

Draw all figures unless otherwise directed.

IQ 1

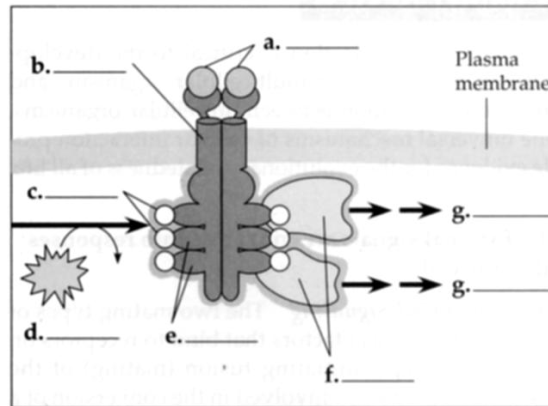
1. Do plant cells communicate using hormones?
2. If so, how do those hormones travel between secreting cells and target cells?

IQ 2

3. Explain why G-protein-regulated pathways shut down rapidly in the absence of a signal molecule.

IQ 3

4. Label the parts in this diagram of an activated receptor tyrosine kinase dimer.



IQ 4

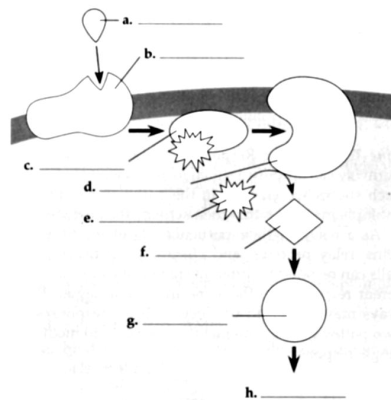
5. What determines whether a cell is a target cell for a particular signal molecule?
6. What determines whether a signal molecule binds to a membrane-surface receptor or an intracellular receptor?

IQ 5

7. What does a protein kinase do?
8. What does a protein phosphatase do?
9. What is a phosphorylation cascade?

IQ 6

10. Label the components in this diagram of the steps in a signal transduction pathway that uses cAMP as a second messenger.



IQ 7

11. Fill in the blanks to review the steps in a signal transduction pathway involving a G-protein-linked receptor and Ca^{2+} as a second messenger.

A _____ binds to a G-protein-linked receptor. An activated _____ activates the enzyme phospholipase C, which cleaves a _____ into DAG and _____, which binds to _____ and opens a ligand-gated channel, releasing _____ from the _____.

IQ 8

12. How do the following mechanisms or molecules maintain a cell's ability to respond to fresh signals?
- reversible binding of signal molecules.
 - GTPase activity of G protein.
 - Phosphodiesterase
 - Protein phosphatases

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question. Write the question and the correct answer.

1. In the yeast signal transduction pathway, after both types of mating cells have released the mating factors and the factors have bound to specific receptors on the correct cells,
- binding induces changes in the cells that lead to cell fusion.
 - the cells then produce the **a** factor and the α factor.
 - one cell nucleus binds the mating factors and produces a new nucleus in the opposite cell.
 - the cell membranes fall apart, releasing the mating factors that lead to new yeast cells.
 - a growth factor is secreted that stimulates mitosis in both cells.
2. Which of the following is *true* of the mating signal transduction pathway in yeast?
- The pathway carries an electrical signal between mating cell types.
 - Mating type **a** secretes a signal called **a** factor.
 - The molecular details of the pathway in yeast and in animals are very different.
 - Scientists think the pathway evolved long after multicellular creatures appeared on Earth.
 - The signal reception, transduction, and response occur in the nucleus.
3. A small molecule that specifically binds to another molecule, usually a larger one
- is called a signal transducer.
 - is called a ligand.
 - is called a polymer.
 - seldom is involved in hormonal signaling.
 - usually terminates a signal reception.
4. Which of the following signal systems use(s) G-protein-linked receptors?
- yeast mating factors
 - epinephrine
 - neurotransmitters
 - A and C only
 - A, B, and C
5. What would be *true* for the signaling system in an animal cell that lacks the ability to produce GTP?
- It would not be able to activate and inactivate the G protein on the cytoplasmic side of the plasma membrane.
 - It could activate only the epinephrine system.
 - It would be able to carry out reception and transduction, but would not be able to respond to a signal.
 - Only A and C are true.
 - A, B, and C are true.
6. Up to 60% of all medicines used today exert their effects by influencing what structures in the cell membrane?
- tyrosine-kinases receptors
 - ligand-gated ion channel receptors
 - growth factors
 - G proteins
 - cholesterol
7. Testosterone functions inside a cell by
- acting as a signal receptor that activates ion-channel proteins.
 - binding with a receptor protein that enters the nucleus and activates specific genes.
 - acting as a steroid signal receptor that activates ion-channel proteins.
 - becoming a second messenger that inhibits adenylyl cyclase.
 - coordinating a phosphorylation cascade that increases glycogen metabolism.
8. Which of the following is *not* considered a second messenger?
- cAMP
 - GTP
 - calcium ions
 - diacylglycerol (DAG)
 - inositol trisphosphate (IP_3)
9. The general name for an enzyme that transfers phosphate groups from ATP to a protein is
- phosphorylase.
 - phosphatase.
 - protein kinase.
 - ATPase.
 - protease.
10. An inhibitor of phosphodiesterase activity would have which of the following effects?
- block the response of epinephrine
 - decrease the amount of cAMP in the cytoplasm
 - block the activation of G proteins in response to epinephrine binding to its receptor
 - prolong the effect of epinephrine by maintaining elevated cAMP levels in the cytoplasm
 - block the activation of protein kinase A