

Camouflage Counts

Use evidence to trace natural selection from survival to allele frequency change.

HS-LS4-4 "Construct an explanation based on evidence for how natural selection leads to adaptation of populations. Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Circle each ecosystem condition or living factor that affects survival. Underline each data point or observation, then number the causal steps that connect inherited fur color to a change in allele frequency.

Pocket Mice on Lava

- ① Rock pocket mice live in deserts of the southwestern United States. Most ground is pale sand and gravel, but some areas are covered by dark lava flows created by ancient eruptions. Owls and other visual predators hunt these mice. A mouse whose fur contrasts with the ground is easier for a predator to spot. Fur color is inherited. A DNA change in a gene involved in pigment production can produce darker fur. This change does not appear because a mouse needs camouflage. It arises by mutation, and mice with either light or dark fur may be born before selection changes the population.
- ② A simulated field-study dataset compared mice at 12 pale sites and 12 lava sites. At pale sites, 86 percent of captured mice had light fur, while 14 percent had dark fur. At lava sites, 81 percent had dark fur, while 19 percent had light fur. In field trials, model mice that contrasted with the ground received more bird attack marks than models that matched it. These observations connect the abiotic difference, ground color, to unequal survival. On dark lava, dark mice were less often detected and were more likely to survive long enough to reproduce than light mice.
- ③ Over many generations, surviving dark mice on lava sites produced offspring, and many offspring inherited alleles associated with dark fur. Because dark mice left more offspring there, the frequency of dark-fur alleles increased in lava populations. The population changed, even though individual mice did not change their inherited fur color during life. On pale ground, light-fur alleles became more common for the same reason. Dark fur is therefore an adaptation in lava habitats, not because every dark mouse is perfect, but because the inherited trait increases reproductive success under those conditions. Different environments can favor different alleles within the same species.

2 ANSWER WITH EVIDENCE _____ Use the passage

- 1** What is the abiotic difference between the two mouse habitats, and what biotic factor creates selection on fur color? Explain how they work together.

- 2** Make a claim about which fur color has a survival advantage on dark lava. Use two pieces of evidence from the passage to support your claim.

- 3** Write the four-step causal sequence that explains how dark-fur alleles became more common in lava populations.

- 4** Why is the change described as a population change rather than a change in individual mice?

3 YOUR TURN _____ Your own words

A mountain wildflower population has an inherited allele that causes earlier flowering. Over 20 years of warmer springs, its frequency rose from 27 percent to 68 percent, and plants with it produced 1.6 times as many seeds. Construct a 3- to 4-sentence explanation of how natural selection could produce an adaptation.

PART 1 • READ AND MARK

Circle each ecosystem condition or living factor that affects survival. Underline each data point or observation, then number the causal steps that connect inherited fur color to a change in allele frequency. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What is the abiotic difference between the two mouse habitats, and what biotic factor creates selection on fur color? Explain how they work together.	Ground color is the abiotic difference, and owls and other visual predators are the biotic factor. Mice whose fur contrasts with the ground are easier for predators to detect, causing unequal survival.
2	Make a claim about which fur color has a survival advantage on dark lava. Use two pieces of evidence from the passage to support your claim.	Dark fur has a survival advantage on dark lava. At lava sites, 81 percent of captured mice had dark fur, and model mice that contrasted with the ground received more bird attack marks than matching models.
3	Write the four-step causal sequence that explains how dark-fur alleles became more common in lava populations.	A mutation produced inherited dark-fur variation; dark lava made light mice easier to detect; dark mice survived and reproduced more; offspring inherited dark-fur alleles, so those alleles increased in frequency.
4	Why is the change described as a population change rather than a change in individual mice?	Individual mice do not change their inherited fur color during life. Across generations, differential reproduction changes the frequency of inherited alleles in the population.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Warmer spring temperatures are the abiotic change. Plants with the earlier-flowering allele produced 1.6 times as many seeds, so they contributed more copies of that allele to later generations. Its rise from 27 percent to 68 percent supports the claim that earlier flowering became an adaptation because it increased reproductive success in the warmer conditions.

Accept equivalent claims that accurately connect an environmental difference, inherited variation, unequal survival or reproduction, and allele-frequency change over generations. For the open task, students should use both given data points and identify earlier flowering as adaptive only in the stated warmer conditions.