New York Science

HS Life Science: Biology

Structure and Function

1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. [Clarification Statement: Emphasis should be on how the DNA code is transcribed and translated in the synthesis of proteins. Types of proteins involved in performing life functions include enzymes, structural proteins, cell receptors, hormones, and antibodies.] [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the detailed biochemistry of protein synthesis.] HS-LS1-1

2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism's system level such as nutrient uptake, water delivery, immune response, and organism response to stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.] HS-LS1-2

3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.] HS-LS1-3

Matter and Energy in Organisms and Ecosystems

4 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.] HS-LS1-5

5 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements such as nitrogen, sulfur, and phosphorus to form amino acids and other carbon-based molecules. [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations for the synthesis of lipids, starches,

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proteins, and nucleic acids.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of structural and molecular formulas for macromolecules.] HS-LS1-6

6 Use a model to illustrate that aerobic 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 the process of aerobic cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in aerobic cellular respiration.] HS-LS1-7

7 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in ecosystems. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration and photosynthesis within ecosystems.] [Assessment Boundary: Assessment does not include the specific chemical processes of aerobic respiration, anaerobic respiration, and photosynthesis.] HS-LS2-3

8 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model such as a pyramid of biomass/energy to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.] HS-LS2-4

9 Develop a model to illustrate the role of various processes in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: Examples of models could include simulations, diagrams, and mathematical models of the carbon cycle (photosynthesis, respiration, decomposition, and combustion).] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.] HS-LS2-5

Interdependent Relationships in Ecosystems

10 Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.] HS-LS2-1

11 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical

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	representations could include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.] HS-LS2-2
	12 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include ecological succession, modest biological or physical changes, such as moderate hunting or seasonal floods; and extreme changes, such as volcanic eruption or sea level rise.] HS-LS2-6
	13 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities could include urbanization, building dams, and dissemination of invasive species. Examples of solutions could include simulations, product development, technological innovations, and/or legislation.] HS-LS2-7
	14 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.] HS-LS2-8
Inheritance and Variation of Traits	15 Use a model to illustrate cellular division (mitosis) and differentiation. [Clarification Statement: Emphasis should be on the outcomes of mitotic division and cell differentiation on growth and development of complex organisms and possible implications for abnormal cell division (cancer) and stem cell research.] [Assessment Boundary: Assessment does not include specific gene control mechanisms or recalling the specific steps of mitosis.] HS-LS1-4
	16 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Clarification Statement: Emphasis should be on the distinction between coding and non-coding regions of DNA.] HS-LS3-1
	17 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, (3) mutations caused by environmental factors and/or (4) genetic engineering. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs including the relevant processes in meiosis and advances in biotechnology.] [Assessment Boundary: Assessment does not include recalling the specific details of the phases of meiosis or the biochemical mechanisms of the specific phases in the process.] HS-LS3-2

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	18	**Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.]** HS-LS3-3
	19	**Use models to illustrate how human reproduction and development maintains continuity of life. [Clarification Statement: Emphasis is on structures and function of human reproductive systems, interactions with other human body systems, embryonic development, and influences of environmental factors on development.] [Assessment Boundary: Assessment does not include the details of hormonal regulation or stages of embryonic development.]** HS-LS1-8
Natural Selection and Evolution	20	**Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]** HS-LS4-1
	21	**Construct an explanation based on evidence that the process of evolution primarily results from 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 using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.]** HS-LS4-2
	22	**Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]** HS-LS4-3
	23	**Construct an explanation based on evidence for how natural selection leads to adaptation of populations. [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a**

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change in gene frequency over time, leading to adaptation of populations.] HS-LS4-4

24 **Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, introduction of invasive species, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]** HS-LS4-5