SCI 215SC - Natural Selection Lab Answers

In this activity, you will simulate the effects of different phenotypic traits on the survivorship of a population. Natural selection refers to the change in frequency of a trait among a population.

Objective
Identify and explain how random mutations leading to a phenotypic trait leads to a change in the frequency of the trait among a population of rabbits.

Introductory Questions
1. What variables can you vary in this simulation?
   - Phenotypic traits: fur color, tail length, tooth length
   - Environmental conditions: location, predator presence, availability of food
2. In this simulation, you will control the mutations that produce a phenotypic trait variance among a population of rabbits. How is this different from what happens in nature?
   - In nature, mutations occur randomly and may lead to a different phenotypic trait. These mutations are not selected with purpose or designed to provide an advantage in an environment.
3. In this simulation, you will also control the environment to introduce challenges that all rabbits will face: the search for food and the existence of predators. Are there other environmental factors that may put a population of rabbits at risk that are not considered in this simulation? What are they?
   - Disease, or other foraging animals in competition for the same food.

Design an Experiment
This simulation will move forward in time for a population of rabbits (F1). These rabbits will die due to the presence of predators or the lack of available food, or they will reproduce offspring (F2) to carry on their phenotypic traits. The simulation will plot the frequency of the traits over each generation to assist you in determining how the frequency changes over time as a result of death and reproduction. Your task is to identify which traits are considered adaptations if they happen to help one type of rabbit survive.

Create three hypotheses and design an experiment to test each one of these hypotheses. Each of your hypotheses should address a different phenotypic trait. Your hypothesis should be specific enough to use the simulation to determine if the hypothesis is correct or incorrect based on the data provided.

I hypothesize that (select a rabbit phenotype) rabbits will be (more/less) likely to survive under (type of selective factor) within the (select type of environment) environment because (explain how their trait will help them to survive or not).

Test your Experiment
For each experiment, you must have a control (no mutation) and fill in the following chart.

<table>
<thead>
<tr>
<th>Experiment and Hypothesis</th>
<th>Phenotype</th>
<th>Selective Factor</th>
<th>Control Group Initial Population at F3</th>
<th>Control Group Final Population</th>
<th>Experiment Group Initial Population at F3</th>
<th>Experiment Group Final Population</th>
<th>Conclusion/Observation</th>
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For each of the experiments, begin by adding a friend and a mutation. Wait until the F3 generation before adding the selective factor. After adding the selective factor, let the simulation run for another 3 or 4 generations (F4, F5, F6, F7).

- Use the population numbers from the chart to get your numbers for the table. Remember, you can zoom in and out on the chart to get more accurate reads.
- Repeat for experiments 2, 3, and 4.

**Synthesis Questions**

1. Based upon your evidence from the simulation, what conclusion are you able to make about each of the three different types of phenotypes in rabbits?
   - Introducing the brown fur color trait leads to a change in the frequency over generations of the trait due to the visibility of the rabbit in the desert environment when wolves are present. Introduction of long teeth leads to no change in the frequency over generations of the trait and is therefore not considered an adaptation to the desert environment when wolves are present.

2. What happens to animals that cannot compete as well with other animals in the wild?
   - The frequency of their trait declines among the population of rabbits.

3. How does this simulation mimic natural selection? In what ways does this simulation fail to represent the process of natural selection?
   - The number of wolves or the amount of food does not track closely with the rabbit population.