The Chromosome Shuffle

Trace how meiosis gives sex cells different genetic information.

L.8.2A.3 "Construct explanations of how genetic information is transferred during meiosis through crossing over and independent assortment."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline one sentence that explains how crossing over moves genetic information and one sentence that explains how independent assortment distributes chromosomes. Label the sentences CO and IA.

Two Ways to Mix Genetic Information

1. In a cell that will make sperm or eggs, chromosomes come in matching pairs. One member of each pair came from the organism's mother, and one came from its father. Before meiosis begins, each chromosome is copied, making two identical sister chromatids. During meiosis I, matching chromosomes line up close together. Then the members of each pair move toward opposite sides of the cell. This separation helps sex cells end up with half the usual number of chromosomes, ready to join another sex cell at fertilization.

2. While matching chromosomes are close, chromatids from different members of a pair may break at matching places and swap equal pieces. This is crossing over. For example, a chromosome that originally came from the mother can gain a piece from its matching chromosome that came from the father. The new chromosome carries a mix of genetic information from both parents. Crossing over happens before the matching chromosomes separate. It changes which versions of genes travel together on a chromosome, even though the genes remain on the chromosomes.

3. Independent assortment makes another kind of mix. In meiosis I, each matching pair lines up without being controlled by how other pairs line up. A chromosome originally inherited from the mother may move toward one side for one pair, while a chromosome inherited from the father moves toward that same side for another pair. After the chromosomes separate and meiosis II divides the cells again, each sex cell has one chromosome from every pair. Which chromosomes it receives can vary, and some may already contain swapped pieces from crossing over.

2 ANSWER WITH EVIDENCE

Use the passage

1. How can a chromosome that originally came from the organism's mother carry genetic information from its father after meiosis?

2. How can one sex cell receive a chromosome originally from the mother for one pair and a chromosome originally from the father for another pair?

3. A student says independent assortment swaps pieces between matching chromosomes. Correct the claim by explaining what each process does.

4. If crossing over did not occur, how could sex cells from the same organism still receive different combinations of chromosomes?

3 YOUR TURN

Your own words

An imaginary animal has two chromosome pairs. Pair 1 has genes for tail length and ear shape, and pair 2 has a gene for fur color. In 4 to 5 sentences, explain how crossing over and independent assortment could give one sex cell a new combination of genetic information. Describe what happens to chromosome pieces and how one chromosome from each pair reaches the sex cell.

ANSWER KEY

The Chromosome Shuffle

GRADE 8 · L.8.2A.3

PART 1 · READ AND MARK

Underline one sentence that explains how crossing over moves genetic information and one sentence that explains how independent assortment distributes chromosomes. Label the sentences CO and IA. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How can a chromosome that originally came from the organism's mother carry genetic information from its father after meiosis?	**During crossing over, a chromatid from the maternal chromosome can swap a piece with a chromatid from its matching paternal chromosome.**
2	How can one sex cell receive a chromosome originally from the mother for one pair and a chromosome originally from the father for another pair?	**Each pair lines up independently in meiosis I, so chromosomes from the two pairs can move toward the same side in that combination.**
3	A student says independent assortment swaps pieces between matching chromosomes. Correct the claim by explaining what each process does.	**Crossing over swaps pieces between chromatids of matching chromosomes. In independent assortment, chromosome pairs line up independently, changing which chromosomes move toward the same side.**
4	If crossing over did not occur, how could sex cells from the same organism still receive different combinations of chromosomes?	**Independent assortment could still send different combinations of chromosomes from the matching pairs into sex cells.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

During crossing over, chromatids from the matching chromosomes in pair 1 swap pieces. A chromosome that originally came from the animal's mother could then carry her version of the tail-length gene and the father's version of the ear-shape gene. In meiosis I, pair 1 and pair 2 line up independently, so that mixed chromosome could move toward the same side as the father's chromosome from pair 2. After meiosis is complete, one sex cell could receive that mixed chromosome from pair 1 and the father's chromosome with a fur-color gene from pair 2.

Accept explanations that distinguish a swap between chromatids of matching chromosomes from the independent movement of different chromosome pairs. The open response should describe one possible sex cell, not claim that a particular combination is guaranteed.