The Origin of Species: Lizards in an Evolutionary Tree

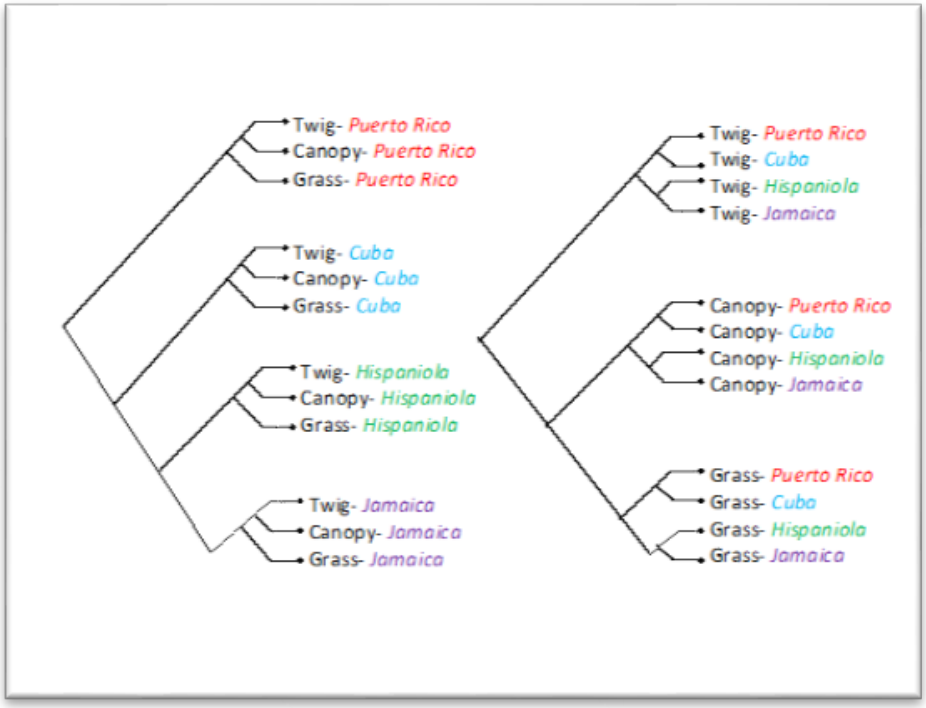
hhmi | BioInteractive

Film Guide
Student Handout

NAME_____ **DATE**_____

This handout supplements the short film *The Origin of Species: Lizards in an Evolutionary Tree*.

1. Puerto Rico, Cuba, Jamaica, and Hispaniola have species of anole lizards with distinct body types, including the grass lizards, which have long tails; the canopy lizards, which have large toe pads; and the twig lizards, which have short legs. Anole species with each of these three body types exist on each of the four islands. The phylogenetic trees in the figure below illustrate two hypotheses for how these types of lizards may have evolved.



   a. Select the pair of statements in the table below that accurately describe the phylogenetic trees in the figure above: _____

	Tree on the Left Side of the Figure	**Tree on the Right Side of the Figure**
A	The twig lizard on Puerto Rico evolved first and is the ancestor of all the other lizards.	The twig lizard evolved first on all of the islands, and then the canopy and grass lizards evolved from the twig lizard.
B	Body types evolved repeatedly and independently on each island.	Different body types evolved once, and then populations of individuals with those body types ended up on different islands.
C	Different body types evolved only once, and then populations of individuals with those body types ended up on different islands.	There are two ancestors to all the lizards, the twig lizard and the canopy lizard.
D	Puerto Rico is the origin of all three lizard body types.	Each body type evolved repeatedly and independently on each island.

b. Select which tree in the figure illustrates the most likely hypothesis for how the different species of anole lizards evolved on the Caribbean islands according to the film:
_____ the tree on the left _____ the tree on the right

c. Using evidence presented in the film, explain the reasoning behind your answer in the question above (Part b).

2. Over many generations, natural selection favors those traits that enable populations to live successfully in a particular habitat. A scientist discovered two species of anole lizards that live in different habitats and display the characteristics listed in the table below. (The scientists based these observations on a sample of 20 lizards from each species.)

Observations of Two Species of Anoles		
Species	**A**	**B**
Habitat	**High trunks and branches**	**Lower trunk and ground**
Body length	130-191 mm	55-79 mm
Limb length	Short	Long
Toe-pad size	Large	Intermediate
Color	Green	Brown
Tail length	Long	Long

a. Describe two differences between the two species of anoles.

b. Formulate two hypotheses to explain why each of these differences may have evolved.

c. Describe an experiment that would test one of your hypotheses stated above.

3. Two organisms are considered to belong to different species if they _____
   a. have differences in appearance, such as different color or leg length.
   b. live in different geographical areas, such as on different islands.
   c. do not mate or produce fertile offspring.
   d. eat entirely different types of foods.

4. In the film, you saw Jonathan Losos place a male and female trunk-ground anole on an island that did not have any trees but had short grass and shrubs. Losos and colleagues visited the island the following year. What had happened? _____
   a. The two anoles died because there were no trees for them to live in.
   b. The two anoles reproduced and their offspring adapted to living in bushes.
   c. The legs of the two anoles got shorter and their offspring inherited shorter legs.
   d. The two anoles reproduced and there were no significant differences in traits from one generation to the next.

5. Which statement best explains why islands can be used as natural laboratories? _____
   a. The climate among islands varies from very wet to very dry.
   b. Islands are smaller in size than the mainland, so in that sense they are like a laboratory.
   c. The islands have similar habitats, but they differ from the mainland habitat.
   d. There are many small islands, meaning researchers can repeat their observations and experiments on several similar islands.

6. Describe the similarities and differences between the terms *microevolution* and *macroevolution*.

7. List two lines of evidence that Jonathan Losos has gathered through observation and experimentation that support the theory of natural selection developed by Charles Darwin.

Use the following information and figure to answer Questions 8-9.

In 2003, Jonathan Losos and his research team experimentally introduced curly-tailed lizards (*Leiocephalus carinatus*) to islands populated by trunk-ground anoles that live primarily on the ground and have relatively long legs (Losos, J. B., T. W. Schoener, and D. A. Spiller. 2004. Predator-induced behaviour shifts and natural selection in field-experimental lizard populations. *Nature* 432: 505-508). The scientists wanted to know how the presence of the curly-tailed lizards, which are anole predators, would affect the habitat in which the anoles lived.

In one experiment, Losos and colleagues measured the "perch height" (or how high off the ground a lizard was perched) for 24 individual anoles. They then placed either a curly-tailed lizard (experimental population) or an inanimate object of the same size (control population) in front of individual trunk-ground anoles and measured the perch height 10 minutes later. They then calculated the average change in the anole's perch height in the experimental and control populations. The results of this experiment are summarized in Figure 1.

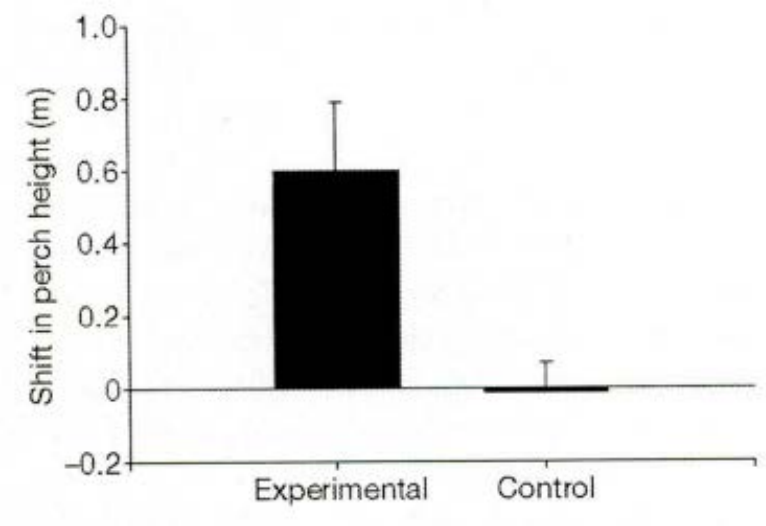


Figure 1. Mean change in perch height (±1 standard error) 10 minutes after introduction of either a large predatory lizard (experimental) or an inanimate object of the same size (control). (Image reproduced with permission from Losos, J. B., T. W. Schoener, and D. A. Spiller. 2004. *Nature* 432: 505-508.)

8. Based on the information above, what research question did the scientists ask that led to this experiment?

9. Using the information in Figure 1, describe the results of the experiment.

Use the following information and figure to answer Questions 10-12.

In another experiment, the scientists left the curly-tailed lizards on the islands for several weeks. They counted the number of anoles living on the ground at the beginning of the experiment in May and then again in July and November. The figure below shows the percentage of anoles living on the ground on islands with curly-tailed lizards (experimental population) and without curly-tailed lizards (control population).

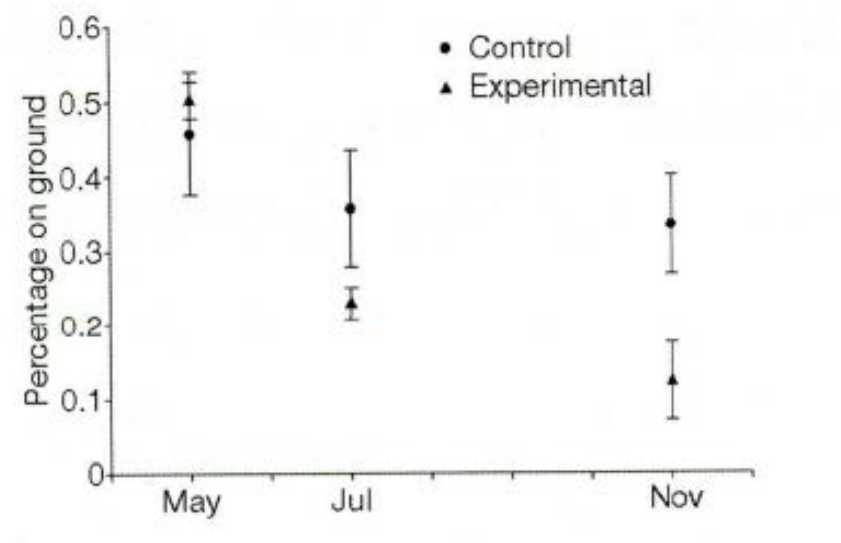


Figure 2. Differences in proportions of anoles observed on the ground in experimental and control populations. Values are mean and ±1 standard error of the mean for all 12 islands. Only four islands were surveyed in July. (Image reproduced with permission from Losos, J. B., T. W. Schoener, and D. A. Spiller. 2004. *Nature* 432: 505-508.)

10. Based on the information above, what research question did the scientists ask that led to this experiment?

11. Using the information in Figure 2, describe the results of the experiment.

12. Provide a scientific explanation for the results of the two experiments summarized in Figures 1 and 2. (Hint: Imagine that you are one of the anoles in each experiment.)

13. If the curly-tailed lizards were left on the islands for several years, predict how the bodies of the trunk-ground anoles might change after many generations of living in the presence of curly-tailed lizards.