

VIRTUAL LAB: NATURAL SELECTION

OBJECTIVES: To investigate a simulated model of natural selection of an organism in different environments. In this model, you will examine how natural selection affects the frequencies of two alleles for a particular trait.

PROCEDURE: (Follow instructions on separate paper)

1. What can natural selection significantly alter within a population's gene pool over time?
2. How can you define evolution in terms of allele frequencies?
3. How many alleles are we investigating in this lab? _____
4. The alleles in this investigation show incomplete dominance; therefore they combine to form _____ phenotypes (colors).

The three genotypes of the bugs in this simulation result in the following three colors:

- AA = yellow bugs
- Aa = green bugs
- aa = grey bugs

DATA TABLE #1

Environment #1 = _____								
Hypotheses	In this environment, I predict the following will happen after natural selection by a predator: <ul style="list-style-type: none"> • The number of yellow bugs (AA) will _____ • The number of green bugs (Aa) will _____ • The number of grey bugs (aa) will _____ 							
	In this environment, I predict the following will happen after natural selection by a predator: <ul style="list-style-type: none"> • The frequency of dominant alleles (A) will _____ • The frequency of recessive alleles (a) will _____ 							
Generation	Allele Frequencies		Number of Individuals					
			Before Natural Selection			After Natural Selection		
	A	a	Yellow (AA)	Green (Aa)	Grey (aa)	Yellow (AA)	Green (Aa)	Grey (aa)
1								
2								
3								
4								
5								

DATA TABLE #2

Environment #2 = _____								
Hypotheses	In this environment, I predict the following will happen after natural selection by a predator: <ul style="list-style-type: none"> • The number of yellow bugs (AA) will _____ • The number of green bugs (Aa) will _____ • The number of grey bugs (aa) will _____ 							
	In this environment, I predict the following will happen after natural selection by a predator: <ul style="list-style-type: none"> • The frequency of dominant alleles (A) will _____ • The frequency of recessive alleles (a) will _____ 							
Generation	Allele Frequencies		Number of Individuals					
	A	a	Before Natural Selection			After Natural Selection		
			Yellow (AA)	Green (Aa)	Grey (aa)	Yellow (AA)	Green (Aa)	Grey (aa)
1								
2								
3								
4								
5								

GRAPHS:

Pick data from ONE of the two environments you collected data from and make TWO graphs:

Graph #1: Effect of Natural Selection on **Allele Frequencies**. This graph should have two lines; a data line for the “A” allele and a line for the “a” allele, plotting one data point the frequency at each generation. (generation on X axis and frequency on Y axis)

Graph#2: Effect of Natural Selection on the **Number of Individuals**. This graph should have **three lines**, one for “AA”, one for “Aa” and one for “aa” genotypes, plotting one data point for the number of individuals **AFTER** natural selection for each generation. (generation on X axis and individuals on Y axis)

MAKE SURE YOU LABEL BOTH AXES, INCLUDE A LEGEND (KEY), AND A TITLE FOR EACH GRAPH!!!

CONCLUSIONS:

5. Looking at the graphs you made, what conclusions can you make with regards to the effect of Natural Selection on:

Allele Frequencies:

Number of Individuals remaining after natural selection:

6. Looking at your hypotheses in the data table for the data that you graphed, evaluate your predictions that you made for: (were you correct or not?)

Allele Frequencies:

Number of Individuals remaining after natural selection:

7. Why do you think that some bug colors were more successful than others?

8. In a certain environment, the grey (aa) bugs have an advantage over both the yellow and the green. What effect does this have on the "a" and "A" allele frequencies over a number of generations?

9. Do you think it would be possible to eliminate the "A" or "a" allele completely in any of these environments? Why or why not?

10. Let's say that the heterozygotes (Aa) also had the ability to run faster than the other two genotypes. How might that affect your results?

(PLEASE TURN THIS PAPER IN WHEN DONE)

PROCEDURE:

1. Go to the website linked on today's website.
2. Read the information on the left side of the screen and answer the questions 1-4:

We will be simulating how natural selection (in the form of predation) impacts the survival of these three phenotypes (and therefore impacts the allele frequencies) in various environments.
3. To start the lab, select the environment you want to test in the left drop down menu. **(DO NOT CHOOSE GRASSLANDS)** Write the name of this environment in Data Table 1. In the right drop down menu, select $A = 0.5$ and $a = 0.5$. This means that you have an equal number of alleles of each type to begin with. Click the "Generation 1" button. You should now see the bugs crawling around on the environment you have selected.
4. Write your predictions for what will happen to both the number of individuals and allele frequencies after natural selection (by a predator) in the hypothesis sections in your Data Table. Hint: for allele frequencies, look to see what allele pairs create each color.
5. Record the allele frequencies displayed from the "Frequency" box on the website into the row for Generation 1 in your data table.
6. Record the number of individuals for Generation 1 of each genotype from the "Number of Individuals Before Natural Selection" columns into your data table.
7. NOW, click the "Natural Selection" button, which simulates some of your bugs getting eaten by a predator.
8. Record the number of individuals for Generation 1 of each genotype from the "Number of Individuals After Natural Selection" columns into your data table.
9. Click the "Generation 2" button, repeat steps 5-8.
10. Repeat for Generations 3-5 to complete data collection for this environment.
11. Click the "Reset" button, and then select a **different** environment from the left drop-down menu. Select $A = 0.5$ and $a = 0.5$ again for the starting allele frequencies. **(again, don't choose grasslands)**
12. Repeat Steps 3-10 for this new environment, recording your information in Data Table 2 below.