Chapter
22

Chemical Coordination and Integration

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

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

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

4. Graves' disease is caused due to
(a) hyposecretion of thyroid gland
(b) hypersecretion of thyroid gland
(c) hyposecretion of adrenal gland
(d) hypersecretion of adrenal gland.
(NEET-II 2016)

5. Name a peptide hormone which acts mainly on hepatocytes, adipocytes and enhances cellular glucose uptake and utilisation.
(a) Insulin (b) Glucagon
(c) Secretin (d) Gastrin
(NEET -II 2016)

6. The posterior pituitary gland is not a 'true' endocrine gland because
(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. *(NEET-II 2016)*

7. Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other?
(a) Aldosterone Atrial Natriuretic Factor
(b) Relaxin Inhibin
(c) Parathormone Calcitonin
(d) Insulin Glucagon
(NEET-I 2016)

8. The amino acid tryptophan is the precursor for the synthesis of
(a) estrogen and progesterone
(b) cortisol and cortisone
(c) melatonin and serotonin
(d) thyroxine and triiodothyronine.
(NEET-I 2016)

9. Which one of the following hormones is not involved in sugar metabolism?
(a) Insulin (b) Glucagon
(c) Cortisone (d) Aldosterone
(2015)

10. Which one of the following hormones though synthesised elsewhere, is stored and released by the master gland?
(a) Prolactin
(b) Melanocyte stimulating hormone
(c) Antidiuretic hormone
(d) Luteinising hormone *(2015)*

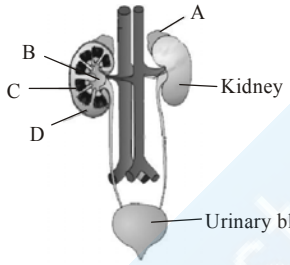
11. A chemical signal that has both endocrine and neural roles is
(a) epinephrine (b) cortisol
(c) melatonin (d) calcitonin.
(2015 Cancelled)

12. Identify the hormone with its correct matching of source and function.
(a) Oxytocin - posterior pituitary, growth and maintenance of mammary glands.

(b) Melatonin - pineal gland, regulates the normal rhythm of sleepwake 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.
(2014)

13. Fight-or-flight reactions cause activation of
(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 norepinephrine
(d) the pancreas leading to a reduction in the blood sugar levels. *(2014)*

14. Figure shows human urinary system with structures labelled A to D. Select option which correctly identifies them and gives their characteristic and/ or functions.



(a) C - Medulla - inner zone of kidney and contains complete nephrons.
(b) D - Cortex - outer part of kidney and do not contain any part of nephrons.
(c) A - Adrenal gland - located at the anterior part of kidney. Secrete catecholamines which stimulate glycogen breakdown.
(d) B - Pelvis - broad funnel shaped space inner to hilum, directly connected to loops of Henle. *(NEET 2013)*

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

16. Which of the following statements is correct in relation to the endocrine system?
(a) Non-nutrient chemicals produced by the body in trace amounts that act as intercellular messenger are known as hormones.
(b) Releasing and inhibitory hormones are produced by the pituitary gland.
(c) Adenohypophysis is under direct neural regulation of the hypothalamus.
(d) Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones. *(NEET 2013)*

17. Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom.

	Endocrine gland	**Hormone**	**Function/ Deficiency symptoms**
(a)	Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(b)	Corpus luteum	Testos -terone	Stimulates spermatogenesis
(c)	Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth
(d)	Posterior pituitary	Growth hormone (GH)	Oversecretion stimulates abnormal growth

(NEET 2013)

18. Select the option which correctly matches the endocrine gland with its hormone and its function.

	Endocrine gland	**Hormone**	**Function**
(a)	Placenta	Estrogen	Initiates secretion of the milk
(b)	Corpus luteum	Estrogen	Essential for maintenance of endometerium
(c)	Leydig's cells	Androgen	Initiates the production of sperms
(d)	Ovary	FSH	Stimulates follicular development and the secretion of estrogens

(Karnataka NEET 2013)

19. Norepinephrine
(i) is released by sympathetic fibers
(ii) is released by parasympathetic fibers
(iii) increases the heart rate
(iv) decreases blood pressure.
Which of the above statements are correct?
(a) (i) and (iii) (b) (ii) and (iii)
(c) (ii) and (iv) (d) (i) and (iv)
(Karnataka NEET 2013)

20. Which of the following represents the action of insulin?
(a) Increases blood glucose level by stimulating glucagon production.
(b) Decreases blood glucose levels by forming glycogen.
(c) Increases blood glucose levels by promoting cellular uptake of glucose.
(d) Increases blood glucose levels by hydrolysis of glycogen.
(Karnataka NEET 2013)

21. 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 neuro-hormonal control system?
(a) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal medulla.
(b) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse.
(c) Hypothalamus activates the para-sympathetic division of brain.
(d) Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal cortex. *(2012)*

22. 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)?
(a) Insulin, glucagon
(b) Thyroxine, insulin
(c) Somatostatin, oxytocin
(d) Cortisol, testosterone *(2012)*

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

24. Match the source gland with its respective hormone and function and select the correct option.

	Source gland	**Hormone**	**Function**
(a)	Anterior pituitary	Oxytocin	Contraction of uterus muscles during child birth
(b)	Posterior pituitary	Vasopressin	Stimulates reabsorption of water in the distal tubules in the nephron
(c)	Corpus luteum	Estrogen	Supports pregnancy
(d)	Thyroid	Thyroxine	Regulates blood calcium level

(2011)

25. Given below is an incomplete table on hormones, their source glands and one major effect of each human body. Identify the option representing correct grouping of hormone its gland and effect.

Gland	**Secretion**	**Effect on body**
A	Estrogen	Maintenance of secondary sexual characters
Alpha cells of Islets of Langerhans	B	Raises blood sugar level
Anterior pituitary	C	Over secretion leads to gigantism

	A	**B**	**C**
(a)	Ovary	Glucagon	Growth hormone
(b)	Placenta	Insulin	Vasopressin
(c)	Ovary	Insulin	Calcitonin
(d)	Placenta	Glucagon	Calcitonin

(2011)

26. The 24 hour (diurnal) rhythm of our body such as the sleep-wake cycle is regulated by the hormone
(a) calcitonin (b) prolactin
(c) adrenaline (d) melatonin.
(Mains 2011)

27. Injury to adrenal cortex is not likely to affect the secretion of which one of the following?
(a) Aldosterone
(b) Both androstenedione and dehydroepiandrosterone
(c) Adrenaline
(d) Cortisol *(2010)*

28. Low Ca^{++} in the body fluid may be the cause of
(a) tetany (b) anaemia
(c) angina pectoris (d) gout. *(2010)*

29. Which one of the following pairs is incorrectly matched?
(a) Glucagon – Beta cells (source)
(b) Somatostatin – Delta cells (source)
(c) Corpus luteum – Relaxin (secretion)
(d) Insulin – Diabetes mellitus (disease)
(2010)

30. Toxic agents present in food which interfere with thyroxine synthesis lead to the development of
(a) toxic goitre (b) cretinism
(c) simple goitre (d) thyrotoxicosis.
(2010)

31. Select the correct matching of a hormone, its source and function.

	Hormone	Source	Function
(a)	Vasopressin	Posterior pituitary	Increases loss of water through urine
(b)	Norepine-phrine	Adrenal medulla	Increases heart beat, rate of respiration and alterness
(c)	Glucagon	Beta-cells of Islets of Langerhans	Stimulates glycogenolysis
(d)	Prolactin	Posterior pituitary	Regulates growth of mammary glands and milk formation in females

(2010)

32. A health disorder that results from the deficiency of thyroxine in adults and characterised by (i) a low metabolic rate, (ii) increase in body weight and (iii) tendency to retain water in tissues is
(a) simple goitre (b) myxoedema
(c) cretinism (d) hypothyroidism.
(2009)

33. Which one of the following pair of organs includes only the endocrine glands?
(a) Thymus and testes
(b) Adrenal and ovary
(c) Parathyroid and adrenal
(d) Pancreas and parathyroid *(2008)*

34. The blood calcium level is lowered by the deficiency of
(a) both calcitonin and parathormone
(b) calcitonin
(c) parathormone
(d) thyroxine. *(2008)*

35. Feeling the tremors of an earthquake a scared resident of seventh floor of a multistoryed building starts climbing down the stairs rapidly. Which hormone initiated this action?
(a) Adrenaline (b) Glucagon
(c) Gastrin (d) Thyroxine
(2007)

36. A person is having problems with calcium and phosphorus metabolism in his body. Which one of the following glands may not be functioning properly?
(a) Parotid (b) Pancreas
(c) Thyroid (d) Parathyroid
(2007)

37. Which hormone causes dilation of blood vessels, increased oxygen consumption and glucogenesis?
(a) Glucagon (b) ACTH
(c) Insulin (d) Adrenaline
(2006)

38. Which of the following is an accumulation and release centre of neurohormones?
(a) Anterior pituitary lobe
(b) Posterior pituitary lobe
(c) Intermediate lobe of the pituitary
(d) Hypothalamus *(2006)*

39. A steroid hormone which regulates glucose metabolism is
(a) cortisone
(b) cortisol
(c) corticosterone
(d) 11-deoxycorticosterone. *(2006)*

40. Which one of the following is not a secondary messenger in hormone action?
(a) cAMP (b) cGMP
(c) Calcium (d) Sodium *(2006)*

41. 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) Neither hormones control neural activity nor the neurons control endocrine activity. *(2006)*

42. Which one of the following hormones is modified amino acid?
(a) Epinephrine (b) Progesterone
(c) Prostaglandin (d) Estrogen *(2004)*

43. Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency?
(a) Luteinizing hormone - Failure of ovulation
(b) Insulin - Diabetes insipidus
(c) Thyroxine - Tetany
(d) Parathyroid hormone - Diabetes mellitus *(2004)*

44. Chemically hormones are
(a) biogenic amines only
(b) proteins, steroids and biogenic amines
(c) proteins only
(d) steroids only. *(2004)*

45. Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency ?
(a) Relaxin – Gigantism
(b) Prolactin – Cretinism
(c) Parathyroid hormone – Tetany
(d) Insulin – Diabetes insipidus *(2003)*

46. Acromegaly is caused by
(a) excess of STH
(b) excess of thyroxine
(c) deficiency of thyroxine
(d) excess of adrenaline. *(2002)*

47. Adrenaline directly affects on
(a) S.A. node
(b) β-cells of Langerhans
(c) dorsal root of spinal nerve
(d) epithelial cells of stomach. *(2002)*

48. When both ovaries are removed from rat then which hormone is decreased in blood?
(a) Oxytocin
(b) Prolactin
(c) Estrogen
(d) Gonadotropin releasing factor *(2002)*

49. Mainly which type of hormones control the menstrual cycle in human beings?
(a) FSH (b) LH
(c) FSH, LH, estrogen
(d) progesterone *(2002)*

50. Which set is similar?
(a) Corpus luteum - Graafian follicles
(b) Sebum - Sweat
(c) Bundle of His - Pace maker
(d) Vitamin B_7 - Niacin *(2001)*

51. Melatonin is secreted by
(a) pineal body (b) skin
(c) pituitary gland (d) thyroid. *(2000)*

52. Which gland secretes odorous secretion in mammals?
(a) Bartholins (b) Prostate
(c) Anal gland (d) Liver *(2000)*

53. MSH is secreted by
(a) anterior lobe of pituitary
(b) middle lobe of pituitary
(c) posterior lobe of pituitary
(d) endostyle. *(2000)*

54. Cholecystokinin and duocrinin are secreted by
(a) adrenal cortex (b) thyroid gland
(c) intestine (d) pancreas. *(1999)*

55. The function of oxytocin is to help in
(a) child birth (b) gametogenesis
(c) growth (d) lactation. *(1999)*

56. Secretion of progesterone by corpus luteum is initiated by
(a) testosterone (b) thyroxine
(c) MSH (d) LH. *(1999)*

57. The gonadotrophic hormones are secreted by
(a) anterior lobe of pituitary
(b) interstitial cells of testes
(c) adrenal cortex
(d) posterior part of thyroid. *(1999)*

58. Diabetes is due to
(a) enzyme deficiency
(b) iodine deficiency
(c) Na^+ deficiency
(d) hormonal deficiency. *(1999)*

59. Calcitonin is a thyroid hormone which
(a) elevates calcium level in blood
(b) has no effect on calcium
(c) elevates potassium level in blood
(d) lowers calcium level in blood. *(1998)*

60. The hormone that stimulates the stomach to secrete gastric juice is
(a) enterokinase (b) enterogastrone
(c) gastrin (d) renin. *(1998)*

61. The contraction of gall bladder is due to
(a) cholecystokinin (b) enterogastrone
(c) gastrin (d) secretin. *(1998)*

62. The hormone which regulates the basal metabolism in our body is secreted from
(a) adrenal cortex (b) pancreas
(c) pituitary (d) thyroid. *(1998)*

63. Hormones thyroxine, adrenaline and the pigment melanin are formed from
(a) tyrosine (b) proline
(c) tryptophan (d) glycine. *(1997)*

64. Which hormone stimulates the secretion of milk from female?
(a) Oxytocin (b) Progesterone
(c) LH (d) Prolactin *(1996)*

65. Which one of the following endocrine glands stores its secretion in the extracellular space before discharging it into the blood?
(a) Testis (b) Thyroid
(c) Pancreas (d) Adrenal *(1995)*

66. According to the accepted concept of hormone action, if receptor molecules are removed from target organs, then the target organ will
(a) continue to respond to the hormone without any difference
(b) not respond to the hormone
(c) continue to respond to the hormone but will require higher concentration
(d) continue to respond to the hormone but in the opposite way. *(1995)*

67. The immediate cause of induction of ovulation in human female is the large plasma surge of
(a) LH (b) FSH
(c) progesterone (d) estradiol. *(1994)*

68. Testosterone is produced by
(a) sertoli cells (b) Leydig's cells
(c) oxyntic cells (d) pituitary gland. *(1993)*

69. Gastric secretion is stopped by hormone
(a) enterogastrone (b) gastrin
(c) pancreozymin (d) cholecystokinin. *(1993)*

70. ADH or vasopressin is
(a) enzyme that hydrolyses peptides
(b) hormone secreted by pituitary that promotes reabsorption of water from glomerular filtrate
(c) hormone that promotes glycogenolysis
(d) energy rich compound connected with muscle contraction. *(1991)*

71. Occurrence of Leydig's cells and their secretion is
(a) ovary and estrogen
(b) liver and cholesterol
(c) pancreas and glucagon
(d) testis and testosterone. *(1991)*

72. Insulin is a
(a) vitamin (b) lipid
(c) hormone (d) enzyme. *(1990)*

73. Addition of a trace of thyroxine or iodine in water containing tadpoles will
(a) keep them in larval stage
(b) hasten their metamorphosis
(c) slow down their metamorphosis
(d) kill the tadpoles. *(1990)*

74. Which hormone possesses anti-insulin effect?
(a) Cortisol (b) Calcitonin
(c) Oxytocin (d) Aldosterone *(1988)*

75. MSH of pars intermedia of middle pituitary is responsible for
(a) darkening of skin in lower vertebrates
(b) light colouration of skin in lower vertebrates
(c) both A and B
(d) darkening of skin in human beings. *(1988)*

Answer Key

1.	(a)	**2.**	(a)	**3.**	(b)	**4.**	(b)	**5.**	(a)	**6.**	(b)	**7.**	(b)	**8.**	(c)	**9.**	(d)	**10.**	(c)
11.	(a)	**12.**	(b)	**13.**	(c)	**14.**	(c)	**15.**	(c)	**16.**	(a)	**17.**	(a)	**18.**	(c)	**19.**	(a)	**20.**	(b)
21.	(a)	**22.**	(d)	**23.**	(c)	**24.**	(b)	**25.**	(a)	**26.**	(d)	**27.**	(c)	**28.**	(a)	**29.**	(a)	**30.**	(c)
31.	(b)	**32.**	(b)	**33.**	(c)	**34.**	(c)	**35.**	(a)	**36.**	(d)	**37.**	(d)	**38.**	(d)	**39.**	(b)	**40.**	(d)
41.	(c)	**42.**	(a)	**43.**	(a)	**44.**	(b)	**45.**	(c)	**46.**	(a)	**47.**	(a)	**48.**	(c)	**49.**	(c)	**50.**	(a)
51.	(a)	**52.**	(c)	**53.**	(b)	**54.**	(c)	**55.**	(d)	**56.**	(d)	**57.**	(a)	**58.**	(d)	**59.**	(d)	**60.**	(c)
61.	(a)	**62.**	(d)	**63.**	(a)	**64.**	(d)	**65.**	(b)	**66.**	(b)	**67.**	(a)	**68.**	(b)	**69.**	(a)	**70.**	(b)
71.	(d)	**72.**	(c)	**73.**	(b)	**74.**	(a)	**75.**	(a)										

EXPLANATIONS

1. (a) : Gonadotropin releasing hormone (GnRH) is secreted by the hypothalamus which stimulates the anterior lobe of pituitary gland to secrete luteinising hormone (LH) and Follicle Stimulating Hormone (FSH).

2. (a) : Epiphyseal plate is a hyaline cartilage plate in the metaphysis at each end of long bone. It is part of long bone where new bone growth takes place. In adults, elevated levels of GH results in acromegaly where no increase in height occurs because of ossified epiphyseal plate.

3. (b) : Corpus luteum is a temporary endocrine gland in human females. It secretes progesterone which stimulates the uterine glands to produce increased amount of watery mucus and is also essential for maintenance of endothelium. In absence of fertilisation, corpus luteum disintegrate leading to menstruation.

4. (b) : Exophthalmic goitre or Graves' disease is a thyroid enlargement (goitre) in which the thyroid secretes excessive amount of thyroid hormone. It is characterised by exophthalmia (protrusion of eye balls because of fluid accumulation behind them), loss of weight, slightly rise in the body temperature, excitability, rapid heart beat, nervousness and restlessness.

5. (a) : Insulin is a peptide hormone, secreted by the β cells of the islets of Langerhans in the pancreas, that promotes the uptake of glucose by body cells, particularly in the liver (hepatocytes) and muscles (adipocytes), and thereby controls its concentration in the blood.

6. (b) : Posterior lobe of pituitary gland does not secrete any hormone. Its hormones are synthesised by the hypothalamus. It only stores and releases these hormones. Hence, it cannot be considered as true gland.

7. (b) : Relaxin hormone is secreted by ovary and placenta during pregnancy, which relaxes ligaments in pelvis and softens and widens cervix during childbirth. Inhibin secreted by granulosa cells in the ovaries inhibits secretion of FSH by anterior pituitary. Thus, relaxin and inhibin have different functions and are not antagonistic.

8. (c) : Tryptophan is an essential amino acid which is precursor for the synthesis of melatonin and serotonin.

9. (d) : Aldosterone (salt-retaining hormone) is the principal mineralocorticoid in humans, secreted by adrenal cortex. Its main function is to regulate sodium content of the body.

10. (c) : Two hormones *viz* oxytocin (OT) and antidiuretic hormone (ADH) are synthesised in the hypothalamus, but stored and released by the posterior lobe of pituitary gland.

11. (a) : Hormones epinephrine and norepinephrine are secreted from adrenal medulla. They are emergency hormones released in condition of stress, emergency etc. Epinephrine and norepinephrine are also released by adrenergic nerve fibres of sympathetic nervous system where they act as neurotransmitters.

12. (b) : Oxytocin is produced by hypothalamus and generally secreted by posterior pituitary. It stimulates secretion of milk from mammary glands; causes contraction of uterus at the time of child birth.
Progesterone is secreted by corpus luteum. It stimulates uterus for pregnancy, implantation, formation of placenta and development of mammary glands.
Atrial natriuretic factor is secreted by atrial wall in response to an increased return of the venous blood. This hormone regulates the blood volume through increased excretion of ions and water.

13. (c) : *Refer to answer 11.*

14. (c) : In the given figure, A is adrenal gland which secretes two catecholamines; adrenaline (epinephrine) and noradrenaline (norepinephrine). Adrenaline increases the conversion of glycogen to glucose providing quick energy for "fight or flight" response. B is renal pelvis which is a sac like cavity of the kidney leading to ureters, is not directly connected to loop of Henle. C is medulla, the inner region of kidney containing loop of Henle, collecting ducts and ducts of Bellini. D is cortex which has proximal and distal convoluted tubules and contains Malpighian corpuscles.

15. (c) : Iodine is needed for the synthesis of T_3 and T_4. Iodine binds to the tyrosine residues in thyroglobulin, which is then hydrolysed into iodotyrosines that combine to form triiodothyronine (T_3) or thyroxine (tetra-iodothyronine or T_4). Therefore, deficiency of iodine in the diet of a pregnant female will lead to improper synthesis of thyroid hormones in newly borne infant. The

deficiency of thyroid hormones in infants causes 'cretinism' whose symptoms are slow heart beat, lower blood pressure, decrease in temperature, stunted growth, low intelligence quotient and abnormal skin.

16. (a) : Releasing and inhibiting factors are released by hypothalamus. The hypothalamus is connected to adenohypophysis by hypophysial portal vein and is connected to the neurohypophysis by axons of neurosecretory cells. Hence, neurohypophysis is directly under the neural control. The cardiocytes of atria of the heart secrete peptide hormone, called atrial natriuretic factor (ANF) in response to an increased return of the deoxygenated (venous) blood. The liver produces angiotensinogen which is changed to angiotensin II by an enzyme renin secreted by juxtaglomerular apparatus (JGA).

17. (a) : Iodine is required for production of thyroxine, thus lack of iodine results in hyposecretion of thyroxine. To compensate, thyroid gland enlarges and the condition is known as goitre. Corpus luteum secretes progesterone which maintains uterine endothelium and mucus secretion in uterus, Fallopian tubes and vagina. Oxytocin stimulates uterine contractions but is secreted by posterior pituitary. Anterior pituitary secretes GH, whose oversecretion causes abnormal growth.

18. (c) : Interstitial cells (or Leydig 's cells) are the cells interspersed between the seminiferous tubules of the testis. They secrete androgens including testosterone in response to stimulation by luteinizing hormone from the anterior pitutary gland. Androgens produce and maintain male characteristics and stimulate germinal epithelium to undergo spermatogenesis.

19. (a) : Norepinephrine is secreted by some neurons of the sympathetic nervous system and also by adrenal medulla. It accelerates heart rate.

20. (b) : *Refer to answer 5.*

21. (a) : *Refer to answer 11.*

22. (d) : Steroid hormones such as cortisol, testosterone, estradiol and progesterone, mostly regulate gene expression or chromosome function by the interaction of hormone-receptor complex with the genome. So, these easily pass through the cell membrane of the target cell and bind to a receptor inside it.

23. (c) : Hormone action involves their reception by target cells. Specific proteins called hormone receptors that are located in target tissues only bind with these hormones. Hormone receptor may be of two types: membrane bound receptor and intracellular receptors. Steroid hormones etc., bind with intracellular receptors while some hormones *e.g.*, pituitary hormones like FSH etc., bind with membrane bound receptors.

24. (b) : Posterior lobe of pituitary stores and releases two hormones, called oxytocin and vasopressin. These hormones are actually produced by the neurosecretary cells in the hypothalamus and stand in the terminals of their axons that pass into the posterior lobe through a stalk. They are released *via* posterior lobe when required. Vasopressin is also called antidiuretic hormone (ADH). It decreases the loss of water in the urine by increasing reabsorption of water in the distal convoluted tubules, collecting tubules and collecting ducts in the kidneys.

25. (a) : The correct option for the three blanks A, B and C are ovary, glucagon and growth hormone respectively.

26. (d) : Melatonin is a hormone secreted by the pineal gland and retinas of vertebrates. Melatonin secretion by the pineal gland is linked to the dark-light cycle of the organism's environment, being greatest at night and lowest by day. The hormone is involved in regulating certain diurnal and seasonal changes in the body, such as the reproductive cycle in seasonally breeding animals. It is used as a drug to treat sleep disorders and symptoms of jet lag.

27. (c) : Adrenal glands or (suprarenal glands) are two triangular endocrine glands, each of which covers the superior surface of a kidney. Each gland has two parts, the medulla and cortex. The medulla forms the grey core of the gland; it consists mainly of chromaffin tissue and is stimulated by the sympathetic nervous system to produce adrenaline and noradrenaline. The cortex is a yellowish tissue surrounding the medulla. It is stimulated by pituitary hormones (principally ACTH) to produce three kinds of corticosteroid hormones, which affect carbohydrate metabolism (*e.g.*, cortisol), electrolyte metabolism (*e.g.*, aldosterone), and the sex glands (oestrogens and androgens). Thus injury to adrenal cortex is not likely to affect the secretion of adrenaline.

28. (a) : Tetany is a spasm and twitching of the muscles, particularly those of the face, hands, and feet. Tetany is usually caused by a reduction in the blood calcium level, which may be due to underactive parathyroid glands, rickets, or alkalosis.

29. (a) : Glucagon is a hormone, secreted by the cells of the islets of Langerhans in the pancreas, that increases the concentration of glucose in the blood

by stimulating the metabolic breakdown of glycogen. It thus antagonizes the effects of insulin.

30. (c) : *Refer to answer 17.*

31. (b) : Vasopressin reduces water loss through urine by stimulating resorption of water by the distal tubules of the kidney. Glucagon is released from α-cells. Prolactin is produced from anterior pituitary.

32. (b) : Myxoedema is caused by deficiency of thyroid hormone or thyroxine in adults. It is characterized by low metabolic rate, body gain, puffy appearance, low body temperature etc. This disease can be treated by administration of thyroid hormones.

33. (c) : Parathyroid and adrenal glands are the endocrine glands because they manufacture hormones and secretes them directly into the blood stream to act at distant sites in the body. Thyroid and pituitary are its other examples.

34. (c) : Parathormone is secreted by chief cells of the parathyroid that regulates the metabolism of calcium and phosphate. It increases calcium absorption from the intestine and also increases calcium resorption from the nephrons of the kidneys. So its deficiency leads to low blood calcium level.

35. (a) : Adrenaline (epinephrine), also called emergency hormone, is a hormone, produced by the medulla of the adrenal glands, that increases heart activity, improves the power and prolongs the action of muscles, and increases the rate and depth of breathing to prepare the body for 'fright, flight, or fight'. At the same time it inhibits digestion and excretion. Similar effects are produced by stimulation of the sympathetic nervous system.

36. (d) : *Refer to answer 34.*

37. (d) : Adrenaline is the hormone secreted by adrenal medulla. It prepares the animal to face special conditions created by physical stress. All these conditions require more energy which is provided by increasing heart beat, blood pressure, respiratory rate, sugar level of blood, blood supply of heart and skeletal muscles and brain through dilation of their small arteries, and oxidative metabolism. It also stimulates the breakdown of liver and muscle glycogen (glucogenesis) to provide glucose for respiration.

38. (d) : *Refer to answer 16.*

39. (b) : *Refer to answer 27.*

40. (d) : Secondary messengers are low-weight diffusible molecules that are used to relay signals within a cell. They are synthesized or released by specific enzymatic reactions, usually as a result of an external signal that is received by a transmembrane receptor. cAMP, cGMP and Ca^{2+} act as secondary messengers and are located within the cytoplasm. Sodium is an essential nutrient which helps to maintain blood volume and keeps nerves functioning.

41. (c) : The endocrine system links the brain to the organs that control body metabolism, growth and development, and reproduction. The endocrine system is regulated by feedback. For example, the hormones that are regulated by the pituitary gland, a signal is sent from the hypothalamus to the pituitary gland in the form of a "releasing hormone," which stimulates the pituitary to secrete a "stimulating hormone" into the circulation. The stimulating hormone then signals the target gland to secrete its hormone. As the level of this hormone rises in the circulation, the hypothalamus and the pituitary gland shut down secretion of the releasing hormone and the stimulating hormone, which in turn slows the secretion by the target gland. This system results in stable blood concentrations of the hormones that are regulated by the pituitary gland.

42. (a) : Epinephrine is synthesized from tyrosine which is a non-essential amino acid possessing cyclic structure with a straight side chain bearing carboxylic and amino group. The conversion of tyrosine to epinephrine involves 4 steps – (i) ring hydroxylation (ii) decarboxylation, (iii) side-chain hydroxylation (iv) N-methylation.

Tyrosine → Dopa → Dopamine → Norepinephrine → Epinephrine.

43. (a) : Ovulation occurs under the influence of luteinizing hormone and FSH (follicle stimulating hormone) of anterior pituitary gland. Thus, deficiency of luteinizing hormone results in failure of ovulation.

44. (b) : Hormones are chemical messengers produced by the ductless glands (sometimes by neurons) and transported in the circulation to target cells. They regulate metabolic processes. Chemically hormones are of different nature like biogenic amines (like thyroxine, adrenaline etc), proteinaceous or polypeptide (like hypothalamic hormones etc.) and steroids (like sex hormones and adrenocorticoids).

45. (c) : *Refer to answer 28.*

46. (a) : Acromegaly is caused by excess of STH (somatotrophic hormone), released by anterior lobe of pituitary after adolescence. The bones of the lower jaw and limbs become abnormally enlarge but the body does not attain a giant stature. Excess of thyroxine causes cretinism and myxoedema. Excess of adrenaline causes increased BMR, heart beat, excitement etc.

47. (a) : Adrenaline directly affects the SA node to increase rate of heartbeat. Adrenaline prepares the body for emergency reactions like fight and flight. Thus there is increase in heart rate, breathing rate, blood pressure, glucose level in blood, peripheral circulation, etc.

48. (c) : Ovary secretes two hormones. Oestrogen before ovulation and progesterone after ovulation. Oxytocin, prolaction are pituitary hormones and gonadotropin releasing factor is secreted by hypothlalamus of brain to stimulate pituitary for the secretion of gonadotropic hormones.

49. (c) : Menstrual cycle is controlled by several endocrinal parameters.
In beginning of the cycle FSH (follicle stimulating hormone) of pituitary initiates development of an ovarian follicle. A growing ovarian follicle gradually secretes increasing amount of estrogen. This in turn leads to sudden surge of LH secretion by the pituitary. As the LH (leutinising hormone) level in blood suddenly increases there is ovulation.

Thus only FSH or LH cannot control all the events of menstrual cycle. Progesteron is released by a corpus luteum after ovulation which actually prepares the uterus for a possible pregnancy.

If there is no fertilisation progesteron level falls and there is beginning of a new cycle.

50. (a) : After ovulation many of the follicular cells remain in the collapsed Graafian follicle on the surface of the ovary. The antrum (cavity) of the collapsed follicle fills with a partially clotted fluid. The follicular cells enlarge and fill with a yellow pigment, lutein. Such a follicle is called a corpus luteum.

51. (a) : *Refer to answer 26.*

52. (c) : The anal glands are small paired sacs located on either side of the anus between the external and internal sphincter muscles. These sebaceous glands within the lining secrete a foul smelling liquid that is used for identification of members within a species. These glands are found in all carnivora except bears.

53. (b) : Middle lobe of pituitary secretes a hormone named melanocyte-stimulating hormone. It stimulates the synthesis of black pigment melanin in the skin, and also causes dispersal of melanin granules in the pigment cells, thereby darkening the colour in certain animals (fishes amphibians). In man it has no such role. Anterior lobe of pituitary secretes FSH, LH, TSH, ACTH and STH. Posterior lobe of pituitary secretes oxytocin and vasopressin.

54. (c) : Cholecystokinin and duocrinin are secreted by intestine. It stimulates pancreas to release enzymes in pancreatic juice and stimulates gall bladder to release bile. Duocrinin causes release of viscous mucus from Brunner's glands into intestinal juice.

55. (d) : *Refer to answer 12.*

56. (d) : Luteinsing Hormone (LH) in the male, induces the interstitial cells of the testes to produce male sex hormones named androgens such as testosterone. In the female, the luteinising hormone causes ovulation, secretion of female sex hormone, estrogen from the maturing ovarian follicle, and progesterone by the corpus luteum.

57. (a) : Gonadotrophic hormones are secreted by anterior lobe of pituitary gland. They are as follows:
(i) Follicle-stimulating hormone (FSH): It stimulates growth of ovarian follicles and their secretion of estrogens in the female, and spermatogenesis (formation of sperms) in the male.
(ii) Interstitial cell stimulating hormone (ICSH): It activates the Leydig's (interstitial) cells of the testis to secrete androgens. In female, it stimulates the corpus luteum of the ovary to secrete progesterone. In female it is termed luteinizing hormone (LH).

58. (d) : Diabetes mellitus is caused by the deficiency of hormone insulin which is secreted by pancreas. Insulin lowers the blood-glucose level. Deficiency of antidiuretic hormone (ADH) leads to diabetes insipidus.

59. (d) : Calcitonin is secreted by the C cells. It regulates the concentration of calcium and phosphorus in the blood. It is under the feedback control of plasma calcium concentration, and is secreted when concentration of calcium rises in the blood. It then lowers the concentration of calcium and phosphorus in the plasma by decreasing their release from the bones.

60. (c) : Gastrin hormone is secreted by mucosa of stomach and it stimulates secretion of gastric juice. Enterogastrone is secreted by duodenal epithelium. Enterokinase is an enzyme that converts trypsinogen into trypsin. Renin is secreted by kidneys. It acts on angiotensinogen to form angiotensin-II.

61. (a) : *Refer to answer 54.*

62. (d) : The basal metabolism is the minimum amount of energy the body uses in order to maintain vital processes of the body. Generally, this expenditure of energy is expressed in terms of heat production per unit of body surface per day on the basal metabolic rate (BMR). Thyroid is the largest endocrine gland

secreting three hormones thyroxine, triiodothyronine and calcitonin. Thyroxine and triiodothyronine control BMR of the body by regulating the rate of oxidation and production of energy.

63. (a) : Hormones thyroxine, adrenaline and the pigment melanin are formed from tyrosine. Tyrosine is transformed into dopa through the enzyme tyrosinase. Then through different metabolic pathways it produces thyroxine, adrenaline, melanin etc.

64. (d) : Prolactin hormone stimulates the growth of milk glands during pregnancy and the secretion of milk after delivery. Oxytocin causes release of milk during sucking by the infant. LH causes ovulation and secretion of estrogen and progesterone from ovarian follicle and corpus luteum respectively. Oxytocin, LH and prolactin are released by anterior lobe of pituitary gland. Progesterone is secreted by corpus luteum.

65. (b) : The thyroid gland secretes three hormones: thyroxine or tetraiodothyronine (T_4), triiodothyronine (T_3) and calcitonin. Thyroxine and Triiodothyronine are iodinated forms of the amino acid tyrosine. They are stored in the colloid that fills the follicles, and are released to the blood when needed. The storage occurs in an unusual place, the extracellular colloid.

66. (b) : The molecules of hormones that are amino acid derivatives, peptides or proteins are large and insoluble in lipids, and cannot enter the target cell. Therefore, they act at the cell surface. They bind to specific receptor molecules located on the surface of the cell membrane. Therefore, if receptor molecules are removed from target organs, then the target organ will not respond to the hormone.

67. (a) : *Refer to answer 64.*

68. (b) : *Refer to answer 18.*

69. (a) : Enterogastrone is secreted by duodenal epithelium and it slows gastric contractions to delay its emptying and also stops secretion of gastric juice. Gastrin stimulates secretion of gastric juice. Cholecystokinin stimulates release of enzymes in pancreatic juice and release of bile from gall bladder. Cholecystokinin is also known as pancreozymin.

70. (b) : *Refer to answer 24.*

71. (d) : *Refer to answer 18.*

72. (c) : *Refer to answer 5.*

73. (b) : In 1912, Gudernatsch discovered that metamorphosis in frog's tadpole is increased by the thyroxine hormone which has the iodine as the main constituent. If thyroxine or iodine in added in water having tadpoles in it, then it increases the rate of metamorphosis in tadpole.

74. (a) : Insulin decreases the level of glucose in the blood while cortisol (secreted by middle region of adrenal cortex) increases the blood-glucose level by converting proteins and fats into carbohydrates which are, in turn, converted to glucose.

75. (a) : Pars intermedia is the boundary between the anterior and posterior lobes of the pituitary. It contains three types of cells - basophils, chromophobes and colloid-filled cysts. This area produces melanocyte stimulating hormone or MSH. It stimulates the synthesis of black pigment melanin in the skin and also causes dispersion of melanin granules in the pigment cells, thereby darkening the colour in certain animals (fishes; amphibians). In man it has no such role.