



# **Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project**

## **Grade 8 Science**

### **Unit 3 Task 3 Specification Tool & Verification of Alignment**

#### **Understanding Earth History and the Origin of Species**

**September 2023**

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# SIPS Grade 8 Unit 3 Task 3 Specification & Verification of Alignment

**Grade: 8**

**Unit: 3**

**Task Number: 3**

**Task Title: What Beak-ame of You?**

## NGSS Performance Expectations

**MS-LS4-4.** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. *[Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]*

**MS-LS4-6.** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. *[Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]*

**MS-LS3-1.** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects on the structure and function of the organism. *[Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]*

## Phenomena or Phenomena-rooted Design Problem

- The task focuses on evidence of finch populations on the Galapagos Islands and how a species' traits and the distribution of those traits in a population change due to natural selection as the environment changes over time.

## Scenario/Context/Situation/Boundaries

- Scenario introduces a topic related to physiological adaptations in living organisms.
- The task introduces a narrative and a data set to support an explanation of how the climate pattern on a Galapagos Island could influence what happened to the finch populations.
- The task provides a model of a normal gene and/or protein along with a description of a mutation and its result.
- The task closes with students examining evidence to support a compare/contrast explanation of the processes of natural selection and mutation using the finches and eye color.

### Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s) to be modeled.
- Domain-specific vocabulary and definitions.
- Phenomenon addressed in the scenario, including but not limited to:
  - Environmental changes over time.
  - Changes in available resources.
  - Changes in phenotypic frequency over time between two populations.
  - Variation in the population.
- Range and complexity of data provided.
- Type and number of variations of a trait within a given population.
- Frequencies of variations of a trait within a given population in response to environmental change.
- Complexity of scientific concept(s) to be modeled.
- Function of the model:
  - To explain a mechanism underlying a phenomenon.
  - To predict future outcomes.
  - To describe a phenomenon.
  - To generate data to inform how the world works.
- Number and type of organism(s).
- Degree and type of similarities and differences of organisms.
- Use of cause-and-effect relationships to explain changes.

### General Description of Task/Chain of Sensemaking

- Students analyze and graph data to explain the cause-and-effect relationship between the patterns of change in anatomical structures of finches' beaks over time and environmental factors. **[Prompt 1: MS-LS4-6, KSA3]**
- Students use a general codon table to identify the effects of a mutation on the resulting protein and a trait of an organism and explain how changes to proteins can affect observable structures and functions in organisms. **(Prompt 2 MS-LS3-1, KSA7)**
- Students compare and contrast the mechanisms and outcomes of mutations and natural selection. **(Prompt 3: MS-LS3-1 & MS-LS4-4, KSA1)**

### Targeted PE-related KSAs

**MS-LS4-6, KSA3:** Use mathematical representations to describe cause and effect relationships with phenomena in relation to the distribution of traits in a population over time.

**MS-LS3-1, KSA7:** Use the model to explain what the effects of a mutation could be on the resulting protein and a trait of an organism.

### Cross-performance Expectations Related KSAs to Target

**MS-LS3-1 & MS-LS4-4, KSA1:** Construct an explanation of how natural selection leads to the predominance of certain traits in a population as compared to how proteins contribute to observable structures and functions in organisms.

### Student Demonstrations of Learning

- Accurately describes how genetic traits have changed over time.
- Accurately describes how a given genetic trait can increase a population’s chance of surviving.
- Accurately explains how changes in genetic traits in a population relate to a species' probability of surviving in a specific environment.
- Demonstrates how mathematical representations be used to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
- Model accurately represents the relationship between genes, proteins, and traits.
- Constructs explanations that describe how genetic variations increase some individuals’ probability of surviving and reproducing.

### Work Products

- Organize data into tables/charts/graphs.
- Summarize numerical data sets.
- Constructed response.
- Interpret a diagram.
- Apply evidence.

### Application of Universal Design for Learning-based Guidelines to Promote Accessibility (<https://udlguidelines.cast.org/> )

#### Multiple Means of Engagement

- Context or content.
- Age appropriate.
- Appropriate for different groups.

#### Multiple Means of Representation

- Provide visual diagrams and charts.
- Make explicit links between information provided in texts and any accompanying representation of that information in

#### Multiple Means of Action & Expression

- Solve problems using a variety of strategies,
- Sentence starters,

- Makes sense of complex ideas in creative ways.
- Vary the degree of challenge or complexity within prompts.
- Illustrations, equations, charts, or diagrams.
- Activate relevant prior knowledge.
- Highlight or emphasize key elements in text, graphics, diagrams, and formulas.
- Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships.
- Give explicit prompts for each step in a sequential process.
- Embed prompts to “show and explain your work”,

### SIPS Assessments Complexity Framework Components

Prompt	A.1 Degree and nature of sense-making about phenomena or problems			B.1 Complexity of the presentation			B.2 Cognitive demand of response development			B.3 Cognitive demand of response production		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
1		X			X			X		X		
2		X				X		X			X	
3			X	X				X				X

### Rubric Considerations

- Accuracy of the graph.
- Sophistication of the explanations.
- Completeness and accuracy of response.

### Assessment Boundaries

- Assessment does not include Hardy Weinberg calculations.
- Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.

### Common Alternate Conceptions

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- **MS-LS4-4**
    - Individual organisms can change their features to suit the environment.
    - All individuals of the same species have the same features.
    - Natural selection occurs within an organism’s lifetime.
    - All organisms in a population are able to adapt to environmental changes and survive.
  - **MS-LS4-6**
    - Organisms can change their features to suit their environment.
    - Animals of the same species all have the same features.
    - Natural selection occurs within an organism’s lifetime.
    - “Survival of the fittest” means the strongest individuals survive.
    - Natural selection is goal-oriented.
  - **MS-LS3-1**
    - Genes and proteins are the same thing.
    - Traits change due to the environment, which in turn changes genes.
    - The information in genes provides instructions for rearranging chromosomes into traits.
    - Mutations are always harmful to the functioning of an organism.

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### Possible Technical Terms for Task

- genetic variation, trait, environmental change, species, phenotypes, evolutionary relationships, natural selection, frequencies of traits, natural selection, survival, reproduction, probability, genes, chromosomes, proteins, traits, mutation, protein function

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### Common Core State Standards for Literacy

#### Reading Informational

- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. **(MS-LS3-1), (MS-LS4-4)**
  - **RST.6-8.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. **(MS-LS3-1)**
  - **RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). **(MS-LS3-1),**
  - **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. **(MS-LS4-4)**
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**Writing**

- **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **(MS-LS4-4)**
- **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. **(MS-LS4-4)**

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**Common Core State Standards for Mathematics**

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**Mathematical Practices**

- **MP.4** Model with mathematics. **(MS-LS4-6)**

**Mathematical Content**

- **6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. **(MS-LS4-4), (MS-LS4-6)**
- **6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or depending on the purpose at hand, any number in a specified set. **(MS-ESS1-4), (MS-LS4-1), (MS-LS4-2)**
- **6.SP.B.5** Summarize numerical data sets in relation to their context. **(MS-LS4-4), (MS-LS4-6)**
- **7.RP.A.2** Recognize and represent proportional relationships between quantities. **(MS-LS4-4), (MS-LS4-6)**

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**Task Notes**

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## SIPS Assessments Complexity Framework

Component	Complexity		
	Low	Moderate	High
<b>Connections to Curriculum and Instruction</b>	<p><b>A.1 Degree and nature of sense-making about phenomena or problems</b></p> <ul style="list-style-type: none"> <li>Requires one or two dimensions</li> <li>One dimension may have a greater degree of emphasis than another</li> <li>Requires previously learned ideas or concepts</li> </ul>	<ul style="list-style-type: none"> <li>Requires integration of two dimensions in the service of sense-making</li> <li>Requires integration of same or different combinations of dimensions as represented in the PE bundle</li> <li>Requires a combination of previously learned ideas or concepts and newly presented information</li> </ul>	<ul style="list-style-type: none"> <li>Requires integration of three dimensions in the service of sense-making</li> <li>Requires integration of same or different combinations of dimensions as represented in the PE bundle</li> <li>Requires a combination of previously learned ideas or concepts and newly presented information</li> </ul>
<b>Characteristics of the Tasks</b>	<p><b>B.1 Complexity of the presentation</b></p> <ul style="list-style-type: none"> <li>The amount and type of information provided in the scenario supports limited simple connections among ideas or concepts</li> <li>Provides few, simple graphics/data/models</li> <li>Includes definitions or examples</li> <li>Phenomenon or problem presented in a concrete way with high level of certainty</li> </ul>	<ul style="list-style-type: none"> <li>The amount and type of information provided in the scenario supports multiple evident connections among ideas or concepts</li> <li>Provides graphics/data/models</li> <li>Limited use of definitions or examples</li> <li>Phenomenon or problem presented with some level of uncertainty</li> </ul>	<ul style="list-style-type: none"> <li>The amount and type of information provided in the scenario supports multiple and varied complex connections among ideas or concepts</li> <li>Provides complex graphics/data/models</li> <li>Phenomenon or problem presented with high-degree of uncertainty</li> </ul>
	<p><b>B.2 Cognitive demand of response development</b></p> <ul style="list-style-type: none"> <li>Requires well-defined set of actions or procedures</li> <li>Requires a connection or retrieval of factual information</li> <li>Response requires a low level of sophistication with routinely encountered well-practiced applications</li> </ul>	<ul style="list-style-type: none"> <li>Requires application of ideas and practices given cues and guidance</li> <li>Requires drawing relationships and connecting ideas and practices</li> <li>Response requires a moderate level of sophistication with typical but relatively complex representation of ideas and application of skills</li> </ul>	<ul style="list-style-type: none"> <li>Requires selection and application of multiple complex ideas and practices</li> <li>Requires high degree of sense-making, reasoning, and/or transfer</li> <li>Response requires a high level of sophistication with non-routine or abstract representation of ideas and application of skills</li> </ul>



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**B.3 Cognitive demand  
of response production**

- Responses include selection from a small set of options presented as text (e.g., word, short phrase) or other formats (e.g., a simple graphic or process)

- Responses include one or more sentences or a paragraph, a moderately complex graphic, or multiple steps in a simple or moderately complex process

- Responses include multiple paragraphs, multiple graphics of at least moderate complexity, or multiple steps in a complex process

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