

Biologic Development

The physical changes of puberty are primarily the result of hormonal activity and are controlled by the anterior pituitary gland in response to a stimulus from the hypothalamus. The obvious physical changes are noted in increased physical growth and in the appearance and development of secondary sex characteristics; less obvious are physiologic alterations and neurogonadal maturity, accompanied by the ability to procreate. Physical distinction between the sexes is made on the basis of distinguishing characteristics. **Primary sex characteristics** are the external and internal organs that carry out the reproductive functions (e.g., ovaries, uterus, breasts, penis). **Secondary sex characteristics** are the changes that occur throughout the body as a result of hormonal changes (e.g., voice alterations, development of facial and pubertal hair, fat deposits) but that play no direct part in reproduction.

Neuroendocrine Events of Puberty

The events of puberty are caused by a cluster of events that trigger the production of gonadotropin-releasing hormone (GnRH) by the hypothalamus. GnRH travels to the anterior pituitary gland, where it stimulates the production and secretion of follicle-stimulating hormone (FSH) and luteinizing hormone (LH). Increasing levels of FSH and LH stimulate a gonadal response, which for females consists of growth of ovarian follicles, production of estrogen, and initiation of ovulation; for males, it consists of maturation of the testicles and testosterone and stimulation of sperm production.

The ovaries, testes, and adrenals secrete sex hormones. These hormones are produced in varying amounts by both sexes throughout the life span. The adrenal cortex is responsible for the small amounts secreted before the pubescent years, but the sex hormone production that accompanies maturation of the gonads is responsible for the biologic changes observed during puberty.

Estrogen, the feminizing hormone, is found in low quantities during childhood. Beginning in early puberty, FSH stimulates estrogen production by the ovaries; however, estrogen levels are not high enough to cause ovulation until mid-puberty. The increasing quantity of estrogen in early puberty causes a building of the endometrial lining of the uterus and first menstruation, or