

HYPOTHALAMUS HORMONES AND RELEASING FACTORIES

The hypothalamus produces two types of endocrine factors;

(a) the hypothalamic neuropeptides

(b) the hypothalamic releasing factors. The releasing factors are inhibitory neuro-secretions synthesized in the hypothalamus and released through the hypothalamic-pituitary portal circulation. They affect the secretion of pituitary tropic hormones.

1. HYPOTHALAMIC NEUROPEPTIDES

The supraoptic and paraventricular nuclei of the hypothalamus produce the hypothalamic neuropeptides. These neurohormones are **anti-diuretic hormone (ADH) and oxytocin**. The precursors of ADH and oxytocin are long polypeptides synthesized in the hypothalamus.

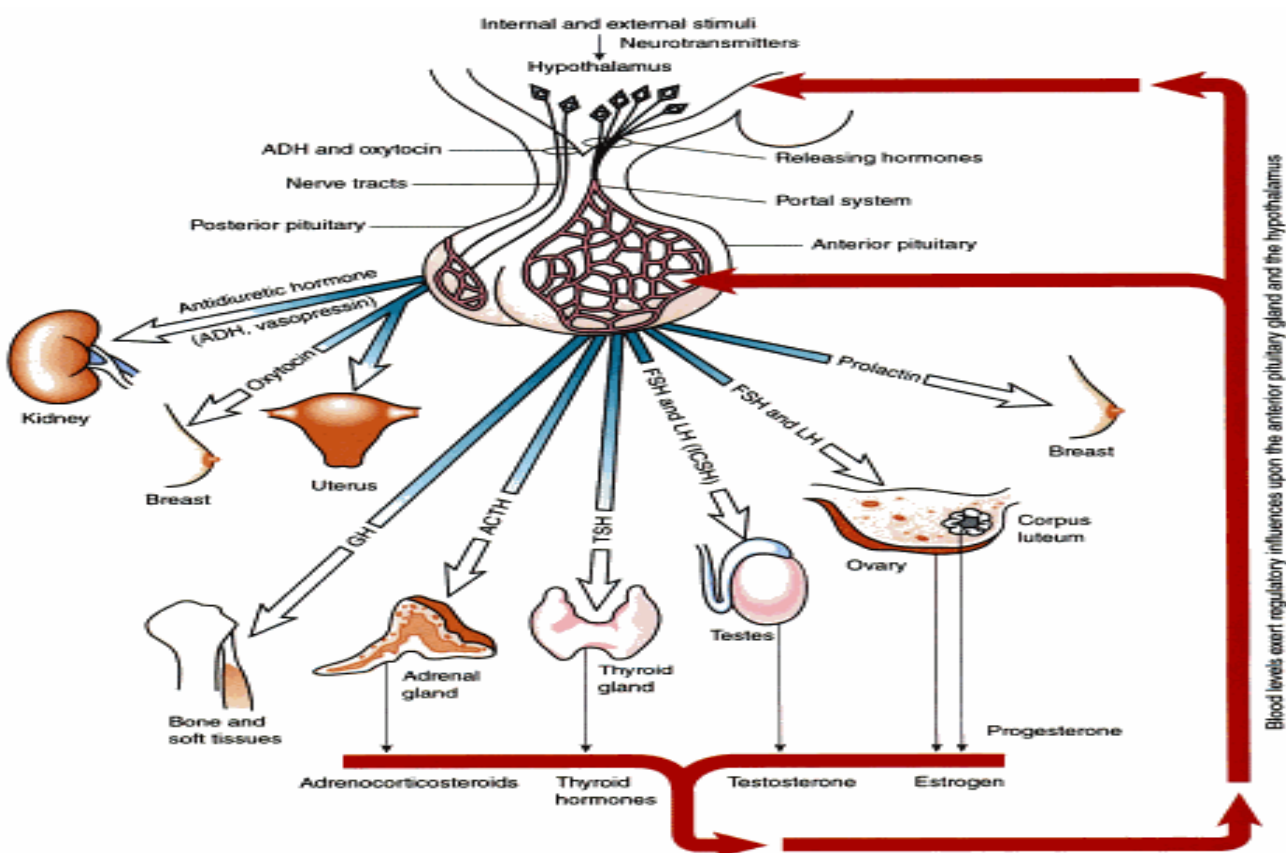


FIGURE 20-2. The pituitary gland, the relationship of the hypothalamus to pituitary action, and the hormones secreted by the anterior, middle, and posterior pituitary lobes.

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2. HYPOTHALAMIC RELEASING FACTORS

The secretion of hormones by adenohypophysis or anterior pituitary is under the control of peptides secreted by the hypothalamus. Several peptides that have effects on the anterior pituitary, either stimulant (releasing factors) or inhibitory, have been identified. The secretion of the hypothalamic peptides is also under the feedback control of anterior pituitary tropic hormones (short loop feedback) as well as the target gland hormones. The median eminence of the hypothalamus is connected directly to the pituitary stalk. Within this stalk is a portal system of blood vessels required to maintain the normal secretory activity of the pituitary gland. The activities of the cells of the anterior lobe are controlled by the nerve cells of the hypothalamus, which send axons to the capillary beds. The nerve endings liberate chemical substances, hypothalamic-releasing factors, or hormones. At present, **10 discrete regulatory factors** have been described that may affect the synthesis and secretion of specific pituitary hormones. Four hypothalamic-releasing hormones (GHRH, corticotropin-releasing hormone [CRH], thyrotropin-releasing hormone [TRH], and gonadotropin-releasing hormone [GnRH]) traverse the hypothalamic portal vessels and impinge upon their respective transmembrane trophic hormone-secreting cell receptors. These distinct cells express GH, ACTH, TSH, and gonadotropins, respectively. In contrast, hypothalamic somatostatin and dopamine suppress GH or PRL and TSH secretion, respectively.

Name	Chemical nature	Biological actions
TRH; thyrotropin releasing hormone	Tripeptide; (pyro-Glu-His-Pro-NH ₂)	Induces secretion of TSH and PRL; neuromodulator
GnRH; gonadotropin releasing hormone	Biologically active portion is a decapeptide	Releases LH and FSH; induces spermatogenesis, ovulation and testosterone
GHRH; growth hormone releasing hormone	37-44 amino acid; amino terminal end is tyrosine	Stimulates growth hormone secretion
CRF; corticotropin releasing factor	Amidated peptide with 41 amino acids	Release of ACTH. Inhibited by cortisol.
Somatostatin; growth hormone inhibitory factor	Cyclic peptide with 14 amino acids	Inhibits secretion of GH and TSH. Inhibits gut hormones, pancreatic and gastric secretion
PIF; prolactin inhibitory factor	Dopamine	Inhibits PRL release

3. HORMONES OF THE ANTERIOR PITUITARY

The anterior pituitary hormones are tropic, stimulating the secretion of hormones from target organs. Secretions of all these hormones are controlled by hypothalamic-releasing or inhibitory factors.

REGULATION OF HORMONE SECRETION

Hormone secretion is strictly under the control of several mechanisms.

A. Neuroendocrinal control mechanism: Nerve impulses control some endocrine secretions. Cholinergic sympathetic fibers stimulate catecholamine secretion from the adrenal medulla. Centers in the midbrain, brainstem, hippocampus, etc., can send nerve impulses that react with the hypothalamus through cholinergic and dopaminergic neurons. At the terminations of these neurons, they release acetylcholine and biogenic amines to regulate the secretions of hypophysiotropic peptide hormones from hypothalamic peptidergic neurons. Some of the endocrine releases are controlled by either stimulatory or inhibitory hormones from a controlling gland, e.g., corticosteroids are controlled by corticotropin and thyroid hormones are controlled by thyrotropin from the anterior pituitary. Hypothalamic-releasing hormones further regulate the tropins.

B. Feedback control mechanism: Such control is brought about mainly through negative feedback. When the blood level of a target gland hormone is high, it may inhibit the secretion of the tropic hormone stimulating that gland. The adrenal cortex secretes a hormone called cortisol, which inhibits the secretion of corticotropin from the anterior pituitary and corticotropin-releasing hormone from the hypothalamus by long-loop feedback. This leads to a reduction in cortisol secretion.

C. Endocrine rhythms: There are certain cyclic rhythms associated with the secretion of hormones over a period of time. When there is a cyclic periodicity of 24 hours, it is called as ***circadian rhythm***. However, if it is more than 24 hours, it is named infradian rhythm, and when it is less than 24 hours, it is called ***ultradian rhythm***. Due to such rhythms, the highest and lowest conc. Corticotropin is normally found in the morning and around midnight. Growth hormone and prolactin rise in the early hours of deep sleep. ***Cortisol peak is found between 4 AM and 8 AM. Endocrine rhythms result from the cyclic activities of a biological clock in the limbic system, supplemented by the diurnal light-dark and sleep activity cycles and mediated by the hypothalamus.***