Cells Take Two Paths

Compare how cell division supports repair and reproduction

FB.3.6 "Compare and contrast the processes and results of mitosis and meiosis."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two steps mitosis and meiosis share, circle two differences in what happens or what results, and write 1 or 2 beside the number of divisions described for each process.

A Scrape and a Sperm Cell

1 A scrape on your arm and the production of sperm both call for new cells, but they do not call for the same kind. In a human skin cell, 46 chromosomes are arranged in 23 pairs. Before either mitosis or meiosis begins, the cell copies its DNA, so each chromosome has two sister chromatids. In both processes, spindle fibers help move chromosomes during division. Yet copying DNA does not mean the cell has doubled its chromosome number; the copies remain joined until they separate. What happens to those copies determines whether new cells repair tissue or take part in reproduction.

2 During mitosis, a skin cell divides once. Its chromosomes line up individually, and sister chromatids separate into opposite sides of the cell. The result is two cells, each with 46 chromosomes. Except for rare copying errors, these cells carry the same genetic information as the starting cell and as each other. This match matters when the body replaces worn skin or closes a scrape. Mitosis keeps the chromosome number steady as tissues grow and repair. A daughter cell can then function as part of the same tissue, rather than joining with another cell during fertilization.

3 Meiosis follows a different route in cells that give rise to sperm. Homologous chromosomes, one from each parent, pair up and can exchange DNA segments. In the first division, these paired chromosomes separate. In the second division, sister chromatids separate, without another round of DNA copying. One starting cell generally produces four cells with 23 chromosomes each, rather than two cells with 46. The cells usually differ genetically because of DNA exchange and the varied ways chromosome pairs separate. When a sperm joins an egg, their 23 chromosomes each combine to restore 46 in the resulting cell.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the number of divisions and the number of cells produced differ between mitosis and meiosis?

2. Compare what separates during mitosis with what separates during each division of meiosis.

3. How do the cells produced by mitosis and meiosis differ in chromosome number and genetic similarity?

4. Why does meiosis produce cells suited to fertilization, while mitosis produces cells suited to repairing a scrape?

3 YOUR TURN

Your own words

Imagine an animal whose body cells have 12 chromosomes. In four to six sentences, compare what happens when it replaces damaged skin cells by mitosis and when it makes sperm by meiosis. Include the divisions, the number and chromosome count of the resulting cells, their genetic similarity, and how each result fits its purpose.

ANSWER KEY

Cells Take Two Paths

HIGH SCHOOL · FB.3.6

PART 1 · READ AND MARK

Underline two steps mitosis and meiosis share, circle two differences in what happens or what results, and write 1 or 2 beside the number of divisions described for each process. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the number of divisions and the number of cells produced differ between mitosis and meiosis?	**Mitosis has one division and produces two cells. Meiosis has two divisions and generally produces four cells.**
2	Compare what separates during mitosis with what separates during each division of meiosis.	**Sister chromatids separate during mitosis. Homologous chromosomes separate in the first division of meiosis, and sister chromatids separate in the second.**
3	How do the cells produced by mitosis and meiosis differ in chromosome number and genetic similarity?	**Mitosis produces two genetically matching cells with 46 chromosomes each, except for rare errors. Meiosis generally produces four genetically different cells with 23 chromosomes each.**
4	Why does meiosis produce cells suited to fertilization, while mitosis produces cells suited to repairing a scrape?	**Meiosis halves the chromosome number so a sperm's 23 chromosomes can combine with an egg's 23 to restore 46. Mitosis keeps 46 chromosomes and produces matching cells that can replace skin cells.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

To replace damaged skin, one body cell divides once by mitosis and makes two cells with 12 chromosomes each. These cells usually have the same genetic information, so they can replace cells in the tissue. To make sperm, a cell divides twice by meiosis and generally makes four cells with 6 chromosomes each. Those cells usually differ genetically because chromosomes exchange DNA and separate in different combinations. A sperm's 6 chromosomes can join with 6 from an egg, restoring 12 in the resulting cell.

Accept descriptions of the results as usually genetically identical or different, since rare copying errors can occur. For the invented animal, each sperm must have 6 chromosomes, half the body-cell count.