

Adaptation and Survival Tools



STANDARD COURSE OF STUDY CORRELATIONS:

Note: All of the objectives in this lesson require that the student understand the relationship between the structure of a molecule and its function, the structure of a cell organelle and its function, or an organism adaptation and its function.

Science, Grade 8, Goal 5: The learner will conduct investigations and utilize appropriate technologies and information systems to build an understanding of evidence of evolution in organisms and landforms.

5.02 Correlate evolutionary theories and processes:

- Biological.
- Geological.
- Technological.

Biology, Goal 2: The learner will develop an understanding of the physical, chemical and cellular basis of life.

2.02 Investigate and describe the structure and function of cells including:

- Cell organelles.
- Cell specialization.
- Communication among cells within an organism.

Biology, Goal 3: The learner will develop an understanding of the continuity of life and the changes of organisms over time.

3.05 Examine the development of the theory of evolution by natural selection including:

- Development of the theory.
- The origin and history of life.
- Fossil and biochemical evidence.
- Mechanisms of evolution.
- Applications (pesticide and antibiotic resistance).

INTRODUCTION TO LESSON: Students will work in groups to examine the structure of a unique tool or device and determine its function. They will then work in groups to design (on paper) a lizard with adaptations that give it an evolutionary advantage in a specific type of island environment. They will later read excerpts from Charles Darwin's *Origin of Species* and share their observations.

BACKGROUND FOR TEACHER: Many aspects of studying biology involve students recognizing the relationship between the form of a structure and its function. The theory of evolution by natural selection states that species in nature will be acted upon by environmental conditions, and adaptations that help an organism survive will be preserved because those surviving organisms will pass on their genes to future generations.

engage > Arrange students in teams of two or three. Give each group a tool or photo of a tool. Tell students to imagine that they are archaeologists of the future who have dug up tools used by a group of humans in the past. They are to develop a hypothesis about the tool's function based on its form and develop a storyline for it. Have groups present their stories, emphasizing what features of the tool led to their hypothesis about its function. *(It is not necessary to reveal the item's actual function. Even if students don't guess the tool's real purpose, they may find an alternative, valid use for it.)*

MATERIALS

- ✂ Odd and unique tools (kitchen, workshop, etc.) or pictures of tools
- ✂ Copies of Lucky Lizard handouts, one per group
- ✂ Drawing supplies
- ✂ Viewing Guides, one per student

PREPARATION

- ✂ Gather eight to 14 odd or unique kitchen, workshop or lab tools. Students will be examining the structure of the tools to guess their function. As an alternative, you may use pictures of tools. Photos of many unusual antique tools may found at: <http://puzzlephotos.blogspot.com/search/label/Best>. You might search mail-order or on-line catalogs for images of unique hardware, farm and kitchen tools.
- ✂ Copy a few excerpts from *Origin of Species* by Charles Darwin. Each group should have a separate passage to read. You can find samples at: <http://history.hanover.edu/courses/excerpts/111dar.html> and <http://web.grinnell.edu/courses/bio/s05/bio373/origin/excerpts.pdf>. The first link provides some short quotes. The second link contains longer passages.

For a follow-along viewing guide for students, see Viewing Guide 19.

explore > Discuss with students the relationship between the form of a certain part of an organism and its function, relating the discussion back to the previous exercise. **Show the video.** Have students answer the Viewing Guide questions and then have a class discussion about the relationship between form and function. Discuss how some of these adaptations might have come to exist in a particular species. (For example, raptor species may have different wing structures that allow them to fly and hunt in different ways. Such adaptations can allow them to occupy niches in environments they must share with other species, improving their survival odds.)

explain > Divide the class into six teams and assign each a letter from A to F. Distribute the corresponding handouts and have students read the description of their group's assigned island habitat. Tell them they are to modify the structure of their island-dwelling lizard, designing adaptations that would help it survive in the environment described. Students will draw their "new" lizards and write answers to the handout questions on the back of their drawings. Have them share their work with the class, explaining the value of some of the animal's adaptations. Finally, have students select one adaptation and explain how it evolved. (Students must explain thoroughly. For example: "Among the population of lizards, there was a lot of variety in tail length. In this environment, predators were likely to grab lizards by the tail, so the lizards with shorter tails were more likely to survive. These hardier creatures were more likely to reproduce and pass on their short-tail genes. Over a very long period of time, the average tail length in the surviving lizards decreased considerably.")

elaborate > Assign each group a separate passage from *Origin of Species*. Have students read the passages and discuss and explain their meaning. Afterward, have them present their explanations to the class.

evaluate >

- Review the Lucky Lizard drawings and presentations.
- Optional: Give groups of students pictures of animal legs/feet/claws/talons. Have students hypothesize what type of animal the parts belong to and how the structure of the part determines its function. Have student groups present their ideas about the relationship between the form of the structure and its function. You can find useful pictures at this link: http://commons.wikimedia.org/wiki/Category:Animal_feet. Sample structures include: hopping legs of grasshoppers, talons of owls, webbed feet of geese, hooved feet of horses, clawed feet of tigers, sticky feet of geckos. For a more challenging evaluation, you might use only bird feet (http://www.infovisual.info/02/img_en/061%20Bird%20feet.jpg).



BEYOND THE CLASSROOM

Take students on a walk through a natural area to look for interesting plant parts or evidence of animal life. Look for examples of adaptations.

Additional Resources:

Galapagos Marine Iguanas • <http://www.savegalapagos.org/galapagos/galapagos-marine-iguanas.shtml> • Short profile with description of adaptations and behavior.

Galapagos Land Iguanas • <http://www.savegalapagos.org/galapagos/galapagos-land-iguanas.shtml> • Short profile with description of adaptations and behavior.

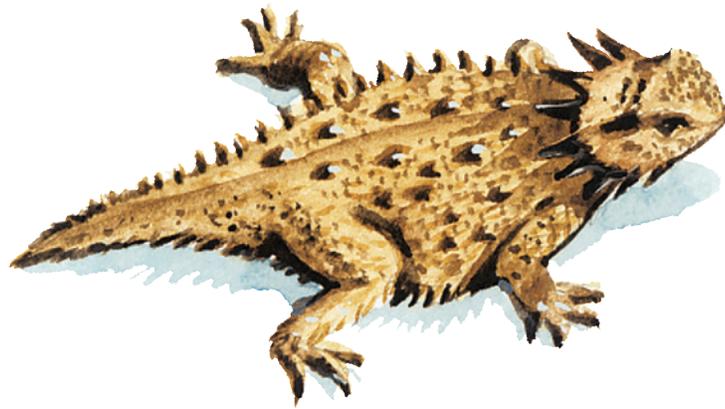


Teacher's Notes:

Island A

Lucky Lizards!

Imagine that millions of years ago lived a species of lizard like the one pictured here. As geologic change happened, members of the species eventually became isolated on different islands. Over many generations, the lizard evolved unique adaptations that allowed it to thrive in the island habitat described below.



ISLAND A

This island is hilly, and the earth is hard. The sparse plants are located mainly at the bottom of hills. Many predatory birds fly around the island, and the ocean waters are full of fish. There are few other animals. Plenty of algae cover the rocks dominating the shoreline. The center of the island has a small pond. The temperature on the island tends to be cold, and it is very windy on the coast. There are some caves near the hills.

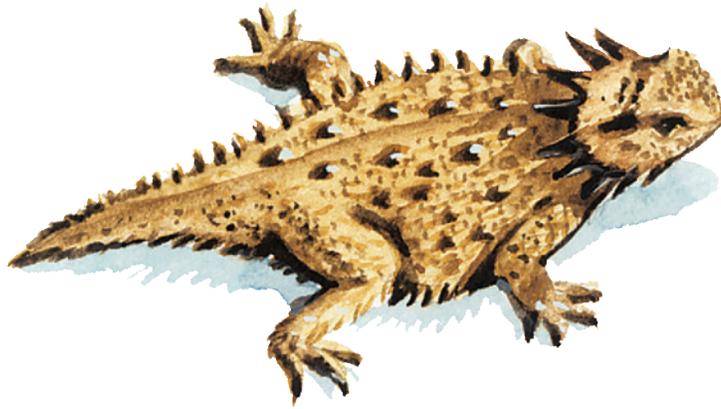
1. Draw the island and the lizard with the adaptations that have evolved.
2. Label the back of your drawing with:
 - Your island's letter.
 - List of the lizard's adaptations.
 - Explanation of how each adaptation enables the lizard to survive in its specific environment.
 - Explanation of the evolution of one adaptation.

Be sure to include explanations of mutations/variations, selection, sexual reproduction and allele frequencies.

Island B

Lucky Lizards!

Imagine that millions of years ago lived a species of lizard like the one pictured here. As geologic change happened, members of the species eventually became isolated on different islands. Over many generations, the lizard evolved unique adaptations that allowed it to thrive in the island habitat described below.



ISLAND B

This island is mostly flat and sandy. Strong waves occasionally pummel the shore. Lots of large kelp (seaweed, a type of algae) wash ashore periodically, and some crabs also come ashore. Plants such as sea oats and ones with hard coverings over their leaves (such as cactus) are built to withstand the weather. The center of the island has a small pond. There are few other animals.

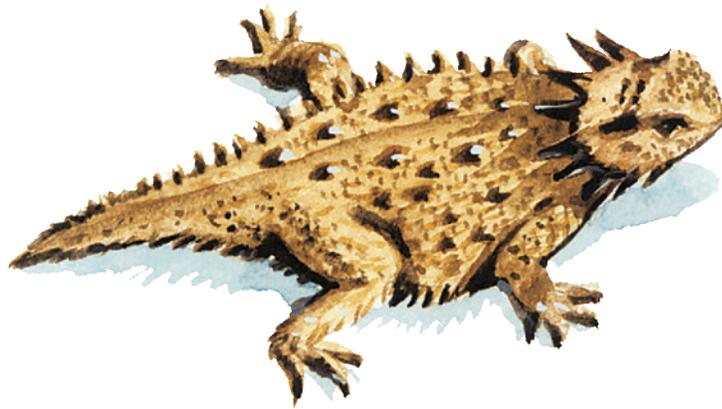
1. Draw the island and the lizard with the adaptations that have evolved.
2. Label the back of your drawing with:
 - Your island's letter.
 - List of the lizard's adaptations.
 - Explanation of how each adaptation enables the lizard to survive in its specific environment.
 - Explanation of the evolution of one adaptation.

Be sure to include explanations of mutations/variations, selection, sexual reproduction and allele frequencies.

Island C

Lucky Lizards!

Imagine that millions of years ago lived a species of lizard like the one pictured here. As geologic change happened, members of the species eventually became isolated on different islands. Over many generations, the lizard evolved unique adaptations that allowed it to thrive in the island habitat described below.



ISLAND C

This island is like a tropical rainforest. Precipitation is heavy, the weather is usually balmy and the temperature mostly constant. There are lush plants and abundant insects. Many animals visit the large lake in the middle of the island. Plentiful rodents and many other animals eat lizards. The ocean has many fish. Predatory birds patrol the sandy shoreline.

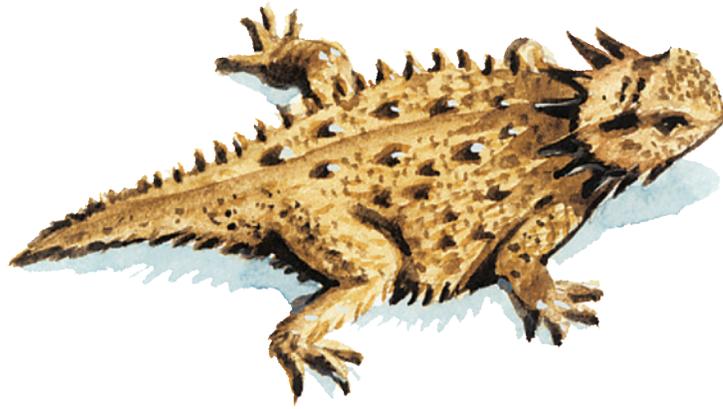
1. Draw the island and the lizard with the adaptations that have evolved.
2. Label the back of your drawing with:
 - Your island's letter.
 - List of the lizard's adaptations.
 - Explanation of how each adaptation enables the lizard to survive in its specific environment.
 - Explanation of the evolution of one adaptation.

Be sure to include explanations of mutations/variations, selection, sexual reproduction and allele frequencies.

Island D

Lucky Lizards!

Imagine that millions of years ago lived a species of lizard like the one pictured here. As geologic change happened, members of the species eventually became isolated on different islands. Over many generations, the lizard evolved unique adaptations that allowed it to thrive in the island habitat described below.



ISLAND D

This island is fairly dry and covered with grasses. There are a lot of insects and small rodents. At the coast, there are rocks and tide pools full of sea anemones, clams, mussels, crabs and small fish. The tides are strong, and waves splash furiously at times. There are a lot of coastal birds and also red foxes. The temperature varies a lot—from very hot and humid to chilly and dry. In the center of the island are a few small oaks.

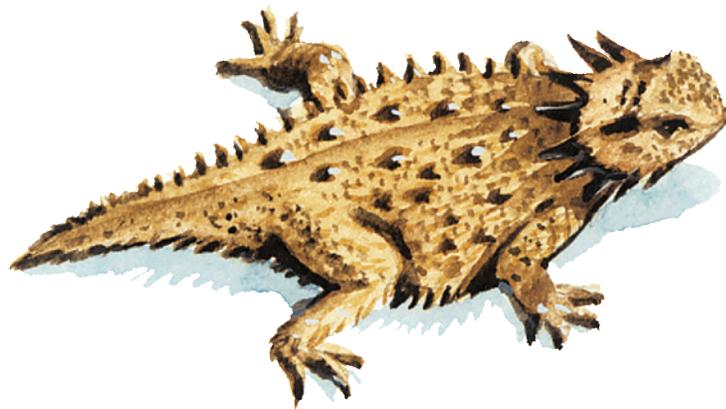
1. Draw the island and the lizard with the adaptations that have evolved.
2. Label the back of your drawing with:
 - Your island's letter.
 - List of the lizard's adaptations.
 - Explanation of how each adaptation enables the lizard to survive in its specific environment.
 - Explanation of the evolution of one adaptation.

Be sure to include explanations of mutations/variations, selection, sexual reproduction and allele frequencies.

Island E

Lucky Lizards!

Imagine that millions of years ago lived a species of lizard like the one pictured here. As geologic change happened, members of the species eventually became isolated on different islands. Over many generations, the lizard evolved unique adaptations that allowed it to thrive in the island habitat described below.



ISLAND E

This island is in a polar region. Summer temperatures rarely exceed 60°F, and winter temperatures are below zero. Winters are long and dark, with plenty of snow. The surface of the earth is often frozen. Plants include grassy sedges and a few small flowers. The island is hilly, with some caves in the hillsides. There are plenty of large fish off the coast. Resident animals include puffins, seals, sea lions, otters and foxes.

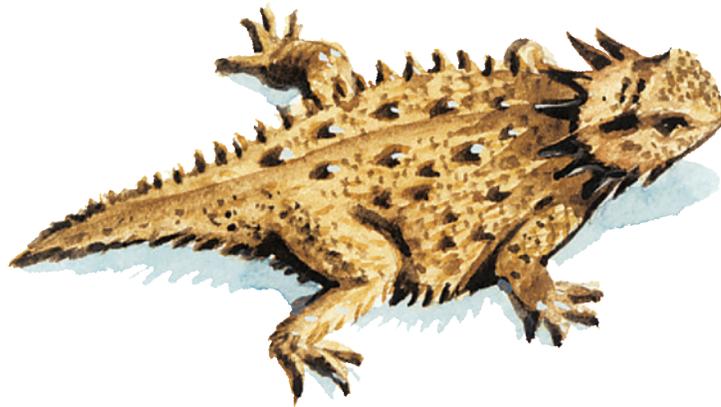
1. Draw the island and the lizard with the adaptations that have evolved.
2. Label the back of your drawing with:
 - Your island's letter.
 - List of the lizard's adaptations.
 - Explanation of how each adaptation enables the lizard to survive in its specific environment.
 - Explanation of the evolution of one adaptation.

Be sure to include explanations of mutations/variations, selection, sexual reproduction and allele frequencies.

Island F

Lucky Lizards!

Imagine that millions of years ago lived a species of lizard like the one pictured here. As geologic change happened, members of the species eventually became isolated on different islands. Over many generations, the lizard evolved unique adaptations that allowed it to thrive in the island habitat described below.



ISLAND F

This island is an abandoned Colonial settlement. There are remains of houses with doors, windows and cabinets. Some houses still have fireplaces and chimneys. Vegetation includes grasses. Shorebirds are abundant. The warm water teems with shrimp and crabs, and various species of algae are plentiful. The island's shoreline is rocky and home to many mollusks.

1. Draw the island and the lizard with the adaptations that have evolved.
2. Label the back of your drawing with:
 - Your island's letter.
 - List of the lizard's adaptations.
 - Explanation of how each adaptation enables the lizard to survive in its specific environment.
 - Explanation of the evolution of one adaptation.

Be sure to include explanations of mutations/variations, selection, sexual reproduction and allele frequencies.