


39–1 The Endocrine System



If you had to get a message to just one or two of your friends, what would you do? You might use the telephone. Wires running from your house to theirs would carry the message almost instantaneously. The telephone is a good way to reach a small number of people, but what if you wanted to get that same message to thousands of people? You might decide to broadcast it on the radio, sending the message in a way that made it possible to contact thousands of people at once.

Your nervous system works much like the telephone: Many impulses move swiftly over a system of wirelike neurons that carry specific messages from one cell to another. But another system, the endocrine system, does what the nervous system generally cannot.  **The endocrine system is made up of glands that release their products into the bloodstream. These products deliver messages throughout the body.** In the same way that a radio broadcast can reach thousands or even millions of people in a large city, the chemicals released by the endocrine system can affect almost every cell in the body. In fact, the chemicals released by the endocrine system affect so many cells and tissues that the interrelationships of other organ systems to one another cannot be understood without taking the endocrine system into account.

Hormones

The chemicals that “broadcast” messages from the endocrine system are called hormones. **Hormones** are chemicals released in one part of the body that travel through the bloodstream and affect the activities of cells in other parts of the body. Hormones do this by binding to specific chemical receptors on those cells. Cells that have receptors for a particular hormone are called **target cells**. If a cell does not have receptors or the receptors do not respond to a particular hormone, the hormone has no effect on it.

In general, the body’s responses to hormones are slower and longer-lasting than the responses to nerve impulses. It may take several minutes, several hours, or even several days for a hormone to have its full effect on its target cells. A nerve impulse, on the other hand, may take only a fraction of a second to reach and affect its target cells.

 **Figure 39–1**  The endocrine system releases hormones that affect the activities of other cells. Much of the increase in heart rate and breathing that the people are experiencing on this ride is due to the actions of hormones.



Guide for Reading

Key Concepts

- What is the function of the endocrine system?
- How does the endocrine system maintain homeostasis?

Vocabulary

hormone
target cell
exocrine gland
endocrine gland
prostaglandin

Reading Strategy: Making Comparisons

As you read, list the differences and similarities between types of glands, and between types of hormones.

Section 39–1

1 FOCUS

Objectives

- 39.1.1 State** the function of the endocrine system.
- 39.1.2 Describe** hormones and glands.
- 39.1.3 Explain** how the endocrine system maintains homeostasis.

Guide for Reading

Reading Strategy

Explain to students that the prefix *endo-* means “within” and that endocrine glands are glands that secrete substances into the bloodstream within the body. Ask: **If *exo-* means “outside,” what do you think exocrine glands are?** (*Glands that secrete substances to the outside*) These substances pass out of the glands into ducts, which lead either directly to the outside of the body (sweat or milk ducts) or into internal structures (saliva and digestive enzymes).

Reading Strategy

Have students study the figures and read the captions to preview the material in the section. Suggest that they write down any questions they have about the material based on the figures and then try to find the answers as they read the section.

2 INSTRUCT

Hormones

Build Science Skills

Using Analogies Help students understand the endocrine system by comparing it with familiar human relationships in which one person directs the actions of others—such as coach and team, conductor and orchestra members, traffic officer and motorists, and movie director and actors. Ask: **How are these relationships similar to those of the endocrine system?** (*An endocrine gland is like a director, the hormones are like verbal or visual directions, and cells are like the people being directed.*) **L1**



SECTION RESOURCES

Print:

- **Teaching Resources**, Lesson Plan 39–1, Adapted Section Summary 39–1, Adapted Worksheets 39–1, Section Summary 39–1, Worksheets 39–1, Section Review 39–1
- **Reading and Study Workbook A**, Section 39–1
- **Adapted Reading and Study Workbook B**, Section 39–1

Technology:

- **iText**, Section 39–1
- **Transparencies Plus**, Section 39–1

39-1 (continued)

Demonstration

Demonstrate hormone-target cell interactions with a model. Have students use an empty egg carton to model a tissue. First, they should create “target cells” by cutting small holes in the top of the carton over a few of the sections. Then, they should pour water over the egg carton to model a circulating hormone. Ask: **Which cells in your model contain hormone?** (*Just the target cells*) **What effect did the hormone have on the other cells?** (*none*) **L1 L2**

Glands

Build Science Skills

Inferring Call on students at random to compare and contrast endocrine and exocrine glands. (*Endocrine glands release their hormones into the bloodstream; exocrine glands release their products through ducts into open spaces.*) Then, ask: **Based on how they release their hormones, what can you infer about the effects on the body of hormones released by endocrine glands and products released by exocrine glands?** (*Hormones released by endocrine glands can affect cells throughout the body, whereas products released by exocrine glands tend to have local effects.*) **L2**

Use Visuals

Figure 39-2 Call students’ attention to the figure. Make sure they understand that the ovaries are found only in females and the testes only in males. Name several different glands, and have students locate them in the figure. As students locate each gland, ask: **What hormones does the gland produce, and what roles do the hormones play in the body?** (*Students should identify the hormones and roles of the glands by reading the appropriate labels in the figure.*) **L1**

Glands

A gland is an organ that produces and releases a substance, or secretion. **Exocrine glands** release their secretions, through tubelike structures called ducts, directly to the organs that use them. Exocrine glands include those that release sweat, tears, and digestive juices. Unlike exocrine glands, **endocrine glands** release their secretions (hormones) directly into the bloodstream. **Figure 39-2** shows the location of the major endocrine glands in the human body.

▼ **Figure 39-2** Endocrine glands produce hormones that affect many parts of the body. **Interpreting Graphics** *What is the function of the pituitary gland?*

CHECKPOINT *What are exocrine glands?*

Hypothalamus

The hypothalamus makes hormones that control the pituitary gland. In addition, it makes hormones that are stored in the pituitary gland.

Pituitary gland

The pituitary gland produces hormones that regulate many of the other endocrine glands.

Parathyroid glands

These four glands release parathyroid hormone, which regulates the level of calcium in the blood.

Thymus

During childhood, the thymus releases thymosin, which stimulates T cell development and proper immune response.

Adrenal glands

The adrenal glands release epinephrine and norepinephrine, which help the body respond to stress.

Pineal gland

The pineal gland releases melatonin, which is involved in rhythmic activities, such as daily sleep-wake cycles.

Thyroid

The thyroid produces thyroxine, which regulates metabolism throughout the body.

Pancreas

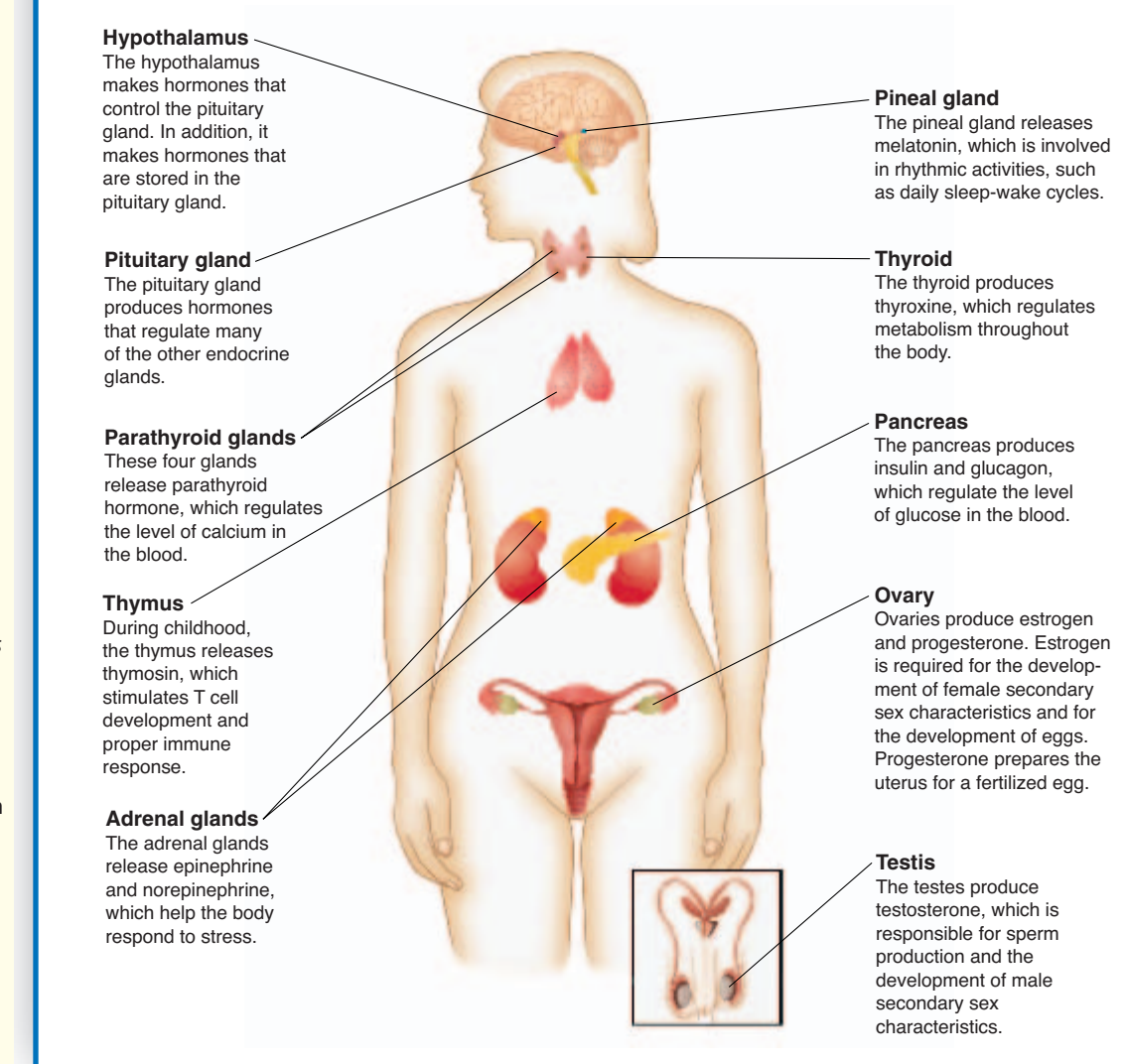
The pancreas produces insulin and glucagon, which regulate the level of glucose in the blood.

Ovary

Ovaries produce estrogen and progesterone. Estrogen is required for the development of female secondary sex characteristics and for the development of eggs. Progesterone prepares the uterus for a fertilized egg.

Testis

The testes produce testosterone, which is responsible for sperm production and the development of male secondary sex characteristics.



UNIVERSAL ACCESS

Inclusion/Special Needs

Help students understand hormone action. First, guide them in creating two parallel flowcharts, one showing how a steroid hormone interacts with a target cell and the other showing how a nonsteroid hormone interacts with a target cell. Then, after the flowcharts are completed, have students identify differences between the two types of hormone action by comparing the flowcharts, step by step. **L1**

Advanced Learners

Challenge students to learn more about prostaglandins. Ask them to find out how prostaglandins were discovered, how they differ from other hormones, and the roles played by specific prostaglandins, such as those in the uterus, blood vessels, or bronchioles. Urge students to share what they learn with the class in a PowerPoint® presentation. **L3**