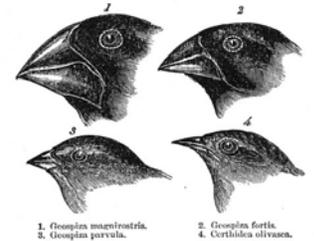


Natural Selection - Battle of the Beak



Contributors

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Intended Audience

K-4	
5-8	
9-12	X

Activity Characteristics

Classroom Setting	X
Requires special equipment	
Uses hands-on manipulatives	X
Requires mathematical skills	
Can be performed individually	
Requires group work	X
Requires more than one (45 min class) period	
Appropriate for special needs student	X

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Introduction

Description

Students simulate birds competing for various foods to understand how natural selection works.

Abstract

Students investigate whether inherited structures provide an adaptive advantage in a competitive environment. Students simulate birds competing for various foods by using different utensils to pick up different objects.

Core Themes Addressed

Microbial Cell Biology	
Microbial Genetics	
Microorganisms and Humans	
Microorganisms and the Environment	
Microbial Evolution and Diversity	
Other – Natural Selection and Evolution	X

Keywords

Fitness, natural selection, adaptive advantage

Learning Objectives

At completion of this activity, learner will

1. Explain how variation among different individuals affects relative fitness
2. Explain how natural selection leads to change in phenotype of a species across generations
3. Describe how evolution works

National Science Education Standards Addressed

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Standard C: Life Science

- Biological evolution

Teacher Handout

Natural Selection - Battle of Beak

Student Prior Knowledge

Students should have the following knowledge prior to completing this activity:

1. Understand that there is natural variation among individuals of all species
2. Be able to distinguish between heritable traits and acquired traits
3. Understand that evolution only works that the population level and not at the individual level

Teacher Background Information

Food is a limited resource in any habitat and the types of food available can also vary. Organisms that are better adapted to take advantage of available foods will have a higher fitness than those who are less well adapted. Individuals with high level of fitness are more likely to survive to reproductive age and pass on their genes. While this concept seems rather obvious, it is essential that each student fully grasp its significance. Understanding the idea of adaptive advantage is vital to understanding populations in ecosystems as well as the process of evolution.

Class Time

This activity will require a minimum of one 45 minute class period.

1. The activity will take approximately 25-30 minutes to complete the activity.
2. It will take students 10-15 minutes to analyze the data and answer the concluding questions.

Teacher Preparation Time

This lesson will require approximately 10 minutes of preparation time.

1. Divide supplies so that each group will have each necessary component.

Materials and Equipment

Have the following for each group of 3-4:

- 1 plastic spoon
- 1 plastic fork
- 4 plastic cups

1 plastic knife
1 pair of chopsticks
food container with prey
prey (100 ml each pinto beans, lima beans, macaroni, and shell pasta)

Methods

1. In your groups of 4, decide who will start with each utensil (spoon, knife, fork, or chopsticks) and each take a plastic cup. You will all be able to use all the utensils.
2. You are hungry birds. You can only eat with your utensil beak. Your cup is your stomach. It must remain upright at all times. Hold your “beak” in one hand and your “stomach” in the other. You can only place food in your stomach with your beak.
3. When the teacher says, “go,” you will have 30 seconds to pick up as many pieces of food as you can. Keep the container of food in the center so that every bird can get food. Try not to spill! After 30 seconds, the teacher will say, "stop". Stop picking up prey. Be listening!
4. Empty your stomach and count the number of each type of prey. Record results under “Day 1.” Share data so that day 1 is complete. If someone in your group has eaten more prey than you have, help them count! Then return all the prey to the tray. Mix the prey in the tray.
5. Share your data for day one with your group. Fill in the chart for Day 1. Then hand your utensil to the person on your right side.
6. Repeat steps 3 - 6 until each member of your group has used each utensil.
7. Make sure you have shared data so that each group member has all the data for all the days filled in.
8. Now add up all your data for all 4 “days” for each section. Find the average by adding up each day and dividing by 4. Record in the last data table.

Tips/Suggestions

- Students could get aggressive when they compete for the food items. Make sure they do not get in a situation that they could hurt each other.
- The "beaks" be could be substituted with other items such as binder clips, forceps, scoopulas, etc.
- The "prey" items could also be substituted with other items such as marshmallows, M&Ms, Jelly beans, etc.

References

This activity was modified from:

<http://www.myteacherpages.com/webpages/tkeilman/files/battleofthebeaks.pdf>

The picture in the student handout is from:

<http://faculty.cerrocoso.edu/pfrasier131m/content/Lectures/Unit%20I/Darwin%27s%20Finches.gif>

Answers to Student Handouts

1. What food was easiest to eat with each type of beak? (HINT: Which one averaged the most?)

Answers will vary depending on results

Fork _____ Spoon _____
Knife _____ Chopsticks _____

2. What utensil did you think was easiest to use? Why?

Answers may vary; however, it is most likely that the spoon was the easiest to use and the average number of food items picked up with the spoon is the highest.

3. Do some utensils perform better than others? If these utensils represent different beak types, which “beak” type (i.e., utensil) has the highest relative fitness in the environment containing only those four “food” types (i.e., lima beans, pinto beans, macaroni, and shell pasta)? Which beak type would have lowest relative fitness?

Answers may vary; however, it is most likely that the spoon would perform better than any other utensils and therefore have the highest fitness. Birds with the spoon “beak” type would be the best adapted to this environment. It is likely that the knife would be the worst performer. Therefore, birds with the spoon “beak” type will have the lowest fitness and be very ill-adapted to this environment.

4. If the knife “beak” type is the most successful in picking up the “food” items, will the frequency of birds with the knife “beak type” increases or decreases after 100 generations? Explain.

Answer: The frequency of birds with the knife “beak” type will increase after 100 generations. Since birds with the knife “beak” type have no problem getting food, most of them will survive to reproductive age and leave offspring. Their offspring will outcompete birds with any other “beak” types for food and therefore will gradually displace birds without the knife “beak” type.

5. What will happen if all the birds with the “beak” types we have been working with flew to an island where no birds had been before and the only food type available was macaroni? Which bird “beak” type would be most likely to be successful? Which “beak” type would likely to disappear from the population? Is this an example of how evolution works?

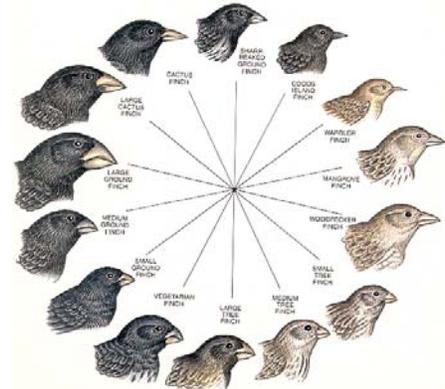
Answers may vary; however the birds with the spoon “beak” type will likely to be most successful. Assuming that birds with the chopsticks “beak” type have a really hard time picking up the macaroni, over time, their number will either decrease or completely disappear from the population due to not being able to get enough food to survive or being outcompeted for food by birds with other “beak” types. This is exactly how evolution works, the environment selects for individuals with the best adapted traits. If certain traits are ill-fitted to survive in a certain environment, those traits will be removed from the population.

Student Handout

Natural Selection - Battle of the Beak

Introduction

While on the Galapagos Islands, Charles Darwin noticed the difference between the beaks of different finches. The finches on each island had different beaks and they were all different from the beaks of the main land finches. He thought they had different types of beaks because through natural selection, they had adapted to the food they ate and the environment where they lived. What do you think?



Student Background Knowledge

Students should have the following knowledge prior to completing this activity:

1. Understand that there is natural variation among individuals of all species
2. Be able to distinguish between heritable traits and acquired traits
3. Understand that evolution only works that the population level and not at the individual level

Vocabulary

Fitness – the ability of individuals with certain genotype to survive and reproduce and therefore be able to contribute to the gene pool of the next generation

Natural selection – a process in which some individuals with traits that improve survival or reproduction produce more offspring than other individuals.

Adaptive advantage – possessing certain traits that allow organisms to better survive and reproduce in a certain environment

Materials Checklist

	1 plastic spoon
	1 plastic fork
	4 plastic cups
	1 plastic knife
	1 pair of chopsticks

	food container with prey
	prey (100 ml of each pinto beans, lima beans, macaroni, and shell pasta)

Procedure

1. In your groups of 4, decide who will start with each utensil (spoon, knife, fork, or chopsticks) and each take a plastic cup. You will all be able to use all the utensils.
2. You are hungry birds. You can only eat with your utensil beak. Your cup is your stomach. It must remain upright at all times. Hold your “beak” in one hand and your “stomach” in the other. You can only place food in your stomachs with your beaks.
3. When the teacher says, “go,” you will have 30 seconds to pick up as many pieces of food as you can. Keep the container of food in the center so that every bird can get food. Try not to spill! After 30 seconds, the teacher will say, “stop”. Stop picking up prey. Be listening!
4. Empty your stomach and count the number of each type of prey. Record results under “Day 1.” Share data so that day 1 is complete. If someone in your group has eaten more prey than you have, help them count! Then return all the prey to the tray. Mix the prey in the tray.
5. Share your data for day one with your group. Fill in the chart for Day 1. Then hand your utensil to the person on your right side.
6. Repeat steps 3 - 6 until each member of your group has used each utensil.
7. Make sure you have shared data so that each group member has all the data for all the days filled in.
8. Now add up all your data for all 4 “days” for each section. Find the average by adding up each day and dividing by 4. Record in the last data table.

Data

First “Day”:

	Pinto Beans	Lima Beans	Shell Pasta	Macaroni
Fork				
Knife				
Spoon				
Chopsticks				

Second “Day”:

	Pinto Beans	Lima Beans	Shell Pasta	Macaroni
Fork				
Knife				
Spoon				
Chopsticks				

Third "Day":

	Pinto Beans	Lima Beans	Shell Pasta	Macaroni
Fork				
Knife				
Spoon				
Chopsticks				

Fourth "Day":

	Pinto Beans	Lima Beans	Shell Pasta	Macaroni
Fork				
Knife				
Spoon				
Chopsticks				

Average:

	Pinto Beans	Lima Beans	Shell Pasta	Macaroni
Fork				
Knife				
Spoon				
Chopsticks				

Student Worksheet

Natural Selection - Battle of the Beak

Student's name _____ Date _____

Questions

1. What food was easiest to eat with each type of beak? (HINT: Which one averaged the most?)

Fork _____ Spoon _____
Knife _____ Chopsticks _____

2. What utensil did you think was easiest to use? Why?

3. Do some utensils perform better than others? If these utensils represent different beak types, which “beak” type (i.e., utensil) has the highest relative fitness in the environment containing only those four “food” types (i.e., lima beans, pinto beans, macaroni, and shell pasta)? Which beak type would have lowest relative fitness?

4. If the knife “beak” type is the most successful in picking up the “food” items, will the frequency of birds with the knife “beak type” increase or decrease after 100 generations? Explain.

5. What will happen if all the birds with the “beak” types we have been working with flew to an island where no birds had been before and the only food type available was macaroni? Which

bird “beak” type would be most likely to be successful? Which “beak” type would likely to disappear from the population? Is this an example of how evolution works?