Two Ways to Grow

Compare how cell division supports two routes to reproduction.

BIO.3A.2 "Compare and contrast mitosis and meiosis in terms of reproduction."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline statements that show how mitosis helps produce a new organism, and circle statements that show how meiosis does so. Put a star beside one sentence that compares offspring from the two routes.

New Hydras in a Pond

1. In a pond, a hydra can grow a small bud on its body. The bud grows as body cells divide by mitosis, then separates as a new hydra. Before mitosis, a cell copies its DNA. One division produces two cells with the same chromosome number as the original cell. Usually, those cells carry the same genetic information, unless a mutation occurs. Mitosis also replaces damaged cells in an adult hydra, but replacing a cell is not the same as producing a new organism. In budding, mitosis helps produce offspring from just one parent.

2. A hydra can also reproduce when a sperm from one hydra fertilizes an egg from another. To make these gametes, cells undergo meiosis. DNA is copied once, but the cell divides twice, producing cells with half the chromosome number of the starting cell. During meiosis, chromosomes exchange pieces and are sorted into gametes in different combinations. When sperm fertilizes an egg, their chromosomes combine, restoring the full number in the new hydra. The offspring inherits genetic material from two parents and usually differs genetically from each. Unlike a bud, this offspring begins with a combination of genes from sperm and egg.

3. Both routes depend on cell division and can add hydras to a pond, but they do not do the same job. Budding uses mitosis to build an offspring without fertilization. Sexual reproduction uses meiosis to make gametes, followed by fertilization and mitotic growth of the embryo. A bud typically resembles its single parent genetically, while an offspring made from two gametes has a new mix of inherited traits. If pond conditions change, different traits among offspring may help some survive. Neither method guarantees survival, and mutations can introduce differences even during asexual reproduction.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do budding and sexual reproduction in hydras differ in the number of parents involved and the need for fertilization?

2. Compare how a new hydra gets a full set of chromosomes through budding and through sexual reproduction.

3. How is the genetic similarity of a bud to its parent different from that of an offspring made from sperm and egg? Explain why.

4. Mitosis plays a part in both routes. Compare its role in budding with its role after fertilization, and identify the different job meiosis does.

3 YOUR TURN

Your own words

Imagine a single-celled species whose adult cells each have eight chromosomes. In four or five sentences, compare what happens when one adult reproduces by mitotic division with what happens when two adults make gametes by meiosis and those gametes fuse. Include the chromosome number and expected genetic similarity of each type of offspring.

Two Ways to Grow

PART 1 · READ AND MARK

Underline statements that show how mitosis helps produce a new organism, and circle statements that show how meiosis does so. Put a star beside one sentence that compares offspring from the two routes. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do budding and sexual reproduction in hydras differ in the number of parents involved and the need for fertilization?	**Budding produces an offspring from one parent without fertilization. Sexual reproduction involves sperm and egg from two parents and requires fertilization.**
2	Compare how a new hydra gets a full set of chromosomes through budding and through sexual reproduction.	**In budding, mitosis keeps the chromosome number the same as in the parent cell. In sexual reproduction, meiosis halves the number in each gamete, and fertilization combines two gametes to restore the full number.**
3	How is the genetic similarity of a bud to its parent different from that of an offspring made from sperm and egg? Explain why.	**A bud is usually genetically like its one parent because it grows through mitosis. An offspring made from sperm and egg has a new mix of genetic material from two parents.**
4	Mitosis plays a part in both routes. Compare its role in budding with its role after fertilization, and identify the different job meiosis does.	**Mitosis builds the bud and grows the embryo after fertilization. Meiosis makes the gametes needed for sexual reproduction.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

When one adult divides by mitosis, it produces two offspring with eight chromosomes each. They are usually genetically identical to that adult. Meiosis produces gametes with four chromosomes each, and fusion restores the number to eight in the new organism. That offspring receives genetic material from two adults and will usually differ genetically from both.

Accept answers that distinguish offspring produced through mitosis from gametes produced through meiosis. Genetic similarity may be described as typical rather than absolute because mutations can occur.