

# Instructions in a Seed

Trace how chromosomes, DNA, and genes connect to inherited characteristics.

**HS-LS3-1** "Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring..."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## 1 READ AND MARK \_\_\_\_\_ Read it twice

**YOUR JOB** Underline each sentence that explains a relationship among chromosomes, DNA, genes, cell products, and characteristics. Circle every question in the passage, then number the two sentences in paragraph 2 that explain why siblings can differ.

### From Seed to Characteristic

- ① At a school garden, Maya notices that her pea plants have purple flowers, like plants grown from seeds collected from both of her grandparents' gardens. She asks how a seed can carry instructions for flower color. Inside most cells of a pea plant, chromosomes hold long molecules of DNA. A chromosome is packaged DNA, not a separate instruction system. Segments of DNA called genes contain instructions that cells can use to make proteins or functional RNA molecules. Those molecules help build and run cells, contributing to characteristics such as flower color.
- ② Chromosomes are passed to offspring through reproductive cells. In sexual reproduction, an offspring receives one set of chromosomes from one parent and one set from the other parent. The paired sets include versions of many of the same genes, although the DNA sequence of a gene can differ between parents. These versions are called alleles. An offspring's combination of alleles can affect which proteins or functional RNA molecules its cells produce. This relationship helps explain why relatives may share characteristics, yet siblings can differ. Environment also influences many characteristics, so DNA is not the only factor that shapes an organism.
- ③ To clarify the chain of relationships, Maya compares a chromosome to a library shelf. The comparison is limited, but useful. A shelf can hold several books, just as a chromosome contains many genes. Each book has written information, just as a gene is a DNA segment with instructions. However, genes do not directly place a finished trait into an organism. Cells read genetic instructions and use them to produce molecules that influence how cells work. Questions can test the model: Is DNA located on chromosomes? Do both parents contribute chromosomes? How could different alleles lead to different cell products?

## 2 ANSWER WITH EVIDENCE Use the passage

- 1 Maya asks how a seed can carry instructions for flower color. What relationship is she trying to clarify?

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- 2 Write a question that would clarify whether DNA and chromosomes are separate instruction systems. Then answer your question using the passage.

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- 3 A student says that siblings must receive identical genetic instructions because they have the same parents. What question from the passage could test this claim, and what is the answer?

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- 4 Write a question that would keep someone from assuming DNA completely determines every characteristic. Then answer it using the passage.

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## 3 YOUR TURN Your own words

A wildlife center records that two wolf pups from the same parents have different coat shades. Write three numbered questions that would clarify how parental chromosomes, DNA, and genes could relate to the pups' coat shade. Then write a three-sentence explanation that answers your questions without claiming DNA alone determines shade.

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**PART 1 • READ AND MARK**

Underline each sentence that explains a relationship among chromosomes, DNA, genes, cell products, and characteristics. Circle every question in the passage, then number the two sentences in paragraph 2 that explain why siblings can differ. Accept any marking that follows this job and points at the right text.

**PART 2 • ANSWERS**

| # | QUESTION                                                                                                                                                                                   | ANSWER                                                                                                                                                                                                             |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Maya asks how a seed can carry instructions for flower color. What relationship is she trying to clarify?                                                                                  | <b>She is trying to clarify how chromosomes contain DNA, DNA contains genes, and gene instructions can contribute to flower color.</b>                                                                             |
| 2 | Write a question that would clarify whether DNA and chromosomes are separate instruction systems. Then answer your question using the passage.                                             | <b>Sample: Are DNA and chromosomes separate instruction systems? No. A chromosome is packaged DNA and contains many genes.</b>                                                                                     |
| 3 | A student says that siblings must receive identical genetic instructions because they have the same parents. What question from the passage could test this claim, and what is the answer? | <b>Sample: How could different alleles lead to different cell products? Siblings can inherit different combinations of alleles, which can affect the proteins or functional RNA molecules their cells produce.</b> |
| 4 | Write a question that would keep someone from assuming DNA completely determines every characteristic. Then answer it using the passage.                                                   | <b>Sample: Can factors besides DNA influence a characteristic? Yes. Environment also influences many characteristics.</b>                                                                                          |

**PART 3 • YOUR TURN (SAMPLE ANSWER)**

1. How do chromosomes from both wolf parents provide DNA to each pup? 2. Where are genes that may influence coat shade located? 3. Why might littermates have different shades even with the same parents? Each pup receives chromosome sets through reproductive cells, one from each parent. The chromosomes contain DNA, and genes are DNA segments whose different alleles can lead cells to produce different molecules that influence coat shade. Littermates can inherit different allele combinations, and environmental conditions can also affect shade.

Accept equivalent questions and explanations that accurately connect chromosomes to DNA, DNA to genes, and genes to cell products that influence characteristics. Students should recognize that offspring receive chromosomes from both parents, siblings may inherit different allele combinations, and environmental factors can influence traits.