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ENDOCRINE SYSTEM – ARTICLE REVIEW

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Abstract:
Severe pain has profound physiologic effects on the endocrine system. Serum hormone abnormalities may result and these serve as biomarkers for the presence of severe pain and the need to replace hormones to achieve pain control. Initially severe pain causes a hyperarousal of the hypothalamic-pituitary- adrenal system which results in elevated serum hormone levels such as adrenocorticotropin, cortisol, and pregnenolone. If the severe pain does not abate, however, the system cannot maintain its normal hormone production and serum levels of some hormones may drop below normal range. Some hormones are so critical to pain control that a deficiency may enhance pain and retard healing.

Keywords: *Help control mood, growth and development, the way our organs work, metabolism, and reproduction*

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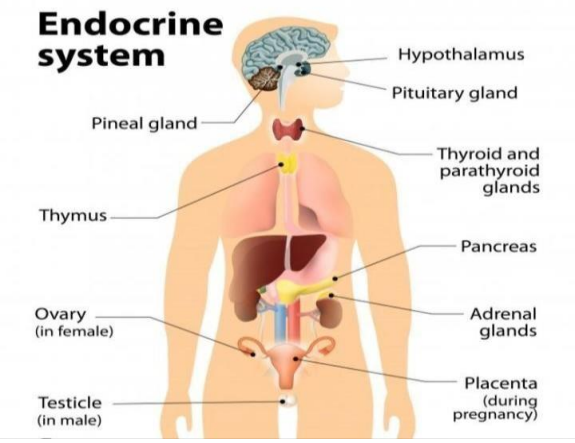
INTRODUCTION:

Animal body has the ductless glands as the distinct organs or cell groups inside an organ or a tissue, which exit their secretions called 'hormones' in the blood circulation to carry to the target destinations. Hormones are involved in the maintenance of physiological functions involved in day-to-day activities like sleep, feeding and drinking etc.,

These hormone secreting glands are called "endocrine" which literally meant "to secrete within" indicating their mode of secretion. The target destinations of the hormones bear the specific receptors which upon binding inducing pathways involved in specific biological functions. There are eight such major along with many minor glands which are grossly conserved in animal kingdom (including human) and share similar morphology among mammals. Figure 1 is showing a schema of the major endocrine glands in male and female.



ENTIRE ENDOCRINE SYSTEM

HISTORY:

Brief Chronological Description of the Progress Made in Endocrinology Earliest descriptions for the endocrine system are found about 200 B.C. when Chinese began isolating sex and pituitary hormones from human urine and using them for medicinal purposes. Later Descriptions are from the medieval Persia by Avicenna, a legendary scientist, who provided a detailed account on diabetes in "The Canon of Medicine" (c. 1025), describing its clinical features as abnormal appetite, collapse of sexual functions, and sweet taste of urine. In 1831 Irish doctor Robert James Graves described a case of Graves' disease. In 1849, Thomas Addison described Addison's Disease. In the same year, Arnold who is regarded as a pioneer in endocrinology, observed that castration had negative effect on male cockerels who did not develop proper sex-speciffic characteristics. Later, in 1889 Brown-Squared, a professor at the College France, reported that self-administration of animal-testes extracts led to enhancements in his physical strength, intellectual capacity, and sexual potency though yearbook reasoned that some secretion from the Ley-dig cells is involved in the development of male characteristics which were named TESTOSTERONE.

CLASSIFICATION OF GLANDS IN ENDOCRINE SYSTEM:

Endocrine glands

Exocrine glands

1)ENDOCRINE GLANDS:

Endocrine glands can be Classified as CENTRAL and PERIPHERAL. Central endocrine glands are those which are present within the cranium and are part of the brain as hypothalamus, pituitary, and pineal glands. The other glands existing outside the cranial premises are called peripheral. Endocrine glands also can be classified as primary and secondary endocrine organs. Primary endocrine organs have the only function to secrete hormones but secondary endocrine organs are primarily meant for the other biological functions and secrete hormones to support and sustain their primary functions. In secondary endocrine organs, only Specific cell groups or tissue components would be devoted for the hormonal secretion. Pancreas, though merits to be a primary endocrine organ, it is only partly endocrine, as it has only a Specific cell group (Islets of Langerhans) dispersed along whole length of organ (mainly tail part) which is endocrine, rest of the pancreas is exocrine –secretes enzymes meant for digestive functions which exit through ducts. Similarly, hypothalamus though considered as a primary endocrine organ, only neurons in the Specific nuclear groups are endocrine

FUNCTIONS:

*Hypothalamus is the central regulator of the entire endocrine system.

*Hypothalamic Neuronal cells secrete releasing/release inhibiting hormones which further Stimulate/inhibit the syn-thesis of stimulating hormones from the anterior pituitary.

*Chiefly accurate nucleus of the tuber region, and some nuclear groups in optic and supra optic regions, which control the secretion of hormones from the anterior pituitary, or the supra optic and para ventricular nuclei, (PVN) of supra optic region

of the hypothalamus which secrete OXYTONIN and VASOPRESSIN.

2)EXOCRINE GLANDS:

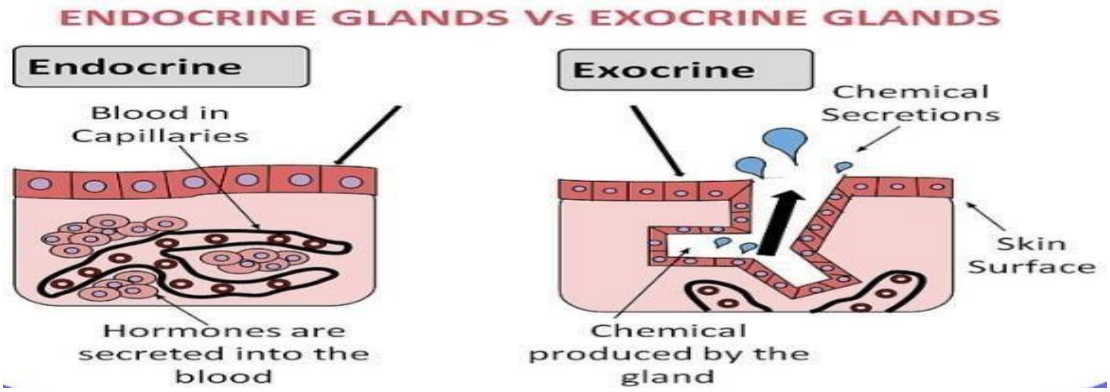
Exocrine glands secrete substances through ducts onto your bodily surfaces. Exocrine glands can be found in many different organs and have many different functions. Exocrine glands secrete sweat from your sweat glands, tears from your Lacrimal glands, saliva from your salivary glands, milk from your mammary glands and more.Exocrine glands release (secrete) substances through openings (ducts) onto your body surfaces. Exocrine glands secrete sweat, tears, saliva, milk and digestive juices. A gland is a unit of cells that work together to create and secrete these substances. Exocrine glands can be found in many different organs in your body.

FUNCTIONS:

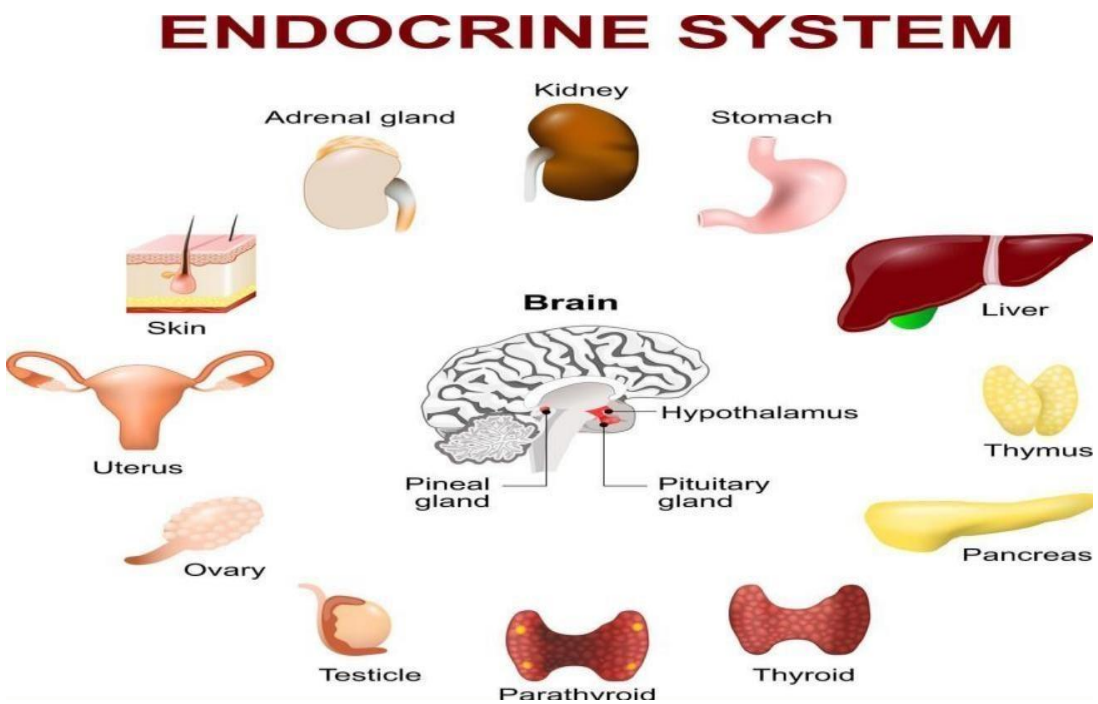
Digest your food.

Absorb nutrients.

- Protect the inner lining of your organs.
- Control your body temperature.



EXOCRINE AND ENDOCRINE GLANDS

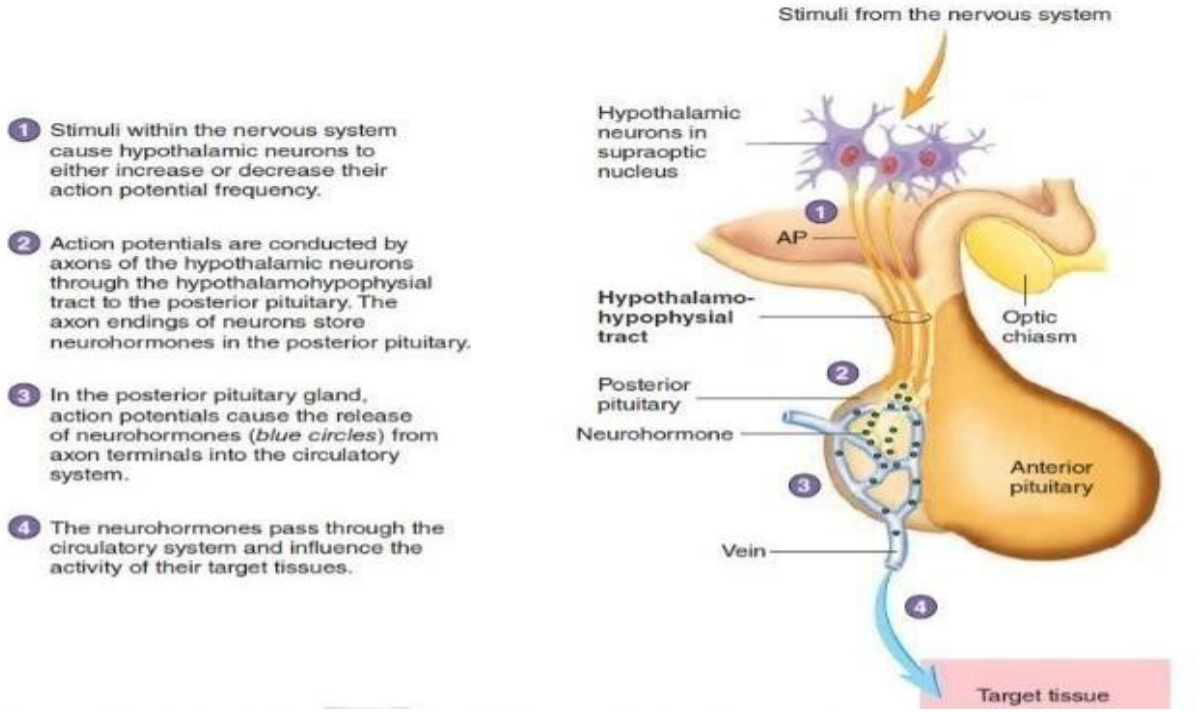


TYPES OF GLANDS IN ENDOCRINE SYSTEM

Pituitary gland:
The pituitary gland is also called the HYPOPHYSIS. It is a small gland about the size of a pea. It rests in a depression of the SPHENOID bone inferior to the hypothalamus of the brain. The hypothalamus is an important autonomic nervous system and endocrine control center of the brain located inferior to the thalamus. The pituitary gland lies posterior to the optic chiasmus and is connected to the hypothalamus by a stalk called the INFUNDIBULUM.

The pituitary gland is divided into two parts:

1. The ANTERIOR PITUITARY made up of epithelial cells derived from the embryonic oral cavity.
2. The POSTERIOR PITUITARY is an extension of the brain and is composed of nerve cells.



MECHANISM OF PITUTARY GLAND
When these nerve cells are stimulated, action potentials from the hypothalamus travel along the axons to the posterior pituitary and cause the release of hormones from the axon endings. Within the hypothalamus and pituitary, the nervous and endocrine systems are closely interrelated. Emotions such as joy and anger, as well as chronic stress, influence the endocrine system through the hypothalamus. Conversely, hormones of the endocrine system can influence the functions of the hypothalamus and other parts of the brain.

HORMONES ACTING ON ANTERIOR PITUITARY:
GROWTH HORMONE:
Stimulates the growth of bones, muscles, and other organs by increasing gene expression. It also resists protein breakdown during periods of food deprivation and favors lipid breakdown. Too little growth hormone secretion can result from abnormal development of the pituitary gland. A young per-son suffering from a deficiency of growth hormone remains small, although normally proportioned, and is called a pituitary dwarf. This condition can be treated by administering growth hormone. Because GH is a protein, it is difficult to produce artificially using conventional techniques. However, human genes for GH have been successfully introduced into bacteria using genetic engineering techniques. The gene in the bacteria causes GH synthesis, and the GH can be extracted from the medium in which the bacteria are grown. Thus, modern genetic engineering has provided a source of human GH for people who produce inadequate quantities.

ADRENO CORTICOTHORMONEROPIC:
Binds to membrane-bound receptors on cells in the cortex of the adrenal glands. ACTH increases the secretion of a hormone from the adrenal cortex called cortisol also called hydrocortisone. ACTH is required to keep the adrenal cortex from degenerating. ACTH

molecules also bind to MELANOCYTES in the skin and increase skin pigmentation. One symptom of too much ACTH secretion is darkening of the skin. The rate of ACTH secretion is increased by a releasing hormone from the hypothalamus.

LEUTINIZING HORMONE:
LH causes the ovulation of OOCYTES and the secretion of the sex hormones estrogen and progesterone from the ovaries. In males, LH stimulates interstitial cells of the testes to secrete the sex hormone testosterone and thus is sometimes referred to as interstitial cell–stimulating hormone (ICSH). Follicle-stimulating hormone (FSH) stimulates the development of follicles in the ovaries and sperm cells in the testes. Without LH and FSH, the ovaries and testes decrease in size, no longer produce OOCYTES or sperm cells, and no longer secrete hormones. A single releasing hormone from the hypothalamus increases the secretion of both LH and FSH.

PROLACTIN:
Prolactin binds to membrane-bound receptors in cells of the breast, where it helps promote development of the breast during pregnancy and stimulates the production of milk following pregnancy. The regulation of prolactin secretion is complex and may involve several substances- released from the hypothalamus.

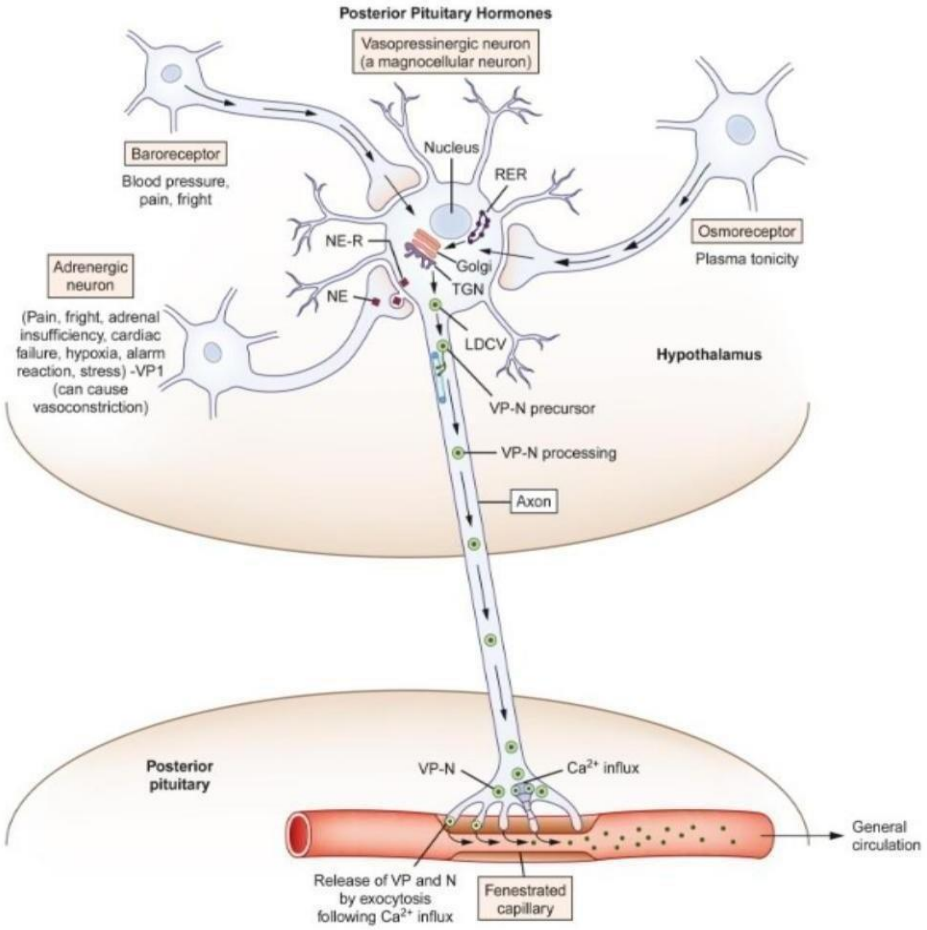
MELANOCYTE STIMULATING HORMONE:
Melanocyte stimulating hormone (MSH) binds to membrane-bound receptors on melanocytes and causes them to synthesize melanin. The structure of MSH is similar to that of ACTH, and over secretion of either hormone causes the skin to darken. Regulation of MSH is not well understood, but there appear to be two regulatory hormones from the hypothalamus— one that increases MSH secretion and one that decreases it.

HORMONES ACTING ON POSTERIOR PITUITARY:
ANTI DIURETIC HORMONE:
Anti diuretic hormone (ADH) binds to membrane-bound receptors and increases water re absorption by kidney tubules. This results in less water lost as urine. ADH can also cause blood vessels to constrict when released in large amounts. Consequently, it is sometimes also called VASOPRESSIN. Reduced ADH release from the posterior pituitary results in large amounts of dilute urine.
A lack of ADH secretion causes diabetes which is the production of a large amount of dilute urine.

OXYTOCIN:
OXYTOCIN binds to membrane-bound receptors, and causes contraction of the smooth muscle cells of the uterus as well as milk letdown from the breasts in lactating women. Commercial preparations of OXYTOCIN, known as PITOCIN, are given under certain conditions to assist in childbirth and to constrict uterine blood vessels following childbirth.

FUNCTIONS OF PITUITARY GLAND:

- HUMAN GROWTHHORMONE(HGH): Responsible for the growth and repair of all cells in the body.
- THYROIDSTIMULATINGHORMONE(TSH): Influences the thyroid gland for the release of THYROXINE, its own hormone. TSH is also called THYROTROPIN.
- ADRENOCORTICOTROPIC HORMONE(ACTH): Influences the adrenal gland to release of Cortisol or the “stress hormone”. ACTH is also known as CORTICOTROPIN.
- LEUTINIZING HORMONE(LH) and Follicle-Stimulating Hormone. Collectively known as GONADOTROPINS, LH and FSH control the sexual and reproductive characteristics in males and females



PITUTARY GLAND SECRETION

- **PROLACTIN(PRL):** Produces milk in the breast. Though it is present at all times, the secretion is increased during and just after pregnancy.
- **MELANOCYTE STIMULATING HORMONE(MSH):** Involved in the stimulation of the production of melanin by skin and hair.
- **ANTI DIURETIC HORMONE(ADH):** Controls the water balance of the body by affecting re absorption of water by the kidneys
- **OXYTOCIN:** Controls certain aspects of pregnancy and childbirth such as uterine contraction and production of milk.

DISORDERS OF PITUITARY GLAND:

- Multiple endocrine neoplasm, type I (MEN I)
- Familial isolated pituitary (FIPA)ADENOMA.
- Change hormone production, leading to symptoms such as weight gain, stunted or excessive growth, high blood pressure, low sex drive or mood changes.
- Press against the pituitary gland, optic nerves or brain tissue, causing vision problems or headaches.
- About six to 11 people in 100,000 live with ACROMEGALY, a disorder caused by too much growth hormone.
- About 10 to 15 people per million are diagnosed with CUSHING disease/syndrome, caused by too much cortisol, each year in the U.S.

CRANIO PHARENGIOMAS, noncancerous pituitary tumors, affect one or two people per million each year in the U.S.

THYROID GLAND:

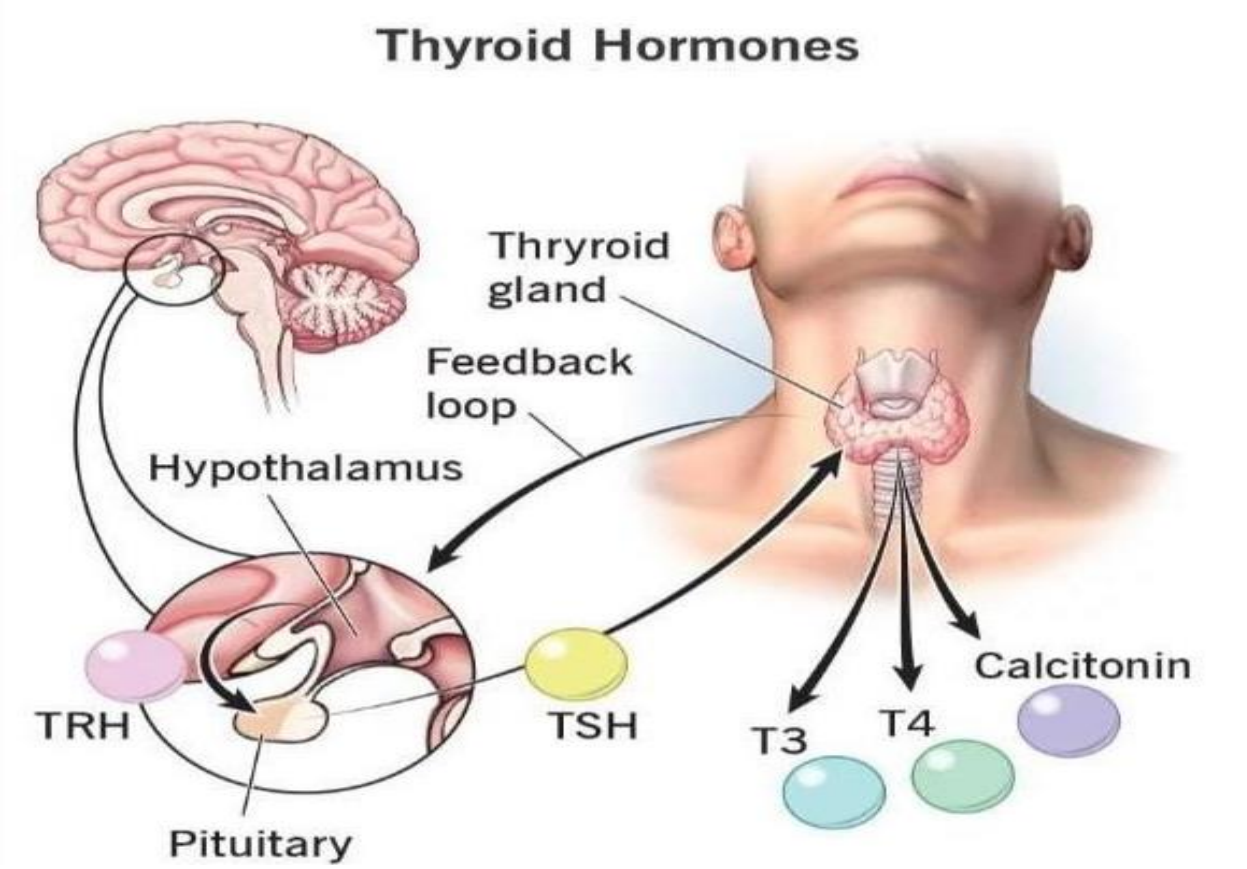
The thyroid gland is made up of two lobes connected by a narrow band called the isthmus . The lobes are located on each side of the trachea, just inferior to the

larynx . The thyroid gland is one of the largest endocrine glands. It appears more red than the surrounding tissues because it is highly vascular. It is surrounded by a connective tissue capsule. The main function of the thyroid gland is to secrete thyroid hormones, which bind to nuclear receptors in cells and regulate the rate of metabolism in the body. Thyroid hormones are synthesized and stored within the gland in numerous thyroid follicles, which are small spheres with walls composed of simple CUBOIDAL epithelium. Each thyroid follicle is filled with the protein THYROGLOBULIN, to which thyroid hormones are attached. Between the follicles is a network of loose connective tissue that contains capillaries and scattered PARAFOLLICULAR cells, or C cells, which secrete the hormone CALCITONIN. A lack of iodine in the diet results in reduced T3 and T4 synthesis. A deficiency of iodine is not as common in the United States as it once was. Table salt with iodine added to it (iodized salt) is available in grocery stores, and vegetables grown in soil rich in iodine can be shipped to most places.

Mainly - T3T4

CALCITONIN:

CALCITONIN is secreted if the blood concentration of Ca2+ becomes too high, and it causes Ca2+ levels to decrease to their normal range. Calcitonin binds to membrane-bound receptors of OSTEOCLASTS and reduces the rate of Ca2+ resorption (breakdown) from bone by inhibiting the osteoclasts. Calcitonin may prevent blood Ca2+ levels from becoming overly elevated following a meal that contains a high concentration of Ca2+.



THYROID GLAND

FUNCTIONS OF THYROID GLAND:

- ✧ Regulating the rate at which your body uses calories (energy). This affects weight loss or weight gain and is called the metabolic rate.
- ✧ Slowing down or speeding up your heart rate.
- ✧ Raising or lowering your body temperature.
- ✧ Influencing the speed at which food moves through your digestive tract.
- ✧ Affecting brain development.

DISORDERS OF THYROID GLAND:

- ◆ Hypothyroidism (under active thyroid).

- Hashimoto's disease (an autoimmune condition that causes hypothyroidism).
- Hyperthyroidism (overactive thyroid).
- Graves' disease (an autoimmune condition that causes hyperthyroidism).
- Thyroiditis (thyroid inflammation).
- Thyroid nodules

PARATHYROID GLAND:

Four tiny parathyroid glands are embedded in the posterior wall of the thyroid gland. The parathyroid glands secrete a hormone called parathyroid hormone (PTH), which is essential for the regulation of blood calcium levels. In fact, PTH is more important than calcitonin in regulating blood Ca2+ levels.

PTH has many effects:

1. PTH binds to membrane-bound receptors of renal tubule cells, which increases active vitamin D formation. Vitamin D causes the epithelial cells of the intestine to increase Ca2+ absorption.
2. PTH binds to receptors on cells of the renal tubules and decreases the rate at which Ca2+ is lost in the urine.
3. PTH binds to receptors on osteoblasts. Substances released by the osteoblasts increase osteoclast activity and cause re absorption of bone tissue to release Ca2+ into the circulatory system.

4.PTH acts on its target tissues to raise blood Ca2+ levels to normal.

Decreasing blood Ca2+ levels stimulate an increase in PTH secretion. For example, if too little Ca2+ is consumed in the diet or if a person suffers from a prolonged lack of vitamin D, blood Ca2+levels decrease, and PTH secretion increases. The increased PTH increases the rate of bone re absorption. Blood Ca2+ levels can be maintained within a normal range, but prolonged re absorption of bone results in reduced bone density, as manifested by soft, flexible bones that are easily deformed in young people and porous, fragile bones in older people.

FUNCTIONS OF PARATHYROID GLAND:

CALCIUM:

The parathyroid hormone functions to release calcium from the bones by stimulating the osteoblast. It facilitates gastrointestinal calcium absorption by activating Vitamin D. It alsopromotes calcium re absorption in the kidneys. Normal calcium levels in the body support strong nervous and muscular systems.

HYPERPARATHYROIDISM:

This condition is developed when an individual produces too much of the PTH hormone. Overproduction of the hormone releases large amounts of calcium, which causes hypercalcemia. The symptoms include extreme thirst, more urine production, abdominal pain and mood changes. Undetected high levels of calcium lead to bone thinning or osteoporosis and can also cause stones in the kidneys.

HYPOPARATHYROIDISM: Low levels of PTH hormone causes hypoparathyroidism and hypocalcemia. The symptoms include tingling sensations, muscle cramps and spasms.

ADRENAL GLAND:

The adrenal glands are two small glands located superior to each kidney. Each adrenal gland has an inner part, called the adrenal medulla (marrow, or middle), and an outer part, called the adrenal cortex (bark, or outer). The adrenal medulla and the adrenal cortex function as separate endocrine glands.

There are 2 types of adrenal gland:

1. ADRENAL MEDULLA
2. ADRENAL CORTEX

1)ADRENAL MEDULLA:

The principal hormone released from the adrenal medulla is - EPINEPHRINE en a person is excited or physically active. These hormones bind to membrane-bound receptors NOR - EPINEPHRINE. Small amounts of nor epinephrine are also released. The adrenal medulla releases epinephrine and nor epinephrine in response to stimulation by the sympathetic nervous system, which becomes most active with their target tissues. Stress and low blood glucose levels can also cause increased sympathetic stimulation of the adrenal medulla. Epinephrine and norepinephrine are referred to as the fight-or-flight hormones because of their role in preparing the body for vigorous physical activity. The major effects of the hormones released from the adrenal medulla are:

1. Increases in the breakdown of glycogen to glucose in the liver, the release of the glucose into the blood, and the release of fatty acids from adipose tissue. The glucose and fatty acids serve as energy sources to maintain the body's increased rate of metabolism.
2. Increased heart rate, which causes blood pressure to rise.
3. Stimulation of smooth muscle in the walls of arteries supplying the internal organs and the skin, but not those supplying skeletal muscle.

Blood flow to internal organs and the skin decreases, as do the functions of the internal organs. Blood flow through skeletal muscles increases.

4. Increased blood pressure due to smooth muscle contraction in the walls of blood vessels in the internal organs and the skin.

ADRENAL CORTEX:

The adrenal cortex secretes three classes of steroid hormones are

i. MINERALO CORTICOIDS
ii. GLUCO CORTICOIDS
iii. ANDROGENS

The molecules of all three classes of steroid hormones enter their target cells and bind to nuclear receptor molecules. However, the hormones and the receptors of each class have unique structural and functional characteristics

MINERALOCORTICOIDS:

The first class of hormones, secreted by the outer layer of the adrenal cortex, the mineralocorticoids, helps regulate blood volume and blood levels of K+ and Na+. Aldosterone is the major hormone of this class. Aldosterone primarily binds to receptor molecules in the kidney, but it also affects the intestine, sweat glands, and salivary glands. Aldostersone causes Na+ and water to be retained in the body and increases the rate at which K+ is eliminated.

GLUCO CORTICOIDS:

The second class of hormones, secreted by the middle layer of the adrenal cortex, the glucocorticoids, helps regulate blood nutrient levels. The major glucoadenoma corticoid hormone is cortisol, which increases the breakdown of proteins and lipids and increases their conversion to forms of energy the body can use.

ANDROGENS:

The third class of hormones, secreted by the inner layer of the adrenal cortex, is composed of the androgens, which stimulate the development of male sexual characteristics. Small amounts of androgens are secreted from the adrenal cortex in both males and females. In adult males, most androgens are secreted by the testes. In adult females, the adrenal androgens influence the female sex drive. If the secretion of sex hormones from the adrenal cortex is abnormally high, exaggerated male characteristics develop in both males and females. This condition is most apparent in females and in males before puberty, when the effects are not masked by the secretion of androgens by the testes.

FUNCTIONS OF ADRENAL GLAND:

CORTISOL:

- Cortisol is a glucocorticoid hormone that plays several important roles.
- It helps control your body's use of fats, proteins and carbohydrates.
- It also suppresses inflammation, regulates your blood pressure, increases blood sugar and helps control your sleep-wake cycle.

ADRENALINE[EPINEPHRINE]AND NOR ADRENALINE [NOR EPINEPHRINE]:

- These hormones are known as the"fight or flight" hormones and are catecholamines.
- Adrenaline and noradrenaline can increase your heart rate and force of heart contractions, increasing blood flow to your muscles and brain and assisting in glucose metabolism.

DISORDERS OF ADRENAL GLAND:

ADDISON'S DISEASE:

* This is rare autoimmune disease that causes your adrenal glands to produce lower-than normal levels of cortisol and aldosterone.

CUSHINGS SYNDROME:

*This condition happens when your adrenal glands produce too much cortisol. It's usually caused by a tumor or certain medications.

HIRSUTISM:

*This condition happens when women and people assigned female at birth (AFAB) develop excessive hair growth due to high levels of androgen, which your adrenal glands make.

PRIMARY ALDOSTERONISM: (CONNS SYNDROME):

* This condition happens when your adrenal glands produce too much aldosterone.

IMMUNE SYSTEM RESPONSE:

- Frequent sickness or infections.

BLOOD PRESSURE SYMPTOM:

- High blood pressure (hypertension) or low blood pressure (hypotension).
- Genetic mutations (changes) Autoimmune diseases.

- Tumors, such as pheochromocytoma, damage to your adrenal glands through injury, infection, or blood loss.
- An issue with your hypothalamus or pituitary gland, which both help regulate your adrenal glands.

PANCREAS, INSULIN, DIABETES:

PANCREAS:

The endocrine part of the pancreas consists of pancreatic islets (islets of Langerhans), which are dispersed through-out the exocrine portion of the pancreas. The islets secrete three hormones are mainly considered:

INSULIN
GLUCAGON
SOMATOSTATIN

which help regulate the blood levels of nutrients, especially glucose. Alpha cells secrete glucagon, beta cells secrete insulin, and delta cells secrete somatostatin.

INSULIN

GLUCAGON:

Glucagon is released from the alpha cells when blood glucose levels are low. Glucagon binds to membrane-bound receptors primarily in the liver, causing the glycogen stored in the liver to be converted to glucose. The glucose is then released into the blood to increase blood glucose levels. After a meal, when blood glucose levels are elevated, glucagon secretion is reduced

SOMATOSTATIN:

Somatostatin is released by the delta cells in response to food intake. Somatostatin inhibits the secretion of insulin and glucagon and inhibits gastric tract activity.

DIABETES:

Diabetes mellitus has several causes:

- ✓ Type 1 diabetes mellitus occurs when too little insulin is secreted from the pancreas.
- ✓ Type 2 diabetes mellitus is caused by insufficient numbers of insulin receptors on target cells or by defective receptors that do not respond normally to insulin. In type 1 diabetes mellitus, tissues cannot take up glucose effectively, causing blood glucose levels to become very high, a condition called hyperglycaemia. Because glucose cannot enter the cells of the satiety center in the brain without insulin, the satiety center responds as if there were very little blood glucose, resulting in an exaggerated appetite. The excess glucose in the blood is excreted in the urine, making the urine volume much greater than normal. Because of excessive urine production, the person tends to become dehydrated and thirsty. Even though blood glucose levels are high, lipids and proteins are broken down to provide an energy source for metabolism, resulting in the wasting away of body tissues, acidosis, and ketosis.

FUNCTIONS OF PANCREAS:

EXOCRINE FUNCTION: Produces substances (enzymes) that help with digestion.

ENDOCRINE FUNCTION: Sends out hormones that control the amount of sugar in your bloodstream.
LIPASE: Works with bile (a fluid produced by the liver) to break down fats.

AMYLASE: Breaks down carbohydrates for energy.

PROTEASE: Breaks down proteins.

DISORDERS OF PANCREAS:

PANCREATITIS:

This happens when digestive enzymes start digesting the pancreas itself
•Pancreatic cancer
•Cystic fibrosis, a genetic disorder in which thick, sticky mucus can also block tubes in your pancreas.

PANCREATIC CARCINOMA: (Pancreatic adenocarcinoma):

We offer clinical trial opportunities for all stages of pancreatic cancer, as well as a highly experienced surgical team. Our pancreatic cancer survival rates are among the best in the nation.

PANCREATIC NEURO ENDOCRINE TUMORS:

Our doctors diagnose pancreatic neuroendocrine tumors with imaging tests and by analyzing biopsy samples in the lab.

PANCREATIC CYSTS:

Our specialists are experts in the diagnosis and treatment of pancreatic cysts. Our minimally invasive diagnosis and treatment options often eliminate the need for surgery.

ACUTE PANCREATITIS: our centre provides minimally invasive diagnosis methods to find out if patients need surgery for acute pancreatitis.

FUNCTIONS OF INSULIN IN DIABETIC PATIENTS:

Insulin provides glucose homeostasis by keeping the plasma glucose value in an optimal range throughout the day. The main effects of insulin are:

1.In the liver, to stimulate glucose oxidation and storage of glucose (glycogenesis), as well as to convert glucose into triglycerides and protein synthesis,

2.In the muscle tissue, it provides glucose uptake into the cells, and be stored as glycogen, (iii) and in fat tissue, it provides glucose uptake and conversion to triglycerides for storage.

DISORDERS:

INSULINOMA

These are tumors of the pancreatic beta cells that lead to excess production of insulin and this results in hypoglycaemia. However, blood glucose level alone is not diagnostic of insulinoma. Fasting insulin level of greater than 24 mu/ml is found in approximately 50% of patients with insulinoma.

METABOLIC SYNDROME:

Metabolic syndrome is a combination of multiple clinical disorders that form a syndrome. It was initially called Syndrome X by Gerald Reaven, Reaven's Syndrome after Reaven

POLYCYSTIC OVARY SYNDROME:

Poly cystic ovarian syndrome or PCOS is complex syndrome in women that includes features of an ovulation (non-production of eggs from the ovary), excess androgens, hirsutism (excess facial hair), infertility etc.

PINEAL GLAND:

The pineal gland is a small, pine cone-shaped structure located superior and posterior to the thalamus of the brain. The pineal gland produces a hormone called melatonin, which is thought to decrease the secretion of LH and FSH by decreasing the release of hypothalamic releasing hormones. Thus, melatonin inhibits the functions of the reproductive system. Animal studies have demonstrated that the amount of available light controls the rate of melatonin secretion.

There are two types of cells present within the gland:

PINEALOCYTES: hormone secreting cells.

GLIAL CELLS: supporting cells.

In middle age, the gland commonly becomes calcified, and can be subsequently identified on radio graphs and CT scans of the head.

FUNCTIONS OF PINEAL GLAND:

SECRETION OF MELATONIN:

Melatonin is a hormone that is mainly produced by your pineal gland. The importance of pineal melatonin in humans is not clear, but many researchers believe it may help to synchronize circadian rhythms in different parts of your body.

CARDIOVASCULAR HEALTH:

The melatonin secretion has a positive impact on the heart and blood pressure. It may also be used for the treatment of cardiovascular diseases.

REPRODUCTION:

Melatonin inhibits the secretion of reproductive hormones from the anterior pituitary, which are responsible for the development and functioning of reproductive organs.

DISORDERS OF PINEAL GLAND:

*Depression
*Mood swings
*Peptic or stomach ulcers
*Disruption in sleep patterns
*An impaired pineal gland leads to hormonal imbalance
*Sexual disorders are caused by the dysfunctioning of the pineal gland

If a tumour develops in the pineal gland, it affects several other factors in the body:
Nausea
Seizures
Headache
Memory disruption
Impaired vision and other senses

THYMUS GLAND:

The thymus lies in the upper part of the thoracic cavity. It is important in the function of the immune system. The thymus secretes a hormone called thymosin which aids the development of white blood cells called T cells. T cells help protect the body against infection by foreign organisms. The thymus is most important early in life; if an infant is born without a thymus, the immune system does not develop normally, and the body is less capable of fighting infections. .

FUNCTIONS OF THYMUS GLAND:
The only purpose of the thymus is to produce white blood cells called T lymphocytes (T cells). They are called T cells because they are primarily produced in the thymus. The thymus produces some T cells before birth and continues the process from birth through adolescence. T cells come in several varieties that perform various roles in the immune response. The most common types of T cells and their roles are:

T4 or CD4 cells:
Alert other white blood cells to pathogens, so they can be destroyed.

T8 or CD8 cells:
Control the overall immune system response by suppressing the activities of other white blood cells.

KILLER T CELLS:
This specific type of CD8 cell recognizes and destroys foreign cells, cancer cells, and those infected with a virus.

DISORDERS OF THYMUS GLAND:

THYMOMA: Tumor of the thymus

THYMIC CANCER: A type of thymoma that often spreads (metastasizes)

MYASTHENIA GRAVIS: A chronic autoimmune and neuromuscular disease

LUPUS: An autoimmune disease that causes chronic, systemic (body-wide) inflammation.

RHEUMATOID ARTHRITIS: An autoimmune disease that causes chronic inflammation of the joint tissues.

TESTES AND OVARIES:
The testes of the male and the ovaries of the female secrete sex hormones, in addition to producing sperm cells or oocytes, respectively. The hormones produced by these organs play important roles in the development of sexual characteristics. Structural and functional differences between males and females, as well as the ability to reproduce, depend on the sex hormones. The main sex hormone in the male is TESTOSTERONE which is secreted by the testes. It is responsible for the growth and development of the male reproductive structures, muscle enlargement, the growth of body hair, voice changes, and the male sexual drive.
In the female, two main classes of sex hormones, secreted by the ovaries, affect sexual characteristics:

ESTROGEN
PROGESTERONE
Together, these hormones contribute to the development and function of female reproductive structures and other female sexual characteristics. Two such characteristics are enlargement of the breasts and the distribution of adipose tissue, which influences the shape of the hips, breasts, and thighs. In addition, the female menstrual cycle is controlled by the cyclical release of estrogen and progesterone from the ovaries.

FUNCTIONS OF TESTES:
The Testis has following three functions.
1.First, it produces spermatozoa, the male gametes.
2.Second, it synthesizes testosterone, the principal male sex hormone.
3.Third, it participates with the hypothalamus-pituitary unit in regulating reproductive function. The principal androgen produced by the testes is testosterone. The production of testosterone by the testes is stimulated by luteinizing hormone (LH), which is produced by the anterior pituitary and acts via receptors on the surface of the Leydig cells.

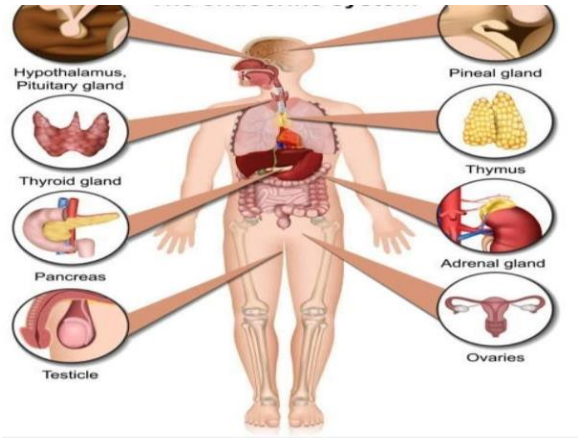
FUNCTIONS OF OVARIES:
- ✧ Ovary stores the produced eggs in it and later releases an egg during ovulation.
- ✧ Ovary acts as an endocrine gland and produces hormones that control the menstrual cycle and pregnancy.
- ✧ The main function of the ovary is to produce the ovum and secrete female sex hormones.

DISORDERS FOR OVARIES AND TESTES:
CRYPTORCHIDISM:
This condition, also called undescended testicles, refers to testicles that don't drop into your scrotum when they should.

EPIDIDYMITIS:
This condition refers to an inflammation of the epididymis.
Spermatocele: This is another name for a cyst that grows above or behind a testis.

POLYCYSTIC OVARIAN SYNDROME:

The most common endocrine pathology in females of reproductive worldwide. Stein and Leventhal initially described it in 1935.
Ovarian cancer
Ovarian cysts and poly cystic ovary syndrome
Premature ovarian failure Ovarian torsion, a twisting of the ovary



ENTIRE ENDOCRINE SYSTEM IN ONE VIEW

CONCLUSION:

Endocrine system - the system of regulation of the internal organs through hormones secreted by endocrine cells directly into the blood, or diffusing through the intercellular space in the adjacent cells.Mixed endocrine and exocrine glands are the pancreas, ovaries and testes they produce hormones but are also involved in other roles.

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