5 Analyzing Reproductive Behaviors . . . . . Chapter 10

HS-LS2 Ecosystems: Interactions Energy, and Dynamics

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS2-a. Design and conduct an investigation to generate mathematical comparisons of factors that affect carrying capacity and biodiversity of similar ecosystems at different scales. **Clarification Statement:** Emphasis is on qualitative comparison of biodiversity and carrying capacity of ecosystems (e.g., wooded lot to a forest, a small pond to a large lake). **Assessment Boundary:** The assessment should provide evidence of students' abilities to make mathematical comparisons and determine which of the factors (e.g., boundaries, resources, climate, competition) affect carrying capacity and biodiversity. Assessments should include mathematical comparisons (e.g., graphs, charts, density, dispersion, histograms, population distributions) taken from simulations or historical data sets. Students should not be expected to derive mathematical equations to make comparisons.	Exploring Change . . . . . Chapter 2 Observing the World Around Us . . . . . Chapter 15 Interactions in the World Around Us* . . . . . Chapter 15 The Pasture Story . . . . . Chapter 15 Mystery on Easter Island* . . . . . Chapter 15 A Jar Full of Interactions* . . . . . Section 5, TR Changing Ecosystems* . . . . . Section 5, TR

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HS-LS2 Ecosystems: Interactions Energy, and Dynamics - Continued

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS2-b. Apply concepts of statistics and probability as mathematical evidence for population changes in ecosystems to support assertions about the tentative nature of scientific explanations and the role of new evidence in revising explanations. **Clarification Statement:** Emphasis is on the difference in historical and contemporary quantitative analysis that demonstrates the changes in explanations about population fluctuations and how explanations for a change at one scale may not explain changes at another scale. Emphasis is not on students only completing mathematical calculations, but using the outcomes to reach a conclusion. **Assessment Boundary:** The assessments should provide evidence of students' abilities to analyze and interpret the effect new information has on explanations (e.g., DDT effects on raptor populations, effects of water temperature below reservoirs on fish spawning, invasive species effects when spread to larger scale).	Exploring Change . . . . . Chapter 2 Explaining Adaptation . . . . . Chapter 2 Just a Theory? . . . . . Chapter 2 Evolution in Action* . . . . . Chapter 2 Islands in the Sky* . . . . . Chapter 15 Tri-Lakes: Identifying Causes of Change* . . . . Chapter 16
HS-LS2-c. Evaluate the impact of new data on a working explanation for cycling of matter and flow of energy in anaerobic respiration and revision of the explanations in light of new data.* **Clarification Statement:** Emphasis is on identifying the impact of new data on scientific explanations about the cycling of matter and flow of energy. **Assessment Boundary:** The assessment should provide evidence of students' abilities to explain how new data (e.g., observations and data of organisms living near deep ocean vents–chemosynthesis) have resulted in revisions of explanations in light of new evidence. Conceptual understanding of the cycling of matter and flow of energy in anaerobic respiration is the emphases of the assessment. The emphasis is not on the specific chemical processes of either aerobic or anaerobic respiration.	Tracing Matter and Energy . . . . . Chapter 8 Matter Goes Round and Round . . . . . Chapter 9 Spinning the Web of Life . . . . . Chapter 9 Generating Some Heat . . . . . Chapter 9
HS-LS2-d. Develop a mathematical model that generates data to support explanations about the flow of matter and energy among organisms in an ecosystem. **Clarification Statement:** Emphasis is on data derived from models of energy stored in biomass that is transferred from one trophic level to another. The model should also account for students understanding that most of the energy is not transferred between organisms but is dissipated into the environment. **Assessment Boundary:** The assessment should provide evidence of students' abilities to develop energy pyramids, food chains, food webs, and other models from data sets.	Tracing Matter and Energy* . . . . . Chapter 8 Matter Goes Round and Round* . . . . . Chapter 9 Spinning the Web of Life* . . . . . Chapter 9 Generating Some Heat . . . . . Chapter 9 Energy, Matter, and Disaster* . . . . . Chapter 9 A Jar Full of Interactions . . . . . Section 5, TR

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HS-LS2 Ecosystems: Interactions Energy, and Dynamics - Continued

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS2-e. Apply scientific knowledge and evidence to explain that elements and energy are conserved as matter cycles and energy flows through ecosystems. **Clarification Statement:** Emphasis is on molecules such as carbon, oxygen, hydrogen, and nitrogen and their conservation in, for example, the water cycle or carbon cycle. **Assessment Boundary:** The assessment should provide evidence of students' abilities to present evidence-based explanations for conservation through the process of cycling of matter and flow of energy.	Releasing Energy. . . . . Chapter 8 Energy in Matter* . . . . . Chapter 8 Tracing Matter and Energy* . . . . . Chapter 8 Matter Goes Round and Round* . . . . . Chapter 9 Spinning the Web of Life . . . . . Chapter 9 Generating Some Heat . . . . . Chapter 9 Energy, Matter, and Disaster* . . . . . Chapter 9
HS-LS2-f. Ask questions to define a problem caused by changes in population, resources, and/or the environment that can be solved through environmental engineering of solutions specific to the competition of organisms for matter and energy.* **Clarification Statement:** Emphasis is on students understanding that competition between organisms is for matter and energy to survive, grow, and reproduce. **Assessment Boundary:** The assessment should provide evidence of students' abilities to identify questions that define the problems when conditions (e.g., invasive species, predator removal, extreme weather, land use) are altered. The questions should be scientific in nature and useful in defining a problem that has an environmental engineering solution.	Explaining Adaptation . . . . . Chapter 2 Interactions in the World around Us . . . . . Chapter 15 Mystery on Easter Island* . . . . . Chapter 15 Tri-Lakes activities* . . . . . Chapter 16 The Gulf of Maine . . . . . Chapter 16 A Jar Full of Interactions . . . . . Section 5, TR Changing Ecosystems . . . . . Section 5, TR
HS-LS2-g. Apply concepts of statistical data to develop an explanation for variations in rates of photosynthesis and cellular respiration and the resulting influence on the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. **Clarification Statement:** Emphasis is on determining the data that supports the role of photosynthesis and cellular respiration in the cycling of carbon (e.g., seasonal fluctuations in carbon dioxide, sinks, and sources of carbon). **Assessment Boundary:** The assessment should provide evidence of students' abilities to explain the influence of different rates of photosynthesis and cellular respiration on the carbon cycle. The emphasis is not on the specific chemical steps of photosynthesis and respiration.	Tracing Matter and Energy . . . . . Chapter 8 Matter Goes Round and Round* . . . . . Chapter 9 Interactions in the World Around Us . . . . . Chapter 15

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Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS2-h. Develop, revise, and use a mathematical model to support an explanation of how complex sets of interactions in ecosystems maintain relatively consistent numbers and types of organisms for long periods of time when conditions are stable. **Clarification Statement:** Emphasis is on mathematical models that support stability in populations through cycles and trends. **Assessment Boundary:** The assessment should provide evidence of students' abilities to derive trends from graphical representations of population trends. The models will be used to support explanations of the nature of interactions that occur in an ecosystem and relate these interactions to the stability and change. The assessment should only use mathematical analysis of the model appropriate to the grade level.	Exploring Change*.....Chapter 2 Matter Goes Round and Round.....Chapter 9 Changing Ecosystems.....Section 5, TR Mystery on Easter Island.....Chapter 15 Islands in the Sky*.....Chapter 15
HS-LS2-i. Use scientific reasoning, theory, and models to link evidence to claims about the effects of modest and extreme biological or physical changes to ecosystems on the natural capacity to reestablish an ecosystem with more or less stable conditions. **Clarification Statement:** Emphasis is on using evidence to support arguments for the mechanisms leading to either a more stable ecosystem or less stable ecosystem. Computational models may be used as evidence to support the argument. **Assessment Boundary:** The assessment should provide evidence of students' abilities to distinguish between evidence supporting the capacity of ecosystems to respond to modest changes (e.g., hunting, fertilizer run-off) and extreme changes (e.g., fire, flood).	Changing Ecosystems*.....Section 5, TR Interactions in the World Around Us*.....Chapter 15 Critters and Interdependence.....Chapter 15 Tri-Lakes: Asking Questions*.....Chapter 16 The Gulf of Maine.....Chapter 16
HS-LS2-j. Design, evaluate, and refine a solution for reducing negative impact of human activities on the environment and ways to sustain biodiversity and maintain the planet's natural capital.* **Clarification Statement:** Emphasis is on human activities (e.g., pollution, climate change, making snow at ski areas, controlled burns, dams) that change the way ecosystems operate in terms of potential impacts on biodiversity, as well as populations. The solutions should be based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. **Assessment Boundary:** The assessment should provide evidence of students' abilities to provide reasonable explanations of what might happen as the basis for proposed engineering solutions.	Exploring Change.....Chapter 2 The Pasture Story*.....Chapter 15 Mystery on Easter Island.....Chapter 15 Islands in the Sky.....Chapter 15 The Gulf of Maine *.....Chapter 16 Tri-Lakes activities*.....Chapter 16 Humans and the Environment: The Influence of Culture.....Section 5, TR Changing Ecosystems*.....Section 5,TR

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HS-LS2 Ecosystems: Interactions Energy, and Dynamics - Continued

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS2-k. Evaluate evidence for its merits in supporting the role of group behavior on individual and species' chances to survive and reproduce. **Clarification Statement:** Emphasis is on advantages of grouping behaviors (e.g., flocking, schooling, herding) and cooperative behaviors (e.g., hunting, migrating, swarming) on survival and reproduction. **Assessment Boundary:** The assessment should provide evidence of students' abilities to: (1) distinguish between group versus individual behavior, (2) identify evidence supporting the outcomes of group behavior, and (3) develop logical and reasonable arguments based on evidence.	Marathon*.....Chapter 7 Reproduction in Humans and Other Organisms*.....Chapter 10 Analyzing Reproductive Behaviors*.....Chapter 10
HS-LS2-l. Design and conduct an investigation to test design solutions for increasing or maintaining the biodiversity of an ecosystem.* **Clarification Statement:** Emphasis is on designing solutions for a proposed problem. The investigation may be a simulation or a performance task in the classroom. **Assessment Boundary:** The assessment should provide evidence of the students' abilities to consider environmental, personal, and social impacts as well as designing a solution and developing methods for measuring the effects of the proposed changes on the system in terms of: (1) increasing biodiversity, and (2) maintaining biodiversity.	Exploring Change.....Chapter 2 The Pasture Story*.....Chapter 15 Mystery on Easter Island.....Chapter 15 Islands in the Sky.....Chapter 15 The Gulf of Maine*.....Chapter 16 Tri-Lakes activities*.....Chapter 16 Changing Ecosystems.....Section 5, TR

HS-LS3 Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS3-a. Ask questions to obtain information about the role of DNA and chromosomes in coding the instructions for forming the characteristic traits of species passed from parents to offspring. **Clarification Statement:** Emphasis is on the practice of asking scientific questions and obtaining reliable information to describe roles of chromosomes and DNA in coding instructions for traits in species. **Assessment Boundary:** The assessment should provide evidence of students' abilities to ask questions and obtain relevant information about the coding of instructions for the passing of traits from parent to offspring. Assessments should not include the phases of meiosis.	Evidence for Evolution *.....Chapter 2 Descent with Modification*.....Chapter 3 Evidence for Common Ancestry*.....Chapter 3 The Genetic Basis of Human Variation.....Chapter 12

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HS-LS3 Heredity: Inheritance and Variation of Traits - Continued

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS3-b. Synthesize, communicate, and evaluate the validity and reliability of the claim that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. **Clarification Statement:** Emphasis is on conceptual and/or simple mathematical understanding of the sources of genetic variation that are heritable. Information on genetic variation should include evidence of understanding the probability of variations and the rarity of mutations. **Assessment Boundary:** The assessment should provide evidence of students' abilities to evaluate and discuss sources of genetic variation in offspring, not the details of the mechanism's variations.	Expression of Genetic Information . . . . . Chapter 11 Effects of Mutations* . . . . . Chapter 11 Human Genetic Disorders* . . . . . Chapter 12
HS-LS3-c. Evaluate the merits of competing ethical arguments for the research, development, and growth of industries based on the development of technologies that modify the genetic make-up of an organism.* **Clarification Statement:** Emphasis is on comparing competing arguments based on ethical as well as scientific principles. **Assessment Boundary:** The assessment should provide evidence of students' abilities to evaluate the merits of genetic modification technologies (e.g., cloning, gene therapy, genetic engineering, selective breeding) in terms of scientific principles as well as ethical considerations and social implications. The assessment should provide evidence of students' abilities to evaluate the merits of genetic modification technologies (e.g., cloning, gene therapy, genetic engineering, selective breeding) in terms of scientific principles as well as cost, safety, and reliability as well as social and environmental impacts.	Genetic Technology* . . . . . Chapter 11 The Genetic Basis of Human Variation . . . . . Chapter 12 Development Gone Awry* . . . . . Chapter 13
HS-LS3-d. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. **Clarification Statement:** Emphasis is on distribution and variation of traits in a population and the use of mathematics (e.g., calculations of frequencies in Punnett squares, graphical representations) to describe the distribution. **Assessment Boundary:** The assessment should provide evidence of students' abilities to use mathematical reasoning to explain the variation observed in a population as a combination of genetic and environmental factors. Hardy-Weinberg calculations are beyond the intent.	Inheritance: What's the Chance? . . . . . Chapter 12 Predicting Inheritance by Using Pedigrees . . Chapter 12 Evidence for Common Ancestry* . . . . . Chapter 3 The Genetic Basis of Human Variation* . . . . . Chapter 12 Descent with Modification . . . . . Chapter 3 Evolution of Darwin's Finches* . . . . . Section 5, TR Human Skin Color Adaptations . . . . . Section 5, TR Gifts from Your Parents* . . . . . Chapter 12 Inheritance: What's the Chance?* . . . . . Chapter 12 Patterns of Inheritance* . . . . . Chapter 12 Predicting Inheritance by Using Pedigrees* . . Chapter 12 The Genetic Basis of Human Variation. . . . . Chapter 12

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HS-LS4 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS4-a. Produce scientific writing that communicates how multiple lines of evidence, such as similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development, contribute to the strength of science theories related to natural selection and biological evolution. **Clarification Statement:** Emphasis is on identifying historically reliable sources of scientific evidence contributing to the strength of the theories of natural selection and biological evolution (e.g., DNA sequencing, embryology, anatomy) and evaluating how multiple lines of evidence contribute to an understanding of evolution. **Assessment Boundary:** The assessment should provide evidence of students' abilities to evaluate the strength of the evidence.	A Cold Hard Look at Culture . . . . . Chapter 1 Exploring Change* . . . . . Chapter 2 Explaining Adaptation* . . . . . Chapter 2 Just a Theory? . . . . . Chapter 2 Evolution in Action* . . . . . Chapter 2 Evolution of Darwin's Finches . . . . . Section 5, TR Human Skin Color Adaptations* . . . . . Section 5, TR
HS-LS4-b. Use a model to support the explanation that the process of natural selection is the result of four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. **Clarification Statement:** Emphasis is on the interrelationship of the four factors that result in natural selection. Mathematical models and simulations of changes in distribution of traits in a population at different times may be used. **Assessment Boundary:** Assessment should provide evidence of students' abilities to explain natural selection in terms of the number of organisms, behaviors, morphology, or physiology factors having a direct effect on survival and reproduction as well as ability to compete for limited resources. Mathematical models may be used to communicate the explanation.	Lucy . . . . . Chapter 2 Exploring Change* . . . . . Chapter 2 Evidence for Evolution . . . . . Chapter 2 Descent with Modification* . . . . . Chapter 3 Evidence for Common Ancestry* . . . . . Chapter 3 The Genetic Basis of Human Variation . . . . . Chapter 12 The Pasture Story* . . . . . Chapter 15 Mystery on Easter Island* . . . . . Chapter 15 Islands in the Sky . . . . . Chapter 15 The Gulf of Maine . . . . . Chapter 16 Tri-Lakes activities . . . . . Chapter 16 Changing Ecosystems . . . . . Section 5, TR A Jar Full of Interactions . . . . . Section 5, TR
HS-LS4-c. Apply concepts of statistics and probability to support explanations for how organisms with an advantageous heritable trait tend to increase in proportion to organisms that lack this trait. **Clarification Statement:** Emphasis is on mathematically analyzing changes in the numerical distribution of heritable traits in a population. **Assessment Boundary:** The assessment should provide evidence of students' abilities to analyze shifts in numerical distribution of traits as evidence to support explanations. Analysis is limited to basic statistical and graphical analysis, not gene frequency calculations.	Exploring Change* . . . . . Chapter 2 Explaining Adaptation . . . . . Chapter 2 Evidence for Evolution . . . . . Chapter 2 Evolution in Action* . . . . . Chapter 2 Inheritance: What's the Chance?* . . . . . Chapter 12 Patterns of Inheritance* . . . . . Chapter 12 Predicting Inheritance by Using Pedigrees* . . Chapter 12

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Students who demonstrate understanding can:	Correlated Content in *BSCS Biology: A Human Approach*
HS-LS4-d. Construct an explanation based on evidence for how natural selection, genetic drift, gene flow through migration, and co-evolution lead to populations dominated by organisms that are anatomically, behaviorally, and physiologically adapted to survive and reproduce in a specific environment. **Clarification Statement:** Emphasis is on quantitative evidence as the basis for clarifying the difference among various processes of adaptation within populations. Data on specific environmental differences and selection for/against traits should be used. Environmental factors may include ranges of seasonal temperature, climate change, acidity, and light. **Assessment Boundary:** The assessment should measure students' abilities to differentiate types of evidence used in explanations.	Exploring Change*.....Chapter 2 Explaining Adaptation .....Chapter 2 Evolution in Action*.....Chapter 2 Inheritance: What's the Chance?*.....Chapter 12 Patterns of Inheritance .....Chapter 12 Predicting Inheritance by Using Pedigrees ..Chapter 12 Evolution of Darwin's Finches*.....Section 5, TR Human Skin Color Adaptations .....Section 5, TR
HS-LS4-e. Synthesize, communicate, and evaluate technical information that describes how changes in environmental conditions can affect the distribution of traits in a population causing: 1) increases in the population of some species, 2) the emergence of new species over time, and 3) the extinction of other species. **Clarification Statement:** Emphasis is on changes in the environment and how these changes affect the distribution of traits in the populations. The rate of change should also be considered in the changes to the environment (e.g., deforestation, fishing, application of fertilizers, drought, flood) and the affect on the distribution of traits. **Assessment Boundary:** The assessment should provide evidence of students' abilities to explain the cause and effect for how changes to the environment affect distribution or disappearance of traits in species.	Exploring Change*.....Chapter 2 Explaining Adaptation .....Chapter 2 Evolution in Action*.....Chapter 2 Inheritance: What's the Chance? .....Chapter 12 Patterns of Inheritance .....Chapter 12 Predicting Inheritance by Using Pedigrees* ..Chapter 12 Evolution of Darwin's Finches.....Section 5, TR
HS-LS4-f. Design and conduct an investigation to find patterns in data indicating the relationship between changes in the environment and natural selection. **Clarification Statement:** Emphasis is on finding patterns in data that support the cause and effect relationships between changes in the environment and natural selection. **Assessment Boundary:** The assessment should provide evidence of students' abilities to present evidence based conclusions for investigations and limitations of findings in terms of the design of an investigation, identification of relevant data, attributes of reliable and accurate measurements, and presentation of evidence-based conclusions.	Exploring Change*.....Chapter 2 Explaining Adaptation* .....Chapter 2 Just a Theory?.....Chapter 2 Evolution in Action*.....Chapter 2 Evolution of Darwin's Finches*.....Section 5, TR Human Skin Color Adaptations* .....Section 5, TR

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