Utah	Biology Standards	Campbell Biology Concepts & Connections 10e
Standard BIO.1.1	Plan and carry out an investigation to analyze and interpret data to determine how biotic and abiotic factors can affect the stability and change of a population. Emphasize stability and change in populations' carrying capacities and an ecosystem's biodiversity. (LS2.A, LS2.C)	**pp. 745–746** mathematical models of population growth; carrying capacity, biotic and abiotic factors; **p. 755** Testing Your Knowledge - Levels 2 and 3
Standard BIO.1.2	Develop and use a model to explain cycling of matter and flow of energy among organisms in an ecosystem. Emphasize the movement of matter and energy through the different living organisms in an ecosystem. Examples of models could include food chains, food webs, energy pyramids or pyramids of biomass. (LS2.B)	**pp. 764-777** food chains and food webs; energy flow in an ecosystem; biomass and energy pyramids; biogeochemical cycles
Standard BIO.1.3	Analyze and interpret data to determine the effects of photosynthesis and cellular respiration on the scale and proportion of carbon reservoirs in the carbon cycle. Emphasize the cycling of carbon through the biosphere, atmosphere, hydrosphere, and geosphere and how changes to various reservoirs impact ecosystems. Examples of changes to the scale and proportion of reservoirs could include deforestation, fossil fuel combustion, or ocean uptake of carbon dioxide. (PS3.D, LS1.C, LS2.B)	**p. 775** photosynthesis, cellular respiration, and the carbon cycle; **pp. 107-111** cellular respiration; **pp. 127-132** photosynthesis; Checkpoint 7.3; **p. 787** greenhouse gas concentrations and the carbon cycle
Standard BIO.1.4	Develop an argument from evidence for how ecosystems maintain relatively consistent numbers and types of organisms in stable conditions. Emphasize how changing conditions may result in changes to an ecosystem. Examples of changes in ecosystem conditions could include moderate biological or physical changes such as moderate hunting or a seasonal flood; and extreme changes, such as climate change, volcanic eruption, or sea level rise. (LS2.C)	**pp. 756-782** Chapter 37: Communities and Ecosystems — factors that promote stability, such as mutualism (p. 760) and balanced food webs (p. 765); change introduced by factors such as parasites (p. 763), invasive species (p. 769), and nutrient inflow (p. 778)
Standard BIO.1.5	Design a solution that reduces the impact caused by human activities on the environment and biodiversity. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Examples of human activities could include building dams, pollution, deforestation, or introduction of invasive species. (LS2.C, LS4.D, ETS1.A, ETS1.B, ETS1.C)	**pp. 785-788** defining the problem; **790-794** conservation and restoration
Standard BIO.2.1	Construct an explanation based on evidence that all organisms are primarily composed of carbon, hydrogen, oxygen, and nitrogen, and that the matter taken into an organism is broken down and recombined to make macromolecules necessary for life functions. Emphasize that molecules are often transformed through enzymatic processes and the atoms involved are used to make carbohydrates, proteins, fats/lipids, and nucleic acids. (LS1.C)	**pp. 41-55** properties of carbon and the synthesis of biomolecules

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Standard BIO.2.2	Ask questions to plan and carry out an investigation to determine how (a) the structure and function of cells, (b) the proportion and quantity of organelles, and (c) the shape of cells result in cells with specialized functions. Examples could include mitochondria in muscle and nerve cells, chloroplasts in leaf cells, ribosomes in pancreatic cells, or the shape of nerve cells and muscle cells. (LS1.A)	**pp. 60-85** Chapter 4: A Tour of the Cell — structure and function; endomembrane system; nucleolus, ribosomes, mitochondria, chloroplasts; **p. 578** neurons
Standard BIO.2.3	Develop and use a model to illustrate the cycling of matter and flow of energy through living things by the processes of photosynthesis and cellular respiration. Emphasize how the products of one reaction are the reactants of the other and how the energy transfers in these reactions. (PS3.D, LS1.C, LS2.B)	**pp. 127-137** photosynthesis; **pp. 107-111** cellular respiration; **p. 144** Test Your Knowledge #10 and #16
Standard BIO.2.4	Plan and carry out an investigation to determine how cells maintain stability within a range of changing conditions by the transport of materials across the cell membrane. Emphasize that large and small particles can pass through the cell membrane to maintain homeostasis. (LS1.A)	**pp. 89–101** maintaining homeostasis with selective permeabiility, passive transport, active transport; endo- and exocytosis
Standard BIO.2.5	Construct an explanation about the role of mitosis in the production, growth, and maintenance of systems within complex organisms. Emphasize the major events of the cell cycle including cell growth and DNA replication, separation of chromosomes, and separation of cell contents. (LS1.B)	**p. 160** mitosis explained via text, diagram, embedded video
Standard BIO.2.6	Ask questions to develop an argument for how the structure and function of interacting organs and organ systems that make up multicellular organisms contribute to homeostasis within the organism. Emphasize the interactions of organs and organ systems with the immune, endocrine, and nervous systems. (LS1.A)	**pp. 424-436** structure and function in animal tissues, organs, organ systems; **pp. 503-524** Chapter 24: The Immune System; **pp. 538-553** Chapter 26: Hormones and the Endocrine System; **pp. 576-600** Chapter 28: Nervous Systems
Standard BIO.2.7	Plan and carry out an investigation to provide evidence of homeostasis and that feedback mechanisms maintain stability in organisms. Examples of investigations could include heart rate response to changes in activity, stomata response to changes in moisture or temperature, or root development in response to variations in water level. (LS1.A)	**p. 436** the scientific method; **pp. 438-439** homeostasis in animals; **p. 442** Test Your Knowledge - Level 3 questions
Standard BIO.3.1	Construct an explanation for how the structure of DNA is replicated, and how DNA and RNA code for the structure of proteins which regulate and carry out the essential functions of life and result in specific traits. Emphasize a conceptual understanding that the sequence of nucleotides in DNA determines the amino acid sequence of proteins through the processes of transcription and translation. (LS1.A, LS3.A)	**pp. 200-216** DNA, RNA, replication, transcription, translation; **pp. 225-226** Test Your Knowledge

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Standard BIO.3.2	Use computational thinking and patterns to make predictions about the expression of specific traits that are passed in genes on chromosomes from parents to offspring. Emphasize that various inheritance patterns can be predicted by observing the way genes are expressed. Examples of tools to make predictions could include Punnett squares, pedigrees, or karyotypes. Examples of allele crosses could include dominant/recessive, incomplete dominant, codominant, or sex-linked alleles. (LS3.A)	**p. 165** karyotypes; **pp. 175-185** inheritance probabilities, Punnett squares, pedigrees, incomplete dominance, codominance; **pp. 194-195** sex-linked inheritance
Standard BIO.3.3	Engage in argument from evidence that inheritable genetic variation is caused during the formation of gametes. Emphasize that genetic variation may be caused by epigenetics, during meiosis from new genetic combinations, or viable mutations. (LS3.B)	**pp. 161-163** meiosis and new gene combinations; **pp. 166-167** Down's Syndrome; new species of plants; **p. 216** replication errors and mutagens
Standard BIO.3.4	Plan and carry out an investigation and use computational thinking to explain the variation and patterns in distribution of the traits expressed in a population. Emphasize the distribution of traits as it relates to both genetic and environmental influences on the expression of those traits. Examples of variation and patterns in distribution of traits could include sickle-cell anemia and malaria, hemoglobin levels in humans at high elevation, or antibiotic resistance. (LS3.B)	**pp. 175-176** probability of inheritance; **p. 186** sickle-cell anemia and high altitudes; **p. 284** mosquitos and DDT-related alleles; **p. 291** antibiotic resistance
Standard BIO.3.5	Evaluate design solutions where biotechnology was used to identify and/or modify genes in order to solve (effect) a problem. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Emphasize arguments that focus on how effective the solution was at meeting the desired outcome. (LS3.B, ETS1.A, ETS1.B, ETS1.C)	**pp. 256-259** recombinant DNA for mass insulin production; genetically engineered cells for vaccines; food shortages and transgenic plants; gene therapy; **p. 273** Testing Your Knowledge #13 and #16
Standard BIO.4.1	Obtain, evaluate, and communicate information to identify the patterns in the evidence that support biological evolution. Examples of evidence could include DNA sequences, amino acid sequences, anatomical structures, the fossil record, or order of appearance of structures during embryological development. (LS4.A)	**p. 296** Testing Your Knowledge #10; **pp. 279-280** homologous structures; **pp. 282** evolution in action (pesticide resistance); **p. 316** fossil record
Standard BIO.4.2	Construct an explanation based on evidence that natural selection is a primary cause of evolution. Emphasize that natural selection is primarily caused by the potential for a species to increase in number, the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, competition for limited resources, and the proliferation of those organisms that are better able to survive and reproduce in the environment. (LS2.D, LS4.B, LS4.C)	**p. 295** Question 1; **pp. 282-291** competition, mutation, sexual reproduction, natural selection
Standard BIO.4.3	Analyze and interpret data to identify patterns that explain the claim that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. Emphasize analyzing shifts in the numerical distribution of traits and using these shifts as evidence to support explanations. (LS4.B, LS4.C)	**pp. 285-289** Hardy-Weinberg equation; directional, stabilizing, and disruptive selection; **p. 296** Testing Your Knowledge #15

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Standard BIO.4.4	Engage in argument from evidence that changes in environmental conditions may cause increases in the number of individuals of some species, the emergence of new species over time, and/or the extinction of other species. Emphasize the cause and effect relationships for how changes and the rate of change to the environment affect distribution or disappearance of traits in a species. Examples of changes in environmental conditions could include deforestation, application of fertilizers, drought, or flood. (LS4.C)	**p. 778** eutrophication; **p. 782** Testing Your Knowledge **#**13; **p. 406** fossil evidence for emergence of land vertebrates as aquatic habitats shrank during drought; **p. 422** Testing Your Knowledge - Levels 2 and 3
Standard BIO.4.5	Evaluate design solutions that can best solve a real-world problem caused by natural selection and adaptation of populations. Define the problem, identify criteria and constraints, analyze available data on proposed solutions, and determine an optimal solution. Examples of real-world problems could include bacterial resistance to drugs, plant resistance to herbicides, or the effect of changes in climate on food sources and pollinators. (LS4.C, ETS1.A, ETS1.B, ETS1.C)	**pp. 790-795** biodiversity conservation solutions such as wildlife corridors, preserves, bioremediation; **p. 273** Testing Your Knowledge #16