# This Lab is for the Birds!!! How does natural selection cause evolution?

**Purpose:** This lab activity will help you understand how natural selection, the driving force of evolution, acts on a population. A <u>population</u> includes all of the individuals within a given species. Sometimes, an individual in a population can be born with a trait that hurts his/her chances for survival. Chances are, this individual will not survive or reproduce. However, an individual can also be born with a trait that actually helps him/her survive. If the individual passes this helpful trait along to its offspring, the trait may ultimately become more common in the population. Sometimes, a change in the environment where a population lives can also cause a change in the population itself, some individuals will be more successful at surviving and reproducing than others.

### Today, you and your classmates are all members of a bird species called, Utensil Birds, or Aves utensilis

**Think about it:** There tends to be variation within a population. For example, some humans have blue eyes and others have brown or green eyes. Can you think of another variation within our own human species? Utensil birds also exhibit variation in their species. Utensil birds have beaks that look like single toothpicks, spoons, forks, or knives. These are the 4 beak <u>phenotypes</u> in *Aves utensilis*. Phenotypes are the physical expressions of a gene in a population.

#### Problem Statement:

Which beak type has the best features for collecting "food" and helping an individual bird survive in a changing environment?

Let's research the problem: Natural selection can cause a population to change over time, or evolve. For natural selection to occur, four basic conditions must exist:

- 1. There must be variation in a population.
- 2. Not all individuals in the population survive to reproduce.
- 3. Survival is not random; the ones who do survive and reproduce have an advantage over their fellow members of the same population. They have an <u>advantageous trait</u>, a trait that helps them survive.
- 4. This advantageous trait possessed by the survivors MUST be <u>heritable</u>; it is genetically passed on to its offspring.

#### Materials:

- 1. 4 beak models, 1 of each model for each lab group: toothpicks, plastic forks, spoons, and knives
- 2. Two large paper plates
- 3. Two model food items: hard food items (beans) and soft food items (raisins)
- 4. One paper cup (model mouth) for each student.
- 5. Stopwatch

#### **Directions:**

- 1. This lab is designed for 4-member lab groups. A student will use the same "beak" throughout the activity. Each group member will have a different beak type.
- 2. While "feeding" you may **only collect one food item at a time**. You must pick up the items and place them in your cup (model mouth). You may not "rake" items towards yourself, nor pick them up with your other hand. The other hand should be behind your back. Be nice to your fellow birds!!
- 3. Please nominate one group member to run the stopwatch.

#### Procedure:

#### Soft Food Trials

- 1. Your group will receive a plate filled with a soft food item, raisins.
- 2. When the timer says "go," each person will collect as many items as possible from the plate that is placed in the center of your table. Collect one food item at a time!
- 3. After 10 seconds, the timer will say "stop" and all birds will put down their "beaks."
- 4. Record the total number of items that each bird collected on the data log titled, "Food Items Collected by Each Beak Type: Soft Food Trials".
- 5. Repeat steps 1-4 for a second and a third trial with the soft food items. "Mother Nature" (aka, your teacher) may need to add more food.
- 6. Calculate the mean number of soft food items collected by each bird.

#### A Changing Environment

You and your fellow birds live on an island with plentiful rainfall; that is why your food items are soft.

#### BUT... uh oh!

A terrible drought begins and the trees on your island begin producing much harder seeds. You and your fellow birds must adapt to this change in the environment or die.

#### Hard Food Trials

- 1. Your group will receive a plate filled with a hard food item, beans.
- 2. When the timer says "go," each person will collect as many items as possible from the plate that is placed in the center of your table.
- 3. After 10 seconds, the timer will say "stop" and all birds will put down their "beaks."
- 4. Record the total number of items that each bird collected on the data log titled, "Food Items Collected by Each Beak Type: Hard Food Trials".
- 5. Repeat steps 1-4 for a second and a third trial with the hard food items
- 6. Calculate the mean number of soft food items collected by each bird.

#### After collecting your data, you will share it with the rest of a class to create a class data table.



Food Items Collected by each Beak Type (Phenotype)



## the food the bird eats.

by Maira Whitehouse PhD

Soft	Food	Tria	ls

Beak Type (Phenotype)	Trial 1	Trial 2	Trial 3	Mean of Trials 1-3
Toothpick				
Spoon				
Fork				
Knife				

# Food Items Collected by each Beak Type (Phenotype) Hard Food Trials

Beak Type (Phenotype)	Trial 1	Trial 2	Trial 3	Mean of Trials 1-3
Toothpick				
Spoon				
Fork				
Knife				

Let's tabulate the class data:

#### Mean Food Items Collected by each Beak Type (Phenotype) for the Entire Class

Food Type	Toothpick	Spoon	Fork	Knife
Collected				
Soft Food Items				
Hard Food Items				

#### Conclusion:

1. The first basic condition for natural selection to occur is that there must be variability within a species. What variability was present in the population of utensil birds?

- 2. Before the terrible drought, which beak types gathered the most food items?
- 3. After the terrible drought, which beak type was most successful?

4. Over time, if drought conditions continue, what will happen to the number of birds with the spoon beaks in the population? What will happen to the birds with the other beak types?

5. As the individuals of the species change over time, the whole species may begin to look very different. It may even become a completely different species. What is the name of this process called?