Cells Build Bodies

Model how cell division and specialization build and repair tissues.

HS-LS1-4 "Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline statements that describe mitosis, circle statements that describe differentiation, and number the sentences that explain how a model can show either process. Your marks should help you trace how both processes contribute to a complex organism.

From One Cell to Many Jobs

1 A fertilized human egg begins as one cell, yet an adult body contains trillions of cells arranged in tissues and organs. A useful model can show this change with arrows and labeled cell groups. Start with one unspecialized cell. Repeated mitosis makes two genetically similar daughter cells, then four, then many more. This growth increases the number of cells available to build the organism. In the model, each dividing cell connects by arrows to its daughter cells. Mitosis does not by itself create a heart, a nerve, or skin. It supplies many cells with the same inherited DNA.

2 During development, some descendants of the original cell differentiate. Differentiation changes a cell into a specialized type with a particular structure and job. For example, muscle cells can contract, nerve cells can send signals, and red blood cells can carry oxygen. Most nucleated body cells retain the same inherited DNA despite different forms and jobs. Mature human red blood cells are an exception: they lose their nucleus during development. A model can represent differentiation by drawing branches from a group of similar cells to differently colored, labeled cell types. The branches show that cell division provides cells, while differentiation organizes those cells into tissues that work together in a complex organism.

③ Cell division and differentiation continue to help maintain an organism after development. Consider a shallow scrape on the skin. Cells near the injury can divide by mitosis, increasing the supply of cells that can replace cells that were lost. Some new cells differentiate into specialized skin cells, helping restore the protective surface. A repair model could use arrows for new cells, a gap for the injury, and labels for the specialized cells that fill the gap. The model should also show limits: mitosis adds cells, but differentiation gives cells the features needed for a specific role. Together, the processes support growth, repair, and everyday maintenance.

2 ANSWER WITH EVIDENCE

Use the passage

1. In the model described in paragraph 1, what do arrows from a dividing cell to daughter cells represent?

2. Why would a model showing only repeated mitosis be incomplete for explaining how a complex organism forms?

3. What do differently colored, labeled cell types and the branches leading to them represent in a model?

4. Using the skin scrape example, explain the different contributions of mitosis and differentiation during repair.

3 YOUR TURN

Your own words

Create a labeled flowchart model for a growing and active hand. Begin with one unspecialized cell, use arrows to show at least two rounds of mitosis, and use branches to show differentiation into muscle, nerve, and skin cells. Add a worn skin area and show how your model represents maintenance, then write exactly two sentences explaining the different roles of mitosis and differentiation.

Cells Build Bodies

PART 1 · READ AND MARK

Underline statements that describe mitosis, circle statements that describe differentiation, and number the sentences that explain how a model can show either process. Your marks should help you trace how both processes contribute to a complex organism. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In the model described in paragraph 1, what do arrows from a dividing cell to daughter cells represent?	**They represent mitosis producing genetically similar daughter cells and increasing the number of cells.**
2	Why would a model showing only repeated mitosis be incomplete for explaining how a complex organism forms?	**Mitosis supplies more cells, but differentiation produces specialized cell types and organizes cells into working tissues.**
3	What do differently colored, labeled cell types and the branches leading to them represent in a model?	**They represent differentiation of similar cells into specialized cell types with different structures and jobs.**
4	Using the skin scrape example, explain the different contributions of mitosis and differentiation during repair.	**Mitosis increases the number of cells near the injury, and differentiation produces specialized skin cells that help restore the protective surface.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Model: unspecialized cell → two similar cells → four similar cells; branches: muscle cell, nerve cell, skin cell; worn skin: skin cell → two cells → replacement skin cell. Mitosis increases the number of similar cells for growth and replacement. Differentiation produces muscle, nerve, and skin cells with different jobs.

Accept equivalent model symbols if arrows clearly show cell division and branches or labels clearly show specialized cell types. The open model must include growth, differentiation into different cell types, maintenance of worn skin, and exactly two explanatory sentences. Mature human red blood cells lack a nucleus; the shared-DNA statement applies to most nucleated body cells. Reference: OpenStax Biology 2e, 40.2 Components of the Blood. This exception does not require gene-control mechanisms or memorized mitosis stages.