
#425134

Topic: Endocrine glands and their hormones

Define the following:

- (a) Exocrine gland
- (b) Endocrine gland
- (c) Hormone

Solution

Endocrine glands

- These are ductless glands (no tube to carry to various parts).
- Their secretions are directly released into the blood which carries them to various parts of the body.

Exocrine glands

- The exocrine glands have ducts.
- The secretions from these glands are carried through the ducts.
- The ducts may open outside the body to release the secretions (e.g.sweat, milk) or may be released on to another surface within the body (e.g. Digestive juices)

Hormones

- These are chemical messengers that regulate physiological processes in living organisms.
- They act upon specific cells/tissues/organs which are called target cells/tissues/organs.
- There are many types of hormones that act on different aspects of bodily functions and processes like growth and development.

#425135

Topic: Endocrine glands and their hormones

Define endocrine gland.

Solution

Endocrine glands are ductless glands which pour their secretions in the blood. The pituitary gland, thyroid gland, adrenal gland etc., are examples of endocrine glands.

#425136

Topic: Endocrine glands and their hormones

Define the term hormone.

Solution

Hormones are chemical messengers that regulate physiological processes in living organisms. They act upon specific cells/tissues/organs which are called target cells/tissues/organs. There are many types of hormones that act on different aspects of bodily functions and processes. Some of these include development and growth.

#425137

Topic: Endocrine glands and their hormones

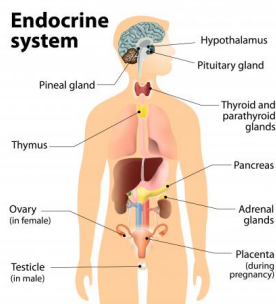
Diagrammatically indicate the location of the various endocrine glands in our body.

Solution

The endocrine system consists of glands widely separated from each other with no physical connections. Endocrine glands are groups of secretory cells surrounded by an extensive network of capillaries that facilitates diffusion of hormones from the secretory cells into the bloodstream.

The endocrine glands in the body are:

- 1) Pineal gland- located in the epithalamus, near the center of the brain.
- 2) Pituitary gland- located at the base of the brain, just below the hypothalamus.
- 3) Hypothalamus- located below the thalamus and above the pituitary gland and brain stem
- 4) Thyroid gland- located in the neck in front of the larynx and trachea
- 5) Parathyroid gland- located in the neck in the posterior surface of the thyroid gland
- 6) Adrenal gland- located on the upper pole of each kidney enclosed within the renal fascia
- 7) Pancreas- located deep inside the abdomen. The head of the pancreas is on the right side of the abdomen and is connected to the duodenum
- 8) Ovaries- located in the lower abdomen, laterally to the left and right of the uterus and inferior to the fallopian tubes
- 9) Testis- located between upper thighs suspended by the spermatic cord in a skin pouch called scrotum
- 10) Thymus gland- located in the upper anterior part of the chest directly behind the sternum and between the lungs
- 11) Heart- lies in the thoracic cavity in the mediastinum (space between the lungs)
- 12) Stomach- located in the superior aspect of the abdomen
- 13) Kidney- located against the back muscles in the upper abdominal area. The left kidney is located slightly more superior than the right kidney due to the larger size of the liver on the right side of the body.



#425139

Topic: Endocrine glands and their hormones

List the hormones secreted by the following:

- (a) Hypothalamus
- (b) Pituitary
- (c) Thyroid
- (d) Parathyroid
- (e) Adrenal
- (f) Pancreas
- (g) Testis
- (h) Ovary
- (i) Thymus
- (j) Atrium
- (k) Kidney
- (l) G-I Tract

Solution

The hormones secreted by the following are:

- (a) Hypothalamus- thyrotropin releasing hormone (TRH), Corticotropin releasing hormone (CRH), gonadotropin-releasing hormone (GnRH), growth hormone releasing hormone (GHRH), somatostatin, dopamine, follistatin, Melanocyte-inhibiting factor (melanostatin), etc.
- (b) Pituitary- Hormones secreted by the anterior pituitary are: Growth Hormone (GH), Thyroid Stimulating Hormone (TSH), Adenocorticotrophic hormone (ACTH), Prolactin (PRL), Follicle Stimulating Hormone (FSH) and Luteinising Hormone (LH). Hormones secreted by the posterior pituitary are: Oxytocin, Antidiuretic hormone (ADH)
- (c) Thyroid - T₃ (tri-iodothyronine), T₄ (thyroxine) and calcitonin
- (d) Parathyroid- Parathyroid hormone (PTH)
- (e) Adrenal- Adrenal cortex secretes: glucocorticoids, mineralocorticoids and sex hormones (androgens). Adrenal medulla secretes: Adrenaline (epinephrine) and Nor-Adrenaline (nor-epinephrine)
- (f) Pancreas- Insulina and glucagon
- (g) Testis- Inhibin
- (h) Ovary- Inhibin
- (i) Thymus- Thymosin
- (j) Atrium- Atrial natriuretic peptide (ANP)
- (k) Kidney- Erythropoietin
- (l) G-I Tract- Gastrin, Secretin, Cholecystokinin (CCK)

#425140

Topic: Endocrine glands and their hormones

List the hormones secreted by pituitary.

Solution

Pituitary: The pituitary gland has two components, i.e., adenohypophysis and neurohypophysis.

Hormones secreted by the adenohypophysis are:

- (i) Growth hormone (GH)
- (ii) Prolactin
- (iii) Thyroid-stimulating hormone (TSH)
- (iv) Adrenocorticotrophic hormone (ACTH)
- (v) Luteinizing hormone (LH)
- (vi) Follicle-stimulating hormone (FSH)
- (vii) Melanocyte-stimulating hormone (MSH)

Hormones secreted by the neurohypophysis are:

- (i) Oxytocin
- (ii) Vasopressin

#425141

Topic: Endocrine glands and their hormones

List the hormones secreted by thyroid gland.

Solution

The follicular cells of the thyroid gland synthesize two thyroid hormones; Tetraiodothyronine (T₄-Thyroxine) and triiodothyronine (T₃) and the C-cells of thyroid gland produces Thyrocalcitonin. The function of these hormones are as follows

- Thyroxine is the main hormone (80% in thyroxine form) secreted into the bloodstream by the thyroid gland.
- It is the inactive form and most of it is converted to an active form called as triiodothyronine (T₃) by organs such as the liver and kidneys.
- Both T₄ and T₃ are synthesized from tyrosine and iodine.
- The thyroid hormones control the metabolism of carbohydrates, protein and fats. They play an important role in regulating the Basal Metabolic Rate (BMR)
- They are also important for maintenance of water and electrolyte balance.
- Thyroid hormones also regulate the RBC production.
- The thyrocalcitonin maintains the blood calcium levels and promotes the bone formation.

#425143

Topic: Mechanism of hormone action

List the hormones secreted by the adrenal gland.

Solution

The adrenal cortex and the adrenal medulla regions of the kidneys secrete several hormones that have a wide range functions in the body.

Hormones of the Adrenal Cortex

- The hormones produced by the adrenal cortex are called the corticoids
- Two types of corticoids are produced; Mineralocorticoids and the Glucocorticoids
- Mineralocorticoids regulate water and electrolyte balance.
- Glucocorticoids regulate the carbohydrate metabolism.
- Aldosterone is the main mineralocorticoid produced by the adrenal cortex.
- Aldosterone acts by stimulating the reabsorption of water and sodium and also causes excretion of potassium and phosphate ions.
- Cortisol, cortisone and corticosterone are the glucocorticoids produced by the adrenal cortex
- Glucocorticoids control the blood glucose levels by stimulating gluconeogenesis, lipolysis and proteolysis.
- Cortisol also has anti-inflammatory activity and has the ability to suppress the immune response.
- Androgens are also produced by the adrenal cortex and they are responsible for the growth of facial hair, pubic hair etc.,

Hormones of the Adrenal medulla

- The medulla produces the catecholamines which include the hormones epinephrine (adrenaline) and norepinephrine (noradrenaline)
- These are released under stress conditions and are called the emergency hormones or hormones of fight or flight.
- Both the hormones stimulate glycogenolysis, lipolysis and proteolysis.
- They increase the heartbeat and rate of respiration

#425144

Topic: Endocrine glands and their hormones

List the hormones secreted by pancreas.

Solution

The four main hormones produced by the endocrine pancreas and their functions are

Glucagon

- It is a polypeptide hormone.
- It is secreted by the pancreas when the glucose level in the blood drops.
- It increases the blood glucose levels by initiating glycogenolysis (glycogen degradation) and stimulating gluconeogenesis (synthesis of glucose from non-carbohydrate molecules) in the liver cells.
- Since it increases the blood glucose levels it is a hyperglycemic (hyper-more, glycemic-sugar levels) hormone
- It also initiates lipolysis (degradation of lipid) in the adipose tissue.

Insulin

- It is also a polypeptide hormone
- It has antagonistic (opposite) effects of the hormone glucagon.
- It is released when the glucose level in the blood raises.
- It lowers blood sugar levels in different ways; increasing the uptake of glucose by all the cells in the body, initiating glycogenesis (glycogen synthesis) in the liver and muscle.
- It initiates lipogenesis (synthesis of lipids/fat) and storage of fat in adipose tissue and inhibits gluconeogenesis
- It is a hypoglycemic (hypo=less) hormone as it reduces the sugar levels in the blood

Somatostatin

- Also known as growth hormone-inhibiting hormone (GHIH)
- It acts locally on the Islets of Langerhans and inhibit the secretion of both insulin and glucagon
- It also reduces gastric secretions and inhibits the release of gastrointestinal hormones

Pancreatic Polypeptide

- It is a polypeptide secreted by the cells of the pancreas.
- Protein is strong stimulus for its production
- It affects gastric and biliary secretion and motility of the GI tract

#425145

Topic: Endocrine glands and their hormones

Write short on the functions of the testis.

Solution

The testis produces various male hormones collectively called as the androgens.

- The androgens include; testosterone, dihydrotestosterone and androstenedione.
- Testosterone is considered to be the primary hormone as it is produced abundantly when compared to others.
- However, dihydrotestosterone is the more active form. The testosterone is ultimately converted to the active form in the target tissues.
- Androgens regulate the development, maturation and function of the male sex organs (e.g. epididymis, seminal vesicles etc..)
- They play an important role in spermatogenesis and male sexual behaviour
- They also promote protein and carbohydrate synthesis.

#425146

Topic: Endocrine glands and their hormones

List the hormones secreted by ovary.

Solution

The ovaries secrete two types of female sex hormones called the estrogens and the progestins.

Estrogens

- In Non-pregnant females, they are predominantly secreted by the ovaries. However, during pregnancy, the placenta secretes a lot of estrogens.
- The three types of estrogens are; β -estradiol, estrone and estriol.
- The most active and the principal estrogen produced by the ovaries is the β -estradiol.
- They play an important role in the growth and development of ovarian follicles and breast
- They are responsible for the development of secondary sexual characteristics (e.g. high pitch voice)
- They inhibit osteoclastic activity and stimulate bone growth. Osteoporosis in menopausal women is because of reduced estrogen levels.
- They also influence the texture of the skin and female sexual behaviour

Progestins (Progesterone)

- The progestins are secreted by the corpus luteum, a structure that is formed from the ruptured follicle (after ovulation/ later half of ovarian cycle).
- Most important progestin is the progesterone. Small amounts of 17- α -hydroxyprogesterone is also secreted along with progesterone.
- Placenta also secretes large amounts of progesterone during pregnancy.
- The progestins mainly have 2 functions; prepare the uterus for pregnancy and prepare breasts for lactation.
- Progesterone acts on mammary glands and stimulates the formation of milk storing sacs called alveoli and milk secretion.

#425150

Topic: Endocrine glands and their hormones

List the hormones secreted by G-I tract.

Solution

Both the stomach and the small intestine of the gastrointestinal tract produce hormones.

Hormones produced by the stomach

The 'G' cells of the stomach secrete the hormone called gastrin.

- The stimuli for gastrin production include; ingestion of meal, distention (swelling/enlargement) of stomach and products of protein digestion.
- It has 2 main functions; stimulation of gastric acid secretion and stimulation of growth of the gastric mucosa.

Hormones produced by the small intestine

The small intestine secretes 4 hormones; cholecystokinin, secretin, gastric inhibitory peptide (GIP) and Motilin.

Cholecystokinin

- Stimulates pancreatic enzyme and bicarbonate secretion
- Stimulates contraction of the gallbladder
- Also stimulates the growth of the exocrine pancreas
- It inhibits gastric emptying (entry of food into intestine by emptying stomach)

Secretin

- It stimulates pepsin secretion from stomach and bicarbonate secretion from both pancreas and gallbladder
- Also promotes the growth of exocrine pancreas.
- It inhibits gastric acid secretion.

GIP

- Stimulates release of insulin from pancreas
- Inhibits gastric acid secretion

Motilin

- It is involved in the motility of the gastrointestinal tract.

#425152

Topic: Endocrine glands and their hormones

Fill in the blanks:

Hormones	Target gland
(a) Hypothalamic hormone
(b) Thyrotrophin (TSH)
(c) Corticotrophin (ACTH)
(d) Gonadotrophins (LH, FSH)
(e) Melanotrophin (MSH)

Solution

(a) Hypothalamic hormones: Pituitary

Hypothalamic hormones include thyrotropin-releasing, gonadotropin-releasing, growth hormone-releasing, corticotrophin-releasing, somatostatin and dopamine hormones.

These hormones release into the blood through the capillaries, travelling to the pituitary gland where their effects are exerted.

(b) Thyrotropin (TSH) : Thyroid

Thyroid stimulating hormone (TSH) is produced and released into the bloodstream by the pituitary gland. It controls the production of the thyroid hormones, thyroxine and triiodothyronine, by the thyroid gland by binding to receptors located on cells in the thyroid gland.

(c) Corticotrophin (ACTH) : Adrenal

The ACTH stimulates the adrenal glands to make and release corticosteroid hormones into the blood.

(d) Gonadotrophins (LH, FSH) : Ovary, Testis

In females, LH and FSH stimulate ovary to produce steroids.

In males, LH stimulates Leydig cells to produce testosterone and FSH stimulates Sertoli cells to produce an androgen-binding protein (ABP), thereby stimulating spermatogenesis.

(e) Melanotropin (MSH) : Melanocyte

MSH stimulate the production and release of melanin (a process referred to as melanogenesis) by melanocytes in skin and hair.

#425153

Topic: Endocrine glands and their hormones

Give the target gland for thyrotrophin (TSH).

Solution

Thyrotropin (TSH) activates the thyroid gland. Thyroid stimulating hormone (TSH) is produced by the anterior pituitary. It stimulates the thyroid gland and stimulates the production of thyroxine which helps in regulation of metabolic activity.

#425154

Topic: Endocrine glands and their hormones

Mention the target gland for corticotrophin (ACTH) hormone.

Solution

ACTH (Adrenocorticotrophic hormone) is a hormone secreted by the anterior lobe of the pituitary glands. ACTH stimulates the adrenal cortex to release corticosteroids namely glucocorticoids such as cortisol and mineralocorticoids such as aldosterone. Glucocorticoids stimulate glucose synthesis. Mineralocorticoids regulate water and ion balance in the body.

#425155

Topic: Endocrine glands and their hormones

Give the target gland for gonadotrophins (LH and FSH).

Solution

The target gland for gonadotropins (LH, FSH) is ovary and testis. In females, LH and FSH stimulate ovary to produce steroids. In males, LH stimulates Leydig cells to produce testosterone and FSH stimulates Sertoli cells to produce an androgen-binding protein (ABP), thereby stimulating spermatogenesis.

#425156

Topic: Endocrine glands and their hormones

Give the target gland for Melanotrophin (MSH).

Solution

Melanotrophin (MSH) is secreted by the anterior pituitary. MSH stimulate the production and release of melanin (a process referred to as melanogenesis) by melanocytes in skin and hair.

#425161

Topic: Endocrine glands and their hormones

Write short notes on the functions of androgens.

Solution

Androgens are the hormones which is responsible for development of secondary sexual characters. The Leydig cells of testis produce androgens such as testosterone. Testosterone is a male sex hormone that regulates the development of secondary sex characteristics such as facial hair, hoarse voice, development of reproductive organ, etc. Androgens also regulate the development, maturation, and functions of various male accessory organs such as epididymis and prostate glands. It stimulates spermatogenesis and formation of mature sperms. It also influences male sexual behaviour.

#425162

Topic: Endocrine glands and their hormones

Write short note on functions of estrogens.

Solution

The ovaries secrete two types of female sex hormones called the estrogens and the progestins.

Estrogens

- In Non-pregnant females, they are predominantly secreted by the ovaries. However, during pregnancy, the placenta secretes a lot of estrogens.
- The three types of estrogens are; beta-estradiol, estrone, and estriol
- The most active and the principal estrogen produced by the ovaries is the beta-estradiol.
- They play an important role in the growth and development of ovarian follicles and breast
- They are responsible for the development of secondary sexual characteristics (e.g. high pitch voice)
- They inhibit osteoclastic activity and stimulate bone growth. Osteoporosis in menopausal women is because of reduced estrogen levels.
- They also influence the texture of the skin and female sexual behavior

#425163

Topic: Endocrine glands and their hormones

Write short note on functions of insulin and glucagon.

Solution

Insulin and Glucagon are two hormones produced by the pancreas whose primary function is to regulate the carbohydrate metabolism.

Glucagon

It is a polypeptide hormone.

It is secreted by the pancreas when the glucose level in the blood drops.

It increases the blood glucose levels by initiating glycogenolysis (glycogen degradation) and stimulating gluconeogenesis (synthesis of glucose from non-carbohydrate molecules) in the liver cells.

Since it increases the blood glucose levels it is a hyperglycemic (hyper-more, glycemic-sugar levels) hormone

It also initiates lipolysis (degradation of lipid) in the adipose tissue.

Insulin

It is also a polypeptide hormone

It has antagonistic (opposite) effects of the hormone glucagon.

It is released when the glucose level in the blood raises.

It lowers blood sugar levels in different ways; increasing the uptake of glucose by all the cells in the body, initiating glycogenesis (glycogen synthesis) in the liver and muscle.

It initiates lipogenesis (synthesis of lipids/fat) and storage of fat in adipose tissue and inhibits gluconeogenesis

It is a hypoglycemic (hypo=less) hormone as it reduces the sugar levels in the

#425165

Topic: Endocrine glands and their hormones

Give example(s) of:

- (a) Hyperglycemic hormone and hypoglycemic hormone
- (b) Hypercalcemic hormone
- (c) Gonadotropic hormone
- (d) Progestational hormone
- (e) Blood pressure lowering hormone
- (f) Androgens and estrogens

Solution

Hyperglycemic hormone is glucagon, while hypoglycemic hormone is insulin.

Hypercalcemic hormone example is parathyroid hormone (PTH).

Gonadotrophic hormone examples are: LH (Luteinizing hormone) and FSH (Follicle stimulating hormone).

Progestational hormone example is progesterone.

Blood pressure lowering hormone example is Nor-adrenalin.

Androgen example is testosterone where as an example of estrogen is estradiol.

#425167

Topic: Endocrine glands and their hormones

Give examples of gonadotrophic hormones.

Solution

FSH and LH together are called the gonadotropins

Follicle stimulating hormone (FSH) stimulates egg formation in females and sperm formation in males.

Luteinizing hormone (LH) Induces ovulation of the Graffian follicles (fully mature follicles), maintains the corpus luteum formed after ovulation. It also stimulates the synthesis and secretion of androgens (hormones) from the testis

#425170

Topic: Endocrine glands and their hormones

Give examples androgens and estrogens.

Solution

Androgens are male sex hormones that are responsible for the development of secondary sexual characters. Testosterone is an example of androgen, Estrogens are female sex hormones, an example of estrogen is estradiol. Testosterone is a hormone produced by the testis and is responsible for the proper development of male sexual characteristics. Estradiol is a female sex hormone produced by the ovaries, adrenal gland and also the placenta during pregnancy.

#425172

Topic: Endocrine glands and their hormones

Which hormonal deficiency is responsible for the following :

- (a) Diabetes mellitus
- (b) Goitre
- (c) Cretinism

Solution

(a) Diabetes mellitus is characterized by abnormally high glucose levels in the blood due to the deficiency of hormone, called insulin. Insulin helps the body use food for energy. When a person has diabetes, the pancreas either cannot produce enough insulin, or the body becomes resistant to insulin or both. Insulin stimulates the cells to uptake glucose. Lack of insulin or the inability of the cells to respond to insulin can lead to problems with the glucose uptake. Since the glucose is not taken up by the cells, the body will not get enough energy and several other problems associated with the increased blood glucose levels are also manifested.

(b) Goitre is characterized by an abnormal enlargement of the thyroid gland due to the deficiency of thyroxine hormone in the body. Symptoms of a goiter include enlargement of the throat, ranging from a small lump to a huge mass, swallowing problems and breathing problems.

(c) Cretinism is characterized by stunted growth in the baby due to the deficiency of thyroid hormone in the body. It usually results from a congenital defect (e.g., an absence of the thyroid, the presence of only a rudimentary gland, the inability of the gland to produce thyroxine). However, it can develop later if there is a lack of iodine in the diet, or if the thyroid is diseased or surgically removed.

#425173

Topic: Endocrine glands and their hormones

Which hormonal deficiency is responsible for goitre?

Solution

The abnormal enlargement of the thyroid gland due to the deficiency of thyroxin hormone in the body causes goitre. Symptoms of a goitre include enlargement of the throat, ranging from a small lump to a huge mass, swallowing problems and breathing problems.

#425174

Topic: Endocrine glands and their hormones

Which hormonal deficiency is responsible for cretinism?

Solution

Thyroid hormone is responsible for the metabolism and growth of the body. The deficiency of thyroxine causes cretinism. Iodine is the precursor for the thyroxine. Deficiency of iodine in the diet causes underdevelopment of thyroid gland. However, it can develop later if there is a lack of iodine in the diet, or if the thyroid is diseased or surgically removed.

#425175

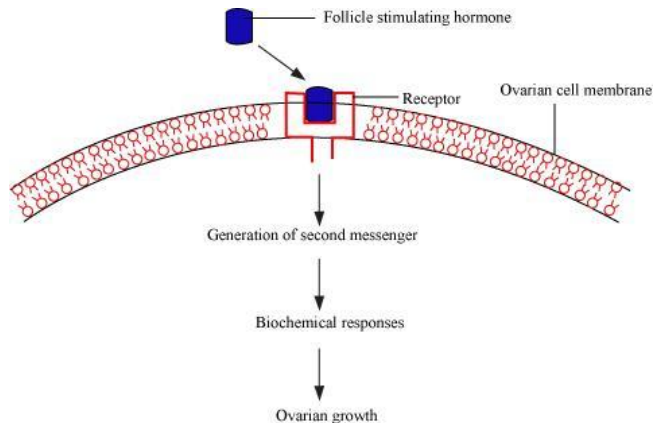
Topic: Endocrine glands and their hormones

Briefly mention the mechanism of action of FSH.

Solution

Follicle stimulating hormone (FSH) is secreted by the pars distalis region of the anterior pituitary. It controls the development, growth, and reproductive processes of the human body. In the ovary, it stimulates the growth and maturation of ovarian follicle. Once the follicle matures, inhibin is released that ends the process of FSH production.

The action of FSH: Follicle stimulating hormone binds to its specific receptors present on the ovarian cell membrane.



Binding of FSH hormone leads to the formation of hormone receptor complex. The formation of this complex leads to a series of biochemical events in the ovarian follicle, present in the ovary. These events lead to the maturation and release of ovarian follicle as mature ovum in the fallopian tube for fertilization.

#425177

Topic: Endocrine glands and their hormones

Match the column.

Column I	Column II
(a) T_4	(i) Hypothalamus
(b) PTH	(ii) Thyroid
(c) GnRH	(iii) Pituitary
(d) LH	(iv) Parathyroid

Solution

T_4 is a hormone produced by the thyroid gland. PTH is parathyroid hormone or parathormone produced by the parathyroid gland. GnRH is the gonadotropin-releasing hormone secreted by the hypothalamus and LH is luteinizing hormone secreted by the pituitary gland.