

T4T SIG Summer Institute

Natural Selection NGSS Aligned Lesson Series

The following learning activities were backwards planned to facilitate the development of students' knowledge and skills for mastery of this NGSS Performance Expectation. Not all of the dimensions and CCSS are covered in the following activities and teachers are encouraged to address them where possible.

Lesson Series Objective: Students will design an organism that is best suited for the environment and determine that organism's probability of surviving when competing against other artificially selected organisms in order to explain why genetic variation allows populations to thrive.

Lesson Series Essential Question: How can humans mimic natural selection by designing an organism to be better suited for its environment?

NGSS Performance Expectations Addressed:

Performance Expectation:

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

Science and Engineering Practices:

Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.

Disciplinary Core Idea:

Natural selection leads to the predominance of certain traits in a population and the suppression of others.

Crosscutting Concepts:

(Cause and Effect)
Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

Common Core State Standard Connections:

Science: *RST.6-8.1* Cite specific textual evidence to support analysis of science and technical texts.

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.

Social Studies: *WHST.6-8.2* Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.6-8.9 Draw evidence from informational texts to support analysis reflection and research.

Language Arts: *SL.8.1* Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent

manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Math: 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

6.SP.B.5 Summarize numerical data sets in relation to their context.

7.RP.A.2 Recognize and represent proportional relationships between quantities.

Performance Expectation:

Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. *[Clarification Statement: Emphasis is synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy) and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]*

Science and Engineering Practices:

Gather, read, and synthesize information from multiple appropriate sources and assess the credibility accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Disciplinary Core Idea:

In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.

Crosscutting Concepts:

(Cause and Effect)
Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

(Interdependence of Science, Engineering, and Technology)
Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.

(Science Addresses Questions About the Natural and Material World)
Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

Common Core State Standard Connections:

Science: RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

Social Studies: *WHST.6-8.8* Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

California State Standards Addressed:

- 7.3.a** Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms.
- 7.3.b** Students know the reasoning used by Charles Darwin in reaching his conclusion that natural selection is the mechanism of evolution.
- 7.3.e** Students know that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.

Lesson Series Overview:

Lesson Title:	Short Description of the lesson:
Lesson 1: Engage	Students will investigate the fossil record to observe the similarities and differences of organisms in a particular geographical area.
Lesson 2: Explore	<p>Students will be given a food source to design an organism that is best suited for the environment. Students will test their organism for the food source, identify relevant “traits”, collect and analyze data, and determine if their organism will survive based on the criteria.</p> <p>Students will then identify the best “traits” for each food source as a class.</p> <p>Students will predict if their organism would survive in the other environments.</p>
Lesson 3: Explore	<p>Students receive an environment with all 4 food types in it. Students are assigned a “set” of favorable traits.</p> <p>Students then have time to redesign their organism to include the best “traits” for the successive generations.</p> <p>Students will test their organism in the environment, identify relevant “traits”, collect and analyze data, and determine if their organism will survive based on the criteria.</p>

	Students will conclude if having a larger list of favorable traits (more genetic variation) is better than having a smaller list of favorable traits (less genetic variation).
Lesson 4: Explain	Students will read the natural selection reading and apply their Engage and Explore activities to what they have just learned.
Lesson 5: Explain	Students create a claim and argument mini essay using the paragraph frames to explain how having a variety of traits in a population allows for natural selection and ultimate survival of the species.
Lesson 6: Extend	<p>Students will complete a reading and discussion on artificial selection in our society today.</p> <p>Students will extend the activities they did and determine if the Explore activity was natural selection or artificial selection.</p>
Lesson 7: Evaluate	Students will research one artificially selected organism and evaluate whether or not the organism has benefited the environment it lives in.