

MS-LS4-6 Biological Evolution: Unity and Diversity

California Science Test—Item Content Specifications

# MS-LS4-6 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

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.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Using Mathematics and Computational Thinking  Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.  Use mathematical representations to support scientific conclusions and design solutions. | LS4.C: Adaptation  2. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. | Cause and Effect  Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. |

## Assessment Targets

Assessment targets describe the focal knowledge, skills, and abilities for a given three-dimensional Performance Expectation. Please refer to the Introduction for a complete description of assessment targets.

### Science and Engineering Subpractice(s)

Please refer to appendix A for a complete list of Science and Engineering Practices (SEP) subpractices. Note that the list in this section is not exhaustive.

5.2 Ability to conduct mathematical and/or computational analyses

### Science and Engineering Subpractice Assessment Targets

Please refer to appendix A for a complete list of SEP subpractice assessment targets. Note that the list in this section is not exhaustive.

5.2.1 Ability to use the results of computational models (e.g., graphical representation in a simulation) to identify the mathematical and/or computational representations to support a scientific explanation or a design solution

5.2.2 Ability to use computational models (e.g., simulations) to make predictions of a scientific phenomenon

5.2.3 Ability to use the results of computational models (e.g., simulations) to identify patterns in natural and/or designed worlds

### Disciplinary Core Idea Assessment Targets

#### LS4.C.2

* Describe that species respond to changes in the environment over generations
* Identify that individuals with favorable traits are more likely to pass on their inherited traits
* Identify that environmental conditions act as a selective pressure
* Identify traits that support successful survival based on environmental conditions
* Identify that the most favorable traits to the environment become more common in a population
* Identify that traits that do not support survival based on the environmental conditions will decrease in frequency within a given population over time
* Recognize that not all populations are able to adapt and survive
* Describe natural selection as a mechanism of evolution that acts over many generations

### Crosscutting Concept Assessment Target(s)

CCC2 Identify that phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides data from a computational model (graph, table, etc.) that displays a measurable change in selected traits in a population over time:

* Identifies patterns of change (5.2.3, LS4.C.2, and CCC2)
* Identifies the specific selective pressure driving the change (5.2.1, LS4.C.2, and CCC2)
* Explains how a specific pressure has led to the observed change (5.2.1, LS4.C.2, and CCC2)

Task provides a simulation of a population where specific environmental conditions can be manipulated:

* Predicts which trait is most adaptive to a specific environmental change (5.2.2, LS4.C.2, and CCC2)
* Predicts which variants of a trait will increase and which variants will decrease in frequency with regard to the manipulated condition (5.2.2, LS4.C.2, and CCC2)
* Predicts that if environmental conditions change too drastically, the population may not have time to adapt and could die off (5.2.2, LS4.C.2, and CCC2)

Task provides data from a simulation that models a change in a specific trait over time:

* Identifies evidence that demonstrates natural selection is acting on the population (5.2.3, LS4.C.2, and CCC2)
* Describes the pattern of change (5.2.3, LS4.C.2, and CCC2)

## Environmental Principles and Concepts

* EP2: The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human societies.

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Defense from predation
* Changes in food sources
* Response to disease or parasitism
* Effect of changes in environmental conditions on phenotype and allele frequency
* Changes in competition with other species for resources
* Changes in competition within a species for resources
* Variation in the population
* Differential reproductive success
* Heritable traits

## Common Misconceptions

Note that the list in this section is not exhaustive.

* 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.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

MS-LS4-6 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/MS-LS4-6 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS-LS4-6%20Evidence%20Statements%20June%202015%20asterisks.pdf)

Environmental Principles and Concepts <http://californiaeei.org/abouteei/epc/>

California Education and the Environment Initiative <http://californiaeei.org/>

The *2016 Science Framework for California Public Schools Kindergarten through Grade 12*

Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in Kindergarten through Grade 12 <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf>

Appendix 2: Connections to Environmental Principles and Concepts <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf>

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