Cells in Cycle

Use reported cell-growth observations to explain development.

BIO.3.b "Using observations of cell growth, construct an explanation of how the cell cycle leads to differentiation in tissue development."

NAME _____ DATE _____

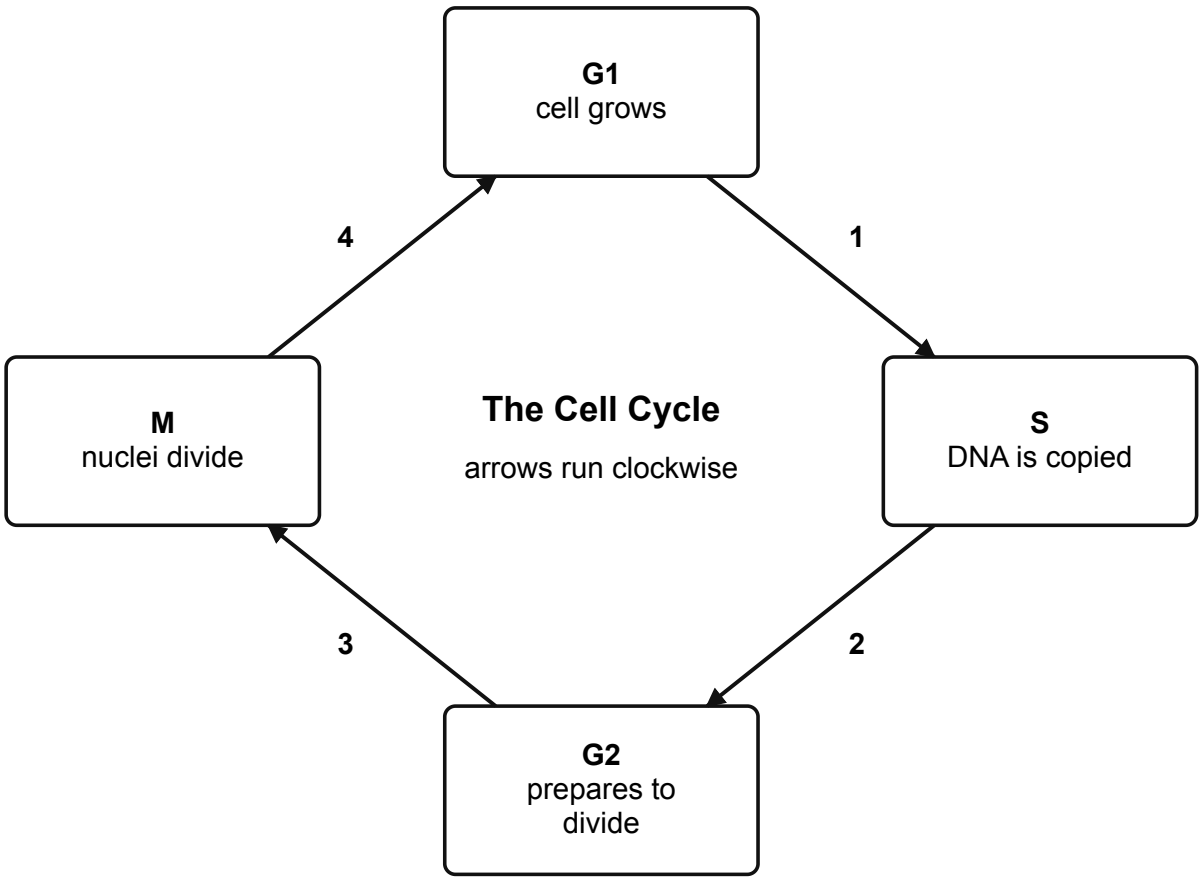
1 LABEL THE MODEL

Word bank below

Write one process from the word bank in each numbered arrow box. Use each process once.

WORD BANK

- Cytokinesis makes two cells
- DNA copying finishes
- G1 checkpoint passed
- G2 checkpoint passed



Arrow numbers match the response boxes on the next student section.

Label the arrows

Use the word bank to write the process for each numbered arrow.

Arrow 1	Arrow 2

Arrow 3	Arrow 4

2 RUN THE MODEL

Use your finished diagram

1. NIH reports that cultured stem cells divide and spread until their dish becomes crowded. Which cycle events explain the increasing cell number? Distinguish this observation from simply seeing each cell grow larger.

2. NIH also reports that suitable culture conditions can preserve unspecialized cells, while changed signals can produce specialized types. Why does division alone not explain tissue development?

3. Use both reported observations to explain how cell growth and division support a developing tissue and how differentiation adds specialized functions. Identify one thing these observations do not establish.

3 CHECK IT

Before you turn it in

- [ ] I traced growth, DNA copying and division.
- [ ] I cited both reported culture observations.
- [ ] I distinguished division from specialization.

TEST THE MODEL

What part of tissue development does this model leave out?

Cells in Cycle

PART 1 · COMPLETED MODEL

ARROW	FROM	TO	PROCESS
1	G1 cell grows	S DNA is copied	G1 checkpoint passed
2	S DNA is copied	G2 prepares to divide	DNA copying finishes
3	G2 prepares to divide	M nuclei divide	G2 checkpoint passed
4	M nuclei divide	G1 cell grows	Cytokinesis makes two cells

PART 2 · RUN THE MODEL

1. **DNA replication, mitosis and cytokinesis produce more cells. A crowded culture following observed divisions supports increased cell number; enlargement of individual cells alone would not establish division.** (NIH reports that cultured stem cells divide and spread until their dish becomes crowded. Which cycle events explain the increasing cell number? Distinguish this observation from simply seeing each cell grow larger.)
2. **Division supplies cells but does not by itself specify their functions. Differentiation depends on changed gene activity in response to signals; daughter cells can remain unspecialized under suitable conditions.** (NIH also reports that suitable culture conditions can preserve unspecialized cells, while changed signals can produce specialized types. Why does division alone not explain tissue development?)
3. **Growth prepares cells for division; repeated DNA copying and division supply cells. Signals can cause some cells to specialize, contributing different tissue functions. These observations alone do not identify a specific controlling signal, division rate or complete tissue organization.** (Use both reported observations to explain how cell growth and division support a developing tissue and how differentiation adds specialized functions. Identify one thing these observations do not establish.)

TEST THE MODEL (SAMPLE ANSWERS)

- It does not show the signals that cause cells to specialize.
- It does not show how new cells form a tissue's shape.

Observation source: NIH Stem Cell Basics, sections II and III (stemcells.nih.gov/info/basics/stc-basics/). These are printed summaries of reported observations, not an invented student experiment. The arrows follow G1, S, G2, M and return through cytokinesis. M-phase includes cytokinesis; the diagram separates it onto the return arrow for clarity. Differentiation is not an automatic step after every division.