Cell Diffusion Explorer Activity: Transport Across Membranes

AP Biology/College Level Teacher Guide

Overview

This guide supports implementation of the Cell Diffusion Explorer Activity: Transport Across Membranes using the 5E instructional model.

Learning Objectives

- Students will analyze how surface area to volume ratio affects diffusion efficiency
- Students will evaluate why cells must remain small to survive
- Students will explain how cell shape adaptations maximize exchange rates

Standards Alignment

Unit 2: Cell Structure and Function

Topic 2.3: Cell Size

- LO 2.3.A: Describe the factors that influence cell size
- EK 2.3.A.1: Surface area to volume ratio limits cell size
- Simulation directly demonstrates SA/V constraints
- Shows mathematical relationship
- Explains why cells must remain microscopic

Topic 2.4: Plasma Membranes

- LO 2.4.A: Describe structure and function of plasma membrane

- EK 2.4.A.3: Membrane surface area limits exchange
- Shows diffusion across membrane surface
- Demonstrates time constraints
- Illustrates selective permeability effects

Topic 2.5: Membrane Transport

- LO 2.5.A: Describe mechanisms of transport across membrane
- EK 2.5.A.1: Passive transport includes simple diffusion
- Models diffusion down concentration gradient
- Shows rate limitations
- Demonstrates why active transport evolved

Cross-Unit Connections:

- Unit 1: Water and life (diffusion in aqueous environment)
- Unit 3: Cellular energetics (nutrient/waste exchange)
- Unit 4: Cell communication (surface receptors)

Prerequisites

- Understanding of diffusion and concentration gradients
- Basic geometry (surface area and volume calculations)
- Cell membrane structure

Time Estimate

50 minutes

Materials Needed

- Computer/tablet with internet access
- Student handout

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!
