PEEBEDU

Protein Modification Visualizer

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

> Open **peebedu.com** and navigate to **Protein Modification Visualizer**. Read the introduction popup, which describes how proteins are synthesized at the ER, transported to the Golgi apparatus, modified through glycosylation, phosphorylation, and cleavage, and then delivered to their final destinations. Close the popup and begin the simulation by dragging the protein toward the Golgi.

Free Response Questions

Question 1 — Conceptual Analysis

> **Simulation Task:** *Drag the protein from the ER toward the Golgi to form a transport vesicle. Once the protein arrives in the Golgi, click* **Glycosylate** *and then* **Phosphorylate** *to apply both modifications. Observe the visual changes to the protein after each modification. Then click* **Package from Golgi** *and drag the vesicle to the* **Cell Membrane***.*

(A) (1 pt) **Describe** the types of chemical modifications a protein can undergo after translation and before reaching its final destination in the cell.

(B) (1 pt) **Explain** why a protein that has the correct amino acid sequence but has not been chemically modified in the Golgi apparatus fails to function properly at the cell membrane.

(C) (1 pt) **Predict** how an epithelial cell's ability to interact with neighboring cells would change if a mutation prevented the Golgi apparatus from adding sugar chains to membrane-bound proteins.

(D) (1 pt) **Justify** your prediction.

6.4.A.1, EK 6.5.A.3.iii

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Reset the simulation and complete the full protein journey twice: first, drag the protein from the ER to the Golgi, apply* **Cleave Protein***, package it, and deliver it to the* **Lysosome***. Then reset and repeat the journey, but this time apply* **Glycosylate***, package it, and deliver it to the* **Cell Membrane***. Compare the two pathways.*

(A) (1 pt) **Describe** how two proteins with identical amino acid sequences can end up at different destinations within the cell after passing through the Golgi apparatus.

(B) (1 pt) **Explain** why two cells that contain the same genome produce different sets of proteins at their cell surfaces, resulting in different cell functions.

(C) (1 pt) **Represent** In the box below, draw a labeled diagram showing the two protein sorting pathways you observed in the simulation. Your diagram should include: the ER, a transport vesicle, the Golgi apparatus (with cis and trans faces labeled), the two different modifications, and the two different destinations (lysosome and cell membrane). Use arrows to show the direction of protein movement.

Draw your diagram here.

(D) (1 pt) **Explain** how a mutation that disrupts post-translational modification of membrane proteins in the Golgi apparatus could affect an organism's fitness.

6.4.A.1, EK 6.5.A.3