

*The Making of the Fittest:  
Natural Selection and Adaptation*

HHMI  
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QUIZ  
STUDENT HANDOUT

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NAME

DATE

1. Define "mutation."
2. Is the following statement true or false? Justify your answer in one or two sentences: "Mutations are caused by selective pressure in the environment."
3. Is the following statement true or false? Justify your answer in one or two sentences: "The same mutation could be advantageous in some environments but deleterious in others."
4. Is the following statement true or false? Justify your answer in one or two sentences: "The appearance of dark-colored volcanic rock caused the mutation for black fur to appear in the rock pocket mouse population."
5. Explain how the environment plays a role in changing the frequency of a mutant allele in a population.



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6. As you saw in the film, rock pocket mice evolved to have dark-colored fur in certain habitats. In three to five sentences, explain how this trait increased in frequency in the population. Include the following key terms: “fitness” (or “fit”), “survival” (or “survive”), “selection” (or “selective”), and “evolution” (or “evolve”).
7. Near the end of the film, Dr. Sean B. Carroll states that “while mutation is random, natural selection is not.” In your own words, explain how this is possible.
8. Suppose you are studying a recently discovered population of rock pocket mice with dark-colored fur that lives on volcanic rock. You take a DNA sample from a member of this new population and determine the DNA sequence of a gene known to play a role in fur color. The sequence you get is identical to that of the same gene in another rock pocket mouse population with dark-colored fur that lives on a different patch of volcanic rock. Which of the following could explain this observation?
- a. The mice in the two populations evolved from the same ancestral population.
  - b. The volcanic rock caused the same mutation in each rock pocket mouse population, resulting in dark coloration.
  - c. The same mutation spontaneously arose in the two different populations.
  - d. Both (a) and (c) are possible.
  - e. All of the above are possible.
9. For rock pocket mice, which of the following contributes to selective pressure favoring dark-colored fur? Write “yes” or “no” next to each of the four possible responses. **There may be more than one yes response.**

Predators \_\_\_\_\_

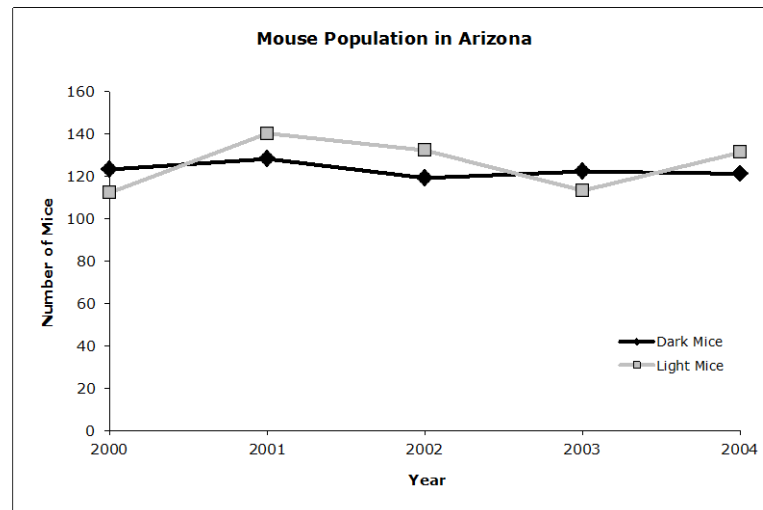
Genetic mutations \_\_\_\_\_

Rock color \_\_\_\_\_

Availability of food for the rock pocket mice \_\_\_\_\_

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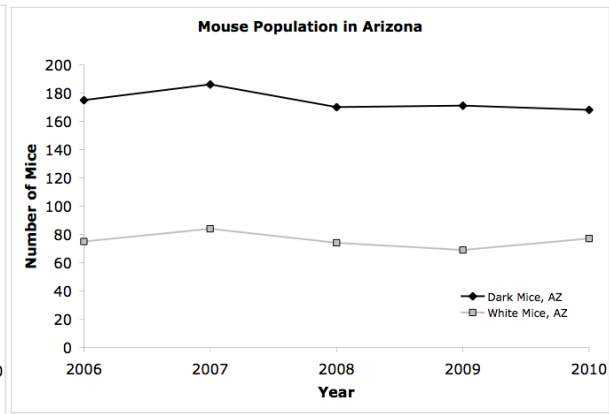
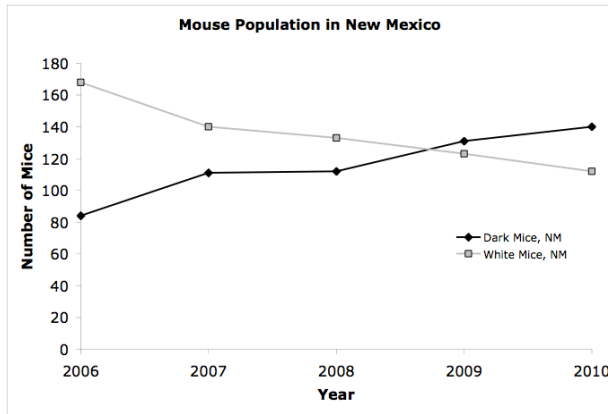
10. Suppose you are studying a new population of rock pocket mice in Arizona. These mice live on a recently discovered patch of dark-colored volcanic rock. This environment does not have nearly as many visual predators as in previously studied areas in New Mexico. You observed the following numbers of light- and dark-colored mice on this new patch of rock.



- a. In one or two sentences, summarize the data presented in the graph.
- b. Provide one possible hypothesis that would explain the observed data. Be sure to include the following key words in your answer: "selection" (or "selective"), "fitness" (or "fit"), and "survival" (or "survive").

You next decide to move 50 of these newly discovered light-colored rock pocket mice from Arizona to a colony in New Mexico that also lives on dark-colored volcanic rock. You also move 50 dark-colored mice from the New Mexico colony to the Arizona colony. You monitor the populations for five years and observe the following.

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- c. In one or two sentences, summarize the data presented in the graphs above.
- d. Provide an explanation for these observations. Be sure to include the following key words in your answer: "selection" (or "selective"), "fitness" (or "fit"), and "survival" (or "survive").

Before your experiment above, you take a DNA sample from one dark-colored mouse in each population and sequence a gene known to play a role in making mice dark colored. You discover that the dark-colored mice from Arizona have a different allele of this gene than the dark-colored mice from New Mexico.

- e. Design an experiment to test which population of dark-colored mice is more evolutionarily fit in an environment of your choice. You may want to use the above experiments as a guide. Be sure to state your hypothesis, as well as what type of data you will record.