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Prey *vs.* Predator — Win, Lose, or Draw?

Student Activity Kit

Introduction

The 19th century naturalist, Charles Darwin, observed that organisms in nature appear to be well-adapted to their habitat. This observation posed the question of how this phenomenon may have occurred. Conduct this activity to simulate the factors Darwin used to propose his theory of natural selection.

Concepts

- Natural selection
- Survival adaptations

Background

On November 24, 1859, Charles Darwin (1809–1882) published *On the Origin of Species by Means of Natural Selection.* The Origin of Species focuses on two main points. First, Darwin presented Natural Selection to account for supporting evidence that species inhabiting Earth today descended from ancestral species. Secondly, Darwin proposed a mechanism for evolution. The basic premise of natural selection is that populations of organisms will change over time if individuals with certain heritable traits that are beneficial for survival survive in greater numbers than those without the trait. They are able to leave more offspring resulting in a larger concentration of that trait in the population. Over time natural selection results in evolutionary adaptation. Evolutionary adaptation is a prevalence of inherited characteristics that benefit organisms' survival and reproduction in specific environments.

It seems that all organisms have "built-in" genetic characteristics that enable them to live in particular habitats. For example, fish live in water because their gills allow them to extract oxygen from the water. Whales and other mammals live in the water because they can stay submerged for long periods of time and then return to the surface to breathe oxygen from the air. Most birds fly because they have lightweight bones and feathers covering their wings. Adult toads can live away from water because they are able to absorb water from moist soil through their skin. Some plants have tiny "claws" that help them cling to hard surfaces like rocks or bricks. In addition, the color of many organism's outer skin, feathers, fur, etc. allows them to blend in with the surrounding environment, improving their chances for survival.

Experiment Overview

This activity will assist in discovering what happens when both prey and predator species in the same environment attempt to do the same thing, that is, survive and pass their genes on to the next generation.

Materials

Multicolored wrapping paper, 2′ × 2′

Seeds, four types and colors—minimum of 300

Stopwatch

Safety Precautions

Once food grade items are brought into the lab they are considered chemicals and should not be consumed. Wash hands thoroughly with soap and water before leaving the laboratory. Please follow all laboratory safety guidelines.

Procedure *Read the* Procedure *and* Rules for Play *sections thoroughly before beginning.*

1. For this simulation, each student in the group will be a different predatory animal and each will have a different primary source of food. The predator and their prey species are as follows:

a. Grackles (a large black bird similar to crows) eat Worms—represented by kidney beans.
b. Bats eat Moths—represented by black beans.
c. Barn owls eat Mice—represented by navy beans.
d. Bobcats eat Rabbits—represented by pinto beans.

2. Each person chooses one of the four food types.
3. Place the "environment/hunting territory" (colored paper) on a table or desktop.
4. Begin each "predator's" hunting session as follows:

a. Remove three seeds from a container and place them in the environment.
b. The "predator" either tightly closes her/his eyes or is blindfolded while the other group members try to place the seeds in areas of the environment that will make it difficult for the "predator" to spot them easily.
c. After the seeds are placed and a group member says, GO, the "predator" opens her/his eyes and has *three seconds* to try and pick up all three "prey" species.
d. Record the results of the hunting session in the data table as indicated by the column headings.

Predator Rules

- When hunting, ***No raking across the paper is allowed!***
- Hunting must stop when time is called!
- Only prey held in the fingers *and off the paper* can be counted as captured.
- Predators *only* reproduce if three prey are captured each hunting session.

  a. If only two prey are captured, the predator survives but does not reproduce.
  b. If only one prey is captured, the predator dies.
- Start each hunting session (generation) with one predator. If no predator exists from the previous generation, assume one new predator migrates into the area.
- As predator numbers increase, all predators must be allowed to hunt prey before the next predator in the group begins to hunt. Therefore, as in step 4*b* above, while the predator's—parent plus offspring—eyes are closed, group members arrange and try to "hide" all the prey.
- When *more* than one predator is "hunting"—parent and offspring—"hunting" time is reduced to two seconds (x) the total number of predators, i.e., 2 seconds × 12 predators = 24 seconds.
- After all predators have hunted each session, the Total Prey Eaten column of the data table should be filled in with the total number of all prey caught by both "parent" and "offspring" predators.
- Use the numbers in the Total Prey Eaten column to determine how many predator offspring will be produced before the next hunting session.

Prey Rules

- All surviving prey species reproduce by doubling. Multiply the number in the Prey Survivors column of the data table by two. This is the number that will be entered in the Prey Type column to begin the next hunting session/generation.
- A minimum of three prey must be in the environment to start each hunting session. If and when the prey are wiped out, assume new prey species migrate into the area and start over.
- If a point is reached, during the game, where no more prey is available to put into the environment, i.e., there are no more of your type of seeds; ***stop*** and complete the data table mathematically.

General Rules

- After each "predator" in the group has completed a hunting session, the next person (predator) in the group completes his/her hunt as described and fills in the data table.
- Continue hunting—steps 4*a* to 4*d*—for 15 generations, if possible. Complete the remaining 10 rows (25 total) of the data table mathematically using the percentages established in the previous rows.
- Each student will graph his own prey/ predator data. (See *Analysis* section.) However, the *Discussion Questions* may be answered with the help of other group members.

Name: ______________________________

Prey *vs.* Predators

Data Table

Generation	Prey Type ( )	Predator Type ( )	Total Prey Eaten	Prey Survivors	Predator Deaths	Predator Survivors	Predator Offspring
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Name: ___________________________________

Post-Lab Questions

1. Graph the data from the table above for all 25 generations. Place the predator and prey data (found on the first two columns) on the same axis (x-axis) so that the relationship between predator and prey can be easily observed.

2. Did some species of "prey" survive and produce more offspring in your group's environment than other prey in the same environment? If yes, why? If no, why not?

3. How did the environmental factor that was given to the group by the instructor affect the prey and/or predator populations? (Briefly describe what happened.)

4. After graphing the data, explain the relationship between predators and prey as shown by the graph. Be specific.

5. *a.* Did the prey species that survived and produced the most offspring in one group's environment survive and produce the most offspring in another group's environment? Why or why not?

   b. How does the answer to 5*a* relate to what happens to populations of organisms in nature when their habitat is changed or destroyed?

   c. Does this ability to survive and produce many offspring in spite of environmental changes apply to human populations as well? Give a specific example from events in the world to explain your answer.