DNA Under Pressure

Connect DNA's shape and organization to the work of a skin cell.

GEN.1A.3 "Relate the structure of DNA to its specific functions within the cell."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline four details about DNA's structure, then circle a cell function that each detail supports. Number each matching structure and function with the same number.

A Skin Cell After Sunlight

1. After a day in the sun, a skin cell may need to repair damage to its DNA. Inside the nucleus, DNA is a long molecule made of two strands twisted into a double helix. Each strand contains a sequence of bases, named A, T, C, and G. A pairs with T, and C pairs with G across the strands. The order of bases carries instructions in genes. One gene contains instructions for a protein that helps repair damaged DNA. Changing that order can change the protein the cell makes, even though the DNA still looks like a double helix.

2. To use a repair gene, the cell must first reach its bases. Much of the DNA winds around proteins called histones, making long strands fit in the nucleus. When a region loosens, a cell can read a gene on one DNA strand and make a matching RNA message. The message travels to the cytoplasm, where a ribosome uses it to build a protein. If a repair gene stays tightly packed, the cell may make less of that repair protein. DNA's packaging therefore helps control which instructions a cell can use at a given time.

3. Sunlight can cause neighboring bases on one DNA strand to bond to each other. This damage bends the DNA and can block a cell from reading a gene or copying its DNA. Repair proteins can recognize the distorted shape, remove a damaged stretch, and replace it using the undamaged opposite strand as a guide. Before a skin cell divides, its DNA must also be copied. The strands separate, and each old strand guides the building of a new partner through A with T and C with G pairing. Accurate pairing helps each new cell receive the same genetic instructions.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does the order of DNA bases affect the repair protein a skin cell makes?

2. How can DNA wrapping around histones affect a skin cell's ability to make a repair protein?

3. Why does the way bases pair help a skin cell copy its DNA before division?

4. How does DNA's two-strand structure help a cell repair damage from sunlight?

3 YOUR TURN

Your own words

Imagine that, while a skin cell copies its DNA, it puts G opposite A on a new strand. In four sentences, explain what should have paired with A, how the two-strand structure could help correct the mistake, and what might happen if the change remains in a gene.

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PART 1 · READ AND MARK

Underline four details about DNA's structure, then circle a cell function that each detail supports. Number each matching structure and function with the same number. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does the order of DNA bases affect the repair protein a skin cell makes?	**The base order carries the gene's instructions. Changing it can change the repair protein the cell makes.**
2	How can DNA wrapping around histones affect a skin cell's ability to make a repair protein?	**Looser wrapping lets the cell read the repair gene and make an RNA message. If the gene stays tightly packed, the cell may make less repair protein.**
3	Why does the way bases pair help a skin cell copy its DNA before division?	**Each old strand guides a new partner because A pairs with T and C pairs with G. This helps each new cell receive the same instructions.**
4	How does DNA's two-strand structure help a cell repair damage from sunlight?	**After a damaged stretch is removed from one strand, the undamaged opposite strand can guide its replacement.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The new strand should have T opposite A, not G. The mismatch breaks the usual pairing pattern between the two strands. A repair protein might replace the G with T, using the old strand as a guide. If the mistake remains in a gene, it could change the protein the cell makes, although some base changes do not affect the protein.

For the marking task, accept any four accurate links between a structural detail and a function stated in the passage. For the open task, accept a possible rather than certain effect on the protein.