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

> Open **peebedu.com** and navigate to **Cell Builder**. Click the **Launch Interactive** button to begin. Read the introduction slideshow, which covers cell theory, organelle functions, and cell types. Use the **Next** button to advance through all slides before building your first cell.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate Cell Builder as a scientific model.

M — Mode

What type of model is Cell Builder? Describe how this computational simulation represents cell structure and organelle function. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about cells.

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A — Accuracy

(a) Identify two things this simulation represents **accurately** about cell structure and organelle function. For each, name the specific simulation feature and explain what biological concept it demonstrates.

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

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P — Purpose

What is the learning goal of this simulation? Explain how Cell Builder is designed to help you understand how subcellular components and organelles contribute to cell function. In your answer, connect at least one specific simulation feature to a biological reason why that organelle matters for the cell.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like Cell Builder. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- How does building a eukaryotic cell and a prokaryotic cell in the simulation help you understand the differences in compartmentalization between these cell types?
- What organelles appear in every eukaryotic cell mission, and why are they essential?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the SA:V ratio readout change when you select different membrane shapes, and why does this measurement matter for real cells?

Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — Organelle Structure and Cell Function

Simulation Task: Click "Choose Membrane" and select the circle shape. Then click "Add Organelles" and place a nucleus, two mitochondria, rough ER, smooth ER, Golgi body, and lysosomes into the cell. Next, click "Investigate" and click on each organelle you placed to read its description. Record the function of the mitochondria and the Golgi body.

(A) (1 pt) **Describe** how membrane-bound organelles in eukaryotic cells carry out distinct metabolic functions within separate compartments.

(B) (1 pt) **Explain** how the double membrane structure of mitochondria, with its highly convoluted inner membrane, enables efficient ATP synthesis during aerobic cellular respiration.

(C) (1 pt) **Predict** what would happen to a eukaryotic cell's ability to produce ATP if its mitochondria lost their inner membrane folds.

(D) (1 pt) **Justify** your prediction using the relationship between membrane surface area and the efficiency of metabolic reactions.

EK 2.1.A.5, 2.9.A.1

Analyze Model / Visual Representation

**Question 2 — Compartmentalization Across Cell Types**

Simulation Task: Complete Mission 1 (Animal Cell) by adding all required organelles. Note the SA:V ratio displayed. Then complete Mission 4 (Prokaryotic Cell) and note which organelles are available and which are absent. Compare the two completed cells.

(A) (1 pt) **Describe** how eukaryotic cells use membrane-bound organelles to compartmentalize intracellular metabolic processes and specific enzymatic reactions.

(B) (1 pt) **Explain** the relationship between the presence of membrane-bound organelles in the eukaryotic animal cell and the absence of these organelles in the prokaryotic cell, and how this difference affects where metabolic processes occur in each cell type.

(C) (1 pt) **Represent** the structural difference between a eukaryotic cell and a prokaryotic cell.

Draw your diagrams here.
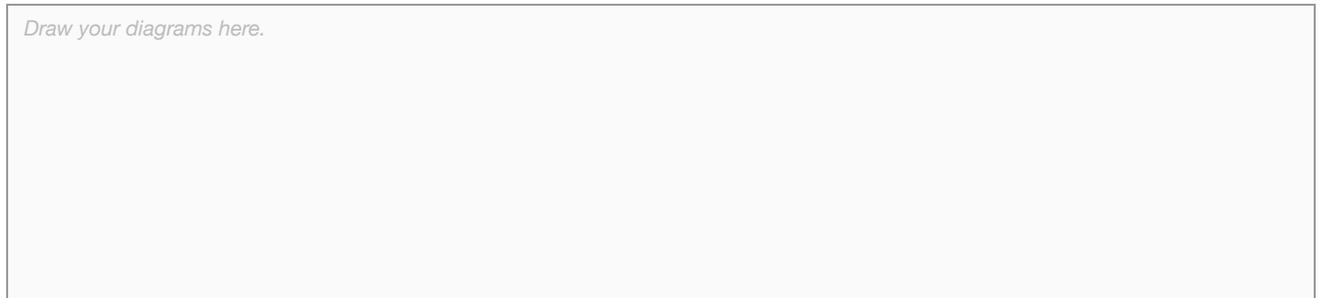
(D) (1 pt) **Explain** how the compartmentalization of enzymatic reactions within membrane-bound organelles in eukaryotic cells could provide a selective advantage in environments where energy demands fluctuate.

EK 2.9.A.1, 2.1.A.1