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.

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.

(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.

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.

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.

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?

Part 2 — NGSS Questions

1.

> *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. Zoom in using the scroll wheel and note the orientation of the purple heads and yellow tails in each layer.*

Describe the arrangement of phospholipids in the cell membrane as shown in the simulation. Explain how the orientation of the heads and tails in the two layers creates a barrier between the watery environments inside and outside the cell.

HS-LS1-2

2.

> *Simulation Task: With the simulation running at the default cholesterol level (25%), observe the movement of the phospholipids and proteins for at least 15 seconds. Watch how all components drift laterally within the membrane.*

Describe the movement you observe among the phospholipids and proteins in the simulation. Explain why the membrane is described as a "fluid mosaic" and how the lateral movement of its components is important for cell function.

HS-LS1-2

3.

> *Simulation Task: Set the cholesterol slider to 0% and observe the speed of phospholipid movement for 15 seconds. Then increase the slider to 75% and observe the same components again for 15 seconds. Compare the speed and range of movement at each setting.*

Describe how increasing the cholesterol level changed the movement of the phospholipids in the simulation. Explain the role cholesterol plays in regulating membrane fluidity and why a cell needs to control how fluid its membrane is.

HS-LS1-2

4.

> *Simulation Task: Rotate the 3D membrane to a top-down view and zoom in to locate the green tube-shaped structures that extend through the full thickness of the membrane (integral proteins). Then rotate to a side view to confirm they span both layers.*

Describe the position of integral proteins in the membrane as shown in the simulation. Explain how their placement across the full thickness of the phospholipid bilayer allows them to serve as channels or passageways for molecules that cannot pass through the bilayer on their own.

HS-LS1-2

5.

> *Simulation Task: Click the info icon (i) to reopen the legend popup. Identify the six membrane components listed. Close the popup and rotate the 3D membrane to locate each component type: purple-headed phospholipids, red cholesterol, green integral proteins, green surface proteins, green peripheral proteins, and pink glycolipids on the outer surface.*

Identify three different types of membrane components visible in the simulation besides phospholipids. For each component, describe where it is located in or on the membrane and explain one function it could perform for the cell.

HS-LS1-2

6.

> *Simulation Task: Rotate the membrane to a side view and zoom in so that the two phospholipid layers, an integral protein, cholesterol molecules, and glycolipids are all visible. Use this view as a reference for your drawing.*

In the box below, draw a cross-section of the cell membrane based on what you see in the simulation. Include and label the following: the two layers of phospholipids (heads and tails), one integral protein spanning the bilayer, at least one cholesterol molecule between phospholipid tails, and one glycolipid on the outer surface. Add arrows to show that the components can move laterally.

Draw your diagram here.

HS-LS1-2

7.

> *Simulation Task: Set the cholesterol slider to 50% and observe the membrane for 30 seconds. Watch how the different components move at different rates while the overall membrane structure stays intact. Then try 0% and 100% to see the extremes.*

The cell membrane must be fluid enough for proteins to move and perform their functions, yet stable enough to act as a barrier. Using your observations from the simulation at different cholesterol levels, explain how the composition of the membrane helps a cell maintain stable internal conditions even when the external environment changes.

HS-LS1-3