Chapter - 22 Chemical Coordination and Integration

Question-1

What are gonodotrophs?

Solution:

FSH and LH are gonadotropins, as they stimulate the growth and maintenance of gonads

Question-2

What is juvenile hormone?

Solution:

The hormone in insects, which prevents them from maturing is called juvenile hormone.

Question-3

What are the causes for diabetes mellitus and diabetes insipidus?

Solution:

Diabetes Mellitus, commonly known as diabetes is a chronic disease that affects the body's ability to use energy from food. It is a life-long condition which is characterized by high levels of sugar or glucose in the blood. The main reason for high blood sugar levels in the body can be due to the body's inability to utilize insulin or due to the defect in production of insulin or a combination of both.

There are three major types of diabetes namely :-

type1 diabetes, type2 diabetes and gestational diabetes.

Type1 diabetes also called as Juvenile diabetes or insulin dependent diabetes mellitus is caused due to the inability of the pancreas to secrete insulin. It usually affects only 5% of the total diabetes population that mainly includes the adults and children.

Type2 diabetes is one of the most common types of diabetes that accounts to almost 95% of the total population affected by diabetes. Also called as non-insulin-dependent diabetes mellitus, it is caused due to improper utilization of insulin by the body cells.

Gestational diabetes generally occurs in pregnant women late in their pregnancy. It is found to affect around 16% of the total pregnant women. This is caused due to the effect of pregnancy hormones on insulin production and utilization

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Question-4

Why is oxytocin called 'birth hormone'?

Solution:

Oxytocin causes the contraction of smooth muscles of uterus during child birth. So it is called birth hormone.

Question-5

Name the inhibiting hormone released by hypothalamus.

Solution:

GHIH - Growth Hormone Inhibiting Hormone.

PIH - Prolactin Inhibiting Hormone.

MIH - Melanocyte Stimulating Hormone Inhibiting Hormone.

Question-6

Differentiate between exopthalmic goitre and iodine deficiency goitre.

Solution:

Exophthalmic goitre	Iodine deficiency goitre
1. It is caused by the hypersecretion of thyroid gland.	1. This disease is caused due to deficiency of iodine in diet.
2. Excess of thyroxine accelerates oxidation.	2. Iodine is necessary for thyroxine synthesis.
3. This results in quick consumption of food leaving nothing for storage. This disease is called exophthalmic goitre. Heat production, high metabolism, bulging eyes are its symptoms.	3. Poor supply of iodine causes enlargement of the gland. This disease is found in hilly regions. It may also lead to cretinism or myxoderma and is also known as Gull's disease.

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Question-7

Differentiate between hormones and pheromones.

Solution:

The difference between the hormone and pheromones are as follows:

Hormones	Pheromones
They are the products of endocrine glands.	They are the products of exocrine glands.
They are released directly into the blood stream.	They are released into the external environment.
They are triggered due to biological changes in the body.	They are triggered either behavioural or developmental processes when perceived by other members of the same species.

Question-8

What is the endocrine control in the 'fight and flight' response? Explain.

Solution:

Physiological changes in the human body occur in response to a perceived threat, including secretion of glucose, endorphins and hormones as well as elevation of heart rate, metabolism, blood pressure, breathing and muscle tension.

There are two adrenals at the top of each kidney. Hormones secreted by adrenal medulla help the body of an individual in handling emergency situations. Adrenaline is known as emergency hormone and is secreted in proportion to the stimulus through the central nervous system. The hormone mobilizes the source of the body to enable it to cope with emergencies, i.e. the fight and flight response to fear.

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Question-9

Name the gland that secretes vasopressin. What are its two principal actions?

Solution:

It is secreted by posterior part of the pituitary gland (formerly called hypophysis).
Function: Osmoregulation, water reabsorption of blood vessel, rise in blood pressure.

Question-10

Name the blood vessels that form the portal system in pituitary. What is its special function?

Solution:

Hypothalamo-hypophysial portal vein forms portal system in pituitary. It is also called hypothalamo- pituitary portal vessel. It is important to control the function of anterior pituitary gland (adenohypophysis) through hypothalamic releasing factors (RF). The anterior lobe of pituitary is connected to hypothalamic nuclei by this vessel. Axons of neuron originate in different areas of hypothalamus and they terminate in the median eminence around the origin of portal vessels. Action potential in these neurons releases hormones which are carried by portal vessels to anterior pituitary where they act upon pituitary cells for control of their secretions or hormones.

Question-11

What is the function of pineal gland?

Solution:

The pineal gland secretes a hormone, melatonin. It reduces the reproductive activity and may also delay the sexual development in an individual.

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Question-12

What forms the corpus luteum? Name the hormones secreted by it.

Solution:

The corpus luteum is formed by the rupturing of mature Graffian follicles. It is a hormone-producing gland in the ovary. It is a yellow body. It secretes progesterone, which helps to maintain pregnancy and to prevent menstruation during this period. Progesterone prevents abortion.

Question-13

Describe the endocrine role of Islets of Langerhans.

Solution:

Islets and Langerhans is a group of epithelial cells. It forms the endocrine part of the pancreas. It is mainly responsible for the secretion of hormones-glucagon and insulin.

Question-14

Give one reason why lysozyme is considered an enzyme and not a hormone. How does it defend the body? Name any two secretions in human body, which contain lysozyme.

Solution:

Lysozyme is an enzyme in human tears that catalyzes the hydrolytic cleavage of complex polysaccharides in the protective cell walls of some families of bacteria. Lysozyme protects our body by dissolving of lysing bacterial cell walls and thus serving as a bacterial agent. Lysozyme present in perspiration and saliva also destroys bacteria and protect our body.

Question-15

Which cells of testis secrete the male sex hormones?

Solution:

Male sex hormone (testosterone) is secreted from the leydig cells which are found around the seminiferous tubules of the testes.

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Question-16

Why is LH known as interstitial cell stimulating hormone?

Solution:

LH is called as ICSH because it stimulates the interstitial cells of leydig to secrete testosterone. When the level of testosterone rises beyond threshold value, then it exerts feedback inhibitory effect on anterior pituitary to cease ICSH secretion.

Question-17

Write the differences between nervous information and hormonal information.

Solution:

The differences between the nervous information and hormonal information are given below:

Nervous information	Hormonal information
It is transmitted by nerve fibre.	It is transmitted by blood.
It is quick acting.	It is not quick acting.

Question-18

What is the role of thymus gland?

Solution:

Thymus gland: The thymus gland is present in the upper part of the thorax just above the heart. It is a bilobed gland. It is a temporary gland present only upto 13-15 years of age (before sexual maturity). After this it degenerates due to activities of sex glands. Histologically, it appears to be fat and lymphoid tissue rather than a endocrine organ. However it contains onion shaped Hassal bodies which are secretary in nature. At birth the thymus weighs less than half ounce. It secretes thymosine hormone.

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Question-19

What is osteities fibrosa cystica?

Solution:

It is an abnormal condition caused due to the excessive secretion of parathormone hormone. It is characterized by an increase in the level of calcium in blood and urine. The calcium is withdrawn from the bones making them soft.

Question-20

Mention the hormonal basis of diabetes mellitus and diabetes insipidus.

Solution:

Hormonal basis of diabetes mellitus. It is a disease caused by the deficiency of insulin. Insulin was invented by Benting and Best (1921). Insulin controls glucose level in blood. When the hormone (insulin) is deficient glucose is not absorbed properly with the result unabsorbed sugar accumulates in the blood causing a disease known as diabetes mellitus. In this condition the excess of sugar is passed along with the wine.

Hormonal basis of diabetes insipidus. It is caused by the deficiency of Antidiuretic hormone (ADH) secreted by the posterior pituitary gland. D. insipidus is characterised by the excessive flow of urine but the urine does not contain glucose. It decreases blood pressure by dilating the peripheral blood vessels. D. insipidus quickly results into dangerous degree of dehydration.

Question-21

What is the function of Leydig's cells?

Solution:

Leydig cells or interstitial cells of testes secrete testosterone hormone. It stimulates the development of external male sex characters such as beard, moustasche and low pitch voice in man. It stimulates the formation of sperms in testes.

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Question-22

Name the disorder caused by the deficiency of thyroxine in adult humans. Give two main symptoms of the disorder.

Solution:

Thyroxine is secreted by thyroid gland. Less secretion of thryroxine results in reduced oxidation of food, less tissue metabolism, slow heart beat and puffy appearance. The disease is known as myxoedema. The symptoms are dry coarse skin, loss of hair, reduced cerebration, slow pulse rate and lack of alertness.

Question-23

What causes myxoedema? Mention any two symptoms of these conditions.

Solution:

Myxodema: Myxodema is caused by the deficiency of thyroxine hormone secreted by the thyroid gland in adults. It is more common in men than in women.

Symptoms of myxodema: The hypoactivity of thyroid hormone causes poor physical and mental development with low metabolism, puffy appearance and reproduction failure.

Question-24

What forms the corpus lutenum? Name the hormones secreted by it.

Solution:

Corpus lutenum: It is formed by the rupturing of mature graffin follicle. It is a hormone producing gland in the ovary. It is a yellow body.

Hormone secrete by corpus luteum: It secretes progesterone which helps to maintain pregnancy and to prevent menstruation during this period. Progesterone prevents abortion.

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Question-25

Name two organs, which are made up of mixed tissues.

Solution:

The two organs, which are made up of mixed tissues are pancreas and gonads.

Question-26

What causes cretinism? Mention any two outwardly visible symptoms of this condition.

Solution:

Cretinism is caused by the hypoactivity of throxine secreted by thyroid gland. Hypothyroidism causes the reduction of metabolic rate. The symptoms of cretinism are hyposecretion of thyroxine in children which causes poor physical and mental development, low metabolism. The child is pot bellied and pigeon chested.

Question-27

Explain the mechanism of hormone action.

Solution:

Upon the target cells, two main kinds of hormone action have been observed:

(i) action at membrane level and

(ii) induction of protein synthesis at gene level.

Hormone acts as first messenger: It is attached to some integral protein at specific receptor site on the surface of cell membrane (of target cell). It stimulates adenyl cyclase (enzyme). It catalyses conversion of ATP to cyclic AMP (which acts as second messenger). It affects cell metabolism.

Gene activation: The steroid hormone enters into the cytoplasm through cell membrane and binds to protein receptors thereof the target cells. This hormone receptor complex stimulates the gene to synthesize a particular enzyme.

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Question-28

Which part of alimentary canal produces hormones?

Solution:

Hormones are produced by the wall of stomach and in the intestine. Example: Gastrin and secretin. Gastrin stimulates the secretion of gastric juice. Secretin accelerates the secretion of pancreatic juice from the pancreatic gland.

Question-29

List the hormones of the anterior pituitary gland and state their functions.

Solution:

Hormones of anterior pituitary gland: Anterior lobe of pituitary releases six hormones which are proteinaceous in nature. They are as follows:

Growth hormone or somatotrophic hormone (GH or STH). It stimulates general body growth by stimulating retention of proteins and calcium in the body, increases the length of bones, controls carbohydrates, proteins and fat metabolism, muscles and visceral growth. Its deficiency caused dwarfism in young and acromicrice in adults (hypoactivity). Its hyperactivity causes gigantism in young and acromegaly in adults.

Thyroid stimulating hormone (TSH). It controls the growth and activity of thyroid gland. It acts on thyroid to release its hormone thyroxin.

Follicle stimulating hormone (FSH). It increases the number and size of Graffian follicles in the Ovaries in the females; and stimulates spermatogenesis in males. This hormone is also called as gonadotropins.

Adrenocortid trophic hormone (ACTH). It controls the growth and secretion of adrenal cortex to release glucocorticoids-Cortisol, cortisone etc.

Luteinizing hormone (LH) or Interstitial cell stimulating hormone stimulates the development and functional activity of interstitial (Leydig) cells to produce testosterone. In females it completes the development of Graffian follicles to its secretory stage and brings about ovulation along with FSH. It also causes appearance, growth and maintenance of corpus luteum and stimulates the secretion of progesterone from the ovaries.

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Question-30

Write the differences between the vitamins and hormones.

Solution:

Vitamins	Hormones
(i) Carried in the food.	(i) Carried by blood.
(ii) Used up during the process.	(ii) Consumed during the metabolic reaction.
(iii) Obtained from food.	(iii) Produced by an endocrine gland.
(iv May be organic acid, acid amide, amine, ester, alcohol or steroid.	(iv) Glycoprotein, steroid or polypeptide.
(v) Act as coenzymes.	(v) Act as stimulating substance.
(vi) Causes deficiency diseases when in less amounts.	(vi) Causes hormonal disorders and diseases when excess.

Question-31

What is the role FHS, LH and estrogen in female reproductive cycle?

Solution:

FSH is a follicle stimulating hormone. It is secreted by anterior pituitary gland (adeno-hypophysis). Liquid filled follicle (graffian follicle) gradually enlarges so as to from the surface of ovary and finally bursts, releasing the oocyte in the funnel of uterine tube (ovulation).

LH is the lutenizing hormone. It is related to the development of corpus luteum and progesterone secretion.

Estrogen - Menstrual cycle (at the end of female reproductive cycle) is regulated by the action of hormones estrogen and progesterone on the uterine tissue. Estrogen stimulates the growth of myometrium. Estrogen is secreted by graffian follicle.

Progesterone is secreted by corpus luteum and the placenta. It promotes the development of mammary glands during pregnancy and protects the uterus from contraction. Progesterone prevents the abortion. This hormone prepares the uterus to receive the egg. It increases the size of breasts and regulates menstrual cycle.

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Question-32

Name the hormones secreted by Islets of Langerhans. Is pancreas a heterocrine gland?

Solution:

Pancreas is a composite heterocrine gland. It is located in the loop of duodeum. Islets of Langerhans consist of alpha cells, beta cells and gamma cells. Alpha cells secrete glucagon hormone. Beta cells secrete insulin. Insulin is an anabolic hormone also termed as antidiabetic factor.

Question-33

What are the neurohormones? How do these neurohormones reach the pituitary glands?

Solution:

Neurohormones: These are the hormones secreted by hypothalamic nuclei of the hypothalamus. These hormones control the activity of pituitary glands. These neurohormones are secreted by the hypothalamus which is secreted to the pituitary gland by the hypophyseal portal vessels. The neurohormones from the hypothalamus reaches to the anterior pituitary gland through the portal vein blood after passing through the stalk. These neurohormones control the secretion of hormones by the cells of pituitary gland. The hypothalamus is located at the base of brain. The pituitary gland hangs below the hypothalamus and is attached to the later by the pituitary stalk.

Question-34

Write the differences between exophthalmic goitre and iodine deficiency goitre.

Solution:

Exophthamic goitre	Iodine deficiency goitre
It is caused by the hypersecretion of thyroid gland.	It is caused due to the deficiency of iodine in diet.
Excess of thyroxine accelerates oxidation.	Iodine is necessary for thyroxine synthesis.
Heat production, high metabolism, bulging eyes etc are its symptoms.	Poor supply of iodine causes enlargement of the gland.

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Question-35

How does sympathetic adrenal system serve as an example of close coordination between nerves and hormones?

Solution:

Adrenal medulla secretes two hormones namely

(i) Adrenaline (Epinephrine) and

(ii) Nor-adrenaline (Nor epinephrine).

Functions of adrenaline:

1. It increases blood glucose, blood lactic acid level, rate and force of heart beat, metabolic rate, heart production and temperature of body.

2. It constricts the arterioles of the skin and the abdominal muscles.

3. Relaxation of smooth muscles of stomach and intestine.

Functions of nor-adrenaline:

1. Regulation of blood pressure.
2. It constricts the small arteries.

3. It increases the metabolic rate and temperature of the body.

4. No effect on bronchiolar muscles.

5. Arterial blood pressure is increased.

Both adrenal medulla and sympathetic nervous system function as a closely integral system. In man, much more adrenaline is secreted than the nor-adrenaline. Secretion of these hormones is stimulated when the nerve impulses reach the adrenal medulla through sympathetic nerve fibres which are stimulated by physical stress like fall in blood pressure or blood sugar, pain or anger etc.

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Question-36

What is the source of progesterone hormone?

Solution:

The corpus luteum of ovary is the source of progesterone hormone.

Question-37

Name the disorder a person would suffer from if there is a tumour in adrenal cortex. Explain the diagnostic symptoms of each disorders.

Solution:

If there is a tumour in adrenal cortex the person will suffer from Cushing's syndrome, Conn's syndrome and adrenal virilism.

1.Cushing's Syndrome: It occurs due to adrenal tumour when the cortisol hormone's secretion is excessively increased. Pituitary tumour may be a symptom of this disorder. Large amount of fat is deposited over the face, neck and abdomen. Hirstuism is caused in males. In females there is growth of beard.

2.Conn's Syndrome: It is called aldosteronism. The disorder is caused due to high secretion of aldosterone from adrenal cortical tumour. High plasma Na^+, low plasma K^+, high blood pressure and muscular weakness are the symptoms of this disorder. Low calcium level in the body may cause muscular tetany.

3.Adrenal Virilism: It is known as adrenogenital syndrome. This disease is caused due to excessive production of adrenal androgen hormone. This disease is concerned with adrenal tumour. Due to excess of sex corticoid in a female male secondary sexual characters are developed such as hoarse voice and beard etc. The ovaries are degenerated. There may be sexual abnormality in male.

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Question-38

Compare the disorders resulting due to malfunctioning of parathyroid gland.

Solution:

Disorder resulting from Malfunctioning of Parathyroid Gland.

Hypoparathyrodism (less secretion)	Hyperparathyroidism (More secretion)
Causes: Accidental damage to the parathyroids or their blood supply during thyroidectomy surgery. The deficiency of Ca^{2+} caused by this disorder causes neurons to depolarize without the usual stimulus. So the nerve and muscle action potential arise spontaneously. This leads to twitches, spasms and convulsions. Now the condition is known as hypocalcemic tetany.	**Causes:** A tumor in the parathyroids causes hypersecretion of PTH hormone. This results in cases demineralization of bone. The bones are deformed and fractured easily. If untreated, this condition leads to osteitis fibrosa cystica. The areas of destroyed bone tissue are replaced by cavities which fill with fibrous tissue.

Question-39

Which hormone is known as birth hormone?

Solution:

Oxytocin is known as the birth hormone.

Question-40

Differentiate between exocrine, endocrine and heterocrine glands.

Solution:

Exocrine gland	Endocrine gland	Heterocrine gland
1. It has a duct.	1. It is ductless gland.	1. It is partly endocrine and partly exocrine.
2. Their secretions are carried by the ducts to the internal part or body surface e.g. Salivary glands in mouth.	2. Their secretions are carried by blood to the target organs. E.g. Parathyroid, pituitary, adrenals.	2. Endocrine part releases hormones into the blood stream while exocrine part into the ducts associated with it. E.g. Pancreas, ovary and testis.

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Question-41

Describe the structure of thyroid gland. Name the hormones secreted by thyroid. Also mention different disorders caused by thyroid hormone imbalance.

Solution:

Thyroid is located in the region of neck. It is blobbed glands. The two lobes are joined by isthumus. It consists of thyroid follicle which is filled with a gelatinous colloid. Thyroid is stimulated by TSH. It secretes three hormones - thyroxine, calcitonin and tri-iodo thyronine. It controls general metabolism and growth of body and mental development.

Thyroid Hormone Imbalance: Other than simple goitre, the mainthyroid imbalances are:

1.Cretinism: Hypoactivity of thyroid in children causes poor physical and mental development, low metabolism. The child is pot bellied and pigeon chested.

2. Myxodema: Hypoactivity of thyroxine in adults causes poor physical and mental development with low metabolism, puffy appearance and reproductive failure.

3. Grave disease is caused by the hyper activity of thyroid hormone. Its characteristics are increased metabolism, bulging of eyeballs and restlessness. Overactivity of thyroid is called hyperthyroidism and hypoactivity is termed hypothyroidism.

Thyroid Hormone Imbalance: Other than simple goitre, the main thyroid imbalances are: Cretinism, myxoedema and Graves, disease (Exophthalmic goitre) in man.

Exophthalmic goitre: Symptoms are:

(i) Caused by hypersecretion of thyroid.

(ii) Oxidation is accelerated.

(iii) Heat production, high metabolism.

(iv) Bulging eyes.

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Question-42

Explain how hormones induce their actions at molecular and cellular levels.

Solution:

It includes the following steps:

Binding of insulin to the receptor: The insulin hormone binds to outer submits of receptor. Then a conformational change occurs in the plasma membrane. It sprawns β -subunits . β - subunit is a tyrosine kinase enzyme. β - subunits are activated. They add phosphate groups of specific tyrpsine residue located in cytoplasmic domain of the receptor and insulin receptor subtracts also.

Second messenger: It is mediator. The transducer protein G activates phosphodiesterase (enzyme). It makes phosphatidylinositol 4,5-biphosphate (pIP_2) into a pair of mediators. These mediators are BIP_3 (Inositoltriphosphates) and DG (diacylglycerol). IP_3 is water soluble. After diffusing into cytoplasm it triggers the release of Ca^+ ions from endoplasmic reticulum. It also activates other processes. DG activates protein kinase C. It activates other enzymes and brings physiological effects.

Amplification of signal: Mediators amplifier signals. The β -nit activates DG. DG and IP_3 are second messengers. Some hormones use second messenger cAMP. Adenyl cyclase is amplifier. It changes adenyl cyclase into ATP them into cAMP. It forms about 10 units of cAMP. Adrenaline binds to receptors in liver or muscle cells. It changes shape and binds to G. protein. Then it binds to GTP and activate adenyl cyclase (protein). Large amount of cAMP are produced. It activates kinase A(enzyme protein). One kinase activates 100 molecules of phosphorylase kinase (enzyme). This one adrenaline molecule releases 100 million moles of glucose ($C_6H_{12}O_6$) in near one or two minutes.

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Question-43

Describe the mode of hormone action with reference to insulin hormone.

Solution:

Target organ cells possess receptors for particular hormones. On the target cell membrane there are extracellular receptors (external receptors). All the vertebrate hormones fall into four chemical groups. These are steriods, amino acids, polypeptide chain and biogenic amines. Some hormones, like adrenaline and thyroid hormone are small molecules. They are derived from the amino acid tyrosine. Vasopressin and oxytocin are short peptides. Hormones such as insulin and glucagons are longer polypeptide chains. Testosterone estrogens are steroid hormones. Catecholamines, peptid and protein hormones are not lipid – soluble. They are unable to enter the target cells through the bilipid layer of plasma membrane. The water soluble hormones interact with a surface receptor mostly a glycoprotein, and show a chain of events within it. You can explain it by the example of insulin hormone.

Extracellular receptors: The membrane bound receptors of insulin is a heterotrameric protein consisting of four subunits. Two α - subunits protrude out from surface of the cell and bind insulin. Two β - subunits may be from fewer than 100 in most cells in our body. But these extracellular receptors are 100, 000 in some liver cells.

Question-44

What are the functions of the oxytocin and cortisol?

Solution:

(i) Oxytocin. Contraction of uterine muscles, production of milk from mammary glands.

(ii) Cortisol increases gluconeogenesis.

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