



19 Chemical Coordination and Integration

19.1. Endocrine Glands and Hormones

- Which one of the following statements is correct?
 - Endocrine glands regulate neural activity, but not *vice-versa*.
 - Neurons regulate endocrine activity, but not *vice-versa*.
 - Endocrine glands regulate neural activity, and nervous system regulates endocrine glands.
 - Neither hormones control neural activity nor the neurons control endocrine activity. [AIPMT 2006]

19.2. Human Endocrine System

- Match List-I with List-II:

List-I	List-II
(a) Epinephrine	(i) Hyperglycemia
(b) Thyroxine	(ii) Smooth muscle contraction
(c) Oxytocin	(iii) Basal metabolic rate
(d) Glucagon	(iv) Emergency hormone

Choose the correct answer from the options given below:

(a)	(b)	(c)	(d)
(A) (ii)	(i)	(iv)	(iii)
(B) (iii)	(ii)	(i)	(iv)
(C) (iv)	(iii)	(ii)	(i)
(D) (i)	(iv)	(iii)	(ii)

[Re-NEET 2024]

- Diuresis is prevented by:

- Renin from JG cells via switching off the osmoreceptors.
- ANF from atria of the heart.
- Aldosterone from adrenal medulla.
- Vasopressin from Neurohypophysis.

[Re-NEET 2024]

- Which of the following is not a steroid hormone?

- Testosterone
- Progesterone
- Glucagon
- Cortisol [NEET 2024]

- Match List I with List II:

List I	List II
(a) Exophthalmic goiter	(i) Excess secretion of cortisol, moon face hyperglycemia.
(b) Acromegaly	(ii) Hyposecretion of thyroid hormone and stunted growth.
(c) Cushing's syndrome	(iii) Hypersecretion of thyroid hormone and protruding eye balls.
(d) Cretinism	(iv) Excessive secretion of growth hormone.

Choose the correct answer from the options given below:

(a)	(b)	(c)	(d)
(A) (iv)	(ii)	(i)	(iii)
(B) (iii)	(iv)	(ii)	(i)
(C) (iii)	(iv)	(i)	(ii)
(D) (i)	(iii)	(ii)	(iv)

[NEET 2024]

- Which of the following are NOT under the control of thyroid hormone?

- Maintenance of water and electrolyte balance.
- Regulation of basal metabolic rate.
- Normal rhythm of sleep-wake cycle.
- Development of immune system.
- Support the process of RBCs formation.

Choose the correct answer from the options given below:

- (III) and (IV) only
- (IV) and (V) only
- (I) and (IV) only
- (II) and (III) only

[NEET 2023]

- Which of the following are not the effects of Parathyroid hormone?

- Stimulates the process of bone resorption.
- Decreases Ca^{2+} level in blood.
- Reabsorption of Ca^{2+} by renal tubules.
- Decreases the absorption of Ca^{2+} from digested food.
- Increases metabolism of carbohydrates.

Choose the most appropriate answer from the options given below:

- (A) (II), (IV) and (V) only
- (B) (I) and (V) only
- (C) (II) and (III) only
- (D) (I) and (III) only

[NEET 2022]

8. Hormones stored and released from neurohypophysis are:

- (A) thyroid stimulating hormone and oxytocin
- (B) oxytocin and vasopressin
- (C) follicle stimulating hormone and luteinizing hormone
- (D) prolactin and vasopressin.

[NEET Oct. 2020]

9. Presence of which of the following conditions in urine are indicative of diabetes mellitus?

- (A) Uremia and Renal calculi
- (B) Ketonuria and Glycosuria
- (C) Renal calculi and Hyperglycemia
- (D) Uremia and Ketonuria

[NEET Sept. 2020]

10. Match the following columns and select the correct option.

Column I	Column II
(a) Pituitary gland	(i) Grave's disease
(b) Thyroid gland	(ii) Diabetes mellitus
(c) Adrenal gland	(iii) Diabetes insipidus
(d) Pancreas	(iv) Addison's disease

Select the correct option.

(a)	(b)	(c)	(d)
(A) (iii)	(ii)	(i)	(iv)
(B) (iii)	(i)	(iv)	(ii)
(C) (ii)	(i)	(iv)	(iii)
(D) (iv)	(iii)	(i)	(ii)

[NEET Sept. 2020]

11. Select the correct statement.

- (A) Glucagon is associated with hypoglycemia.
- (B) Insulin acts on pancreatic cells and adipocytes.
- (C) Insulin is associated with hyperglycemia.
- (D) Glucocorticoids stimulate gluconeogenesis.

[NEET Sept. 2020]

12. Which of the following glucose transporters is insulin-dependent?

- (A) GLUT II
- (B) GLUT III
- (C) GLUT IV
- (D) GLUT I

[NEET National 2019]

13. Match the following hormones with the respective disease.

Column I	Column II
(a) Insulin	(i) Addison's disease
(b) Thyroxin	(ii) Diabetes insipidus
(c) Corticoids	(iii) Acromegaly
(d) Growth hormone	(iv) Goitre
	(v) Diabetes mellitus

Select the correct option.

(a)	(b)	(c)	(d)
(A) (ii)	(iv)	(iii)	(i)
(B) (v)	(iv)	(i)	(iii)
(C) (ii)	(iv)	(i)	(iii)
(D) (v)	(i)	(ii)	(iii)

[NEET National 2019]

14. Which of the following hormones is responsible for both the milk ejection reflex and the foetal ejection reflex?

- (A) Oestrogen
- (B) Prolactin
- (C) Oxytocin
- (D) Relaxin

[NEET Odisha 2019]

15. Which of the following conditions will stimulate parathyroid gland to release parathyroid hormone?

- (A) Fall in active vitamin D levels
- (B) Fall in blood Ca^{+2} levels
- (C) Fall in bone Ca^{+2} levels
- (D) Rise in blood Ca^{+2} levels

[NEET Odisha 2019]

16. Which of the following hormones can play a significant role in osteoporosis?

- (A) Estrogen and parathyroid hormone
- (B) Progesterone and aldosterone
- (C) Aldosterone and prolactin
- (D) Parathyroid hormone and prolactin

[NEET 2018]

17. Hypersecretion of growth hormone in adults does not cause further increase in height because:

- (A) growth hormone becomes inactive in adults
- (B) epiphyseal plates close after adolescence
- (C) bones lose their sensitivity to growth hormone in adults
- (D) muscle fibres do not grow in size after birth.

[NEET 2017]

18. A temporary endocrine gland in the human body is:

- (A) pineal gland
- (B) corpus cardiacum
- (C) corpus luteum
- (D) corpus allatum.

[NEET 2017]

19. Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other?

- (A) Insulin – Glucagon
- (B) Aldosterone – Atrial Natriuretic Factor
- (C) Relaxin – Inhibin
- (D) Parathormone – Calcitonin

[NEET Phase-I 2016]

Endocrine gland	Hormone	Function/deficiency symptoms
(A) Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth
(B) Posterior pituitary	Growth Hormone (GH)	Oversecretion stimulates abnormal growth
(C) Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(D) Corpus luteum	Testosterone	Stimulates spermatogenesis

[NEET 2013]

30. Which of the following represents the action of insulin?

- (A) Increases blood glucose level by stimulating glucagon production.
- (B) Decreases blood glucose level by forming glycogen.
- (C) Increases blood glucose level by promoting cellular uptake of glucose.
- (D) Increases blood glucose level by hydrolysis of glycogen.

[NEET Karnataka 2013]

[NEET Karnataka 2013]

31. Given ahead is an incomplete table about certain hormones, their source glands and one major effect of each on the body in humans. Identify the correct option for the three blanks a, b and c.

Gland	Secretion	Effect on Body
a	Oestrogen	Maintenance of secondary sexual characters
Alpha cells of islets of Langerhans	b	Raises blood sugar level
Anterior pituitary	c	Oversecretion leads to gigantism

(A) Oxytocin
 (B) Prolactin
 (C) Estrogen
 (D) Gonadotrophic releasing factor

47. Adrenalin directly affects:

(A) SA node
 (B) β -cells of Langerhans
 (C) dorsal root of spinal cord
 (D) epithelial cells of stomach.

48. Acromegaly is caused by:

(A) excess of STH
 (B) excess of thyroxin
 (C) deficiency of thyroxin
 (D) excess of adrenaline.

49. Which set is similar?

(A) Corpus luteum : Graafian follicles
 (B) Sebum : Sweat
 (C) Bundle of his : Pace maker
 (D) Vitamin B₇ : Niacin

50. A common scent-producing gland among mammals is:

(A) anal gland (B) prostate gland
 (C) adrenal gland (D) Bartholin's gland.

51. Secretion of progesterone by corpus luteum is initiated by:

(A) thyroxine (B) LH
 (C) MSH (D) testosterone

52. The gonadotropic hormones are produced by:

(A) interstitial cells of testes
 (B) adrenal cortex
 (C) adenohypophysis of pituitary
 (D) posterior part of thyroid

53. Diabetes is due to:

(A) iodine deficiency (B) hormonal deficiency
 (C) Na^+ deficiency (D) enzyme deficiency

54. The hormone which regulates the basal metabolism in our body is secreted from:

(A) pituitary (B) thyroid
 (C) adrenal cortex (D) pancreas

55. Which one of the following hormones stimulates the 'let down' (release) of milk from the mother's breasts when the baby is sucking?

(A) Progesterone (B) Oxytocin
 (C) Prolactin (D) Relaxin

56. Which of the following endocrine gland stores its secretion in the extracellular space before discharging into the blood?

(A) Pancreas (B) Adrenal
 (C) Testis (D) Thyroid

57. Testosterone is produced by:

(A) Sertoli cells (B) Leydig cells
 (C) Oxyntic cells (D) Pituitary gland

58. Occurrence of Leydig cells and their secretion is:

(A) ovary and estrogen
 (B) liver and cholesterol
 (C) pancreas and glucagon
 (D) testis and testosterone.

59. Insulin is a:

(A) Vitamin (B) Lipid
 (C) Hormone (D) Enzyme

60. Which hormone possesses anti-insulin effect?

(A) Cortisol (B) Calcitonin
 (C) Oxytocin (D) Aldosterone

61. MSH of pars intermedia of middle pituitary is responsible for:

(A) darkening of skin in lower vertebrates
 (B) light colouration of skin in lower vertebrates
 (C) both (A) and (B)
 (D) darkening of skin in human beings.

19.3. Hormones of Heart, Kidney and Gastrointestinal Tract

62. Identify the wrong statements:

(I) Erythropoietin is produced by juxtaglomerular cells of the kidney.
 (II) Leydig cells produce Androgens.
 (III) Atrial Natriuretic factor, a peptide hormone is secreted by the seminiferous tubules of the testes.
 (IV) Cholecystokinin is produced by gastrointestinal tract.
 (V) Gastrin acts on intestinal wall and helps in the production of pepsinogen.

Choose the most appropriate answer from the options given below:

(A) (IV) and (V) only
 (B) (I) and (II) only
 (C) (III) and (V) only
 (D) (I) and (III) only

63. Match List I with List II:

List I	List II
(a) CCK	(i) Kidney
(b) GIP	(ii) Heart
(c) ANF	(iii) Gastric gland
(d) ADH	(iv) Pancreas

Choose the correct answer from the options given below:

(a) (b) (c) (d)
 (A) (ii) (iv) (i) (iii)
 (B) (iv) (ii) (iii) (i)
 (C) (iv) (iii) (ii) (i)
 (D) (iii) (ii) (iv) (i)

[NEET 2023]

64. Which hormones do stimulate the production of pancreatic juice and bicarbonate?

(A) Angiotensin and epinephrine
 (B) Gastrin and insulin
 (C) Cholecystokinin and secretin
 (D) Insulin and glucagon

[NEET Phase-II 2016]

65. Which of the following statement is correct in relation to the endocrine system?

(A) Adenohypophysis is under direct neural regulation of the hypothalamus.
 (B) Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones.
 (C) Non-nutrient chemicals produced by the body in trace amount that act as intercellular messenger are known as hormones.
 (D) Releasing and inhibitory hormones are produced by the pituitary gland.

[NEET 2013]

66. Which one of the following pairs of chemical substances, is correctly categorised?

(A) Calcitonin and thymosin—Thyroid hormones
 (B) Pepsin and prolactin—Two digestive enzymes secreted in stomach
 (C) Troponin and myosin—Complex proteins in striated muscles
 (D) Secretin and rhodopsin—Polypeptide hormones

[AIPMT Mains 2012]

67. The contraction of gall bladder is due to:

(A) cholecystokinin (B) enterogastrone
 (C) gastrin (D) secretin.

[AIPMT 1998]

68. The hormone that stimulates the stomach to secrete gastric juice is:

(A) Enterokinase (B) Enterogastrone
 (C) Gastrin (D) Renin

[AIPMT 1998]

69. Gastric secretion is stopped by hormone:

(A) Enterogastrone (B) Gastrin
 (C) Pancreozymin (D) Cholecystokinin

[AIPMT 1993]

19.4. Mechanism of Hormone Action

70. Match the following columns and select the correct option from the codes given below.

Column I	Column II
(a) Pituitary hormone	(i) Steroid
(b) Epinephrine	(ii) Neuropeptides
(c) Endorphins	(iii) Peptides, proteins
(d) Cortisol	(iv) Biogenic amines

Select the correct option.

(a) (b) (c) (d)
 (A) (iv) (i) (ii) (iii)
 (B) (iii) (iv) (ii) (i)
 (C) (iv) (iii) (i) (ii)
 (D) (iii) (i) (iv) (ii)

[NEET Oct. 2020]

71. Which of the following is an amino acid derived hormone?

(A) Estradiol (B) Ecdysone
 (C) Epinephrine (D) Estriol

[NEET 2018, AIPMT 2004]

72. The amino acid, tryptophan is the precursor for the synthesis of:

(A) thyroxine and triiodothyronine
 (B) estrogen and progesterone
 (C) cortisol and cortisone
 (D) melatonin and serotonin.

[NEET Phase-I 2016]

73. What is correct to say about the hormone action in humans?

(A) Glucagon is secreted by β -cells of islets of Langerhans and stimulates glycogenolysis.
 (B) Secretion of thymosin is stimulated with ageing.
 (C) In females, FSH first binds with specific receptors on ovarian cell membrane.
 (D) FSH stimulates the secretion of oestrogen and progesterone.

[AIPMT Screening 2012]

74. Which one of the following is not a secondary messenger in hormone action?

(A) cAMP (B) cGMP
 (C) Calcium (D) Sodium

[AIPMT 2006]

75. Chemically hormones are:

(A) biogenic amines only
 (B) proteins, steroids and biogenic amines
 (C) proteins only
 (D) steroids only.

[AIPMT 2004]

76. Hormones thyroxine, adrenaline and the pigment melanin are formed from:

(A) tyrosine (B) proline
 (C) tryptophan (D) glycine

[AIPMT 1997]

SOLUTIONS

1. (C) The endocrine glands are regulated by the neurological system. Endocrine glands, on the other hand, govern brain activity. The best examples are the hormones epinephrine and norepinephrine, which are released by the adrenal glands. It is secreted in response to stress of any kind and during emergency situations, and is known as emergency hormones or Fight or Flight hormones. It has an effect on the autonomous nervous system, which regulates processes such as heart rate, pupil dilation, and sweat and saliva secretion.

Related Theory

Along with the nervous system, the endocrine system coordinates the body's functions to maintain homeostasis during rest and exercise. The nervous and endocrine systems also work together to initiate and control movement, and involves all the physiological processes.

2. (C) Epinephrine is known as the emergency hormone, involved in the body's fight-or-flight response. Thyroxine regulates the body's basal metabolic rate, influencing metabolism. Oxytocin is associated with smooth muscle contraction, particularly during childbirth and lactation. Glucagon raises blood glucose levels, leading to hyperglycemia by promoting the release of glucose from the liver.

3. (D) Diuresis, the increased production of urine, is primarily prevented by the action of vasopressin and aldosterone, but aldosterone is secreted from adrenal cortex (not medulla). Aldosterone promotes sodium and water reabsorption, reducing diuresis. Vasopressin (antidiuretic hormone) from the neurohypophysis (posterior pituitary) promotes water reabsorption in the kidneys, reducing diuresis. Renin from JG (juxtaglomerular) cells regulates blood pressure and fluid balance but does not directly prevent diuresis. ANF (Atrial Natriuretic Factor) promotes diuresis by increasing the excretion of sodium and water.

4. (C) Glucagon is a peptide hormone secreted by alpha cells of islets of Langerhans of pancreas, and plays an important role in maintaining the normal blood glucose levels. Testosterone, progesterone and cortisol are steroid hormones.

5. (C) Exophthalmic goiter, also called Graves' disease is a form of hyperthyroidism, characterised by enlargement of the thyroid gland, protrusion of the eyeballs, increased basal metabolic rate, and weight loss. Acromegaly is caused due to excess secretion of growth hormone in adults especially in middle age that may result in severe disfigurement (especially of the face). Cushing's syndrome is caused due to excess cortisol production, characterised by moon

face and hyperglycemia. Cretinism occurs due to hyposecretion of thyroid hormones resulting in stunted growth.

6. (A) Thyroid hormone plays a role in many physiological processes in the body, but not all processes are under its control.

"Normal rhythm of sleep-wake cycle," is not under the control of thyroid hormone. The sleep-wake cycle is regulated by the suprachiasmatic nucleus in the hypothalamus and the pineal gland, which produce melatonin, a hormone that helps regulate sleep.

"Development of immune system," is also not under the control of thyroid hormone. The immune system develops through a complex series of interactions between various cells and organs in the body, and while thyroid hormones can affect immune function, they do not directly control its development.

7. (A) Four parathyroid glands are located on the posterior side of the thyroid gland in humans. Parathyroid hormone is a peptide hormone secreted by the parathyroid glands (PTH). PTH secretion is regulated by calcium ion levels in the blood. Ca^{2+} levels in the blood are raised by parathyroid hormone (PTH). PTH effects on bones by stimulating bone resorption (dissolution/demineralisation). PTH also increases Ca^{2+} absorption from digested food and stimulates reabsorption of Ca^{2+} by the renal tubules. As a result, it is clear that PTH is a hypercalcemic hormone, meaning that it raises blood Ca^{2+} levels. It also decreases carbohydrate metabolism.

8. (B) Neurohypophysis (or pars nervosa) or posterior pituitary stores and releases two hormones, i.e., oxytocin and vasopressin. They are synthesized in hypothalamus and transported axonally to neurohypophysis. Adenohypophysis or anterior pituitary gland stores and releases Growth Hormone, Prolactin, Thyroid Stimulating Hormone (TSH), Adreno-Cortico Tropic Hormone (ACTH), Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH).

Related Theory

The neurohypophysis coordinates the fluid balance and reproductive function through the action of two peptide hormones: vasopressin and oxytocin. Oxytocin mediates contraction of the smooth muscle of the uterus and mammary gland, while vasopressin has antidiuretic action on the kidney and mediates vasoconstriction of the peripheral vessels.

Mnemonics

Look at the simple trick given below. This will definitely help you remember the names of the hormones released from the neurohypophysis (pars nervosa/posterior pituitary).

Oh! Amazing

Oh - Oxytocin

Amazing - Antidiuretic hormone (Vasopressin)

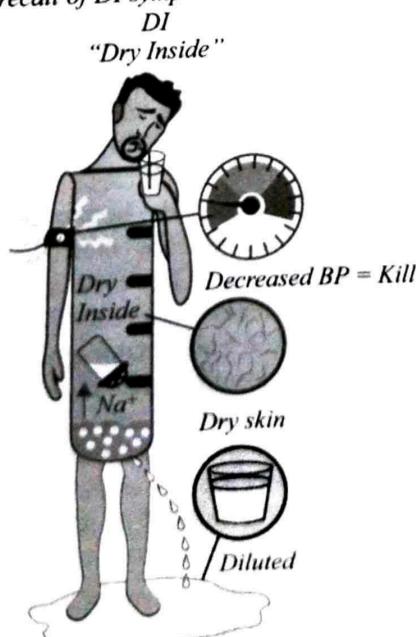
9. (B) Presence of glucose (glycosuria) and ketone bodies (ketonuria) in urine is indicative of Diabetes mellitus. In this condition, excess of ketone bodies are produced as an alternative source of energy (Type 1 diabetes mellitus). When insulin cannot transport blood sugar into body's cell effectively, blood sugar can be passed out in urine. Uremia is the condition of having high levels of urea in the blood. Kidney stones (also called renal calculi, nephrolithiasis or urolithiasis) are hard deposits made of minerals and salts that are formed inside kidneys. Hyperglycemia or high blood glucose (blood sugar) happens when the body has too little insulin or when the body can't use insulin properly.

Related Theory

→ Diabetes mellitus is caused due to the lack of insulin or hyposecretion of insulin. There are two types of diabetes mellitus viz type 1 diabetes mellitus and type 2 diabetes mellitus. The type 1 diabetes mellitus is also called Insulin Dependent Diabetes Mellitus (IDDM). The type 2 diabetes mellitus is called Non-Insulin Dependent Diabetes Mellitus (NIDDM). Diabetes mellitus causes high blood glucose, or blood sugar, resulting from the body's inability to use blood glucose for energy. Diabetes insipidus is caused by the deficiency of ADH. In this, the person suffers from polyuria. It is also called Drinker's disease. People with diabetes insipidus have normal blood glucose levels; however, their kidneys cannot balance fluid in the body. Diabetes insipidus is a rare disorder that occurs when a person's kidneys pass abnormally large volume of urine that is insipid—dilute and odourless.

Caution

→ Students usually get confused between diabetes mellitus and diabetes insipidus. DI (Diabetes insipidus) is a water regulation disorder that affects the action or secretion of antidiuretic hormone (ADH) in the body. If you're having trouble remembering the symptoms of this disease, take a look at the easy approach shown in the image. This will undoubtedly aid in your recall of DI symptoms.



10. (B) Grave's disease is an immune system disorder. It occurs due to excess secretion of thyroid hormones. Diabetes mellitus is due to hyposecretion of insulin from β -cells of pancreas. Diabetes insipidus is due to hyposecretion of ADH from posterior pituitary gland. Addison's disease also called adrenal insufficiency occurs when the outer layer of the adrenal glands are damaged leading to hyposecretion of adrenal hormones.

11. (D) Glucocorticoids are steroid hormones that promote gluconeogenesis in liver, whereas in skeletal muscle and white adipose tissue they decrease glucose uptake and utilization by antagonizing insulin response. Glucagon is associated with hyperglycemia (increased glucose level in blood). Insulin acts on hepatocytes and adipocytes and act as an antagonistic to glucagon, i.e., associated with hypoglycemia.

Mnemonics

→ The major hormones which help in increasing the blood glucose level can be memorised using the following mnemonics:

TEN Girls Go to School

TEN

Thyroid hormone, Epinephrine, Norepinephrine

Girls – Glucocorticoids

Go to – Glucagon

School – Somatotropin

12. (C) GLUT IV is an insulin dependent glucose transporter. It helps in the transport of glucose molecules into muscles and adipose cells under anabolic conditions. It permits facilitated diffusion of circulating glucose. However, GLUT I, GLUT II and GLUT III are insulin independent glucose transporter.

Related Theory

→ Glucose transporters are required for the movement of glucose from the extracellular space into cells. Glucose enters the β -cells of the pancreas through the glucose transporter GLUT II and this is a major signal leading to the release of insulin from these cells that reaches the bloodstream. Insulin in the blood is taken up through a transporter GLUT IV, in adipose and muscle cells resulting in the reduction of blood glucose. There are two families of glucose transporters: the sodium coupled glucose transporters (SGLT, sodium glucose transporter; symporters) and glucose facilitative transporters, the GLUT (glucose transporter) family.

13. (B) The deficiency of insulin causes Diabetes mellitus, which is characterised by uncontrolled high blood glucose levels. Excess production of thyroid hormone, i.e., thyroxine causes goitre (due to deficiency of iodine). Deficiency of corticoids causes Addison's disease or Adrenal insufficiency. It occurs when the outer layer of the adrenal glands is damaged leading to hyposecretion of adrenal hormones. Hypersecretion of growth hormone

causes acromegaly, which is characterised by enlarged hands and feet of the affected person.

14. (C) Oxytocin is secreted from posterior pituitary and is responsible for milk ejection after parturition and foetal ejection reflex during parturition. Oestrogen is secreted from ovaries and is responsible for ovulation and for female sexual characters. Prolactin is secreted from anterior pituitary and is responsible for the milk production (lactation). Relaxin hormone is secreted by corpus luteum and placenta, relaxes the ligaments in the pelvis and softens and widens the cervix during parturition.



Caution

→ Students usually get confused between the function of oxytocin and prolactin. Prolactin stimulates the production of milk while oxytocin contracts the smooth muscle cells around the glands in the breasts, so that they release the milk.

15. (B) Parathyroid hormone is secreted by the parathyroid glands that regulates the serum calcium concentration through its effects on bone, kidney, and intestine. When calcium level falls, parathyroid hormone is released into the blood and causes the bones to release calcium and increase its level in the blood stream.



Related Theory

→ Calcitonin is a peptide hormone secreted by parafollicular cells (also known as C cells) of the thyroid gland in humans. It acts to reduce blood calcium (Ca^{2+}), opposing the effects of parathyroid hormone (PTH). It is antagonistic to parathyroid hormone.

16. (A) Estrogen and parathyroid hormones play a significant role in osteoporosis. It is caused due to the deficiency of estrogen and excessive activity of parathormones. The other listed hormones also contribute to osteoporosis but their effects are insignificant, e.g., low level of progesterone and aldosterone and high level of prolactin causes bone loss and lead to osteoporosis, but only to low extent.

17. (B) In adults, ossification of epiphyseal plates occurs. The epiphyseal growth plate is the main site of longitudinal growth of the long bones. At a certain age, this cartilage is then calcified, degraded, and replaced by osseous tissue. This inhibits exaggerated and prolonged growth of bones. Thus, even due to hypersecretion of growth hormone, adult's height does not increase.



Related Theory

→ In adolescents, hypersecretion of growth hormone (before ossification of epiphyseal plates) leads to gigantism or acromegaly.

18. (C) Corpus luteum is a temporary gland formed after the ovulation, from follicular cells in ovary. It secretes progesterone and oestrogen and maintains

the pregnancy in case of fertilisation. However, in absence of fertilisation, it degenerates and then formed again in next menstrual cycle. Corpus cardiacum (brain hormone) and corpus allatum (juvenile hormone) are found in insects. Pineal gland is found in forebrain and produces melatonin which modulates sleep patterns in both circadian and seasonal cycles.



Related Theory

→ In case if pregnancy occurs it is important to prevent the disintegration of the corpus luteum. Thus, the trophoblast of the embryo combat the regular drop in progesterone by producing human chorionic gonadotropin (similar to LH). This allows the survival of the corpus luteum as it enlarges during pregnancy until the placenta is able to make enough progesterone and estrogen to maintain the uterus' mucosa. Furthermore, estrogen or progesterone released by the corpus luteum is said to directly inhibit the release of follicle stimulating hormone, to prevent the next menstrual cycle. This, in turn, prevents a double pregnancy.

19. (C) Relaxin hormone is secreted by posterior pituitary and function in relaxing of pubic symphysis during parturition. Inhibin hormone is secreted from anterior pituitary and decreases the secretion of FSH.

20. (B) Grave's disease or hyperthyroidism is caused due to excessive secretion of thyroid hormone. Hyposecretion of thyroid gland causes goitre and creatinism. On the other hand, hyposecretion of adrenal glands leads to Addison's disease and hypersecretion from the adrenal glands is associated with hypertension, which results in Conn syndrome, Cushing syndrome and pheochromocytoma.



Related Theory

→ The thyroid gland is butterfly shaped and is located anterior to the trachea. The production of the thyroid hormones is dependent on the component i.e., iodine. The low blood levels of T_3 and T_4 stimulate the release of thyrotropin-releasing hormone (TRH) from the hypothalamus, which triggers secretion of TSH from the anterior pituitary. In turn, TSH stimulates the thyroid gland to secrete T_3 and T_4 .

21. (A) Insulin is the peptide hormone, which enhances the uptake of glucose molecules by liver cells (hepatocytes) and fat cells (adipocytes) for its cellular utilisation. It brings down the level of glucose in the blood. Glucagon is an antagonistic hormone to insulin. Secretin is a peptide hormone produced by S-cells of the duodenum and jejunum and stimulates the pancreas and bile ducts to release sodium bicarbonate to neutralise the acid. Gastrin is produced by G-cells of the duodenum and stomach and stimulates the parietal cells to release HCl.

22. (B) Posterior pituitary/neurohypophysis stores and releases two hormones i.e., oxytocin and vasopressin. These hormones are synthesised in

hypothalamus, which are transported to pituitary gland through hypophysial portal system.

Related Theory

→ Vasopressin (antidiuretic hormone) helps in maintaining osmolarity in the extracellular fluid, decreased arterial pressure, and reduced cardiac filling, i.e., decreased blood volume by acting on the kidneys and the blood vessels. Oxytocin is released in the bloodstream as a hormone for stretching of the cervix and uterus during labor and also during breastfeeding. This hormone helps with birth, bonding with the baby, and milk production. It stimulates forceful contractions of the uterus and cervix, facilitating childbirth.

Caution

→ Students should remember that adenohypophysis secretes its own hormones while neurohypophysis secretes hormones synthesised in hypothalamus.

23. (C) Epinephrine (or adrenaline) is a neurotransmitter in the sense that, within the brain, it helps neurons to communicate with one another. However, epinephrine is also a hormone secreted by the medulla of the adrenal glands and that functions primarily to increase cardiac output and to raise glucose levels in the blood. Melatonin, calcitonin and cortisol act as endocrine hormone only.

Mnemonics

→ Adrenal glands (medullary) hormones can be learnt by this easy way:

MEN

M – Medulla

E – Epinephrine

N – Norepinephrine

24. (B) Aldosterone is a steroid hormone produced by adrenal cortex and plays role in the regulation of blood pressure by acting on DCT and collecting tubules of nephrons. Insulin is secreted by β -cells of pancreas and decrease blood sugar levels, while glucagon is secreted by α -cell of pancreas and increase blood sugar levels by glucogenesis and gluconeogenesis.

Caution

→ Students need to understand that cortisol is produced by the adrenal glands and suppresses inflammatory and allergic responses. Cortisone medications mimic the action of cortisol but tend to be more powerful.

25. (A) Oxytocin and ADH or vasopressin are neuropeptide hormone synthesized in hypothalamus, but stored and released from posterior lobe of pituitary gland. Luteinising hormone and Prolactin are produced from the pars distalis region of anterior pituitary while, Melanocyte stimulating hormone is secreted from the pars intermedia region of adenohypophysis.

Related Theory

→ The anterior lobe of the pituitary receives hypothalamic-releasing hormone from the hypothalamus that bind with receptors on endocrine cells in the anterior pituitary that

regulates the release of adrenal hormones into the circulatory system. Hormones from the hypothalamus are rapidly degraded in the anterior pituitary, which prevents them from entering the circulatory system. The posterior lobe of the pituitary gland develops as an extension of the hypothalamus. It is not capable of producing its own hormones; instead, it stores hypothalamic hormones to be released into the systemic circulation.

Caution

→ Students should remember that posterior pituitary gland stores and releases hormones synthesised in hypothalamus, while anterior pituitary hormone synthesised and release hormones, in response to the signals received from hypothalamus.

26. (B) Melatonin is a hormone primarily released by the pineal gland at night and maintains circadian rhythms (24-hour internal clock) and sleep wake cycle. It also releases pigment melatonin in skin. Oxytocin is secreted from posterior pituitary and functions in parturition. Progesterone is a pregnancy hormone, secreted from corpus luteum and prepares the endometrium for the potential of pregnancy after ovulation. ANF is secreted by the heart atria in response to atrial stretch. It acts on the kidney to increase sodium excretion and GFR, to antagonize renal vasoconstriction, and to inhibit renin secretion.

Related Theory

→ Melatonin controls pigmentation changes by aggregation of melanin into the melanocytes within the skin, causing the skin to change colour. This interaction is also responsible for the paler skin colour of elderly people and those with insomnia.

27. (C) The adrenal medulla controls hormones that initiate the flight or fight response by secreting epinephrine (adrenaline) and norepinephrine (noradrenaline). In fight or flight situations, kidney activate renin-angiotensinogen aldosterone pathways for the absorption of water from the kidney. Pancreas glucagon hormone increase the blood sugar levels in blood.

Caution

→ During fight and flight situation, students should remember that sympathetic nervous system is active, thus all the physiological effects are the result of SNS only.

28. (B) The corpus luteum secretes progesterone which is required for maintaining pregnancy. It helps the endometrium to thicken and become spongy. It inhibits uterine contractions and improves blood flow and oxygen flow.

Related Theory

→ The corpus luteum lies at top of the female ovaries. It begins to form at the site of the follicle after it has matured and is commencing the process of ovulation. The corpus luteum is formed in the ovary and is made up of a cell type called the lutein cell. It is a temporary endocrine structure.

29. (C) Thyroid gland produce thyroxine. Deficiency of iodine in our diet results in hypothyroidism and enlargement of the thyroid gland, commonly called

goitre. Posterior pituitary produces oxytocin, which stimulates uterus contractions during child birth. Anterior pituitary produces growth hormone. Oversecretion of growth hormone leads to gigantism. Corpus luteum secretes progesterone in females, which supports and maintains pregnancy.



Related Theory

→ The thymus gland is a lobular structure located between lungs behind sternum on the ventral side of aorta. It secretes the peptide hormones called thymosins which help in the differentiation of T-lymphocytes providing cell-mediated immunity. Thymosins also promote production of antibodies to provide humoral immunity. Thymus is degenerated with increased age.

30. (B) Insulin is released by the β -cells of islets of Langerhans in the pancreas. Its role is to lower glucose levels in the bloodstream and promote the storage of glucose in fat, muscle, liver and other body tissues. α -cells of the islets of Langerhans produce another important hormone, glucagon, which increases blood sugar levels.



Related Theory

→ Type 1 diabetes is an autoimmune reaction that attacks cells in pancreas that produce insulin and is caused by inherited genetics or environmental elements. Type 2 diabetes happens when body becomes resistant to insulin and is associated with genetics and lifestyle choice.



Mnemonics

All you need to remember is 'AG BIDS For Pen.' It is relatively easy to recall the pancreatic hormones secreted by the individual alpha, beta, delta, and F-cells of the Islets of Langerhans using this mnemonic.

AG BIDS For Pen

AG – Alpha cells: Glucagon
BI – Beta cells: Insulin
DS – Delta cells: Somatostatin
For Pen – F-cells: Pancreatic polypeptide

31. (D) Ovary is the primary female sex organ that produces the female gamete (ovum) and steroid hormones oestrogen and progesterone. α -cells of islets of Langerhans of the endocrine pancreas secrete a hormone called glucagon which stimulates glycogenolysis and gluconeogenesis resulting in an increased blood sugar (hyperglycemia). It reduces the cellular glucose uptake and utilization. Anterior pituitary secretes Growth Hormone. Oversecretion of GH stimulates abnormal growth of the body leading to gigantism and low secretion of GH results in stunted growth resulting in pituitary dwarfism.

32. (D) Melatonin or sleep hormone, is a central part of the body's sleep-wake cycle. Its production increases with evening darkness, promoting healthy sleep and helping to orient our 24 hours circadian rhythm. Calcitonin is secreted by thyroid gland and helps in

to regulate levels of calcium and phosphate in the blood, opposing the action of parathyroid hormone. Adrenaline is secreted by adrenal gland and is involved as fight and flight response. Prolactin is secreted by anterior pituitary and stimulates milk production in mammary gland of female.



Related Theory

→ Calcitonin secretion is stimulated by increase in the serum calcium concentration and calcitonin protects against the development of hypercalcemia. Calcitonin is also stimulated by gastrointestinal hormones such as gastrin.

33. (C) If the adrenal cortex is injured it will not affect the secretion of adrenaline, because it is secreted by adrenal medulla. The adrenal cortex secretes cortisol, aldosterone, dehydroepiandrosterone (DHEA) and androgenic steroids, epinephrine (adrenaline) and norepinephrine (noradrenaline) are secreted from adrenal medulla.



Related Theory

→ Adrenal glands produce hormones in response to signals from the pituitary gland in the brain, which reacts to signalling from the hypothalamus, also located in the brain. This is referred to as the hypothalamic pituitary adrenal axis.



Mnemonics

→ Adrenal glands (cortex) hormones can be learnt by this easy way:
Make Good Sweets
Make – Mineralocorticoids, (aldosterone)
Good – Glucocorticoids, (cortisol)
Sweets – Sex hormone, (androgen)

34. (A) Glucagon hormone is secreted by alpha cells of pancreas. Somatostatin is secreted by delta cells of pancreas. Insulin is secreted by beta cells of pancreas. Low secretion of insulin causes Diabetes mellitus. Corpus luteum secretes relaxin, oxytocin and progesterone.



Related Theory

→ Glucagon and insulin are antagonistic hormones. Glucagon works along with the hormone insulin to control blood sugar levels and keep them within set levels. Glucagon is released to stop blood sugar levels dropping too low (hypoglycaemia), while insulin is released to stop blood sugar levels rising too high (hyperglycaemia).

35. (C) Toxic agents in food which interfere with thyroxine synthesis will lead to simple goitre. Thyrotoxicosis and toxic goitre are under the category of hyperthyroidism.

36. (C) Deficiency of thyroxine in adults is called Myxoedema or Gull's disease characterised by low metabolic rate, increase in body weight and tendency to retain water in tissues. Decrease in secretion of thyroxine hormone from thyroid gland causes hypothyroidism. Simple goitre is caused by

lower intake of iodine through diet. Cretinism occurs due to hyposecretion of thyroxine during the growth years.

Related Theory

→ Myxoedema causes low BMR, low body temperature, tendency to retain water in tissues, reduced heart rate, pulse rate, blood pressure and cardiac output, low sugar and iodine level in blood, muscular weakness and oedema.

37. (D) Oxytocin is known as Birth Hormone as it causes the contraction of smooth muscles of the uterus leading to the birth of the child. It also stimulates the ejection of milk from mammary glands. It is secreted from the posterior pituitary. Vasopressin is also secreted from posterior pituitary and increases the reabsorption of water in distal convoluted tubule, collecting tubules and collecting ducts of nephrons of kidney.

38. (A) Parathyroid or parathormone (PTH) stimulates the release of calcium by bones into the bloodstream, absorption of calcium from food by the intestines, conservation of calcium by the kidneys, etc. Calcitonin acts as a antagonistic to PTH. Thyroxine hormone is secreted by the thyroid gland and functions in regulation of various metabolic processes.

39. (A) The parathyroid glands produce parathyroid hormone, which increases levels of calcium in the blood. The adrenal cortex produces androgens, oestrogens, aldosterone and cortisol. The adrenal medulla produces catecholamines such as epinephrine and norepinephrine. On the other hand, pancreas is an exocrine and endocrine gland. Thymus, testes and ovary are heterocrine glands.

40. (D) Parathyroid hormone causes the increase in the blood calcium level. This increases the excitability of nerves and muscles causing cramps and convulsions. Parotid gland is the largest salivary gland, involved in the digestion process. Pancreas is a mixed gland, and it secretes hormones – Insulin and glucagon, maintaining blood sugar levels. Thyroid gland secretes thyroxine (T_4) and triiodothyronine (T_3), which regulate the basal metabolism of the body.

Related Theory

→ PTH has effects antagonistic to those of calcitonin by increasing blood calcium levels by stimulating osteoclasts to break down bone and release calcium secreted by the parafollicular C-cells of the thyroid gland.

41. (A) Adrenaline or epinephrine is an emergency hormone, which is responsible for this action as it is known as the 3F hormone—fright, flight and fight hormone. Glucagon increases blood sugar level, and is stimulated by adrenal glands during emergency condition. Similarly, Thyroxine increases basal metabolism.

regulates metabolic rate and is stimulated during the condition. Gastrin is a peptide hormone primarily responsible for enhancing gastric mucosal growth, gastric motility, and secretion of hydrochloric acid (HCl) into the stomach. It is present in G cells of the gastric antrum and duodenum.

42. (B) Cortisol or hydrocortisone is the principal glucocorticoid hormone of many mammals including humans. It regulates the glucose metabolism and promotes gluconeogenesis, especially during starvation, and raises blood pressure. Cortisone is an inactive form of cortisol.

Related Theory

→ Cortisol is the main glucocorticoid released from the zona fasciculata layer of the adrenal cortex. The hypothalamus-pituitary-adrenal axis regulates both production and secretion of cortisol. Loss of regulation can lead to cortisol excess disorders, such as Cushing syndrome, or cortical insufficiency, such as Addison disease.

43. (D) Adrenaline (epinephrine) is a hormone produced by the adrenal medulla and is secreted in great amounts during emotional stress. It elevates the glucose level in the blood stream (by glycogenolysis) which is accompanied by an increase in oxygen consumption, body temperature and heat production. Adrenaline also causes an increase in the flow of blood by dilating the blood vessels. Insulin and glucagon regulates the glucose level in blood. Adrenocorticotropic hormone (ACTH) is a hormone that stimulates the production of cortisol.

44. (D) Thymus is the primary lymphoid organ, which is involved in the production and maturation of T-lymphocytes. T-lymphocytes provide cell mediated immunity. B-cells, which mature in the bone marrow, are responsible for antibody-mediated immunity.

45. (A) The ovulatory phase witnesses the maximum concentration of both oestrogen and progesterone. LH surge stimulates the rupture of Graafian follicle into corpus luteum and it leads to the release of ovum. Deficiency of LH causes failure of ovulation.
Diabetes mellitus – Insulin
Tetany – Parathormone
Diabetes insipidus – ADH

46. (C) Estrogens are produced primarily by the ovaries. They are released by the follicles on the ovaries and are also secreted by the corpus luteum after the egg has been released from the follicle and from the placenta. Thus, if the ovaries of rat are removed, then the level of estrogen is decreased in blood.

Related Theory

→ Secretion of progesterone from corpus luteum maintains the endometrium which is necessary for implantation of fertilised ovum and other events of pregnancy.

47. (A) Adrenaline prepares the body for emergency reactions like fight and flight. Therefore, it directly affects the SA node to increase the rate of heart beat.

48. (A) Acromegaly is a condition caused by an excess of growth hormone (somatotropin hormone), which stimulates the growth of essentially all tissues of the body, including bone. When it develops before the end of puberty, it's known as gigantism.

49. (A) A Graafian follicle is the follicle that ruptures and releases the ovum. The Graafian follicle develops into the corpus luteum after ovulation. The corpus luteum secretes progesterone, which is essential for pregnancy continuation. The corpus luteum is a type of follicle. On the other hand, the sebaceous gland secretes an oily, waxy material called sebum. Vitamin B₃ is niacin. As the electrical signal begins in the heart, the SA node is known as the natural pacemaker of the heart.

50. (A) Anal glands are small glands found in many mammals. They are located near the anus and these glands secrete fluid having exclusive scent.

51. (B) LH or luteinizing hormone is secreted by the pituitary gland. LH stimulates ovulation and aids in the maintenance of the corpus luteum, which is made up of Graafian follicle remnants (fluid-filled structure of the mammalian ovary). Ovulation is induced by the LH surge, which occurs around the 14th day of the menstrual cycle. LH is essential to maintain luteal function for the next two weeks after ovulation. The LH hormone helps in the secretion of progesterone which is the essential pregnancy hormone as it induces the thickening of the endometrial wall.



Related Theory

- Thyroxine is the T₄ hormone that is produced by the thyroid gland in the neck. It, together with the T₃ hormone, aids in the regulation of the body's metabolism.
- MSH stands for melanocyte-stimulating hormone. It promotes the quick translocation of melanin granules (melanosomes) in cutaneous melanophores, resulting in rapid colour change. It also aids in the formation of melanin in both normal and pathological (melanoma) epidermal melanocytes.
- The testes create testosterone, a steroid male sexual hormone. It aids in the maturation of secondary male sexual characteristics and regulates male libido.

52. (C) The anterior pituitary gland (adenohypophysis) secretes gonadotropic hormones. These hormones have an effect on the gonads, which include the ovaries and testes. Gonadotropin-releasing hormones released by the hypothalamus stimulate the pituitary gland to synthesize and secrete gonadotropins. Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) are the two primary gonadotropins. The interstitial cells of testes are known as Leydig

cells. They release testosterone hormone. Adrenal cortex releases hormones known as corticoids. Thyroid gland releases triiodothyronine and tetraiodothyronine and thyrocalcitonin hormones.

53. (B) In the pancreas, insulin is produced. Insulin is produced by β -cells within the islets of Langerhans and released into the bloodstream. The hormone insulin aids in the absorption of glucose by cells so they can utilize it for energy. When the body is unable to efficiently use or produce enough insulin, diabetes mellitus develops. Diabetes insipidus develops when anti-diuretic hormone (ADH) is absent.

54. (B) The thyroid gland hormones control the body's basal metabolic rate. The thyroid gland generates the hormones tetraiodothyronine, also called thyroxine (T₄), and triiodothyronine (T₃). The body's iodine levels regulate the synthesis of these hormones. Thyroid hormones regulate the metabolism of proteins, lipids, and carbohydrates. The balance of water and electrolytes is another thing that the thyroid hormones have a role in regulating.

55. (B) The contraction of the mammary gland muscles brought on by oxytocin aids in the passage of milk from the mammary glands to the infant's mouth. It is also known as milk ejection hormone for this reason.

56. (D) Endocrine glands are a type of gland that secretes hormones directly into the bloodstream without the use of ducts. The body's different functions are maintained and regulated by hormones. The thyroglobulin protein, which is stored in the follicular lumen, is bound to the hormones the thyroid releases. As a result, the thyroid stores its secretions in extracellular spaces before discharging them into the bloodstream.

57. (B) The male gonad consists of testes, which produce reproductive cells and secrete hormones to control reproductive organs, which are also known as sex hormones. These hormones begin to secrete around the age of puberty or sexual maturity. In a testis, the connective tissue between the seminiferous tubules contains small clusters of endocrine cells known as interstitial cells or Leydig cells. These cells produce testosterone, a male sex hormone. Sertoli cells secrete various proteins involving androgen-binding protein and hormones such as inhibin. Oxytic cells produce the best-known component of gastric juice i.e., HCl (hydrochloric acid). Pituitary gland produces the luteinizing hormone (LH), follicle-stimulating hormone (FSH), growth hormone (GH), adrenocorticotrophic hormone (ACTH), etc.

58. (D) Leydig cells, or interstitial cells are present in the testis near seminiferous tubules. These cells secrete various male sex hormones called androgens. The

principle androgen is testosterone which helps in the development of secondary sexual characteristics in males. Testosterone also stimulates spermatogenesis i.e., formation of sperms from germ cells.

59. (C) Insulin is a peptide hormone produced by β -cells of the pancreatic islets encoded in humans by the INS gene. It is thought to be the body's primary anabolic hormone. It affects carbohydrate, lipid, and protein metabolism by boosting glucose absorption from the blood into liver, fat, and skeletal muscle cells. In these tissues, glucose is turned into glycogen by glycogenesis or fats (triglycerides) via lipogenesis, or both in the case of the liver. High levels of insulin in the blood substantially impede glucose synthesis and secretion by the liver.

60. (A) Cortisol is a glucocorticoid, secreted by middle region of adrenal cortex. It takes part in carbohydrate metabolism, which increases the rate of gluconeogenesis (conversion of proteins in liver into sugar) and decreases peripheral utilisation of glucose, therefore, it possess anti-insulin effect.

61. (A) MSH (melanocyte-stimulating hormone) stimulates the production of melanin pigment in the cells. It stimulates the synthesis of skin pigment melanin in the skin and also causes dispersion of melanin granules in the pigment cells and thereby causes darkening the skin in certain animals. In humans, it has no such role.

Related Theory

→ Pars intermedia also called middle lobe of pituitary is the boundary between the anterior and posterior lobes of the pituitary. It contains three cells – basophils, chromophores and colloid-filled cysts. This area produces melanocyte stimulating hormone or MSH.

Caution

→ Students usually make mistakes in such questions by choosing option (D). MSH is produced in human during foetal stage which releases melanin pigment in skin melanocytes that decides the baby's complexion. Its production decreases as the baby grows. Hence, it is entirely absent in adult stage.

62. (C) Erythropoietin is produced by the juxtaglomerular cells of the kidney in response to low oxygen levels. Leydig cells in the testes produce a class of hormones called androgens, mainly testosterone. Atrial Natriuretic Factor (ANF), a peptide hormone is secreted by the atria of the heart. Cholecystokinin (CCK) is produced by the small intestine of the gastrointestinal tract. Gastrin stimulates the stomach lining to produce gastric acid and pepsinogen, not the intestinal wall.

63. (C) (a) CCK (cholecystokinin) is a hormone secreted by the small intestine in response to the presence of fats and amino acids in the chyme. It stimulates the pancreas to secrete digestive enzymes.

(b) GIP (gastric inhibitory peptide) is a hormone secreted by the small intestine in response to the presence of food in the stomach. It inhibits the secretion of gastric acid from the gastric glands.

(c) The atrial wall of heart secretes a very important peptide hormone called atrial natriuretic factor (ANF).

(d) Vasopressin or ADH acts mainly at the kidney and stimulates resorption of water and electrolytes by distal tubules and thereby reduce loss of water through urine.

64. (C) Cholecystokinin and secretin stimulate the pancreas to release pancreatic juice and bicarbonates. Secretin is a peptide hormone produced by S cells of the duodenum and jejunum and stimulates the pancreas and bile ducts to release sodium bicarbonate to neutralize the acid while the cholecystokinin is another peptide hormone secreted by I cells of the duodenum and stimulates the release of digestive enzymes in the pancreas, and stimulates the contraction of the gall bladder to empty bile into the duodenum. Angiotensinogen is produced in the liver and act as vasoconstrictor. Epinephrine (adrenaline) is secreted by the medulla of the adrenal glands and increase cardiac output and to raise glucose levels in the blood. Gastrin is produced by G cells of the duodenum and stomach and stimulates the parietal cells to release HCl. Insulin is secreted by β -cells of pancreas and decrease blood sugar level. Glucagon is secreted by α -cells of pancreas and increase blood sugar levels.

Caution

→ In case of confusion within the options, student must use elimination technique by eliminating the option in which one hormone is not complementary to the function described.

Mnemonics

→ The trick to remember the GI tract hormones is: Do Garlic Cloves Smell Very Exotic? Go through this trick and remember the gastro-intestinal hormones.

Do – Duocrinin

Garlic – Gastrin

Cloves – Cholecystokinin

Smell – Secretin

Very – Villikinin

Exotic – Enterogastrone

65. (C) Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amount. Adenohypophysis is controlled by hypothalamic hormones via portal system, not by neural control. Organs like GI tract produce gastrin, secretin, etc., hormones, while heart produce ANF. The releasing and inhibitory hormones are secreted by hypothalamus, e.g., corticotropin-releasing

hormone, growth hormone-releasing hormone, gonadotropin-releasing hormone, thyrotropin-releasing hormone, etc.

Related Theory

→ On the basis of their chemical nature, hormones can be divided into groups:

- (1) peptide, polypeptide, protein hormones (e.g., insulin, glucagon, pituitary hormones, hypothalamic hormones, etc.)
- (2) steroids (e.g., cortisol, testosterone, oestradiol and progesterone)
- (3) iodothyronines (thyroid hormones)
- (4) amino-acid derivatives (e.g., epinephrine).

66. (C) Striated muscle consists of large number of muscle fibres called myofibrils. Myofibrils are made up of actin and myosin protein. The actin or secondary myofilaments also possess troponin and tropomyosin protein. Thymosin hormone is secreted from thymus gland. Prolactin is a hormone secreted from anterior lobe of pituitary gland. Rhodopsin is a pigment found in rod cells of eye, while secretin hormone is secreted by S cells in the duodenum.

67. (A) Cholecystokinin is secreted in the intestine by entero-endocrine cells. It stimulates the gall bladder and pancreas for the secretion of bile juice and pancreatic enzymes, respectively.

Related Theory

→ Gall bladder is a bag-like organ that is situated under the liver. This is the organ that stores bile before it is released into the small intestine. Bile is a fluid that aids in the process of digestion of fats.

68. (C) Gastrin is a group of digestive hormones secreted by the pyloric end of the stomach in mammals (the place where the stomach meets the small intestine). When food reaches the stomach, it is released into the bloodstream and delivered by the circulatory system to the gastric cells in the stomach wall, where it causes the secretion of gastric juice. This juice is mostly composed of hydrochloric acid, which aids in the breakdown of fibrous matter in meals and kills bacteria that may have been ingested, and pepsinogen, a precursor of the protein splitting enzyme pepsin.

69. (A) An enterogastrone is a hormone released by the mucosa of the duodenum in the lower gastrointestinal tract. Enterogastrone hormones are in charge of limiting stomach motility and inhibiting gastric secretion.

Related Theory

→ Gastrin is secreted in stomach by the parietal cells and stimulates the secretion of gastric juices from the gastric glands.

→ Pancreozymin is a peptide hormone. It is produced by the pancreas that aids in fat and protein digestion.

→ Cholecystokinin is secreted from the duodenum and causes contraction of gall bladder and secretion of pancreatic juice into duodenum.

70. (B) Pituitary hormones are chemically peptides and proteins. Epinephrine are biogenic amines. Endorphins are neuropeptides. Cortisol are steroids.

Caution

→ Students must remember that peptide hormones are of two types, i.e., short peptide hormones and long peptide hormones. Short peptide hormones include melanocyte stimulating hormone (MSH), oxytocin, vasopressin and glucagon. Long peptide hormones include parathyroid, adrenocorticotrophic hormone (ACTH), thyrocalcitonin and insulin.

Mnemonics

→ If it is giving you a tough time to memorize the names of short and long peptide hormones, look at the simple trick given below. This will definitely help you remember the exact names.

Short peptide hormones:

GO Mohan and Vikas

GO – Glucagon, Oxytocin

Mohan – Melanocyte Stimulating Hormone (MSH)

Vikas – Vasopressin

Long peptide hormones:

Ishwar Travels to Andhra Pradesh

Ishwar – Insulin

Travels – Thyrocalcitonin

Andhra – Adrenocorticotrophic Hormone (ACTH)

Pradesh – Parathyroid

71. (C) Epinephrine, an amino derivative hormone is a catecholamine secreted by adrenal glands. Estradiol and estriol are steroid hormones, involved in the regulation of oestrous and menstrual cycle. Ecdysone is a steroid hormone that controls moulting in insects.

Caution

→ It can be difficult for students to recall if a certain hormone is an amino acid-derived hormone or a steroid hormone. So by using a simple method, quick identification of these hormones by their names can be made possible.

Steroid hormones: examples are cortisol, testosterone, aldosterone, estradiol and progesterone.

Amino acid derived hormones (ending in '-ine'): Examples are epinephrine, norepinephrine.

72. (D) Melatonin and serotonin are the derivatives of tryptophan amino acid. Thyroxin and tri-iodothyronine are derivatives of tyrosine amino acid. Oestrogen, progesterone, cortisone and cortisol are steroid derivatives.

73. (C) A hormone receptor is of two types: membrane-bound receptor and intracellular receptor. FSH is a proteinaceous hormone, has a large molecular weight and is insoluble in lipids, therefore, it cannot enter the target cell. Thus, it binds with the membrane-bound receptor present on the ovarian

cell membrane. Glucagon is secreted by α -cells and insulin by β -cells of islets of Langerhans in pancreas. With aging, secretion of thymosin (from thymus gland) is decreased gradually. FSH stimulates granulosa cells in the ovarian follicles to synthesize aromatase, which converts androgens produced by the thecal cells to oestradiol.

⚠ Caution

→ Students usually mistake FSH as steroid hormone, but all hormones secreted from pituitary gland are proteinaceous. However, FSH stimulate the secretion of steroid hormone Oestrogens.

74. (D) Secondary messengers are the organic molecules whose production or release usually amplifies a signal such as a hormone and are received at the cell surface.

Sodium (Na) is not a secondary messenger in hormone action.

🌐 Related Theory

→ Secondary messengers are molecules that relay signals received at receptors on the cell surface such as the arrival of protein hormones, growth factors, etc., to target molecules in

the cytosol and/or nucleus. Second messengers also serve to greatly amplify the strength of the signal. Binding of a ligand to a single receptor at the cell surface may end up causing massive changes in the biochemical activities within the cell. There are 3 major classes of secondary messengers:

- (1) Cyclic nucleotides (e.g., cAMP and cGMP)
- (2) Inositol trisphosphate (IP_3) and diacylglycerol (DAG)
- (3) Calcium ions (Ca^{2+})

75. (B) Chemically hormones are of different nature like biogenic amines (like thyroxine, adrenaline, etc.), proteinaceous or polypeptide (like hypothalamic hormones, etc.) and steroids (like sex hormones and adrenocorticoids).

🌐 Related Theory

→ Hormones are chemical messengers released by glands without ducts to perform various functions. They are chemically classified under four categories- proteins and peptides, steroids, amino acids derivatives, and fatty acid derivatives.

76. (A) The non-essential amino acid tyrosine acts as a precursor for hormones thyroxine, adrenaline, nor adrenaline and also for melanin pigment.

