

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.

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## **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.

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## **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?

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## Part 2 – NGSS Questions

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1.

*Simulation Task: Click “Add Organelles” and place a nucleus, two mitochondria, rough ER, and a Golgi body into your cell. Then click “Investigate” and click on the nucleus to read its description. Record what the nucleus contains and what it controls.*

Explain the role of the nucleus in a eukaryotic cell. Describe how the nucleus stores genetic information and coordinates cell activities such as growth, protein production, and reproduction.

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HS-LS1-2

2.

*Simulation Task: With your organelles placed, click “Investigate” and click on a mitochondrion to read its description. Then click on the rough ER and the Golgi body and read each description. Note the specific function listed for each organelle.*

Describe the functions of mitochondria, rough ER, and the Golgi body. Explain how these three organelles work together as a system to provide the cell with energy and functional proteins.

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HS-LS1-2

**3.**

*Simulation Task: Click “Choose Membrane” and select the circle shape. Note the SA:V ratio displayed in the data panel. Then switch to the oval shape and record the new SA:V ratio. Finally, select the rod shape and record its SA:V ratio.*

Compare the surface-area-to-volume ratios you recorded for the three membrane shapes. Explain why a higher SA:V ratio allows a cell to exchange materials with its environment more efficiently, and describe how this ratio limits how large a cell can grow.

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HS-LS1-2

**4.**

*Simulation Task: Start Mission 4 (Prokaryotic Cell). Add the organelles available for this cell type. Then start Mission 1 (Animal Cell) and add all required organelles. Compare the two completed cells side by side.*

Describe the structural differences you observed between the prokaryotic cell and the animal cell in the simulation. Explain how the presence of membrane-bound organelles in eukaryotic cells allows different chemical reactions to occur in separate compartments at the same time.

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HS-LS1-2

**5.**

*Simulation Task: Start Mission 3 (Plant Cell). Add all required organelles, including chloroplasts and a cell wall. Then compare this cell to your completed Mission 1 (Animal Cell). Note which organelles appear in the plant cell but not in the animal cell.*

Identify the organelles that are present in the plant cell but absent from the animal cell. Explain how chloroplasts and a cell wall each contribute to the survival of a plant cell, and describe why animal cells do not require these structures.

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**6.**

*Simulation Task: Open your completed Mission 1 (Animal Cell) and your completed Mission 4 (Prokaryotic Cell). Use “Investigate” mode to review the organelles in each cell. Pay attention to which structures are shared and which are unique to the eukaryotic cell.*

In the box below, draw a labeled diagram of a eukaryotic cell and a prokaryotic cell. Include at least four labeled organelles in the eukaryotic cell. Show that the prokaryotic cell lacks membrane-bound organelles but contains ribosomes and a cell membrane. Add an arrow to each cell pointing to where proteins are made.

*Draw your diagrams here.*

HS-LS1-2

**7.**

*Simulation Task: Rebuild Mission 4 (Prokaryotic Cell) and note that it contains ribosomes. Then open Mission 1 (Animal Cell) and confirm that it also contains ribosomes. Use “Investigate” mode to read the ribosome description in both cells.*

Both prokaryotic and eukaryotic cells contain ribosomes that carry out protein synthesis. Explain how the presence of ribosomes in all cell types provides evidence that prokaryotes and eukaryotes share a common ancestor. Describe one additional similarity between these cell types that supports this conclusion.

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