

An Overview of Cell Signaling

1. Describe the basic signal-transduction pathway used for mating in yeast. Explain why we believe these pathways evolved before the first multicellular organisms appeared on Earth.

2. Define paracrine signaling and give an example.

3. Define local regulation and explain why hormones are not local regulators.

4. Explain how plant and animal hormones travel to target cells.

5. List and briefly define the three stages of cell signaling.

Signal Reception and the Initiation of Transduction

6. Describe the nature of a ligand-receptor interaction and state how such interactions initiate a signal-transduction system.

7. State where signal receptors may be located in target cells.

8. Compare and contrast G-protein-linked receptors, tyrosine-kinase receptors, and ligand-gated ion channels.

Signal-Transduction Pathways

9. Describe two advantages of using a multistep pathway in the transduction stage of cell signaling.

10. Explain how the original signal molecule can produce a cellular response when it may not even enter the target cell.

11. Describe how phosphorylation propagates signal information.

12. Explain why a single cell may require hundreds of different protein kinases.

13. Explain how protein phosphatases turn off signal-transduction pathways.

14. Define the term second messenger. Briefly describe the role of these molecules in signaling pathways.

15. Describe how cyclic AMP is formed and how it propagates signal information in target cells.

16. Explain how the cholera bacterium causes the symptoms of cholera by disrupting G-protein-signaling pathways.

17. Describe how the cytosolic concentration of Ca^{2+} can be altered and how the increased pool of Ca^{2+} is involved with signal transduction.

Cellular Responses to Signals

18. Describe how signal information is transduced into cellular responses in the cytoplasm and in the nucleus.

19. Describe how signal amplification is accomplished in target cells.

20. Explain why different types of cells may respond differently to the same signal molecule.

21. Explain how scaffolding proteins help to coordinate a cell's response to incoming signals.