

Neuroendocrine Axes: Hypothalamus, Pituitary and Beyond

Karen K. Miller, MD

Dr. Miller's introductory lecture will provide a review of the hypothalamic-pituitary endocrine axes, with a focus on classic hormone feedback loops and effects. The hypothalamus releases several pituitary stimulating hormones, which in turn stimulate release of pituitary hormones, which stimulate the release of hormones from endocrine glands. These endocrine systems include the hypothalamic-pituitary-gonadal axis, in which the hypothalamus releases gonadotropin releasing hormone (GNRH) in a pulsatile fashion, which regulates the release of gonadotrophs (leutinizing hormone (LH) and follicle stimulating hormone (FSH)) from the pituitary, which stimulate the gonads (testes and ovaries) to release testosterone and estrogens/progesterone/testosterone, respectively. It should be noted that after menopause, although the ovaries stop producing estrogens and progesterone, they continue to produce testosterone, and that in males and postmenopausal females, estrogens are synthesized from testosterone by aromatases, primarily in adipose tissue. The hypothalamus also produces corticotrophin releasing hormone (CRH), which stimulates the pituitary to produce adrenocorticotrophic hormone (ACTH), which stimulates the adrenal glands to produce glucocorticoids, such as cortisol, and pre-androgens, including dehydroepiandrosterone (DHEA). Thyroid hormones are produced in response to thyroid stimulating hormone (TSH) release from the pituitary, which is in turn under the control of thyrotropin-releasing hormone (TRH). Growth hormone (GH) is released from the pituitary gland in response to growth-hormone releasing hormone (GHRH) and to a lesser extent, ghrelin, but is also under inhibitory control from somatostatin. The control of prolactin is most inhibitory, by dopamine. LH, FSH, ACTH, TSH, GH and prolactin are the main hormones synthesized by the pituitary gland. In contrast, the posterior pituitary is not actually a "gland" but rather serves as a storage area for two hormones that are synthesized in the hypothalamus: oxytocin and antidiuretic hormone (ADH). Many, if not most, of these hormones have neurologic effects, some of which will be discussed in subsequent lectures of this session.