

Endocrine glands and hormones:

Endocrine glands are ductless glands of the endocrine system that secrete their products, hormones, directly into the blood.

The major glands of the endocrine system include the pineal gland, pituitary gland, pancreas, ovaries, testes, thyroid gland, parathyroid gland, hypothalamus and adrenal glands. The hypothalamus and pituitary glands are neuroendocrine organs.

Pituitary gland

The pituitary gland hangs from the base of the brain by the pituitary stalk, and is enclosed by bone. It consists of a hormone-producing glandular portion the anterior pituitary and a neural portion the posterior pituitary, which is an extension of the hypothalamus. The hypothalamus regulates the hormonal output of the anterior pituitary and creates two hormones that it exports to the posterior pituitary for storage and later release.

Four of the six anterior pituitary hormones are tropic hormones that regulate the function of other endocrine organs. Most anterior pituitary hormones exhibit a diurnal rhythm of release, which is subject to modification by stimuli influencing the hypothalamus.

Somatotropic hormone or growth hormone (GH) is an anabolic hormone that stimulates growth of all body tissues especially skeletal muscle and bone. It may act directly, or indirectly via insulin-like growth factors (IGFs). GH mobilizes fats, stimulates protein synthesis, and inhibits glucose uptake and metabolism. Secretion is regulated by growth hormone releasing hormone (GHRH) and growth hormone inhibiting hormone (GHIH), or somatostatin. Hypersecretion causes gigantism in children and acromegaly in adults; hyposecretion in children causes pituitary dwarfism.

Thyroid-stimulating hormone (TSH) promotes normal development and activity of the thyroid gland. Thyrotropin-releasing hormone (TRH) stimulates its release; negative feedback of thyroid hormone inhibits it.

Adrenocorticotrophic hormone (ACTH) stimulates the adrenal cortex to release corticosteroids. ACTH release is triggered by corticotropin-releasing hormone (CRH) and inhibited by rising glucocorticoid levels.

The gonadotropins—follicle-stimulating hormone (FSH) and luteinizing hormone (LH) regulate the functions of the gonads in both sexes. FSH stimulates

sex cell production; LH stimulates **gonadal hormone** production. Gonadotropin levels rise in response to **gonadotropin-releasing hormone** (GnRH). Negative feedback of gonadal hormones inhibits gonadotropin release.

Prolactin (PRL) promotes milk production in human females

Its secretion is prompted by **prolactin-releasing hormone** (PRH) and inhibited by **prolactin-inhibiting hormone** (PIH).

The intermediate lobe of pituitary gland secretes only one enzyme that is **melanocyte stimulating hormone**(MSH). It is linked with the formation of the black pigment in our skin called melanin.

The **neurohypophysis** stores and releases two hypothalamic hormones:

- **Oxytocin** stimulates powerful uterine contractions, which trigger labor and delivery of an infant, and milk ejection in nursing women. Its release is mediated reflexively by the hypothalamus and represents a positive feedback mechanism.
- **Antidiuretic hormone** (ADH) stimulates the kidney tubules to reabsorb and conserve water, resulting in small volumes of highly concentrated urine and decreased plasma osmolarity. ADH is released in response to high solute concentrations in the blood and inhibited by low solute concentrations in the blood. Hyposecretion results in diabetes insipidus.

Thyroid gland

- The thyroid gland is located at the front of the neck, in front of the **thyroid cartilage**, and is shaped like a butterfly, with two wings connected by a central **isthmus**. Thyroid tissue consists of follicles with stored protein called colloid, containing **thyroglobulin**, a precursor to other thyroid hormones, which are manufactured within the colloid.
- The **thyroid hormones** increase the rate of **cellular metabolism**, and include **thyroxine** (T4) and **triiodothyronine** (T3). Secretion is stimulated by the hormone TSH, secreted by the anterior pituitary. When thyroid levels are high, there is negative feedback that decreases the amount of TSH secreted. Most T4 is converted to T3 (a more active form) in the target tissues.
- **Calcitonin**, produced by the parafollicular cells of the thyroid gland in response to rising blood calcium levels, depresses blood calcium levels by inhibiting bone matrix resorption and enhancing calcium deposit in bones. Excessive secretion cause hyperthyroidism and deficiency causes hypothyroidism.

Parathyroid hormone

The parathyroid glands, of which there are 4–6, are found on the back of the thyroid glands, and secrete [parathyroid hormone](#) (PTH),^[1] which causes an increase in blood calcium levels by targeting bone, the intestine, and the kidneys. PTH is the antagonist of [calcitonin](#). PTH release is triggered by falling blood calcium levels and is inhibited by rising blood calcium levels.

Adrenal glands

The adrenal glands are located above the kidneys in humans and in front of the kidneys in other animals. The adrenal glands produce a variety of hormones including [adrenaline](#) and the steroids [aldosterone](#) and [cortisol](#).^[2] It controls the behaviour during crisis and emotional situations. It stimulates the heart and its conducting tissues and metabolic processes

Pancreas

The pancreas, located in the abdomen, below and behind the stomach, is both an [exocrine](#) and an endocrine gland. The [alpha](#) and [beta cells](#) are the endocrine cells in the [pancreatic islets](#) that release [insulin](#) and [glucagon](#) and smaller amounts of other hormones into the blood. Insulin and glucagon influence [blood sugar levels](#). Glucagon is released when blood glucose level is low, and stimulates the liver to release [glucose](#) into the blood. Insulin increases the rate of glucose uptake and metabolism by most body cells.

[Somatostatin](#) is released by [delta cells](#) and acts as an inhibitor of GH, insulin and glucagon.

Gonads

The ovaries of the female, located in the pelvic cavity, release two main hormones. Secretion of [oestrogens](#) by the ovarian follicles begins at [puberty](#) under the influence of FSH. Estrogens stimulate maturation of the female reproductive system and development of the secondary sexual characteristics. [Progesterone](#) is released in response to high blood levels of LH. It works with estrogens in establishing the [menstrual cycle](#).

The testes of the male begin to produce [testosterone](#) at puberty in response to LH. Testosterone promotes maturation of the male reproductive organs, development of secondary sex characteristics such as beard, hoarse voice, etc. and production of sperm by the testes

Pineal gland

The pineal gland is located in the [diencephalon](#) of the brain. It primarily releases [melatonin](#), which influences daily rhythms and may have an [antigonadotropic](#) effect in humans. It may also influence the melanotropes and melanocytes located in the skin.