Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_ Date**: \_\_\_\_\_\_\_\_\_\_\_**

**Beaks of Finches Lab**

**Background**: Charles Darwin observed in his journal that finches living on different Galapagos Islands had different beaks. He also observed that the environment on each of four islands was quite different from the environment on the other three islands. In particular, the type of food available to the finches was different on each island. He developed a hypothesis that the finches had all been the same species at one time although there were variations in their beak shape and size. These variations made some beak types better adapted to the food on each island. The birds with those beaks survived and reproduced more than the others that did not have beaks with favorable adaptations.

These are an example of four different types of beaks found in finches living in the four different islands.



**Task**: We are going to perform a simulation activity for each of the islands that resulted in different beak shapes for each of the finches.

**Materials**

1 stopwatch per team

1 paper plate per team (the feeding ground)

4 plastic cups per team (the stomach)

One of the following tools for each “bird”

 Forceps

 Hair clip

 Large Binder Clip

 Clothespin

One of the following foods on the “island” plate per team

 Rice (Island A)

Marble (Island B)

 Rubber bands (Island C)

 Toothpicks (Island D)

 Black Beans (Island E)

Dry Red Kidney Beans (Island F)

**Procedure:**

You will work in groups of four “birds” at each island. Each of you will be given one tool to simulate the various types of beaks that may be present in any finch population. Each student will also receive a cup which will represent the finch’s stomach. On each island, one type of food will be present simulating the limited variety of food available to the finches. You will attempt to eat as much food as you can during each feeding period. The most successful bird will be the bird that eats the most and that bird will produce the most offspring. The least successful bird will die without leaving any offspring.

**The “birds” on each island shall conduct the following procedure:**

1. For each generation, record the type of bird beak (“tool”) each person on your island has selected in your table. **THERE MUST BE FOUR DIFFERENT BEAKS (“TOOLS”) AT EACH FEEDING ISLAND.**
2. Prior to feeding, make sure you know the most efficient way to pick up food with your selected tool.
3. One member of your team will announce the beginning and end of each feeding period, so make sure you are listening and ready to feed! Each feeding period will last only 10 seconds, so preparation counts! There will be four feeding periods in each generation, so each member of your team will have the opportunity to feed. This portion of the procedure should take between 10 and 20 minutes to complete.
4. During each feeding period, one member of the team uses their selected tool to pick up as much food as possible within **10 seconds** and places it into the cup (stomach).

RULES:

* + **Any food that falls on the floor or cup does not count.**
	+ **The food must be inside of the cup to be counted as “eaten” before the end of the feeding period is announced.**
	+ **The food cannot be touched with hands or anything other than the bird’s “beak”.**
	+ **Only one food piece (i.e., seed, raisin, paper clip) can be picked up at a time.**
	+ **The plate and the cup may be held steady by another team member.**

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1. After the end of the feeding period, record the number of pieces of food each type of bird “consumed” in that generation in the table provided.
2. All food in your cup must be returned to the plate prior to the next feeding period.
3. Repeat this procedure until each bird on your island has had an opportunity to feed.
4. Using the following heredity rules, determine the number of offspring for each bird.

**Heredity rules**

* + *The bird with the* ***smallest amount of food*** *consumed is declared “starved to* ***death*** *without reproducing”. This bird will not have any offspring and will not be included in the next generation.*
	+ *The bird with the* ***most food*** *consumed is declared “thriving” and is rewarded with* ***two offspring*** *with the same beak. Those two children will be listed on the next generation’s table.*
	+ *The remaining two birds survive and have* ***one offspring*** *each with the same beak.*

Using the heredity rules, fill in the number of offspring produced for each generation. Next, determine which beak types will be present for the following generation. For the second generation, the population will consist of two birds with beak types that had eaten the most food in the previous generation, no beak types for the bird eating the least food, and one bird for each of the remaining two beak types.

* Each member on the island must be assigned a beak type for each generation. Their beak type may change over the generations.
1. Repeat the feeding episodes with each new generation until one type of beak (tool) dominates the population on this island.
2. You must complete at least 3 generations.
3. Your teach will ask you to record your data on the board.

**Pre Lab Questions:**

1. Why did the finch populations on each different island develop different types of beak?
2. Describe what each tool, cup, and materials on the plate represent.
3. What trait is being evaluated in this activity? Is it a genetic or acquired trait?
4. Make a prediction about which type of food each bird will be most successful at capturing.

|  |  |  |
| --- | --- | --- |
| Type of Bird Beak (Tool) | Type of Food | Why? |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_Date: \_\_\_\_\_\_\_\_\_

**Circle the food type on your island:**

**Toothpicks Marbles Rubber Bands Rice Black Beans Kidney Beans**

**Table 1: Generation 1**

|  |  |  |
| --- | --- | --- |
| Bird Beak (Tool) | Number of Pieces of Food Eaten | Number of Offspring |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Table 2: Generation 2**

|  |  |  |
| --- | --- | --- |
| Bird Beak (Tool) | Number of Pieces of Food Eaten | Number of offspring |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Table 3: Generation 3**

|  |  |  |
| --- | --- | --- |
| Bird Type (Tool) | Number of Pieces of Food Eaten | Number of Offspring |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Table 4: Generation 4**

|  |  |  |
| --- | --- | --- |
| Bird Type (Tool) | Number of Pieces of Food Eaten | Number of Offspring |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_

 Total Points: \_\_\_\_\_\_\_/ 24 points

Team Members:

DATA ANALYSIS

1. Which bird (beak type) became extinct on each island? Why? (6 points)

|  |  |  |
| --- | --- | --- |
| Island | Beak Type | Why? |
| Island A (Rice) |  |  |
| Island B (Marbles)  |  |  |
| Island C (Rubber Bands)  |  |  |
| Island D (Toothpicks) |  |  |
| Island E (Black Beans) |  |  |
| Island F (Kidney Beans) |  |  |

1. Describe the results of the simulation for each of the birds on your island (8 points)

|  |  |  |
| --- | --- | --- |
| Bird Type | Type of Food | Successful or not? Why? |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

1. Describe how this simulation reflected natural selection and the “survival of the fittest” as it occurred in the evolution of the finches of the Galapagos Island? Use evidence from your data to support your answer and use the term “adaptation” in your answer. (3 pts)
2. a. What “genes/traits” are we examining in this simulation of natural selection?

b. What aspect of this simulation represents the different alleles on the island? Be specific in your answer and provide examples of the alleles.

1. Make two pie charts comparing the allele frequency of bird beak types using the data from generation 1 and generation 4. Using this data, discuss how the frequency of each allele changed over time on your island. (6 pts)
2. What would happen to the allele frequency of the birds on your island if a new species were introduced that had a similar beak type that favored the dominant food resource on your island?
3. Suppose that large, hard seeds dominated islands that had less than average rainfall. On islands that experienced above average rainfall, small insects and small seeds were dominant. If a severe drought hit your island, would the drought affect your current population of birds? (remember in the “real” world, species have variation, therefore assume that your current population of birds have genetic variation within there species, for example the hair clip bird would have slight differences in size)**.**