BOX 22–1

MAJOR HORMONES AND THEIR GENERAL FUNCTIONS

Anterior pituitary hormones are growth hormone (also called somatotropin), corticotropin, thyroid-stimulating hormone, follicle-stimulating hormone, luteinizing hormone, and prolactin. Most of these hormones function by stimulating secretion of other hormones.

Posterior pituitary hormones are antidiuretic hormone (ADH or vasopressin) and oxytocin. ADH helps maintain fluid balance; oxytocin stimulates uterine contractions during childbirth.

Adrenal cortex hormones, commonly called corticosteroids, include the glucocorticoids, such as cortisol, and the mineralocorticoids, such as aldosterone. Glucocorticoids influence carbohydrate storage, exert anti-inflammatory effects, suppress corticotropin secretion, and increase protein catabolism. Mineralocorticoids help regulate electrolyte balance, mainly by promoting sodium retention and potassium loss. The adrenal cortex also produces sex hormones. The adrenal medulla hormones are epinephrine and norepinephrine (see Chap. 17).

Thyroid hormones include triiodothyronine (T_3 or liothyronine) and tetraiodothyronine (T_4 or thyroxine). These hormones regulate the metabolic rate of the body and greatly influence growth and development.

Parathyroid hormone, also called parathormone or PTH, regulates calcium and phosphate metabolism.

Pancreatic hormones are insulin and glucagon, which regulate the metabolism of glucose, lipids, and proteins.

Ovarian hormones (female sex hormones) are estrogens and progesterone. Estrogens promote growth of specific body cells and development of most female secondary sexual characteristics. Progesterone helps prepare the uterus for pregnancy and the mammary glands for lactation.

Testicular hormone (male sex hormone) is testosterone, which regulates development of masculine characteristics.

Placental hormones are chorionic gonadotropin, estrogen, progesterone, and human placental lactogen, all of which are concerned with reproductive functions.

hibitory factors, which regulate functions of the anterior pituitary. The anterior pituitary, in turn, secretes hormones that act on target tissues, usually to stimulate production of other hormones. For example, hypothalamic corticotropin-releasing hormone stimulates the anterior pituitary to produce corticotropin, and corticotropin, in turn, stimulates the adrenal cortex to produce cortisol. This complex interrelationship is often referred to as the *hypothalamic–pituitary–adrenocortical* axis. It functions by a *negative feedback* system, in which hormone secretion is stimulated when hormones are needed and inhibited when they are not needed. The hypothalamic–pituitary–thyroid axis also functions by a negative feedback mechanism.

GENERAL CHARACTERISTICS OF HORMONES

Hormones are extremely important in regulating body activities. Their normal secretion and function help to maintain the internal environment and determine response and adaptation to the external environment. Hormones participate in complex interactions with other hormones and nonhormone chemical substances in the body to influence every aspect of life. Although hormones are usually studied individually, virtually all endocrine functions are complex processes that are influenced by more than one hormone.

Although hormones circulating in the bloodstream reach essentially all body cells, some (eg, growth hormone, thyroid hormone) affect almost all cells, whereas others affect specific "target" tissues (eg, corticotropin stimulates the adrenal cortex). In addition, *one hormone can affect different tissues* (eg, ovarian estrogen can act on ovarian follicles to promote their maturation, on the endometrial lining of the uterus to stimulate its growth and cyclic changes, on breast tissue to stimulate growth of milk ducts, and on the hypothalamic–pituitary system to regulate its own secretion), or *several hormones can affect a single tissue or function* (eg, catecholamines, glucagon, secretin, and prolactin regulate lipolysis [release of fatty acids from adipose tissue]).

Several hormones are secreted in cyclic patterns. For example, ACTH, cortisol, and growth hormone are secreted in 24-hour (circadian) cycles, whereas estrogen and progestin secretion is related to the 28-day menstrual cycle.

Hormone Pharmacokinetics

Protein-derived hormones (amines, amino acids, peptides, and polypeptides) are synthesized, stored, and released into the bloodstream in response to a stimulus. The steroid hormones, which are synthesized in the adrenal cortex and gonads from cholesterol, are released as they are synthesized. Most hormones are constantly present in the blood; plasma concentrations vary according to body needs, the rate of synthesis and release, and the rate of metabolism and excretion.

Protein-derived hormones usually circulate in an unbound, active form. Steroid and thyroid hormones are transported by specific carrier proteins synthesized in the liver. (Some drugs may compete with a hormone for binding sites on the carrier protein. If this occurs, hormone effects are enhanced because more unbound, active molecules are available to act on body cells.)

Hormones must be continuously inactivated to prevent their accumulation and excessive effects. Several mechanisms operate to eliminate hormones from the body. The water-soluble, protein-derived hormones have a short duration of action and are inactivated by enzymes mainly in the liver and kidneys. The lipid-soluble steroid and thyroid hormones have a longer duration of action because they are bound to plasma proteins. Once released by the plasma proteins, these hormones are conjugated in the liver to inactive