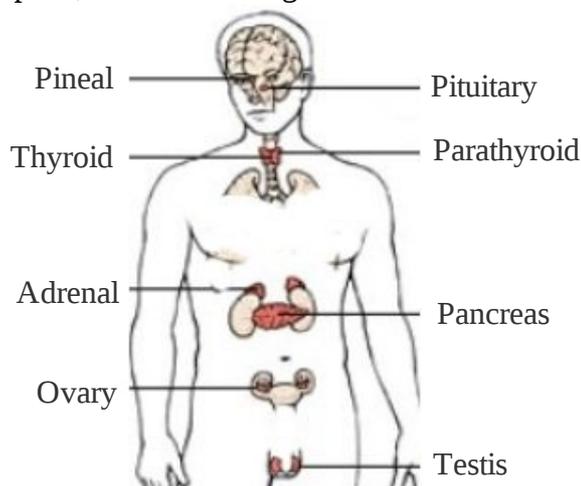


3 – THE CHEMISTRY BEHIND RESPONSES

MAJOR IDEAS

- * Homeostasis is maintained by the complementary activities of both quick neural system and slow hormonal system.
- * Different types of chemicals [Hormones] are secreted by endocrine glands. Though hormones are discharged in to the blood stream, each hormone act only in its target tissue, having specific receptors for accepting the same hormone.
- * Thyroxine, Cortisol, Insulin, Glucagon, Somatotropin (growth hormone), Adrenalin & Noradrenalin are hormones, involved in metabolism.
- * Aldosteron, Vasopresin (ADH), Parathormon & Calcitonin are hormones in salt-water balance.
- * The stimulating hormones [Tropic hormones] influence the action of other glands. TSH, ACTH & GTH are tropic hormones, secreted by the pituitary, under the influence of hypothalamus.
- * Variation in the production of hormones results disorders like Dwarfism, Gigantism, Acromegaly, Myxoedema, Exophthalmic goiter, Tetany, Diabetes mellitus, Diabetes insipidus and kidney stone.
- * Insects and other animals release certain chemicals, called Pheromones, to their surroundings, for communicating among the members of same species.
- * The Phytohormones like Auxins, Cytokinins and Gibberellins are growth substances, while Ethylene and Abscisic acid are growth inhibitors.
- * Auxins influence in positive and negative phototropism, results in bent growth of stem or root.
- * Artificial or synthetic plant hormones like NAA, IBA, 2,4-D, Ethylene and Ethyphon are useful chemicals, but a few are to be used with utmost care.

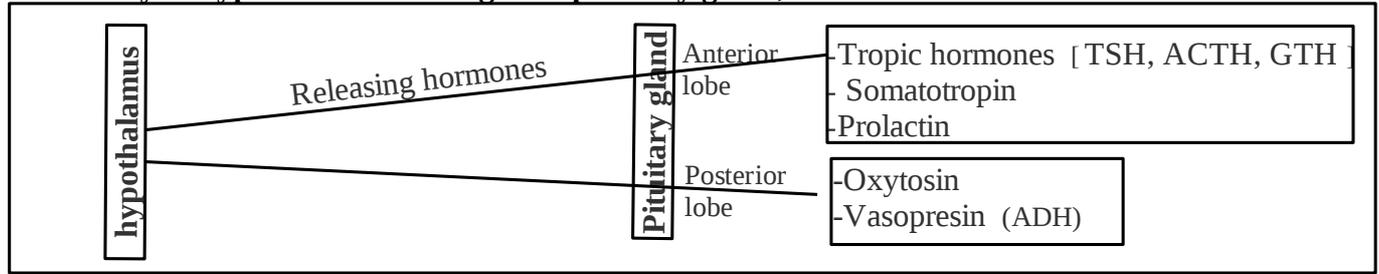


Activity	Related Hormones
Growth	Thyroxine, Somatotropin ..
Water control	Vasopresin (ADH), Aldosteron ..
Maintaining blood glucose level	Insulin, Glucagon ..
Regulation of blood calcium level	Calcitonin, Parathormone.
Facing emergency situations	Adrenalin, Noradrenalin.
Effecting changes during adolescence	Testosterone (in male), Estrogen (in female)

(Also see the table given below)

2. Hormone secreting 'ductless glands' are known as 'Endocrine glands'. Why?
 The hormones secreted by these glands are discharged directly in to blood, not through particular ducts.
3. How is it possible to act a hormone at its own target tissues?
 Each hormone act only in its target tissue, having specific receptors for accepting the same hormone. Each hormone molecule combines with the respective receptor to form a hormone-receptor complex. As a result, the enzymes in that cells are activated to function well.
4. Name the two types of hormones of hypothalamus that control endocrine glands.
Releasing hormones and Inhibitory hormones.
 Releasing hormones influence the the action of certain other glands through the stimulating hormones (Tropic hormones). Inhibitory hormones inhibit the secretion of hormones from certain glands.

The activity of hypothalamus through the pituitary gland,



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5. Hormones, produced mainly in females ?

- * Estrogens – Changes in adolescent period, growth of sex organs, production of ovum, menstrual cycle
- * Progesteron – Menstrual cycle, pregnancy, fixing of embryo, development of uterus...
- * Oxytosin – Facilitating child birth, ejection of milk
- * Prolactin - Production of milk.

6. Vasopresin is also known as anti diuretic hormone [ADH]. Why?

Vasopresin reduces the loss of water through urine.

7. Sometimes, pregnant women take oxytosin injection. Give reason.

Oxytosin helps in facilitating child birth by effecting smooth muscles contraction.

8. Name the hormones, which are related with growth and development. How does the deficiency of these hormones affect our body ?

Somatotropin (growth hormone) and Thyroxine.

The deficiency of somatotropin in children causes a disorder, dwarfism (stunted growth of bones).

The deficiency of thyroxine in children results cretinism (retarded physical-mental growth).

9. What is acromegaly ?

The condition, in which the enlargement of internal organs, thickening of bones [especially hands, feet and face] due to over secretion of somatotropin in adults.

10. Migration of birds and fishes, Sleeping and waking up, Crow of cock in early morning, Hibernation etc. are examples for diurnal or seasonal rhythmic activities. How is this possible?

By the action of melatonin secreted from the 'biological clock', ie, the pineal gland.

11. The most important metabolic hormones?

Thyroxine.

12. Name the gland which needs iodine. How the deficiency of iodine affects the gland?

Thyroid gland needs iodine to produce thyroxine. Deficiency of iodine results the disorder, goitre.

13. A doctor advised one of his patients to include leafy vegetables and marine items in his diet. Why ?

14. Give examples for the conditions due to hyperthyroidism and hypothyroidism.

Over secretion of thyroxine (hyperthyroidism) may causes a condition known as exophthalmic goitre.

Under secretion of thyroxine (hypothyroidism) results cretinism in children and myxoedema in adults.

Symptoms of Hypothyroidism

- * Low energy production
- * Bloating of body
- * Slowing down of heartbeat
- * Loss of appetite, Lethargy (inactiveness)
- * Dry skin

Symptoms of Hyperthyroidism

- * Increased energy production
- * Emaciation (leanness) of body
- * Increased heartbeat
- * Increased appetite
- * Frequent sweating * Shivering of hands

15. What is the normal level of calcium in blood? How is it maintained?

10 – 12 mg /100 ml blood.

This rate is maintained by the complementary activities of calcitonin of thyroid gland and parathormone of the parathyroid gland. When blood calcium increases, calcitonin is released and hence deposition of calcium in bones and elimination of calcium through urine or faeces are enhanced. When calcium level decreases, calcium is regained from bones, kidneys and intestine occur by the action of parathormone.

16. Over production of parathormon makes the bone fragile. Give reason.

17. What is the normal level of glucose in blood? How is it maintained?

70 – 110 mg /100 ml blood.

This rate is maintained by the antagonistic activities of insulin and glucagone, released from Islets of Langerhans of the pancreas. Insulin, released from the beta cells of Islets of Langerhans helps to reduce

blood sugar by accelerating the process of glucose intake by cells and conversion of glucose into glycogen, lipids and proteins. When blood glucose level falls, glucagone, released from the alpha cells converts glycogen or amino acids to glucose.

18. When a child conducted a test by adding Benedict's reagent to urine and then boiling, the colour of the solution became orange-red. What conclusion can arrive from this?
High concentration of glucose. (diabetes mellitus-(α1β2α0))
19. The following hormones, except one, increase blood glucose level. Find out the hormone which decreases glucose level. [Cortisol, Thyroxine, Glucagon, Insulin, Adrenalin & Noradrenalin]
20. Hormone used in the treatment of allergy diseases (like asthma) and inflammation (like arthritis)?
Is it advisable to give this hormone to diabetic patients, having asthma or arthritis? Why?
Cortisol of the adrenal gland.
Cortisol is not advisable to person having diabetes mellitus, as it increase blood glucose level.
21. Hormone responsible for salt-water balance ?
Aldosterone of the adrenal cortex.
22. Why Adrenalin is termed as 'emergency hormone'?
Adrenalin help to face emergency situations.
23. How do adrenalin and noradrenalin prepare our body to overcome emotions like anger or fear?
By undertaking the activities of sympathetic nervous system (ie, increasing heart beat, blood pressure, blood flow to the limbs and blood glucose level) and thus create more energy in our body.
24. Adrenal cortex : Cortisol ; -----?----- : Adrenalin. [Adrenal medulla]
25. Cretinism : Hypothyroidism ; -----?----- : Hyperthyroidism. [Exophthalmic goitre]
26. Hormone related disorders.

Goitre	-Abnormal growth of thyroid lobes [bulged throat] due to iodine deficiency
Exophthalmic Goitre	The condition in which increased energy production, heart beat and appetite with mental abnormalities and bulged eyes, due to over production of thyroxine (Hyperthyroidism).
Cretinism	- Retarded physical – mental growth in children, due to deficiency of thyroxine (Hypothyroidism), during early period of growth.
Myxoedema	Inflamed condition of body in adult due to deficiency of thyroxine in adults.
Dwarfism	-Stunted growth of bones due to under secretion of somatotropin in children.
Gigantism	-Growing tall and heavy due to over secretion of somatotropin in children.
Acromegaly	-Enlargement of internal organs, thickening of bones [especially hands, feet and face] due to over secretion of somatotropin in adults.
Diabetes Mellitus	The condition in which high glucose level in blood, due to deficiency or inactivity of insulin.
Diabetes Insipidus	-The condition of excessive loss of water through urine due to deficiency of ADH [vasopresin].
Tetani	-A condition with muscle spasms due to decreased calcium level in blood by the deficiency of parathormone.

27. Migration of birds and fishes, Sleeping and waking up, Crow of cock in early morning, Hibernation etc. are examples for diurnal or seasonal rhythmic activities. How is this possible?
By the action of melatonin secreted from the 'biological clock', ie, the pineal gland.
28. Compare between [1]- cretinism and dwarfism [2]- goitre and exophthalmic goitre [3]-diabetes mellitus and diabetes insipidus
29. Find out the hormonal disorders of following
1- Insulin injection, diet control.
2- Treatment with thyroxine tablets.
3- Iodized salt, leafy vegetables and marine food items.
4- Calcium contained food and tablets.
30. How is homeostasis maintained?

Homeostasis is maintained by the complementary activities of both quick neural system and slow hormonal system.

31. Define pheromones with examples. How are they useful ?

Insects and other animals release certain chemicals, called Pheromones, to their surroundings, for communicating among the members of same species. Pheromones are produced to give alarm, to detect locomotory pathways, to demarcate territory, to indicate presence or to attract mates.

Examples:- Civetone of civet cat, muscone of the musk deer and bombycol of female silk worm moth.

32. Civet cat : Civetone ; -----?----- : Bombycol.

33. Certain phytohormones are known as 'growth substances'. Why? Give examples.

The Phytohormones like Auxins, Cytokinins and Gibberellins are called growth substances, for, they enhance cell division, cell enlargement and cell differentiation. While Ethylene and Absciscic acid are growth inhibitors.

34. Find out the name of plant hormones related to the following action,

- a)- Sprouting of leaves b)- Maturation and ripening of fruits c)- dropping of ripe fruits
d)- Prevent sprouting of potatoes e)- Stem grows toward the direction of stem.

a. Gibberellins b. Ethylene c. Absciscic acid d. IBA e. Auxins

35. Synthetic / artificial plant hormones and their uses

NAA [NaphthaleneAceticAcid]	- To develop roots on stem, induce fruiting
IBA [IndolButyricAcid]	- Prevent sprouting and dropping of fruits prematurely
2,4-D	- Destruction of weeds
Ethylene	- Induce flowering and fruit ripening
Ethyphon	- Induce latex production in rubber plants

36. Ethylene : Ripening of fruit ; Ethyphon : ----?-----.

37. Give examples for occasions in which we utilize plant hormones in our daily life.

38. Plantain (banana) when keep under the influence of smoke, ripens quickly. Suggest reason.
Smoke contains the hormone ethylene gas.

39. What will be the consequence if the production of absciscic acid stops in plants?

40. Compare the role of auxins in stem and roots.

Auxins promote the elongation of cells at the stem tip, but they check the cell elongation in the tap root.

41. Why plant stem grow bent towards the direction of sun light?

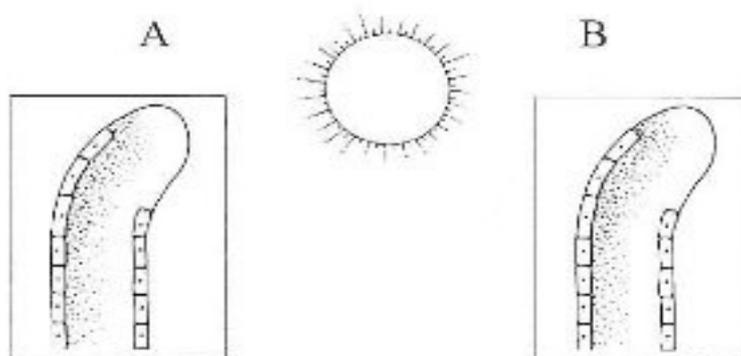
Auxins influence in positive and negative phototropism, results in bent growth of stem or root.

42. Though artificial plant hormones are useful, its application should be with utmost care. What is your opinion?

Majority of the synthetic plant hormones are strong chemicals.

43. In the given figure, which one is the stem and which one is root ? Which is the hormone behind this?

How does the activity of this hormone vary in **A** and **B** ?



A is stem and **B** is root. Stem bends towards the direction of sun light (Stem shows positive phototropism.) Root shows negative phototropism.

The hormone auxins promote the elongation of cells at the stem tip, but they check the cell elongation in the tap root.

44. Name the hormone which is inactive under sun light. [Auxins]

3. THE CHEMISTRY BEHIND RESPONSES

GLANDS	HORMONES	TARGET TISSUES	FUNCTIONS	DISORDER
HYPOTHALAMUS	1.Oxytosin 2. Vasopressin [ADH]	-Smooth muscles -Kidneys	-Facilitating child birth, ejection of milk -Reduces water loss through urine	Diabetes insipidus
PITUITARY	1.TSH 2.ACTH 3.GTH 4.Somatotropin [growth hormone] 5.Prolactin	-Thyroid -Adrenal cortex -Gonads[sex organs] -All body tissues	-Influences thyroid secretions -Influences adrenal cortex secretions -Influences sex organs -Promotes growth	Dwarfism, Gigantism, Acromegaly
PINEAL	Melatonin	-----	-Production of milk diurnal or seasonal rhythmic activities	-----
THYROID	1. Thyroxine 2. Calcitonin-	-Most of the tissues -Kidneys, bones, intest	-Metabolism and growth [breakdown of nutrients, energy production, mental-physical growth, heartbeat etc] -Prevents the increase of blood calcium level	Cretinism, Myxoedema, Exophthalmic goiter
PARATHYROID	Parathormon	-Kidneys, bones, intest	-Prevents the decrease of blood calcium level	Tetany, kidney stone
ADRENAL	1.Cortisol 2.Aldosteron 3.Sex hormones 4.Adrenalin 5.Noradrenalin	-Liver, lipid tissues ----- -Most of the tissues -Most of the tissues	-Breakdown of proteins and lipids, glucose production, Storage of glycogen in liver. -Salt-water balance ----- -Prepare our body to overcome emotions like anger, fear, joy or anxiety	-----
PANCREAS [Islets of Langerhans]	1.Insulin 2.Glucagon	All, except nervous Liver, muscle, lipid.	-Lowers blood glucose level, when it is increased. -Increases blood glucose level, when it is lowered.	Diabetes mellitus
TESTES OVARIES	Testosteron 1.Oestrogen 2.Progesterone	Most of the tissues Most of the tissues Ovaries, uterus	-Changes in adolescent period, growth of sex organs, production of sperms/ovum etc. -Menstrual cycle, pregnancy, fixing of embryo, development of uterus ..	-----

PLANT HORMONES [Phytohormones] & Functions.

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1. **AUXINS** – Elongation of stem, lateral roots, plumule and radicle, production of female flowers, dominance of terminal bud etc.
2. **CYTOKININS** – Accelerating cell division and cell growth, germination of seeds, prevents dropping of flowers and leaves
3. **GIBBERELLINS** – Germination of seeds, sprouting of leaves, stem elongation, cell division and growth
4. **ETHYLENE** – Prevents cell division. Helps to mature and ripen leaves and fruits
5. **ABSCISIC ACID** – Prevents cell division and growth. Helps falling of matured leaves and fruits. Helps in the dormancy of seeds and buds.