

Chapter 45: Hormones and the Endocrine System

- 45.1** *Explain how receptor specificity and location govern responses to hormones and other chemical signals.*
- 45.2** *Describe examples of the role of negative feedback and coordination with the nervous system in hormone pathways.*
- 45.3** *Compare and contrast hormonal regulation in homeostasis, development, and behavior.*

The nervous and endocrine systems transmit signals throughout the body. Hormones are chemical signals carried through the blood to target tissues. Information you learned in Chapter 11, Cell Communication, will once again be important to your understanding of hormones. The role of hormones in maintaining homeostasis is the central focus, but also take care to understand the role of feedback loops in the regulation of hormone production and the ways target cells receive and respond to chemical signals.

Study Tip: Figure 45.1 in your text presents an important overview of how variable the response to a hormonal signal can be between sexes or even between different tissues in the same individual. Explain three variables that shape a hormone's effect on both body and behavior.

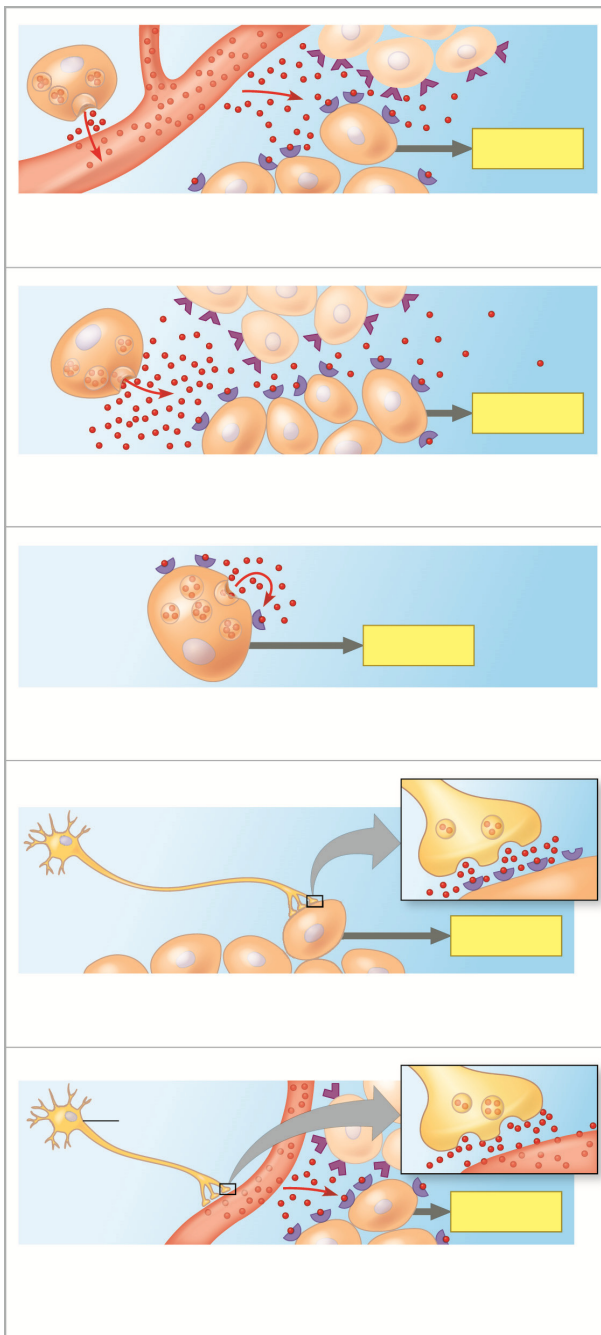
- a.
- b.
- c.

Concept 45.1 *Hormones and other signaling molecules bind to target receptors, triggering specific response pathways*

LO 45.1: *Explain how receptor specificity and location govern responses to hormones and other chemical signals.*

1. What is a *hormone*?
2. Why does a hormone elicit a response only with *target cells*?
3. The body has two long-distance regulating systems. Which involves chemical signals by hormones?

4. What is the other major communication and control system?
5. Figure 45.2 shows five different types of intercellular communication by secreted molecules. Label and explain each type of communication.

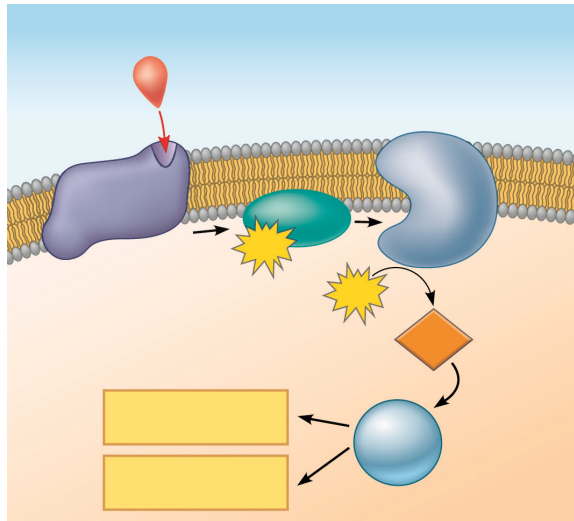


6. Not all intercellular signaling molecules are hormones. Discuss the action of each of the following examples.
 - a. **local regulators**
 1. **prostaglandins**
 2. **nitric oxide**
 - b. **neurotransmitters**
 - c. **neurohormones**
 - d. **pheromones**
7. *Prostaglandins* contribute to the pain of menstrual cramps. Why are aspirin and ibuprofen effective in relieving this pain?
8. Explain how the local regulator *nitric oxide (NO)* is affected by Viagra, a drug used to treat male erectile dysfunction.
9. Recall that target cells have receptors for specific hormones. Where are the receptors for lipid-soluble hormones found?
10. Where are the receptors for the water-soluble hormones found?
11. Carefully read the section Cellular Hormone Response Pathways and use that information to complete this table.

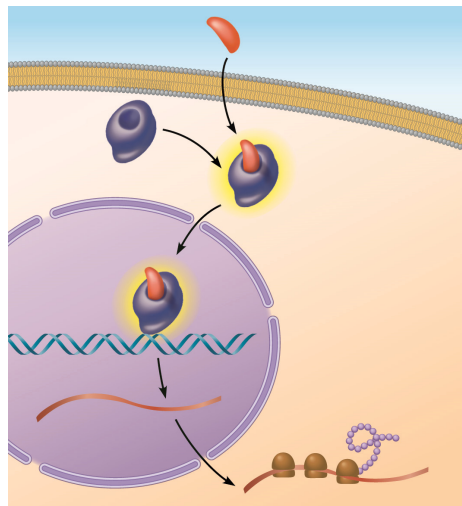
Hormone Type	Method of Secretion	Mode of Travel in Bloodstream	Location of Receptors	Examples
Water-soluble				
Lipid-soluble				

12. What endocrine gland secretes *epinephrine*?

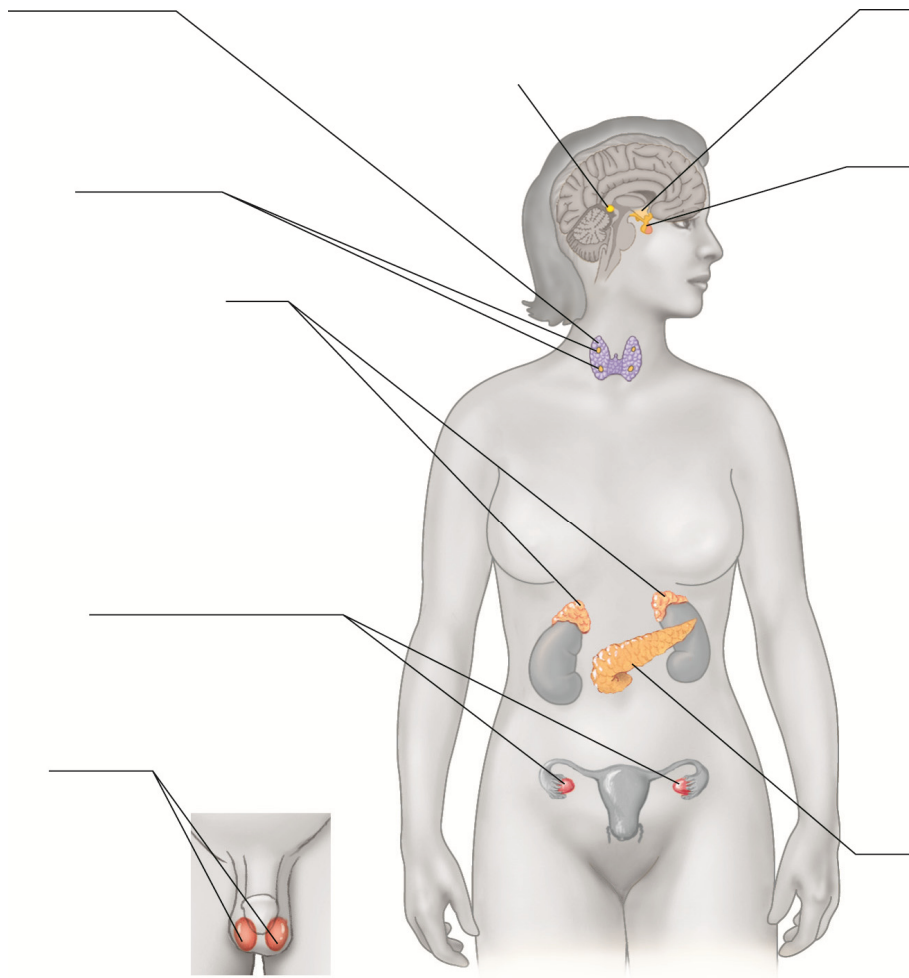
13. What are the two intracellular responses in the liver to epinephrine? How do these help the body deal with short-term stress?
14. Label the following figure and then explain the *signal transduction* pathway for *epinephrine*. (You may need to review signal transduction in Chapter 11.)



15. *Lipid-soluble hormones*, such as estradiol, bind to *intracellular receptors*. Label and explain the action of this *steroid hormone* in the following figure.



16. As you saw in the introductory figure for this chapter, one hormone can have several different effects. For example, epinephrine can cause the release of glucose from liver cells, dilate blood vessels in skeletal muscles, and constrict intestinal blood vessels. All these effects prepare the body for “fight or flight.” Explain how these multiple effects are possible.
17. By working through the major endocrine glands and their primary functions in Figure 45.8, you will be positioned to better understand the specific actions that are featured in the next two concepts.



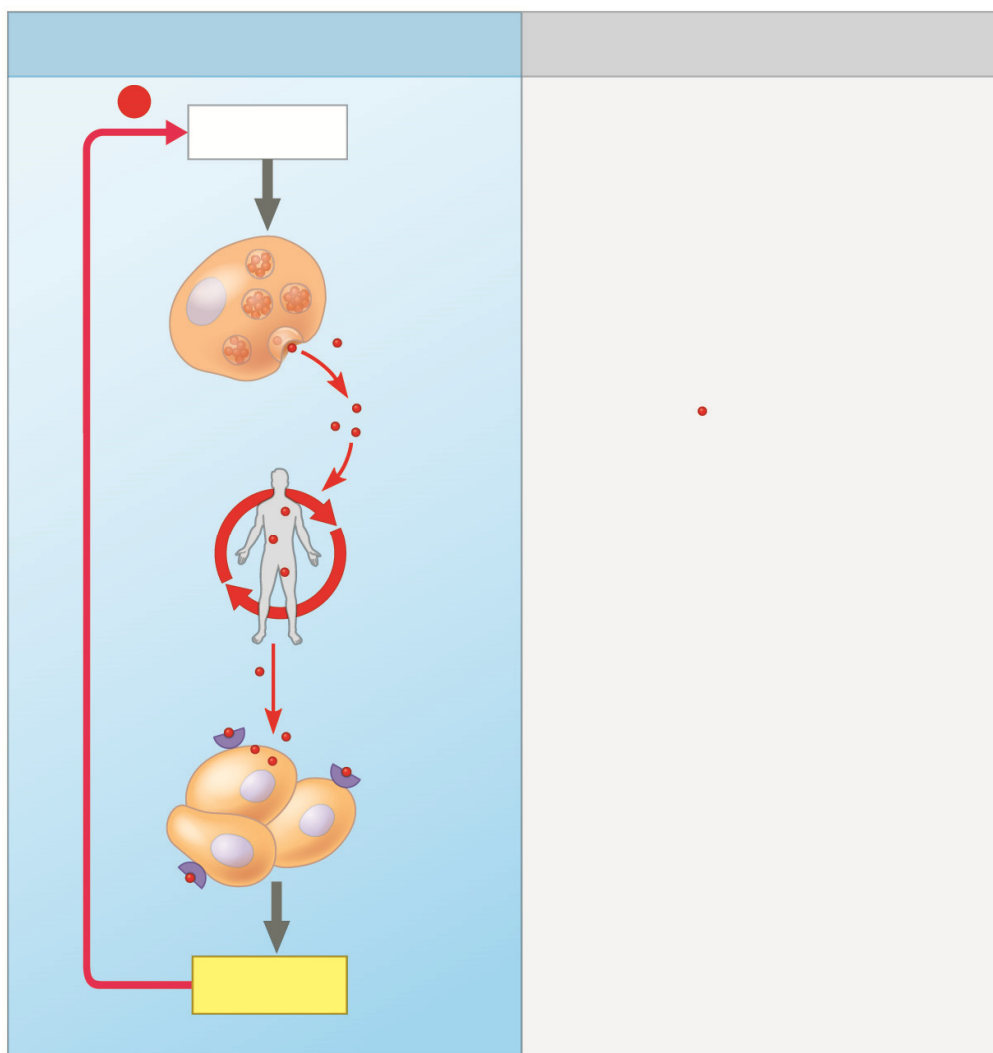
Study Tip

Come back to this figure as you work through the chapter and use it as self-check to see if you know the endocrine glands and their hormones.

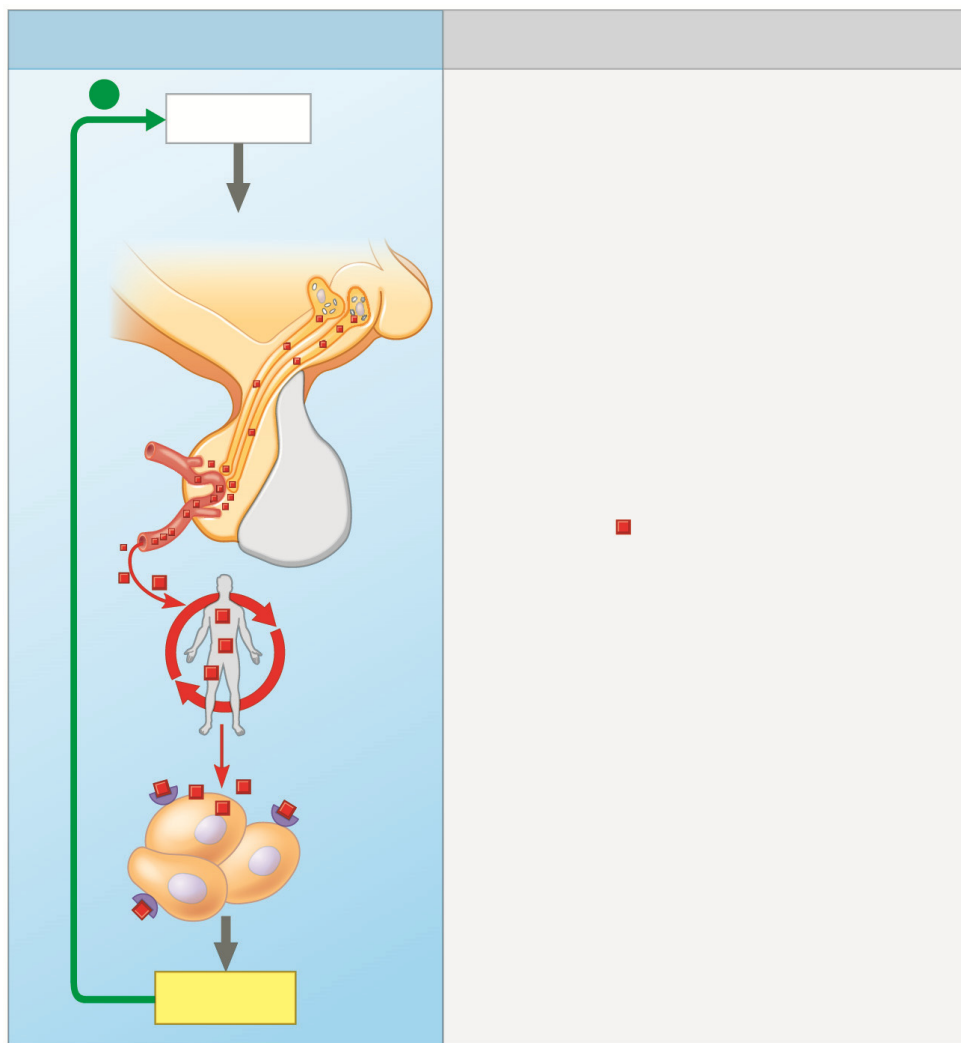
Concept 45.2 *Feedback regulation and coordination with the nervous system are common in hormone pathways*

LO 45.2: *Describe examples of the role of negative feedback and coordination with the nervous system in hormone pathways.*

18. Feedback regulation involves positive and negative feedback loops. Using the figure below, label and explain this simple endocrine *negative feedback* pathway.

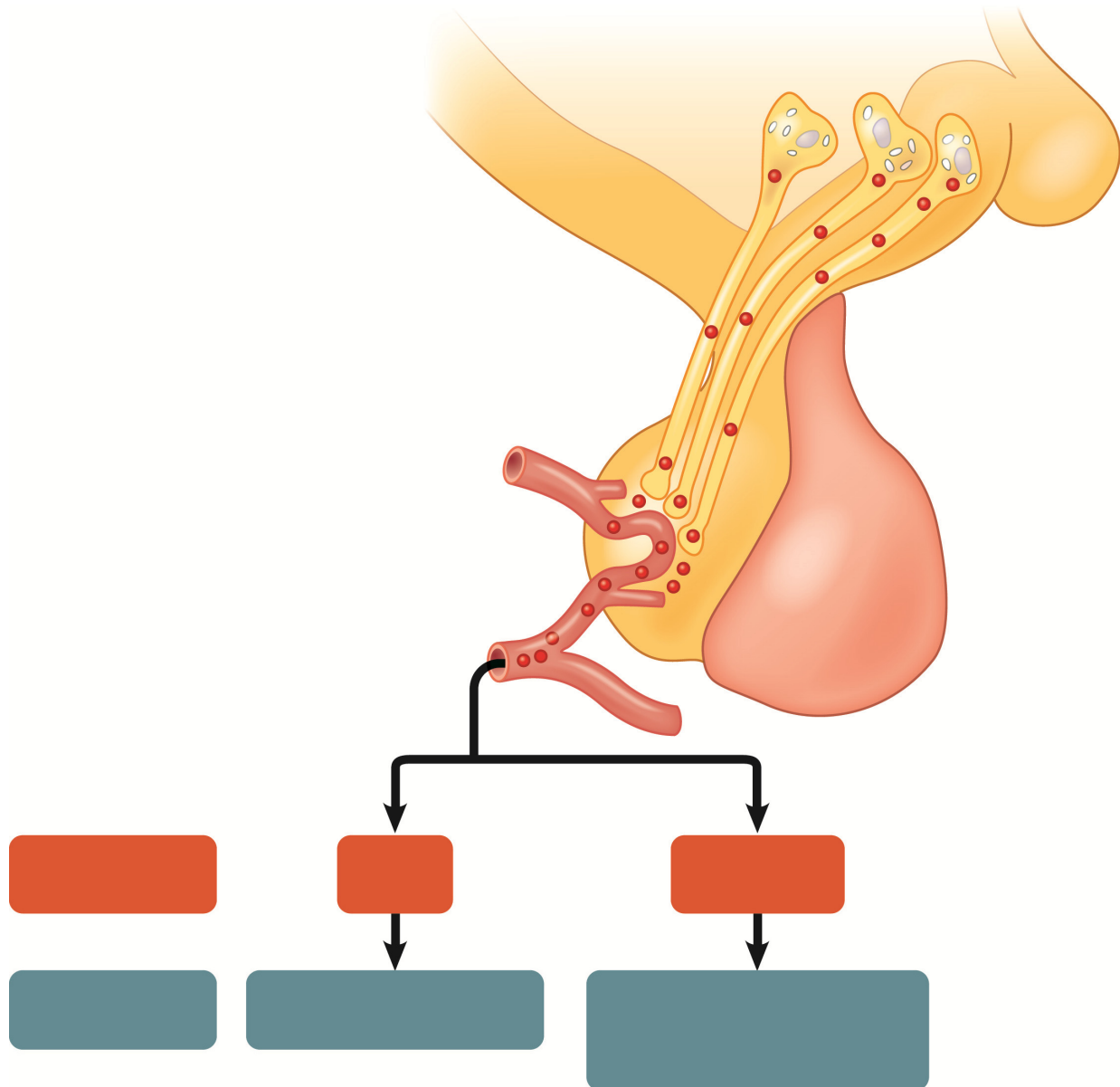


19. Label and explain this simple neuroendocrine *positive feedback* pathway.

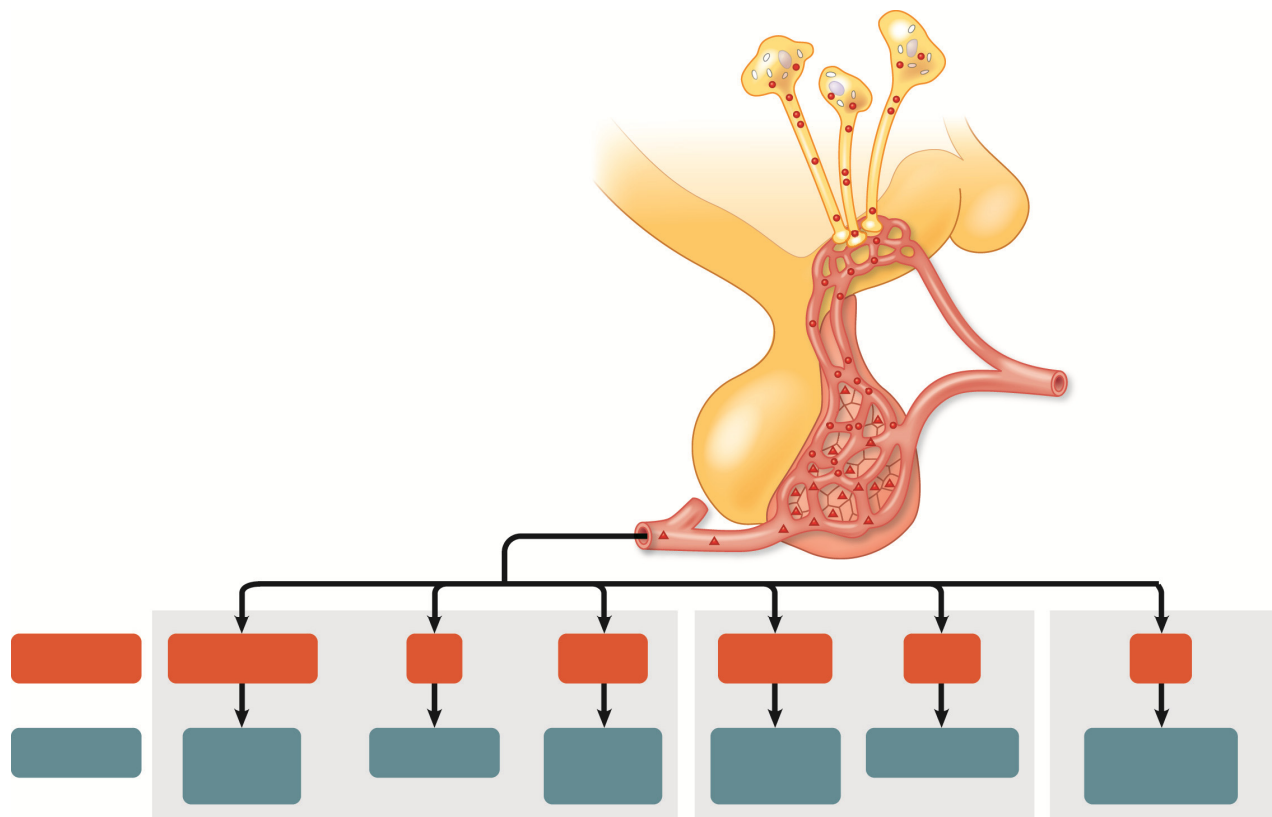


20. Explain the fundamental differences between negative and positive feedback loops. Why do only negative feedback restore a preexisting state?
21. Provide an example of both a positive and a negative hormonal feedback loop different from the two examples in the figures above.

22. The *posterior pituitary* is an extension of the *hypothalamus*. *Neurosecretory cells* in the hypothalamus directly produce neurohormones that are stored in the posterior pituitary. Use the figure below to label the anatomical structures, the hormones produced, and their target tissues.

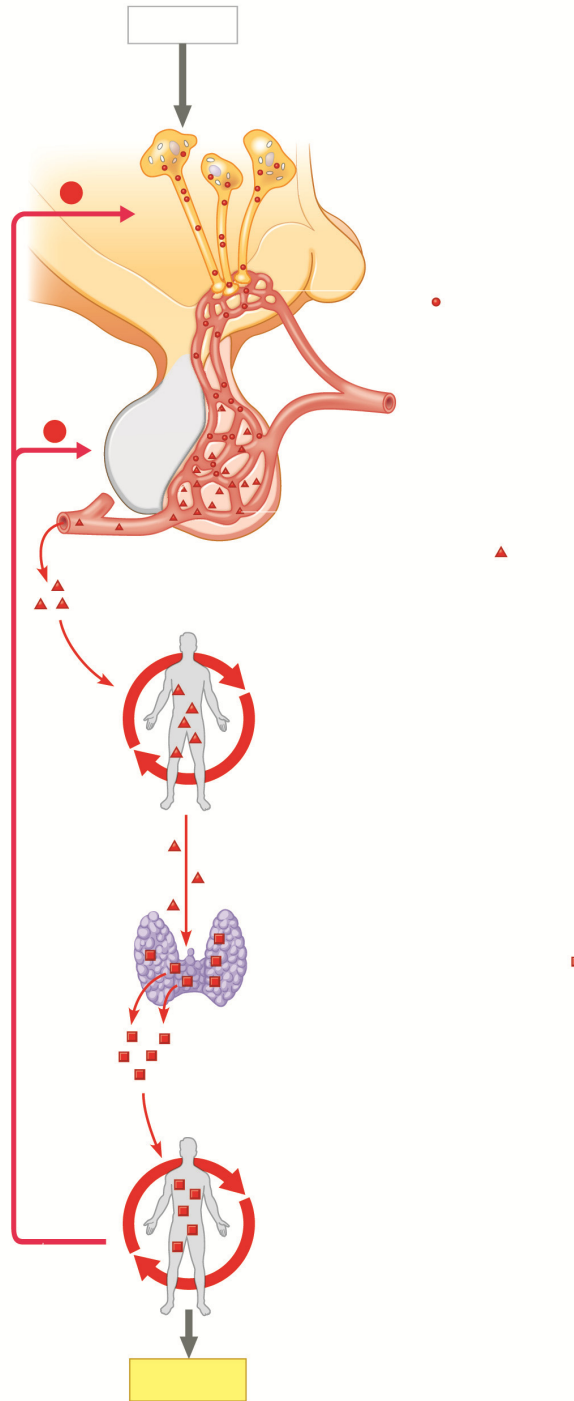


23. The hypothalamus produces both *releasing* and *inhibiting hormones* that control release of all anterior pituitary hormones. In turn, the anterior pituitary produces a variety of hormones, including many *tropic hormones*. What is the general action of all tropic hormones?
24. Use the figure below to label the anatomical structures of the anterior pituitary, the hormones produced, and their target tissues. Take time to appreciate the differences in how the anterior and posterior lobes of the pituitary differ in function.



25. What is a *hormone cascade pathway*?

26. Regulation of the thyroid hormones is an example of a hormone cascade pathway. Using the figure below as an example, explain the six steps to thyroid hormone control.



27. Every hormone causes a response in target cells. Too little or too much of the signal can disrupt homeostasis. Select two hormones and describe the effect of *hyposecretion* and *hypersecretion* of the signaling molecule.

Hormone	Effect of Hyposecretion	Effect of Hypersecretion

Study Tip: *The Problem-Solving Exercise on p. 1010 will give you an understanding of how hyposecretion or hypersecretion of thyroid hormones can lead to a variety of disorders, and how they can be diagnosed and treated.*

Concept 45.3 *Endocrine glands respond to diverse stimuli in regulating homeostasis, development, and behavior*

LO 45.3: *Compare and contrast hormonal regulation in homeostasis, development, and behavior.*

28. What two hormones are antagonistic controllers of blood calcium levels?
29. Note three ways the *parathyroid hormone (PTH)* raises blood calcium.
30. Are blood calcium levels regulated by positive or negative feedback? Justify your response.
31. Discuss the similarity between the adrenal gland and the pituitary.

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32. The adrenal medulla plays an important role in the “fight or flight” response to danger. What two hormones are produced by the adrenal medulla?
33. What four things increase under the influence of the hormones from the adrenal medulla?
34. How does epinephrine affect normal blood flow patterns?
35. Use epinephrine as an example to explain how a single hormone can have many different effects on the human body.
36. Under direction from ACTH released by the anterior pituitary, the adrenal cortex releases a group of steroids collectively called corticosteroids in response to stress. What are the stressful conditions that activate the release of *corticosteroids*?
37. What is the role of *glucocorticoids* in the stress response?
38. What is the role of *mineralocorticoids* in the stress response?
39. The three major sex hormones—*androgens*, *estrogens*, and *progesterone*—are found in both males and females. What accounts for their different effects in males and females?
40. What are two estrogen-like *endocrine disrupters* that occur in the environment? What effect does each seem to have?

41. Where is melatonin produced and what role does it play in the human body?

Test Your Understanding, p. 1017.

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
7. _____