NEET CRASH COURSE

CHEMICAL COORDINATION AND ITS INTEGRATION



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Endocrine Glands - Hormone - Lipids I to coordinate with neural system 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 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:

•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 HORMONES



•Excess secretion of Growth Hormone causes over growth 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 child birth and milk ejection from mammary glands.

•Vasopressin stimulates absorption of water and electrolyte in kidney.

•MSH acts on the melanocytes and regulates skin pigmentation.

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The pineal Gland- located on dorsal side of forebrain and release <u>melatonin</u> hormone that helps to regulate diurnal rhythm of body like sleeps wake cycle/Circadian rhythm/24 hour cycle and body temperature.



CHEMICAL COORDINATION AND ITS INTEGRATION THYROID GLAND →

Hyoid bone **Location:** This is the largest endocrine gland of our body. It is SK located in our neck upon the ventral aspect of larynx (sound box or Adam's apple) and a few anterior most tracheal rings. It is a dark brown and H-shaped bilobed gland. Larvnx Hormones of thyroid: Thyroid gland secretes two jodinated hormones. Pyramidal lob (a) **Thyroxine:** It is an iodine containing (6% iodine) amine Metamo Thusis hormone which is derived from the hormone which is derived from tyrosine amino acid. Chemically land thyroxine is tetraidothyronine though also found as tri-Lateral lobe iodothyronine. Secretion of thyroxine is inversely proportional to the blood level of thyroxine (feedback mechanism). thyroid gland (b) Thyrocalcitonin ((TCT)) It is a long peptide hormone secreted by parafollicular by cells of thyroid gland (C-cells). It 11 secretion is regulated by increased plasma level of calcium by feedback mechanism. 4 thosph stc Son

Irregularities of thyroid gland Thy no xi net - M fip-(a) Hypothyroidism: (Decreased section of thyroxine from thyroid gland).

(b) Hypersecretion of thyroid hormones (Hyperthyroidism or thyrotoxicosis) : This may also be a genetic defect, but usually it is provided by chronic infections (influenza, rheumatism, tonsilitis, tuberculosis, measles, whooping cough, etc.) pregnancy, intake of large doses of iodine, over-eating, etc. It results into a considerable increase in glucose and oxygen consumption by cells and the rate of oxidative metabolism in the mitochondria.



Thypoid

Parathyroid

gland

Parathyroid Gland – located on the back side of thyroid gland, secretes peptide hormone called <u>parathyroid</u> () Jurthorm one <u>hormone</u> (PTH). PTH regulates the calcium ion concentration in the blood. It also helps in reabsorption of calcium from renal tubules and digestive tracts.



Thymus– located on the dorsal side of heart and the aorta.

This gland releases peptide hormone thymosins that help in differentiation of T-Lymphocytes for cell-mediated immunity.

It also promotes production of antibodies to provide humeral immunity.



Adrenal Gland – located on anterior part of each kidney, composed of two types of tissues central adrenal medulla and outside adrenal cortex.

Adrenal medulla

secretes <u>adrenaline</u> and <u>noradrenaline</u> hormone commonly called as catecholamines.

These hormones are also called as emergency hormone. These hormones increase alertness, pupilary dilation, sweating, heart beat, rate of respiration, glycogenolysis.

The **adrenal cortex** secretes glucocorticoids, mineralocorticoids and sexocorticoids.

Glucocorticoids stimulate gluconeogenesis.

Mineralocorticoids regulate water and electrolyte contents of the body.





Pancreas – acts 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. \mathcal{Y}
- •<u>Glucagon</u> 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 – 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 behaviour.

<u>Progesterone</u> regulates pregnancy.



Hormones of Heart, Kidney and Gastrointestinal Tract

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

On the basis of chemical nature, hormones are grouped as-1. Peptide, polypeptide and protein hormones- insulin, glucagon, instruction pituitary hormone, hypothalamic hormones. 2. Steroids- cortisol, testosterone, progesterone. (sex hormones) ipid solution 3. lodothyronines- thyroid hormones. Ta Tu 4. Amino acid derivatives- epinephrine.

Protein

Mechanism of Hormone Action

•Hormone produce their effects on target tissues by binding to specific protein called hormone receptors located in the target tissue.

•Binding of hormones to receptor leads to the formation of hormone receptor complex. This binding leads to change in target tissue.



- The hormones that bind with membrane bound receptors normally do not enter the target cells but generate second messenger which in turn regulate cellular metabolism.
- The hormones (steroid hormones) which interact with intracellular receptors mostly regulate gene expression or chromosome function by interaction with hormonereceptor complex with the genome. These biochemical actions results in physiological and developmental effects.



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