

HS-LS4-1 Biological Evolution: Unity and Diversity

California Science Test—Item Content Specifications

# HS-LS4-1 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

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.]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Obtaining, Evaluating, and Communicating Information  Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.  Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).  Connections to Nature of Science  Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena  A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. | LS4.A: Evidence of Common Ancestry and Diversity   1. Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. | Patterns  Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.  Connections to Nature of Science  Scientific Knowledge Assumes an Order and Consistency in Natural Systems  Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. |

## 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.

8.1 Ability to comprehend and evaluate text in terms of its validity, reliability, and sources

8.2 Ability to communicate about science and engineering (especially regarding the investigations conducted and the observations made)

### 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.

8.1.3 Ability to summarize information from a single source and/or combine and synthesize information from multiple sources to address a question or solve a problem

8.2.1 Ability to produce written and illustrated text that communicate one’s own ideas

8.2.2 Ability to use appropriate combinations of language, models, and mathematical expressions to communicate one’s understanding or to ask questions about a concept, event, system, or design

### Disciplinary Core Idea Assessment Targets

#### LS4.A.6

* Use comparisons of DNA gene sequences to draw conclusions about common ancestry and evolution
* Use comparisons of amino acid sequences among organisms from different species to draw conclusions about common ancestry and evolution
* Use the fossil record and phenotypic similarities of organisms to draw conclusions about common ancestry
* Use patterns of anatomical and/or embryonic similarities to draw conclusions about common ancestry and evolutionary patterns
* Use evidence (e.g., genetic, anatomical, and fossil) to distinguish between convergent and divergent evolution

### Crosscutting Concept Assessment Target(s)

CCC1 Identify different patterns at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides single-source data (nucleic acid sequence, amino acid sequence, fossil record, anatomical, and/or embryonic) relating to the evolutionary relationships among organisms of different species:

* Summarizes the data and indicates trends (8.1.3, LS4.A.6, and CCC1)
* Determines whether the data can be used to support biological evolution and common ancestry (8.1.3, LS4.A.6, and CCC1)

Task provides data from multiple sources (nucleic acid sequence, amino acid sequence, fossil record, anatomical, and/or embryonic) relating to the evolutionary relationship among organisms of different species:

* Combines and synthesizes the data to determine whether the data can be used to support biological evolution and common ancestry (8.1.3, LS4.A.6, and CCC1)
* Communicates whether the data supports or does not support the proposed relationships (8.2.1, LS4.A.6, and CCC1)
* Analyzes the data to identify evolutionary relationships and constructs a diagram indicating the likely evolutionary relationships among the organisms (8.2.1, LS4.A.6, and CCC1)
* Explains how the different forms of data support the proposed relationships (8.2.1, LS4.A.6, and CCC1)
* Uses appropriate scientific language and figures (e.g., cladograms) to communicate how the different forms of data can be used individually or together to determine or support established evolutionary relationships (8.2.2, LS4.A.6, and CCC1)
* Identifies additional information or data to complement the information provided by using sources of equal strength and reliability (8.2.2, LS4.A.6, and CCC1)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Similarities or differences in nucleic acid sequences of DNA or rRNA from different sources
* Similarities or differences in protein sequences from different sources
* Anatomical similarities or differences among organisms from different species
* Fossils that include several fossilized organisms and/or extant organisms
* Cladograms that diagram relationships among species or other higher taxa

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Cladograms show definitive relationships.
* Fossils can provide exact dates that an organism or a species existed and show common ancestors that no longer exist.
* Phenotypic similarities between species imply a close evolutionary relationship.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS4-1 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS4-1 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS4-1%20Evidence%20Statements%20June%202015%20asterisks.pdf)

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>

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