MOSA MACK SCIENCE

Adaptations Lesson 2: "The Make"

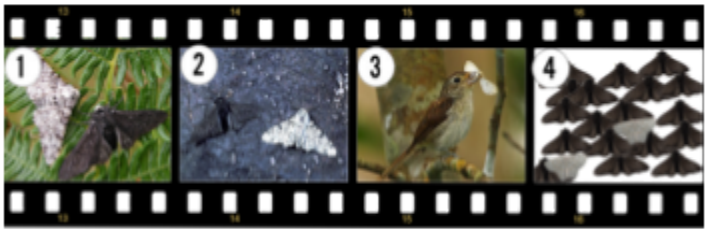
Educator's Resource Guide

Objective:

In the Make, students will:

1. Research an animal that has evolved over time, focusing on one specific focal trait.
2. Create an annotated filmstrip that shows how their focal trait has evolved over time, based on environment.
3. Communicate their understanding that individuals with the traits that best fit their environment will be naturally selected for and have the greater chance of survival.

A sample filmstrip:



1. There are two types of peppered moths: moths with dark wings and moths with light wings.

2. During the Industrial Revolution, the smog from the factories killed the white lichen on the tree, making the bark appear dark. During this time, the dark-winged moths camouflaged against the dark bark.

3. Predators like birds could easily see the light-winged moths and eat them.

4. This means that more dark winged survived and mated with each other. This caused the dark-winged population to increase.

Time Required: 200 minutes

Materials Required	**Safety Considerations**	**Science & Engineering Practices**
• Student handouts • Introduction to Make Powerpoint • Pencils and Colored Pencils or Crayons • Markers • Rulers • Large Construction Paper • Computers or Pre-printed resource cards	None	• Developing and Using Models • Constructing Explanations or Arguments From Evidence

Inquiry Scale:

Level 1: (*recommended for grades 4-5)*
Split students into groups and assign them one of the focal traits in Appendix A. As student groups research their traits, provide them with support and website recommendations from Appendix B. Students will then present their research to the class. As a class, brainstorm a first draft of each filmstrip. Following the brainstorm, break students into small group discussions to complete the final draft filmstrip of their choice.

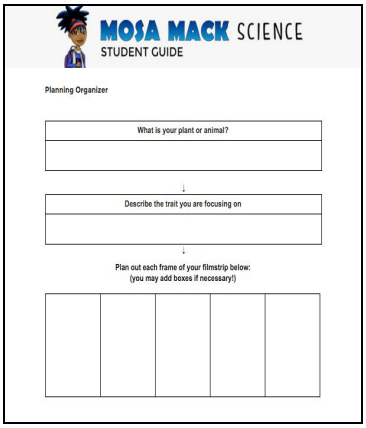
Level 2: (*recommended for grades 5-6)*
Have students choose the specific trail they'll be focusing on, using recommendations from Appendix A. Students will research the trait of their choice in small groups, but come back together for a class-wide discussion of each plant or animal, so all students understand how the adaptations came about. Provide students with recommendations from Appendix B as needed. Learners then construct their filmstrip in groups independently.

Level 3: (*recommended for grades 6-7)*
Give students a choice of plants or animals to consider. Spark student ideas with ideas from Appendix A as needed. Learners conduct the rest of the Make process independently in their groups: first conducting research and then planning and executing their filmstrip.

Level 4: (*recommended for grades 7-8)*
Learners are given freedom of choice in their plant and animal, and independently complete all aspects of the Make process, including conducting research and then planning and executing their filmstrip.

Agenda:

I. Show PowerPoint to introduce the Make Activity (10-15 minutes)
The PowerPoint will review essential concepts learned in "The Solve" and provide context for their upcoming "Make" challenge.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STUDENT GUIDE

Planning Organizer

What is your plant or animal?

Describe the trait you are focusing on

Plan out each frame of your filmstrip below:
(you may add boxes if necessary!)

II. Make Activity (120 minutes)
Guide students through their planner to brainstorm an organism and a specific trait that organism has. As guided by the organizer, students will:

1. Identify the organism and trait. *If students need extra support picking a topic, provide them with recommendations from **Appendix A** as needed.*
2. Research their trait. Using computers or textbooks and printed resources gathered by their teacher. *Prompt students with research prompts and website recommendations from **Appendix B** as needed.*

3. Make a filmstrip using construction paper, colored pencils, and markers

III. Exit Ticket (10 minutes)

Students complete the exit ticket that summarizes their understanding of the Make and connects students to the upcoming Engineering challenge.

Note: In collaborative classrooms, this serves as the individual accountability in an otherwise group project.

Exit Ticket Answer Key

1. What is the function of the trait you chose?
   Varies.
2. How does it help your organism survive and/or reproduce?
   Varies.
3. Explain the process which made this trait become more common in your population of animal/plant over time. (Hint: how does adaptation work?)
   Varies, but should include an explanation of how the variation entered the population, was favorable in that environment, and thus allowed the individual with that trait to survive longer, reproduce, and pass on those genes to the next generation, and so on, making the trait more common.
4. How would this trait be helpful to humans?
   Varies.
5. Brainstorm one way we could make this trait available for human use.
   Varies.

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Make Assessment: Project Grade and Rubric Score Sheet - Adaptations

Project Submitted by _____

Challenge: Create a filmstrip that shows how the evolution of a trait over time.

Adaptations Make Checklist: Content Concepts and Practices

Your Challenge: Create a filmstrip that shows the change of a trait over time

- ❏ The filmstrip is complete and includes:
  - ❏ A title that identifies both the name of the plant/animal and the focal trait
  - ❏ Neat work done in color
  - ❏ At least 4 frames (you can choose to include more)
- ❏ The filmstrip is accurate and includes:
  - ❏ A change in a plant/animal population over many generations
  - ❏ Annotations that explain why this trait became more common in the specific environment

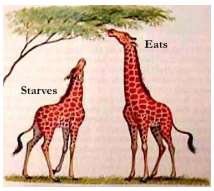
Science & Engineering Practices Rubric:

	Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Developing and Using Models	Drawings, diagrams, or visual models include major misconceptions or have missing parts. Explanation of the model is minimal or not present.	Drawings, diagrams, or visual models include minor misconceptions or have missing parts. Explanation of the model is minimal.	Drawings, diagrams, or visual models are complete, but contain a minor misconception. Explanation of the model is complete but lacking complexity.	Drawings, diagrams, or visual models have no misconceptions and contain all details. Explanation of the model is complete and complex.
Constructing Explanations or Arguments From Evidence	Constructs an explanation with no clear sources of evidence.	Uses scientific principles and/or data from at least one source to construct or evaluate an explanation, but explanation contains minor misconceptions.	Uses accurate but incomplete scientific principles and/or data from multiple sources to construct or evaluate an explanation.	Uses accurate and complete scientific principles and/or data from multiple sources to construct or evaluate an explanation.

Teacher Comments:

Final Score: Final Grade:

Appendix A: Recommendations to Spark Student Ideas

Animal	Trait to Research	Background Information
Giraffe 	Neck Length	Giraffes' neck bones varied in length. The giraffes with necks that were not long were unable to reach food high in the trees and died. The giraffes with the longer necks reached the food, survived, and passed on their long-necked genes. Thus, there are more long-necked giraffes in the population.
Peacock 	Feathers	Male peacock feathers varied in color and pattern. The more dull males were unable to attract mates and died without reproducing and passing on their genes. The males with colorful, elaborate patterns were able to attract more mates, reproduce, and pass on their colorful genes. Thus, there are more colorful peacocks in the population. *This is an example of sexual selection, in which the trait does not help the organism survive, only reproduce. It actually makes the peacock more vulnerable to predators. Some call this an evolutionary trade-off.
Finch 	Beak	When a species of finch from the mainland was blown to the Galapagos island, the finches on each island eventually evolved to have a different type of beak, depending on what food source was there. For example, on an island that mainly had crunchy seeds, the finches with longer thin beaks were unable to crunch the seeds and died. The finches with shorter sturdier beaks ate the seeds and survived, passing on this trait. Thus, there were more finches with short finches in the population.
Elephant 	Tusks	Elephant tusk size varied in length. Elephant tusks are used for scraping bark from trees and defense. Unfortunately, poachers like to hunt elephants with the largest tusks. Thus, elephants with the largest tusks were hunted, died, and could not pass on their long-tusk genes. The elephants with shorter tusks survived and passed on their genes. Thus, there are now more shorter-tusked elephants in the population.
Polar Bear 	White Fur	Polar bear fur once varied in color. In their environment of white snow, the polar bears with dark fur were visible to predators, died, and did not pass on their dark-fur genes. Those with fur that appears white (air spaces in the fur scatter light) were able to camouflage, survive, and pass on those genes. Thus, there are more white-looking polar bears in the population.

Appendix B:
Research Support: Prompt Questions and Recommended Websites

Research Support

To help kids get started with online research, they may want to use the following research stems: “Natural selection of _____” or “how did _____ evolve over time?”

Encourage students to experiment with different types of search terms. For example, if students selected “fur” they can research broadly “Evolution of fur” as well as a more specific question, "How did fur evolve in the Arctic wolf?"

As students begin their research, prompt them with questions as needed, such as:

1. Was there a point in history when this animal did not have this trait? Or was there a point in history when this trait did not exist? What did animals have in place of this trait?
2. How does this trait help the animal or plant survive?
3. Why might this trait be advantageous?
4. What happened to the animal or plant that *didn’t* have this trait?
5. How does this trait help the animal or plant survive?
6. What environmental factors make this trait advantageous?
7. If the environment changed, do you think this trait would be advantageous? Why or why not?

Recommended Websites

If you’d like to provide them with specific science-related websites, steer them towards:
National Geographic (http://www.nationalgeographic.com/)
PBS (pbs.org)
San Diego Zoo (http://animals.sandiegozoo.org/)
Bronx Zoo (http://bronxzoo.com/)
BBC Wildlife (http://www.bbc.co.uk/nature/animals/)

If students find information on Wikipedia, make sure they follow the citation to the original source to confirm their findings.