MODELING NATURAL SELECTION

Introduction
In this activity you will model the effects of predation on a prey population. The prey consists of paper squares that represent a variation in the shade of individuals in a species. You and your classmates will be the predators. By analyzing the selective effects of predation in this model, you will gain a better understanding of how natural selection can change the average characteristics and variation of a population.

Objectives – The objectives of this activity is for you to:
1. Determine the “typical-ness” (average) of a population
2. Observe how a typical characteristic of a population can change over time.
3. Determine the variation in a population
4. Examine how an environment (habitat and predator) affects the both the typical characteristic and the variation in a population.

Materials (per team of 3)
2 petri dishes
1 sheet of paper, either Habitat A (black) or Habitat B (white).
3 plastic bags containing 200 paper squares of each color.
Shaded goggles (or sunglasses)
Supply of additional paper squares (offspring)
- plastic bag of 0% squares (white)
- plastic bag of 50% squares (medium grey)
- plastic bag of 100% squares (black)
1 pair of forceps.

Procedure
1. Create a Table in your Lab book

<table>
<thead>
<tr>
<th>Generation number</th>
<th>Starting Population</th>
<th>Surviving Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0% shade</td>
<td>50% shade</td>
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<tr>
<td>1</td>
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<td>4</td>
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2. Select Roles
Two members of your team will play the role of predators of paper squares. As predators, each will hunt paper squares (the prey) in their habitat (the piece of paper). The third member will be the game warden, who will keep track of the hunting.
3. **Measure the variation in the Starting Population – Record in your table.**
Examine the paper squares in the bag labeled Starting Population and record the number of individuals (squares) of each shade. The shaded squares represent individuals of a particular species. The individuals of this species can be one of five shades.

4. **Predators**
   - Obtain petri dish (your “stomach” where you will put the squares you eat)
   - Put on shaded goggles or sunglasses.
   - Face AWAY from the habitat.

5. **Game Warden**
Spread the Starting Population squares throughout the habitat. Spread the squares as uniformly as possible so that no squares are sticking together or covering other squares.

6. **Begin a round of Predation**
   **Game Warden:** Direct the predators to face the habitat and begin picking up squares (prey); say “Stop” after 15 seconds.
   **Predators:** Pick up as many paper squares (prey) as possible until the game warden says “Stop.”
   Use only your eyes to locate your prey. Use only your forceps to pick up the prey. Pick up one square at a time and put each square into your petri dish before taking another square.

7. **Measure the variation in the Surviving Population**
Collect the remaining paper squares from the paper and sort them by shade. Record the number of each shade of the remaining paper squares.

8. **Create a new generation**
Simulate reproduction among the paper squares by adding two paper squares for each remaining square of the same shade.
The two paper squares of each shade represent offspring. Obtain these offspring from the bags containing single shades of squares.

9. **Measure the variation in the new Starting Population.**
Record the number of each shade of paper square in your table in the next generation row.

10. **Repeat** Steps 4—9 for two more rounds of predation.

-----------*Do not continue unless you are now at the end of generation 3!*-----------

11. **Calculate the Starting Population for generation 4.**
Calculate the number of each shade of paper square; if each surviving paper squares from generation 3 were to produce two offspring. Record this information as Fourth Generation Starting Population.

12. **Clean-Up**
Sort the shaded squares into their respective plastic bags, and then return the bags to your materials bin. Your Starting Population bag should be empty.
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Questions to answer in your lab book

1. Which, if any, shades of paper squares survived better than others in the second, third, and fourth generation starting populations of paper squares?

2. What might be the reason that predators did not select these shades as much as they did other shades?

3. What effect did capturing a particular shade square have on the numbers of that shade in the following generations?

4. a) How has the average characteristic of the population changed over time?
   b) How could you show this change in average characteristic?

5. a) How has the amount of variation in the population changed over time?
   b) How could you show this change in variation?

6. What affect do you think the environment (habitat and predator) has on the average characteristic and the variation of a population?

7. What do you think we will do with all of this data on Monday?
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