AP Biology **Name** _____
Cell Communication
Chapter 11 Guided Reading
10ed

This chapter is often considered difficult as you have not covered it in your introductory biology course. Plan on reading this chapter at least twice and go slowly. I would suggest that you read the key concepts in bold first and then for each concept, look at the headings, then the figures and then read.

1. What are three examples of signals that cells may receive? What is the most common type of signal?

2. How does cell signaling provide evidence to justify the claim that all life is related?

3. What is a *signal transduction pathway*?

4. How does yeast mating serve as an example of a signal transduction pathway?

5. What is *quorum sensing*? How is it related to *biofilms*?

6. How can chemical signals pass between animal cells? Plant cells?

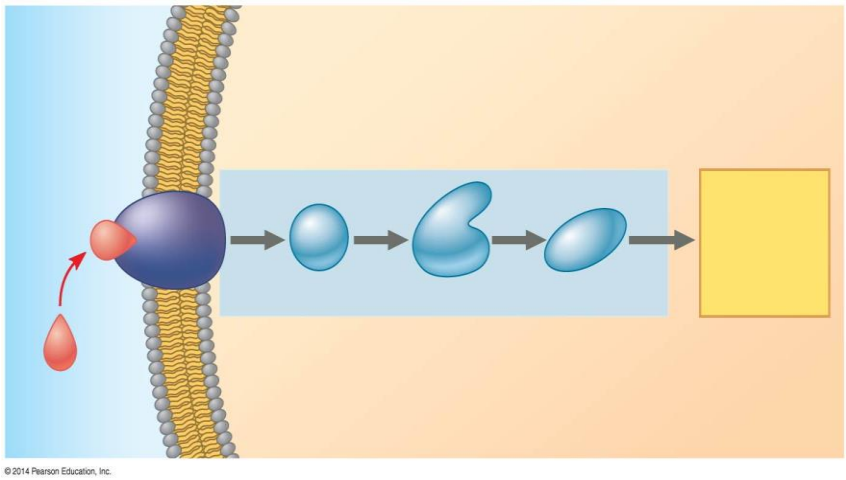
7. Some chemical signals are received by specific target cells. What is required for reception by a target cell?

8. Complete the chart of local chemical signaling in cell communication in animals.

Local Signaling Types	**Description**	**Specific example**
Paracrine		
Synaptic		

9. How does a hormone qualify as a *long-distance signaling* example?

10. A signal transduction pathway has three stages. Use Figure 11.6 to label the missing parts of the following figure, then briefly explain each step.



Reception

Transduction

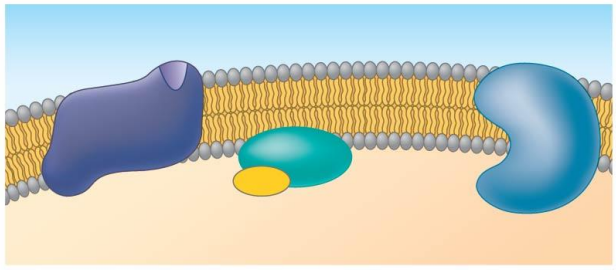
Response

11. Explain the term *ligand*.

12. Study the GPCR shown on the top of page 215, Figure 11.8 and read the accompanying text. How does a G protein receive a signal? Why are cells able to respond to many different signals?

13. What process in humans depend on GPCRs? What are examples of errors in GPCR signaling?

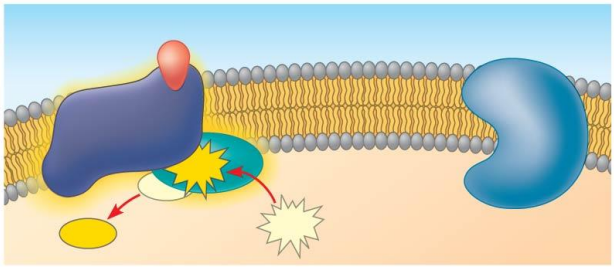
14. The text explains the three major types of membrane receptors in Fig 11.8 This material is of fundamental importance, so we will work through the specific figures for each type of membrane receptor. The first example is a G protein-coupled receptor (GPCR). In the first figure, label the components and then describe the role of the three components.



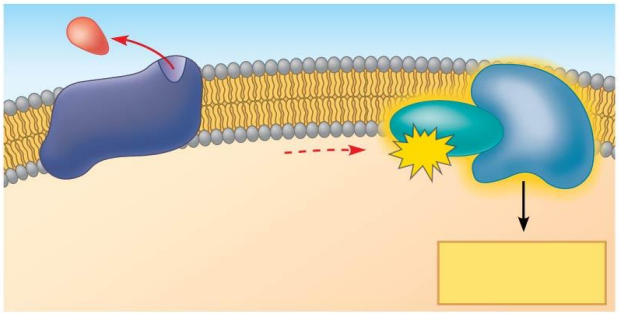
G protein-coupled receptor

G protein

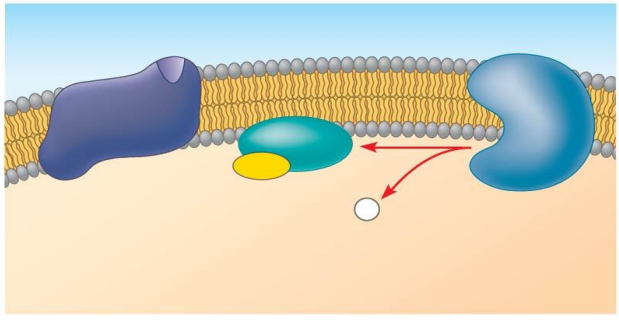
GDP



15. Label and describe what happens in step 2.



16. Label and then describe what happens in step 3. (The yellow box at the bottom right is important!)



17. Equally important to starting a signal is stopping a signal. Step 4 stops the signal (Failure to do so can lead to serious problems, like cancer) Label and then describe how the signal is halted.

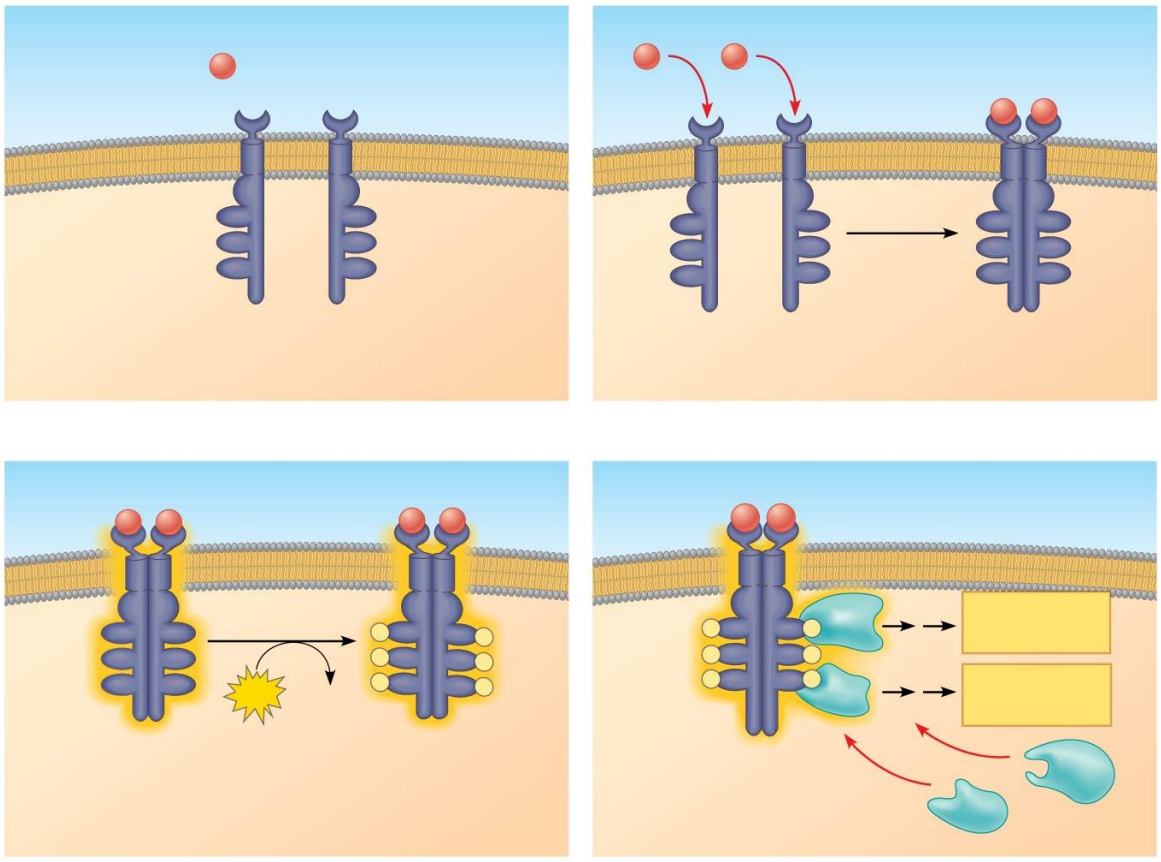
18. A G protein is also called a GTPase enzyme. Why is this important?

19. The second type of receptor described is the *receptor tyrosine kinases (RTKs)*. Explain what a *kinase* enzyme does.

20. How does tyrosine kinase function in the membrane receptor?

21. What is a key difference between receptor tyrosine kinases and G protein-coupled receptors?

22. Label using information from Fig 11.8? Then explain what is happening in each step.



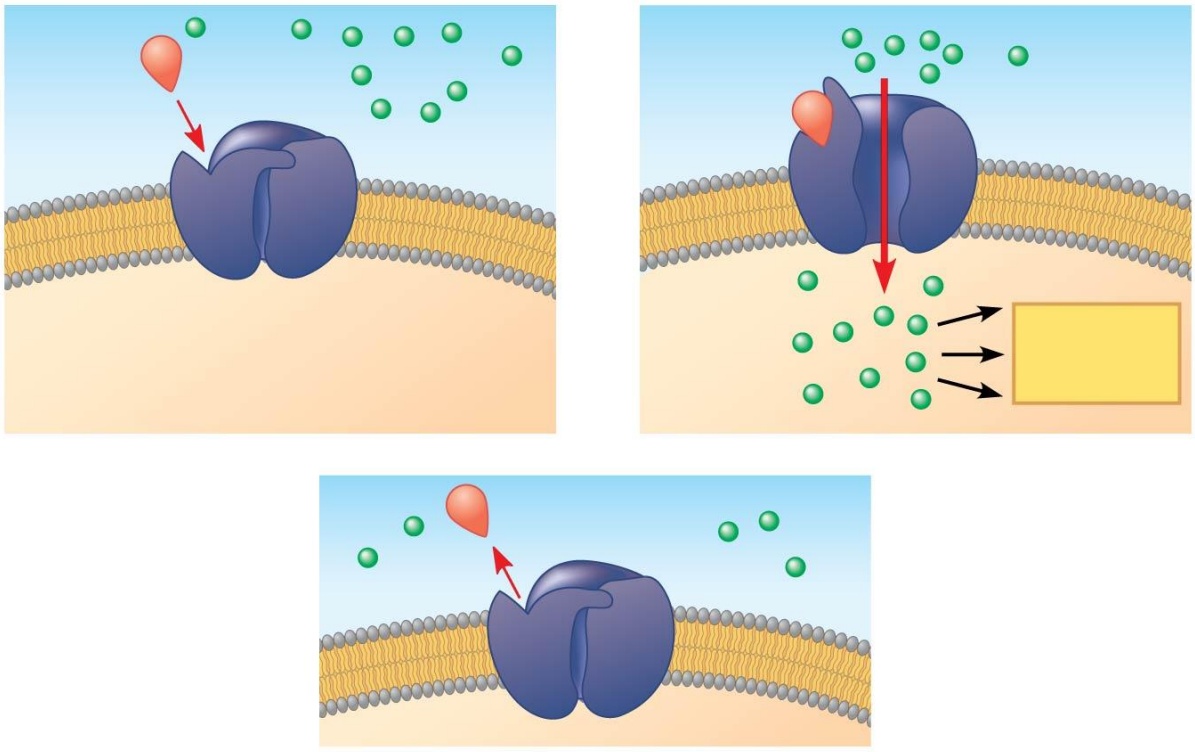
Step 1:

Step 2:

Step 3:

Step 4:

23. Look at the *ion channel receptors*. **Label** the diagram of the steps and explain the role of the molecules and/or steps.



Step 1: ligand

Ligand-gated ion channel receptor

Ions

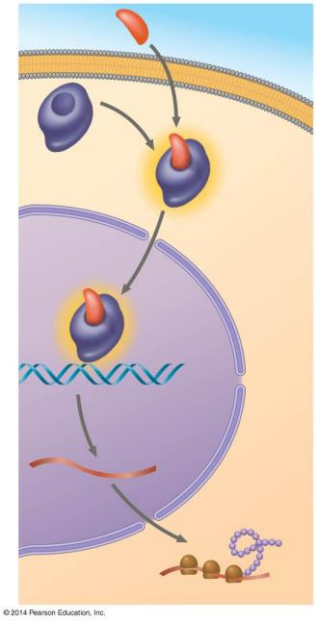
Step 2:

Step 3:

24. In what body system are *ligand-gated ion channels* and *voltage-gated ion channels* of particular importance?

25. Where are intracellular receptors found? What types of molecules can serve as signals? Give two examples.

26. Label and then at each arrow in the figure below, add an explanation of what is happening in the cell



27. Explain the function of *transcription factors* in the cell.

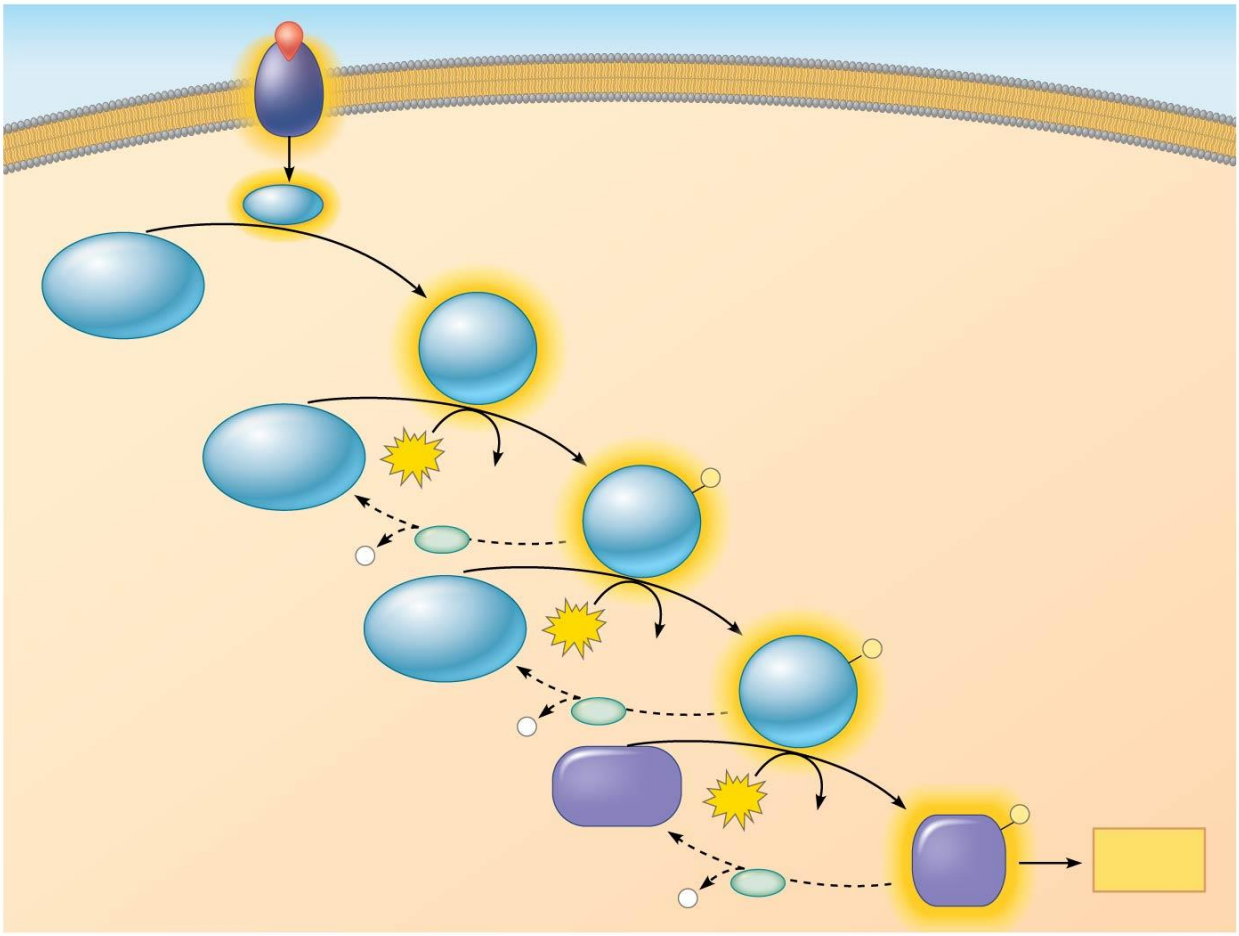
28. What are two benefits of multistep pathways like the one in Fig 11.10 in your book?

29. Explain the role in transduction of these two categories of enzymes:

Protein kinases

Protein phosphatases

30. Label the following diagram.



31. What is the difference between a first messenger and a second messenger?

32. Two common *second messengers* are *cyclic AMP (cAMP)* and *calcium ions* (Ca^{2+}). Explain the role of the second messenger cAMP in Fig 11.11.

33. Consider again the discussions of how epinephrine triggers the breakdown of glycogen in the liver, began in Concept 11.1. For this pathway, what is the first messenger? _____ What is the second messenger? _____ Why could glycogen phosphorylase be activated only when epinephrine was added to intact cells?

34. What is the important relationship between the second messenger and *protein kinase A?*

35. Figure 11.12 explains how a cellular response is initiated; how might that response be inhibited?

36. Use your knowledge of cell signaling to explain the mechanism of disease in cholera.

37. List the three types of cellular responses often induced by calcium ions. Be sure to include a plant example!

38. What happens to the cytoplasmic concentration of calcium when it is used as a second messenger?

39. The response to a cell signal can occur either in the nucleus or in the cytoplasm. What normally happens in a nuclear response?

40. Fig 11.16 shows a cytoplasmic response to a signal. How is this different from a nuclear response in terms of both the signal molecule and its effect?

41. Fig 11.16 shows how a signal can be amplified in a phosphorylation cascade. A single molecule of epinephrine results in the formation of approximately how many molecules of glucose 1-phosphate?

42. How is it that some cells do not respond to specific signaling molecules, and for the cells that do respond, it is often in different ways?

43. Fig 11.17 shows four different cellular results from a single signaling molecule. Briefly describe each response.
Cell A

Cell B

Cell C

Cell D

43. How do *scaffolding proteins* enhance a cellular response?

45. What specifically happens to a cell during the process of *apoptosis?*

46. Describe three examples of apoptosis, including normal function as well as abnormal function.

47. The signal for apoptosis can come from outside or inside the cell. Give **one** example when the signal comes from outside the cell and **two** examples of cellular occurrences that would prompt an apoptosis signal from inside the cell.