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Male Reproductive Endocrinology

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INTRODUCTION

The testes are composed of Leydig (interstitial) cells, which secrete testosterone and estradiol, and the seminiferous tubules, which produce sperm. They are regulated by the luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which are secreted by the anterior pituitary under the influence of the hypothalamic decapeptide gonadotropin-releasing hormone (GnRH) (Fig. 65-1). LH stimulates the Leydig cells to secrete testosterone, which feeds back in a negative fashion at the level of the pituitary and hypothalamus to inhibit further LH production. FSH stimulates sperm production through interaction with the Sertoli cells in the seminiferous tubules. Feedback inhibition of FSH is through gonadal steroids, as well as through inhibin, a glycoprotein produced by Sertoli cells.

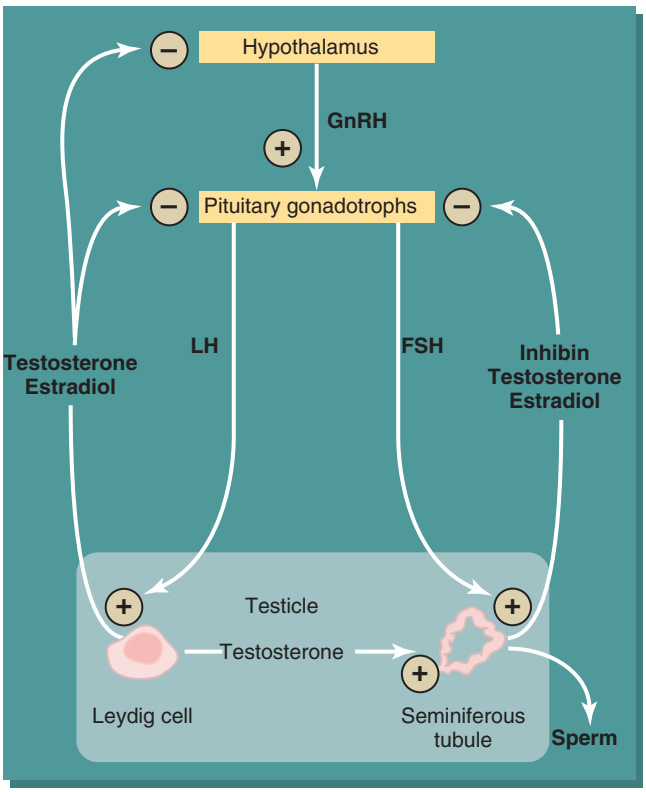

FIGURE 65-1 Regulation of the hypothalamic-pituitary-testicular axis. The *plus (+)* and *minus (–)* symbols indicate positive and negative feedback, respectively. FSH, Follicle-stimulating hormone; GnRH, gonadotropin-releasing hormone; LH, luteinizing hormone.

Biochemical evaluation of the hypothalamic-pituitary-Leydig axis is carried out by measurement of serum LH and testosterone concentrations, whereas a semen analysis and serum FSH determination provide an assessment of the hypothalamic-pituitary-seminiferous tubular axis. The ability of the pituitary to release gonadotropins can be tested dynamically through GnRH stimulation, and the ability of the testes to secrete testosterone can be evaluated through injections of human chorionic gonadotropin (HCG), a glycoprotein hormone that has biologic activity similar to that of LH.

HYPOGONADISM

Either testosterone deficiency or defective spermatogenesis constitutes *hypogonadism*. Often both disorders coexist. The clinical manifestations of androgen deficiency depend on the time of onset and the degree of deficiency. Testosterone is required for development of the wolffian duct into the epididymis, vas deferens, seminal vesicles, and ejaculatory ducts, as well as for virilization of the external genitalia through the major intracellular testosterone metabolite, dihydrotestosterone (DHT). Consequently, early prenatal androgen deficiency leads to the formation of ambiguous genitalia and to male pseudohermaphroditism. Androgen deficiency occurring later during gestation may result in micropenis or *cryptorchidism*, the unilateral or bilateral absence of testes in the scrotum resulting from the failure of normal testicular descent.

During puberty, androgens are responsible for male sexual differentiation, which includes growth of the scrotum, epididymis, vas deferens, seminal vesicles, prostate, penis, skeletal muscle, and larynx. Additionally, androgens stimulate the growth of axillary, pubic, facial, and body hair and increase sebaceous gland activity. They are also responsible through conversion to estrogens for the growth and fusion of the epiphyseal cartilaginous plates, clinically seen as the *pubertal growth spurt*. Prepubertal androgen deficiency leads to poor muscle development, decreased strength and endurance, a high-pitched voice, sparse axillary and pubic hair, and the absence of facial and body hair. The long bones of the lower extremities and arms may continue to grow under the influence of growth hormone; this condition leads to eunuchoid proportions (i.e., arm span exceeding total height by ≥5 cm) and greater growth of the lower extremities relative to total height. Postpubertal androgen deficiency may result in a decrease in libido, impotence, low energy, fine wrinkling around the corners of the eyes and mouth, and diminished facial and body hair.