CHAPTER 6 READING QUESTIONS

These reading questions are designed to help you focus your reading on the most important points in the chapter. They are arranged using chapter section headers so that the file can be easily edited to reflect the material covered in class.

6.1 CELL-TO-CELL COMMUNICATION

1. Contrast electrical signals with chemical signals.
2. What are target cells (targets)?
3. List and describe the basic methods of cell-to-cell communication. (Fig. 6.1)

Gap Junctions Create Cytoplasmic Bridges

4. What kinds of signals pass through gap junctions? (Fig. 6.1a)
5. What proteins create gap junctions?
6. Where do you find gap junctions?

Contact-Dependent Signals Require Cell-to-Cell Contact

7. Give examples of contact-dependent signaling. What are some of the proteins involved? (Fig. 6.1b)

Local Communication Uses Paracrine and Autocrine Signals

8. Distinguish between paracrine and autocrine signals.
9. How do chemical signals secreted by cells spread to adjacent cells? What limitation does this present? (Fig. 6.1c)
10. Give examples of some important local signal molecules.

Long-Distance Communication May Be Electrical or Chemical

11. What are hormones? How do they reach their targets?
12. Why don't all cells react to hormones circulating in the body? (Fig. 6.1d)

13. In the nervous system, what kinds of signals are used to transmit information?

14. Distinguish between a neurotransmitter, neuromodulator, and neurohormone. (Fig. 6.1e, f)

Cytokines May Act as Both Local and Long-Distance Signals

15. What are cytokines? Give examples of some of the cellular responses they mediate.

16. How are cytokines different from hormones?

6.2 Signal Pathways

17. Why do some cells respond to a chemical signal while other cells ignore it? (Fig. 6.1)

18. What features do all signal pathways share in common? (Fig. 6.2)

Receptor Proteins Are Located Inside the Cell or on the Cell Membrane

19. Where can receptor proteins be found in target cells?

20. Make a simple chart that shows the differences in behavior of lipophobic vs. lipophilic signal molecules. Include receptor location and the general cellular response to each. (Fig. 6.3a, b)

21. What are the major categories of membrane receptors? (Fig. 6.3c)

Membrane Proteins Facilitate Signal Transduction

22. Define the terms transducer, signal transduction, second messenger, cascade, amplifier enzyme, and signal amplification. (Figs. 6.4, 6.5, 6.6 *Essentials: Signal Transduction*)

23. Diagram the components of a basic signal transduction pathway. (Fig. 6.5a)

The Most Rapid Signal Pathways Change Ion Flow through Channels

24. Diagram the signal pathways of ligand-gated ion channels and describe how these receptors produce a cellular response. (Fig. 6.7)

Most Signal Transduction Uses G Proteins

25. Sketch a G protein-coupled receptor (GPCR) and describe how GPCRs accomplish signal transduction. Name the two most common amplifier enzymes for GPCRs. (Fig. 6.3c)

Many Lipophobic Hormones Use GPCR-cAMP Pathways

26. Diagram the G protein-coupled adenylyl cyclase-cAMP system. Identify the amplifier enzyme and the second messenger. (Fig. 6.8a)

G Protein-Coupled Receptors Also Use Lipid-Derived Second Messengers

27. Diagram the G protein-coupled phospholipase C (PLC) signal transduction system. Identify the amplifier enzyme, the second messengers, and the actions initiated by the second messengers. (Fig. 6.8b)

Receptor-Enzymes Have Protein Kinase or Guanylyl Cyclase Activity

28. Sketch an example of a receptor-enzyme and describe how receptor-enzymes accomplish signal transduction. Name two examples of enzymes found in receptor-enzymes. (Figs. 6.3c, 6.9)

Integrin Receptors Transfer Information from the Extracellular Matrix

29. Describe the structure and function of integrins. (Fig. 6.3c)

6.3 Novel Signal Molecules

Calcium Is an Important Intracellular Signal

30. Diagram the ways Ca^{2+} can bring about an intracellular response. How does extracellular calcium enter the cell? Where and how is intracellular calcium stored? What effects can a calcium spark initiate? (Fig. 6.11)

Gases Are Ephemeral Signal Molecules

31. How is NO synthesized in tissues? Name the amplifier enzyme and second messenger. What are some of the effects of nitric oxide signals?

Some Lipids Are Important Paracrine Signals

32. Sketch the arachidonic acid cascade. (Fig. 6.12) What important class of lipid-derived paracrine signal molecules are formed in this cascade?

6.4 Modulation of Signal Pathways

33. For most signal molecules, what determines the nature of the target cell response?

Receptors Exhibit Saturation, Specificity, and Competition

34. Why do receptors exhibit characteristics of specificity, competition, and saturation?

Specificity and Competition: Multiple Ligands for One Receptor

35. Use norepinephrine and epinephrine as examples to describe specificity and competition for membrane receptors.

Agonists and Antagonists

36. Distinguish between an agonist and an antagonist.

One Ligand May Have Multiple Receptors

37. What are isoforms? What is their significance? Give an example of isoforms found in the body. (Fig. 6.13)

Up- and Down-Regulation Enable Cells to Modulate Responses

38. Describe and compare the processes of up- and down-regulation. What is the effect of each of these processes on the target cell's response?

Cells Must Be Able to Terminate Signal Pathways

39. Give examples and describe the ways a cell might terminate a signal pathway.

6.5 Homeostatic Reflex Pathways

Cannon's Postulates Describe Regulated Variables and Control Systems

40. List Walter B. Cannon's four postulates. (Figs. 6.13, 6.15)

Long-Distance Pathways Maintain Homeostasis

41. Diagram the steps of a generalized reflex pathway. (Fig. 6.16)

Sensors

42. Give two different meanings for the word receptor.

43. What is a threshold for a receptor? What role does the threshold play in the reflex?

Input Signal, Integrating Center, Output Signals, Targets,

Responses

44. Distinguish the meanings of the terms cellular response and systemic response.

Control Systems Vary in Their Speed and Specificity

45. Why does the body need different types of control systems? (Fig. 6.18, Tbl. 6.2)

46. Compare and contrast neural and endocrine control systems on the basis of these five key areas (Tbl. 6.2):

    Specificity

    Nature of the signal

    Speed

    Duration of action

Coding for stimulus intensity

Complex Reflex Control Pathways Have Several Integrating Centers

47. Draw the different reflexes from Figure 6.19 for yourself. Color-code the components and learn the distinctions between the reflex types. Match the patterns with examples in the textbook.