Skin in Motion

Model how a tissue repairs itself and stays functional

BIO.1E.1 "Construct models to explain how the processes of cell division and cell differentiation produce and maintain complex multicellular organisms."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline evidence that division supplies cells, circle evidence that cells specialize, and number three phrases that trace a path from a basal cell to a protective surface barrier.

How a Scrape Heals

1. When a skateboarder scrapes a knee, the outer skin loses cells that normally form a protective barrier. Beneath the surface, cells in the basal layer of the epidermis can divide by mitosis. Before division, a cell copies its DNA; mitosis distributes the copied chromosomes so each new cell receives the same genetic instructions. One daughter cell may remain in the basal layer and keep dividing, while another begins a path toward becoming a specialized skin cell. Division increases the number of cells available for repair, but adding cells alone does not restore a working barrier.

2. As some daughter cells move toward the surface, they differentiate. They still carry essentially the same DNA as the cells that produced them, but they use different sets of genes. This change in gene activity helps them make large amounts of keratin, a tough protein. As they mature, these cells flatten and form layers that resist friction and reduce water loss. Near the surface, they eventually die, yet their remains still help protect the living tissue below. A model of healing skin must therefore show more than a growing cell count: it must show a change in cell function.

3. Repair is not the only reason skin needs these processes. Even without a scrape, cells at the surface are continually shed. Dividing cells deeper in the epidermis supply new cells, and differentiation produces replacements suited to the surface. The rate of replacement must roughly match the rate of loss to keep the barrier intact. If division stopped, worn surface cells would not be replaced. If new cells never differentiated, the skin would gain cells but not enough cells with the features needed for protection. Together, repeated division and differentiation allow this multicellular tissue to grow, heal, and stay functional.

2 ANSWER WITH EVIDENCE

Use the passage

1. Write a three-step arrow model showing how a basal cell helps replace cells lost in a scrape. Label where division and differentiation occur.

2. In a model with normal cell division but no differentiation, what would increase, and why would the skin barrier still fail?

3. Use an arrow chain to show how the epidermis can keep its barrier even while surface cells are shed.

4. Two daughter cells have essentially the same DNA, but one keeps dividing and the other forms part of the surface layer. What link belongs in a model explaining their different roles?

3 YOUR TURN

Your own words

A section of intestinal lining loses cells that absorb nutrients. Stem cells in the lining can divide, and some daughter cells can specialize to absorb nutrients. Write a four-stage arrow model showing how the lining recovers and continues to replace worn cells; label division and differentiation, then explain what would happen if either process stopped.

ANSWER KEY

Skin in Motion

PART 1 · READ AND MARK

Underline evidence that division supplies cells, circle evidence that cells specialize, and number three phrases that trace a path from a basal cell to a protective surface barrier. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Write a three-step arrow model showing how a basal cell helps replace cells lost in a scrape. Label where division and differentiation occur.	**Basal cell divides by mitosis → a daughter cell differentiates as it moves upward → mature cells form a protective surface layer.**
2	In a model with normal cell division but no differentiation, what would increase, and why would the skin barrier still fail?	**The number of cells would increase, but they would not develop the specialized features needed to form an effective protective barrier.**
3	Use an arrow chain to show how the epidermis can keep its barrier even while surface cells are shed.	**Surface cells shed → deeper cells divide to supply replacements → replacements differentiate into protective surface cells.**
4	Two daughter cells have essentially the same DNA, but one keeps dividing and the other forms part of the surface layer. What link belongs in a model explaining their different roles?	**They use different sets of genes. The cell moving toward the surface differentiates and develops protective features.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Intestinal stem cell → division produces daughter cells → differentiation makes some daughters absorptive cells → absorptive cells take in nutrients, then wear out. Continued stem-cell division supplies replacements for the worn cells. If division stops, too few replacement cells form. If differentiation stops, new cells do not become absorptive cells.

Accept arrow models with equivalent wording if they distinguish division, which supplies cells, from differentiation, which gives cells specialized functions. For Part 3, look for both recovery and ongoing replacement, plus a distinct consequence for stopping each process.