CHAPTER › 22

Chemical Coordination and Integration

NEET KEY NOTES

- Human body is made up of several organs. These organs work together in a coordinated manner, so that the human body can function properly. These coordination and integration are developed and maintained by two special systems, i.e. nervous system and endocrine system.

Endocrine Glands and Hormones

- The endocrine glands are **ductless glands**, i.e. lack ducts. They pour their secretion into the surrounding blood for transport to the site of action or distantly located target organ.
- Their secretions are called **hormones** or **internal secretion**.
- **Hormones** are specific non-nutrient chemicals, which act as intercellular messengers and are produced in trace amounts. These hormones regulate metabolism, growth and development of our organs, the endocrine glands or certain cells.
- The organised endocrine glands also secrete a number of new molecules in addition to the hormones.
- Vertebrates have large number of chemicals acting as hormones that provide coordination, while invertebrates possess very simple endocrine system with few hormones.

Human Endocrine System

- The endocrine system is composed of hypothalamus, pituitary and pineal, thyroid, adrenal, pancreas, parathyroid, thymus and gonads (testis and ovary).
- In addition to these, some other organs, e.g. gastrointestinal tract, kidney, heart, etc., also produce hormones.
- A brief account of the structure and functions of all major endocrine glands and hypothalamus of the human body is given in the following sections

Hypothalamus

- It is the basal part of diencephalon, forebrain and it regulates a wide spectrum of body functions. It contains several groups of neurosecretory cells called nuclei, which produce hormones.
- The hormones produced by hypothalamus are of two types
  - **Releasing hormones** (which stimulate secretion of pituitary), e.g. Gonadotropin Releasing Hormone (GnRH).
  - **Inhibiting hormones** (which inhibit secretions of pituitary hormones), e.g. somatostatin.
- These hormones reach the pituitary gland through a portal circulatory system and regulate the functions of the anterior pituitary. The posterior pituitary is under the direct neural regulation of the hypothalamus.

Pituitary Gland

- The pituitary gland also referred as **master gland** is located in a bony cavity called **sella tursica** and is attached to hypothalamus by a stalk.
- Anatomically it is divided into an **adenohypophysis** (anterior pituitary) and a **neurohypophysis** (posterior pituitary).

- Various hormones secreted by different parts of pituitary glands are as follows

Parts of Pituitary Gland	Hormones	Functions
1. **Adenohypophysis**		
Pars distalis	Growth Hormone (GH)	• Stimulates body growth. • Hyposecretion causes dwarfism, i.e. stunted growth. • Hypersecretion causes **gigantism**. • Excess secretion of GH in adults causes **acromegaly**.
	Prolactin (PRL)	Stimulates the growth of mammary glands, lactation and maintenance of corpus luteum.
	Thyroid Stimulating Hormone (TSH)	Synthesis and secretion of thyroid hormones T_3 and T_4 from thyroid gland.
	Adrenocorticotropic Hormone (ACTH)	Synthesis and secretion of **glucocorticoids** from the adrenal cortex.
	Luteinizing Hormone (LH)	• In males, stimulates the synthesis and secretion of **androgens** from testes. • In females, induces ovulation and maintain corpus luteum
	Follicle Stimulating Hormone (FSH)	• In males, FSH and androgens regulate spermatogenesis. • In females, stimulates the growth and development of ovarian follicles.
Pars intermedia	Melanocyte Stimulating Hormone (MSH)	• Acts on melanocytes and regulate skin pigmentation. • Hypersecretion causes hyper pigmentation.
2. **Neurohypophysis** (Pars nervosa)	Oxytocin	• Acts on the smooth muscles and stimulates their contraction during childbirth. • Stimulates milk ejection from the mammary glands.
	Vasopressin (Anti-Diuretic Hormone or ADH)	• Acts mainly at kidneys and helps in H_2O and electrolytes resorption and prevents diuresis. • Hyposecretion causes **diabetes insipidus**.

Pineal Gland

- It is located on the dorsal side of forebrain. It secretes **melatonin** which functions to regulate biological clock, i.e. 24 hours sleep-wake cycle.
- It maintains sleep-wake cycle, body temperature metabolism, pigmentation, menstrual cycle, etc.
- Serotonin is also secreted by the pineal gland which helps in vasoconstriction of blood vessels.

Thyroid Gland

- It composed of two lobes located on either side of the trachea interconnected with isthmus.
- The thyroid gland is composed of **follicles** and **stromal tissues**.
- The thyroid follicular cells synthesise **tetraiodthyronine** or **thyroxine** (T_4) and **triiodothyronine** (T_3) and iodine is essential for the normal rate of thyroid hormones.
- Thyroid hormones regulate the basal metabolic rate of body and influence water and electrolyte balance.
- **Hypothyroidism** and **goitre** (enlargement of the thyroid gland) result due to the deficiency of iodine in diet.
- Hypothyroidism during pregnancy causes **cretinism** in babies.
- In adult women, hypothyroidism may cause menstrual cycle to become irregular.
- Exopthalmic goitre, also called **Grave's disease** is a form of **hyperthyroidism** characterised by enlargement of thyroid gland, increased basal metabolic rate and weight loss.
- Thyroid gland also secretes **Thyrocalcitonin** (TCT), which regulates the blood calcium levels.

Parathyroid Gland

- It is present as four small pouches. Present on the back side of thyroid gland. Two each embedded in the posterior surface of each lobe of thyroid gland.
  - It secretes peptide hormone called **Parathyroid Hormone** (PTH).
  - It increases the Ca^{2+} levels in blood.
  - It acts directly on bones to increase bone resorption and mobilises Ca^{2+} ion.
  - It stimulates the reabsorption of Ca^{2+} ion by renal tubule and increase Ca^{2+} absorption from the digested food. It is known as **hypercalcemic hormone**.

Thymus Gland

- It is found between lungs behind sternum on the ventral side of aorta.
- It secretes peptide hormones called **thymosins.**
- Thymosins play a major role in the differentiation of **T-lymphocytes**, which provide **cell-mediated immunity** and production of antibodies to provide **humoral immunity.**
- It is degenerated in old individuals due to which the immune responses become weak.

Adrenal Gland

- Pair of adrenal glands are found at the anterior part of each kidney.
- It is composed of the centrally located adrenal medulla and the outer adrenal cortex.
- **Adrenal medulla** secretes catecholamines– adrenaline (epinephrine) and nor-adrenaline (nor-epinephrine). These are **emergency hormones** or **hormones of fight** or **flight**. They increase heart rate, respiration rate, sweating, glycogenolysis, lipolysis, proteolysis, alertness, pupilary dilation, piloerection, etc.
- **Adrenal cortex** is divided into three layers, **zona reticularis** (inner), **zona fasciculata** (middle) and **zona glomerulosa** (outer). It secretes three types of hormones commonly called as **corticoids**.
  - **Glucocorticoids**, e.g. cortisol, regulate carbohydrate metabolism, stimulate gluconeogenesis, lipolysis, proteolysis, inhibit utilisation of amino acids, maintain heart and kidney functions.
  - **Mineralocorticoids**, e.g. aldosterone, maintain water and electrolyte balance by stimulating reabsorption of Na^+ and H_2O and excretion of K^+ and phosphate ions at renal tubules.
  - **Androgenic steroids** promote growth of axial hair, pubic hair, facial hair during puberty.

Pancreas

- It is a composite gland, which acts as both exocrine and endocrine gland.
- Exocrine part includes acini, which secretes pancreatic juice.
- Endocrine part consists of islets of Langerhans. The two main type of Langerhan cells are
  - **α-cells**
  - **β-cells**
- α-cells secrete 'glucagon' a peptide hormone, which plays an important role in maintaining blood glucose level.
  - It acts on hepatocytes (liver cells) and stimulates glycogenolysis, i.e. breakdown of glucose.
  - It results in increased blood sugar level, i.e. **hyper glycemia.** Thus, also known as **hyperglycemic hormone**. It reduces the cellular glucose uptake.
- β-cells secrete **insulin** which acts on hepatocytes and adipocytes and enhances cellular glucose uptake
  - It converts glucose into glycogen known as **glycogenesis.**
- Rapid movement of glucose from blood to hepatocytes results in **hypoglycemic condition.**
- Increased concentration of glucose in blood leads to hyperglycemic condition called **diabetes mellitus**. It is associated with the loss of glucose through urine and formation of harmful ketone bodies.

Testis

- In male, individuals a pair of **testis** is present in the scrotal sac. It is primary sex organ and functions as endocrine gland also.
  - It is composed of **seminiferous tubules**, **stromal/intestial tissue** or leydig cells.
  - **Leydig cells** are present in intertubular spaces and produce sex hormones called **androgens** mainly **testosterone.**
  - Androgens mainly testosterone plays an important role in the process of spermatogenesis, i.e. formation of spermatozoa.
  - It regulates the development, maturation and functions of male accessory sex organs like epididymis, vas deferens, seminal vesicle, prostate gland, urethra, etc.
  - This hormone also stimulates secondary sex characteristics like muscular growth, growth of facial and axillary hair aggressiveness low pitch of voice, etc.
  - It acts on the central nervous system and influence male sexual behaviour (libido). These hormones also produce anabolic (synthetic) effects on protein and carbohydrate metabolism.

Ovary

- It is the primary female sex organ located in the abdomen.
- It also acts as exocrine gland by synthesising two groups of steroid hormone **oestrogen** and **progesterone**.
- Each ovary produces one ovum during each menstrual cycle.
- It is composed of ovarian follicles and stromal tissues.
- Growing ovarian follicle secretes oestrogen. It stimulates the growth of
  - female secondary sex organs
  - mammary gland development
  - it regulates female sexual behaviour.
  - it stimulates female secondary sex characters.
- Progesterone is secreted by **corpus luteum**, which is a ruptured follicle.
- Progesterone supports pregnancy. It acts on the mammary gland and stimulates the formation of alveoli and milk secretion.

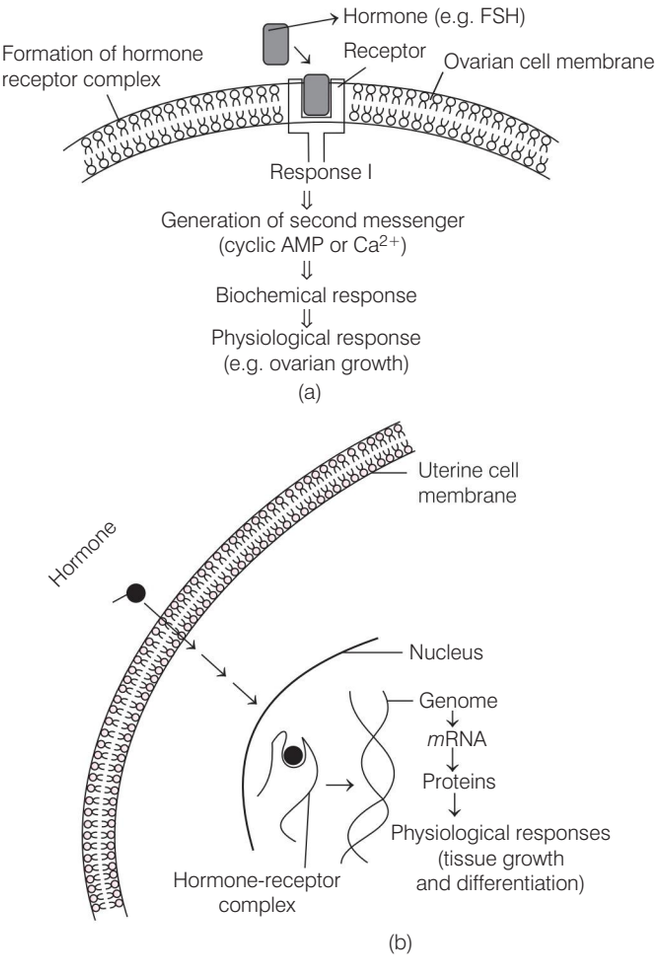
Hormones of Heart, Kidney and Gastrointestinal Tract

Various hormones secreted by non-endocrine glands are as follows

Hormones	Sources	Functions
Atrial Natriuretic Factor (ANF)	Atrial wall of heart	Decrease blood pressure by dilating blood vessels.
Erythropoietin	Juxtaglomerular cells of kidney	Stimulates erythropoiesis or Formation of RBCs.
Gastrin	GI tract	Acts on the gastric glands and stimulates the secretion of HCl and pepsinogen.
Secretin	GI tract	Acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions.
Cholecystokinin	GI tract	Acts on both pancreas and gall bladder to stimulate the secretion of pancreatic enzymes and bile juice.
Gastric Inhibitory Peptide (GIP)	GI tract	Inhibits gastric secretion and motility.
Growth factors	Several non-endocrine tissues	Essential for the normal growth and repair/ regeneration of tissues.

Mechanism of Hormone Action

- Hormones produce their effects on target tissue by binding to specific **hormone receptors** found in the target tissues only. They are of two types
  - **Membrane bound receptors** present on the cell membrane of the target cells.
  - **Intracellular receptors** present inside the target cell mostly nuclear receptors (present in the nucleus). **Hormone-receptor complex** is formed by the binding of a specific hormone to its specific receptor leading to biochemical changes in the target tissue.
- On the basis of their chemical nature, hormone can be divided into following groups
  - **Peptide, polypeptide, protein hormones** (e.g. insulin, glucagon, pituitary, hypothalamic hormone, etc.)
  - **Steroid hormone** (e.g. cortisol, testosterone, estradiole, progesterone).
  - **Iodothyronines** (thyroid hormones).
  - **Amino acid derivatives** (e.g. epinephrine).
- Hormones act through receptors that are present either intracellularly for hydrophobic hormones, e.g. **testosterone**, **aldosterone** or extracellularly for hormones that being hydrophilic cannot cross cell membranes, e.g. follicle stimulating hormone, growth hormone.
- Hormones, which interact with membrane bound receptors and directly do not enter the target cell control the cellular metabolism. They generate second messengers like IP_3, Ca^{2+}, *c*AMP, etc.
- The hormone which enter the cell and interact with intracellular receptors (e.g. steroid hormones, iodothyronines, etc.) mostly regulate gene expression or chromosome function by the interaction of hormone receptor complex with the genome. Cumulative biochemical actions result in physiological and developmental effects.



Diagrammatic representation of the mechanism of hormone action: (a) Protein hormone (b) Steroid hormone

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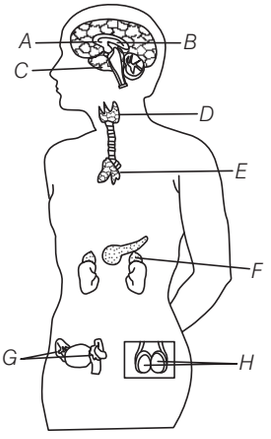
MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Human Endocrine System : Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Thymus, Adrenal and Pancreas Gland*

1 Hormones are non-nutrient chemicals, which are produced in trace amount and acts as
(a) intercellular messengers (b) intracellular messengers
(c) extracellular messengers (d) None of these

2 Identify different endocrine glands in human (*A*-*H*).



(a) A–Pineal, B–Hypothalamus , C–Pituitary, D–Thyroid and Parathyroid, E–Thymus, F–Adrenal, G–Ovary, H–Testis
(b) A–Hypothalamus, B–Pineal, C–Pituitary, D–Thyroid and Parathyroid, E–Thymus, F–Adrenal, G–Ovary, H–Testis
(c) A–Hypothalamus, B–Pineal, C–Pituitary, D–Thyroid and Parathyroid, E–Thymus, F–Adrenal, G–Testis, H–Ovary
(d) A–Hypothalamus, B–Pineal, C–Pituitary, D–Thyroid and Parathyroid, E–Adrenal, F–Thymus, G–Testis, H–Ovary

3 Hypothalamus is the
(a) anterior part of diencephalon
(b) posterior part of diencephalon
(c) interior part of diencephalon
(d) basal part of diencephalon

4 Hypothalamus contains several groups of hormone producing neurosecretory cells called
(a) parietal cells (b) oxyntic cells
(c) nuclei (d) G-cells

5 Hypothalamus releases two types of hormones known as
(a) stimulating hormones and releasing hormones
(b) stimulating hormones and inhibiting hormones
(c) exocrine hormones and inhibiting hormones
(d) exocrine hormones and stimulating hormones

6 GnRH (Gonadotropin Releasing Hormone) stimulates the
(a) pituitary to release the gonadotropins
(b) pituitary for synthesis and release of gonadotropins
(c) testis to release the gonadotropin
(d) hypothalamus to release the gonadotropin

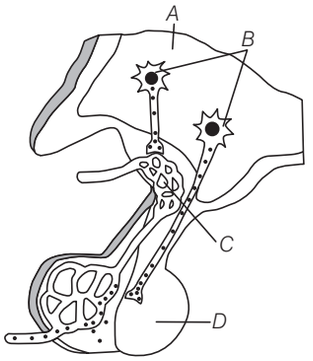
7 GnRH, a hypothalamic hormone, needed in reproduction, acts on ***NEET 2017***
(a) anterior pituitary gland and stimulates secretion of LH and oxytocin
(b) anterior pituitary gland and stimulates secretion of LH and FSH
(c) posterior pituitary gland and stimulates secretion of oxytocin and FSH
(d) posterior pituitary gland and stimulates secretion of LH and relaxin

8 Somatostatin from hypothalamus gland
(a) activates the release of growth hormone from the adrenal gland
(b) inhibits the release of growth hormone from the pituitary
(c) inhibits the release of enzymes in the digestive tract
(d) activates the release of enzymes from the pineal gland

9 The posterior pituitary gland is not a true endocrine gland because ***NEET 2016***
(a) it is provided with a duct
(b) it only stores and releases hormones
(c) it is under the regulation of hypothalamus
(d) it secretes enzymes

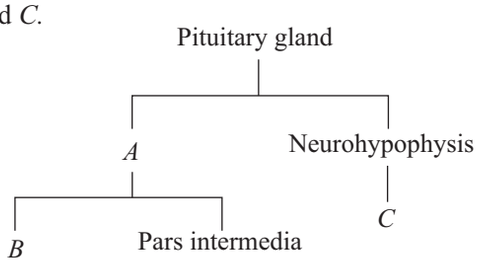
10 The pituitary gland is located in a bony cavity called
(a) centrum (b) cranium
(c) sella tursica (d) pars media

11 Identify *A* to *D* in the given figure and choose the correct combination.



(a) A–Hypothalamic neurons, B–Hypothalamus, C–Portal circulation, D–Posterior pituitary
(b) A–Hypothalamus, B–Hypothalamic neurons, C–Portal circulation, D–Posterior pituitary
(c) A–Hypothalamus, B–Hypothalamic neurons, C–Posterior pituitary, D–Portal circulation
(d) A–Hypothalamus, B–Hypothalamic neurons, C–Posterior pituitary, D–Neurohypophysis

12 Consider the flowchart given below and identify *A, B* and *C*.



	A	B	C
(a)	Adenohypophysis	Pars nervosa	Pars distalis
(b)	Hypophysis	Pars distalis	Pars nervosa
(c)	Posteriophysis	Pars nervosa	Pars distalis
(d)	Adenohypophysis	Pars distalis	Pars nervosa

13 Which of the following hormones are produced by pars distalis or anterior pituitary?
(a) Growth hormone and prolactin
(b) Thyroid stimulating hormone and adrenocorticotropic hormone
(c) Luteinizing hormone and follicle stimulating hormone
(d) All of the above

14 Oxytocin and ADH are produced by hypothalamus and released from ***AIIMS 2019***
(a) anterior pituitary
(b) posterior pituitary
(c) pineal gland
(d) thymus

15 What will be the effect of removal of posterior pituitary?
(a) Oxytocin and ADH will not be synthesised
(b) Oxytocin and ADH will be synthesised but could not be stored
(c) Only oxytocin will be synthesised
(d) Only ADH will be synthesised

16 Gigantism and dwarfism are the disease related to
(a) prolactin hormone of mammary gland
(b) growth hormone of adenohypophysis
(c) luteinizing hormone of pituitary gland
(d) thyroid stimulating hormone of thyroid

17 Acromegaly is caused due to
(a) excess secretion of GH in adults
(b) hyposecretion of MSH in children
(c) reduced secretion of gonadotropins in adults
(d) hypersecretion of PRL in adults

18 Hypersecretion of growth hormone in adults does not cause further increase in height because ***NEET 2017***
(a) growth hormone becomes inactive in adults
(b) epiphyseal plates close after adolescence
(c) bones loose their sensitivity to growth hormone in adults
(d) muscle fibres do not grow in size after birth

19 Which of the following pituitary hormones works indirectly? ***JIPMER 2018***
(a) MSH (b) TSH (c) GH (d) Oxytocin

20 Like TSH stimulates thyroid gland, the target organ/gland of ACTH is
(a) adenohypophysis (b) kidney
(c) adrenal cortex (d) adrenal medulla

21 In males, the spermatogenesis is regulated by
(a) FSH (b) androgens
(c) Both (a) and (b) (d) hypothalamus

22 Function of oxytocin is/are
(a) smooth muscle contraction
(b) contraction of uterus at the time of childbirth
(c) milk ejection from mammary glands
(d) All of the above

23 The activity of formation of milk and the ejection of milk is controlled by
(a) oxytocin and prolactin, respectively
(b) prolactin and oxytocin, respectively
(c) prolactin and prolactin, respectively
(d) oxytocin and oxytocin, respectively

24 Reabsorption of water and electrolytes by distal tubules of kidney so as to reduce the loss of water through urine (diuresis) is done by
(a) oxytocin (b) vasopressin
(c) FSH (d) LH

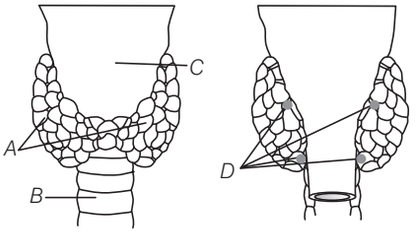
25 Pineal gland is located on the
(a) ventral side of forebrain
(b) lateral side of forebrain
(c) dorsal side of forebrain
(d) back side of forebrain

26 Artificial light, extended work time and reduced sleep-time disrupt the activity of ***NEET (Odisha) 2019***
(a) thymus gland (b) pineal gland
(c) adrenal gland (d) posterior pituitary gland

27 The amino acid tryptophan is the precursor for the synthesis of ***CBSE-AIPMT 2015***
(a) thyroxine and tri-iodothyronine
(b) oestrogen and progesterone
(c) cortisol and cortisone
(d) melatonin and serotonin

28 Identify the hormone with its correct matching of source and function. ***CBSE-AIPMT 2014***
(a) Oxytocin–Posterior pituitary, growth and maintenance of mammary glands
(b) Melatonin–Pineal gland, regulates the normal rhythm of sleep-wake cycle
(c) Progesterone–Corpus luteum, stimulation of growth and activities of female secondary sex organs
(d) Atrial natriuretic factor–Ventricular wall increases the blood pressure

29 Identify *A, B, C* and *D* in the given diagram and choose the correct combination.



(a) A–Thyroid, B–Trachea, C–Vocal cord, D–Parathyroid glands
(b) A–Trachea, B–Thyroid, C–Vocal cord, D–Parathyroid glands
(c) A–Trachea, B–Vocal cord, C–Thyroid, D–Parathyroid glands
(d) A–Parathyroid glands, B–Thyroid, C–Vocal cord, D–Trachea

30 The thyroid gland is composed of
(a) follicles (b) stromal tissue
(c) trachea (d) Both (a) and (b)

31 By which part of thyroid gland, T_3 and T_4 hormones are synthesised?
(a) Follicles (b) Stromal tissue
(c) Isthmus (d) Both (a) and (c)

32 Hypothyroidism and enlargement of thyroid gland, i.e. goitre is caused due to the deficiency of
(a) iodine (b) calcium
(c) proteins (d) carbohydrates

33 A pregnant female delivers a baby, who suffers from stunted growth, mental retardation, low intelligence quotient and abnormal skin. This is the result of ***NEET 2013***
(a) deficiency of iodine in the diet
(b) low secretion of growth hormone
(c) cancer of the thyroid gland
(d) over secretion of pars distalis

34 Irregular menstrual cycle in adult women and cretinism in children are related to
(a) hyperthyroidism
(b) goitre
(c) hypothyroidism
(d) Both (b) and (c)

35 Graves' disease is caused due to the ***NEET 2016***
(a) hyposecretion of thyroid gland
(b) hypersecretion of thyroid gland
(c) hyposecretion of adrenal gland
(d) hypersecretion of adrenal gland

36 Congential removal of thyroid will cause
(a) myxoedema
(b) cretinism
(c) Both (a) and (b)
(d) exophthalmic goitre

37 The function of thyroid gland is to
(a) regulate the basal metabolic rate
(b) support the process of RBCs formation
(c) regulate the blood calcium level
(d) All of the above

38 Blood calcium level is regulated by
(a) T_3 and T_4
(b) T_3 and thyrocalcitonin
(c) thyrocalcitonin secreted by thyroid gland
(d) thyrocalcitonin secreted by parathyroid gland

39 In humans, parathyroid glands
(a) are four in number present on the back side of the thyroid gland
(b) secrete steroid hormones
(c) Both (a) and (b)
(d) None of the above

40 Secretion of PTH is regulated by the circulating levels of
(a) Na^+ ions (b) I^- ions
(c) Ca^{2+} ions (d) Fe^{2+} ions

41 Which of the following conditions will stimulate parathyroid gland to release parathyroid hormone? ***NEET (Odisha) 2019***

(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

42 PTH is a

(a) hypercalcemic hormone (b) hypocalcemic hormone
(c) endocalcemic hormone (d) exocalcemic hormone

43 Hormone that stimulates Ca^{2+} reabsorption by renal tubules and increases Ca^{2+} absorption from the digested food is

(a) calcitonin (b) parathormone
(c) insulin (d) ACTH

44 Which of the following hormones can play a significant role in osteoporosis? ***NEET 2018***

(a) Oestrogen and parathyroid hormone
(b) Progesterone and aldosterone
(c) Aldosterone and prolactin
(d) Parathyroid hormone and prolactin

45 Increase in bleeding time and delay in blood coagulation is due to the deficiency of which hormone?

(a) Adrenaline (b) Nor-adrenaline
(c) Parathormone (d) Thyroxine

46 Thymus gland is

(a) found on the ventral side of the aorta
(b) involved in the development of the immune system
(c) degenerated in old individuals
(d) All of the above

47 The thymus gland secretes the peptide hormones called

(a) antibodies (b) androgens
(c) thymosins (d) oestrogens

48 Major role of thymus gland in humans is/are

(a) differentiation of T-lymphocytes to provide cell mediated immunity
(b) differentiation of B-lymphocytes
(c) enhanced production of antibodies to provide humoral immunity
(d) Both (a) and (c)

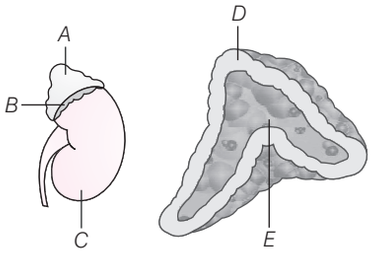
49 A child with a weak immune system could have problem in which of the following glands?

(a) Thyroid gland (b) Parathyroid gland
(c) Thymus (d) Pituitary gland

50 Adrenal gland is present at the

(a) lateral side of each kidney
(b) dorsal side of each kidney
(c) posterior side of each kidney
(d) anterior side of each kidney

51 Identify *A* to *E* in the following figure and choose the correct option.



(a) A–Adrenal gland, B–Fat, C–Kidney, D–Adrenal cortex, E–Adrenal medulla
(b) A–Fat, B–Adrenal gland, C–Kidney, D–Adrenal cortex, E–Adrenal medulla
(c) A–Fat, B–Adrenal gland, C–Kidney, D–Adrenal medulla, E–Adrenal cortex
(d) A–Adrenal gland, B–Fat, C–Kidney, D–Adrenal medulla, E–Adrenal cortex

52 Fight or flight reactions cause activation of ***CBSE-AIPMT 2014***

(a) the parathyroid glands, leading to increased metabolic rate
(b) the kidney, leading to suppression of renin angiotensin-aldosterone pathway
(c) the adrenal medulla, leading to increased secretion of epinephrine and nor-epinephrine
(d) the pancreas leading to a reduction in the blood sugar levels

53 The heartbeat increases at the time of interview due to

(a) secretion of adrenaline
(b) corticotropic hormone
(c) hypersecretion of renin
(d) antidiuretic hormone secretion

54 A chemical signal that has both endocrine and neural roles is ***CBSE-AIPMT 2015***

(a) melatonin
(b) calcitonin
(c) epinephrine
(d) cortisol

55 A person entering an empty room suddenly finds a snake right in front on opening the door. Which one of the following is likely to happen in his neurohormonal control system? ***CBSE-AIPMT 2012***

(a) Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal medulla
(b) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse
(c) Hypothalamus activates the parasympathetic division of brain
(d) Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal cortex

56 The layer of adrenal cortex from outer to inner region are
(a) zona glomerulosa, zona fasciculata, zona reticularis
(b) zona reticularis, zona glomerulosa, zona fasciculata
(c) zona fasciculata, zona reticularis, zona glomerulosa
(d) zona reticularis, zona fasciculata, zona glomerulosa

57 Gluconeogenesis, lipolysis and proteolysis processes are stimulated by
(a) glucocorticoids
(b) mineralocorticoids
(c) Both (a) and (b)
(d) None of the above

58 Cortisol is involved in
(a) maintaining the cardio-vascular system and kidney functions
(b) produces anti-inflammatory reactions
(c) stimulation of RBCs production
(d) All of the above

59 Islets of Langerhans are
(a) endocrine cells of adrenal medulla
(b) exocrine cells of adrenal cortex
(c) endocrine cells of pancreas
(d) exocrine cells of pancreas

60 A patient of diabetes mellitus excretes glucose in urine even when he is kept on a carbohydrate free diet. It because
(a) fats are catabolised in adipose tissues to form glucose
(b) amino acids are catabolised in kidney to form glucose
(c) amino acids are discharged in blood stream from liver
(d) glycogen from muscles is released in blood stream

61 The two main types of cells in the islets of Langerhans called α-cells and β-cells secrete
(a) glucagon and insulin, respectively
(b) insulin and glucagon, respectively
(c) insulin and glycogen, respectively
(d) glycogen and insulin, respectively

62 Which of the following given features are appropriate for glucagon?
(a) Peptide hormone which act on hepatocytes
(b) Increases the blood sugar by stimulating glycogenolysis
(c) Reduces the cellular glucose uptake and utilisation
(d) All of the above

63 Insulin, a peptide hormone is
(a) mainly acts on hepatocytes and adipocytes
(b) enhances cellular glucose uptake and utilisation
(c) stimulates conversion of glucose to glycogen in the target cells
(d) All of the above

64 Study the following table and select the correct option for endocrine gland, its hormone and its deficiency disorder.

	Endocrine glands	Hormones	Deficiency disorders
(a)	Neurohypophysis	Vasopressin	Diabetes mellitus
(b)	Adrenal cortex	Corticosteroids	Addison's disease
(c)	Parathyroid gland	Parathormone	Myxoedema
(d)	Thyroid gland	Calcitonin	Acromegaly

TOPIC 2 ~ *Human Endocrine System : Testes, Ovary and Hormones of Heart, Kidney and GIT*

65 The Leydig or interstitial cells found in the intertubular spaces produce a group of hormones called
(a) LH and FSH
(b) Gonadotropins
(c) Androgens
(d) All of the above

66 Which of the following given features are appropriate for androgens?
(a) Regulates development and maturation of accessory sex organs
(b) Stimulate muscular growth and influence libido
(c) Stimulate the formation of spermatozoa
(d) All of the above

67 Androgens produce synthetic effects on
(a) protein metabolism (b) carbohydrate metabolism
(c) Both (a) and (b) (d) lipid metabolism

68 The steroid hormones, oestrogen and progesterone are secreted by which part/structure of ovary?
(a) Ova and Leydig cells, respectively
(b) Ovarian follicle and corpus luteum, respectively
(c) Corpus luteum and corpus albicans, respectively
(d) Graafian follicle and ova, respectively

69 A temporary endocrine gland in the human body is
NEET 2017
(a) pineal gland (b) corpus cardiacum
(c) corpus luteum (d) corpus allatum

70 Study the following table and identfy *A, B* and *C*.

Glands	Secretion	Functions
A	Oestrogen	Secondary sexual characters.
α-cells of Langerhans	*B*	Increases blood sugar level.
Anterior lobe of pituitary	*C*	Over secretion leads to gigantism.

	A	B	C
(a)	Ovary	Glucagon	GH
(b)	GH	Glucagon	PRL
(c)	GH	Glucagon	MSH
(d)	Ovary	Glucagon	MSH

71 Which of the following given features are appropriate for oestrogen?
(a) Stimulates the development of growing ovarian follicle
(b) Stimulates the appearance of secondary sex characters
(c) Stimulates the growth of mammary glands
(d) All of the above

72 Which of the following given features are appropriate for progesterone?
(a) Supports the pregnancy
(b) Acts on the mammary glands and stimulates the formation of alveoli
(c) Stimulates milk secretion
(d) All of the above

73 Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other? ***NEET 2016***

(a) Insulin	Glucagon
(b) Aldosterone	Atrial natriuretic factor
(c) Relaxin	Inhibin
(d) Parathormone	Calcitonin

74 Which of the following peptide hormone is secreted by non-endocrine gland?
(a) ANF and erythropoietin
(b) Gastrin and secretin
(c) Cholecystokinin and gastric inhibitory peptide
(d) All of the above

75 The peptide hormone, 'Atrial Natriuretic Factor' (ANF) is secreted by
(a) Graafian follicle
(b) Atrial wall of heart
(c) Both (a) and (b)
(d) None of the above

76 'ANF' is a hormone, which
(a) is secreted in response to increased BP
(b) decreases BP
(c) causes vasodilation
(d) All of the above

77 Juxtaglomerular cells secrete

(a) ANF	(b) erythropoietin
(c) renin	(d) Both (b) and (c)

78 The peptide hormone, erythropoietin
(a) stimulates erythropoiesis
(b) inhibits erythropoiesis
(c) inhibits platelet formation
(d) stimulates platelet formation

79 Gastrin hormone acts on gastric glands so as to
(a) stimulates the secretion of HCl and pepsinogen
(b) inhibits the secretion of pepsinogen
(c) inhibits the secretion of HCl
(d) stimulates the breakdown of pepsin hormone

80 Which hormone acts on the exocrine part of pancreas and stimulates the secretion of water and bicarbonate ions?

(a) Gastric	(b) Secretin
(c) CCK	(d) GIP

81 Cholecystokinin (CCK) acts on

(a) pancreas	(b) gall bladder
(c) Both (a) and (b)	(d) liver

82 GIP (Gastric Inhibitory Peptide)
(a) inhibits the gastric secretion and motility
(b) inhibits the gastric secretion
(c) stimulates the gastric secretion and motility
(d) stimulates the gastric secretion

TOPIC 3 ~ *Mechanism of Hormone Action*

83 Hormones produce their effects on target tissue by binding to specific proteins called as
(a) target proteins anywhere in body
(b) activator proteins in muscles and glands
(c) inhibitor proteins in blood
(d) hormone receptors on target tissues

84 Intracellular receptors are mostly

(a) cytoplasmic receptors	(b) membrane receptors
(c) nuclear receptors	(d) ER receptors

85 Among the following sets of hormones, which one contain only peptide hormones?
(a) Epinephrine, cortisol, pituitary hormones
(b) TSH, hypothalamic hormones, oestradiol
(c) Insulin, progesterone, cortisol
(d) Insulin, glucagon, prolactin

86 Hormones of which of the following endocrine glands lacks peptides, amines and sulphur?

(a) Testes	(b) Thyroid and adrenal glands
(c) Anterior pituitary	(d) Posterior pituitary and pancreas

87 Which of the following is an amino acid derived hormone? ***NEET 2018***

(a) Estradiol (b) Ecdysone
(c) Epinephrine (d) Estriol

88 Inhibin is composed of ***JIPMER 2018***

(a) glycoprotein
(b) lipoprotein
(c) steroid
(d) amino acid derivative

89 Hormones, which interact with membrane bound receptors normally

(a) enters into the cell membrane
(b) do not enter the target cell
(c) generate secondary messengers
(d) Both (b) and (c)

90 How does steroid hormone influence the cellular activities? ***NEET (Odisha) 2019***

(a) Binding to DNA and forming a gene-hormone complex
(b) Activating cyclic AMP located on the cell membrane
(c) Using aquaporin channels as second messenger
(d) Changing the permeability of the cell membrane

91 Steroid hormones typically alter the activity of target cells by

(a) activating primary messenger
(b) activating secondary messenger
(c) interacting with intracellular receptors
(d) None of the above

92 What is the mechanism of action of steroid hormones?

(a) They enter into the target cells and bind with specific receptor and activate specific genes to form protein
(b) They bind to cell membrane
(c) They catalyse the formation of AMP
(d) None of the above

93 Which one of the following is not a second messenger in hormone action?

(a) Calcium (b) Sodium
(c) *c*AMP (d) *c*GMP

94 Which one of the following pairs of hormones are the examples of those that can easily pass through the cell membrane of the target cell and bind to a receptor inside it (mostly in the nucleus)? ***CBSE-AIPMT 2012***

(a) Insulin and glucagon
(b) Thyroxin and insulin
(c) Somatostatin and oxytocin
(d) Cortisol and testosterone

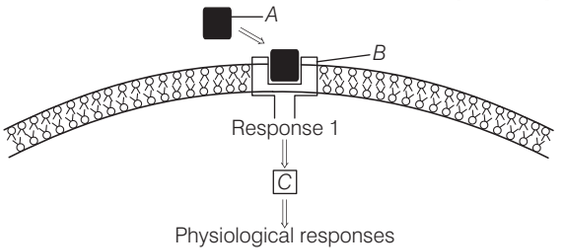
95 Oestrogen and testosterone hormones bind to

(a) cytoplasmic receptors
(b) G-protein linked membrane proteins
(c) enzyme linked proteins
(d) membrane receptors

96 If receptor molecules are removed from target organs, then the target organ will

(a) continue to respond to the hormone without any difference
(b) continue to respond to the hormone, but will require higher concentration
(c) continue to respond to the hormone, but in the opposite way
(d) not respond to the hormone

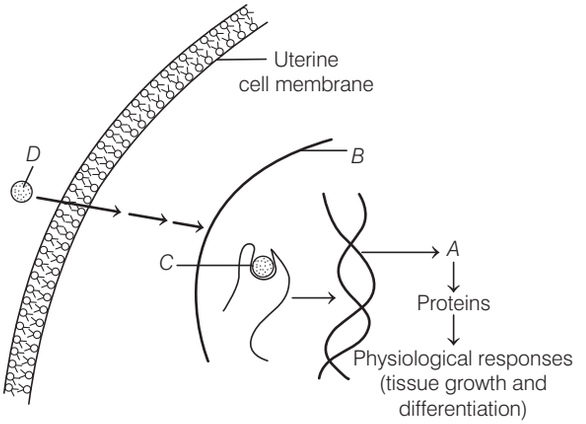
97 Identify *A, B* and *C* in the diagrammatic representation of the mechanism of hormone action. ***NEET (Odisha) 2019***



Select the correct option from the following

(a) A – Steroid hormone, B–Hormone-receptor complex, C – Protein
(b) A – Protein hormone, B – Receptor, C – Cyclic AMP
(c) A – Steroid hormone, B-Receptor, C-Second messenger
(d) A – Protein hormone, B – Cyclic AMP, C – Hormone-receptor complex

98 Identify *A* to *D* in the given diagrammatic representation of the mechanism of hormone action and choose the correct combination.



(a) A–DNA, B–Nucleus, C–Hormone-receptor complex, D–Hormone
(b) A–*m*RNA, B–Nucleus, C–Hormone-receptor complex, D–Hormone
(c) A–*m*RNA, B–Nucleus, C–Hormone-receptor complex, D–Protein
(d) A–DNA, B–Nucleus, C–Hormone-receptor complex, D–Protein

NEET

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

■ **Direction** (Q. No. 99-108) *In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R).*
Of the statements, mark the correct answer as

(a) If both A and R are true and R is the correct explanation of A
(b) If both A and R are true and R is not the correct explanation of A
(c) If A is true, but R is false
(d) If A is false, but R is true

99 **Assertion** (A) Endocrine glands are called ductless glands.
Reason (R) Hormones produced by endocrine glands are released into the blood and transported to distant target organs.

100 **Assertion** (A) GnRH stimulates the pituitary synthesis and release of gonadotropins.
Reason (R) Hypothalamic hormones regulate the synthesis and secretion of pituitary hormones.

101 **Assertion** (A) Grave's disease is due to the enlarged adrenal gland.
Reason (R) Grave's disease leads to protusion of the eyeballs, increased basal metabolic rate and weight loss.

102 **Assertion** (A) Diabetes insipidus is marked by excessive urination and too much thirst of water.
Reason (R) ADH is secreted by posterior lobe of pituitary.

103 **Assertion** (A) Our body secretes adrenaline in intense cold.
Reason (R) Adrenaline raises metabolic rate.

104 **Assertion** (A) In old persons, there is gradually weakening of immune system.
Reason (R) It is because of degeneration of thymus gland.

105 **Assertion** (A) Pancreas is a composite gland.
Reason (R) It acts both as an exocrine and an endocrine gland.

106 **Assertion** (A) CCK acts on both pancreas and gall bladder.
Reason (R) It stimulates the secretion of pancreatic enzymes and inhibits the secretion of bile juice.

107 **Assertion** (A) The physiological functions of target tissues are regulated by hormones.
Reason (R) The hormone-receptors complex formation leads to certain irreversible changes in the target tissue that leads to lysis of target tissue.

108 **Assertion** (A) Hormones interacting with membrane bound receptors normally do not enter the target cells.
Reason (R) They generate second messengers like cyclic AMP, IP_3 and $Ca.^{2+}$

II. Statement Based Questions

109 Choose the correct statement.
(a) Unorganised endocrine gland include pineal gland pituitary gland, pancreas, liver, ovary and testis
(b) In nervous system, the response is for long duration whereas in endocrine system it is for short duration
(c) Invertebrates possess very simple endocrine system whereas a large number of chemicals act as hormones in vertebrates
(d) Hormones are produced in trace amounts by ducted glands

110 Which one of the following statements is correct?
(a) Endocrine glands regulate neural activity, but not *vice-versa*
(b) Neurons regulate endocrine activity, but not *vice-versa*
(c) Endocrine glands regulate neural activity and nervous system regulates endocrine glands
(d) Neural transmission is slow whereas endocrine transmission is fast

111 Which of the following statements is correct in relation to the endocrine system? ***NEET 2013***
(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 messengers are known as hormones
(d) Releasing and inhibitory hormones are produced by the pituitary gland

112 Which of the following statements is incorrect?
(a) Pituitary gland is under the control of hypothalamus
(b) All glands in the human body are heterocrine glands
(c) Testes and ovaries are endocrine glands
(d) Pancreas gland performs dual functions

113 Which of the following statements is incorrect regarding hypothalamus?
(a) Hypothalamus is the basal part of mesencephalon
(b) It regulates wide spectrum of body functions
(c) Neurosecretory cells of hypothalamus secrete hormones
(d) Hormones of hypothalamus regulate the synthesis of pituitary hormones

114 Select the incorrect statement.
(a) Sleep-wake cycle and pigmentation are regulated by hypothalamus
(b) Insulin plays a major role in glucose homeostasis
(c) There are about 1-2 million islets of Langerhans in a normal human pancreas
(d) Adrenaline increases alertness and pupilary dilation

115 Select the incorrect statement.
(a) Proteinaceous hormones are composed of chains of amino acids
(b) Glycoproteinaceous hormones are composed of proteins and carbohydrates
(c) Adrenocorticoids are steroid hormones
(d) Melatonin and adrenaline are polypeptide hormones

116 Select the incorrect statement.
(a) The thyroid gland play a negligible role in the regulation of the basal metabolic rate
(b) The thyroid gland secretes thyroxine (T_4) and triiodothyronine (T_3)
(c) The lobes of thyroid gland are interconnected with a thin flap of connective tissue called isthmus
(d) The thyroid gland is composed of two lobes which are located on either side of the trachea

117 Which statement is incorrect about inhibin?
(a) It is a lipoprotein ***JIPMER 2018***
(b) Decreases FSH secretion
(c) Molecular weight is between 10K-30K Dalton
(d) Secreted by Sertoli cells

118 Select the incorrect statement.
(a) Steroid hormones do not interact with intracellular receptors
(b) Hormones which interact with intracellular receptors (e.g. steroid hormones, iodothyronines, etc.) mostly regulate gene expression
(c) Steroid hormones can interact with genome through hormone-receptor complex
(d) None of the above

119 Select the incorrect statement.
(a) IP_3 is a secondary messenger, while *c*AMP is a primary messenger
(b) Cyclic AMP is generated by hormone which interact with membrane bound receptors
(c) Hormone receptor complex is formed by membrane bound receptors
(d) IP_3 and *c*AMP are secondary messengers that can regulate cellular metabolism

120 What is correct to say about the hormone action in humans? ***CBSE-AIPMT 2012***
(a) Glucagon is secreted by β-cells of islets of Langerhans and stimulates glycogenolysis
(b) Secretion of thymosin with ageing
(c) In females, FSH first binds with specific receptors on ovarian cell membrane
(d) FSH stimulates the secretion of oestrogen and progesterone

121 Consider the following statements.
I. Hypothalamic hormones originate in the hypothalamic neurons, pass through axons and release from their nerve endings.
II. Hypothalamic hormones reach the pituitary gland through the portal circulatory system.

Select the correct option
(a) I is true, II is false (b) Both I and II are true
(c) I is false, II is true (d) Both I and II are false

122 Consider the following statements.
I. T_3 and T_4 are synthesised by follicular cells of thyroid gland.
II. TCT and PTH play a significant role in calcium balance in the body.

Select the correct option.
(a) Both I and II are true (b) Both I and II are false
(c) I is true, II is false (d) I is false, II is true

123 Consider the following statements.
I. Parathyroid gland regulates calcium and phosphate level in the blood.
II. PTH stimulates reabsorption of Ca^{2+} by renal tubules and increases Ca^{2+} absorption from digested food.

Select the correct option.
(a) Both I and II are true (b) Both I and II are false
(c) I is true, II is false (d) I is false, II is true

124 Consider the following statements.
I. ACTH, GH, MSH and oxytocin are polypeptide hormones.
II. Oestradiol and progesterone are amino acid derivative hormones.

Select the correct option.
(a) Both I and II are true (b) Both I and II are false
(c) I is true, II is false (d) I is false, II is true

125 Consider the following statements.
I. LH causes ovulation of Graafian follicle and maintains corpus luteum in females.
II. LH do not perform any function in males.

Select the correct option.
(a) Both I and II are true (b) Both I and II are false
(c) I is true, II is false (d) I is false, II is true

126 Consider the following statements.

I. Adrenaline increases blood pressure during emergency situations.

II. Nor-adrenaline has no role in regulating blood pressure.

Select the correct option.

(a) Both I and II are true
(b) Both I and II are false
(c) I is true, II is false
(d) I is false, II is ture

127 Consider the following statements.

I. The glucose homeostasis in blood is maintained by insulin and glucagon.

II. Glucagon reduces cellular glucose uptake and utilisation, while insulin enchances the same.

Select the correct option.

(a) Both I and II are true
(b) Both I and II are false
(c) I is true, II is false
(d) I is false, II is true

128 Consider the following statements.

I. PTH increases Ca^{2+} absorption from digested food and thus increases blood Ca^{2+} level.

II. Addison's disease is caused due to the underproduction of hormones by adrenal cortex leading to impaired carbohydrate metabolism.

Select the correct option.

(a) Both I and II are true
(b) Both I and II are false
(c) I is true, II is false
(d) I is false, II is true

129 Consider the following statements.

I. Diabetes mellitus is characterised by loss of glucose through urine and the formation of ketone bodies.

II. Diabetes mellitus can be treated with insulin therapy.

Select the correct option.

(a) Both I and II are true
(b) Both I and II are false
(c) I is true, II is false
(d) I is false, II is true

130 Consider the following statements.

I. Double vision, irritability and hypoglycemia are caused due to hypersecretion of glycogen.

II. In hypoglycemia, there is rapid movement of glucose from blood to hepatocytes and adipocytes.

Select the correct option.

(a) Both I and II are true
(b) Both I and II are false
(c) I is true, II is false
(d) I is false, II is true

131 Consider the following statements.

I. Diabetes mellitus is caused due to prolonged hyperglycemia.

II. Diabetes insipidus is caused due to deficiency of insulin.

Select the correct option.

(a) Both I and II are true
(b) Both I and II are false
(c) I is true, II is false
(d) I is false, II is true

132 I. Hypothyroidism may cause irregularity of menstrual cycle.

II. Hyperthyroidism is characterised by increased synthesis and secretion of thyroid hormones due to the cancer of thyroid gland or due to development of nodules of thyroid glands.

III. Grave's disease is characterised by increased matabolic rate, weight loss, enlargement of thyroid gland and hyperthyroidism.

IV. Hypothyroidism causes goitre, while the exophthalmic goitre is a form of hyperthyroidism.

Which of the above statements are correct?

(a) III and IV
(b) I, II and IV
(c) I, II and III
(d) All of the above

133 I. Somatostatin inhibits intestinal absorption of glucose.

II. Leydig cells secrete progesterone.

III. Melatonin is secreted by pineal gland.

IV. Myxoedema is a thyroid disorder.

V. ACTH is secreted by neurohypophysis.

Select the correct statements and choose the option.

(a) I, III and IV
(b) II, III and V
(c) I, IV and V
(d) II, IV and V

134 Consider the following statements.

I. Calcitonin regulates the metabolism of calcium.

II. Oxytocin stimulates contraction of uterine muscles.

III. Graves' disease is caused by excess secretion of hormones of thyroid gland.

IV. Vasopressin stimulates the absorption of water in the renal tubules.

V. Adrenaline and nor-adrenaline are called as the emergency hormones of hormones.

Select the correct statements and choose the option.

(a) I, II, III, IV and V
(b) III, IV and V
(c) I, II and V
(d) II, III and IV

135 Consider the following statements.

I. Increase of heartbeat.
II. Increase of respiration rate.
III. Stimulate breakdown of glycogen.
IV. Stimulate breakdown of lipid and protein.

Which of the following are correct functions of catecholamines?

(a) Only II (b) I and II
(c) II and IV (d) I, II, III and IV

136 I. The adrenal cortex secretes many hormones called corticoids.
II. Corticoids involved in carbohydrate metabolism are called as glucocorticoids.
III. Glucocorticoids play a role in the growth of axial hair, pubic hair and facial hair during puberty.
IV. Aldosterone is the main mineralocorticoid, which helps in the maintenance of electrolytes, body fluid volume, etc.

Select the correct combination from the given options.

(a) I, II and III (b) II, III and IV
(c) I, II and IV (d) I, II, III and IV

137 Consider the following statements.

I. Pituitary gland is called master gland and it is attached to hypothalamus by a stalk.
II. In humans, pars intermedia is almost merged with pars nervosa.
III. Oxytocin is synthesised by hypothalamus and is transported axonally to neurohypophysis.

Select the correct option.

(a) Only I (b) Only II
(c) I, II and III (d) I and III

138 Choose the statements which correctly indicates the functioning of thyroid hormones.

I. Regulation of the basal metabolic rate.
II. Stimulate the process of RBCs formation.
III. Regulating the blood phosphorus levels.
IV. Maintenance of pH and lipids balance.

The correct option is

(a) I, II and IV (b) I and II
(c) I, II, III and IV (d) III and IV

139 The events in the mechanism of protein hormones are listed below. Arrange them in correct sequence.

I. Hormone binds to receptor on plasma membrane.
II. Physiological responses.
III. Biochemical responses.
IV. Generation of secondary messenger.

Choose the correct option.

(a) I, II, III and IV
(b) II, I, III and IV
(c) I, IV, III and II
(d) III, I, II and IV

140 Read the statements given below and mark the option containing the correct statement.

I. Catecholamines decrease the heartbeat, the strength of heart contraction and the rate of respiration.
II. Aldosterone acts on collecting duct to increase absorption of water along with electrolytes.
III. Androgenic steroids secreted by the adrenal cortex stimulate growth of axial hair, pubic hair and facial hair during puberty.
IV. Aldosterone is the main glucocorticoid, whereas cortisol is the mein mineralocorticoid.

(a) Only I
(b) Only II
(c) Only III
(d) Only IV

141 Choose the statements which correctly indicates functioning of gonads.

I. Androgens stimulate growth of facial hairs and axillary hairs, muscular growth, low pitch of voice, etc., in males.
II. Ovary produces one ovum during each menstrual cycle and produces three groups of steroid hormones called androgens, oestrogen and progesterone.
III. Androgens influence both male and female sex behaviours.
IV. Androgens produce catabolic (synthetic) effects on carbohydrate and protein metabolism.

(a) Only I
(b) II and III
(c) Only III
(d) I and IV

142 Read the following statements and mark the incorrect option.

I. Epinephrine do not produce secondary messengers.
II. Insulin deficiency and /or insulin resistance result in a disease called diabetes mellitus.
III. Thymosins increase the production of interferons to provide cell-mediated immunity.
IV. The pituitary hormones regulate the growth and development of somatic tissues and activities of peripheral endocrine glands.

(a) I and II
(b) II and III
(c) I and III
(d) I and IV

III. Matching Type Questions

143 Match the following hormones with the respective disease. ***NEET (National) 2019***

	Column I		Column II
A.	Insulin	1.	Addison's disease
B.	Thyroxine	2.	Diabetes insipidus
C.	Corticoids	3.	Acromegaly
D.	Growth hormone	4.	Goitre
		5.	Diabetes mellitus

Codes

	A	B	C	D		A	B	C	D
(a)	2	4	3	1	(b)	5	4	1	3
(c)	2	4	1	3	(d)	5	1	2	3

144 Match the following columns.

	Column I (Hormones)		Column II (Functions)
A.	FSH	1.	Synthesises the milk in breast
B.	MSH	2.	Regulates the pigmentation
C.	ADH	3.	Prevents diuresis
D.	PRL	4.	Stimulates the development of ovarian follicle

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	4	2	3	1
(c)	4	1	2	3	(d)	4	3	2	1

145 Match the following columns.

	Column I (Hormones)		Column II (Functions)
A.	Gastrin	1.	Inhibits gastric secretion
B.	Secretin	2.	Acts on gall bladder
C.	CCK	3.	Stimulates secretion of H_2O and HCO_3^-
D.	GIP	4.	Secretion of HCl

Codes

	A	B	C	D		A	B	C	D
(a)	4	2	3	1	(b)	1	2	3	4
(c)	4	3	2	1	(d)	4	3	1	2

146 Match the following columns.

	Column I (Types)		Column II (Examples)
A.	Protein hormones	1.	Epinephrine
B.	Steroid hormones	2.	Testosterone, progesterone
C.	Iodothyronines hormones	3.	Thyroid hormones
D.	Amino acid derivative hormones	4.	Insulin and glucagon

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	4	3	2	1
(c)	4	2	3	1	(d)	4	2	1	3

147 Match the following columns and choose the correct option from the codes given below.

	Column I (Types)		Column II (Glands)
A.	Exocrine gland	1.	Ovary
B.	Endocrine gland	2.	Thyroid
C.	Heterocrine gland	3.	Salivary glands

Codes

	A	B	C		A	B	C
(a)	3	2	1	(b)	2	1	3
(c)	2	3	1	(d)	1	2	3

148 Match the following columns.

	Column I (Hormones of adrenal gland)		Column II (Functions)
A.	Mineralocorticoids (Aldosterone)	1.	Suppresses immune response
B.	Cortisol	2.	Growth of pubic hair and axial hair during puberty
C.	Androgenic steroids of adrenal cortex	3.	Increased blood glucose concentration
D	Catecholamine	4.	Regulates balance of H_2O and electrolytes

Codes

	A	B	C	D
(a)	3	4	1	2
(b)	2	3	4	1
(c)	4	1	2	3
(d)	1	2	3	4

149 Match the hormones with its sources of secretion.

	Column I (Hormones)		Column II (Sources of secretion)
A.	Somatostatin	1.	Pineal gland
B.	Melatonin	2.	Corpus luteum
C.	Aldosterone	3.	Placenta
D.	Progesterone	4.	Adrenal cortex
E.	HCG	5.	Islets of Langerhans

Codes

	A	B	C	D	E
(a)	5	1	5	2	3
(b)	1	2	4	3	5
(c)	2	5	4	1	3
(d)	5	1	4	2	3

150 Match the following columns.

	Column I		Column II
A.	Adrenaline	1.	Myxoedema
B.	Hyperparathyroidism	2.	Accelerates heartbeat
C.	Oxytocin	3.	Salt-water balance
D.	Hypothyroidism	4.	Childbirth
E.	Aldosterone	5.	Demineralisation

Codes

	A	B	C	D	E
(a)	1	2	3	4	5
(b)	5	4	3	2	1
(c)	2	5	4	1	3
(d)	2	5	4	3	1

151 Match the following columns.

	Column I (Hormones)		Column II (Functions)
A.	ANF	1.	Regulates blood calcium levels
B.	MSH	2.	Decreases blood pressure
C.	GIP	3.	Pigmentation
D.	TCT	4.	Inhibits gastric secretion

Codes

	A	B	C	D		A	B	C	D
(a)	4	1	2	3	(b)	2	1	4	3
(c)	2	3	1	4	(d)	2	3	4	1

152 Match the following columns.

	Column I (Hormones)		Column II (Functions)
A.	ADH	1.	Synthesis and secretion of glucocorticoids
B.	ACTH	2.	Mineralocorticoids
C.	Aldosterone	3.	Diabetes mellitus
D.	Insulin	4.	Diabetes insipidus

Codes

	A	B	C	D		A	B	C	D
(a)	1	4	2	3	(b)	4	2	1	3
(c)	4	1	2	3	(d)	4	1	3	2

153 Match the following columns.

	Column I (Actions)		Column II (Hormones)
A.	Maintain the normal blood glucose level	1.	Cortisol
B.	Regulation of glucose homeostasis	2.	Aldosterone
C.	Maintenance of electrolytes	3.	Insulin
D.	Anti-inflammatory responses	4.	Glucagon

Codes

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	3	4
(c)	4	3	2	1
(d)	2	1	4	3

154 Match the following columns.

	Column I (Hormones)		Column II (Related processes)
A.	Glucagon	1.	Glucogenolysis
B.	Insulin	2.	Spermatogenesis
C.	Androgen	3.	Ovulation
D.	Progesterone	4.	Glycogenesis

Codes

	A	B	C	D
(a)	4	3	2	1
(b)	1	4	2	3
(c)	3	2	1	4
(d)	2	1	3	4

NCERT & NCERT Exemplar

MULTIPLE CHOICE QUESTIONS

NCERT

155 Which of the following is not a deficiency related disorder?
(a) Cretinism
(b) Diabetes insipidus
(c) Diabetes mellitus
(d) Cushing's syndrome

156 Hormones involved in maintaining Ca^{2+} balance in human body includes all except
(a) cortisol
(b) aldosterone
(c) parathormone
(d) thyrocalcitonin

157 Gradual atrophy degeneration with ageing is shown by
(a) pineal gland (b) thymosin
(c) adrenal cortex (d) Both (a) and (b)

158 Demineralisation of bones in females is observed after they attain menopause. This is due to lack of
(a) progesterone
(b) thymosin
(c) melatonin
(d) oestrogen

159 Gonadotropins essentially target all glands listed below except.
(a) Ovarian follicles (b) Leydig cells
(c) Sertoli cells (d) Posterior pituitary

NCERT Exemplar

160 Which of the following hormones is not secreted by anterior pituitary?
(a) Growth hormone
(b) Follicle stimulating hormones
(c) Oxytocin
(d) Adrenocorticotropic hormone

161 Mary is about to face an interview. But during the first five minutes before the interview she experiences sweating, increased rate of heartbeat, respiration, etc. Which hormone is responsible for her restlessness?
(a) Oestrogen and progesterone
(b) Oxytocin and vasopressin
(c) Adrenaline and nor-adrenaline
(d) Insulin and glucagon

162 Leydig cells produce a group of hormones called
(a) androgens
(b) oestrogens
(c) aldosterone
(d) gonadotropins

163 Which of the following conditions is not linked to deficiency of thyroid hormone?
(a) Cretinism
(b) Goitre
(c) Myxoedema
(d) Exophthalmia

164 Select the right match of endocrine gland and their hormones among the options given below.

	Column I		Column II
A.	Pineal	1.	Epinephrine
B.	Thyroid	2.	Melatonin
C.	Ovary	3.	Oestrogen
D.	Adrenal medulla	4.	Tetraiodothyronine

Codes

	A	B	C	D
(a)	4	2	1	3
(b)	2	4	1	3
(c)	3	2	1	4
(d)	2	4	3	1

165 The steroid responsible for balance of water and electrolytes in our body is
(a) insulin (b) melatonin
(c) testosterone (d) aldosterone

166 Thymosin is responsible for
(a) raising the blood sugar level
(b) raising the blood calcium level
(c) differentiation of T-lymphocytes
(d) decrease in blood RBCs

167 In the mechanism of action of a protein hormone, one of the second messengers is
(a) Cyclic AMP (b) Insulin
(c) T_3 (d) Gastrin

168 Corpus luteum secretes a hormone called
(a) prolactin (b) progesterone
(c) aldosterone (d) testosterone

169 Cortisol is secreted from
(a) pancreas (b) thyroid
(c) adrenal (d) thymus

170 A hormone responsible for normal sleep-wake cycle is
(a) epinephrine (b) gastrin
(c) melatonin (d) insulin

171 Hormones are called chemical signals that stimulate specific target tissues. Their action depend on the presence of receptors on the respective target tissues. Which of the following is the correct location of these receptors in case of protein hormones?
(a) Extracellular matrix (b) Blood
(c) Plasma membrane (d) Nucleus

172 Match the following columns.

	Column I		Column II
A.	Epinephrine	1.	Stimulates muscle growth
B.	Testosterone	2.	Decrease in blood pressure
C.	Glucagon	3.	Breakdown of liver glycogen
D.	Atrial natriuretic factor	4.	Increases heartbeat

Codes

	A	B	C	D		A	B	C	D
(a)	2	1	3	4	(b)	4	1	3	2
(c)	1	2	3	4	(d)	1	4	2	3

173 Which of the following do not play any role in calcium balance in the human body?
(a) Vitamin-D (b) Parathyroid hormone
(c) Thyrocalcitonin (d) Thymosin

174 Which of the following organs in mammals does not consist of a central 'medullary' region surrounded by a cortical region?
(a) ovary (b) adrenal
(c) liver (d) kidney

Answers

Mastering NCERT with MCQs

1 (a)	2 (b)	3 (d)	4 (c)	5 (b)	6 (b)	7 (b)	8 (b)	9 (b)	10 (c)
11 (b)	12 (d)	13 (d)	14 (b)	15 (b)	16 (b)	17 (a)	18 (b)	19 (b)	20 (c)
21 (c)	22 (d)	23 (b)	24 (b)	25 (c)	26 (b)	27 (d)	28 (b)	29 (a)	30 (d)
31 (a)	32 (a)	33 (a)	34 (c)	35 (b)	36 (b)	37 (d)	38 (c)	39 (a)	40 (c)
41 (b)	42 (a)	43 (b)	44 (a)	45 (c)	46 (d)	47 (c)	48 (d)	49 (c)	50 (d)
51 (a)	52 (c)	53 (a)	54 (c)	55 (a)	56 (a)	57 (a)	58 (d)	59 (c)	60 (a)
61 (a)	62 (d)	63 (d)	64 (b)	65 (c)	66 (d)	67 (c)	68 (b)	69 (c)	70 (a)
71 (d)	72 (d)	73 (c)	74 (d)	75 (b)	76 (d)	77 (d)	78 (a)	79 (a)	80 (b)
81 (c)	82 (a)	83 (d)	84 (c)	85 (d)	86 (a)	87 (c)	88 (a)	89 (d)	90 (a)
91 (c)	92 (a)	93 (b)	94 (d)	95 (a)	96 (d)	97 (b)	98 (b)		

NEET Special Types Questions

99 (a)	100 (a)	101 (d)	102 (b)	103 (a)	104 (a)	105 (a)	106 (c)	107 (c)	108 (a)
109 (c)	110 (c)	111 (c)	112 (b)	113 (a)	114 (a)	115 (d)	116 (a)	117 (a)	118 (a)
119 (a)	120 (c)	121 (b)	122 (a)	123 (a)	124 (c)	125 (c)	126 (c)	127 (a)	128 (a)
129 (a)	130 (d)	131 (c)	132 (d)	133 (a)	134 (a)	135 (d)	136 (c)	137 (d)	138 (b)
139 (c)	140 (c)	141 (a)	142 (c)	143 (b)	144 (b)	145 (c)	146 (c)	147 (a)	148 (c)
149 (d)	150 (c)	151 (d)	152 (c)	153 (c)	154 (b)				

NCERT & NCERT Exemplar Questions

155 (d)	156 (b)	157 (a)	158 (d)	159 (d)	160 (c)	161 (c)	162 (a)	163 (d)	164 (d)
165 (d)	166 (c)	167 (a)	168 (b)	169 (c)	170 (c)	171 (c)	172 (b)	173 (d)	174 (c)

Answers & Explanations

4 (*c*) Hypothalamus contains several groups of neurosecretory cells called nuclei, which produce hormones. These hormones regulate the synthesis and secretion of pituitary hormones.

5 (*b*) Hormones produced by hypothalamus are of two types, the releasing hormones (which stimulate secretion of pituitary hormones) and the inhibiting hormones (which inhibit secretions of pituitary hormones).

7 (*b*) GnRH is a hypothalamic hormone. It stimulates the anterior lobe of pituitary gland to secrete LH and FSH, which in turn stimulates the gonadal activity.

8 (*b*) Somatostatin or growth hormone inhibiting hormone is released from the hypothalamus to inhibit adenohypophysis of pituitary gland to secrete growth hormone.

9 (*b*) The posterior pituitary gland is not a true endocrine gland because it only stores and releases two hormones, oxytocin and vasopressin. These are actually synthesised by the hypothalamus and are transported to the posterior pituitary through the hypophyseal portal system.

10 (*c*) Pituitary gland is located in a bony cavity called sella tursica and is attached to hypothalamus by a stalk.

12 (*d*) Option (d) is correct.
Pituitary gland is divided anatomically into an adenohypophysis and a neurohypophysis. Adenohypophysis consists of two portions, pars distalis and pars intermedia. The pars distalis region of pituitary, commonly called anterior pituitary. Neurohypophysis (pars nervosa) also known as posterior pituitary.

16 (*b*) Gigantism and dwarfism are disease related to Growth Hormone (GH). As oversecretion of GH stimulates abnormal growth of the body leading to a condition called gigantism and low secretion of GH results in stunted growth resulting in dwarfism.

17 (*a*) Excess secretion of growth hormone in adults especially in middle age can result in severe disfigurement (especially of the face) called acromegaly, which may lead to serious complications and premature death if unchecked. The disease is hard to diagnose in the early stages and often goes undetected for many years, until changes in external features become noticeable.

18 (*b*) Option (b) is correct and can be explained as follows Chronic hypersecretion of Growth Hormone (GH) leads to gigantism or acromegaly depending on the age of the individual.

If its hypersecretion occurs before the ossification of epiphyseal plates, it causes exaggerated and prolonged growth in long bones. It results in gigantism.

In adults, hypersecretion of GH leads to acromegaly. Hence, hypersecretion of growth hormone in adults does not cause further increase in height because epiphyseal plates close after adolescence.

19 (*b*) Among the given hormones, TSH (Thyroid Stimulating Hormone), secreted by anterior lobe of pituitary gland, works indirectly. This hormone controls the growth and activity of the thyroid gland. It influences the uptake of iodine and synthesis of the hormones; thyroxine and tri-iodothyronine by the thyroid gland.

Rest of the hormones, i.e. MSH (Melanocyte Stimulating Hormone), GH (Growth Hormone) and oxytocin work directly on their target organ. They do not stimulate any other gland.

20 (*c*) ACTH stimulates the synthesis and secretion of steroid hormones called glucocorticoids from the adrenal cortex.

23 (*b*) Prolactin regulates the growth of the mammary glands and formation of milk. Oxytocin acts on the smooth muscles of our body and stimulates their contraction. In females, it stimulates a vigorous contraction of uterus at the time of childbirth and milk ejection from the mammary gland.

24 (*b*) Vasopressin released by the posterior lobe of pituitary acts mainly on the kidney and stimulates reabsorption of water and electrolytes by the distal tubules and thereby, reduces the loss of water through urine (diuresis). Hence, it is also called Anti-Diuretic Hormone (ADH).

25 (*c*) The pineal gland is located on the dorsal side of forebrain. It secretes a hormone called melatonin, which plays a very important role in regulating the 24 hours (diurnal) rhythm of our body. It also influences pigmentation, menstrual cycle as well as our defence capability.

26 (*b*) Artificial light, extended work time and reduced sleep time disrupt the activity of pineal gland. This is because the circadian rhythm or sleep-wake cycle is regulated by pineal gland. Thus, any external change in the rhythm cycle affects the pineal activity.

27 (*d*) The amino acid, tryptophan is the precursor for the synthesis of hormone melatonin and neurotransmitter serotonin.

28 (*b*) Option (b) represents the correct matching of hormone with its sources and functions. Rest of the options are incorrect and can be corrected as

- Oxytocin stimulates contractions of uterine walls to facilitate childbirth.
- Progesterone maintains pregnancy, helps in the mammary gland development and milk secretion.

Oestrogen is responsible for the development secondary sexual characters.

- ANF is secreted by the atrial walls of the heart, which decrease blood pressure.

29 (*a*) Option (a) is correct.

The thyroid gland is composed of two lobes which are located on either side of the trachea. Vocal cords are flaps present over the trachea. There are four parathyroid glands present on the back side of thyroid gland, one pair each in the two lobes of the thyroid gland.

30 (*d*) The thyroid gland is composed of follicles and stromal tissue. Thyroid gland is the largest endocrine gland composed of two lobes connected by an isthmus. It has some 3 million follicles, arranged in lobules (40 follicles in each lobule) and embedded in stromal tissue rich in blood capillaries. Each thyroid follicle is composed of follicular cells, enclosing a cavity.

31 (*a*) The follicle cells of thyroid gland synthesise two hormones, tetraiodothyronine or thyroxine (T_4) and tri-iodothyronine (T_3).

32 (*a*) Hypothyroidism occurs due to the deficiency of iodine. In this enlargement of thyroid gland occurs, as a consequence of distress development by the body to rope in whatever iodine is available in the diet and produce more thyroxine. Iodine is essential for thyroxine hormone production.

33 (*a*) Deficiency of iodine in the diet causes hypothyroidism. If this condition occurs during pregnancy, the baby will suffer from defective development, stunted growth (cretinism), mental retardation, low intelligence, abnormal skin, deaf-mutism, etc.

34 (*c*) In adult women, hypothyroidism may cause irregular menstrual cycle and in infants or children it causes cretinism.

35 (*b*) Graves' disease or hyperthyroidism is caused due to the excessive secretion of thyroid hormones by the thyroid gland. It is also called exophthalmic goitre and is characterised by an enlarged thyroid gland, protruded eyes, increased BMR, weight loss, etc.

36 (*b*) Cretinism is caused by the deficiency of thyroid hormone in infants therefore, congenital removal of thyroid will cause cretinism. It will also cause dwarfism and mental retardation slow body growth and reduced metabolic rate of body.

39 (*a*) In humans, four parathyroid glands are present on the back side of the thyroid gland, one pair each in the two lobes of the thyroid gland. The parathyroid glands secrete a peptide hormone called Parathyroid Hormone (PTH).

40 (*c*) The parathyroid glands secrete a peptide hormone called Parathyroid Hormone (PTH). The secretion of PTH regulated by the circulating levels of calcium ions (Ca^+) in the blood.

41 (*b*) Fall in blood Ca^{+2} levels will stimulate parathyroid gland to release parathyroid hormone. This hormone exerts its effects on bones and kidneys. When calcium levels are low, parathyroid hormone is released by the parathyroid glands into the blood and causes the bones to release calcium ions and increase calcium level in the bloodstream.

42 (*a*) Parathyroid Hormone (PTH) is a hypercalcemic hormone, i.e. it increases the blood Ca^{2+} levels.

44 (*a*) Oestrogen and parathyroid hormones can play a significant role in osteoporosis. It is caused due to the deficiency of oestrogen and excessive activity of parathormone. Oestrogen helps to promote the activity of osteoblasts (helps in the formation of bone cells) and inhibits osteoclast activity. On the other hand, parathormone promotes the mobilisation of calcium from bones into blood and hence, causes demineralisation.

45 (*c*) Parathormones (PTH) regulate Ca^{2+} ions level in body. These ions plays a significant role in blood clotting. Thus, deficiency of PTH would lead to deficiency of Ca^{2+} ions. Due to this, the process of blood clotting would be delayed and bleeding time would increase.

46 (*d*) The thymus gland is a lobular structure located between lungs behind sternum on the ventral side of aorta. The thymus plays a major role in the development of the immune system. Thymus is degenerated in old individuals resulting in a decreased production of thymosing. As a result, the immune responses of old persons become weak.

48 (*d*) Thymus gland secretes the peptide hormones called thymosins. Thymosin plays a major role in the differentiation of T-lymphocytes, which provides cell-mediated immunity.

In addition, thymosins also promote the production of antibodies to provide humoral immunity.

49 (*c*) Thymus gland provides antibody-mediated immunity or humoral immunity. Thus, a child with weak immune system could have problem in his thymus gland.

51 (*a*) Option (a) is correct and can be explained as

Our body has one pair of adrenal glands, each at the anterior part of each kidney. The gland is composed of two types of tissues. The centrally located tissue is called adrenal medulla and outer region is adrenal cortex.

52 (*c*) Fight or flight reactions cause activation of the adrenal medulla. It secretes adrenaline (epinephrine) and nor-adrenaline (nor-epinephrine) hormones under the conditions of stress, these hormones are secreted in high concentration and stimulate, sweating, increased heartbeat and breathing rate.

These also cause dilation of the coronary artery, bronchioles and pupil.

54 (*c*) Epinephrine acts both as a hormone and as a neurotransmitter. Thus, it has both endocrine and neural roles.

55 (*a*) Epinephrine and nor-epinephrine are secreted by adrenal medulla (under the control of sympathetic nervous system) in response to stress of any kind or during emergency situations.

These are also called emergency hormones or hormones of flight and fight. Thus, if a persons on suddenly entering a room finds a snake right in front of him, his sympathetic nervous system would get activated leading to the release of epinephrine and nor-epinephrine from the adrenal medulla.

57 (*a*) Glucocorticoids are steroid hormones secreted by zona glomerulosa of adrenal cortex. The hormones are involved in metabolism of carbohydrates, proteins and fats.

These function in gluconeogenesis or synthesis of glucose from sources other than carbohydrates, breakdown of fats (lipolysis) and proteolysis (formation of amino acids from proteins).

58 (*d*) Cortisol is involved in maintaining the cardio-vascular system as well as kidney function. Glucocorticoids, particularly cortisol, produces anti-inflammatory reactions and suppresses the immune response. Cortisol also stimulates the RBCs production.

59 (*c*) The endocrine pancreas consists of islets of Langerhans. There are about 1 to 2 million islets of Langerhans in a normal human pancreas representing only 1 to 2 per cent of the pancreatic tissue. The two main types of cells in the islets of Langerhans are called α-cells and β-cells.

60 (*a*) A patient of diabetes mellitus excretes glucose in urine even, when he is kept on a carbohydrate free diet. It is because fats are catabolised in adipose tissues to form glucose.

Glucose moves from hepatocytes and adipocytes into the blood in a patient of diabetes mellitus, which increases blood glucose level (hyperglycemia).

62 (*d*) Glucagon is a peptide hormone which plays an important role in maintaining the normal blood glucose level. Glucagon acts mainly on the liver cells (hepatocytes) and stimulates glycogenolysis, resulting in an increased blood sugar level (hyperglycemia).

63 (*d*) Insulin is a peptide hormone, which plays a major role in the regulation of glucose homeostasis. It acts mainly on hepatocytes and adipocytes (cells of adipose tissue) and enhances cellular glucose uptake and utilisation.

As a result, there is a rapid movement of glucose from blood to hepatocytes and adipocytes resulting in decreased blood glucose levels (hypoglycemia). Insulin also stimulates conversion of glucose to glycogen (glycogenesis) in the target cells.

64 (*b*) Only option (b) is correct. Others are incorrect and can be corrected as

Endocrine glands	Hormones	Deficiency disorders
Neurohypophysis	Vasopressin	Diabetes insipdus
Parathyroid gland	PTH	Hypocalcemic tetany
Thyroid gland	Calcitonin	Osteoporosis

65 (*c*) The Leydig cells or interstitial cells, which are present in the intertubular spaces produce a group of hormones called androgens mainly testosterone.

66 (*d*) Option (d) is correct.

Androgens regulate the development, maturation and functions of the male accessory sex organs like epididymis, vas deferens, seminal vesicles, prostate gland, etc.

These hormones stimulate muscular growth, growth of facial and axillary hair, aggressiveness, low pitch voice, etc. Androgens play a major stimulatory role in the process of spermatogenesis (formation of spermatozoa). Androgens act on the central neural system and influence the male sexual behaviour (libido).

69 (*c*) Corpus luteum is a temporary endocrine gland in the human body. It secretes small amount of oestradiol and significant amount of progesterone hormone. In the absence of fertilisation, the corpus luteum degenerates.

71 (*d*) Option (d) is correct.

Oestrogen produces wide ranging actions such as stimulation of growth and activities of female secondary sex organs, development of growing ovarian follicle, appearance of female secondary sex characters (e.g. high pitch voice, etc.), mammary glands development, etc.

Oestrogen also regulates the female sexual behaviour.

73 (*c*) The pair of hormones given in option (c) are not antagonistic to each other. Relaxin hormone which is secreted by the posterior pituitary gland relaxes the pubic symphysis during parturition, while inhibin decreases the secretion of FSH from anterior pituitary. Rest pairs of hormones are antagonistic (having opposite effects) to each other.

76 (*d*) Atrial Natriuretic Factor (ANF) is a hormone which decreases blood pressure. ANF is secreted when blood pressure is high and causes dilation of the blood vessels. This reduces the blood pressure.

Thus, option (d) is correct.

77 (*d*) The juxtaglomerular cells of kidney produce a peptide hormone called renin, which increases blood pressure through angiotensin-II and erythropoietin which stimulates the formation of RBCs.

78 (*a*) Erythropoietin or EPO, is a glycoprotein hormone that controls erythropoiesis or red blood cells production. It is a cytokine (protein signaling molecule) for erythrocytes (red blood cells) precursors in the bone marrow.

80 (*b*) Secretin, a digestive hormone secreted by the wall of the upper part of the small intestine (the duodenum) acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions. Secretin is a polypeptide made up of 27 amino acids.

81 (*c*) CCK acts on both pancreas and gall bladder and stimulate the secretion of pancreatic enzyme and bile juice, respectively.

82 (*a*) Gastric Inhibitory Polypeptide (GIP), functions to neutralise stomach acid to protect the small intestine from acid damage. It reduces the rate at which food is transferred through the stomach and inhibit the Gl motility and secretion of hydrochloric acid.

84 (*c*) Hormone receptors present on the cell membrane of the target cells are called membrane bound receptors and receptors present inside the target cells are called intracellular receptors, which are mostly nuclear receptors (present in the nucleus).

85 (*d*) Set of hormones given in option (d) contain only peptide hormones. These are insulin, glucagon and prolactin (a pituitary hormone).

Rest sets are incorrect and can be corrected as

Progesterone, oestradiol, cortisol, testosterone are steroid hormones.

Thyroid hormones, e.g. T_3 and T_4 are iodothyronines and epinephrine is an amino acid derivative hormone.

86 (*a*) Hormones of testes lack peptides, amines and sulphur. These hormones are steroid in nature. They are derived from cholesterol.

87 (*c*) Among the following, epinephrine is an amino acid derived hormone. It is a catecholamine which is produced in the chromaffin cells of adrenal medulla from the amino acid tyrosine. On the other hand, estradiol and estriol are steroid hormone that are involved in the regulation of estrous and menstrual cycles.

Ecdysone is also a steroid hormone that controls moulting in insects.

88 (*a*) Inhibins are dimeric glycoproteins composed of an α-subunit and either a β_A (inhibin A) or a β_B subunit (inhibin B). They are mainly produced in gonads and provide negative regulation of FSH secretion.

89 (*d*) Hormones, which interact with membrane bound receptor normally do not enter the target cell, but generate secondary messengers (e.g. cyclic AMP, IP_3, Ca^{2+}, etc.), which in turn regulate cellular metabolism.

90 (*a*) Steroid hormones are able to bind to DNA and form a gene-hormone complex. These hormones can easily cross the lipid bilayer of the cell and do not require secondary messengers for the same.

Steroid hormones bind to intracellular receptors in the nucleus to form hormone receptor complex, which in turn interacts with the genome.

91 (*c*) Steroid hormones are the lipid soluble hormones and are categorised as hydrophobic hormones. They directly pass through the cell membrane and interact with intracellular receptors present inside the cell (generally within the nucleus).

93 (*b*) Sodium is not a second messenger in hormone action. Second messengers are cyclic AMP, IP_3, calcium ions, etc.

94 (*d*) Cortisol and testosterone are lipid soluble hormones, which can directly pass through the cell membrane of the target cell and bind with the intracellular receptors.

95 (*a*) Oestrogen and testosterone are female and male sex hormones, respectively. Chemically, these are steroid hormones (lipid soluble) which easily pass through the cell membrane and bind to specific (cytoplasmic) intracellular receptors.

96 (*d*) Binding of a hormone to its receptor leads to the formation of a hormone receptor complex which causes certain biochemical changes in the target tissue. Thus, if receptor molecules are removed from the target organs, then the target organ will not respond to the hormone.

99 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The endocrine glands are ductless glands, i.e. lack ducts. They pour their secretion into the surrounding blood for transport to the site of action or distantly located target organ. Their secretions are called hormones.

100 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The hypothalamic hormones regulate the synthesis and secretion pituitary hormones. Like GnRH (Gonadotropin Releasing Hormone) is released into the pituitary through a portal circulating system where it causes the anterior pituitary to release hormones like LH and FSH. These two hormones stimulate gonadal activity and hence called gonadotropins.

101 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

Grave's disease caused by the enlargement of the thyroid gland due to hyperthyroidism.

102 (*b*) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion.

ADH is secreted by the posterior lobe of the pituitary gland. It mainly acts on the kidneys and stimulates reabsorption of water and electrolytes by distal tubules and thereby, reduce diuresis.

An impairment affecting synthesis or release of ADH results in the diminished ability of the kidneys to conserve water leading to water loss and dehydration. This condition is known as diabetes insipidus.

103 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Adrenaline is secreted in our body during cold, which raises metabolic rate. It causes vasoconstriction of essentially all the blood vessels of the body and increased activity of the heart which prevents heat loss. Shivering which is a rhythmic contraction of skeletal muscles produces heat. Adrenaline, nor-adrenaline, etc., increase the metabolic rate by stimulating the breakdown of fats.

104 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

In old persons, there is gradually weakening of immune system because of degeneration of thymus gland. Thymus secretes a hormone named thymosin which stimulates the development of certain kinds of WBCs involved in generating immunity. It is prominent at the time of birth, but it gradually atrophies in adults and its disappearance causes ageing.

105 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Pancreas is a composite gland because it acts both as an exocrine gland and an endocrine gland. The endocrine pancreas consists of islets of Langerhans, which have two main types of cells called α-cells and β-cells. The α-cells secrete a hormone called glucagon, while the β-cells secrete insulin.

The exocrine part of the pancreas consists of rounded lobules (acini) that secrete an alkaline pancreatic juice with pH 8.4. The pancreatic juices help in the digestion of starch, proteins, fats and nucleic acids.

106 (*c*) Assertion is true, but Reason is false. Reason can be corrected as

Cholecystokinin (CCK) stimulates the secretion of both the pancreatic enzymes as well as the bile juice.

107 (*c*) Assertion is true, but Reason is false. Reason can be corrected as

A hormone-receptor complex is formed when a hormone binds to its receptor. This leads to certain biochemical changes such as target tissue, metabolism and regulates various physiological functions of the target tissues or organs.

108 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Hormones interacting with membrane band receptors normally do not enter the target cells because they generate second massengers like cyclic AMP, IP_3, Ca^{2+}, etc. These are responsible for the amplification of signal. The hormone is called first messenger and *c*AMP is termed as second messenger.

109 (*c*) Statement in option (c) is correct. Rest of the statements are incorrect and can be corrected as

- Organised endocrine glands include pineal gland, pituitary gland, pancreas, liver, ovary and testis.

- In the nervous system, the response is for a short duration whereas in the endocrine system, it is for a long duration.
- Hormones are produced in trace amounts by ductless (endocrine) glands.

110 (*c*) Statement in option (c) is correct. Rest of the statements are incorrect and can be corrected as
- Endocrine glands can regulate neural activity.
- Neurons can regulate endocrine activity.
- Neural transmission is fast whereas endocrine transmission is slow.

111 (*c*) Statement in option (c) is correct in relation to the endocrine system. Rest statements are incorrect and can be corrected as
- Neurohypophysis is under the direct neural regulation of the hypothalamus.
- Organs in the body like GI tract, heart, kidneys produce hormones.
- Releasing and inhibitory hormones are produced by the hypothalamus.

112 (*b*) Statement in option (b) is incorrect and can be corrected as

Glands which have dual functions due to the presence of both exocrine as well as endocrine regions are called heterocrine glands, such as ovaries, testes and pancreas.

Rest of the statements are correct.

113 (*a*) Statement in option (a) is incorrect and can be corrected as

Hypothalamus is the basal part of diencephalon, i.e. forebrain and not mesencephalon.

Rest of the statements are correct.

114 (*a*) Statement in option (a) is incorrect and can be corrected as

Pineal gland helps in maintaining the normal rhythms of sleep-wake cycle, body temperature. In addition, melatonin also influences metabolism, pigmentation, etc.

Rest of the statements are correct.

115 (*d*) Statement in option (d) is incorrect and can be corrected as

Adrenaline is an amino acid derivative hormone derived from tyrosine amino acid. The precursor to melatioin is serotonin, a neurotransmitter that itself is derived from the amino acid tryptophan.

Rest of the statements are correct.

116 (*a*) Statement in option (a) is incorrect and can be corrected as

The thyroid gland plays an important role in the regulation of the basal metabolic rate.

Rest of the statements are correct.

117 (*a*) Option (a) is incorrect about inhibin. It can be corrected as follows

It is a glycoprotein, not a lipoprotein.

Rest of the statements are correct.

118 (*a*) Statement in option (a) is incorrect and can be corrected as

Steroid hormones interact with intracellular receptors. Rest of the statements are correct.

119 (*a*) Statement in option (a) is incorrect and can be corrected as

Both IP_3 and cyclic Adenosine Monophosphate (*c*AMP) are secondary messengers in hormone action.

Rest of the statements are correct.

120 (*c*) Statement in option (c) is correct about the hormone action in humans and rest are incorrect. They can be corrected as
- Glucagon is secreted by α-cells of islets of Langerhans and stimulates glycogenolysis.
- Secretion of thymosin reduces with ageing.
- FSH stimulates growth and development of ovarian follicles in females.

124 (*c*) Statement I is true, but II is false and can be corrected as

Oestradiol and progesterone are steroid hormones.

125 (*c*) Statement I is true, but II is false and can be corrected as

In males, LH stimulates the synthesis and secretion of androgens.

126 (*c*) Statement I is true, but II is false and can be corrected as

Both adrenaline and nor-adrenaline are emergency hormones and they increase heart contraction and thus, blood pressure is also increased during emergency situation.

130 (*d*) Statement I is false and II is true. The false statement can be corrected as

Double vision, irritability and hypoglycemia are caused due to hypersecretion of glucagon.

131 (*c*) Statement I is true, but II is false and it can be corrected as

Diabetes insipidus is caused due to impaired synthesis or release of ADH or vasopressin. It results in diminished ability of kidney to conserve water leading to water loss and dehydration.

133 (*a*) Statements I, III and IV are correct, while statements II and V are incorrect and can be corrected as

Leydig cells secrete testosterone hormone which stimulates spermatogenesis.

Neurohypophysis secretes oxytocin and ADH.

136 (*c*) Statements I, II and IV are correct. Statement III is incorrect and can be corrected as

Small amounts of androgenic, steroidal hormones secreted by the adrenal cortex play a major role in the growth of axial hair, pubic hair and facial hair during puberty.

137 (*d*) Statements I and III are correct whereas statement II is incorrect. It can be corrected as

In humans, pars intermedia is almost merged with pars distalis to form adenohypophysis.

138 (*b*) Statements I and II are correctly indicate the functioning of thyroid hormones. Statements III and IV are incorrect and can be corrected as

- Thyroid hormones regulate the blood calcium levels.
- Thyroid hormones maintain the balance of water and electrolytes.

139 (*c*) Option (c) depicts the correct sequence of events. The events in sequence describing the mechanism of action of protein hormones are as follows

- Hormone binds to receptor on plasma membrane.
- Response-I (given by receptor) generation of secondary messenger (cyclic AMP or Ca^{2+}).
- Biochemical responses.
- Physiological responses, e.g. ovarian growth, etc.

140 (*c*) The statement III is correct, while statements I, II and IV are incorrect. Their corrected forms are as follows

- Catecholamines increase the heartbeat, the strength of heart contraction and the rate of respiration.
- Aldosterone acts on the renal tubules and stimulates the reabsorption of Na^+ ions and water and removal of K^+ and phosphate ions.
- Aldosterone is the main mineralocorticoid, whereas cortisol is the main glucocorticoid.

141 (*a*) Statement I is correctly indicates the functioning of gonads, statements II, III and IV are incorrect and can be corrected as follows

- Ovary produces one ovum during each menstrual cycle and produces two groups of steroid hormones called oestrogen and progesterone.
- Androgens influence male sex behaviour (libido) and not female sex behaviour.
- Androgens produce anabolic (synthetic) effects on carbohydrate and protein metabolism.

142 (*c*) Statements I and III are incorrect and can be corrected as

- Epinephrine (an amino acid derivative hormone) interacts with membrane bound receptors normally do not enter the target cell, but generate secondary messengers.
- Thymosin increases the production of antibodies to provide humoral immunity.

Rest of the statements are correct.

155 (*d*) Cushing's syndrome is not a deficiency related disorder as it is caused due to the excess secretion of glucocorticoid, i.e. cortisol.

160 (*c*) Oxytocin is the hormone secreted by posterior pituitary. It acts on the smooth muscles of uterus and stimulates their contraction also plays an important role in milk secretion. Rest of the hormones are secreted by anterior pituitary.

161 (*c*) Mary, during her first five minutes before interview experiences sweating, increased heartbeat and respiration because she is under stress due to which emergency hormones or hormones of flight and fight, i.e. adrenaline and nor-aderaline are being released in her body by the adrenal medullary part of the adrenal gland. These hormones stimulate the breakdown of glycogen resulting in increased a concentration of glucose in the blood.

162 (*a*) Leydig cells synthesise androgens when stimulated by leutinizing hormone. This in turn stimulates the process of spermatogenesis.

163 (*d*) Exophthalmia is a condition that is not linked to deficiency of thyroid hormone. It is casued by the oversecretion of thyroid hormone.

166 (*c*) Thymosin is responsible for differentiation of T-lymphocytes which provide cell-mediated immunity. They also increase the production of antibodies to provide humoral immunity.

168 (*b*) Corpus luteum secretes a hormone called progesterone, which supports pregnancy and stimulates the development of mammary glands for milk production in mammalian females.

169 (*c*) Cortisol is secreted from the adrenal gland. The zona fasciculata region of adrenal cortex secretes cortisol, corticosterone and cortisone. These hormones are involved in maintaining glucose homeostasis.

171 (*c*) Hormones are called chemical signals that stimulate specific target tissues and their action depend on the presence of receptors on the respective target tissues. The receptors are located in plasma membrane in case of protein hormones.

174 (*c*) Liver is the largest gland of body surrounded by the abdominal cavity. It does not consist of a central 'medullary' regions, surrounded by a cortical region. Rest three options, i.e. ovary, adrenal and kidney bear a prominent 'medullary and cortical region'.