

that produces the stimulating hormone, a process known as *feedback inhibition*.

Several processes can disturb the normal activity of the endocrine system, including impaired synthesis or release of hormones, abnormal interactions between hormones and their target tissues, and abnormal responses of target organs. Endocrine diseases can be generally classified as (1) diseases of *underproduction or overproduction* of

hormones and their resulting biochemical and clinical consequences, and (2) diseases associated with the development of *mass lesions*. Such lesions might be nonfunctional, or they might be associated with overproduction or underproduction of hormones. The study of endocrine diseases requires integration of morphologic findings with biochemical measurements of the levels of hormones, their regulators, and other metabolites.

## PITUITARY GLAND

The pituitary gland is composed of two morphologically and functionally distinct components: the anterior lobe (adenohypophysis) and the posterior lobe (neurohypophysis). The *anterior pituitary* constitutes about 80% of the gland. The production of most pituitary hormones is controlled in large part by positively and negatively acting factors from the hypothalamus (Fig. 24-1), which are carried to the anterior pituitary by a portal vascular system.

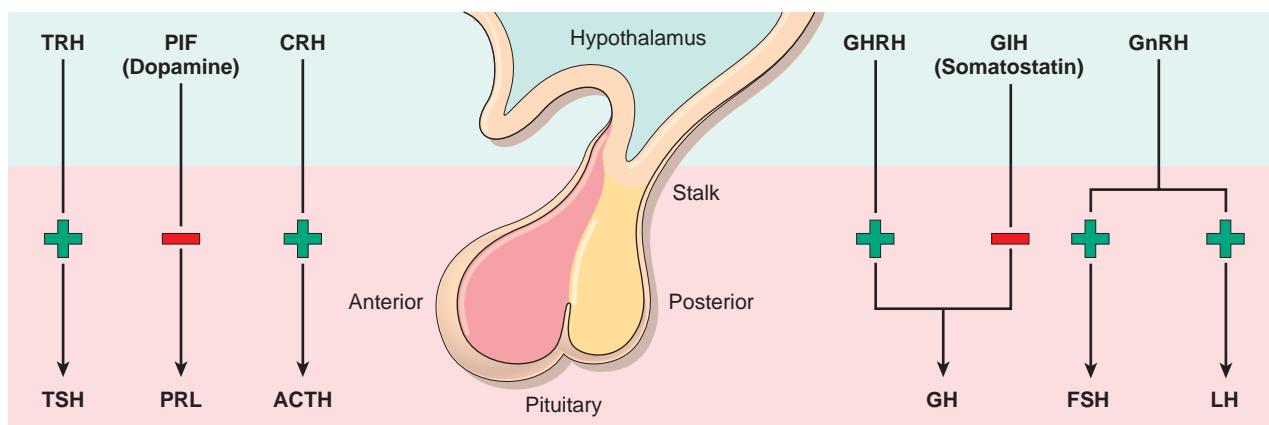
In routine histologic sections of the anterior pituitary, a colorful array of cells is present that contain eosinophilic cytoplasm (*acidophil*), basophilic cytoplasm (*basophil*), or poorly staining cytoplasm (*chromophobe*) cells (Fig. 24-2). There are six terminally differentiated cell types in the anterior pituitary, including:

- Somatotrophs, producing growth hormone (GH)
- Mammosomatotrophs, producing GH and prolactin (PRL)
- Lactotrophs, producing PRL
- Corticotrophs, producing adrenocorticotropic hormone (ACTH) and pro-opiomelanocortin (POMC), melanocyte-stimulating hormone (MSH)
- Thyrotrophs, producing thyroid-stimulating hormone (TSH), and
- Gonadotrophs, producing follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH stimulates

the formation of graafian follicles in the ovary, and LH induces ovulation and the formation of corpora lutea in the ovary. The same two hormones also regulate spermatogenesis and testosterone production in males

Specific *transcription factors* have been identified that regulate the differentiation of pluripotent stem cells within the Rathke's pouch into these terminally differentiated cell types. For example, somatotrophs, mammosomatotrophs, and lactotrophs are derived from stem cells that express the pituitary transcription factor, PIT-1. By contrast steroidogenic factor -1 (SF-1) and GATA-2 are factors that are required for gonadotroph differentiation.

The *posterior pituitary* consists of modified glial cells (termed *pituicytes*) and axonal processes extending from the hypothalamus through the pituitary stalk to the posterior lobe (*axon terminals*). Two peptide hormones are secreted from the posterior pituitary, *oxytocin* and *antidiuretic hormone* (ADH, also called *vasopressin*). These are actually synthesized in the hypothalamus and stored within the axon terminals residing in the posterior pituitary. In response to appropriate stimuli, the preformed hormones are released directly into the systemic circulation through the venous channels of the pituitary. For example, dilation of the cervix in pregnancy results in massive oxytocin release, leading to contraction of the



**Figure 24-1** Hormones released by the anterior pituitary. The adenohypophysis (anterior pituitary) releases five hormones that are in turn under the control of various stimulatory and inhibitory hypothalamic releasing factors. TSH, Thyroid-stimulating hormone (thyrotropin); PRL, prolactin; ACTH, adrenocorticotropic hormone (corticotropin); GH, growth hormone (somatotropin); FSH, follicle-stimulating hormone; LH, luteinizing hormone. The stimulatory releasing factors are TRH (thyrotropin-releasing hormone), CRH (corticotropin-releasing hormone), GHRH (growth hormone-releasing hormone), GnRH (gonadotropin-releasing hormone). The inhibitory hypothalamic influences comprise PIF (prolactin inhibitory factor or dopamine) and growth hormone inhibitory factor (GIH or somatostatin).