Beetles by Numbers

Use simulation data to investigate natural selection.

GEN.5.5 "Enrichment: Analyze computer simulations of the effects of natural selection on allelic frequencies in a population."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the settings kept the same in both runs, circle the allele-frequency values at generations 0 and 15, and write 1 beside the sentence that explains why researchers need repeated runs.

A Beetle Population on Dark Bark

1. On a dark volcanic slope, some beetles blend into the bark while others stand out. A computer simulation begins with equal frequencies of allele A, linked to dark color, and allele a, linked to light color. In this model, beetles with AA or Aa are dark, and beetles with aa are light. Birds hunt by sight.

2. The simulation follows two populations for 15 generations. They start with the same number of beetles and the same allele frequencies. In one population, birds hunt; in the other, birds are absent. Bark stays dark in both. Mutation and movement between populations are turned off. The table shows the frequency of A in one run of each condition.

FREQUENCY OF ALLELE A

Generation	Birds hunt	Birds absent
0	0.50	0.50
5	0.62	0.49
10	0.76	0.51
15	0.86	0.50

3. An allele frequency is the fraction of all copies of a gene that are a particular allele, not the fraction of beetles with a trait. Each generation, surviving adults reproduce, and the simulation records the next generation's alleles. Chance also affects which beetles reproduce. To test a claim about selection, researchers would repeat each condition and compare results.

2 ANSWER WITH EVIDENCE

Use the passage

1. During which five-generation interval did A increase most in the population with birds? How much did it increase?

2. Compare the change in A from generation 0 to 15 in the two populations. What difference does the comparison show?

3. Do these results show that birds will always increase A in this simulation? Use a detail from the passage to support your answer.

4. Mutation was turned off. Explain how hunting could still make A more common on dark bark.

3 YOUR TURN

Your own words

Design a new simulation test with pale bark and birds present. In 3 to 4 sentences, state what you would keep the same as the original run, predict how A's frequency would change over 15 generations, explain why, and describe how repeated runs would test your prediction.

Beetles by Numbers

PART 1 · READ AND MARK

Underline the settings kept the same in both runs, circle the allele-frequency values at generations 0 and 15, and write 1 beside the sentence that explains why researchers need repeated runs. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	During which five-generation interval did A increase most in the population with birds? How much did it increase?	**From generation 5 to 10, A increased by 0.14, from 0.62 to 0.76.**
2	Compare the change in A from generation 0 to 15 in the two populations. What difference does the comparison show?	**With birds, A rose by 0.36, from 0.50 to 0.86. Without birds, it began and ended at 0.50. The rise occurred in the run with birds.**
3	Do these results show that birds will always increase A in this simulation? Use a detail from the passage to support your answer.	**No. The table shows only one run of each condition, and chance affects reproduction. Researchers would need repeated runs to test whether the pattern is consistent.**
4	Mutation was turned off. Explain how hunting could still make A more common on dark bark.	**Dark AA and Aa beetles may be harder for sight-hunting birds to spot. If more of them survive and reproduce, they can pass existing A alleles to more offspring.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would keep the starting population size, allele frequencies, and mutation setting the same. I predict that A would become less common over 15 generations on pale bark. Dark beetles with A may be easier for birds to spot than light aa beetles, so fewer A alleles may be passed on. I would repeat both bark conditions many times and compare their frequency changes.

Accept other well-supported predictions for the pale-bark test if students explain how survival and reproduction could change allele frequency. A single run cannot establish that a pattern will occur every time.