



**ADAPTATIONS, GENETIC VARIATION
AND NATURAL SELECTION**

Seventh Grade

**Piloted at West Hawaii Explorations
Academy
(WHEA)**

By:

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PRISM UHH GK-12 Program

ADAPTATIONS, GENETIC VARIATION AND NATURAL SELECTION

GRADE LEVEL: Seventh Grade

PURPOSE:

This curriculum was designed to communicate concepts about evolutionary processes to seventh grade students. Hawaii is home to many endemic species that exhibit different genetic variations. These unique species are excellent examples to utilize to help students understand evolution.

STANDARDS/BENCHMARKS:

Standard 1: The Scientific Process: SCIENTIFIC INVESTIGATION: Discover, invent, and investigate using the skills necessary to engage in the scientific process

Benchmark SC.7.1.1 Design and safely conduct a scientific investigation to answer a question or test a hypothesis

Benchmark SC.7.1.2 Explain the importance of replicable trials

Benchmark SC.7.1.3 Explain the need to revise conclusions and explanations based on new scientific evidence

Standard 3: Life and Environmental Sciences: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment

Benchmark SC.7.3.2 Explain the interaction and dependence of organisms on one another

Standard 5: Life and Environmental Sciences: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms

Benchmark SC.7.5.2 Describe how an inherited trait can be determined by one or more genes which are found on chromosomes

Benchmark SC.7.5.3 Explain that small differences between parents and offspring could produce descendants that look very different from their ancestors

Benchmark SC.7.5.4 Analyze how organisms' body structures contribute to their ability to survive and reproduce

Benchmark SC.7.5.6 Explain why variation(s) in a species' gene pool contributes to its survival in a constantly changing environment

RATIONALE:

The Hawaiian Island chain is the most isolated archipelago on the planet. This isolation has limited the number of animal and plant species that have arrived here naturally. When organisms do colonize the islands successfully, their populations must change over time in order to suit the conditions of their new environment. As a result of millions of years of evolution in isolation, the Hawaiian Islands are home to many fascinating endemic species, such as Hawaiian honeycreepers, Happy-face spiders, and Ohia trees.

This curriculum focuses on examples of Hawaii's native flora and fauna to understand evolutionary concepts, including genetic variation, natural selection, and adaptation.

Additional reading material developed by Full Option Science System (FOSS) at the Lawrence Hall of Science is included for each topic. Background information is included at the beginning of each lesson, but more detailed information with added examples from FOSS is included for added teacher support. This unit can be used as supplemental teaching materials with the FOSS Populations and Ecosystems Course, lessons Adaptations, Genetic Variation and Natural Selection.

LESSONS PLAN:

This unit was designed to last from 8-9 weeks, depending on the total number of field trips taken or how long it takes to complete "Build a Hawaiian Bird". Most lessons can be completed within a 45-minute class period, but some lessons need several weeks to be completed. Lessons that include a field trip take the entire school day. Depending on the number of science classes taught each week, the duration of this unit will vary. Due to complex topics, students may need extra time to review concepts before starting lessons, which will also affect the duration of this unit.

Although the topics are introduced in a particular order and the unit is designed to flow well, the lessons can be used out of context or used individually to address specific concepts.

All lesson plans start with a summary of the lesson and a list of objectives students will learn. Lessons also include detailed materials lists as well as instructions for teacher preparation at the beginning of each lesson. The instructor should scan these lists prior to beginning of each lesson since materials must be purchased (some ordered), hand-outs should be Xeroxed, and field trips must be organized. Background information is also included with each lesson for the instructor and vocabulary words that can be used for vocabulary or spelling lessons are introduced here as well.

Week 1: Students are introduced to the concepts of adaptations, (founder species, endemism, adaptive radiation, Hawaiian honeycreepers, Hawaii as an archipelago, etc.) and a verbal pre-assessment of what the students already know about the topic is conducted. Students can be given background information on Adaptations before the start of the first lesson and this could also be discussed.

The students then learn about particular adaptations Hawaiian birds have in order to survive and study a poster of different bird bills. They then engage in a hands-on Hawaiian Bird Beak Adaptation Lab to simulate how birds have particular beak shapes to acquire different food sources.

Week 2: If applicable, students will explore different bird habitats on a field trip. In this unit, students visited Puu waa waa Forest Bird Sanctuary. Other ideas for field trips could be Hawaii Volcanoes National Park, Kaloko-Honokohau National Park or Kipuka 21 on Saddle Road. Students will observe different adaptations birds have in order to survive in their respective habitat. If a field trip is not possible, a classroom simulation of a bird habitat could be created. After the field trip, students will write a paper about a Native Hawaiian Forest Bird.

Week 3-4 (could last to week 5): Students get creative and apply what they have learned in prior weeks with “Build a Hawaiian Bird”. They first develop a bird from paper cut-outs provided. After the model is completed, the bird is then constructed using papier mache. The actual building of the birds can take several weeks depending how detailed the birds become. After the birds are completed, students write a paper describing their bird and its specific adaptations. Each bird should also be presented to the class.

Week 5: Students are introduced to the subject of Genetic Variation. Genetics can be a confusing concept for students, having students read the background material provided helps with complex vocabulary. After discussing the reading material, students play Vocabulary Bingo to get more comfortable with the topic. If more review is needed, a vocabulary review is also provided. Students then study human traits in the lesson, “Exploring Human Traits” where they survey their own traits.

Week 6: Students will learn how genes are passed from generation to the next by studying Happy-Face Spiders. They will act as captive breeders and choose traits to breed that are beneficial for survival. Punnet squares will also be introduced.

Week 7: After students have a solid understanding of adaptations and genetic variation they are introduced to the topic of Natural Selection. They participate in a natural selection simulation in which they create and modify “paper airplanes” over several generations to see how favorable heritable traits are passed on.

Week 8: Students get another chance to get out of the classroom with a field trip to the Ohia Common Garden in Volcano. Ohia from different elevations have morphological differences and students get a chance to observe this phenomenon. After the trip to the garden, students write a reflection about their field trip.

advantages of their features, and how the birds are adapted to their environments. Finally, students improve their communication skills by giving oral presentations on their project.

After learning about genetic variation of Happy-face spiders, students will choose the color of spider they would use to breed so the spider can survive in the wild. They then color a picture of a Happy-face spider using the colors they chose to breed. They will continue to improve on communication by presenting their pictures to the class and defending their selection. Finally, after studying natural selection, the student will write a reflection about their trip to the Ohia Common Garden and Hawaii Volcanoes National Park.

This unit was developed and piloted by Leayne Patch-Highfill and Jessica Schwarz at West Hawaii Explorations Academy (WHEA).