

# AAPS Blended Unit Planning Document #2

## Grade Level/Content Area

HS Biology

## Unit Title

Evolution

## Unit Abstract

A description of the featured unit of study that characterizes the subject matter to be studied and states very generally what students are expected to learn and the types of learning activities that will be conducted to provide opportunities for learning.

In this unit on evolution, students will investigate and communicate information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. Students will also explain that the process of evolution occurs from four factors: (1) the potential for species to increase in number, (2) the heritable genetic variation of individuals due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of organizations that are better able to survive and reproduce in their environment. Students will also apply concepts of probability and statistics to support explanations that organisms with advantageous traits will increase in number compared to organisms lacking these traits. Students will explain how natural selection leads to adaptation of populations. Finally, student will evaluate evidence supporting claims that changes in the environment may lead to: (1) increases in the population of some species, (2) the emergence of new species over time, and (3) the extinction of some species.

## Standards/Benchmarks

Identifying Expectations and Standards helps to ensure curricular alignment.

*Are the appropriate goals (ie: content standards, benchmarks, curriculum objectives) identified?*

HS-LS4-1.

**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-LS4-2.**

**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-LS4-3.**

**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-LS4-4.**

**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 change in gene frequency over time, leading to adaptation of populations.]

**HS-LS4-5.**

**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, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

## Essential Questions

A meaning of “essential” involves important questions that recur throughout one’s life. Such questions are broad in scope and timeless by nature. They are perpetually arguable – What is justice? Is art a matter of taste or principles? How far should we tamper with our own biology and chemistry? Is science compatible with religion? Is an author’s view privileged in determining the meaning of a text? We may arrive at or be helped to grasp understandings for these questions, but we soon learn that answers to them are invariably provisional. In other words, we are liable to change our minds in response to reflection and experience concerning such questions as we go through life, and that such changes of mind are not only expected but beneficial. A good education is grounded in such life-long questions, even if we sometimes lose sight of them while focusing on content mastery. The big-idea questions signal that education is not just about learning “the answer” but about learning how to learn. (Wiggins, Understanding by Design)

- How do changes in the environment affect the community of organisms that live within it?
- How does a beneficial adaptation affect a population?
- How do species compete for limited resources? What is the long-term effect in the genetic variation of a species?
- How does a new species emerge?
- What are impacts we have on the evolution of organisms?

## Student will know...

Summarizing the key content by setting up knowledge and skill goals for the unit helps designers focus lesson content.

### **LS4.A: Evidence of Common Ancestry and Diversity**

- 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. (HS-LS4-1)

### **LS4.B: Natural Selection**

- Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2),(HS-LS4-3)
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)

### **LS4.C: Adaptation**

- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment’s limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)
- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4)
- Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)
- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. (HS-LS4-5)
- Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species’ evolution is lost. (HS-LS4-5)

## Students will be able to....

Summarizing the key skills goals for the unit helps designers focus lesson content.

- Students will evaluate the role of natural selection in the development in the theory of evolution.
- Students will be able to explain how fossil, biochemical, and other evidence support the theory of evolution.
- Students will be able to recognize the role of evolution in antibiotic resistance.
- Students will be able to relate plant and animal adaptations, including behaviors, to the ability to survive stressful environmental conditions.

## Current Teaching Design\*

List every activity that you currently complete in your traditional classroom situation to teach this unit.

1. Taxonomy - How do we classify organisms? Students summarize the six kingdoms of life.
2. Dichotomous Keys Part 1- Students practice using a dichotomous key in lab where they classify jelly beans.
3. Dichotomous Keys Part 2 - Students develop their own classification system, scientific names, and dichotomous key for an alien ecosystem.
4. Evolution Guided Notes - Notes cover the Charles Darwin, the Theory of Evolution, Natural Selection, and Artificial Selection
5. Natural Selection Worksheet
6. Peppered Moths Lab
7. What Darwin Never Knew Video
8. Guided Notes on Empirical Evidence for Evolution
9. Amino Acids Sequence Activity
10. Natural Selection of Rabbits PhET Lab
11. Antibiotic Resistance Frontline Video
12. Antibiotic Resistance Simulation
13. Antibiotic Resistance Essay
14. Guided Notes on Adaptations and Tropisms
15. 20 Minute Quickwrite w/ Peer Review on the role of adaptations in natural selection
16. HHMI Pocket Mice Activity
17. In this the end of humanity PBL project
18. Unit Test

## Models

Recommended models for implementation. (ie flex, station rotation, lab rotation, flipped, individual, A La Carte, enriched virtual)

- Online labs
- Stations

- Flipped classroom
- PBL
- Online collaboration
- Online Assessment

## Instruction and Activities

Based on what you have learned so far what instruction and activities will students engage with in the face-to-face (F2F) environment? Which will you now move to the online environment? For more support in planning this way, [watch this video](#).

F2F	Online
<ol style="list-style-type: none"> <li>1. Introduction to the kingdoms of life</li> <li>2. Jelly Bean Dichotomous Key Lab</li> <li>3. Peppered Moths Lab</li> <li>4. Empirical Evidence of Evolution Station Rotation lab</li> <li>5. Amino Acids Sequence Activity</li> <li>6. Antibiotic Resistance Frontline Video and Class Discussion</li> <li>7. Guided Notes on Adaptations and Tropisms</li> <li>8. HHMI Pocket Mice Activity</li> </ol>	<ol style="list-style-type: none"> <li>1. Dichotomous Keys Part 2 - Students develop their own classification system, scientific names, and dichotomous key for an alien ecosystem. Using Inspiration. The classification diagrams will be uploaded into a google doc, which allow students to collaborate virtually.</li> <li>2. Evolution Notes using Quizlet</li> <li>3. <a href="#">Natural Selection Worksheet</a></li> <li>4. What Darwin Never Knew Video - Using Quizlet</li> <li>5. Empirical Evidence of Evolution Notes Using Quizlet</li> <li>6. Natural Selection of Rabbits PhET Lab</li> <li>7. <a href="#">Antibiotic Resistance Simulation</a></li> <li>8. Antibiotic Resistance Essay w/ Peer Review Using Google Docs</li> <li>9. 20 Minute Quick-write w/ peer review on the role of adaptations in natural selection using Google Docs</li> <li>10. <a href="#">Is This the End of Humanity PBL Project</a></li> </ol>

## Assessments

Based on what you have learned so far what instruction assessments will students engage with in the face-to-face (F2F) environment? Which will you now move to the online environment? Think about how you balance your assessment strategies (formative and summative).

F2F	Online
-----	--------

<ul style="list-style-type: none"> <li>● Jelly Bean Dichotomous Key Lab (formative)</li> <li>● Bell Warmers (formative)</li> <li>● Peppered Moths Lab</li> <li>● Empirical Evidence of Evolution Rotation Lab</li> <li>● Class discussion</li> <li>● Howard Hughes Medical Institute Activity</li> </ul>	<ul style="list-style-type: none"> <li>● Quizlet (formative)</li> <li>● Kahoot Quizzes (formative)</li> <li>● Essay revisions (formative and summative)</li> <li>● Phet Labs - Lab Writeups on Google Docs and Google Classroom</li> <li>● Antibiotic Resistance Simulation</li> <li>● PBL Check-ins on Google Docs</li> </ul>
--	--

## Resources

A selected repertoire of high quality resources that would equip a teacher to teach the unit is listed here.

F2F	Online
Materials for labs, class projector, videos for the HHMI activity, articles on antibiotic resistance, HHMI Pocket Mice Videos, Antibiotic Resistance Frontline Video	Prepare quizlets for notes, prepare Kahoot quizzes, Quality youtube videos for quizlets, PheT Labs

## TO-DO\*

What items must you complete in order to finish the creation of this unit. If any of the items to the right must be modified for online delivery list it here. For example, create a short podcast, find a YouTube video, write a discussion question, re-write directions for an activity so it can take place online.

Convert notes to quizlets - find quality youtube videos and convert to quizlets, make kahoot quizzes, convert lab writeups to google docs and post on google classroom, convert essays to google docs and post on google classroom, Convert Dichotomous Key Part 2 to Google Doc format.
--