The endocrine glands regulate and integrate all body functions. Disorders result from a hypersecretion or hyposecretion of the hormones released by the glands. Many factors can influence hormonal imbalance such as tumors, infections, surgical removal, and overstimulation or understimulation by an indirect hormone.

**Structure and Function of the Endocrine System**

The endocrine system is made up of small glands that maintain and achieve homeostasis (balance) in the body. From the 4-ounce pancreas to the pea-sized pineal, these glands work with the circulatory and nervous system to control the body. The endocrine glands include the pituitary, pineal, thyroid, parathyroids, thymus, pancreas, adrenals, ovaries, and testes (Figure 29-1). Table 29-1 lists the endocrine organs and their function. Note: The gonads (ovaries and testes) are discussed in depth in separate chapters. Chapter 30 covers the male reproductive system and disorders, and Chapter 39 covers the female reproductive system and disorders.

Glands are categorized into two groups: endocrine and exocrine glands. The ductless endocrine glands secrete substances directly into the blood, which circulate to target cells in the body. These substances, called **hormones**, are chemical messengers that function individually, in conjunction with another hormone, or as part of interconnected actions. Target cells are cells found in target organs that are influenced either by neurotransmitters or hormones. An example of an endocrine gland is the thyroid gland, which secretes thyroid hormones directly into the bloodstream. The hormones then affect target cells in various tissues throughout the body. Exocrine glands secrete substances through ducts that reach the epithelial surface inside the body or on the skin. An example of an exocrine gland is a sweat gland. It produces fluid that is secreted through ducts to the surface of the skin. Some glands function as both endocrine and exocrine glands. An example of this is the pancreas. The pancreas releases pancreatic enzymes through a duct into the duodenum to break down foods for digestion. It also releases insulin directly into the bloodstream to help the body use glucose.

**Tropic hormones** (indirect-acting hormones) are secreted by one gland and target another endocrine gland, stimulating growth and secretion. For example, thyroid-stimulating hormone is secreted by the pituitary. It is **thyrotropic** (stimulates the target cells in the thyroid gland to release the thyroid hormones). Direct-acting hormones are ones that have a specific local effect. For example, the pancreas releases insulin specifically to affect the level of glucose in the blood.

**HYPOTHALAMUS**

Although the pituitary gland has been called the “master gland” of the endocrine system, it is itself controlled by the hypothalamus, located at the base of the brain. The hypothalamus is the command center for the autonomic nervous system, which influences involuntary activities. The hypothalamus is joined to the pituitary by nerve fibers and blood vessels. It also produces the hormones vasopressin and oxytocin and then stores them in the posterior pituitary.

**Negative feedback** is a method by which hormone production is decreased. Generally endocrine glands have a tendency to oversecrete hormones. Then, when the desired effect has been achieved, information is sent back to the gland that enough hormone has been produced. The gland then slows (inhibits) further secretions. For example, when the blood level of a certain hormone is high, the hypothalamus sends the message to decrease the production of that hormone. The endocrine gland responds to that inhibiting factor, and the correct blood level of the hormone is maintained. If the hormone level is low, the hypothalamus sends a message to release more of the hormone.

**PITUITARY GLAND (HYPOPHYSIS)**

The pituitary, also referred to as the **hypophysis**, is a small but powerful gland. It is well protected, sitting at the base of the brain.