

14

Endocrine System

Answers and Explanations

I. Introduction to the Endocrine System

A. Multiple Choice Questions

1. (b) – Because target cells have specific cytoplasmic receptor proteins as binding sites, they respond quite precisely to the presence of particular hormones within the blood.
2. (a) – The effects of hormones are frequently long lasting—from hours to even weeks or months.
3. (c) – The parotid is a salivary gland located under the skin in front of the ear.
4. (b) – The pancreas is a mixed gland in that it serves both the endocrine and digestive systems.
5. (d) – The three types of hormones are steroids, proteins, and amines.
6. (a) – Steroids, including the sex hormones produced by the gonads and the corticosteroids produced by the adrenal cortex, are classified as lipids. Cholesterol serves as the precursor molecule for the steroid hormones.

B. True–False Questions

1. False – Hormones are secreted from endocrine glands into the bloodstream. Exocrine glands secrete hormones into ducts.
2. True – The sex hormones are produced in the male and female gonads.
3. False – Of the three categories of hormones (steroids, proteins, and amines), only the steroids and amines can be administered orally.
4. True – An amine molecule contains atoms of carbon, hydrogen, and nitrogen and always has an amine group ($-\text{NH}_2$) associated with it.
5. True – The presence of specific receptor sites on the cell membrane ensures the correct signaling of hormones to target cells.
6. False – Most endocrine glands are regulated by negative feedback mechanisms.

II. Pituitary Gland

A. Multiple Choice Questions

1. (c) – The anterior portion of the pituitary is called the adenohypophysis, and the posterior portion is called the neurohypophysis.
2. (a) – Thyrotropin-releasing hormone (TRH) from the hypothalamus causes the release of thyroid-stimulating hormone (TSH) from the adenohypophysis.
3. (b) – Follicle-stimulating hormone (FSH) stimulates the production of sperm cells in a male.
4. (c) – The secretion of hormones from the anterior pituitary is controlled by hormones secreted by the hypothalamus.
5. (a) – Antidiuretic hormone (ADH) is released by the posterior pituitary.
6. (d) – Releasing and inhibiting hormones from the hypothalamus travel through the hypothalamo-hypophyseal portal system to control the secretion of hormones from the anterior pituitary.

B. True–False Questions

1. True – The dura mater surrounds the entire central nervous system.
2. True – It is through pituicites that nerve fibers extend through the infundibulum, which is the connecting stalk to the hypothalamus.
3. True – The pituitary gland is also known as the hypophysis. Removal of a portion or all of the pituitary gland is therefore known as a hypophysectomy.
4. False – The adenohypophysis produces the hormones that it secretes.
5. True – The term *trophic* means “food,” and this term is used in reference to the hormones secreted by the anterior pituitary because their effect is to make the target tissues hypertrophy.
6. True – Growth hormone, or somatotrophin, promotes cellular growth.

7. False – Positive feedback mechanisms control the release of oxytocin from the posterior pituitary.
8. False – The pituitary gland was once called the master gland, but this was before the controlling mechanisms of the hypothalamus on the neurohypophysis were known.

III. Thyroid and Parathyroid Glands

A. Multiple Choice Questions

1. (b) – Chromaffin cells are found in the adrenal medulla.
2. (c) – Located between the follicles, the parafollicular cells produce calcitonin that lowers blood calcium levels.
3. (b) – Thyroid-stimulating hormone (TSH), secreted from the adenohypophysis of the pituitary gland, is responsible for the secretion of thyroxine.
4. (a) – Parathyroid hormone (PTH) promotes a rise in blood calcium levels by acting on the bones, kidneys, and small intestine.

B. True–False Questions

1. True – Although larger, the testis is a mixed gland. With its only function to produce hormones, the thyroid gland is the largest true endocrine gland.
2. True – Adequate amount of hormones from the thyroid gland are necessary to maintain energy levels within the body.
3. True – There are usually four parathyroid glands embedded in the posterior surfaces of the lateral lobes of the thyroid gland.
4. False – Parathyroid hormone (PTH) is the only hormone secreted by the parathyroid glands.

IV. Pancreas

A. Multiple Choice Questions

1. (b) – Beta cells secrete insulin, and alpha cells secrete glucagon.
2. (c) – Glucagon stimulates the liver to convert glycogen into glucose, causing the blood glucose level to rise.
3. (e) – Basically, the function of insulin is opposite that of glucagon.
4. (c) – Diabetes mellitus and hyperglycemia are conditions associated with the pancreas. Diabetes insipidus is associated with the posterior pituitary.

B. True–False Questions

1. False – Since they are hormones, glucagon and insulin do not pass through ducts; rather, they pass directly into the bloodstream.
2. False – Hyperglycemia results when alpha cells continuously secrete glucagon.
3. True – Glucagon increases the level of blood glucose; insulin decreases the level of blood glucose.

V. Adrenal Glands

A. Multiple Choice Questions

1. (b) – From superficial to deep, the three zones of the adrenal cortex are the zona glomerulosa, zona fasciculata, and zona reticularis.
2. (b) – As a mineralocorticoid, aldosterone regulates the amounts of sodium and potassium eliminated in urine.
3. (c) – Mineralocorticoids regulate the extracellular electrolytes sodium (Na^+) and potassium (K^+).
4. (d) – Hormones from the adrenal medulla prepare the body for greater physical exertion—the “fight-or-flight” response.
5. (b) – The effects of the hormones secreted from the adrenal medulla are similar to those caused by stimulation of the sympathetic division of the autonomic nervous system, except that the hormonal effects are about 10 times longer lasting.

B. True–False Questions

1. False – The adrenal gland has only endocrine functions.
2. True – In structure and function, the two portions of the adrenal gland (cortex and medulla) may be considered two distinct endocrine glands. Corticosteroids are secreted by the adrenal cortex, and epinephrine and norepinephrine are secreted by the adrenal medulla.
3. True – With three arteries serving the adrenal gland, the adrenal tissues are highly vascular.
4. False – Aldosterone is secreted by the zona glomerulosa of the adrenal cortex.
5. False – Adrenaline and epinephrine are two names for the same hormone, but norepinephrine is a different hormone.
6. False – The male sex hormones are androgens; the sex hormones of the female are estrogens.

VI. Gonads and Other Endocrine Glands

A. Multiple Choice Questions

1. (b) – Estrogen is produced by several reproductive organs, including the testes of the male, but is not produced by the uterus.
2. (b) – By itself, estrogen would cause abortion of the fetus because it promotes menstrual changes of the uterus.
3. (a) – Secreted by the pineal gland, melatonin is thought to affect the hypothalamus by stimulating the secretion of certain releasing factors.
4. (d) – Secreted by the thymus, T cells are important in maintaining body immunity.
5. (c) – The functions of the placenta are focused on maintaining pregnancy and continued fetal development.

B. True–False Questions

1. True – The size of the thymus decreases sharply after puberty.
2. False – Secretin, cholecystakinin, and gastric inhibitory peptide are three hormones secreted by the small intestine.

VII. Developmental Exposition of the Endocrine System

A. Multiple Choice Questions

1. (c) – The anterior portion of the pituitary gland is called the adenohypophysis, and the posterior portion is called the neurohypophysis.
2. (c) – The pars intermedia is a small segment of the pituitary gland that atrophies during fetal development, so that it no longer exists as a separate lobe in adult humans.
3. (b) – As a developmental outpouching of the gut, the thyroid gland is derived from endoderm.
4. (c) – Derived as two outpouchings of the gut, the pancreas develops from endoderm.
5. (a) – The adrenal cortex is derived from mesoderm, and the adrenal medulla is derived from neuroectoderm.
6. (d) – Although functional at birth, the adrenal gland is not completely developed until the end of the third year of age.

B. True–False Questions

1. True – The pituitary gland forms from both the neuroectoderm of the developing brain and the ectoderm lining the primitive oral cavity. The infundibulum arises from the same neuroectoderm that forms the diencephalon.
2. False – As development of the thyroid gland continues, the thyroglossal duct becomes the foramen cecum. In an adult, the foramen cecum is a vestigial pit at the base of the tongue.
3. False – The pancreas develops as an outpouching of the gut where it maintains a connection through the pancreatic duct at the developing duodenum.
4. True – The adrenal medulla is formed from neuroectodermal cells derived from neural crest cells, and the adrenal cortex is derived from mesoderm.

VIII. Clinical Considerations

A. Multiple Choice Questions

1. (a) – Insufficient release of antidiuretic hormone (ADH) from the posterior pituitary causes diabetes insipidus.
2. (b) – Sufficient intake of iodine is essential in guarding against the development of a goiter.
3. (b) – A tumor of the adrenal cortex or oversecretion of ACTH from the adenohypophysis causes an abundance of corticosteroids, which results in Cushing’s syndrome.

B. True–False Questions

1. False – Total pituitary impairment is referred to as panhypopituitarism.
2. True – Hypersecretion of growth hormone in a child causes gigantism, whereas hypersecretion of growth hormone in an adult causes acromegaly.
3. True – Insufficient amounts of thyroxine production in a child causes cretinism.

IX. Chapter Review

A. Completion Questions

- | | |
|-------------------------------|-----------------------------|
| 1. hormones | 10. neurohypophysis |
| 2. target cells | 11. GnRH |
| 3. hypophysis | 12. suprarenal |
| 4. mixed | 13. principal |
| 5. amines | 14. islets |
| 6. negative | 15. pineal |
| 7. releasing-factor | 16. hypothalamo–hypophyseal |
| 8. ectoderm/mesoderm/endoderm | 17. Melatonin |
| 9. gonads | |

B. Matching Questions

- | | |
|--------|--------|
| 1. (d) | 6. (g) |
| 2. (e) | 7. (h) |
| 3. (f) | 8. (c) |
| 4. (a) | 9. (i) |
| 5. (b) | |