PEEBEDU

Signal Transduction Visualizer

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

> Open **peebedu.com** and navigate to **Signal Transduction Visualizer**. Click **Start Exploring** to dismiss the introduction popup. Read the introduction, which describes how to select pathways, control animations, and highlight components. Begin with the **GPCR/cAMP** pathway selected.

Free Response Questions

Question 1 — Conceptual Analysis

> **Simulation Task:** *Select the* **GPCR/cAMP** *pathway and click* **Start Signaling**. *Reduce the animation speed to observe each step. Watch the Amplification and Active Molecules counters as the signal moves from the ligand through the G protein, adenylyl cyclase, cAMP, and PKA to the cellular response.*

(A) (1 pt) **Describe** the characteristics of a receptor protein that allow it to receive a signal.

(B) (1 pt) **Explain** why a single ligand molecule binding to one receptor can result in the activation of thousands of intracellular molecules by the end of the signaling pathway.

(C) (1 pt) **Predict** how the final reading on the Active Molecules counter would change if a chemical blocked adenylyl cyclase from converting ATP into cAMP, compared with the same pathway run with no chemical present.

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

4.2.B.1, 4.2.B.2, 4.3.B.2

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Select the* **GPCR/cAMP** *pathway and click* **Start Signaling**. *Observe the complete pathway. Then switch to the* **Steroid Hormone** *pathway, reset, and click* **Start Signaling** *again. Compare where the receptor is located and how the cellular response differs between the two pathways.*

(A) (1 pt) **Describe** the relationship between the location of a receptor protein and the type of signaling molecule it recognizes.

(B) (1 pt) **Explain** why a steroid hormone can alter gene expression in a target cell without the use of a second messenger cascade, whereas a peptide hormone binding to the same cell's surface requires an intracellular signaling cascade to produce a response.

(C) (1 pt) **Represent** the path of a lipid-soluble signaling molecule from outside the cell to the activation of transcription in the nucleus by drawing a labeled diagram that includes the phospholipid bilayer, the signaling molecule, the receptor, the nuclear envelope, DNA, and mRNA.

Draw your diagram here.

(D) (1 pt) **Explain** how a change in the amino acid sequence of a receptor protein could prevent that receptor from binding its normal ligand.

4.2.B.1, 1.7.A.3