Fluid Mosaic Model

Name: _____   **Period:** _____   **Date:** _____

> Open **peebedu.com** and navigate to **Fluid Mosaic Model**. Read the introduction popup, which describes the fluid mosaic model and shows a visual legend identifying six membrane components: Phospholipids, Cholesterol, Integral Proteins, Surface Proteins, Peripheral Proteins, and Glycolipids. Click **Start Visualization** to begin.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Fluid Mosaic Model simulation as a scientific model.

M — Mode

What type of model is the Fluid Mosaic Model simulation? Describe how this computational 3D simulation represents cell membrane structure. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about the plasma membrane.

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A — Accuracy

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

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(b) Identify two things this simulation **oversimplifies or leaves out** about cell membrane structure and function. Consider what you cannot observe in the simulation that would be important for a complete understanding of how the plasma membrane works.

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P — Purpose

What is the learning goal of this simulation? Explain how the Fluid Mosaic Model visualization is designed to help you understand how phospholipids, proteins, cholesterol, and glycolipids are organized in the plasma membrane and how they move laterally within the bilayer. In your answer, connect at least one specific simulation feature to the role it plays in maintaining the internal environment of the cell.

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P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries about membrane structure might change or improve a simulation like the Fluid Mosaic Model visualization. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

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Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for cell membrane structure?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does adjusting the cholesterol slider help you understand the relationship between membrane composition and fluidity?

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Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — Phospholipid Bilayer Organization

Simulation Task: Click Start Visualization and use the mouse to rotate the 3D membrane so you are viewing it from a side angle. Observe the two layers of phospholipids. Note the orientation of the purple heads and yellow tails in each layer. Then zoom in using the scroll wheel to examine the interior of the bilayer.

(A) (1 pt) **Describe** the arrangement of phospholipids in the plasma membrane bilayer, including the orientation of the hydrophilic phosphate heads and hydrophobic fatty acid tails relative to the aqueous environments inside and outside the cell.

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(B) (1 pt) **Explain** how the chemical properties of the hydrophilic heads and hydrophobic tails of phospholipids cause them to spontaneously arrange into a bilayer when placed in an aqueous environment.

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(C) (1 pt) **Predict** how the structure of the phospholipid bilayer would change if the hydrophobic fatty acid tails were replaced with hydrophilic molecules.

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(D) (1 pt) **Justify** your prediction by explaining how the interaction between hydrophobic and hydrophilic regions of phospholipids is essential for forming a stable membrane barrier that separates the internal environment of the cell from the external environment.

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Analyze Model / Visual Representation

Question 2 — Membrane Composition and Fluidity

Simulation Task: Set the cholesterol slider to 0% and observe the movement of all membrane components for 15 seconds. Then increase the cholesterol slider to 75% and observe how the movement of the phospholipids, proteins, and other components changes. Note the difference in the speed and range of lateral movement at each setting.

(A) (1 pt) **Describe** the components that make up the plasma membrane as represented in the simulation, including the roles of phospholipids, proteins, cholesterol, and glycolipids in the fluid mosaic model.

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(B) (1 pt) **Explain** the relationship between cholesterol concentration and membrane fluidity.
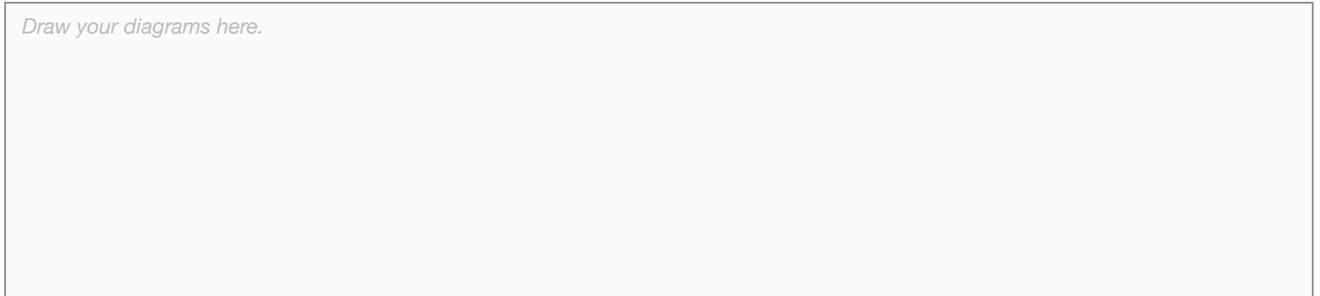
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(C) (1 pt) **Represent** the structural differences between a membrane with low cholesterol and a membrane with high cholesterol.

Draw your diagrams here.

(D) (1 pt) **Explain** how changes in membrane fluidity could affect the function of membrane proteins involved in cell signaling.

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