## Lab 2 Worksheet: Natural Selection

In this lab, we will be simulating the effects of natural selection using different utensils to represent different mouthparts and beans and M&Ms to represent prey items.

Natural selection is the process by which certain traits become more frequent in a population. If certain organisms in a population possess traits that help them to survive and reproduce, they will pass that trait on to their offspring (if it is heritable), resulting in an increase in the frequency of that trait in the population over time.

In this activity, we will examine the effect of differently shaped mouthparts on predator feeding efficiency and prey colour on prey survival. (70)

Each group will be given a habitat patch, which is a container filled with *inedible* dried beans of various kinds, plus *edible* garbanzo beans and M&Ms. Garbanzo beans and M&Ms are the food; assorted dried beans are not considered food but are the substrate in which the food occurs. Each team has a cup that represents your stomach and each forager will have an item that represents your mouthparts – what you use to capture and eat your prey. Variation in mouthparts will consist of a fork, a spoon, a knife, and chopsticks. Assume that mouthpart shape and prey colour are both heritable traits.

How might natural selection affect the different traits in these populations?

Hypothesis (4):

How do you think natural selection will affect the frequency of the different predator mouthparts? How do you think natural selection will affect the frequency of prey colouration? Come up with a prediction for how trait frequencies might change in each population.

Predictions (4):

## Methods:

- Once each forager in your group has a mouthpart, you will each complete a foraging bout. Foraging bouts consist of digging through the patch with your mouthparts, finding an edible item, capturing it, and transporting it back to the cup (stomach) using only your mouthparts. *Note: you can only use one hand to manipulate your mouthpart and you CANNOT switch hands while you are foraging. Your cup (stomach) must remain in your other hand. You cannot manipulate the habitat patch with your hands during the foraging bout. Your fellow foragers cannot assist you in your foraging bout.*
- Each foraging bout will last for 45s with a single forager attempting to collect prey items.
- When the time is up, record the amount of prey caught in Table 1 and calculate a value that represents the Energy Gained for that foraging bout. M&Ms & Garbanzos = 1 kcal, Assorted dried beans (mistakenly collected or spilled from patch) = MINUS ONE KCAL (you've just eaten dirt).
- When the first forager is done, replace all the dried beans, garbanzos and M&Ms to the tray and repeat the exercise with the other foragers in your group.
- Once each forager has completed a foraging bout, calculate the total number of food items obtained from each mouthpart, and the total number of M&Ms and Garbanzos eaten. Report these numbers to your instructor. Class data will be pooled to fill out Table 2 and Table 4.
- Based on the total number of energy gathered produced by the class, we will redistribute the mouthparts in the next generation to reflect the correct frequencies as well as replenishing each patch with prey items to reflect the frequency of the prey in the next generation.
- You will then repeat this procedure for 3 more generations.
- Construct a line graph to document the frequency of each mouthpart in the population over time and a separate line graph to document the frequency of prey colouration in the population over time. (14)

Using your graphs, answer the following questions (28):

- Was there any variation in predator efficiency (amount eaten in 60s)? If so, what were the causes?
- How did the frequency of each mouthpart type change over time?
- What happened to the genetic diversity of the predator population? Explain.
- How did the frequency of prey colouration change over time?
- What happened to the genetic diversity of the prey population? Explain.
- Did you notice a pattern between the two populations? Explain.
- Was your initial hypothesis supported? Why or why not?

For this lab, you will submit a formal lab report of your results. Your write up should include:

- an introduction (10)
  - including your hypothesis and predictions from above,
- the methods (5)
  - o a summary of what we did in class
- the class results
  - all the data tables below, your graphs, as well as a written description of the results (5)
- a discussion of the results (5)
  - including answers to the above questions
- a conclusion (5)
  - explain what you learned from this lab

Forager Name/ID	Generation	Mouthpart Type	# M&Ms (x 1kcal)	# garbanzos (x 1kcal)	# dried beans (- 1kcal)	Total Energy Gained (kcal)

Table 1. Energy obtained by each forager in each generation (6)

Mouthpart Type	Initial Number	Number in Generation 2	Number in Generation 3	Number in Generation 4	Number in Generation 5
Fork	6				
Spoon	6				
Knife	6				
Chopsticks	6				
Total:	24				

Table 3. Frequency of Mouthpart Type in each Generation (8)

Mouthpart Type	Initial Frequency	Frequency in Generation 2	Frequency in Generation 3	Frequency in Generation 4	Frequency in Generation 5
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Fork	0.25				
Spoon	0.25				
Knife	0.25				
Chopsticks	0.25				

Table 4. Total Number of Prey Items in each Generation (1)

Prey Item	Initial Number	Number in Generation 2	Number in Generation 3	Number in Generation 4	Number in Generation 5
Garbanzos	60				
M&Ms	60				
Total:	120				

## Table 5. Frequency of Prey Item in each Generation (4)

Prey Item	Initial Frequency	Frequency in Generation 2	Frequency in Generation 3	Frequency in Generation 4	Frequency in Generation 5
Garbanzos	0.5				
M&Ms	0.5				