Mutation Clues

Trace possible causes of DNA changes

GEN.2B.1 "Identify factors that cause mutations (e.g., environmental, errors in replication, and viral infections)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline four possible causes of mutations in the passage, then circle a phrase that shows how each cause can change DNA.

What Changed the DNA?

1 At a clinic, three tissue samples raise the same question: what changed the DNA? A mutation is a lasting change in a cell's DNA sequence. In a skin sample, a patch of cells carries a DNA change. The patient spent many afternoons outdoors without shade. Ultraviolet (UV) light from the sun can damage DNA by causing neighboring DNA bases to bond to each other. When a cell repairs that damage incorrectly or copies the damaged DNA, a mutation can remain. Sunlight is an environmental factor, but the outdoor history alone cannot prove it caused this particular change.

2 Another sample comes from the lining of a smoker's lung. Chemicals in tobacco smoke can react with DNA and damage its bases. If the damage is copied or repaired incorrectly, the sequence can change. Smoke is an environmental exposure, not a copying mistake made from nothing. Even cells kept away from smoke and strong sunlight can acquire mutations, however. Before a cell divides, it copies its DNA. Sometimes the copying machinery puts the wrong base in a new strand. Most errors are corrected, but an error that escapes repair can become a lasting mutation in the daughter cells.

3 The third sample is from cervical tissue infected with human papillomavirus (HPV). In some infected cells, HPV DNA becomes inserted into the cell's DNA. Insertion changes the DNA sequence at that site and may disrupt a gene. Viral infection is therefore another possible source of mutation, although not every infection causes an insertion. The three samples do not reveal a single universal cause. To identify a possible cause, look for a mechanism that changes DNA: damage from an exposure, an uncorrected error during copying, or genetic material inserted during an infection. Finding a mutation alone does not reveal which mechanism occurred.

2 ANSWER WITH EVIDENCE

Use the passage

1. What environmental factor could have caused a mutation in the skin sample, and how could it lead to a lasting DNA change?

2. What environmental factor could have caused a mutation in the lung sample, and how could it change DNA?

3. How could a mutation arise in a cell that was not exposed to smoke or strong sunlight?

4. How could the viral infection in the cervical tissue change a cell's DNA?

3 YOUR TURN

Your own words

Imagine a mutation is found in a person's throat cells. In three or four sentences, describe how an environmental exposure, a DNA-copying error, and a viral infection could each have caused it, and make clear that you do not know which one did.

Mutation Clues

PART 1 · READ AND MARK

Underline four possible causes of mutations in the passage, then circle a phrase that shows how each cause can change DNA. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What environmental factor could have caused a mutation in the skin sample, and how could it lead to a lasting DNA change?	**UV light from the sun can make neighboring DNA bases bond. Incorrect repair or copying of that damage can leave a mutation.**
2	What environmental factor could have caused a mutation in the lung sample, and how could it change DNA?	**Chemicals in tobacco smoke can damage DNA bases. Incorrect repair or copying of that damage can change the sequence.**
3	How could a mutation arise in a cell that was not exposed to smoke or strong sunlight?	**The cell could put the wrong base into a new DNA strand while copying its DNA. If the error escapes correction, it can become a lasting mutation.**
4	How could the viral infection in the cervical tissue change a cell's DNA?	**HPV DNA could insert into the cell's DNA, changing the sequence at that site and possibly disrupting a gene.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Chemicals in tobacco smoke could damage DNA in the throat cells, and faulty repair could leave a mutation. A mistake while one throat cell copied its DNA could also survive correction and be passed to daughter cells. An HPV infection could insert viral DNA into a throat cell's DNA and alter its sequence. The mutation alone does not show which of these causes was responsible.

Accept other plausible environmental exposures if the student explains how they could change DNA. Responses should distinguish a possible cause from a confirmed cause.