Cell Cycle Simulator Activity: Modeling Cell Division

AP Biology/College Level Teacher Guide

Overview

This guide supports implementation of the Cell Cycle Simulator Activity: Modeling Cell Division using the 5E instructional model.

Learning Objectives

- Students will analyze the sequential stages of the eukaryotic cell cycle
- Students will evaluate how checkpoints regulate cell cycle progression
- Students will predict the effects of disruptions on cell division

Standards Alignment

Topic 4.5: Cell Cycle

- **LEARNING OBJECTIVE 4.5.A:** Describe the events that occur in the cell cycle.
- **ESSENTIAL KNOWLEDGE 4.5.A.1:** The cell cycle is a highly regulated series of events that controls the growth and reproduction of eukaryotic cells.
- i. The cell cycle consists of sequential stages of interphase (G1, S, G2), mitosis, and cytokinesis.
- ii. G1 phase: The cell is metabolically active, duplicating organelles and cytosolic components.
- iii. S phase: DNA is in the form of chromatin and replicates to form two sister chromatids connected at a centromere.
- iv. G2 phase: Protein synthesis occurs, ATP is produced in large quantities, and centrosomes replicate.

Topic 4.6: Regulation of Cell Cycle

- **LEARNING OBJECTIVE 4.6.A:** Describe the role of checkpoints in regulating the cell cycle.
- **ESSENTIAL KNOWLEDGE 4.6.A.1:** A number of internal controls or checkpoints regulate progression through the cell cycle.
- **ESSENTIAL KNOWLEDGE 4.6.A.2:** Interactions between cyclins and cyclin-dependent kinases control the cell cycle.
- **LEARNING OBJECTIVE 4.6.B:** Describe the effects of disruptions to the cell cycle on the cell or organism.
- **ESSENTIAL KNOWLEDGE 4.6.B.1:** Disruptions to the cell cycle may result in cancer or apoptosis (programmed cell death).

Prerequisites

- Understanding of cell structure
- Basic knowledge of DNA replication
- Concept of cell division

Time Estimate

50 minutes

Materials Needed

- Computer with internet access
- Student Activity Sheet
- Timer/stopwatch

Teaching Tips by Phase

Phase 1: ENGAGE (5-10 minutes)

- Start with the phenomenon or problem presented
- Elicit student predictions and prior knowledge
- Create cognitive dissonance if possible
- Build excitement for investigation

Phase 2: EXPLORE (15-20 minutes)

- Allow students to investigate with minimal guidance
- Circulate and ask probing questions
- Encourage systematic data collection
- Note common discoveries and difficulties

Phase 3: EXPLAIN (10-15 minutes)

- Have students share their findings first
- Build on their observations to introduce concepts
- Address misconceptions directly
- Connect to broader biological principles

Phase 4: ELABORATE (10 minutes)

- Apply knowledge to new scenarios
- Make real-world connections
- Encourage deeper investigation
- Support transfer of learning

Phase 5: EVALUATE (5-10 minutes)

- Use varied assessment strategies
- Focus on conceptual understanding
- Provide immediate feedback
- Plan follow-up based on results

> **Remember:**
>
> The goal is student discovery through guided inquiry. Resist the urge to explain concepts before students have explored them!
