

Prelab Information

Purpose	Explore natural selection using a laboratory simulation.
Time	Approximately 45 minutes.
Question	What is the effect of the type of food available on the frequency of different types of bird beaks?
Hypothesis	If the type of the food available changes, then the frequency of beak types will change, because birds with beaks more suited to the available food will be more successful over time.
Variables	<i>Independent Variable:</i> type of food available <i>Dependent Variable:</i> frequency of each type (size and shape) of beak
Summary	You will simulate three flocks of birds with three different beaks. The birds will compete for three types of food. As they feed, the flocks will change in size over generations. You will repeat this process (with identical flocks) with only two types of food. This will allow you to compare results after the third generation.

Lab Procedure

NOTE: If you are doing this lab virtually, you will omit the steps in **orange text**, which explain how to simulate the bird beaks and food in a classroom setting.

Step 1: Simulate Birds with Three Beak Phenotypes

Each flock of birds will have a different beak phenotype. Flock X will have pointed, piercing beaks that are good at piercing. Flock Y will have strong, spoon like beaks. Flock Y will have thin pinching beaks.

When doing this in the classroom, the class should divide into three equally sized “flocks.” Each student should obtain a plastic cup to represent the bird’s stomach and one of the “beaks”:

Flock X: pointed, piercing beaks (pairs of forks)

Flock Y: strong, spoon like beaks (pair of spoons)

Flock Z: thin pinching beaks (pair of knives)

Step 2: Simulate an Environment with Equal Amounts of Insects, Seeds, and Fruit

You will simulate a field with 300 pieces of food—100 seeds, 100 pieces of fruit, and 100 insects. Which flock will be able to eat the most? The least? Why? Record a prediction on the data sheet.

In the classroom, lay out the food below at random on a large table cloth.

100 seeds (sunflower seeds)

100 pieces of fruit (raisins)

100 insects (grains of rice)

Step 3: Simulate Feeding

The birds will use their beaks to pick up as much food as they can.

Here's how to do it in the classroom:

- a) Gather around the edge of the table cloth, mixing the three groups fairly evenly.
- b) Pick up food pieces only with your tool, using the pair of utensils in one hand, simulating the action of a beak.
- c) Pick up one piece of food at a time, and put it in your cup ("stomach") before picking another piece of food.
- d) Keep your body off the table cloth and pick up food only within your reach.
- e) Start only when the teacher says "Go" and finish when all food has been "eaten."

Step 4: Compile Data and Compute Totals

In the data table, record the number of pieces of each type of food that each flock ate (as a group). Then compute the totals for each flock.

To do this quickly in the classroom, count the pieces of each food type in your own cup and add the results with others in your flock to obtain totals. Then ask other flocks to share their data. Record all totals in the data table.

Step 5: Use the Data to Model the Sizes of the Flocks in the Second Generation

The flock that ate the most will be the most successful at breeding, increasing in size. The flock that ate the least will shrink in size. You will use each flock's food percentage as its population percentage in the next generation. Here's how:

- a) First compute the row of the table titled "Percentage of Food Eaten." You can use a calculator. Check your computations by making sure that the total percentage is 100%.
- b) Then, multiply each food percentage by the total number of birds (students) and round to the nearest whole number. Record the number in the last row of the table.

Step 6: Simulate Feeding Again

Select **Start Feeding**.

Step 7: Determine the Sizes of the Flocks in the Third Generation

The flock that ate the most will be the most successful at breeding, increasing in size. The flock that ate the least will shrink in size. You will use each flock's food percentage as its population percentage in the next generation. Here's how:

- a) First compute the row of the table titled "Percentage of Food Eaten." You can use a calculator. Check your computations by making sure that the total percentage is 100%.
- b) Then, multiply each food percentage by the total number of birds (students) and round to the nearest whole number. Record the number in the last row of the table.

Step 8: Simulate an Environment with Equal Amounts of Insects and Seeds, But No Fruit

Write the answers to the questions in the predictions box above Table C.

Step 9: Simulate Feeding Again

Select **Start Feeding**.

Step 10: Determine the Sizes of the Flocks in the Second Generation

The flock that ate the most will be the most successful at breeding, increasing in size. The flock that ate the least will shrink in size. You will use each flock's food percentage as its population percentage in the next generation. Here's how:

- a) First compute the row of the table titled "Percentage of Food Eaten." You can use a calculator. Check your computations by making sure that the total percentage is 100%.
- b) Then, multiply each food percentage by the total number of birds (students) and round to the nearest whole number. Record the number in the last row of the table.

Step 11: Simulate Feeding Again

Select **Start Feeding**.

Step 12: Determine the Sizes of the Flocks in the Third Generation

The flock that ate the most will be the most successful at breeding, increasing in size. The flock that ate the least will shrink in size. You will use each flock's food percentage as its population percentage in the next generation. Here's how:

- a) First compute the row of the table titled "Percentage of Food Eaten." You can use a calculator. Check your computations by making sure that the total percentage is 100%.
- b) Then, multiply each food percentage by the total number of birds (students) and round to the nearest whole number. Record the number in the last row of the table.

When finished, be sure to dispose of all material according to your teacher's directions.

Data—Environment with Equal Amounts of Insects, Seeds, and Fruit

Prediction

Table A: Feeding Results of the First Generation

	Flock X	Flock Y	Flock Z
Insects Eaten			
Seeds Eaten			
Fruit Eaten			
Total Pieces of Food Eaten			
Percentage of Food Eaten*			
Simulated Number of Birds in Flock for 2nd Generation**			

(Total = 300)

(Total = 100%)

(Total birds = 30)

Table B: Feeding Results of the Second Generation

	Flock X	Flock Y	Flock Z
Insects Eaten			
Seeds Eaten			
Fruit Eaten			
Total Pieces of Food Eaten			
Percentage of Food Eaten*			
Simulated Number of Birds in Flock for 3rd Generation**			

(Total = 300)

(Total = 100%)

(Total birds = 30)

* Divide each flock's total pieces of food by 300, the total number of pieces of food eaten.

** Multiply the food percentage for each flock by the total number of birds (students).

Data—Changed Environment with Equal Amounts of Insects and Seeds but No Fruit

Prediction

Table C: Feeding Results of the First Generation

	Flock X	Flock Y	Flock Z
Insects Eaten			
Seeds Eaten			
Total Pieces of Food Eaten			
Percentage of Food Eaten*			
Simulated Number of Birds in Flock for 2nd Generation**			

(Total = 300)

(Total = 100%)

(Total birds)

Table D: Feeding Results of the Second Generation

	Flock X	Flock Y	Flock Z
Insects Eaten			
Seeds Eaten			
Total Pieces of Food Eaten			
Percentage of Food Eaten*			
Simulated Number of Birds in Flock for 3rd Generation**			

(Total = 300)

(Total = 100%)

(Total birds)

* Divide each flock's total pieces of food by 300, the total number of pieces of food eaten.

** Multiply the food percentage for each flock