

34.1 The Endocrine System

Lesson Objectives

- ☐ Describe the structure and function of the endocrine system.
- ☐ Explain how hormones work.

Lesson Summary

Hormones and Glands The endocrine system is made up of endocrine glands that release hormones into the blood.

- ▶ **Hormones** are chemicals made in one part of the body that affect cells in other parts of the body. Hormones travel throughout the body in the bloodstream.
 - Hormones bind to **target cells**, which are cells that have specific receptors for a hormone either in the cell membrane or inside the cell.
 - A hormone will not affect a cell that does not have receptors for the hormone.
- ▶ Glands are organs that release secretions. The body has two types of glands.
 - **Exocrine glands** release their secretions through ducts either outside the body or into the digestive system.
 - **Endocrine glands** release hormones directly into the bloodstream. Other structures that are not usually considered glands, such as bones, fat tissue, the heart, and the small intestine, also produce and release hormones.
- ▶ All cells, except for red blood cells, produce hormonelike substances called **prostaglandins**. Prostaglandins are modified fatty acids that usually affect only nearby cells and tissues. They are sometimes called "local hormones."

Hormone Action There are two types of hormones.

- ▶ Steroid hormones are produced from cholesterol. They can cross cell membranes of target cells, bind with their receptors, and enter the nucleus. The hormone-receptor complexes change the expression of genes in the target cell, often resulting in dramatic changes in the cell's activity.
- ▶ Nonsteroid hormones can be proteins, small peptides, or modified amino acids. They cannot cross cell membranes. The receptors for nonsteroid hormones are on the cell membrane. Compounds called secondary messengers carry the messages of nonsteroid hormones inside target cells.

Hormones and Glands

For Questions 1–4, write True if the statement is true and False if the statement is false.

- _____ 1. Hormones are chemical messengers that are transported by the bloodstream.
- _____ 2. Any cell can be a target cell for a hormone.
- _____ 3. The body's response to hormones is the same as it is for nerve impulses.
- _____ 4. Insulin and glucagon are two opposing hormones.

5. Complete the table that summarizes major endocrine glands of the human body.

Gland	Hormone(s) Produced	Function
Parathyroid	Parathyroid hormone	
Pineal		Regulates rhythmic activities
	Thyroxine	
	Corticosteroids, epinephrine, norepinephrine	
		Maintains the level of glucose in the blood
		Regulates formation of eggs and development of secondary female sex characteristics; prepares uterus for fertilization
	Testosterone	

6. What are prostaglandins? How is their action different from that of hormones?

Hormone Action

7. **THINK VISUALLY** Steroid and nonsteroid hormones affect their target cells in different ways. In the spaces below, draw diagrams that show how each type of hormone affects its target cells. Be sure to label the cell membrane, cytoplasm, nucleus, the hormones, and their receptors.

How Steroid Hormones Work	How Nonsteroid Hormones Work

- 8. Summarize the action of a steroid hormone on a target cell.**

- 9. Summarize the action of a nonsteroid hormone on a target cell.**

Apply the Big Idea

- 10. Compare the release of a hormone to the broadcast of a television commercial.**

34.2 Glands of the Endocrine System

Lesson Objectives

- ☒ Identify the functions of the major endocrine glands.
- ☒ Explain how endocrine glands are controlled.

Lesson Summary

The Human Endocrine Glands Endocrine glands are scattered throughout the body.

- ▶ The **pituitary gland** is a bean-size structure at the base of the brain. Consisting of two parts, the anterior pituitary and the posterior pituitary, it secretes hormones that regulate body functions and control the actions of other endocrine glands.
- ▶ The hypothalamus controls the secretions of the pituitary gland and is the link between the central nervous system and the endocrine system. The hypothalamus controls the posterior pituitary through neurosecretory cells. The hypothalamus produces **releasing hormones** that control the secretions of the anterior pituitary.
- ▶ An adrenal gland sits on top of each kidney. The adrenal glands make hormones that help the body prepare for and deal with stress. They consist of a cortex and a medulla.
 - The adrenal cortex produces more than two dozen **corticosteroids**, which help maintain homeostasis.
 - The adrenal medulla produces the “fight or flight” hormones **epinephrine** and **norepinephrine**, which help the body respond to stress.
- ▶ The pancreas is both an exocrine gland and an endocrine gland. As an exocrine gland, the pancreas releases digestive enzymes.
- ▶ Insulin and glucagon, hormones produced by the islets of Langerhans in the pancreas, help keep levels of glucose in the blood stable.
- ▶ The thyroid gland wraps around the trachea at the base of the neck. The four parathyroid glands are on the back surface of the thyroid gland. **Thyroxine**, produced by the thyroid gland, regulates metabolism. A hormone from the thyroid gland, **calcitonin**, and one from the parathyroid glands, **parathyroid hormone**, work together to maintain blood calcium levels.
- ▶ Reproductive glands, or gonads, make gametes and secrete sex hormones. The female gonads, ovaries, produce eggs. The male gonads, testes, produce sperm.

Control of the Endocrine System Feedback mechanisms involving hormones help maintain homeostasis. In feedback inhibition, increasing levels of a substance inhibit the process that produced the substance. Secretions of the hypothalamus and pituitary gland regulate the activity of other endocrine glands in this way.

- ▶ Actions of the hypothalamus and posterior pituitary gland regulate water balance. The hypothalamus signals the posterior pituitary gland to increase (in the case of dehydration) or decrease (in the case of overhydration) its release of anti-diuretic hormone (ADH). In response to ADH levels the kidneys produce less or more urine.
- ▶ The hypothalamus and anterior pituitary regulate metabolism and body temperature by controlling the amount of thyroxine produced by the thyroid gland.

The Human Endocrine Glands

For Questions 1–4, complete each statement by writing the correct word or words.

1. The pituitary gland is located at the base of the _____ and consists of the _____ pituitary and the _____ pituitary.
2. _____ cells in the _____ produce hormones that are released by the _____.
3. The two hormones released from the posterior pituitary are oxytocin and _____.
4. _____ hormones secreted into blood vessels leading to the _____ pituitary control its secretions.

For Questions 5–9, match each pituitary hormone with its action.

Hormone

Action

- | | |
|---------------|---|
| _____ 5. MSH | A. Stimulates ovaries and testes |
| _____ 6. TSH | B. Stimulates the release of thyroxine |
| _____ 7. LH | C. Stimulates release of hormones from adrenal cortex |
| _____ 8. GH | D. Stimulates protein synthesis and growth in cells |
| _____ 9. ACTH | E. Stimulates melanocytes to increase production of melanin in the skin |

10. Complete the table. Fill in the missing information about each adrenal gland.

Part of the Adrenal Gland	Hormone(s) Produced	Function
Adrenal cortex		
Adrenal medulla		

11. How does the pancreas use insulin and glucagon together to control blood glucose levels in the body?

12. What is diabetes mellitus?

For Questions 13–19, write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

_____ 13. A major role of the thyroid gland is controlling the body's metabolism.

_____ 14. The body needs calcium in order to produce thyroxine.

_____ 15. Too little thyroxine leads to a condition called hyperthyroidism.

_____ 16. Calcitonin is a hormone produced by the thyroid gland.

_____ 17. The parathyroid glands are located on the back of the pituitary gland.

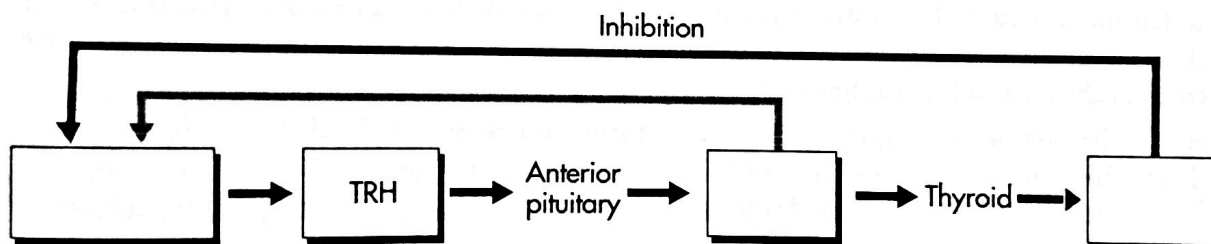
_____ 18. Parathyroid hormone promotes the proper functioning of nerves and muscles.

_____ 19. The reproductive organs are referred to as gametes.

Control of the Endocrine System

20. What is feedback inhibition?

21. Complete the flowchart to show how feedback controls regulate the thyroid gland.



22. Explain how feedback control regulates the rate of metabolism.

Apply the Big Idea

23. Which gland, the hypothalamus or the pituitary gland, should be given the title “master gland”? Explain your choice.
