target tissues; the other five act indirectly by stimulating target tissues to produce other hormones.

Corticotropin, also called ACTH, stimulates the adrenal cortex to produce corticosteroids. Secretion is controlled by the hypothalamus and by plasma levels of cortisol, the major corticosteroid. When plasma levels are adequate for body needs, the anterior pituitary does not release corticotropin (negative feedback mechanism).

Growth hormone, also called somatotropin, stimulates growth of body tissues. It promotes an increase in cell size and number, including growth of muscle cells and lengthening of bone, largely by affecting metabolism of carbohydrate, protein, fat, and bone tissue. For example, it regulates cell division and protein synthesis required for normal growth. In children, levels of growth hormone rise rapidly during adolescence, peak in the 20s, then start to decline. Deficient growth hormone in children produces dwarfism, a condition marked by severely decreased linear growth and, frequently, severely delayed mental, emotional, dental, and sexual growth as well. Deficient hormone in adults (less than expected for age) can cause increased fat, reduced skeletal and heart muscle mass, reduced strength, reduced ability to exercise, and worsened cholesterol levels (ie, increased low-density lipoprotein [LDL] cholesterol and decreased high-density lipoprotein [HDL] cholesterol), which increase risk factors for cardiovascular disease.

Excessive growth hormone in preadolescent children produces gigantism, resulting in heights of 8 or 9 feet if untreated. Excessive growth hormone in adults produces acromegaly, which distorts facial features and is associated with an increased incidence of diabetes mellitus and hypertension.

Thyrotropin (also called TSH) regulates secretion of thyroid hormones. Thyrotropin secretion is controlled by a negative feedback mechanism in proportion to metabolic needs. Thus, increased thyroid hormones in body fluids inhibit secretion of thyrotropin by the anterior pituitary and of TRH by the hypothalamus.

FSH, one of the gonadotropins, stimulates functions of sex glands. It is produced by the anterior pituitary gland of both sexes, beginning at puberty. FSH acts on the ovaries in a cyclical fashion during the reproductive years, stimulating growth of ovarian follicles. These follicles then produce estrogen, which prepares the endometrium for implantation of a fertilized ovum. FSH acts on the testes to stimulate the production and growth of sperm (spermatogenesis), but it does not stimulate secretion of male sex hormones. Drug preparations of FSH include urofollitropin (Fertinex), follitropin alfa (Gonal-F), and follitropin beta (Follistim). These drugs are used to stimulate ovarian function in the treatment of infertility.

LH (also called *interstitial cell-stimulating hormone*) is another gonadotropin that stimulates hormone production by the gonads of both sexes. In women, LH is important in the maturation and rupture of the ovarian follicle (ovulation). After ovulation, LH acts on the cells of the collapsed sac to produce the corpus luteum, which then produces progesterone during the last half of the menstrual cycle. When blood progesterone levels rise, a negative feedback effect is exerted on hypothalamic and anterior pituitary secretion of gonadotropins. Decreased pituitary secretion of LH causes the corpus luteum to die and stop producing progesterone. Lack of progesterone causes slough and discharge of the endometrial lining as menstrual flow. (Of course, if the ovum has been fertilized and attached to the endometrium, menstruation does not occur.) In men, LH stimulates the Leydig's cells in the spaces between the seminiferous tubules. These cells then secrete androgens, mainly testosterone.

Prolactin plays a part in milk production by nursing mothers. It is not usually secreted in nonpregnant women because of the hypothalamic hormone PIF. During late pregnancy and lactation, various stimuli, including suckling, inhibit the production of PIF, and thus prolactin is synthesized and released.

Melanocyte-stimulating hormone plays a role in skin pigmentation, but its function in humans is not clearly delineated.

Posterior Pituitary Hormones

The posterior pituitary gland stores and releases two hormones that are synthesized by nerve cells in the hypothalamus.

Antidiuretic hormone (ADH), also called vasopressin, functions to regulate water balance. When ADH is secreted, it makes renal tubules more permeable to water. This allows water in renal tubules to be reabsorbed into the plasma and so conserves body water. In the absence of ADH, little water is reabsorbed, and large amounts are lost in the urine.

Antidiuretic hormone is secreted when body fluids become concentrated (high amounts of electrolytes in proportion to the amount of water) and when blood volume is low. In the first instance, ADH causes reabsorption of water, dilution of extracellular fluids, and restoration of normal osmotic pressure. In the second instance, ADH raises blood volume and arterial blood pressure toward homeostatic levels.

Oxytocin functions in childbirth and lactation. It initiates uterine contractions at the end of gestation to induce childbirth, and it causes milk to move from breast glands to nipples so the infant can obtain the milk by suckling.

THERAPEUTIC LIMITATIONS

There are few therapeutic uses for hypothalamic hormones and pituitary hormones. Most hypothalamic hormones are used to diagnose pituitary insufficiency. Pituitary hormones are not used extensively because most conditions in which they are indicated are uncommon; other effective agents are available for some uses; and deficiencies of target gland hormones (eg, corticosteroids, thyroid hormones, male or female sex hormones) are usually more effectively treated with those hormones than with anterior pituitary hormones that stimulate their secretion. However, the hormones perform important functions when used in particular circumstances, and drug formulations of most hormones have been synthesized for these purposes.