Before You Read

On the lines below, describe how your body felt during a stressful situation. Then read the section to learn how the endocrine system participates in the fight or flight response.

Read to Learn

Action of Hormones

The endocrine system is composed of glands and works as a communication system. **Endocrine glands** produce hormones, which are released into the bloodstream and distributed to body cells. A **hormone** acts on certain target cells and tissues to produce a specific response.

Hormones are classified as steroid hormones and nonsteroid, or amino acid, hormones based on their structure and how they do their job.

**How do steroid hormones produce a response?**

All steroid hormones cause target cells to start protein synthesis. Steroid hormones diffuse through the plasma membrane of target cells and bind to receptors inside the cell. The hormones and receptors move together into the cell nucleus, where they bind to DNA, activating certain genes.

**How do amino acid hormones work?**

Nonsteroid hormones are made of amino acids. They cannot diffuse into a cell. Instead, they bind with receptors on the plasma membrane of target cells, activating an enzyme inside the membrane that produces the desired response.

Make an Outline

Make an outline of the information you learn in this section. Start with the headings. Include the underlined terms.

Organize Information

Make a Foldable chart, as shown below. As you read, include information about glands or organs, the hormones they produce, and their functions.
Negative Feedback

An internal feedback process called negative feedback maintains homeostasis in the body. When a body system is too different from a set point, negative feedback returns the system to the set point.

For example, parathyroid hormone maintains the proper amount of calcium in the blood. If blood calcium drops below a certain level, the parathyroid glands respond by releasing more hormone. The hormone causes calcium to be released from the bones. This raises the amount of calcium in the blood. If the amount of calcium in the blood rises too high, parathyroid glands stop making the hormone, causing the opposite effect.

Endocrine Glands and Their Hormones

The endocrine system includes all the glands that secrete hormones. The locations of these glands are shown in the figure on the next page.

Why is the pituitary gland called the master gland?

The pituitary gland secretes hormones that control many body functions as well as other endocrine glands. The pituitary gland is sometimes called the “master gland.” It is located at the base of the brain. Human growth hormone secreted by the pituitary gland stimulates cell division in muscle and bone tissue.

How do parathyroid and thyroid glands work together?

The thyroid gland makes thyroxine and calcitonin. Thyroxine does not act on specific organs. Instead, it causes body cells to have a higher metabolic rate. Calcitonin (kal suh TOH nun) is partly responsible for controlling blood clotting, nerve function, and muscle contraction. Calcitonin also lowers blood calcium levels by signaling bones to absorb more calcium and also by signaling the kidneys to excrete more calcium.

When blood calcium levels are too low, the parathyroid glands make more parathyroid hormone. Parathyroid hormone increases blood calcium levels by stimulating the bones to release calcium. They also cause the kidneys to reabsorb more calcium and the intestines to absorb more calcium from food. The hormones of the thyroid and parathyroid work together to maintain homeostasis.
What hormones does the pancreas secrete?
The pancreas secretes insulin and glucagon, which work together to maintain homeostasis. When blood glucose levels are high, the pancreas secretes insulin. **Insulin** signals body cells to convert more glucose to glycogen, which is stored in the liver. When blood glucose levels are low, the pancreas secretes glucagon. **Glucagon** (GLEW kuh gahn) signals liver cells to convert glycogen to glucose and release the glucose into the blood. The process is shown in the figure below.

What do adrenal hormones affect?
The adrenal glands are located just above the kidneys. The adrenal cortex, or outer part, makes steroid hormones. The hormone **aldosterone** (al DAWS tuh rohn) affects the kidneys and aids sodium reabsorption. **Cortisol** raises blood glucose levels and reduces inflammation.

How do adrenal glands respond to stress?
During a stressful situation, the adrenal glands create a sudden burst of energy. The inner part of the adrenal glands secretes epinephrine (eh puh NEH frun), also called adrenaline, and norepinephrine. These hormones work together to increase heart rate, blood pressure, breathing rate, and blood sugar levels. All of these responses increase the activity of body cells as part of the fight or flight response.
Link to the Nervous System

Both the nervous and endocrine systems regulate the activities of the body and help maintain homeostasis. The hypothalamus, located in the brain, serves as a link between the nervous system and the endocrine system. The hypothalamus produces two hormones—antidiuretic hormone (ADH) and oxytocin (ahk sih TOH sun). You will learn about oxytocin in Chapter 36.

The antidiuretic (AN ti DY yuh REH tic) hormone (ADH) controls water balance. ADH affects collecting tubules in the kidneys.

Cells in your hypothalamus detect when the level of water in your blood drops too low. The hypothalamus responds by releasing ADH. The figure below illustrates how ADH works. ADH travels in the blood to the kidneys. There, it binds with receptors on certain kidney cells. This causes the kidneys to reabsorb more water and decrease the amount of water leaving the body as urine.

If the level of water in your blood rises too high, the hypothalamus releases less ADH. This causes the kidneys to reabsorb less water and increases the amount of water leaving the body as urine.

6. Decide What two hormones are produced by the hypothalamus?

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7. Identify ADH helps maintain homeostasis by controlling the balance of which important substance in the body? (Circle your answer.)
   a. calcium
   b. glucose
   c. water