

**Instructor:** Ashley Grapes  
**Grade:** 7<sup>th</sup> Grade Life Sciences  
**Duration:** Lab 30 minutes  
Discussion 20-30 minutes

## **Darwin's Finches: Natural Selection (5-E Model)**

**Purpose:** Darwin's theory on natural selection is arguably the most revolutionary in all of science. It is at least the foundation of biology and is vital for any scientifically literate individual to understand. During this activity the student will be able to visualize firsthand the driving force of natural selection as the class role models a pseudo population of finches, much like the finches that sparked Darwin's theory. The student will understand through this activity that species are specially adapted to their environment and only the fittest will reproduce to pass on their genes. At the conclusion of this activity the student will know and understand the terms natural selection, artificial selection, adaptation, variation, niche, species and habitat.

### **SOLs:**

- LS.1 The student will plan and conduct investigations in which data are organized into tables showing repeated trials and means; variables are defined; dependent variables, independent variables, and constants are identified; interpretations from a set of data are evaluated and defended; and
- LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include competition.
- LS.9 The student will investigate and understand interactions among populations in a biological community. Key concepts include competition and cooperation and niches.
- LS.10 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include adaptations that enable organisms to survive within a specific ecosystem.
- LS.11 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and long term). Key concepts include factors that increase or decrease population size; and eutrophication, climate changes, and catastrophic disturbances.
- LS.14 The student will investigate and understand that organisms change over time. Key concepts include the relationships of mutation, adaptation, natural selection, and extinction; evidence of evolution of different species in the fossil record; and how environmental influences, as well as genetic variation, can lead to diversity of organisms.

**NSES Standards:** Populations and ecosystems, diversity and adaptations of organisms, biological evolution

### **Materials and Resources:**

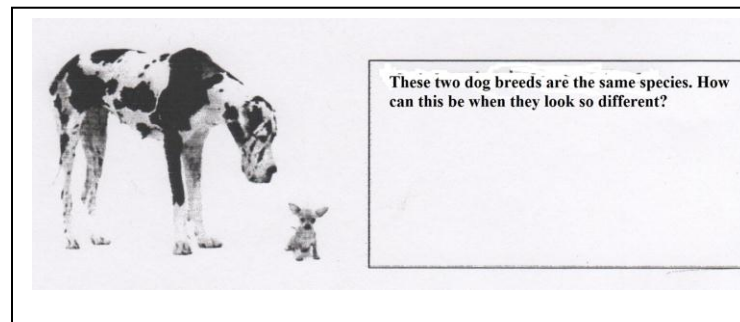
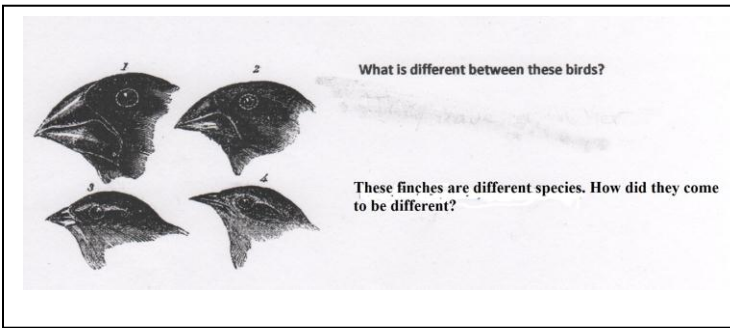
Chopsticks	20 of four different colored beads (80 total)	Ruler
Plastic spoons	Grass field (outside) or large carpet (inside)	Pencil
Tape	Graph paper	
Colored pencils	Plastic cups	

Lab adapted from <http://www.lessonplansinc.com/science.php/biology/lessonplans/C95/> entitled "Adaptions from Darwin's Finches."

**Safety:** Collision of students is possible during the frenzy of the 10 second "generation period." Care must be taken to limit the number of students involved and establish consequences for pushy behavior. Students involved in the generation period should be on their knees so they don't slip on the beads. Other objects may be used to represent the seeds in order to minimize the possibility of injury. Those not involved must remain at a safe distance from the "ecosystem" to avoid slipping on escaping beads.

**Procedure:**

**Engage:** Inquiry-based questions were given to the students prior to the activity to identify their misconceptions and prior knowledge.



Prepare a PowerPoint or Smart Notebook presentation to curv any misconceptions the students had and present material/background on natural selection. The PowerPoint presentation first defines a species and the students play a game to determine if two animals are the same species or not. The example chosen were black bear vs. grizzly bear (different), great dane vs. chihuahua (same), maine coon vs. siamese cat (same), nile crocodile vs. cuban crocodile (different) and clydesdale vs. miniature horse (same). The student's will be engaged because the animals that look so different are actually the same species (although they are different sub-species) and the animals that look similar are actually different! Ask them why they think this may be? Next present the concepts of artificial and natural selection (man vs. nature, short-period vs. long-period, vain vs. survival, meaningless, vs. fitness). Next discuss variability and the struggle for life which allows for natural selection, which allows for evolution. Play another game at the end of the presentation. A introduced species is introduced into an ecosystem, what may happen to this species physically to help it survive better?

**Explore:** The lab activity simulates Darwin's finches that whose beaks adapted over a long period of time to what they ate (seeds vs. flower nectar). Split the class up into 4 groups and assign them a "beak" (spoons, chopsticks, tied thumb, left free hand). Have them stand in each corner of the room and place a large red shaggy carpet in the middle of the classroom. This may be adapted to go outside in nice weather! Give each group five plastic cups labeled "red," "blue," "black," and "white," and "discard," or whatever the colors are of the seeds you have chosen to use. Count 20 of each color seed and disperse them randomly on the red shaggy carpet. Have each group designate two people to count seeds and one person to be the bird in the first generation.

Have the four birds with their specialized beaks kneel at each of the four corners of the carpet with a plastic cup. Tell them to pick up as many seeds they can with "their beak" in 10 seconds. This time frame will represent a generation. After the 1<sup>st</sup> generation, have each group count the number of total seeds. The bird with the last seeds goes extinct. They remaining birds survive each have a "baby" so that there will

be 6 birds in the next generation with 3 different beaks. Have the groups count separate and count how many of each color seed they picked up. Calculate how many of each color is still in the carpet and add two “baby” seeds of that color in the next generation.

Repeat this for 2 more generations so that there are eight children with the same beak at the end. Count the seeds that are left in the “ecosystem.” Students should be recording results along the way.

**Explain:** Have the student’s fill out the post-activity sheet and then discuss it as a class. Discuss how adapting and natural selection is vital to an organism’s survival and how failing to do so will result in extinction. Discuss which birds left first, second, and third and discuss possibilities for this. Discuss which seed was most successful (the red one). Discuss how it is not just animals, but all organisms that adapt to their environments. Discuss how this lab activity was “unrealistic” (stable environment, no niches for other birds, natural selection takes 10’s of 1000’s of years). Discuss what kind of environments would be suitable for the other bird types (cracks in the sidewalk = chopsticks, etc.)

**Elaborate:** Have the student research any animal and present their findings as a PowerPoint presentation to the class. One to two class periods should be designated to research and preparing the presentation. In this PowerPoint the student will discuss the origins of their animal, it’s taxonomy, and how it has become especially adapted (physically and behaviorally) to its environment. Have the students present one or two other animals from the same genus as their organism and discuss how and why they became different species in terms of their different niches and special adaptations.

**Evaluate:** The student will be evaluated informally on the completion of the activity sheet, their activity etiquette, and formally on a PowerPoint presentation by use of a rubric. The informal evaluation will be based on class behavior, effort, participation, and clean-up. This activity should be done as a class, but time should be given between each generation to fill out the activity sheet. It is flexible for the instructor to choose in the time length of generation, the number and kinds of beaks and seeds, the length of discussions and amount of scaffolding throughout the lab. The lab may also be done outside and the presentation under engage can be modified to each classes personality, misconceptions, and prior knowledge. Every student should be involved in this activity, either seed counting, note taking, or being a bird. Different students may be chosen for different roles based on their personalities and abilities. The students should be given freedom to choose their animal, but sufficient guidelines for their presentation for uniformity and increased objectivity in grading.



**Generation One**

	Left Hand	Thumb	Spoon	Chopsticks	
Red					4( - ___ ) = __
Green					
White					
Black					
Total					

**Generation Two**

Red				4( - ___ ) = __
Green				
White				
Black				
Total				

**Generation Three**

Red			4( - ___ ) = __
Green			
White			
Black			
Total			

**Generation Four**

Red		3( - ___ ) = __
Green		
White		
Black		
Total		

**Most Adapted Bird:**

**Most Adapted Seed:**

**Post Activity Questions:**

Does the data support your hypothesis? Why or why not?

Which bird was best adapted to the “red-rug” ecosystem?

Which bird was least adapted to the “red-rug” ecosystem? Can you think of an ecosystem where this bird might be the most adapted out of all the birds?

Which seed was best adapted to the ecosystem? What adaptation did this seed have that the other seeds did not?

Why was this activity unrealistic? What do you know about ecosystems and natural selection that was not true in our “red-rugged” ecosystem.

## Darwin's Finches Follow-up Assignment

Choose an animal or plant to do a PowerPoint presentation on. In this presentation you will discuss it's taxonomy, it's ancestors, and it's specific adaptations that make it successful. You will also contrast and compare one or two other animals to your animal that are in the same genus. How did your animal adapt to fill a specific niche in its environment? How did the other similar organisms differ, and how do their differences help them succeed in their niche? You will be allotted 10 minutes and will be evaluated using the rubric below.

### PowerPoint Presentation guidelines

Title Page (1 slide)

Introduction of animal (1-3 slides)

Taxonomy (1 slide)

Ancient phylogenic ancestors/How it has become the animal it is today (1-2 slides)

Description of its natural habitat/ecosystems (1-2 slides)

Specific behaviors that allow it to be specially adapted to its environment or make it successful (1-2 slides)

Specific physical characteristics that allow it to be specially adapted to its environment (1-2 slides)

Present briefly (one slide) One or two animals of the same genus.

How are they slightly different and give one example of how that makes them specially adapted to their niche (1-2 slides)

Works Cited (one slide)

	<b>1 Poor Comments</b>	<b>2 Fair Comments</b>	<b>3 Ok Comments</b>	<b>4 Good Comments</b>	<b>5 Excellent Comments</b>
<b>Completeness</b> Required length Required components					
<b>Content</b> Relevant Strong Accurate					
<b>Organization</b> Thoughts and topics grouped together Presentation flows logically					
<b>Writing Style</b> Grammar Spelling Punctuation Transitions No first tense					
<b>Presentation</b> Neat Easy on the eyes Not too wordy/busy Contains supporting graphics					
<b>Total Categorical Points</b>					