

Chemical Coordination And Integration

Question and Answer:

Question 1.

Define the following:

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

Answer:

(a) Exocrine gland:

Exocrine glands are glands that have ducts to carry their secretions to the target site or surface of organs.

Example: Salivary glands, sweat glands, and gastric glands.

(b) Endocrine gland:

Endocrine glands are ductless glands that release their secretions (hormones) directly into the bloodstream to reach target organs.

Example: Pituitary gland, thyroid gland, adrenal gland.

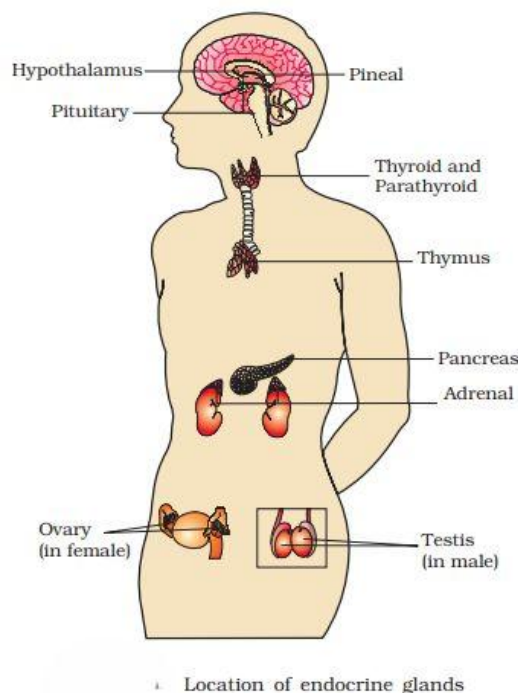
(c) Hormone:

Hormones are non-nutrient chemical messengers produced in very small quantities by endocrine glands and transported through the blood to specific target tissues where they regulate various physiological processes.

Question 2.

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

Answer:



Question 3.

List the hormones secreted by the following:

- Hypothalamus
- Pituitary
- Thyroid
- Parathyroid
- Adrenal
- Pancreas
- Testis
- Ovary
- Thymus
- Atrium
- Kidney
- G-I Tract

Answer:

(a) Hypothalamus:

- Releasing hormones (e.g., Gonadotrophin Releasing Hormone – **GnRH**)

- Inhibiting hormones (e.g., **Somatostatin**)

(b) Pituitary gland:

Anterior pituitary (Adenohypophysis):

- Growth Hormone (**GH**)
- Prolactin (**PRL**)
- Thyroid Stimulating Hormone (**TSH**)
- Adrenocorticotrophic Hormone (**ACTH**)
- Luteinizing Hormone (**LH**)
- Follicle Stimulating Hormone (**FSH**)
- Melanocyte Stimulating Hormone (**MSH**)

Posterior pituitary (Neurohypophysis):

- Oxytocin
- Vasopressin or Antidiuretic Hormone (**ADH**)

(c) Thyroid gland:

- Thyroxine (**T₄**)
- Triiodothyronine (**T₃**)
- Thyrocalcitonin (**TCT**)

(d) Parathyroid gland:

- Parathyroid Hormone (**PTH**)

(e) Adrenal gland:

Adrenal medulla:

- Adrenaline (Epinephrine)
- Noradrenaline (Norepinephrine)

Adrenal cortex:

- Glucocorticoids (e.g., **Cortisol**)
- Mineralocorticoids (e.g., **Aldosterone**)
- Small amounts of Androgenic steroids

(f) Pancreas (Islets of Langerhans):

- Insulin (from β -cells)
- Glucagon (from α -cells)

(g) Testis:

- Androgens (mainly Testosterone)

(h) Ovary:

- Estrogen
- Progesterone

(i) Thymus:

- Thymosins

(j) Atrium (Heart):

- Atrial Natriuretic Factor (ANF)

(k) Kidney:

- Erythropoietin

(l) Gastro-Intestinal (G-I) Tract:

- Gastrin
- Secretin
- Cholecystokinin (CCK)
- Gastric Inhibitory Peptide (GIP)

Question 4.

Fill in the blanks:

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

Answer:

- (a) Pituitary
- (b) Thyroid
- (c) Adrenal Cortex
- (d) Testis and Ovaries
- (e) Pineal gland

Question 5.

Write short notes on the functions of the following hormones:

- (a) Parathyroid hormone (PTH)
- (b) Thyroid hormones
- (c) Thymosins
- (d) Androgens
- (e) Estrogens
- (f) Insulin and Glucagon

Answer:

(a) Parathyroid Hormone (PTH):

- Secreted by the parathyroid glands.
- Increases the calcium (Ca^{2+}) level in the blood (hypercalcemic hormone).
- Stimulates bone resorption (release of Ca^{2+} from bones).
- Enhances reabsorption of Ca^{2+} from renal tubules.
- Promotes absorption of Ca^{2+} from the intestine.
- Works in coordination with thyrocalcitonin (TCT) to maintain calcium balance in the body.

(b) Thyroid Hormones (T_3 and T_4):

- Regulate basal metabolic rate (BMR) and energy metabolism.
- Control the metabolism of carbohydrates, proteins, and fats.
- Essential for growth and development of the body, especially the brain and nervous system.
- Support red blood cell formation (erythropoiesis).

- Maintain water and electrolyte balance.
- Thyrocalcitonin (TCT) helps reduce blood calcium levels.

(c) Thymosins:

- Secreted by the thymus gland.
- Promote the differentiation of T-lymphocytes, providing cell-mediated immunity.
- Stimulate the production of antibodies, aiding humoral immunity.
- Important in the development and maintenance of the immune system.

(d) Androgens:

- Secreted by Leydig (interstitial) cells in the testis.
- Main androgen: Testosterone.
- Promote development and functioning of male accessory sex organs.
- Responsible for secondary sexual characters in males (e.g., beard, deep voice, muscular growth).
- Stimulate spermatogenesis (formation of sperm).
- Influence male sexual behaviour (libido) and have anabolic effects on protein and carbohydrate metabolism.

(e) Estrogens:

- Secreted mainly by growing ovarian follicles in females.
- Stimulate growth and functioning of female reproductive organs.
- Responsible for female secondary sexual characters (e.g., high-pitched voice, breast development).
- Promote growth of ovarian follicles and regulate the menstrual cycle.
- Influence female sexual behaviour and mammary gland development.

(f) Insulin and Glucagon:

Insulin:

- Secreted by β -cells of the Islets of Langerhans (pancreas).
- Lowers blood glucose level (hypoglycemic hormone).
- Promotes glucose uptake and utilization by body cells.
- Stimulates glycogenesis (conversion of glucose to glycogen) in the liver and muscles.

Glucagon:

- Secreted by α -cells of the Islets of Langerhans.
- Raises blood glucose level (hyperglycemic hormone).
- Stimulates glycogenolysis (breakdown of glycogen to glucose) and gluconeogenesis (formation of glucose from non-carbohydrate sources).

Together, insulin and glucagon maintain blood glucose homeostasis.

Question 6.

Give example(s) of:

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

Answer:

- (a) **Hyperglycemic hormone:** Glucagon. **Hypoglycemic hormone:** Insulin.
- (b) **Hypercalcemic hormone:** Parathyroid hormone (PTH).
- (c) **Gonadotrophic hormones:** Follicle Stimulating Hormone (FSH) or Luteinizing Hormone (LH).
- (d) **Progestational hormone:** Progesterone.
- (e) **Blood pressure lowering hormone:** Atrial Natriuretic Factor (ANF).

(f) **Androgen:** Testosterone. **Estrogens:** Estrone, Estradiol, Estrol.

Question 7.

Which hormonal deficiency is responsible for the following:

(a) Diabetes mellitus

(b) Goitre

(c) Cretinism

Answer:

(a) Insulin

(b) Thyroxine

(c) Thyroxine

Question 8.

Briefly mention the mechanism of action of FSH,

Answer:

- Follicle Stimulating Hormone (FSH) is a peptide hormone secreted by the anterior pituitary gland.
- Being a water-soluble hormone, it cannot enter the target cell directly.
- FSH binds to specific receptor proteins present on the cell membrane of the target cell (ovarian follicles in females and Sertoli cells in males).
- This activates the enzyme adenylate cyclase, which converts ATP into cyclic AMP (cAMP).
- The cAMP acts as a second messenger, triggering a cascade of biochemical reactions inside the cell.
- These reactions stimulate growth and maturation of ovarian follicles in females and spermatogenesis in males.

Question 9.

Match the following:

Column I

(a) T

Column II

(i) Hypothalamus

(b) PTH

(c) GnRH

(d) LH

(ii) Thyroid

(iii) Pituitary

(iv) Parathyroid

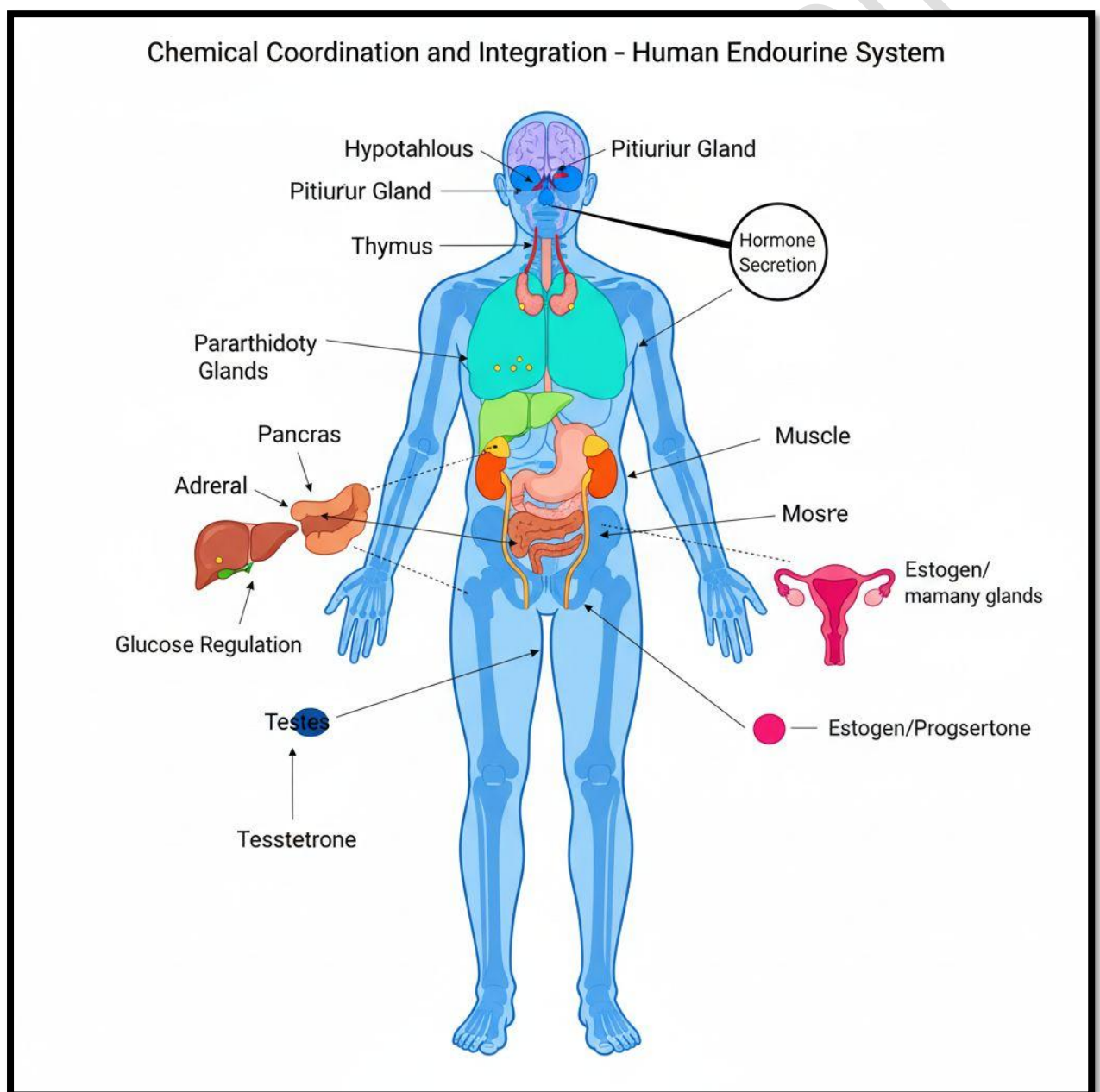
Answer:

(a) T → Thyroid

(b) PTH → Parathyroid

(c) GnRH → Hypothalamus

(d) LH → Pituitary



Additional Questions And Answers

Question 1.

What is the difference between endocrine glands and exocrine glands?

Answer:

Endocrine Glands	Exocrine Glands
Ductless glands; secrete hormones directly into the blood.	Have ducts to pour their secretions to a specific site.
Example: Pituitary, Thyroid, Adrenal.	Example: Salivary gland, Sweat gland, Liver.
Secretion is called hormone .	Secretion is called enzyme, mucus, or other fluids .

Question 2.

What is the role of hypothalamus in endocrine control?

Answer:

- The hypothalamus controls the pituitary gland, also called the master gland.
- It secretes releasing hormones (RH) and inhibiting hormones (IH).
 - For example:
 - **TRH** – Thyrotropin Releasing Hormone
 - **CRH** – Corticotropin Releasing Hormone
 - **GnRH** – Gonadotropin Releasing Hormone
- Thus, it **regulates secretion of hormones** from the pituitary and maintains **homeostasis**.

Question 3.

Name the hormones secreted by the adrenal cortex and

mention one function of each.

Answer:

Hormone	Function
Aldosterone (Mineralocorticoid)	Regulates sodium and potassium balance in blood.
Cortisol (Glucocorticoid)	Maintains carbohydrate metabolism and reduces inflammation.
Androgens	Influence development of secondary sexual characters.

Question 4.

What are the effects of insulin deficiency?

Answer:

- Deficiency of **insulin** causes **Diabetes mellitus**.
- Leads to increased blood glucose level (**hyperglycemia**).
- Glucose appears in urine (**glycosuria**).
- Causes frequent urination, thirst, weakness, and weight loss.

Question 5.

What is the function of melatonin?

Answer:

- Secreted by the pineal gland.
- Regulates sleep–wake cycle (circadian rhythm).
- Influences body temperature, metabolism, and mood.
- Helps maintain biological rhythms of the body.

Question 6.

Differentiate between diabetes mellitus and diabetes insipidus.

Answer:

Diabetes Mellitus	Diabetes Insipidus
Caused by insulin deficiency .	Caused by ADH (vasopressin) deficiency .
Leads to high blood sugar and glucose in urine .	Leads to excessive urination and loss of water , but no glucose in urine .
Controlled by insulin injection .	Controlled by ADH administration .

Question 7.

Name the hormones involved in calcium regulation.

Answer:

1. **Parathyroid Hormone (PTH)** – Increases blood calcium level.
2. **Thyrocaltitonin (TCT)** – Decreases blood calcium level.
3. **Vitamin D (Calcitriol)** – Enhances absorption of calcium from the intestine.

Together, they maintain **calcium homeostasis** in the body.