### Chapter 16 Evolution of Populations

# **Modeling Natural Selection**

## Introduction

In the process of natural selection, organisms that are better adapted to their environment than other members of their species reproduce more successfully. This difference in reproduction causes evolution that is, a gradual change in the genes of a population. In this investigation, you will examine how natural selection results in evolution in a small population of animals.

## Problem

How does natural selection bring about a change in the genetic makeup of a population?

## **Pre-Lab Discussion**

Read the entire investigation. Then, work with a partner to answer the following questions.

- **1.** What advantage does a white mouse have over a brown one in a white sand dune environment?
- **2.** In this experiment, is chance a factor in determining whether or not a brown mouse survives? Explain your answer.
- **3.** Do you expect the proportion of brown mice to white mice to increase from one generation to the next? Explain your answer.
- **4.** In this experimental model, two variables interact to influence the responding variable. What are these two independent variables?

5. What is the responding variable?

## Materials (per group)

scissors metric ruler black construction paper white crayon or chalk marking pen 25 index cards

## Safety 👪

Be careful when handling sharp instruments. Note the safety alert symbol next to step 1 in the Procedure and review the meaning of the symbol by referring to Safety Symbols on page 8.

## Procedure

### Part A. Building the Model

- **1.** Cut out 50 6-cm-square cards from the black construction paper. **CAUTION:** *Be careful when handling the scissors. Point the blades away from you when you cut.* 
  - **2.** Using the white crayon or chalk, mark 25 of the black cards on one side with a capital "*W*." These cards will represent the allele that codes for white fur, which is dominant.
  - **3.** Mark the other 25 black cards on one side with a lowercase "w." These cards will represent the the allele that codes for brown fur, which is recessive.
  - **4.** Mark 15 of the index cards on one side with an "X." These cards will represent predators. Leave the rest of the index cards blank.
  - **5.** Shuffle the black cards so that the *W* cards and the *w* cards are mixed together at random. Then place the stack of black cards face down on a desk or table.
  - **6.** Shuffle the index cards so that the predator cards and the blank cards are mixed together. Then place the stack of index cards face down next to the black cards.

### Part B. Using the Model

**1.** Draw the two top cards from the stack of black cards. If the two cards together read *WW* or *Ww*, you have a white mouse. If they read *ww*, you have a brown mouse. Record the type of mouse you have by making a tally mark in the appropriate column next to Generation 1 in the Data Table.

#### Data Table

Generation	White Mice	Brown Mice	Live	Die
1				
2				
3				
4				

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Name	Class	Date
2. Use the model to stuin a white sandy descards. If you choose the mouse will be card with an X and y the predator by hidi blank card, there is n	ady the survival of white mice ar sert. Draw the top card from the a card with an X and you have a hught and eaten by the predator. you have a white mouse, the mouse ng in the white sand and live. If no predator and either color mou	nd brown mice stack of index brown mouse, If you choose a use will escape you choose a use will live.
<b>3.</b> Record the fate of you appropriate column return the black care died, set aside the black the black contom of the stack.	our mouse by making a tally mar of the Data Table. If your mouse ds to the bottom of the stack. If yo lack cards. Then return the index	k in the survived, our mouse card to the
<b>4.</b> Repeat steps 1–3 unicompletes the first g	til you have selected all 25 pairs o reneration of mice.	of cards. This
<b>5.</b> Count the number of line below, record the total number of blace	of black cards still remaining in the number of allele pairs remaining in the cards divided by 2.)	ne stack. On the ng. (This is the
<b>6.</b> Repeat steps 1–3 as Record your results	many times as you have allele pa in the Data Table next to Genera	airs remaining. tion 2.
7. Count the number o below, record the nu	of black cards remaining in the sta umber of allele pairs remaining.	ack. On the line
<b>8.</b> Repeat step 6, but th in the Data Table.	is time record your results next t	to Generation 3
9. Count the number o number of allele pai	of black cards. On the line below, rs remaining.	record the
<b>10.</b> Repeat step 6, but th in the Data Table.	is time record your results next t	to Generation 4
<b>Analysis and Conclu</b> <b>1. Analyzing Data</b> How m generation?	<b>usions</b> nany brown mice were produced	l in the first

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- **2. Comparing and Contrasting** How did the proportion of brown mice produced in the third and fourth generations compare to the proportion produced in the first generation?
- **3.** Evaluating Which allele, *W* or *w*, was removed from the gene pool by predation?

- **4. Using Models** Does this model illustrate the concept of evolution by natural selection? Explain your answer.
- **5. Predicting** If the main predator of mice in this white-sand desert were an animal that hunted by smell rather than sight, would you expect the same results as this model produced? Explain your reason.

### **Going Further**

In this experimental model, the total number of mice decreases each generation. Do you think this represents what would occur in a real situation? In a brief paragraph, explain how you could change the model to make it more realistic.