Mixing Genes

Trace chromosomes from parent cells to offspring.

L.8.2A.4 "Construct a model of meiosis to explain its role in sexual reproduction, which results in offspring that have a new combination of genetic information different from either parent."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what separates during meiosis I and circle what separates during meiosis II. Number the steps that lead from a parent cell to an offspring.

A Fish Family Model

1. Imagine a model fish species with four chromosomes in each body cell. The chromosomes form two matching pairs. One pair carries versions of gene A, and the other carries versions of gene B. A mother fish has AaBb, while a father fish has aaBb. These letters track only two genes, not all of a fish's genetic information. Each body cell has two versions of each tracked gene, one on each chromosome in a pair. To make an egg or sperm, a parent must reduce the chromosome number by half.

2. Before meiosis begins, each chromosome copies itself, making two attached sister chromatids. During meiosis I, the matching chromosomes separate into different cells. In the mother fish, an A chromosome can move with a B chromosome or with a b chromosome. Each new cell receives one chromosome from each pair, but each chromosome still has two sister chromatids. During meiosis II, the sister chromatids separate. The resulting cells have one chromosome from each original pair. In this simple model, the mother can produce eggs labeled AB, Ab, aB, or ab.

3. The father's aaBb body cells also start with two chromosome pairs. His sperm can carry aB or ab, since each sperm gets an a but receives either B or b. When an egg and a sperm join at fertilization, their chromosomes make two pairs again. For example, an Ab egg and an ab sperm form an Aabb offspring. Its A pair combines A from the mother and a from the father. Its B pair has one b from each parent. This offspring's Aabb combination differs from both parents' combinations, AaBb and aaBb.

2 ANSWER WITH EVIDENCE

Use the passage

1. In a model of the mother fish's meiosis, what separates during meiosis I, and what separates during meiosis II?

2. Could the mother's meiosis produce an aB egg? Explain which chromosome from each pair that egg would receive.

3. What two sperm labels can the father's meiosis produce in this model? Explain why neither label has two versions of gene B.

4. Model fertilization between an AB egg and an aB sperm. What is the offspring's gene combination, and how does it compare with each parent's?

3 YOUR TURN

Your own words

In three panels, model two parents that are both CcDd, with C/c on one chromosome pair and D/d on another. Show how meiosis I and II can produce a Cd egg and a Cd sperm, then join them, label the offspring, and explain how it differs from both parents.

ANSWER KEY

Mixing Genes

GRADE 8 · L.8.2A.4

PART 1 · READ AND MARK

Underline what separates during meiosis I and circle what separates during meiosis II. Number the steps that lead from a parent cell to an offspring. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In a model of the mother fish's meiosis, what separates during meiosis I, and what separates during meiosis II?	**Matching chromosomes separate during meiosis I. Sister chromatids separate during meiosis II.**
2	Could the mother's meiosis produce an aB egg? Explain which chromosome from each pair that egg would receive.	**Yes. It would receive the a chromosome from the A/a pair and the B chromosome from the B/b pair.**
3	What two sperm labels can the father's meiosis produce in this model? Explain why neither label has two versions of gene B.	**The labels are aB and ab. Matching chromosomes separate during meiosis, so each sperm receives either B or b, not both.**
4	Model fertilization between an AB egg and an aB sperm. What is the offspring's gene combination, and how does it compare with each parent's?	**The offspring is AaBB. It differs from the mother's AaBb and the father's aaBb.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: Each parent starts with chromosome pairs C/c and D/d. After copying, the C and d chromosomes move to one cell during meiosis I, while c and D move to another. Panel 2: Sister chromatids separate during meiosis II, producing a Cd egg and a Cd sperm. Panel 3: The egg and sperm join to form CCdd. This combination differs from both CcDd parents.

Accept models that show homologous chromosomes separating in meiosis I and sister chromatids separating in meiosis II. The selected Cd gametes must combine to make CCdd, which differs from both parents' CcDd combination.