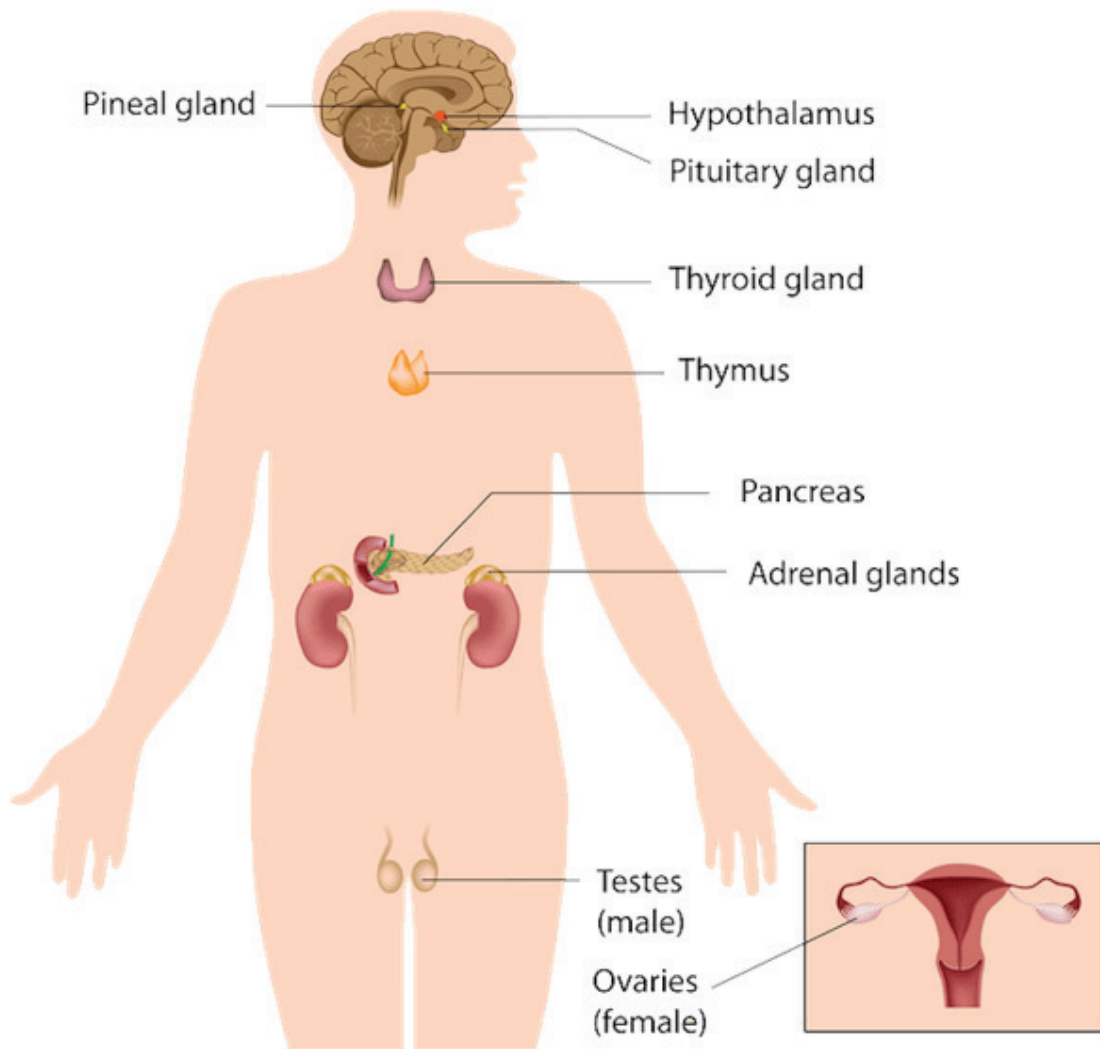


CHEMICAL COORDINATION AND INTEGRATION



CHEMICAL COORDINATION AND INTEGRATION

Control and coordination

In animals, control and coordination is performed by neural system and endocrine system jointly. As the nerve fibers do not innervate all cells of the body, the endocrine system is required to coordinate the functions.

Endocrine Glands

Endocrine glands are ductless glands. They release their secretion directly into blood which is then transported to specific target organs to initiate a particular metabolic change. The endocrine glands secrete chemicals called hormones. Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amount.

Human Endocrine System: The endocrine glands and hormone producing tissues/cells are located in different parts of the body. Gastrointestinal tract, kidney, liver, and heart also produce small quantity of hormones to control and coordinate the function of respective organs.

Hypothalamus For Quick Revision and Smart Practice

Hypothalamus contains several groups of neurosecretory cells called nuclei which produce hormones. Hormones released by Hypothalamus regulate the synthesis and secretion of pituitary hormones.

Hypothalamus produces two types of Hormones:

- Releasing hormones (Gonadotrophin releasing hormones GnRH)
- Inhibiting hormones (Somatostatin)

The hormones released from hypothalamus reaches the anterior pituitary through portal circulatory system and regulate its function.

The posterior pituitary is under direct control of hypothalamus.

Pituitary Gland

Pituitary Gland is located in sella tursica, a bony cavity. It is attached to the hypothalamus by a stalk.

Pituitary Gland are divided into two parts:

- Adenohypophysis.
- Neurohypophysis/ posterior pituitary (oxytocin, vasopressin).

Adenohypophysis are divided into two parts:

- Pars distalis/ Anterior pituitary (GH, Prolactin, TSH, ACTH, LH & FSH)
- Para intermedia (Melanocyte stimulating hormone)

Pituitary gland:

- Excess secretion of Growth Hormone causes overgrowth of the body leading to gigantism and low secretion causes stunted growth called dwarfism.
- Prolactin stimulates growth of mammary gland and production of milk.
- TSH stimulates production and release of thyroid hormone.
- LH and FSH stimulate activity of the gonads. In male, LH stimulates synthesis and secretion of androgen hormone from testis. In female, LH induces ovulation of fully mature ovum from ovary.
- Oxytocin helps in contraction of uterus during childbirth and milk ejection from mammary glands.
- Vasopressin stimulates absorption of water and electrolyte in kidney.
- MSH acts on the melanocytes and regulates skin pigmentation.

The pineal Gland

The pineal Gland located on dorsal side of forebrain and release melatonin hormone that helps to regulate diurnal rhythm of body like sleeps wake cycle and body temperature.

Thyroid Gland

For Quick Revision and Smart Practice

It is composed of two lobes on either side of trachea connected by isthmus.

Thyroid gland is made of follicles and stromal tissues:

- Iodine is essential for synthesis of thyroid hormones. Deficiency of iodine leads to hypothyroidism (Goiter). During pregnancy, hypothyroidism may cause stunted growth of baby and mental retardation.
- Thyroid hormones regulate the basal metabolic rate. They support the process of red blood cell formation. They control the metabolism of carbohydrates, proteins and fats. Thyrocalcitonin hormone regulates blood calcium levels.

Parathyroid Gland

It is located on the back side of thyroid gland, secretes peptide hormone called parathyroid hormone (PTH). PTH regulates the calcium ion concentration in the blood. It also helps in reabsorption of calcium from renal tubules and digestive tracts.

Thymus

It is located on the dorsal side of heart and the aorta. This gland releases peptide hormone thymosin's that help in differentiation of T-Lymphocytes for cell-mediated immunity. It also promotes production of antibodies to provide humeral immunity.

Adrenal Gland

It is located on anterior part of each kidney, composed of two types of tissues central adrenal medulla and outside adrenal cortex. Adrenal medulla secretes adrenaline and noradrenaline hormone commonly called as catecholamines. These hormones are also called as emergency hormone. These hormones increase alertness, pupillary dilation, sweating, heartbeat, rate of respiration, glycogenolysis.

The adrenal cortex secretes glucocorticoids and mineralocorticoids. Glucocorticoids stimulate gluconeogenesis. Mineralocorticoids regulate water and electrolyte contents of the body.

Pancreas

- They act as both endocrine and exocrine gland. Endocrine pancreas consists of "Islets of Langerhans" which contain α -cells and β -cells. The α -cells secrete hormone glucagon and β -cells secrete insulin. Both hormones are involved in maintenance of blood sugar levels.
- Glucagon is a peptide hormone that stimulates glycogenolysis resulting in increased blood sugar (hyperglycemia).
- Insulin is a peptide hormone that play major role in regulation of glucose homeostasis. It triggers rapid movement of glucose from blood to hepatocytes and adipocytes resulting in decreased blood glucose levels (hypoglycemia).

Testis

They perform dual functions as a primary sex organ as well as endocrine glands. Leydig cells or interstitial cells produce androgen mainly testosterone which regulate maturation of primary sex organs and spermatogenesis.

Ovary

Produce two groups of steroid hormones called estrogen and progesterone. Estrogen is synthesized and secreted by growing ovarian follicles. After ovulation, ruptured ovum called corpus luteum, secretes progesterone. Estrogen produces wide range actions like growth of female secondary sex organs, development of growing ovarian follicles, and regulation of female sexual behavior. Progesterone regulates pregnancy.

Hormones of Heart, Kidney and Gastrointestinal Tract

- Atrial wall of heart secretes peptide hormone called atrial natriuretic factor (ANF) which decreases blood pressure.
- The juxtaglomerular cells of kidney produce erythropoietin hormone which stimulate erythropoiesis.
- Gastro-intestinal tract secrete four major peptide hormones:
- Gastrin stimulates the secretion of hydrochloric acid and pepsinogen.
- Secretin acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions.
- Cholecystokinin (CCK) stimulates the secretion of pancreatic enzymes and bile juice



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