

Questions

1. What has happened to the number of blue beads in the meadow over four generations?
2. What has happened to the number of pink beads in the meadow over four generations?
3. How would you explain this difference?
4. Which color is adaptive, blue or pink?
5. What evidence indicates this color is an adaptive trait?
6. Do you think this color would be an adaptive trait in all meadows?
7. Was the mutation from blue to yellow an adaptive mutation? Why?
8. Was the mutation from pink to gray adaptive? Why?

Commentary

1 & 2.

Students should have observed that one color of beads--blue, for example--increased in relative percentage, and that the other color (pink) decreased.

3. Students should be able to explain this difference by recognizing that (blue) beads have a reproductive advantage; few are seen and captured by birds before reproduction, while more of the (pink) beads are seen and eaten by birds before reproducing.

4 & 5.

The *only* evidence that is relevant from a biological perspective is that the (blue) beads produced more offspring. Answers focusing on how (blue) beads blend in with the meadow are irrelevant.

6. Students should recognize that blue would not be adaptive in *all* situations.

7 & 8.

Students should recognize that one mutation (for example, yellow) was not adaptive because individuals of this color tended to have poor survival rates.

Students should recognize that the other mutation was adaptive (for example, gray) because these individuals tended to have high survival rates.

9. Did any of the individual bead bugs change or adapt?
  
10. Did adaptation occur in your bead bug population?
  
11. What was the source of the new color traits in the population?
  
12. Do the environmental conditions in which a population lives affect the kind of mutation that occurs in the population?
  
13. What do you think would happen if the environment changed, for example, if the flowers in the meadow were mostly yellow?
  
14. Bead bugs vary in size as well as color. Over many generations, would you expect the average size of the individual bead bugs to change? Why or why not?

9. Students should understand that no changes occurred in individual bead bugs.
  
10. Students should recognize that adaptation occurred in the population (e.g., that the population as a whole changed) even though the individuals in that population did not change.
  
11. Students should recognize mutation as the source of new colors.
  
12. Students should recognize that specific mutations are chance (random) occurrences and that the environment does not directly affect the number and kind of mutations which occur.
  
13. Students should recognize that if the environment changed, different traits would be adaptive (in the above example, the blue-to-yellow mutation would be adaptive) and that, through differential reproduction, the color composition of the populations would change over time.
  
14. Students may initially predict that smaller bead bugs would be harder for birds to see and, therefore smaller size would evolve. However, perceptive students may realize that size is not inherited (in this organism) and, therefore, cannot evolve.

Data Table 2  
 Percent of Bead Bugs Which Survived to Reproduce  
 First Generation

	Blue		Pink
Class data			
Average			

Data Table 3  
 Numbers of Beads in Each Color in Population  
 Fifth Generation

	Blue	Yellow	Pink	Gray
Class data				
Average				