

## CHAPTER – 19

### CHEMICAL COORDINATION AND INTEGRATION

#### EXERCISES

#### 2 Mark Questions

**Q1: Which hormonal deficiency is responsible for the following:**

- (a) Diabetes mellitus
- (b) Goitre
- (c) Cretinism.

**Answer:**

- (a) Insulin
- (b) Thyroxine and Triiodothyronine
- (c) Thyroxine and Triiodothyronine.

**Q1: Briefly mention the mechanism of action of FSH.**

**Answer:** (Follicle stimulating hormone) being glycoprotein is insoluble in lipids, therefore,

cannot enter the target cells. It binds to the specific receptor molecules located on the surface of the cell membrane to form hormone – receptor complex. This complex causes the release of an enzyme adenylate cyclase from the receptor site. This enzyme forms the cell cyclic adenosine monophosphate (cAMP) from ATP. The cAMP activates the existing enzyme system of the cell. This accelerates the metabolic reactions in the cell. The hormone is called the first messenger and the cAMP is termed the second messenger. The hormone- receptor complex changes the permeability of the cell membrane to facilitate the passage of materials through it. This increases the activities of the cell as it receives the desired materials.

**Q1: Match the following:**

Column I	Column II
(a) T <sub>4</sub>	(i) Hypothalamus
(b) PTH	(ii) Thyroid
(c) GnRH	(iii) Pituitary

(d) LH                      (IV) Parathyroid.

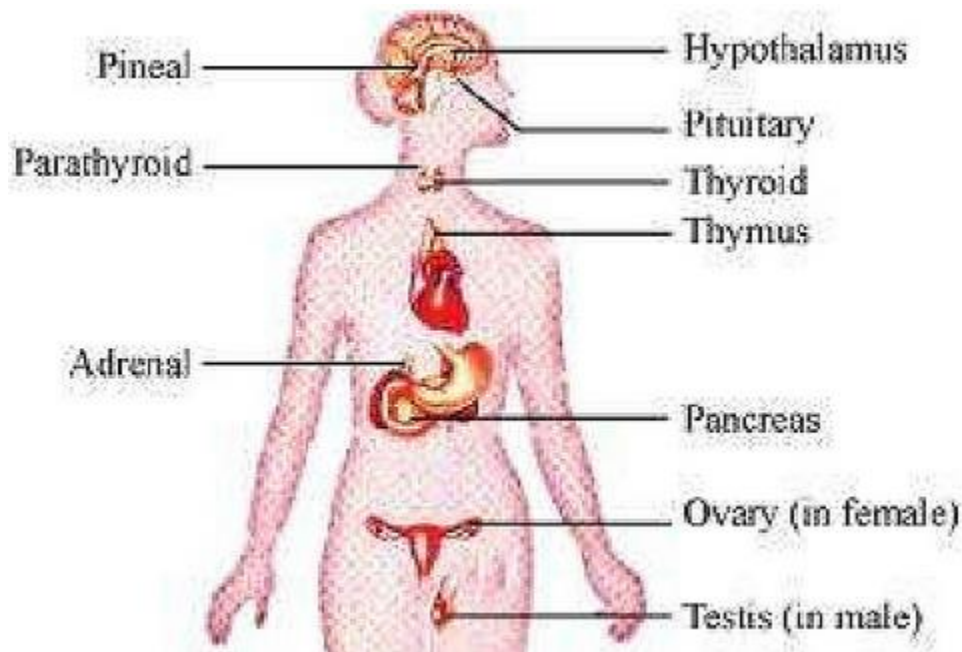
Answer:

(a) – (ii); (b) – (IV); (c) – (i) ; (d) – (iii)

## 4 Mark Questions

**Q1: Diagrammatically indicate the location of the various endocrine glands in our body.**

Answer:



**Q1: Fill in the blanks:**

**Hormones**

**Target gland**

(a) Hypothalamic hormones

.....

(b) Thyrotrophic (TSH)

.....

(c) Corticotrophin (ACH)

.....

(d) Gonadotrophins (LH, FSH)

.....

(e) Melanotrophin (MSH)

.....

**Answer:**

- (a) Pituitary
- (b) Thyroid
- (c) Adrenal cortex
- (d) Gonads -Testes in male and ovaries in female
- (e) Skin.

**Q1: 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) Glucagon, Insulin
- (b) Parathormone (PTH)
- (c) Follicle stimulating hormone (FSH) and Luteinizing hormone (LH)
- (d) Progesterone
- (e) Atrial natriuretic factor
- (f) Testosterone and Estradiol.

## **7 Mark Questions**

**Q1: Write short notes on the functions of the following hormones:**

- (a) Parathyroid hormones (PTH)**
- (b) Thyroid hormones**
- (c) Thymosin**
- (d) Androgens**
- (e) Estrogens**
- (f) Insulin and Glucagon.**

**Answer:**

- (a) Parathyroid hormone increases the level of calcium and decreases the level of phosphate in the blood.
- (b) Thyroid gland secretes three hormones: thyroxine, triiodothyronine and

calcitonin. Thyroxine and triiodothyronin control the general metabolism of the body, promote growth of body tissues and stimulates tissue differentiation.

Calcitonin regulates the concentration of calcium in the blood.

(c) Thymosin is secreted by thymus. It accelerates cell division, stimulates the development and differentiation of T-lymphocytes and also hastens attainment of sexual maturity.

(d) Androgens are secreted by testis. They stimulate the development of male reproductive system, formation of sperms, and development of male accessory sex characters and also determine the male sexual behaviour and the sex urge.

(e) Estrogens are secreted by ovaries. They stimulate the female reproductive tract to grow to full size and become functional, differentiation of ova and development of accessory sex characters.

(f) Insulin is secreted by the  $\beta$ -cells of the pancreas. It lowers blood glucose level, and promotes synthesis of proteins and fats. Glucagon is secreted by the  $\alpha$ -cells of the pancreas. It increases the level of glucose in the blood.

**Q1: Define the following:**

**(a) Exocrine gland,**

**(b) Endocrine gland,**

**(c) Hormone.**

**Answer:** (a) Exocrine gland is a gland that pours its secretion on the surface or into a particular region by means of ducts for performing a metabolic activity, e.g., sebaceous glands, sweat glands, salivary glands and intestinal glands.

(b) Endocrine gland is an isolated gland (separates even from epithelium forming it) which secretes informational molecules or hormones that are poured into venous blood or lymph for reaching the target organ because the gland is not connected with the target organ by any duct. Therefore endocrine gland is also called ductless gland e.g. thyroid gland.

(c) Hormone is a substance that is manufactured and secreted in very small quantities into the blood stream by an endocrine gland or a specialized nerve cell and regulates the growth or functioning of a specific tissue organ in a distant part of the body e.g. insulin.

**Q1: List the hormones secreted by the following:**

**(a) Hypothalamus**

**(b) Pituitary**

- (c) **Thyroid**
- (d) **Parathyroid**
- (e) **Adrenal**
- (f) **Pancreas**
- (g) **Testis**
- (h) **Ovary**
- (i) **Thymus**
- (j) **Atrium**
- (k) **Kidney**
- (l) **G-I Tract.**

**Answer:** (a) Two types of hormones are produced by hypothalamus: releasing hormones (that stimulate secretion of pituitary hormones) and inhibiting hormones (that inhibit secretion of pituitary hormones).

These hormones are:

1. Thyrotrophin-releasing hormone
2. Adrenocorticotrophin-releasing hormone
3. Follicle-stimulating hormone-releasing hormone
4. Luteinizing hormone-releasing hormone
5. Growth hormone-releasing hormone
6. Growth inhibiting hormone
7. Prolactin releasing hormone
8. Prolactin inhibiting hormone
9. Melanocyte stimulating hormone-releasing hormone
10. Melanocyte stimulating hormone- inhibiting hormone.

(b) Different parts of pituitary secrete different hormones.

Hormones secreted by anterior lobe of pituitary are:

1. Follicle stimulating hormone
2. Luteinizing hormone
3. Thyroid stimulating hormone
4. Adrenocorticotrophic hormone
5. Somatotrophic or Growth hormone
6. Prolactin hormone or Luteotrophic hormone.

Middle (intermediate) lobe of pituitary: Melanocyte stimulating hormone.

Posterior lobe of pituitary:

- (i) Oxytocin
- (ii) Vasopressin or antidiuretic hormone.

(c) Thyroid secretes 3 hormones:

1. Thyroxine or tetraiodothyronine
2. Triiodothyronine
3. Calcitonin.

(d) Parathyroid gland secretes a single hormone called parathormone (PTH) or Collip's hormone.

(e) Adrenal glands have two regions, namely, outer adrenal cortex and inner adrenal medulla. Both these regions secrete different hormones.

Hormones of adrenal cortex are grouped into three categories:

1. Glucocorticoids, e.g., cortisol
2. Mineralocorticoids, e.g., aldosterone
3. Sexcorticoids e.g testosterone. Adrenal medulla secretes two hormones
  - (i) Epinephrine (adrenaline)
  - (ii) Nor-epinephrine (nor-adrenaline).

(f) Pancreas secretes following hormones:

1. Insulin
2. Glucagon
3. Somatostatin.

(g) Testis secretes androgens such as testosterone.

(h) Ovary secretes:

1. Estrogens such as estradiol
2. Progesterone
3. Relaxin.

(i) Thymus secretes thymosin hormone.

(j) Atrium secretes atrial natriuretic factor (ANF).

(k) Kidney secretes:

(i) Renin (ii) Erythropoetin

(l) G.I. tract secretes:

1. Gastrin
2. Secretin
3. Cholecystokinin
4. Enterocrinin
5. Duocrinin
6. Villikinin.

## **Multiple Choice Questions**

1. \_\_\_\_\_ **controls the concentration of urine**

1. ADH
2. Oxytocin
3. ACTH
4. None of the above

**Answer:** ADH

**2.Children who have damaged thymus may result in\_\_\_\_\_**

- 1.Loss of an antibody-mediated immunity
- 2.Reduction in stem cell production
- 3.Deafness
- 4.Loss of cell-mediated immunity

**Answer:** Loss of cell-mediated immunity

**3.A group of hormones called \_\_\_\_\_ are released due cortex**

- 1.Glucose
- 2.Glucocorticoid
- 3.Glucagon

4. None of the above

**Answer:** Glucocorticoid

**4. Adrenocorticotrophic hormones stimulate the adrenal cortex to produce**

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1. Testosterone

2. Aldosterone

3. Cortisol

4. None of the above

**Answer:** Cortisol

**5. Deficiency of this element causes the thyroid gland to swell up**

1. Calcium

2. Iodine

3. phosphorous

4. None of the above

**Answer:** Iodine

## **SUMMARY**

There are special chemicals which act as hormones and provide chemical coordination, integration and regulation in the human body. These hormones regulate metabolism, growth and development of our organs, the endocrine glands or certain cells. 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. The pituitary gland is divided into three major parts, which are called as pars distalis, pars intermedia and pars nervosa. Pars distalis produces six trophic



hormones. Pars intermedia secretes only one hormone, while pars nervosa (neurohypophysis) secretes two hormones. The pituitary hormones regulate the growth and development of somatic tissues and activities of peripheral endocrine glands. Pineal gland secretes melatonin, which plays a very important role in the regulation of 24-hour (diurnal) rhythms of our body (e.g., rhythms of sleep and state of being awake, body temperature, etc.). The thyroid gland hormones play an important role in the regulation of the basal metabolic rate, development and maturation of the central neural system, erythropoiesis, metabolism of carbohydrates, proteins and fats, menstrual cycle. Another thyroid hormone, i.e., thyrocalcitonin regulates calcium levels in our blood by decreasing it. The parathyroid glands secrete parathyroid hormone (PTH) which increases the blood  $\text{Ca}^{2+}$  levels and plays a major role in calcium homeostasis. The thymus gland secretes thymosins which play a major role in the differentiation of T-lymphocytes, which provide cell-mediated immunity. In addition, thymosins also increase the production of antibodies to provide humoral immunity. The adrenal gland is composed of the centrally located adrenal medulla and the outer adrenal cortex. The adrenal medulla secretes epinephrine and norepinephrine. These hormones increase alertness, pupillary dilation, piloerection, sweating, heart beat, strength of heart contraction, rate of respiration, glycogenolysis, lipolysis, proteolysis. The adrenal cortex secretes glucocorticoids and mineralocorticoids. Glucocorticoids stimulate gluconeogenesis, lipolysis, proteolysis, erythropoiesis, cardio-vascular system, blood pressure, and glomerular filtration rate and inhibit inflammatory reactions by suppressing the immune response. Mineralocorticoids regulate water and electrolyte contents of the body. The endocrine pancreas secretes glucagon and insulin. Glucagon stimulates glycogenolysis and gluconeogenesis resulting in hyperglycemia. Insulin stimulates cellular glucose uptake and utilisation, and glycogenesis resulting in hypoglycemia. Insulin deficiency and/or insulin resistance result in a disease called diabetes mellitus. The testis secretes androgens, which stimulate the development, maturation and functions of the male accessory sex organs, appearance of the male secondary sex characters, spermatogenesis, male sexual behaviour, anabolic pathways and erythropoiesis. The ovary secretes estrogen and progesterone. Estrogen stimulates growth and development of female accessory sex organs and secondary sex characters. Progesterone plays a major role in the maintenance of pregnancy as well as in mammary gland development and lactation. The atrial wall of the heart produces atrial natriuretic factor which decreases the blood pressure. Kidney produces erythropoietin which

stimulates erythropoiesis. The gastrointestinal tract secretes gastrin, secretin, cholecystokinin and gastric inhibitory peptide. These hormones regulate the secretion of digestive juices and help in digestion.