Beetles in Balance

Trace genes to traits and use evidence to evaluate a mutation

L.8.2C "Students will demonstrate an understanding that chromosomes contain many distinct genes and that each gene holds the instructions for the production of a specific protein, which in turn affects the traits of an individual..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the two different genes and the proteins they provide instructions for. Circle each survival result, then number the gene, protein, and trait in the order they are connected.

When Color Changes

1. Imagine a beetle with a hard outer shell called wing covers. Inside its cells, chromosomes are long strands of DNA that hold many distinct genes. Each gene provides instructions for making a particular protein. In this beetle model, a pigment gene gives instructions for a protein that helps produce dark color in the wing covers. A different gene gives instructions for a protein that helps break down food. The proteins do different jobs, so the genes can affect different traits.

2. Suppose a mutation changes the pigment gene. Its protein now works less effectively, and the beetle's wing covers become pale. To test how this trait might matter, scientists placed equal groups of pale and dark beetles in two fenced habitats with hunting birds. On dark soil, 6 of 20 pale beetles survived, compared with 14 of 20 dark beetles. On pale sand, 15 of 20 pale beetles survived, compared with 8 of 20 dark beetles. Birds could more easily spot beetles whose color stood out.

3. The same mutation can have different effects in different surroundings. Pale color appears harmful on dark soil but beneficial on pale sand because it changes how well beetles blend in. In a third enclosure without birds, 18 of 20 pale beetles and 18 of 20 dark beetles survived. In that test, the color change had no measured effect on survival, so it was neutral for that outcome. These results do not prove the mutation has no effect on every trait or in every habitat.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace the path from the pigment gene to the beetle's wing-cover color. What does the gene provide instructions for, and what does that protein do?

2. Why are the pigment gene and the food-breaking gene described as distinct genes? Explain using their proteins and the traits they affect.

3. Make a claim about whether the pigment-gene mutation was harmful on dark soil. Support your claim with survival evidence.

4. Was the color change neutral for survival in the enclosure without birds? Use the results, and state one limit of that conclusion.

3 YOUR TURN

Your own words

In the box, draw a chromosome with two different labeled genes. Use arrows to connect each gene to its protein and trait, and show a mutation in one gene. Then write two sentences predicting its effect on beetles living on pale gravel with hunting birds, using evidence from the passage.

ANSWER KEY

Beetles in Balance

GRADE 8 · L.8.2C

PART 1 · READ AND MARK

Underline the two different genes and the proteins they provide instructions for. Circle each survival result, then number the gene, protein, and trait in the order they are connected. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace the path from the pigment gene to the beetle's wing-cover color. What does the gene provide instructions for, and what does that protein do?	**The pigment gene provides instructions for a protein that helps produce dark color in the wing covers.**
2	Why are the pigment gene and the food-breaking gene described as distinct genes? Explain using their proteins and the traits they affect.	**They provide instructions for different proteins. One protein helps produce wing-cover color, while the other helps break down food.**
3	Make a claim about whether the pigment-gene mutation was harmful on dark soil. Support your claim with survival evidence.	**It appears harmful on dark soil: 6 of 20 pale beetles survived, compared with 14 of 20 dark beetles.**
4	Was the color change neutral for survival in the enclosure without birds? Use the results, and state one limit of that conclusion.	**It was neutral for measured survival there because 18 of 20 beetles survived in each color group. That result does not show that the mutation is neutral for every trait or habitat.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Chromosome: [mutated pigment gene] [food-breaking gene]
Mutated pigment gene -> less effective pigment protein -> pale wing covers
Food-breaking gene -> food-breaking protein -> ability to break down food
On pale gravel with hunting birds, the mutation may help pale beetles blend in and survive. On pale sand with hunting birds, 15 of 20 pale beetles survived, compared with 8 of 20 dark beetles.

Accept diagrams that connect two distinct genes to different proteins and traits. The prediction should use passage evidence and treat the effect on pale gravel as possible, not certain.