DNA Replication Simulator Activity: Modeling DNA Synthesis

AP Biology/College Level Teacher Guide

Overview

This guide supports implementation of the DNA Replication Simulator Activity: Modeling DNA Synthesis using the 5E instructional model.

Learning Objectives

- Students will model the sequential steps of DNA replication
- Students will identify the roles of key enzymes in replication
- Students will distinguish between leading and lagging strand synthesis

Standards Alignment

Topic 6.2: Replication

- **LEARNING OBJECTIVE 6.2.A:** Describe the mechanisms by which genetic information is copied for transmission between generations.
- **ESSENTIAL KNOWLEDGE 6.2.A.1:** DNA replication ensures continuity of hereditary information.
- i. DNA is synthesized in the 5' to 3' direction.
- ii. Replication is a semiconservative process, meaning one strand of DNA serves as the template for a new strand of complementary DNA.
- iii. Helicase unwinds the DNA strands.
- iv. Topoisomerase relaxes supercoiling in front of the replication fork.
- v. DNA polymerase requires RNA primers to initiate DNA synthesis.

- vi. DNA polymerase synthesizes new strands of DNA continuously on the leading strand and discontinuously on the lagging strand.
- vii. Ligase joins the fragments on the lagging strand.

Prerequisites

- DNA structure and base pairing rules
- Understanding of 5' to 3' directionality
- Basic enzyme function

Time Estimate

50 minutes

Materials Needed

- Computer with internet access
- Student Activity Sheet

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!
