

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Cell Cycle Simulator**. Click **Begin Exploring** to dismiss the introduction popup. Read the Cell Cycle Stages Reference panel at the bottom of the screen, which describes each phase of interphase and mitosis. Place a starting cell, add nutrients, and press **Play** to watch a cell progress through the cycle.

Part 1 – Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Cell Cycle Simulator as a scientific model.

M – Mode

What type of model is the Cell Cycle Simulator? Describe how this computational simulation represents the eukaryotic cell cycle. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about cell division.

A – Accuracy

(a) Identify two things this simulation represents **accurately** about the cell cycle. For each, name the specific simulation feature and explain what aspect of the cell cycle it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about the cell cycle. Consider what you cannot observe in the simulation that would be important for a complete molecular-level understanding of cell division.

P – Purpose

What is the learning goal of this simulation? Explain how the Cell Cycle Simulator is designed to help you understand how eukaryotic cells grow and divide through a regulated series of stages. In your answer, connect at least one specific simulation feature to a biological reason why cell cycle regulation matters for a multicellular organism.

P – Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like the Cell Cycle Simulator. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for the cell cycle?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect observable cell behaviors to the molecular events occurring at each stage?

Part 2 – NGSS Questions

1.

Simulation Task: Set Cell Type to “Patient 1,” Viability to “Viable,” Starting Phase to “G1 Phase,” and Cell Age to “Young (0%).” Place one starting cell, add nutrients using the “Concentric Circles” pattern, and press Play at 1x speed. Watch the cell change color as it moves through each stage shown in the Cell Stages Legend.

Describe the sequence of stages a cell passes through from the beginning of interphase to the end of cell division. For each major stage (G1, S, G2, and mitosis), explain one key event that must occur before the cell can move to the next stage.

HS-LS1-4

2.

Simulation Task: Clear the simulation. Place one viable Patient 1 cell starting in G1. Do NOT add any nutrients. Press Play and observe the cell for at least 30 seconds. Then pause, add nutrients using the “Concentric Circles” pattern, and press Play again. Watch what happens next.

Describe how the cell behaved before and after nutrients were added. Explain why cells need to pass through checkpoints before they can continue dividing, and describe what happens to a cell that does not receive the signals it needs to move forward in the cycle.

HS-LS1-4

3.

Simulation Task: Clear the simulation. Place one viable Patient 1 cell in G1 (Young). Add nutrients and press Play at 5x speed. Let the population grow until many cells appear crowded together. Watch the activity log for messages about cells entering G0.

Explain what happened to cells as the population became crowded. Describe why it is important for a multicellular organism to have a mechanism that stops cells from dividing when space or resources are limited.

HS-LS1-4

4.

Simulation Task: Clear the simulation. Place one "Patient 1" viable cell and one "Cancer" cell side by side. Add nutrients and press Play at 5x speed. After about 2 minutes of simulation time, compare the population graph and the statistics panel for normal versus cancer cells.

Describe how the cancer cell population grew compared to the normal cell population. Explain what happens when a cell no longer responds to the signals that normally stop cell division, and describe why uncontrolled cell division is dangerous for an organism.

HS-LS1-4

5.

Simulation Task: Using the same simulation from Question 4 (normal and cancer cells growing together), click “Spray Colchicine” and observe what happens to both cell populations. Check the activity log for details about which cells were affected.

Describe what happened to the normal cells and the cancer cells after colchicine was applied. Colchicine prevents the spindle from forming during mitosis. Explain why blocking this step stops cell division and why this type of treatment affects rapidly dividing cells more than cells that are not dividing.

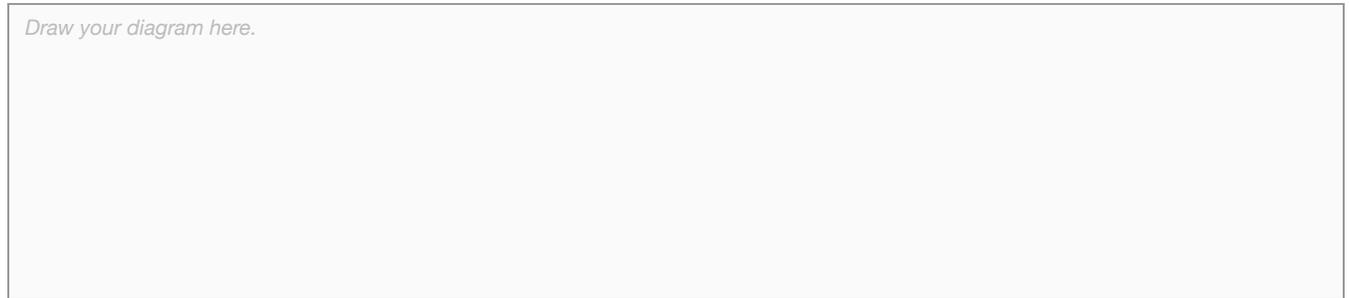
HS-LS1-4

6.

Simulation Task: Clear the simulation. Place one viable Patient 1 cell in G1 and add nutrients. Press Play at 1x speed and carefully observe the cell through one complete division, noting each color change that corresponds to a stage in the Cell Stages Legend.

In the box below, draw a circular diagram showing the cell cycle. Label each stage (G1, S, G2, prophase, metaphase, anaphase, telophase, cytokinesis). Mark where the cell grows, where DNA is copied, and where the cell physically splits into two. Add an arrow showing where a cell would exit the cycle into G0 if conditions are not favorable.

Draw your diagram here.



HS-LS1-4

7.

Simulation Task: Clear the simulation. Place one viable Patient 1 cell and one Cancer cell. Add nutrients and press Play at 5x speed. As the populations grow, observe the activity log for entries about apoptosis in normal cells and continued division in cancer cells.

In a multicellular organism, cells receive signals that tell them when to divide, when to stop, and when to self-destruct. Explain how a permanent change in a cell's DNA could cause that cell to ignore stop signals and divide without limit. Describe how this unchecked growth could disrupt the normal functioning of a tissue or organ in the body.

HS-LS3-2