

HUMAN ENDOCRINE SYSTEM

The human endocrine system consists of ductless glands which releases hormones directly to the bloodstream. Glands are any tissue or organ which secretes chemical compounds useful for the particular functions of the body. A Hormone is any molecule secreted by an endocrine gland which are carried by the blood and stimulate/ inhibit specific physiological processes required by the body. The first discovered hormone is secretin. Hormones from the hypothalamus regulate the secretion of hormones from the pituitary gland.

The Hypothalamus.

It is present in the base of the diencephalon, a part of the forebrain. It is composed of nervous tissue. Hypothalamus is connected to the pituitary gland by the hypophyseal portal blood vessels. The neurosecretory cells of the hypothalamus releases hormones which are known as neurohormones. The hypothalamic hormones are also called as releaser hormones. It also secretes inhibitory hormones. The 10 hypothalamic hormones are:

1. Follicle stimulating hormone releasing hormone (FSH-RH): Stimulates anterior pituitary to release Follicle stimulating hormone.
2. Luteinising hormone releasing hormone (LH-RH): Stimulates anterior pituitary to release Luteinising hormone.
3. Growth hormone releasing hormone (GH-RH): Stimulates anterior pituitary to release growth hormone.
4. Growth hormone inhibiting hormone (GH-IH): Stimulates anterior pituitary to inhibit secretion of growth hormone.
5. Prolactin releasing hormone (PRL-RH): Stimulates the anterior pituitary to release prolactin.
6. Prolactin release inhibiting hormone (PRL-IH): Inhibits secretion of prolactin.
7. Thyrotropin releasing hormone (T-RH): Stimulates anterior pituitary to release thyroid stimulating hormone (TSH).
8. Adrenocorticotrophic releasing hormone (A-RH): Stimulates anterior pituitary to release Adrenocorticotrophic hormone.

9. Melanocyte stimulating hormone releasing hormone (MSG-RH): Stimulates the posterior lobe of pituitary to release melanocyte stimulating hormone.
10. Melanocyte stimulating hormone inhibitory hormone (MSG-IH): Inhibits secretion of melanocyte secreting hormone.

A. The Pituitary gland:

The pituitary gland is the master gland of the body which controls the secretion of hormones by all other glands. It consists of three lobes:

- Anterior lobe (pars anterior/adenohypophysis)
- Intermediate lobe (pars intermedia)
- Posterior lobe (pars nervosa/ neurohypophysis)

The hormones secreted by each lobe are as under.

- Anterior lobe: Produces six hormones.
 - (a) Growth hormone: Stimulates the growth of the body and development of tissues.
 - (b) Follicle stimulating hormone (FSH): Aids in sperm formation in males and growth of follicles in the ovaries in females.
 - (c) Luteinising hormone (LH): In males, it induces the formation of testosterone and in females it aids the formation of oestrogen and progesterone.
 - (d) Thyroid stimulating hormone (TSH): promotes growth of thyroid follicles and production of thyroid hormones.
 - (e) Prolactin: It stimulates the growth of breasts during pregnancy and production of milk in them after delivery of the baby.
 - (f) Adrenocorticotrophic hormone: Stimulates adrenal cortex to produce mineralocorticoids and glucocorticoids.
- Intermediate lobe: It only produces one hormone, Melanocyte stimulating hormone which stimulates the synthesis of melanin which gives the dark colour of the skin.
- Posterior lobe: It stores and releases two hormones. These hormones are actually synthesised by the hypothalamus.

- (a) Oxytocin: It is also known as the birth hormone as it induces powerful contraction the uterine muscles for the delivery of the baby. It has one more function of release of milk from the mammary glands after the delivery of the baby, hence the name 'milk ejecting hormone'.
- (b) Vasopressin: Also known as the anti- diuretic hormone. It decreases loss of water from the body and increases the reabsorption of water from the DCT and collecting duct of the nephron.

B. Thyroid Gland:

The Thyroid gland is composed of thyroid follicles which help in secretion of hormones. It is in the front of the larynx. The thyroid gland secretes three hormones, namely thyroxine (T4), triiodothyronine (T3) and calcitonin. Thyroxine is the activated form of thyroid hormone and T3 is converted into T4. The major functions of Thyroid hormones are to promote growth of the body, maintain the BMR of the body, control the metabolism of the body, controls working of the kidneys etc. Calcitonin regulates the calcium levels in the blood.

Certain disorders are also associated with the malfunctioning of the thyroid gland. Some of those disorders are Goitre (Enlargement of thyroid gland due to deficiency of iodine in diet. As a result, thyroid hormone is not synthesised), Cretinism (caused due to hyposecretion of thyroid hormones in small children resulting in stunted growth, mental retardation, pigeon belly), Myxoedema (caused due to hyposecretion of thyroid hormones in adults resulting in edema or puffy appearance) and Grave's disease (hypersecretion of thyroid hormones resulting in irritability, trembling, high body temperature).

C. Parathyroid glands:

Four, small glands located two on each side of the thyroid gland. They secrete the hormone Parathormone or Collip's hormone. The function of parathormone is to increase the calcium levels of the blood by demineralisation of bones. Hypersecretion of the hormone

results in weaker bones resulting into osteoporosis. Such bones are more prone to fracture because they are very brittle. Hyposecretion of the hormone reduces the calcium concentration of the blood and can cause parathyroid tetany. Calcium, when present in lesser amounts in blood causes the excitation of the muscular tissue resulting in prolonged cramps.

- D. Pineal gland: The pineal gland secretes the hormone melatonin. It helps in maintaining the 24-hour sleep wake cycle. The synthesis of melatonin takes place only in the dark and that is the reason why some people do not get sleep in light. Also, the secretion of melatonin increases around evening time and decreases during the day time.

- E. Thymus gland: The thymus gland secretes the hormone thymosin which stimulates the development of T- lymphocytes. It helps in fighting infections and hence, maintaining the immunity. The thymus gland is very large at the time of the birth of an individual and keeps on decreasing in size as the individual grows. That is the reason why older people have a weak immune system as compared to young children.

- F. Adrenal glands: Adrenal glands are placed on the top of the kidneys. It has two parts, the adrenal cortex and adrenal medulla. The adrenal cortex releases 3 hormones:
 - (a) Mineralocorticoids: The major mineralocorticoid is aldosterone, which helps in maintaining the sodium-potassium balance of the body.
 - (b) Glucocorticoids: They regulate the metabolism of carbohydrates, proteins and fats. The most important glucocorticoid is cortisol.
 - (c) Sex corticoids: They release small amounts of sex hormones which help in development of secondary sexual characters in males and females.

The adrenal medulla secretes flight or fight hormones-Adrenaline and noradrenaline. They help in increasing metabolism in the moments of

stress, anger, fear, cold, accident or injury. They are very important for the survival of organisms as they play a major role in emergency hence are known as glands of emergency. It increases piloerection (raising of body hair), sweating, increases heartbeat, increases the breathing rate as well as expansion of the eyeball.

G. Pancreas: The endocrine part of the pancreas releases 3 hormones:

(a) Insulin: It is secreted by the beta cells of the pancreas and helps in the lowering of the blood glucose levels. The deficiency of hormone insulin may cause diabetes.

(b) Glucagon: It is secreted by the alpha cells of the pancreas. It helps in increasing the blood glucose level. It is also known as hyperglycaemic hormone.

(c) Somatostatin: It is secreted by the delta cells of the pancreas. It inhibits the secretion of insulin and glucagon.

H. Testes: The testes secrete male sex hormones androgens. One of the important androgen is testosterone. It stimulates the development of male reproductive system during puberty, promotes spermatogenesis (formation of sperms), promotes development of male accessory sex characters and regulation of male sexual urge (libido).

I. Ovaries: they secrete three hormones.

(a) Estrogen: They are secreted by ovarian follicles and help in oogenesis (development of ovum) in females. Also, it helps in regulation of female secondary sexual characters such as development of breasts, growth of body hair, broadening of pelvis, onset of menstrual cycle and fat deposition on thighs.

(b) Progesterone. It is secreted by corpus luteum. It helps in maintaining the endometrial layer of the uterus during pregnancy. It also helps in development of the placenta.

(c) Relaxin: Produced by corpus luteum at the end of gestation period. It helps in relaxation of the pelvic girdle for an easy passage of the baby out of the uterus.

For more info visit www.studytoday.net