

From Gene to Trait

Trace how chromosome changes can affect an organism.

MS-LS3-1 "Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline every phrase that names a step from a chromosome change to an organism trait. Circle each phrase that tells whether an effect may be beneficial, harmful, or neutral.

A Change's Path

- ① Inside many body cells, chromosomes carry long stretches of genetic information called genes. A gene contains directions that a cell can use to make a protein. Proteins help build body parts and help cells do jobs. For example, proteins in a lizard's skin can help produce its color pattern. A chromosome change can alter a gene's directions. When the directions change, the cell may make a protein with a different shape or job, make less of a protein, or sometimes make no working protein.
- ② Imagine a population of lizards living near both dark volcanic rocks and pale sand. A structural change in a chromosome may change a gene involved in skin color. The changed gene may lead to a different pigment protein, which can produce a darker pattern. On dark rocks, that pattern may make some lizards harder for birds to spot, so the effect can be beneficial. On pale sand, the same pattern may make a lizard easier to see. There, the effect can be harmful because it can reduce the lizard's chance of surviving.
- ③ Not every chromosome change has an obvious effect on an organism. A change may alter a gene, yet the resulting protein may still do its job well enough for the organism to function in the same way. The change could also occur in genetic material that does not change the protein used for a trait. In either case, the effect may be neutral in the current environment. Scientists use models with arrows to show a possible chain: chromosome change, gene directions, protein, trait, and effect on survival or function.

2 ANSWER WITH EVIDENCE Use the passage

- 1 According to paragraph 1, what may happen to a protein after a chromosome change alters a gene's directions?

- 2 Use arrows to show the chain in paragraph 2 from a chromosome change to a darker lizard pattern.

- 3 Why can the same darker pattern be beneficial on dark rocks but harmful on pale sand?

- 4 Give one reason from paragraph 3 that a chromosome change may have a neutral effect.

3 YOUR TURN Your own words

Create a labeled arrow model for a made-up organism. Show this path: a structural chromosome change, a gene change, a protein change, a trait change, and a possible beneficial, harmful, or neutral effect in a named environment.

PART 1 • READ AND MARK

Underline every phrase that names a step from a chromosome change to an organism trait. Circle each phrase that tells whether an effect may be beneficial, harmful, or neutral. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	According to paragraph 1, what may happen to a protein after a chromosome change alters a gene's directions?	The cell may make a protein with a different shape or job, make less of a protein, or make no working protein.
2	Use arrows to show the chain in paragraph 2 from a chromosome change to a darker lizard pattern.	Structural chromosome change → changed gene → different pigment protein → darker skin pattern.
3	Why can the same darker pattern be beneficial on dark rocks but harmful on pale sand?	On dark rocks, the pattern may hide a lizard from birds. On pale sand, it may make the lizard easier for birds to see.
4	Give one reason from paragraph 3 that a chromosome change may have a neutral effect.	The resulting protein may still work well enough, or the change may not affect the protein used for a trait.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Structural chromosome change → changed gene directions → different pigment protein → darker snail shell. On dark rocks, the darker shell may make the snail harder for birds to spot, so the effect may be beneficial.

Accept models that correctly connect chromosome change, gene, protein, trait, and an effect on the organism in an environment. Effects may be beneficial, harmful, or neutral if the explanation matches the stated environment.