HYPOTHALAMUS CONTROL ON ADENOHYPOPHYSIS (Chinmoy Chatterjee)

The hypothalamus serves as a gateway between the nervous *system* and endocrine *system*. One of the most important functions of the hypothalamus is linking the nervous *system* to the endocrine *system* via the pituitary gland. Control over the adenohypophysis is exerted through a portal system called hypothalamohypophyseal portal system.

Hypophyseal portal system.: In a portal system blood is circulated into the first capillary bed by an artery and is usually called the primary capillary bed. It then flows through a portal vein and into a second capillary bed, called the secondary capillary plexus. Connected to the secondary plexus is a venule for drainage into the venous circulation.

The primary capillary plexus is found on the infundibulum of the pituitary gland and is formed by the superior hypophyseal artey; which is a branch of the internal carotid artery .It *supplies blood to the median eminence,* a prolongation of the hypothalamus. From this capillary system, the blood is drained in hypophyseal portal veins into the secondary plexus around the anterior pituitary.

The hypothalamus secretes releasing and inhibiting hormones which are synthesized in the arcuate, paraventricular, periventricular and supraoptic nuclei of the hypothalamus that control anterior pituitary hormone secretion. Parvocellular neurons send their axons into the capillary bed of the superior hypophyseal arteries located around the base of the median eminence. Both of these are secreted into the primary capillary plexus from various centers of the hypothalamus. Both of these also travel in this order: primary capillary plexus — portal vein — secondary capillary plexus — diffuse into adenohypophysis. The peptides released at the median eminence enter the primary plexus capillaries. From there, they are transported to the anterior pituitary via hypophyseal portal veins to the secondary plexus. The secondary plexus is a network of fenestrated sinusoid capillaries that provide blood to the anterior pituitary.

Once the hormones reach their target cells in the anterior pituitary, these hormones bind to specific receptors located on the surface of pituitary cells. Depending on which cells are activated through this binding, the pituitary will either begin secreting or stop secreting hormones into the rest of the bloodstream. For example, thyrotropin releasing hormone (TRH) only stimulates thyrotropes (cells that produce the hormone TSH) to secrete its hormone. While the inhibiting hormones do the opposite.

Control of secretion of the releasing factors, pituitary hormones and peripheral endocrine hormones is inter-related in a set of feedback loops. The **ultra-short feedback loop** is mediated by the hypothalamic releasing factors limiting their own release by a type of autocrine effect on targets in the hypothalamus. Inhibition of releasing-factor secretion by pituitary hormones comprises **short loop feedback**. Finally, peripheral hormone inhibition of pituitary secretion comprises the **direct long-loop feedback** and inhibition on hypothalamic secretion of the releasing factors comprises the **indirect long-loop feedback**.



| Hhypothalamic hormones | Abbreviation | Produced by | Effect |
|--|-------------------|---|--|
| <u>Thyrotropin-releasing</u> <u>hormone</u> (Prolactin-releasing hormone) | TRH, TRF, or PRH | <u>Parvocellular</u> <u>neurosecretory cells</u> of the <u>paraventricular</u> <u>nucleus</u> | Stimulate thyroid-stimulating hormone (TSH) release from anterior pituitary (primarily) Stimulate prolactin release from anterior pituitary |
| <u>Corticotropin-releasing</u> <u>hormone</u> | CRH or CRF | Parvocellular neurosecretory cells of the paraventricular nucleus | Stimulate <u>adrenocorticotropic hormone (ACTH)</u> release from <u>anterior</u> <u>pituitary</u> |
| <u>Dopamine</u> (Prolactin-inhibiting hormone) | DA or PIH | Dopamine neurons of the arcuate nucleus | Inhibit <u>prolactin</u> release from <u>anterior pituitary</u> |
| <u>Growth-hormone-</u> <u>releasing hormone</u> | GHRH | <u>Neuroendocrine</u> neurons of the <u>Arcuate nucleus</u> | Stimulate <u>growth-hormone (GH)</u> release from <u>anterior pituitary</u> |
| <u>Gonadotropin-releasing</u> <u>hormone</u> | GnRH or LHRH | <u>Neuroendocrine</u> cells of the <u>Preoptic area</u> | Stimulate <u>follicle-stimulating hormone (FSH)</u> release from <u>anterior pituitary</u> Stimulate <u>luteinizing hormone (LH)</u> release from <u>anterior pituitary</u> |
| <u>Somatostatin^[14]</u> (growth-hormone- inhibiting hormone) | SS, GHIH, or SRIF | <u>Neuroendocrine</u> cells of the <u>Periventricular</u> <u>nucleus</u> | Inhibit growth-hormone (GH) release from <u>anterior pituitary</u> Inhibit (moderately) <u>thyroid-stimulating hormone (TSH)</u> release from <u>anterior pituitary</u> |