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Investigation

NATURAL SELECTION

Background Information

Natural selection is the process by which organisms adapt or die out. Natural selection occurs when organisms that are well adapted to their environment survive and transmit their genes to their descendants. For example, all other things being equal, a predator that can run faster may be more likely than a slower predator to catch prey, survive and reproduce. These survivors pass on genes that help their offspring survive, e.g., the gene for speed.

Charles Darwin proposed the theory of evolution by natural selection in 1859, in his book *On The Origin of Species by Means of Natural Selection.*

Plants and animals compete for limited resources—food, shelter, water, mates—in most environments. Environmental factors such as weather can alter these resources and act as agents of natural selection. Species that die faster than they can reproduce when their environments change become endangered or extinct. Species that cannot migrate become geographically isolated, and if they do not adapt, they may die out.

In this activity you will simulate and compare the effects of two genetic variations expressed as camouflage and protective coloration. Camouflage means that an organism's shape resembles a shape or pattern found in its habitat, e.g., the insect called a "walking stick" that looks like a twig. Protective coloration means the animal is the same color as its habitat, e.g., a polar bear.

In the activity below, a student will simulate a predator hunting for food. Prey will be represented by two kinds of small paper spots. One set of spots is a solid color representing the prey's protective coloration against the same color background "habitat." The other set of spots is patterned and represents camouflaged prey seen against a similarly patterned background "habitat."

Problem *(fill in problem):* _____

_____

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NATURAL SELECTION INVESTIGATION CONT.

Hypothesis

If _____

Then _____

Materials

1 1/2 sheets of any solid-colored paper
1 1/2 sheets of patterned paper (filling a piece of paper with the same alphabetical character typed over and over works best)
2 hole punches
timing device

Procedure

1. Work in pairs. One person will be the predator and the other the scientist.
2. Punch as many spots as possible out of the half-sheets of solid-colored and patterned paper.
3. The predator looks away while the scientist evenly spreads out all the spots (representing prey) on the full-size sheet of solid-colored paper.
4. When the scientist says "go," the predator quickly turns around, faces the "prey," and removes as many solid-colored spots as possible in 10 seconds.
5. Count the number of "prey" collected and record.
6. Repeat 2 more times.
7. The predator again faces away while the scientist spreads out all the spots on the sheet of solid-colored paper.
8. When the scientist says "go" the predator quickly turns around, faces the "prey," and removes as many patterned spots as possible in 10 seconds.
9. Count the number of "prey" collected and record.
10. Repeat 2 more times.
11. Repeat steps 3 through 10 using the patterned background.

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NATURAL SELECTION INVESTIGATION CONT.

Observations

	SOLID BACKGROUND		PRINTED BACKGROUND	
Trial No.	No. of solid circles	No. of patterned circles	No of. solid circles	No. of patterned circles
1				
2				
3				

Conclusion

1. Which phenotype (type of paper spots) in which environment had the highest rate of survival?

   _____

   Why? _____

2. Which is the better adaptive tool, camouflage or protective coloration?_____

3. How could this model of natural selection be improved? _____

   _____

Application

4. Predict what would happen if the environment (background color) changed. _____

   _____

5. Give an example of how a natural change in the environment can create a new stressor for organisms and lead to natural selection of some of those organisms.

   _____

   _____

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NATURAL SELECTION INVESTIGATION CONT.

6. Darwin observed slight differences in the finches and tortoises found on different islands in the Galapagos group. For example, the finches' beaks had different shapes, which Darwin associated with the foods they ate. Explain how the theory of natural selection could be used to explain this phenomenon. _____

_____

_____

7. The peppered moths living near English industrial cities illustrate natural selection. The moths' color varies from dark to light. During the nineteenth century, soot from coal-burning furnaces darkened the bark on trees in the moths' habitat. Predict what happened to the moths' coloration. _____

_____

8. In the 1950s air-pollution controls reduced the amount of soot in the peppered moths' habitat. Predict what happened to the moths' coloration. _____

_____

Going Further

9. Natural selection occurs in plants as well as animals. Compare and contrast the possible effects that global warming could have on forests and agricultural crops. _____

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