

**Class: 12th**

**Subject: Biology**

**Chapter 17: Coordination And Control**

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**Important MCQs:**

**1. Coordination in living organisms is necessary for:**

- (a) Growth
- (b) Survival
- (c) Excretion
- (d) Movement



**2. The process by which living organisms respond to internal or external changes is called:**

- (a) Integration
- (b) Coordination
- (c) Homeostasis

(d) Sensation

**3. In unicellular organisms, coordination exists between:**

(a) Organs

(b) Tissues

(c) Cellular processes

(d) Hormones

**4. In multicellular organisms, each cell can respond to:**

(a) Changes in distant organs

(b) Changes in its immediate environment

(c) Hormonal secretions only

(d) External temperature only

**5. Which of the following shows that plants are not passive organisms?**

(a) They move rapidly

(b) They respond to stimuli

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(c) They have nervous system

(d) They breathe through lungs

**6. The main difference between plant and animal behaviour is due to:**

(a) Mode of reproduction

(b) Sessile and motile life

(c) Mode of nutrition

(d) Presence of chlorophyll



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**7. In plants, coordination and control occur through:**

(a) Muscles

(b) Nerves

(c) Hormones

(d) Enzymes

**8. Hormonal control in plants is:**

(a) Rapid and short term

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(b) Slow and long lasting

(c) Electrical and quick

(d) Random and unorganized

**9. The delay between hormone secretion and its action in plants is:**

(a) Very long

(b) Negligible

(c) Rapid

(d) Immediate

**10. The yellowing of leaves due to lack of mineral nutrients is called:**

(a) Necrosis

(b) Chlorosis

(c) Etiolation

(d) Wilting

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**11. When plants are grown without light, they become very long and yellow. This condition is called:**

- (a) Chlorosis
- (b) Etiolation
- (c) Wilting
- (d) Tropism

**12. Galls in plants are produced due to:**

- (a) Deficiency of water
- (b) Parasitic infection
- (c) Lack of sunlight
- (d) Overgrowth of roots

**13. The term "Circadian" is derived from Latin words meaning:**

- (a) About a year
- (b) About a day

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(c) About a month

(d) About an hour

**14. Biological rhythms that repeat approximately every 24 hours are called:**

(a) Circannual rhythms

(b) Circadian rhythms

(c) Seasonal rhythms

(d) Lunar rhythms



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**15. Biological rhythms are influenced by:**

(a) Only genes

(b) Only environment

(c) Both internal and external factors

(d) Only external stimuli

**16. The natural plant hormone indole acetic acid (IAA) belongs to which group?**

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(a) Gibberellins

(b) Cytokinins

(c) Auxins

(d) Absciscic acid

**17. In stems, auxins promote:**

(a) Cell enlargement

(b) Root elongation

(c) Leaf fall

(d) Abscission



**18. High concentration of auxins in roots causes:**

(a) Rapid root growth

(b) Growth inhibition

(c) Cell division

(d) Apical dominance

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**19. Which plant hormone promotes apical dominance and fruit growth?**

(a) Auxins

(b) Cytokinins

(c) Gibberellins

(d) Abscisic acid

**20. Gibberellins are produced commercially from:**

(a) Plant roots

(b) Bacterial cultures

(c) Fungal cultures

(d) Algae cultures

**21. The process of “bolting” in rosette plants is promoted by:**

(a) Cytokinins

(b) Auxins

(c) Gibberellins

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(d) Abscisic acid

**22. Gibberellins are used commercially to:**

(a) Stop fruit growth

(b) Delay germination

(c) Promote seedless grapes and larger berries

(d) Reduce  $\alpha$ -amylase production

**23. Which hormone promotes cell division in apical meristem and cambium?**

(a) Cytokinins

(b) Auxins

(c) Ethene

(d) Abscisic acid

**24. The hormone that causes delay in leaf senescence and keeps flowers fresh is:**

(a) Ethene

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(b) Cytokinins

(c) Abscisic acid

(d) Gibberellin

**25. The plant hormone that promotes closing of stomata during water stress is:**

(a) Auxin

(b) Cytokinin

(c) Abscisic acid

(d) Gibberellin

**26. Which hormone promotes fruit ripening and flowering in pineapple?**

(a) Ethene

(b) Gibberellin

(c) Cytokinin

(d) Abscisic acid

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**27. Ethene is commercially used to:**

- (a) Inhibit fruit ripening
- (b) Stimulate ripening of tomatoes and citrus fruits**
- (c) Delay seed germination
- (d) Stop flower formation

**28. Coordination in animals is brought about by:**

- (a) Muscles and bones
- (b) Hormones only
- (c) Nervous and chemical coordination**
- (d) Skeletal system

**29. The type of coordination that involves specialized cells called neurons is:**

- (a) Hormonal coordination
- (b) Nervous coordination**

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(c) Muscular coordination

(d) Structural coordination

**30. The receptors that respond to stimuli of light are called:**

(a) Mechanoreceptors

(b) Chemoreceptors

(c) Photoreceptors

(d) Thermoreceptors

**31. Which of the following sensations is not detected by receptors in the skin?**

(a) Touch

(b) Pain

(c) Sight

(d) Heat

**32. The receptors situated at the base of hairs which receive touch stimulus are called:**

- (a) Pacinian corpuscles
- (b) Meissner's corpuscles
- (c) Hair end organs
- (d) Thermoreceptors

**33. Meissner's corpuscles are mainly responsible for:**

- (a) Pain
- (b) Touch
- (c) Pressure
- (d) Heat



**34. Pacinian corpuscles are found deep in the body and respond to:**

- (a) Light touch
- (b) Deep pressure
- (c) Heat
- (d) Pain

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**35. Which type of receptors are most abundant in human skin?**

- (a) Heat receptors
- (b) Cold receptors
- (c) Pain receptors
- (d) Pressure receptors

**36. The number of cold receptors is approximately how many times greater than heat receptors?**

- (a) 5 times
- (b) 10 times
- (c) 15 times
- (d) 20 times

**37. Which neurons connect sensory neurons to motor neurons?**

- (a) Receptor neurons
- (b) Relay or associative neurons

- 
- (c) Motor neurons
  - (d) Effector neurons

**38. The chief structural and functional unit of the nervous system is:**

- (a) Brain cell
- (b) Neuroglia
- (c) Neuron
- (d) Axon

**39. The cells that provide nutrition and protection to neurons are called:**

- (a) Neuroglia
- (b) Dendrites
- (c) Axons
- (d) Myofibrils

**40. The function of effectors in the nervous system is to:**

- (a) Receive stimulus

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(b) Carry impulses

(c) Respond by action

(d) Store energy

**41. The simplest functional pathway in the nervous system is known as:**

(a) Reflex arc

(b) Nerve impulse

(c) Synapse

(d) Dendron

**42. Reflex action is:**

(a) Voluntary

(b) Involuntary

(c) Controlled by brain only

(d) A conscious response

**43. In a reflex arc, the correct sequence of impulse transmission is:**



- 
- (a) Receptor → Motor neuron → Sensory neuron → Effector
- (b) Sensory neuron → Receptor → Motor neuron → Effector
- (c) Receptor → Sensory neuron → Association neuron → Motor neuron → Effector ✓
- (d) Effector → Sensory neuron → Brain → Motor neuron

**44. The resting membrane potential of a neuron is approximately:**

- (a) +70 mV
- (b) -70 mV ✓
- (c) +50 mV
- (d) -50 mV



**45. During a nerve impulse, the movement of ions across the membrane involves:**

- (a) Na<sup>+</sup> moving out and K<sup>+</sup> moving in
- (b) Na<sup>+</sup> moving in and K<sup>+</sup> moving out ✓
- (c) K<sup>+</sup> and Na<sup>+</sup> both moving in

(d) No ion movement

**46. What is the small gap between two consecutive neurons called?**

(a) Axon hillock

(b) Dendrite junction

(c) Synapse

(d) Node of Ranvier

**47. The chemical substances that transmit nerve impulses across synapses are called:**

(a) Hormones

(b) Neurotransmitters

(c) Enzymes

(d) Proteins

**48. Which of the following is not a neurotransmitter?**

(a) Acetylcholine

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(b) Dopamine

(c) Serotonin

(d) Insulin

**49. Which neurotransmitter is mainly responsible for transmission outside the central nervous system?**

(a) Dopamine

(b) Acetylcholine

(c) Serotonin

(d) Nor-epinephrine

**50. In Hydra, the type of nervous system found is:**

(a) Centralized

(b) Diffused

(c) Peripheral

(d) Sympathetic

**51. Which animal shows the beginning of a centralized nervous system?**

- (a) Hydra
- (b) Amoeba
- (c) Planaria
- (d) Paramecium

**52. The nervous system of Planaria is better developed than Hydra because it has:**

- (a) Nerve net
- (b) Ganglia acting as brain
- (c) Only sensory neurons
- (d) Only motor neurons

**53. Which part of the human nervous system controls voluntary actions?**

- (a) Autonomic nervous system
- (b) Somatic nervous system

(c) Sympathetic system

(d) Parasympathetic system

**54. The cerebrospinal fluid (CSF) in brain and spinal cord functions to:**

(a) Produce hormones

(b) Provide energy

(c) Cushion and protect the brain

(d) Control reflexes

**55. Which part of the brain controls emotions such as fear, rage, and pleasure?**

(a) Cerebrum

(b) Limbic system

(c) Cerebellum

(d) Medulla

**56. The largest part of the human brain is:**

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(a) Cerebrum

(b) Midbrain

(c) Cerebellum

(d) Thalamus

**57. The left hemisphere of the brain controls:**

(a) Left side of the body

(b) Right side of the body

(c) Only face muscles

(d) Both sides equally



**58. Which part of the brain regulates breathing, heartbeat, and blood pressure?**

(a) Pons

(b) Medulla oblongata

(c) Cerebrum

(d) Thalamus

**59. The cerebellum is mainly responsible for:**

(a) Intelligence

(b) Coordination and balance

(c) Breathing control

(d) Emotion control

**60. Which nervous disorder is caused by the death of dopamine-producing cells in the brain?**

(a) Alzheimer's disease

(b) Epilepsy

(c) Parkinson's disease

(d) Meningitis

**61. Which of the following statements best describes hormones?**

(a) They initiate new biochemical reactions

- 
- (b) They control only nervous responses
  - (c) They regulate existing enzymatic reactions
  - (d) They act only on non-living tissues

**62. Which hormone type includes insulin and glucagon?**

- (a) Amino acid derivatives
- (b) Polypeptides
- (c) Proteins
- (d) Steroids

**63. Which of the following is secreted by the hypothalamus and stored in the posterior pituitary?**

- (a) Oxytocin and ADH
- (b) FSH and LH
- (c) TSH and ACTH
- (d) Insulin and Glucagon

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**64. Overproduction of somatotrophin in adults leads to:**

- (a) Dwarfism
- (b) Gigantism
- (c) Acromegaly
- (d) Cretinism

**65. Thyroid-stimulating hormone (TSH) secretion increases when:**

- (a) Thyroxine level is high
- (b) Thyroxine level is low
- (c) ACTH level is low
- (d) Growth hormone level is high

**66. Which hormone stimulates milk production in females?**

- (a) FSH
- (b) LH
- (c) Prolactin

(d) Oxytocin

**67. The hormone responsible for darkening of the skin in Addison's disease is:**

(a) TSH

(b) MSH

(c) ACTH

(d) FSH

**68. Deficiency of antidiuretic hormone (ADH) causes:**

(a) Diabetes mellitus

(b) Myxoedema

(c) Diabetes insipidus

(d) Cretinism

**69. Which hormone causes milk ejection from mammary glands?**

(a) FSH

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(b) Oxytocin

(c) Prolactin

(d) LH

**70. The thyroid gland primarily regulates:**

(a) Blood calcium concentration

(b) Basal metabolic rate

(c) Blood pressure

(d) Water balance



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**71. Deficiency of thyroxine during infancy causes:**

(a) Myxoedema

(b) Cretinism

(c) Goiter

(d) Addison's disease

**72. Parathormone controls the level of which ion in the blood?**

- (a) Sodium
- (b) Calcium**
- (c) Potassium
- (d) Chlorine

**73. Lack of insulin results in which disease?**

- (a) Addison's disease
- (b) Diabetes mellitus**
- (c) Cretinism
- (d) Myxoedema



**74. Adrenaline and noradrenaline are secreted by:**

- (a) Adrenal cortex
- (b) Adrenal medulla**
- (c) Thyroid gland
- (d) Pituitary gland

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**75. Aldosterone helps to:**

- (a) Increase blood sugar
- (b) Prevent sodium loss from kidneys
- (c) Regulate calcium absorption
- (d) Promote protein synthesis

**76. Which hormone is secreted by ripening follicles in the ovary?**

- (a) Progesterone
- (b) Oestrogen
- (c) LH
- (d) FSH

**77. The main function of oestrogen is to:**

- (a) Prevent ovulation
- (b) Cause development of secondary female sexual characters
- (c) Stimulate milk secretion

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(d) Maintain pregnancy

**78. Which hormone repairs and thickens the uterine wall after menstruation?**

(a) Progesterone

(b) Oestrogen

(c) LH

(d) FSH

**79. Progesterone is produced by:**

(a) Follicle cells

(b) Ruptured follicle

(c) Corpus callosum

(d) Pituitary gland

**80. Which of the following inhibits the secretion of FSH?**

(a) Corpus callosum

---

(b) Progesterone

(c) Oestrogen

(d) Testosterone

**81. Progesterone prepares the uterus for:**

(a) Ovulation

(b) Fertilization

(c) Pregnancy

(d) Menstruation

**82. Which hormone is the main component of birth control pills?**

(a) Oestrogen

(b) Progesterone

(c) LH

(d) FSH

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**83. The hormone responsible for development of male secondary sexual characteristics is:**

- (a) Oestrogen
- (b) Progesterone
- (c) Testosterone
- (d) Cortisol

**84. The hormone that promotes male sex drive is:**

- (a) FSH
- (b) LH
- (c) Testosterone
- (d) ACTH

**85. Which hormone is stimulated by ICSH (LH in males)?**

- (a) Progesterone
- (b) Testosterone

(c) Oestrogen

(d) Insulin

**86. The failure to produce sex hormones results in:**

(a) Obesity

(b) Sexual immaturity and sterility

(c) Diabetes

(d) Gigantism

**87. The feedback mechanism in hormone regulation helps to:**

(a) Stop enzyme activity

(b) Maintain hormonal balance

(c) Produce new hormones

(d) Eliminate metabolic wastes

**88. When thyroxine level rises in blood, it:**

(a) Stimulates more TSH secretion

- 
- (b) Inhibits TSH secretion
  - (c) Increases insulin secretion
  - (d) Decreases body temperature

**89. Which of the following systems shows faster response?**

- (a) Nervous coordination
- (b) Chemical coordination
- (c) Endocrine system
- (d) Hormonal feedback system

**90. Hormonal coordination is characterized by:**

- (a) Immediate but short-term effects
- (b) Slow but prolonged effects
- (c) Electrical impulses
- (d) Temporary and local effects

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**91. Who defined learning as the process which manifests itself by adaptive changes in behaviour as a result of experience?**

(a) Pavlov

(b) Thorpe

(c) Skinner

(d) Kohler

**92. How many types of learning behaviour were classified by Thorpe?**

(a) Four

(b) Five

(c) Six

(d) Seven

**93. Imprinting is most commonly observed in:**

(a) Mammals

(b) Birds

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(c) Reptiles

(d) Amphibians

**94. The tendency of young birds to follow the first moving object they see is known as:**

(a) Conditioning

(b) Habituation

(c) Imprinting

(d) Insight learning



**95. Which type of learning helps animals save energy by ignoring repeated harmless stimuli?**

(a) Imprinting

(b) Habituation

(c) Latent learning

(d) Operant conditioning

**96. Pavlov's experiment on dogs is an example of:**

- 
- (a) Imprinting
  - (b) Conditioning or conditioned reflex type I**
  - (c) Operant conditioning
  - (d) Insight learning

**97. In Pavlov's experiment, the ringing of the bell was a:**

- (a) Natural stimulus
- (b) Primary stimulus
- (c) Conditioned stimulus**
- (d) Reflex action



**98. The "trial and error" type of learning is known as:**

- (a) Conditioning type I
- (b) Operant conditioning**
- (c) Habituation
- (d) Latent learning

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**99. Who demonstrated operant conditioning by experiments on rats and cats?**

- (a) Thorpe
- (b) Pavlov
- (c) Thorndike and Skinner
- (d) Kohler

**100. The highest form of learning shown by chimpanzees is:**

- (a) Latent learning
- (b) Conditioning
- (c) Insight learning
- (d) Imprinting

### **Exercise Short Questions:**

**(i) Define circadian rhythm.**

**Answer:**

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👉 Circadian rhythm is the natural, internal biological cycle of about 24 hours that regulates various physiological activities such as sleep, feeding, hormone release, and body temperature in living organisms.

🕒 **Example:** Sleeping at night and waking up in the morning follows a circadian rhythm.

**(ii) What is the difference between CNS and PNS?**

**Answer:**

👉 The Central Nervous System (CNS) consists of the brain and spinal cord; it controls and coordinates all body activities.

👉 The Peripheral Nervous System (PNS) includes all nerves outside the CNS; it connects the CNS with the rest of the body.

**(iii) What are the functions of parathyroid gland?**

**Answer:**

👉 The parathyroid glands secrete parathormone (PTH) which:

- Increases calcium level in the blood.
- Regulates phosphate metabolism.
- Maintains the balance of calcium and phosphorus in bones and body fluids.

**(iv) Define the term hormone.**

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**Answer:**

👉 A hormone is a chemical messenger secreted by an endocrine gland directly into the bloodstream, which regulates specific physiological processes such as growth, metabolism, and reproduction.

**(v) What are the commercial applications of auxins?**

**Answer:**

👉 Auxins are plant hormones used in agriculture and horticulture.

**Applications:**

- Promote root formation in cuttings.
- Prevent premature fruit drop.
- Induce fruit development without fertilization (parthenocarpy).
- Control weed growth (as synthetic auxins act as herbicides).

**(vi) List different types of tropisms.**

**Answer:**

👉 Major types of tropisms are:

1. Phototropism – movement toward light.
2. Geotropism – response to gravity.

3. Hydrotropism – response to water.
4. Thigmotropism – response to touch.
5. Chemotropism – response to chemicals.

**(vii) Write a note on Alzheimer's disease.**

**Answer:**

👉 Alzheimer's disease is a degenerative disorder of the brain that causes progressive memory loss, confusion, and personality changes.

🧠 It results from degeneration of neurons in the cerebral cortex, especially those involved in memory and learning.

👉 Common in elderly people, and no permanent cure exists—only supportive treatment to slow progression.

### **Important Short Questions:**

**1. What is coordination and why is it important for organisms?**

**Answer:**

👉 Coordination is the process that ensures all body parts work together in response to internal or external stimuli.

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👉 It is essential for integration of functions and survival, helping organisms respond properly to environmental changes.

## 2. How do unicellular and multicellular organisms show coordination?

**Answer:**

👉 In unicellular organisms, coordination exists among various cellular processes that respond to temperature, light, and chemicals.

👉 In multicellular organisms, although cells perform specialized functions, each cell can respond to changes in its surroundings to maintain balance.

## 3. How do plants control their body functions?

**Answer:**

👉 Plants control their body functions through plant hormones (growth hormones) which regulate growth, development, flowering, fruiting, and ripening.

Hormonal control in plants is slow but effective.

## 4. What are the two main types of plant movements?

**Answer:**

👉 The two main types of plant movements are:

1. Autonomic movements – self-initiated movements.
2. Paratonic movements – movements in response to external stimuli (like light, touch, or gravity).

### **5. What is the difference between circadian and circannual rhythms?**

**Answer:**

👉 Circadian rhythm: Biological cycle of about 24 hours (e.g., sleeping and waking).

👉 Circannual rhythm: Biological cycle of about 365 days (e.g., seasonal changes in behaviour or reproduction).

### **6. What are plant growth regulatory substances?**

**Answer:**

👉 These are special chemicals (hormones) produced by plants that influence growth, development, and response to stimuli such as light, gravity, and touch.

### **7. What is the main function of auxins in plants?**

**Answer:**

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👉 Auxins promote cell enlargement, cell division in cambium, root initiation, fruit growth, and apical dominance, and they can also delay leaf senescence.

## 8. What are gibberellins and their major functions?

**Answer:**

👉 Gibberellins (GA) are plant hormones that promote cell elongation, seed germination, bud initiation, and fruit development.

They also help break dormancy and promote bolting in rosette plants.

## 9. Write two commercial uses of gibberellins.

**Answer:**

👉 (i) Used to grow seedless grapes and increase fruit size.

👉 (ii) Used in the brewing industry to stimulate  $\alpha$ -amylase in barley for malting.

## 10: What are cytokinins and what are their functions?

**Answer:**

👉 Cytokinins are hormones that promote cell division, lateral bud growth, leaf expansion, and delay leaf aging (senescence).

They also break seed dormancy and promote stomatal opening.

### **11. What is the main function of abscisic acid (ABA)?**

**Answer:**

👉 Abscisic acid is a growth inhibitor that causes bud and seed dormancy, leaf abscission, stomatal closure during drought, and inhibits growth under stress conditions.

### **12. What are the commercial applications of abscisic acid?**

**Answer:**

👉 Spraying ABA on tree crops helps regulate fruit drop at the end of the season, reducing the need for repeated picking.

### **13. What are the effects of ethene on plants?**

**Answer:**

👉 Ethene (ethylene gas) promotes fruit ripening, flowering in pineapple, breaking bud dormancy, and stimulates latex flow in rubber plants.

### **14. What is the function of receptors in animals?**

**Answer:**

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👉 Receptors are specialized cells or organs that detect changes in the internal or external environment (like light, touch, or temperature) and send signals to the nervous system for response.

**15. Name five different types of sensory receptors present in the skin.**

**Answer:**

The skin has receptors for touch, pressure, heat, cold, and pain. These detect different kinds of sensations from the environment.

**16. Where are Meissner's corpuscles located and what is their function?**

**Answer:**

- Meissner's corpuscles are located in the papillae of the fingertips.
- Their function is to detect light touch and help us feel fine textures.

**17. What is the main function of Pacinian corpuscles in the skin?**

**Answer:**

Pacinian corpuscles are found deep in the skin and respond to deep pressure and vibration stimuli.

**18. Which receptors are situated at the base of hair and what do they detect?**

**Answer:**

- Hair end organs are located at the base of hair follicles.
- They detect touch or movement of the hair.

**19. How is the intensity of stimulus transmitted to the central nervous system (CNS)?**

**Answer:**

The intensity of a stimulus is transmitted to the CNS either by repeated impulses or by more sensory fibers carrying impulses to the brain or spinal cord.

**20. Why are pain receptors more abundant than heat receptors in human skin?**

**Answer:**

- Pain receptors are more abundant because they protect the body from injury by quickly detecting harmful stimuli.
- They are about 27 times more numerous than cold receptors.

**21. Differentiate between touch receptors and pressure receptors.**

**Answer:**

- **Touch receptors:** Located near the surface (like Meissner's corpuscles), detect light touch.
- **Pressure receptors:** Found deep in the skin (like Pacinian corpuscles), detect deep pressure and vibration.

**22. Explain the role of receptors, sensory neurons, and motor neurons in a reflex arc.**

**Answer:**

- Receptors detect a stimulus and send impulses through sensory neurons to the spinal cord.
- The impulse passes through an association neuron to a motor neuron, which sends the impulse to an effector (muscle or gland) for response.

**23. What is the function of neuroglia in the nervous system?**

**Answer:**

Neuroglia are supporting cells that provide nutrition, protection, and insulation (myelin sheath) to neurons. They make up about half of the nervous system.

**24. Define nerve impulse and mention the normal speed of nerve impulse in humans.**

**Answer:**

- A nerve impulse is a wave of electrochemical changes that travels along a neuron.
- Its normal speed in humans is about 100 meters per second.

**25. What is a synapse?**

**Answer:**

A synapse is a microscopic gap between the axon ending of one neuron and the dendrite of the next neuron where the transmission of nerve impulses occurs through chemical messengers.

**26. How is a nerve impulse transmitted from one neuron to another?**

**Answer:**

When a nerve impulse reaches the synaptic knob, synaptic vesicles release neurotransmitters into the synaptic cleft. These chemicals bind to receptors on the postsynaptic membrane, generating a new impulse in the next neuron.

**27. Name any three common neurotransmitters.**

**Answer:**

Three common neurotransmitters are acetylcholine, adrenaline, and dopamine.

**28. What is the function of acetylcholine?**

**Answer:**

Acetylcholine transmits nerve impulses across synapses that lie outside the central nervous system and helps in muscle contraction.

**29. Why can't action potential jump directly from one neuron to another?**

**Answer:**

Action potential cannot jump directly because there is no cytoplasmic connection between neurons; instead, impulses are transmitted chemically across the synaptic cleft.

**30. Differentiate between pre-synaptic and post-synaptic membranes.**

**Answer:**

- **Pre-synaptic membrane:** The membrane of the axon terminal that releases neurotransmitters.
- **Post-synaptic membrane:** The membrane of the next neuron that receives and responds to the neurotransmitters.

**31. Define neurotransmitter and give two examples.**

**Answer:**

Neurotransmitters are chemical messengers that transmit impulses across synapses between neurons.

**Examples:** Acetylcholine and Serotonin.

**32. Name two main types of nervous systems found in the animal kingdom.**

**Answer:**

1. Diffused nervous system – found in Hydra and jellyfish.
2. Centralized nervous system – found in Planaria and higher animals like humans.

**33. Differentiate between diffused and centralized nervous systems.**

**Answer:**

**Diffused:** Has a network of neurons without brain or nerve cords (e.g., Hydra).

**Centralized:** Has brain, nerve cords, and specialized neurons (e.g., Planaria, humans).

**34. How is the nervous system of Planaria more advanced than that of Hydra?**

**Answer:**

Planaria has a brain-like structure (bilobed ganglia), sensory organs, and distinct sensory, associative, and motor neurons – all absent in Hydra.

**35. What is the function of the limbic system in the human brain?**

**Answer:**

The limbic system controls emotions, drives (hunger, thirst, fear), memory formation, and behaviors such as pleasure and anger.

**36. What are meninges and what is their function?**

**Answer:**

Meninges are three protective layers surrounding the brain and spinal cord. They protect the CNS and hold cerebrospinal fluid, which cushions it against shocks.

**37. Name the three main parts of the human brain.**

**Answer:**

1. Forebrain (cerebrum, thalamus, hypothalamus)
2. Midbrain
3. Hindbrain (pons, medulla, cerebellum)

**38. Differentiate between the central nervous system (CNS) and peripheral nervous system (PNS).**

- **CNS:** Includes brain and spinal cord; controls and coordinates body activities.
- **PNS:** Includes cranial and spinal nerves; carries messages to and from the CNS.

**39. What is the function of the spinal cord in the human body?**

**Answer:**

The spinal cord controls reflex actions and serves as a pathway for the transmission of nerve impulses between the brain and body parts.

**40. What is the autonomic nervous system (ANS)?**

**Answer:**

The autonomic nervous system controls involuntary activities of internal organs. It has two divisions: sympathetic and parasympathetic, both working automatically to maintain body balance.

**41. Differentiate between sympathetic and parasympathetic nervous systems.**

**Answer:**

- **Sympathetic system:** Active during stress or emergencies (“fight or flight”), increases heartbeat, dilates pupils, and inhibits digestion.
- **Parasympathetic system:** Active during relaxation, slows heartbeat, constricts pupils, and promotes digestion.

**42. What is the main function of the sympathetic nervous system?**

**Answer:**

It prepares the body for emergency actions by increasing heartbeat, raising blood pressure, dilating pupils, and reducing digestive activities – known as the “fight or flight” response.

**43. What is Parkinson’s disease and its cause?**

**Answer:**

Parkinson’s disease is a nervous disorder characterized by involuntary tremors, stiffness, and weak motor control. It occurs due to the death of brain cells that produce dopamine.

**44. What is epilepsy?**

**Answer:**

Epilepsy is a nervous disorder caused by abnormal electrical discharges in the brain, leading to sudden convulsions, unconsciousness, or sensory disturbances.

**45. Write a short note on Alzheimer’s disease.**

**Answer:**

Alzheimer’s disease is a brain disorder that causes memory loss and mental decline. It is linked to aging, genetics, and possibly high levels of aluminum in the brain.

**46. What is the effect of nicotine on the nervous system?**

**Answer:**

Nicotine mimics the action of acetylcholine, stimulating nerve impulses. It increases heartbeat, blood pressure, and digestion, but may cause vomiting and water retention.

**47. Define hormones.****Answer:**

Hormones are chemical messengers secreted by endocrine glands directly into the blood. They regulate body functions such as growth, metabolism, and reproduction.

**48. What are the main chemical types of hormones?****Answer:**

**There are four types of hormones:**

- (i) Proteins (e.g. Insulin)
- (ii) Amino acid derivatives (e.g. Thyroxine)
- (iii) Polypeptides (e.g. Oxytocin)
- (iv) Steroids (e.g. Testosterone)

**49. What is the function of the hypothalamus in chemical coordination?**

**Answer:**

The hypothalamus converts nerve impulses into hormonal responses. It produces oxytocin and ADH, which are stored and released by the posterior pituitary gland.

**50. What is the function of parathyroid glands?**

**Answer:**

Parathyroid glands secrete parathormone, which regulates the calcium ( $\text{Ca}^{2+}$ ) level in blood by increasing its concentration when it falls too low.

**51. What happens due to under-activity and over-activity of parathyroid glands?**

**Answer:**

- **Under-activity:** Causes low blood calcium leading to muscular tetany.
- **Over-activity:** Causes bone demineralization and kidney stones, which can be fatal.

**52. What are Islets of Langerhans?**

**Answer:**

Islets of Langerhans are groups of endocrine cells in the pancreas that secrete insulin (by  $\beta$ -cells) and glucagon (by  $\alpha$ -cells) to regulate blood sugar levels.

**53. What is the function of insulin?**

**Answer:**

Insulin reduces blood glucose level by increasing glucose utilization, glycogen formation, and conversion of glucose into fat and protein.

**54. What is diabetes mellitus?**

**Answer:**

It is a disease caused by insulin deficiency, leading to high blood sugar, presence of sugar in urine, dehydration, and nervous system disturbance.

**55. What is glucagon and its function?**

**Answer:**

Glucagon is a hormone secreted by  $\alpha$ -cells of the pancreas that increases blood glucose by converting glycogen to glucose in the liver and muscles.

**56. Where are adrenal glands located and what are their parts?**

**Answer:**

A pair of adrenal glands is located on top of each kidney. Each gland has two parts:

1. Adrenal cortex (outer layer)
2. Adrenal medulla (inner layer)

**57. Name two hormones secreted by adrenal medulla and their functions.**

**Answer:**

- **Adrenaline (epinephrine):** Increases heart rate, dilates blood vessels in muscles, and raises blood glucose.
- **Noradrenaline (norepinephrine):** Constricts some blood vessels and helps increase blood pressure.

**58. What are the main hormones secreted by adrenal cortex?**

**Answer:**

Adrenal cortex secretes cortisol, corticosterone, aldosterone, and androgens, which control metabolism, stress response, and salt balance.

**59. What is Addison's disease and what is its cause?**

**Answer:**

Addison's disease is caused by destruction of the adrenal cortex, leading to weakness, salt loss, and collapse under stress.

**60. What is the function of gastrin hormone?**

**Answer:**

Gastrin is secreted by the stomach lining and stimulates the secretion of gastric juice during digestion.

**61. What is the function of secretin hormone?**

**Answer:**

Secretin is produced by the duodenum and stimulates the pancreas to release pancreatic juice and the liver to produce bile.

**62. What are the functions of oestrogen and progesterone in females?**

**Answer:**

- **Oestrogen:** Develops secondary female characters, thickens uterine wall, and helps repair it after menstruation.
- **Progesterone:** Prepares uterus for pregnancy and prevents further ovulation.

**63. What is feedback mechanism?**

**Answer:**

---

Feedback mechanism is a self-regulating system where the level of a hormone controls its own production – e.g., high thyroxine level inhibits further TSH release.

**64. Differentiate between innate and learned behaviour.**

**Answer:**

- **Innate behaviour:** Inborn and inherited; occurs without learning (e.g., reflexes, taxis).
- **Learned behaviour:** Acquired through experience and practice during an organism's lifetime.

**65. Define instinctive behaviour.**

**Answer:**

Instinctive behaviour is the inborn and inherited behaviour of an animal that depends on heredity. It occurs without prior experience or learning, helping the organism adapt to its environment.

**66. Define learning behaviour.**


**Answer:**

Learning behaviour is the modification of behaviour through experience. It depends on both heredity and environmental influence and helps the organism adjust to changing conditions.

**57. What is a sign stimulus?**

**Answer:**

A sign stimulus is a specific external cue or signal that triggers an instinctive response.

 **Example:** The red belly of a male three-spined stickleback fish acts as a sign stimulus for aggression in other males.

**58. What is an innate releasing mechanism (IRM)?**

**Answer:**

The innate releasing mechanism is an inborn neural system that helps an animal recognize a sign stimulus and perform the appropriate instinctive response automatically.

**59. Give an example of instinctive behaviour in animals.**

**Answer:**

The female digger wasp builds a nest, hunts caterpillars, places them inside, lays eggs, and seals the nest – all performed instinctively without learning.

**60. Define learning according to Thorpe.**

**Answer:**

---

According to Thorpe, learning is the process that results in adaptive changes in individual behaviour as a result of experience.

### 61. What is imprinting?


**Answer:**

Imprinting is a type of learning seen in young birds such as ducklings, which follow the first moving object they see after hatching – usually their mother.

### 62. What is habituation?

**Answer:**

Habituation is the simplest form of learning in which an animal gradually stops responding to a repeated, harmless stimulus.

 **Example:** A snail stops retracting into its shell after repeated tapping on glass.

### 63. Differentiate between classical and operant conditioning.

**Answer:**

- **Classical (Conditioned Reflex Type I):** Learning by association between two stimuli (Pavlov's dog salivating at a bell).
- **Operant (Conditioned Reflex Type II):** Learning through trial and error with reward (Skinner's rat pressing a lever for food).

## 64. What is insight learning?

### Answer:

Insight learning is the highest form of learning involving reasoning and problem-solving without prior experience.

✚ **Example:** A chimpanzee stacking boxes to reach hanging fruit.

## Q.5. Exercise Long Questions:

☀ **Q1: Describe different types of learning behaviour.**

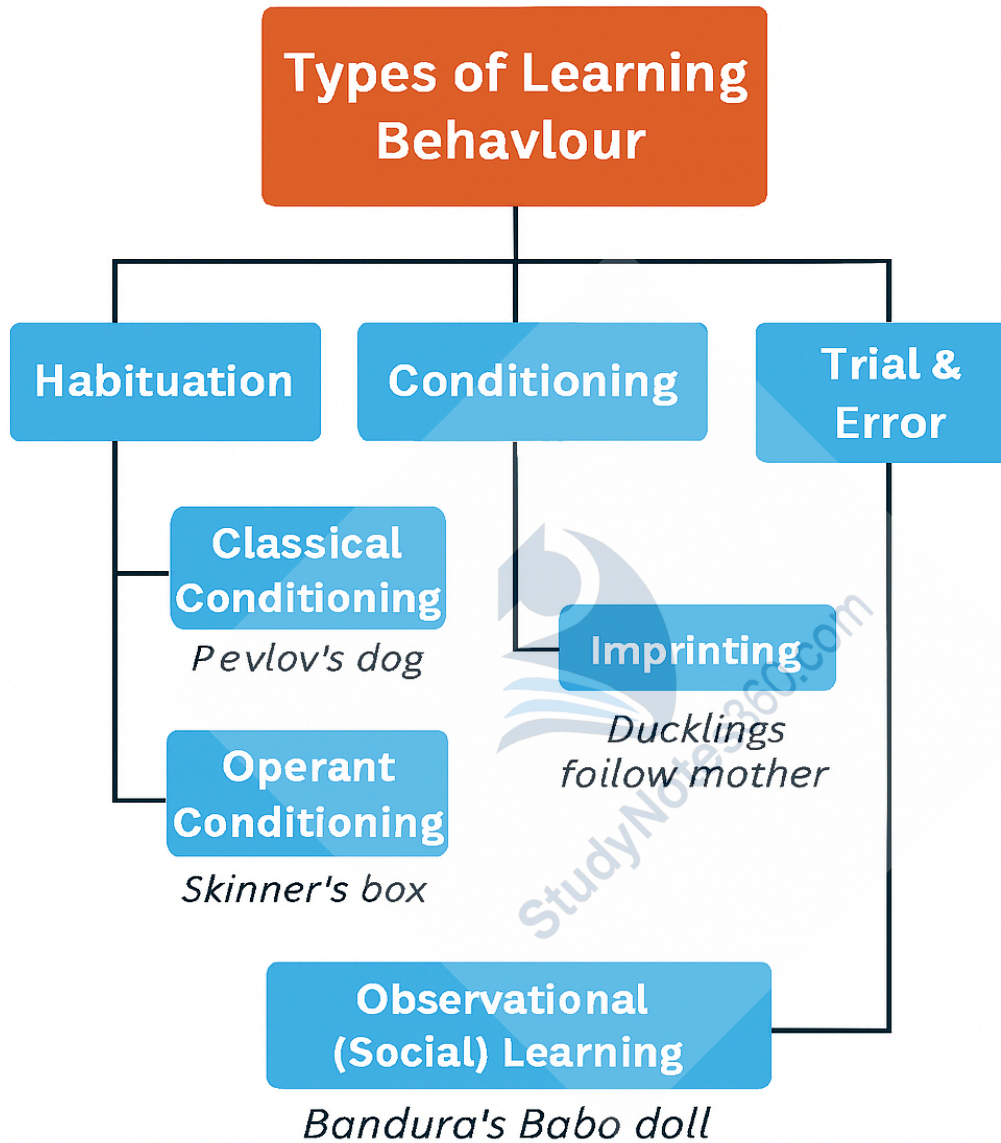
### ❖ Introduction:

Learning is the process by which animals or humans change their behaviour as a result of experience or practice. It allows them to adapt better to their environment and survive more efficiently.

### ◆ Definition of Learning Behaviour:

> Learning behaviour is a relatively permanent change in behaviour that occurs due to experience or practice.

This helps organisms respond correctly to situations instead of depending only on instincts.



---

## 1. Habituation

- **Definition:** Gradual reduction in response to a repeated, harmless stimulus.
- **Example:** A snail stops withdrawing into its shell when touched repeatedly without danger.
- **Purpose:** Helps animals ignore unnecessary or non-harmful stimuli.

## 2. Conditioning

Learning through association between a stimulus and a response.

There are two major types:

### (a) Classical Conditioning (by Ivan Pavlov)

- **Concept:** Learning by association of two stimuli.
- **Example:** Pavlov's dog learned to salivate at the sound of a bell when the bell was paired with food.
- **Result:** The sound alone triggered salivation.

### (b) Operant Conditioning (by B.F. Skinner)

- **Concept:** Learning through consequences – reward or punishment.
- **Example:** A rat learns to press a lever to get food.
- **Result:** Behaviour increases if rewarded and decreases if punished.

## 3. Trial and Error Learning (by Edward Thorndike)

- 
- **Definition:** Learning by attempting several responses until the correct one is found.
  - **Example:** A cat in a puzzle box learns to pull a lever to get out.
  - **Result:** Wrong attempts are reduced over time; successful responses are learned.

#### 4. Insight Learning (by Wolfgang Köhler)

- **Definition:** Sudden understanding or realization of a solution without trial and error.
- **Example:** A chimpanzee uses a stick to bring food closer.
- **Result:** Shows intelligence and problem-solving ability.

#### 5. Imprinting (by Konrad Lorenz)

- **Definition:** Learning that occurs during a sensitive or critical period of early life and becomes permanent.
- **Example:** Ducklings follow the first moving object they see (mother or human).
- **Purpose:** Helps in survival and bonding.

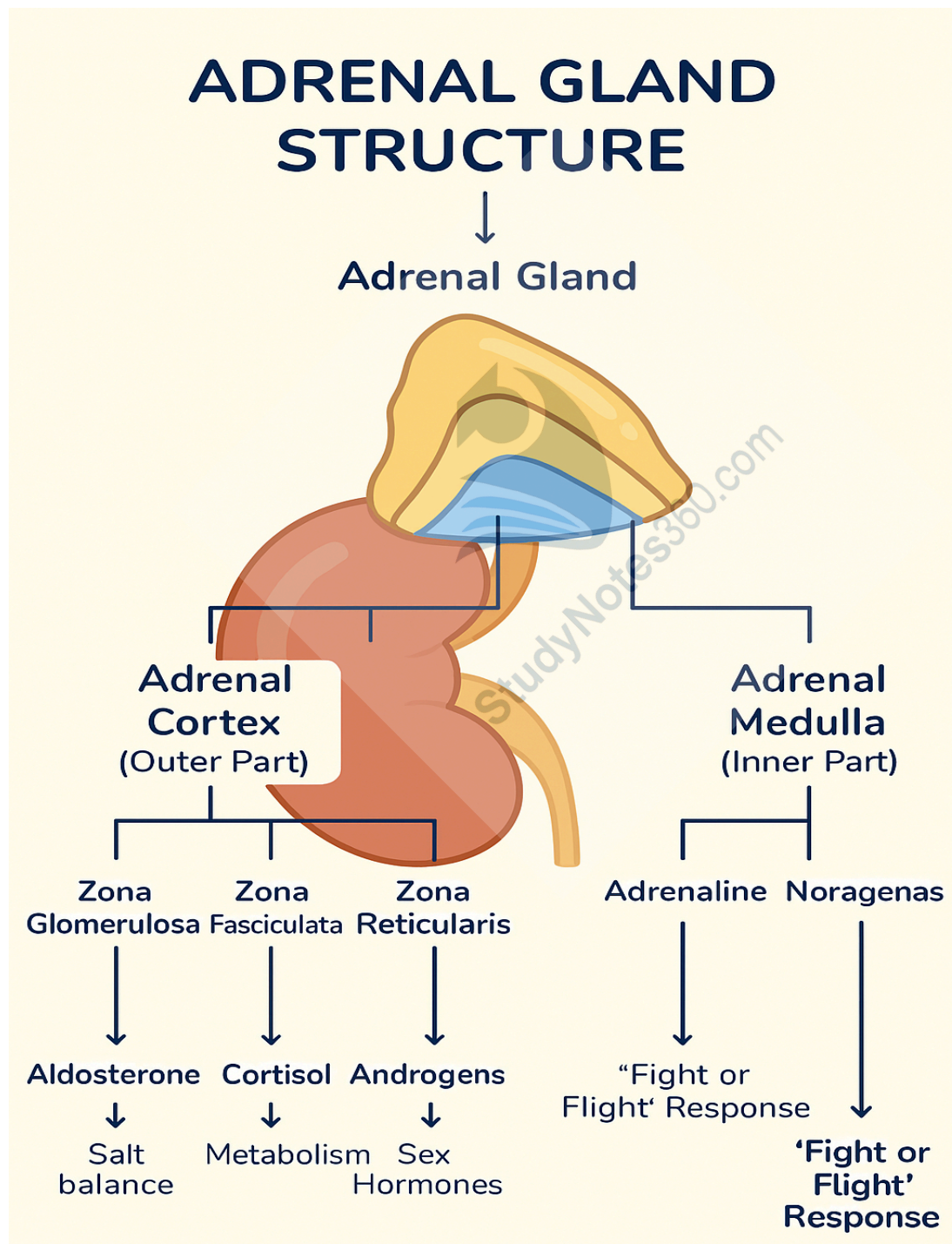
#### 6. Observational (Social) Learning

- **Definition:** Learning by observing and imitating others' behaviour.
- **Example:** Young monkeys learn nut-cracking by watching adults.
- **Result:** No direct reinforcement required; imitation plays a key role.

✦ Q2: Describe in detail the role of adrenal glands.

❖ Introduction:

The adrenal glands are two small endocrine glands situated on top of each kidney. They play an important role in controlling stress, metabolism, blood pressure, and salt-water balance through secretion of different hormones.



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### ◆ Structure of Adrenal Glands:

Each adrenal gland consists of two distinct regions:

1. Adrenal Cortex (Outer part)
2. Adrenal Medulla (Inner part)

Both parts function independently and secrete different hormones.

#### 1. Adrenal Cortex (Outer Part):

The adrenal cortex is the outer region that secretes steroid hormones. It has three layers, each producing a specific hormone group.

##### (a) Zona Glomerulosa – Mineralocorticoids

**Main Hormone:** Aldosterone

##### **Functions:**

- Regulates sodium ( $\text{Na}^+$ ) and potassium ( $\text{K}^+$ ) balance in the blood.
- Maintains blood pressure and water level by acting on kidney tubules.
- Helps in water retention by controlling salt balance.

##### (b) Zona Fasciculata – Glucocorticoids

**Main Hormone:** Cortisol (Hydrocortisone)

**Functions:**

- Controls metabolism of carbohydrates, proteins, and fats.
- Increases blood glucose by converting proteins into sugar.
- Helps in long-term stress response.
- Reduces inflammation and allergic reactions.

**(c) Zona Reticularis – Sex Hormones**

**Hormones:** Androgens (male hormones) and small amounts of estrogens (female hormones).

**Functions:**

- Help in the development of secondary sexual characteristics.
- Influence sexual behaviour and body hair growth.

**2. Adrenal Medulla (Inner Part):**

The adrenal medulla lies in the center of the gland and acts as part of the sympathetic nervous system. It secretes catecholamine hormones that prepare the body for emergencies.

**(a) Adrenaline (Epinephrine)**

- Increases heart rate and blood pressure.
- Dilates air passages to improve oxygen supply.
- Increases blood sugar by converting glycogen into glucose.
- Prepares the body for “fight or flight” situations during stress or danger.

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### (b) Noradrenaline (Norepinephrine)

- Constricts blood vessels to maintain blood pressure.
- Works with adrenaline in emergency responses.
- Keeps the body alert, focused, and ready for quick reactions.

#### ◆ Summary:

- The adrenal glands secrete hormones that regulate the body's response to stress, control metabolism, maintain salt and water balance, and help in sexual development.
- The adrenal cortex produces aldosterone, cortisol, and sex hormones for long-term regulation.
- The adrenal medulla releases adrenaline and noradrenaline for immediate emergency response.
- Together, these hormones maintain stability and enable the body to cope with physical and emotional challenges.

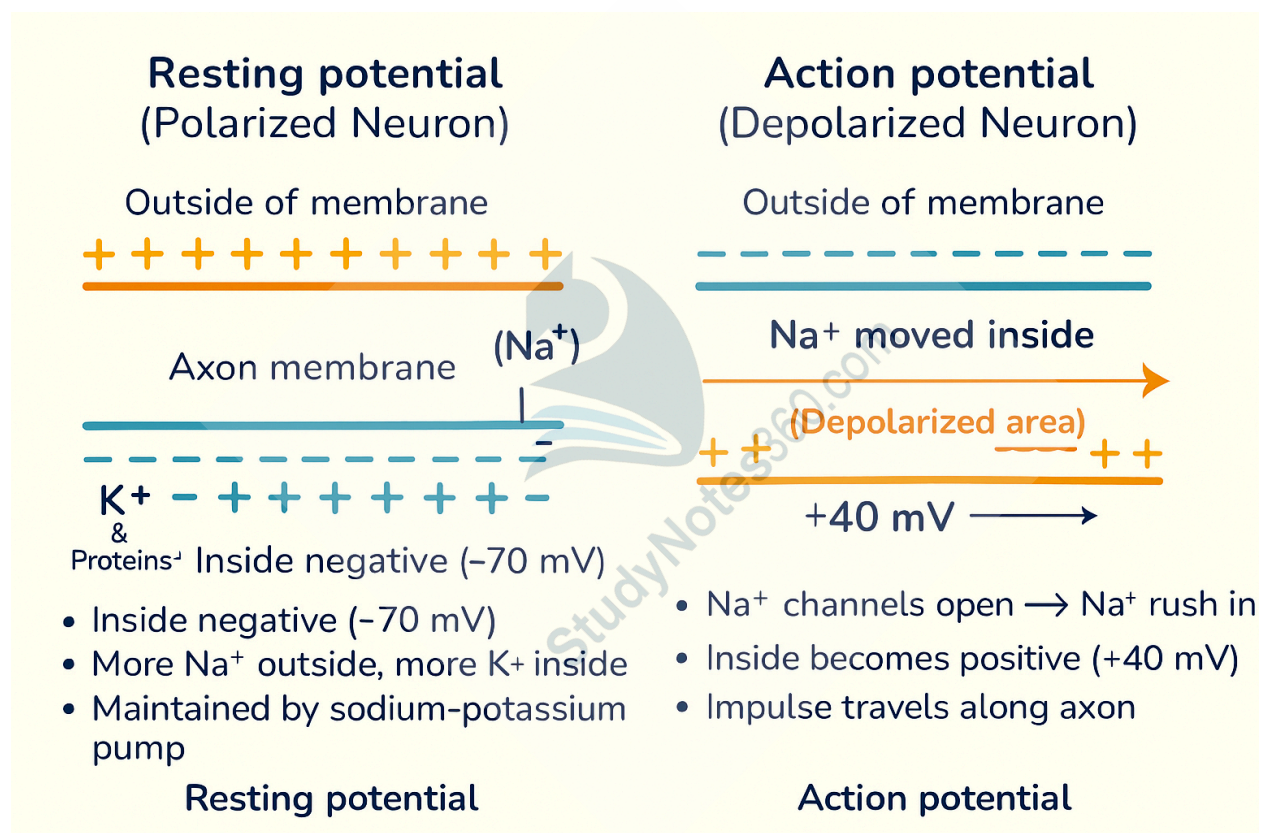
★ Q3: Define nerve impulse. Explain the mechanism involved by labelled diagrams.

#### ❖ Definition:

- A nerve impulse is an electrical signal that travels along the length of a neuron.
- > It is a wave of electrochemical changes that passes through the nerve fiber, allowing communication between different parts of the body.
- In simple words, a nerve impulse is the message or signal transmitted through a neuron in the form of electrical and chemical changes.

## ❖ Introduction:

The nervous system works through the transmission of nerve impulses. When a receptor is stimulated (by touch, sound, or light), it generates an electrical message that travels along the neuron to the brain or spinal cord for response.



## ◆ Mechanism of Nerve Impulse Transmission:

The mechanism of nerve impulse involves three main stages:

### 1. Resting Potential (Polarized State)

- When a neuron is not transmitting any impulse, it is said to be in the resting state.

### During this state:

- The inside of the neuron's membrane has negative charge (due to more  $K^+$  and large negative proteins).
- The outside has positive charge (due to  $Na^+$  ions).
- The difference in electrical charge across the membrane is about  $-70$  mV.
- This condition is maintained by the sodium-potassium pump, which actively transports  $Na^+$  out and  $K^+$  in.

### ◆ Result:

Neuron is polarized (ready to transmit impulse).

## 2. Action Potential (Depolarization)

When a stimulus reaches the neuron (above threshold level):

- Sodium channels open and  $Na^+$  ions rush inside the neuron.
- This makes the inside positive and the outside negative – called depolarization.
- The electrical potential rises from  $-70$  mV to  $+40$  mV.
- This sudden reversal of charge is called an action potential, and it represents the nerve impulse.

### Result:

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Impulse begins and travels along the axon.

### 3. Repolarization and Return to Resting State

After the impulse passes:

- Potassium channels open and  $K^+$  ions move out of the neuron.
- The membrane regains its original charge difference (inside negative, outside positive).
- Sodium-potassium pump again restores normal ion distribution.

#### Result:

Neuron becomes ready for the next impulse.

#### ◆ Direction of Impulse:

- Nerve impulse always travels in one direction – from dendrites → cell body → axon → axon terminal.
- At the end of the axon, the impulse is transmitted to the next neuron or effector through the synapse (using neurotransmitters like acetylcholine).

#### ◆ Summary:

- A nerve impulse is an electrochemical message that travels along a neuron due to the movement of sodium ( $Na^+$ ) and potassium ( $K^+$ ) ions across its membrane.
- At resting potential, the neuron is polarized.

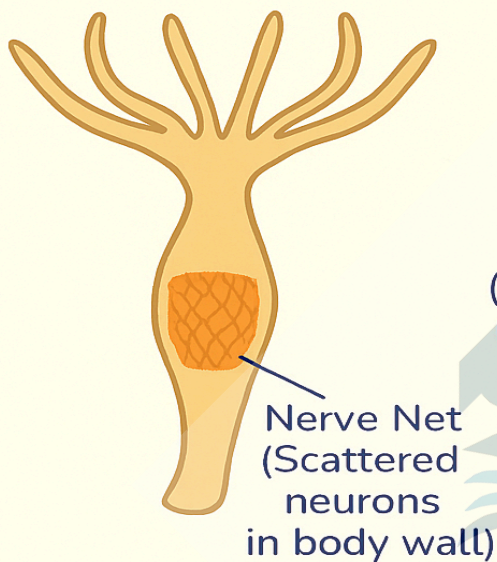
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- On stimulation, sodium ions enter causing depolarization (action potential).
  - Then potassium ions leave, restoring repolarization.
  - This cycle allows rapid transmission of signals throughout the nervous system.

**☀ Q4: How is the nervous system of Planaria better developed than that of Hydra?**

**❖ Introduction:**

- The nervous system helps animals coordinate their body functions and respond to environmental changes.
- In lower animals like Hydra and Planaria, the nervous system is simple but shows a clear difference in development and organization.
- Planaria has a more advanced and centralized nervous system than Hydra.

## Nervous System of Hydra

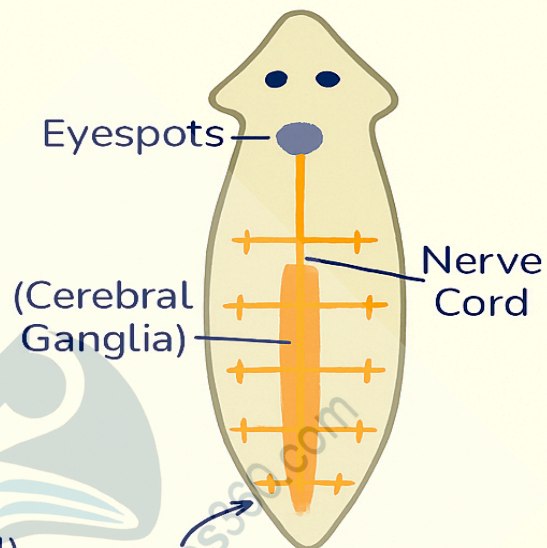


- No brain
- Impulses spread in all directions

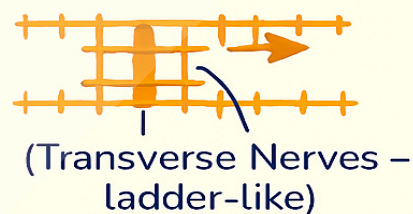
- No brain
- Impulses spread in all directions

**Nervous potential**

## Nervous System of Planaria



- Centralized system
- Directional impulse flow



- Centralized system

**Action potential**

### ◆ Nervous System of Hydra:

- Hydra is a simple aquatic animal (phylum Cnidaria).

- It has a nerve net system, which is the simplest form of a nervous system.

### Structure:

- The neurons are spread in the body wall, forming a network of nerve cells.
- There is no brain or central control.
- Impulses travel in all directions because of random interconnections.

### Function:

- Helps Hydra respond to touch or light.
- Controls simple movements like contraction of tentacles.

### Limitation:

- No coordination between different body parts.
- Cannot send messages in one specific direction.

### In short:

Hydra has a diffuse nerve net, without brain, ganglia, or sensory organs.

### Nervous System of Planaria:

- Planaria belongs to phylum Platyhelminthes (flatworms).
- It shows a bilateral body plan, leading to a centralized nervous system.

### Structure:

- Contains a pair of cerebral ganglia in the head region (acts as a simple brain).
- Two long nerve cords run along the length of the body.
- The nerve cords are connected by transverse nerves, giving a ladder-like appearance.
- Has sensory organs such as eyespots (for light detection).

### Function:

- Impulses move in a specific direction – from sensory organs to the brain and then to effectors.
- Shows better coordination and controlled movement.
- Able to detect light, touch, and chemical signals.

### In short:

Planaria has a centralized nervous system with ganglia (brain), nerve cords, and sense organs.

### ◆ Summary:

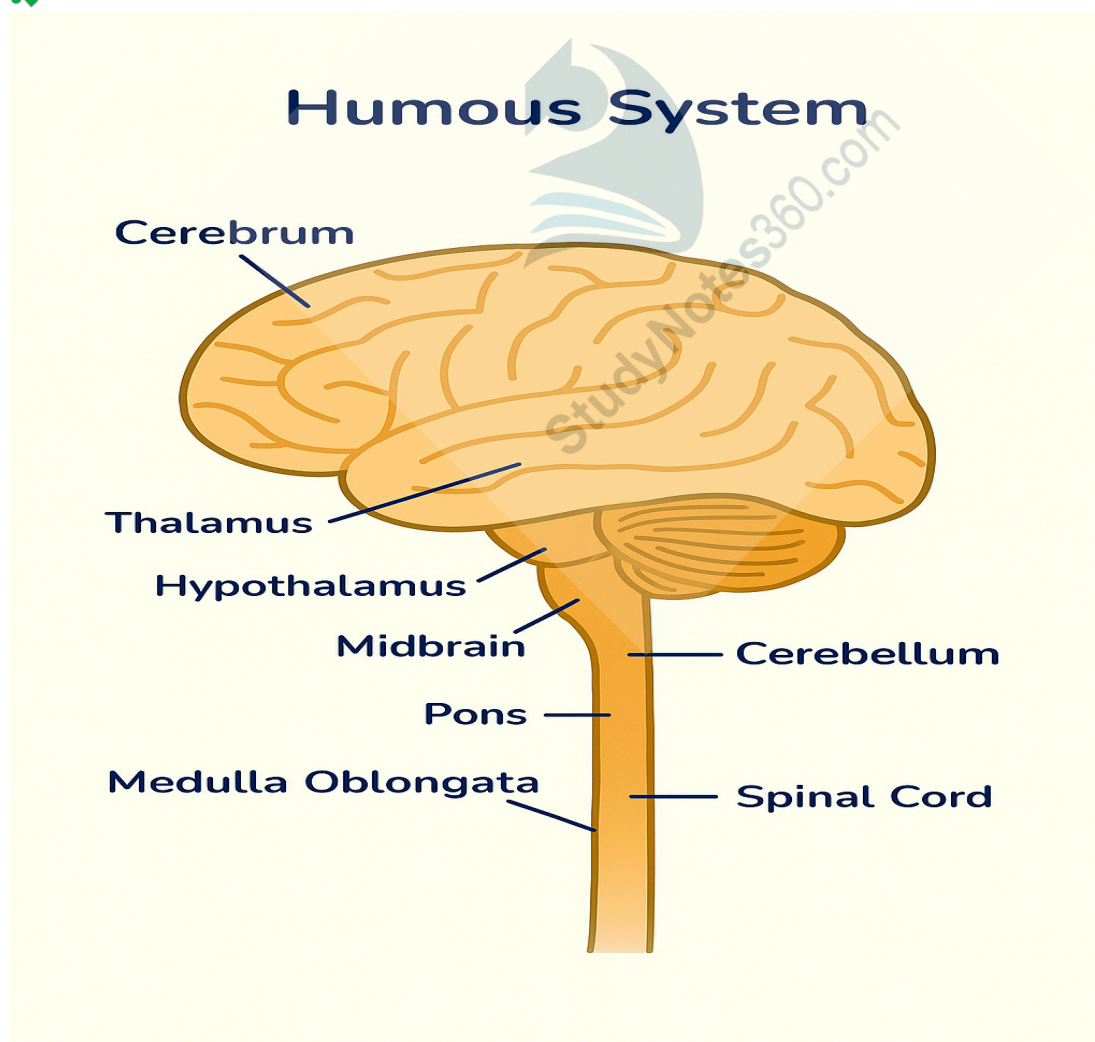
- The nervous system of Planaria is more advanced than that of Hydra because:
- It has a simple brain (cerebral ganglia).
- Possesses two main nerve cords with transverse connections.
- Allows unidirectional flow of impulses and better coordination of activities.
- In contrast, Hydra only has a nerve net, with no brain or direction control, making it the most primitive type of nervous system.

★ Q5: Describe the structure and functions of the different parts of the human brain.

### ❖ Introduction:

- The human brain is the main control center of the nervous system.
- It is responsible for controlling all body functions – such as thinking, movement, emotions, heartbeat, and breathing.
- It is enclosed in the skull and protected by three meninges and cerebrospinal fluid (CSF) which cushion it from shocks.

### ✚ Main Parts of the Human Brain:



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The human brain is divided into three main regions:

1. **Forebrain**
2. **Midbrain**
3. **Hindbrain**

### 1. Forebrain:

- The forebrain is the largest and most complex region of the brain.
- It controls voluntary actions, intelligence, memory, and emotions.

#### ◆ Cerebrum:

- It is the largest part of the brain, making up about 80% of its weight.
- Divided into two hemispheres, left and right, connected by a corpus callosum.
- Each hemisphere has four lobes — frontal, parietal, temporal, and occipital.

#### Functions:

- Controls voluntary movements like walking and writing.
- Receives and interprets sensory information from eyes, ears, and skin.
- Responsible for thinking, memory, intelligence, and emotions.

#### ◆ Thalamus:

- Located just below the cerebrum.
- Works as a relay center for all sensory messages (except smell).

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### Functions:

- Receives impulses from sense organs and sends them to the cerebrum.
- Plays a role in alertness and awareness.

### ◆ Hypothalamus:

- Lies below the thalamus.
- A small but very important part of the brain.

### Functions:

- Controls body temperature, hunger, thirst, and sleep.
- Regulates the pituitary gland, which links the nervous system and endocrine system.
- Maintains homeostasis (internal body balance).

## 2. Midbrain:

- The midbrain lies between the forebrain and hindbrain.
- It forms a small central part of the brainstem.

### Functions:

- Controls reflexes of sight and hearing, such as turning the head toward a sound or bright light.
- Maintains body posture and muscle tone.
- Acts as a pathway for messages between the forebrain and hindbrain.

### 3. Hindbrain:

- The hindbrain connects the brain with the spinal cord and controls automatic functions of the body.

#### ◆ Cerebellum:

- Located below the cerebrum at the back of the brain.
- Has two hemispheres with a folded surface.

#### Functions:

- Maintains balance, coordination, and posture.
- Ensures smooth and controlled movements.
- Helps in maintaining body equilibrium.

#### ◆ Pons:

- Lies between the midbrain and medulla oblongata.
- Functions as a bridge connecting various parts of the brain.

#### Functions:

- Helps in controlling breathing.
- Transmits signals between the cerebrum and cerebellum.

#### ◆ Medulla Oblongata:

- Located at the base of the brain, connecting it to the spinal cord.

- Also known as the brainstem.

### Functions:

- Controls involuntary actions such as heartbeat, breathing, and digestion.
- Regulates blood pressure and reflexes like coughing, sneezing, and swallowing.

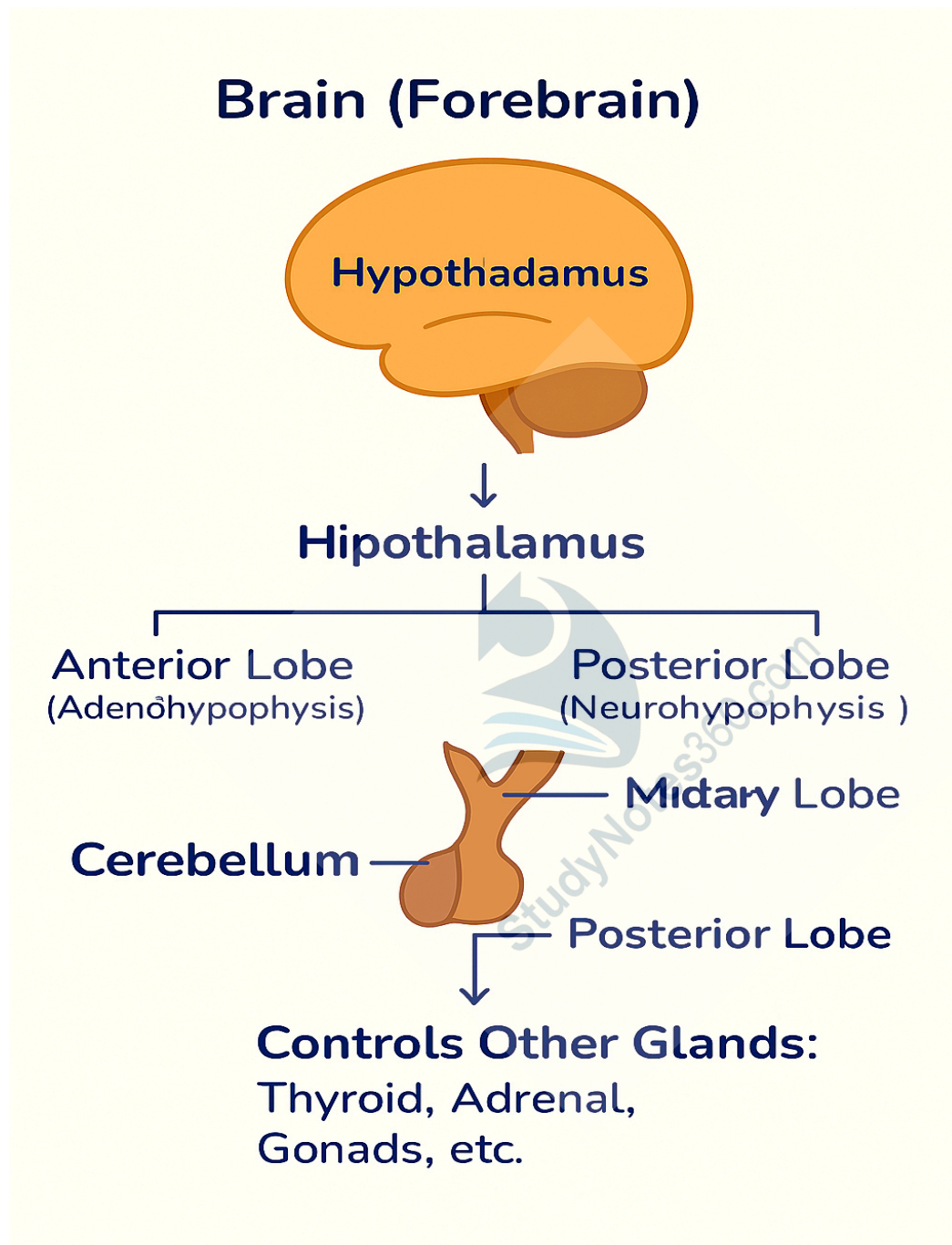
### ◆ Summary:

- The human brain is a highly developed organ with specialized parts.
- The forebrain controls voluntary actions, intelligence, and emotions.
- The midbrain coordinates reflexes of sight and sound.
- The hindbrain regulates involuntary functions such as heartbeat, breathing, and balance.
- Together, these parts work in coordination to maintain life and control all bodily activities.

### ☀ Q6: Write a note on Pituitary Gland.

#### ❖ Introduction:

- The pituitary gland is a small, pea-sized gland located at the base of the brain, just below the hypothalamus.
- It is often called the “master gland” of the endocrine system because it controls the activities of many other glands in the body.
- The hypothalamus and pituitary gland work closely together to regulate body functions.



### ✿ Structure of Pituitary Gland:

The pituitary gland is divided into two main parts:

1. Anterior lobe (Front part)
2. Posterior lobe (Back part)

### 1. Anterior Lobe (Adenohypophysis):

- It is the larger part of the pituitary gland.
- It produces and releases several important hormones that control other endocrine glands.

### Important Hormones and Their Functions:

#### Growth Hormone (GH):

- Stimulates growth of bones and muscles.
- Its deficiency causes dwarfism, and excess causes gigantism or acromegaly.

#### Thyroid Stimulating Hormone (TSH):

- Stimulates the thyroid gland to release thyroxine.

#### Adrenocorticotrophic Hormone (ACTH):

- Controls the adrenal cortex to secrete its hormones.

#### Follicle Stimulating Hormone (FSH):

- Stimulates ovary and testes for the production of eggs and sperms.

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### Luteinizing Hormone (LH):

- Helps in ovulation and the formation of corpus luteum in females; controls testosterone secretion in males.

### Prolactin:

- Stimulates milk production after childbirth.

### 2. Posterior Lobe (Neurohypophysis):

- It does not produce hormones itself but stores and releases hormones made by the hypothalamus.

### Main Hormones and Their Functions:

#### Antidiuretic Hormone (ADH):

- Controls the amount of water in the body by acting on kidneys.
- Its deficiency causes diabetes insipidus (excessive urination).

#### Oxytocin:

Causes contraction of uterus during childbirth and helps in milk ejection after delivery.

#### ◆ Summary:

- The pituitary gland plays a vital role in regulating growth, metabolism, reproduction, and water balance in the body.
- Its anterior lobe secretes hormones that control other glands, while its posterior lobe stores hormones from the hypothalamus.
- Because of its overall control, it is rightly called the “Master Gland” of the endocrine system.

## Important Long Questions:

☀ **Q1: Describe the role of hormones in coordination and control in plants.**

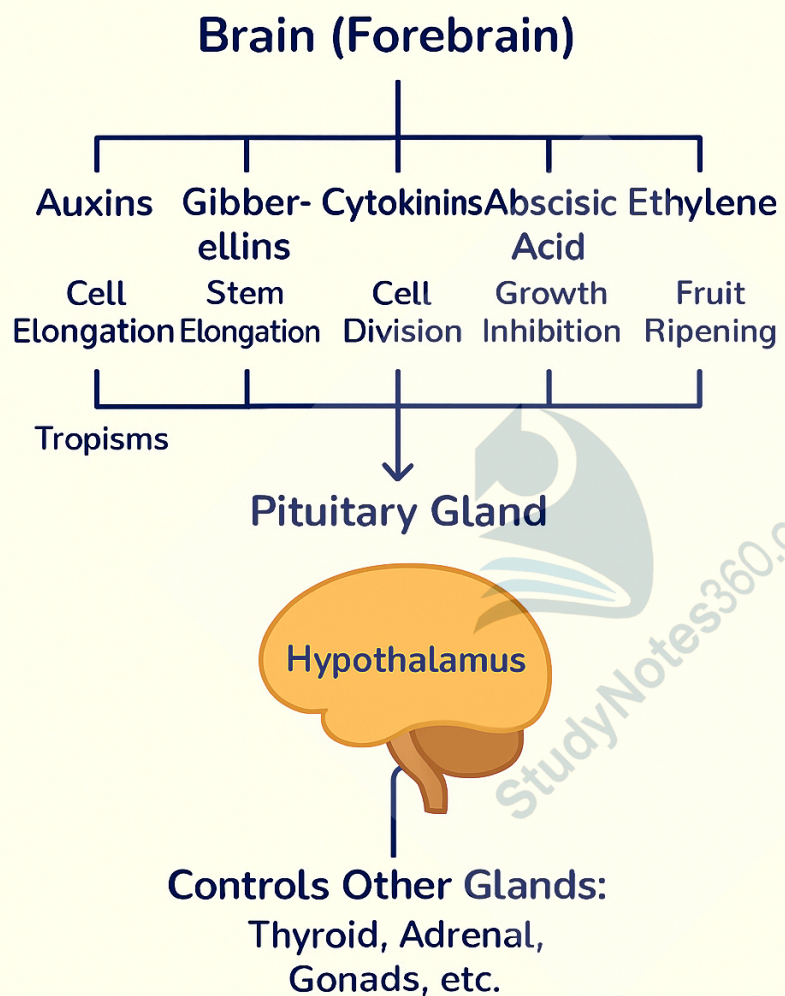
### ❖ Introduction:

- Plants, like animals, need coordination to control their growth and respond to environmental changes.
- However, unlike animals, plants lack a nervous system.
- Their control and coordination are carried out entirely by chemical messengers called plant hormones (also known as phytohormones).
- These hormones regulate all life processes – from seed germination to fruit ripening – and help the plant respond to external and internal stimuli.

### ✚ Definition of Plant Hormones:

- Plant hormones are organic chemical substances produced in small quantities at one part of the plant and transported to another part where they influence growth and development.
- They are responsible for coordination, regulation, and control of various physiological processes in plants.

# PLANT HORMONES



## Characteristics of Plant Hormones:

- Produced in very small quantities.
- Transported through xylem or phloem.
- Act at a site different from where they are produced.

- 
- May stimulate or inhibit growth.
  - Act in coordination with other hormones.

## **Main Plant Hormones and Their Functions:**

### **1. Auxins**

- Discovered by Charles Darwin.
- Produced in growing tips of shoots and roots.

#### **Functions:**

- Promote cell elongation and growth.
- Control phototropism (growth toward light) and geotropism (growth toward gravity).
- Help in root formation in cuttings.
- Delay leaf and fruit abscission (falling).
- Stimulate fruit development.

### **2. Gibberellins**

- Found in young leaves, seeds, and buds.
- First discovered in the fungus *Gibberella fujikuroi*.

#### **Functions:**

- Promote stem elongation and internodal growth.
- Break dormancy of seeds and buds.
- Induce flowering in long-day plants.
- Increase fruit size (e.g., in grapes).

### 3. Cytokinins

- Produced in roots and transported to other parts.

#### Functions:

- Promote cell division (cytokinesis).
- Delay aging (senescence) of leaves.
- Promote growth of lateral buds.
- Work with auxins to control tissue differentiation.

### 4. Abscisic Acid (ABA)

- Also known as stress hormone.
- Produced in leaves when plants face stress conditions (like drought).

#### Functions:

- Inhibits growth and cell division.
- Causes stomatal closure during water shortage.
- Promotes dormancy in buds and seeds.
- Helps plants survive unfavorable conditions.

### 5. Ethylene

- A gaseous hormone produced in ripening fruits and aging tissues.

#### Functions:

- 
- Promotes ripening of fruits.
  - Causes leaf abscission and senescence.
  - Breaks seed and bud dormancy.
  - Stimulates flowering in some plants (e.g., pineapple).

## **Role of Hormones in Plant Coordination:**

### **1. Regulate Growth:**

- Hormones like auxins and gibberellins control cell elongation and division.

### **2. Control Flowering and Fruiting:**

- Gibberellins and ethylene help in flower initiation and fruit ripening.

### **3. Response to Stimuli:**

- Auxins play a major role in tropic movements (like bending toward light).

### **4. Adaptation to Stress:**

- Abscisic acid (ABA) protects plants from drought and harsh environmental conditions.

### **5. Balance and Coordination:**

- Hormones act in balance – one promotes growth while another inhibits – ensuring proper coordination in the plant body.

#### ◆ Summary:

- Plant hormones are chemical messengers that coordinate various physiological activities in plants.
- They regulate growth, flowering, fruit formation, ripening, dormancy, and responses to stimuli.
- Thus, all plant activities – from germination to aging – are controlled through hormonal coordination.

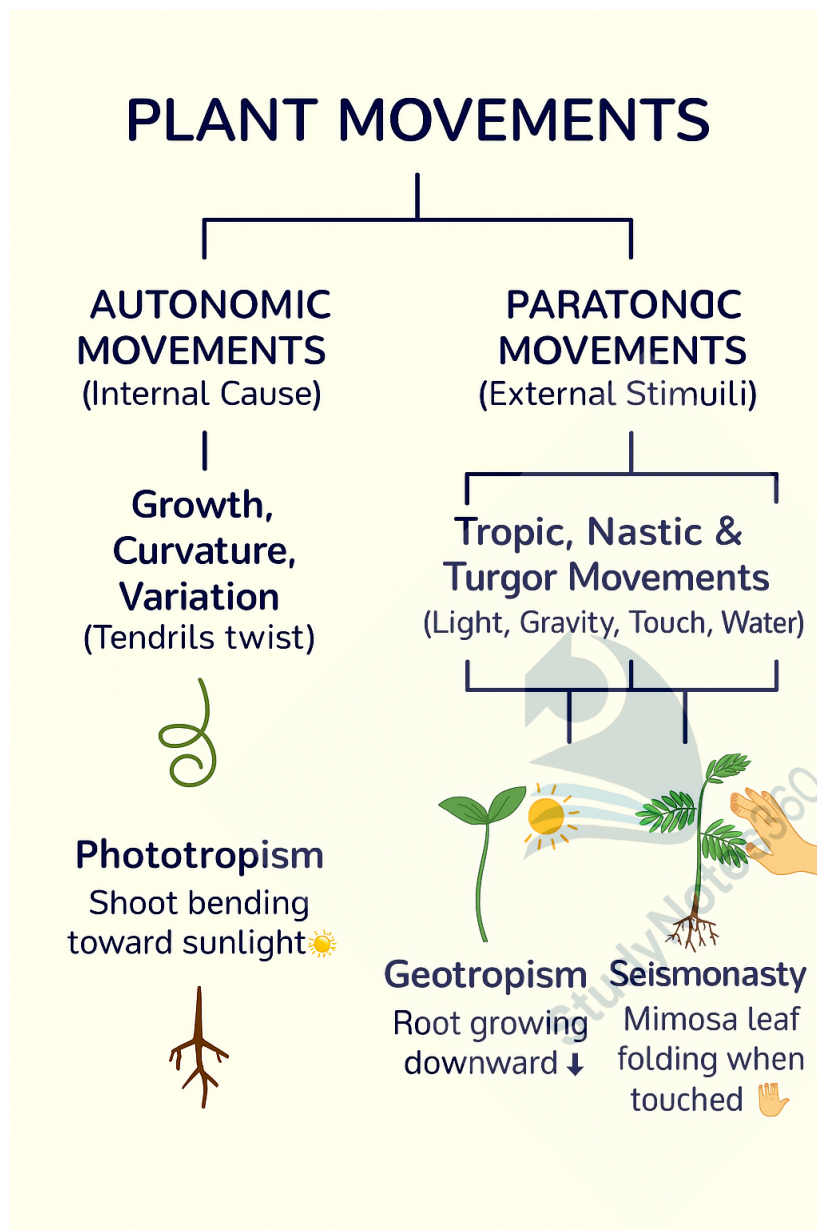
#### ✨ Q2: Explain different types of plant movements with examples

##### ❖ Introduction:

Plants, though fixed in one place, are not motionless. They can show movements in response to various internal and external factors. These movements help plants adjust to their surroundings, obtain sunlight, absorb water, and protect themselves from harm. Plant movements occur mainly due to growth or turgor pressure changes within their cells.

##### 🌱 Definition:

- Plant movement is the change in the position of any part of a plant in response to internal or external stimuli.
- These movements are generally slow and take place in specific parts like stems, roots, flowers, or leaves.



## 🌱 Main Types of Plant Movements:

Plant movements are divided into two main categories:

### 1. Autonomic Movements (Spontaneous Movements)

---

## 2. Paratonic Movements (Induced Movements)

### 1. Autonomic Movements

- These movements occur spontaneously, without any external stimulus.
- They are caused by internal factors like growth or internal chemical changes within the plant body.

#### (a) Autonomic Growth Movement:

- This occurs when different parts of a plant grow at unequal rates, causing bending or twisting.

**Example:** Twisting of tendrils in climbing plants like pea and cucumber.

#### (b) Autonomic Curvature Movement:

- In some plants, different parts grow at different speeds, resulting in a natural curvature.
- Example: Curved growth of fern fronds during development.

#### (c) Autonomic Variation Movement:

- This occurs due to changes in turgor pressure (water pressure in cells).

**Example:** Telegraph plant (*Desmodium gyrans*) moves its leaflets up and down continuously due to turgor changes.

---

## 2. Paratonic Movements (Induced Movements)

- These movements occur in response to external stimuli like light, gravity, touch, temperature, or chemicals.
- They help plants to adapt and survive in their environment.

### (a) Tropic Movements:

- These are directional growth movements toward or away from the source of stimulus.
- They are permanent and depend on the direction of the stimulus.

**Phototropism:** Movement in response to light. Shoots bend toward light to absorb more sunlight.

**Geotropism:** Movement in response to gravity. Roots grow downward (positive geotropism), while shoots grow upward (negative geotropism).

**Hydrotropism:** Movement in response to water. Roots grow toward moisture in the soil.

**Thigmotropism:** Movement in response to touch. Tendrils coil around any nearby support.

**Chemotropism:** Movement in response to chemicals. Pollen tube grows toward ovule during fertilization.

### (b) Nastic Movements:

- These movements are non-directional and occur due to external stimuli, but their direction does not depend on the direction of the stimulus.
- They usually occur due to changes in turgor pressure in special cells.

**Photonasty:** Movement in response to light, such as flowers opening in the morning and closing at night.

**Thermonasty:** Movement in response to temperature, such as tulip flowers opening in warm weather.

**Seismonasty:** Movement in response to touch, such as folding of leaves in *Mimosa pudica* when touched.

### (c) Turgor Movements:

- These movements are caused by increase or decrease in water pressure within cells.
- When a plant part loses water, it becomes flaccid and moves.

**Example:** *Mimosa pudica* folds its leaves rapidly when touched due to loss of turgor pressure in the pulvinus cells.

### Importance of Plant Movements:

- Help plants to adapt and survive in changing environments.
- Assist in pollination and seed dispersal.
- Protect plants from injury and stress.
- Allow plants to maximize light absorption for photosynthesis.

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☀️ **Q3: What are biological clocks and circadian rhythms? Explain their importance in plants.**

❖ **Introduction:**

- All living organisms, including plants, animals, and even microorganisms, show certain regular and rhythmic activities.
- These rhythmic activities occur in a fixed time pattern such as daily, monthly, or yearly cycles.
- These time-based regularities are controlled by biological clocks, which help organisms to stay synchronized with their environment.

🕒 **Definition of Biological Clocks:**

- A biological clock is an internal timing mechanism present in living organisms that controls various physiological, biochemical, and behavioral activities according to specific time intervals.
- It enables organisms to perform certain functions at particular times of the day or year, even without external cues.

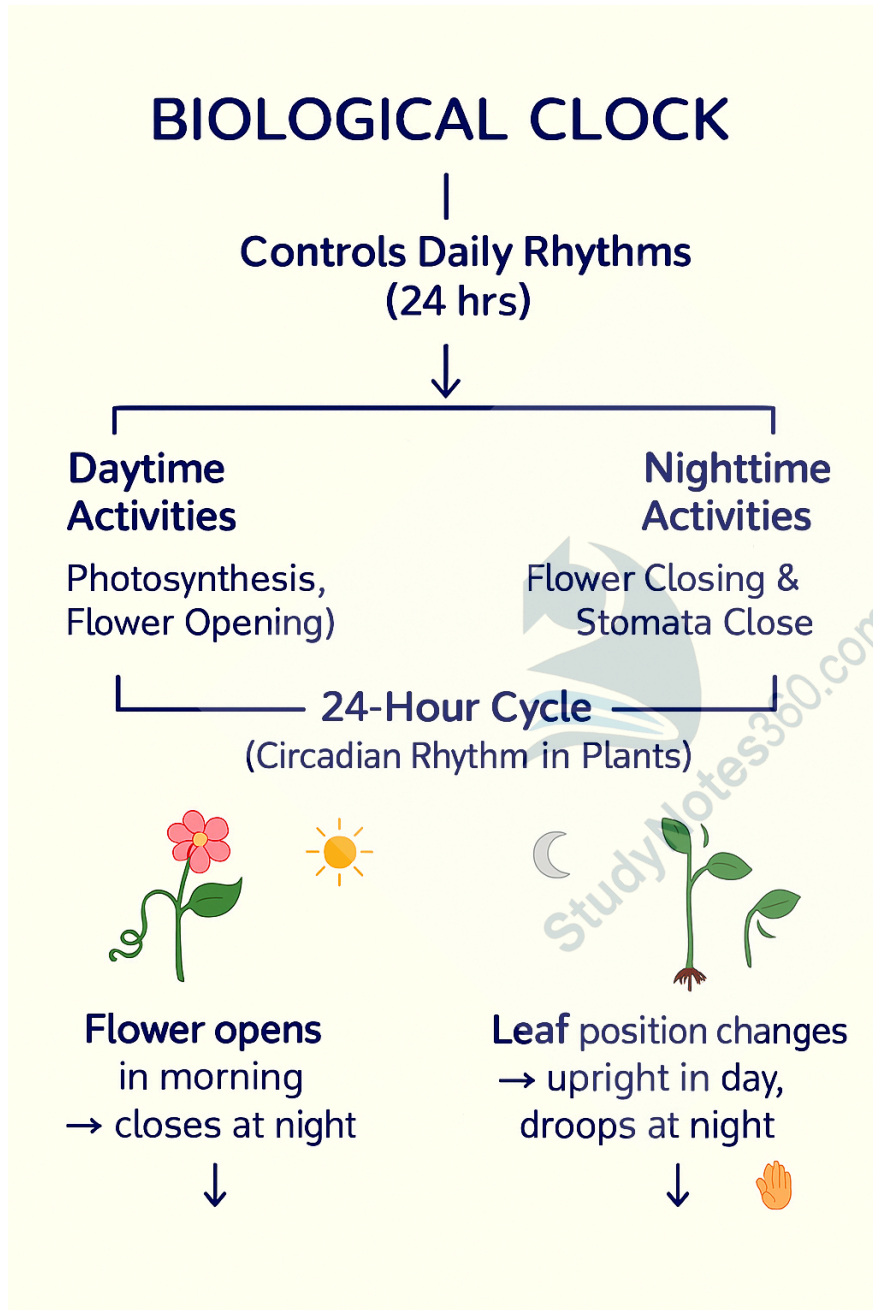
**In simple words:**

Biological clocks are internal timekeepers that regulate the timing of life processes.

☀️ **Definition of Circadian Rhythms:**

- The term circadian comes from Latin words circa (about) and dies (day), meaning “about a day.”
- Therefore, circadian rhythms are biological activities that repeat approximately every 24 hours.

- These rhythms continue even in constant environmental conditions, indicating that they are controlled internally by biological clocks.



### 🌱 Examples of Circadian Rhythms in Plants:

1. Opening and closing of flowers at specific times of the day.

- 
2. Leaf movements (rising and falling) in *Mimosa pudica* or bean plants that follow day-night cycles.
  3. Photosynthesis rate increases during the day and decreases at night.
  4. Stomata opening during the day and closing at night.
  5. Growth rate of shoots and roots changing with time of day.

### **Causes of Biological Rhythms:**

Biological rhythms may be influenced by both internal and external factors.

#### **1. Internal (Endogenous) Control:**

- Controlled by genetic and biochemical mechanisms within the organism.
- The rhythm continues even in the absence of light or temperature changes.

#### **2. External (Exogenous) Control:**

- Affected by environmental factors such as light, temperature, day length, and seasons.
- These factors reset or synchronize the internal biological clock with the environment.

#### **3. Combination of Both:**

- 
- In most plants, the rhythm is mainly genetic, but the environment fine-tunes it.

## **Importance of Biological Clocks and Circadian Rhythms in Plants:**

### **1. Regulation of Daily Activities:**

- Help plants to regulate periodic activities like photosynthesis, respiration, and hormone release.

### **2. Efficient Use of Energy:**

- Enable plants to perform certain processes only when most beneficial – e.g., photosynthesis during daylight.

### **3. Synchronization with Environment:**

- Allow plants to adapt to regular environmental changes such as day and night.

### **4. Control of Flowering and Pollination:**

- Some flowers open or close at specific times, matching the activity time of their pollinators.

### **5. Regulation of Growth:**

- Growth hormones like auxins and gibberellins are released in a rhythmic pattern, controlling stem elongation and leaf movement.

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## 6. Adaptation and Survival:

- Biological clocks help plants to anticipate environmental changes and adjust accordingly, improving survival chances.

☀ **Q4: Define co-ordination in animals. Describe the two main types of co-ordination with examples.**

### ❖ Definition of Co-ordination:

- Co-ordination in animals is the process by which different organs and systems of the body work together in an organized way to perform various functions efficiently.
- It ensures that all parts of the body act harmoniously to produce a unified response to both internal and external changes.
- In simple words, co-ordination means the controlled integration of body activities so that the organism can respond properly to any stimulus.

### ◆ Importance of Co-ordination:

- Maintains balance and stability in body functions.
- Allows the body to respond quickly to external stimuli.
- Helps in communication between organs.
- Ensures proper working of all body systems like muscular, nervous, and endocrine systems.

### ⚙ **Main Types of Co-ordination in Animals:**

Co-ordination in higher animals is brought about by two main systems:

---

## 1. Nervous Co-ordination

## 2. Chemical (Hormonal) Co-ordination

### 1. Nervous Co-ordination:

#### Definition:

- Nervous co-ordination is achieved through specialized cells called neurons that form a network to connect receptors (which receive stimuli) and effectors (which perform responses).
- This system helps in quick, short-term, and specific responses like reflex actions, movement, or sensory perception.

#### Main Components of Nervous Co-ordination:

##### 1. Receptors:

These are sense organs or nerve endings that detect changes (stimuli) in the environment.

**Example:** Eyes (light), Ears (sound), Skin (touch).

##### 2. Neurons:

- These are nerve cells that transmit impulses from one part of the body to another.
- They connect receptors to the Central Nervous System (CNS) and then to effectors.

### 3. Effectors:

- These are muscles or glands that carry out the response when they receive impulses.
- **Example:** Muscles contract when you pull your hand away from a hot object.

### Example of Nervous Co-ordination:

When you touch a hot object:

- Receptors in your skin detect heat.
- Sensory neurons carry the impulse to the spinal cord.
- Motor neurons carry response signals to the muscles of the hand, which contract and pull the hand away.
- This entire process is a reflex action, an example of nervous co-ordination.

### 2. Chemical (Hormonal) Co-ordination:

#### Definition:

- Chemical co-ordination is carried out by hormones, which are chemical messengers secreted by endocrine glands.
- These hormones regulate and control the growth, metabolism, reproduction, and other long-term processes of the body.

#### Characteristics:

- Slow but long-lasting in action.

- Hormones are carried through the bloodstream to target organs.
- They maintain balance in body functions and support the nervous system.

### Examples of Chemical Co-ordination:

- Insulin secreted by the pancreas controls blood sugar level.
- Thyroxine from the thyroid gland regulates metabolism.
- Adrenaline from the adrenal gland prepares the body for “fight or flight” during emergencies.

### Comparison Between the Two Types:

- **Nervous** co-ordination acts rapidly and controls immediate responses.
- **Chemical** co-ordination acts slowly and maintains long-term regulation.
- Both systems work together to keep the body functions balanced.

 **Q5: Define nerve impulse. Describe in detail the mechanism of its transmission along a neuron.**

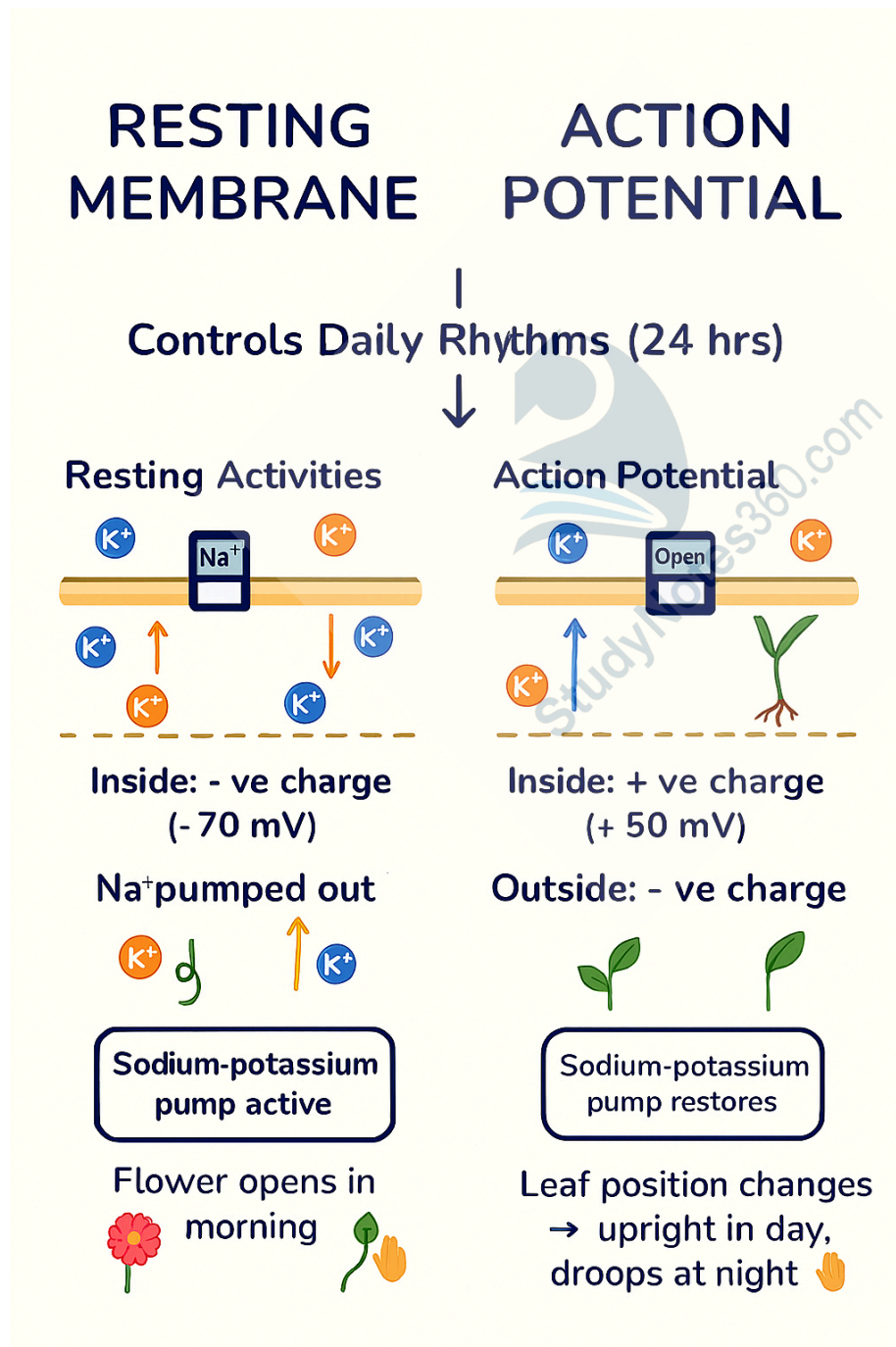
#### ◆ Definition of Nerve Impulse:

- A nerve impulse is a wave of electrochemical changes that travels along the length of a neuron.
- It involves movement of ions across the neuron's plasma membrane, leading to temporary changes in the electrical potential of the membrane.
- This impulse allows the neuron to transmit information from receptors to effectors quickly and efficiently.

#### Resting Membrane Potential:

A resting neuron is not conducting an impulse. At this stage:

- The inside of the neuron is more negative compared to the outside.
- The membrane potential is approximately  $-70$  mV.



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◆ **Factors maintaining resting potential:**

**1. Sodium ( $\text{Na}^+$ ) and Potassium ( $\text{K}^+$ ) ions:**

- $\text{Na}^+$  concentration is higher outside,  $\text{K}^+$  is higher inside.
- Sodium-potassium pump actively transports 3  $\text{Na}^+$  out and 2  $\text{K}^+$  in, using ATP, keeping the inside negative.

**2. Negative Organic Ions:**

- Proteins and other organic ions inside the neuron are negatively charged, contributing to negative resting potential.

**3.  $\text{K}^+$  Leakage:**

- Neuron membranes are slightly permeable to  $\text{K}^+$ , so some  $\text{K}^+$  diffuses out, increasing negativity inside.

◆ **Initiation of Nerve Impulse (Action Potential):**

- A threshold stimulus triggers the nerve impulse at one end of the neuron.
- This causes a brief reversal of charges across the membrane known as action potential.

**During action potential:**

- The inside becomes positive, and the outside becomes negative for a very short time (~1 millisecond).

## Mechanism of Transmission:

### 1. Depolarization:

- Sodium channels (sodium gates) open.
- $\text{Na}^+$  rushes into the neuron by diffusion.
- The inside becomes positive relative to outside.

### 2. Repolarization:

- Sodium gates close; potassium gates open.
- $\text{K}^+$  moves out of the neuron.
- Membrane potential returns toward negative inside (restoring polarity).

### 3. Restoration of Resting Potential:

- Sodium-potassium pump restores original ion concentrations.
- Neuron is ready for the next impulse.

## Propagation of Nerve Impulse:

- The action potential spreads along the length of the neuron.
- In myelinated neurons, the impulse jumps from one node of Ranvier to the next (saltatory conduction), speeding up transmission.
- Speed of nerve impulse:  $\sim 100$  m/s in humans (maximum recorded: 120 m/s).

 **Q6: What is action potential? Explain the process of depolarization and repolarization in nerve impulse transmission.**

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### ❖ Definition of Action Potential:

- An action potential is a temporary reversal of the electrical charges across the neuron membrane that occurs when a neuron is stimulated.
- During this, the inside of the neuron becomes positive relative to the outside for a brief moment.
- It allows the neuron to transmit impulses along its length.

### ⚡ Role of Threshold Stimulus:

- A minimum strength of stimulus, called threshold stimulus, is required to trigger an action potential.
- Stimuli weaker than this cannot generate an impulse.

### ⚙️ Process of Depolarization and Repolarization:

#### 1. Depolarization:

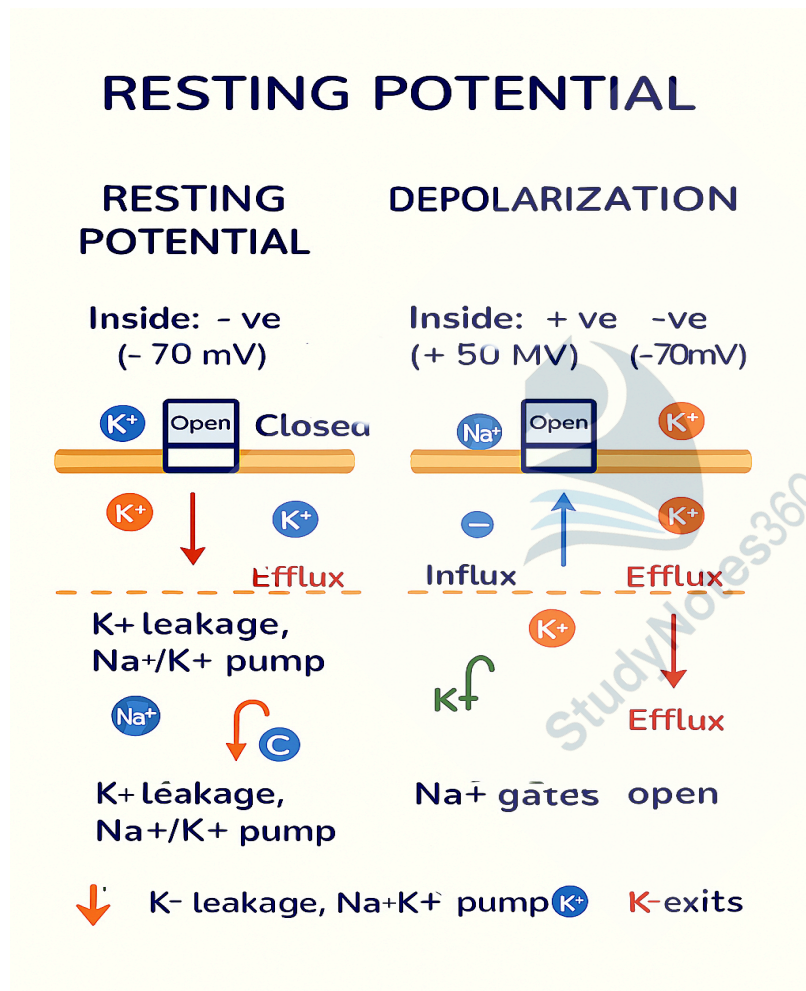
- Stimulus opens sodium gates in the membrane.
- $\text{Na}^+$  ions rush into the neuron by diffusion.
- The inside becomes positive compared to the outside.
- This is the active phase of the membrane.

#### 2. Repolarization:

- Sodium gates close; potassium gates open.
- $\text{K}^+$  ions move out of the neuron.
- The inside becomes negative again, restoring polarity.

### 3. Restoration of Resting Potential:

- Sodium-potassium pump restores the original  $\text{Na}^+/\text{K}^+$  concentrations.
- The neuron is ready to conduct the next impulse.



#### ⌚ Duration:

Depolarization and repolarization are extremely rapid, occurring in 2–3 milliseconds.

---

☀ **Q7: Describe the role of sodium and potassium ions in the generation and conduction of nerve impulse.**

❖ **Introduction:**

The generation and conduction of nerve impulses depend mainly on the movement of sodium ( $\text{Na}^+$ ) and potassium ( $\text{K}^+$ ) ions across the neuron membrane.

⚡ **Role of  $\text{Na}^+$  and  $\text{K}^+$  Ions:**

**1.  $\text{Na}^+/\text{K}^+$  Concentration Gradient:**

- $\text{Na}^+$  is higher outside,  $\text{K}^+$  is higher inside.
- This gradient is essential for establishing resting potential.

**2. Active Transport ( $\text{Na}^+-\text{K}^+$  Pump):**

- Pump uses ATP to move 3  $\text{Na}^+$  out and 2  $\text{K}^+$  in against their concentration gradients.
- Maintains negative resting potential inside neuron.

**3. Depolarization ( $\text{Na}^+$  Entry):**

- During action potential, sodium gates open.
- $\text{Na}^+$  rushes in, making the inside of the neuron positive.
- Initiates nerve impulse transmission.

**4. Repolarization ( $\text{K}^+$  Exit):**

- Potassium gates open, and  $K^+$  moves out.
- Restores negative inside and positive outside.

## 5. Restoration of Resting Potential:

- Sodium-potassium pump restores the original ion balance.
- Neuron is ready for another impulse.

### ⚡ Effect of Ionic Movement on Membrane Charge:

- $Na^+$  influx → depolarization → inside positive
- $K^+$  efflux → repolarization → inside negative
- This sequential ion movement creates the electrochemical wave known as nerve impulse.

☀ **Q8: Describe the evolution of the nervous system in animals. Compare the nervous systems of Hydra, Planaria, and humans.**

❖ **Answer:**

### 1. Diffused Nervous System (Hydra)

Found in Cnidarians like Hydra and jellyfish.

- **Lifestyle:** Sedentary; dangers can come from any direction.
- **Structure:** Network of neurons between ectoderm and endoderm.

**Characteristics:**

- No head, brain, or centralized nerve cords.
- Neurons not differentiated into sensory, motor, or associative types.
- No specialized sense organs; some nerve cells more sensitive to stimuli.
- **Response:** Whole body responds as a unit; tentacles respond faster to stimuli.

## 2. Centralized Nervous System (Planaria)

More advanced than Hydra.

### Structure:

- Bilobed anterior ganglia acts as “brain”.
- **Differentiation of neurons:** sensory, associative, and motor neurons.
- Longitudinal and lateral nerve cords; superficial and deep nerve plexuses.
- **Sensory Organs:** Eyes and chemoreceptors; pressure-sensitive receptor cells.

### Advantages over Hydra:

- Better coordination due to centralized processing.
- Specialized neurons allow directed responses.

## 3. Centralized Nervous System (Humans)

Highly advanced and well-developed.

### Structure:

- **CNS:** Brain and spinal cord.
- **PNS:** Cranial and spinal nerves connecting CNS with body.

### Features:

- Highly specialized neurons.
- Complex sensory organs and association areas for memory, thinking, and emotions.
- **Advantage:** Enables complex behaviors, voluntary and involuntary control, learning, and adaptation.

☀ **Q9: Explain the structure and functions of the human brain.**

❖ **Answer:**

### 1. Forebrain

#### Cerebrum:

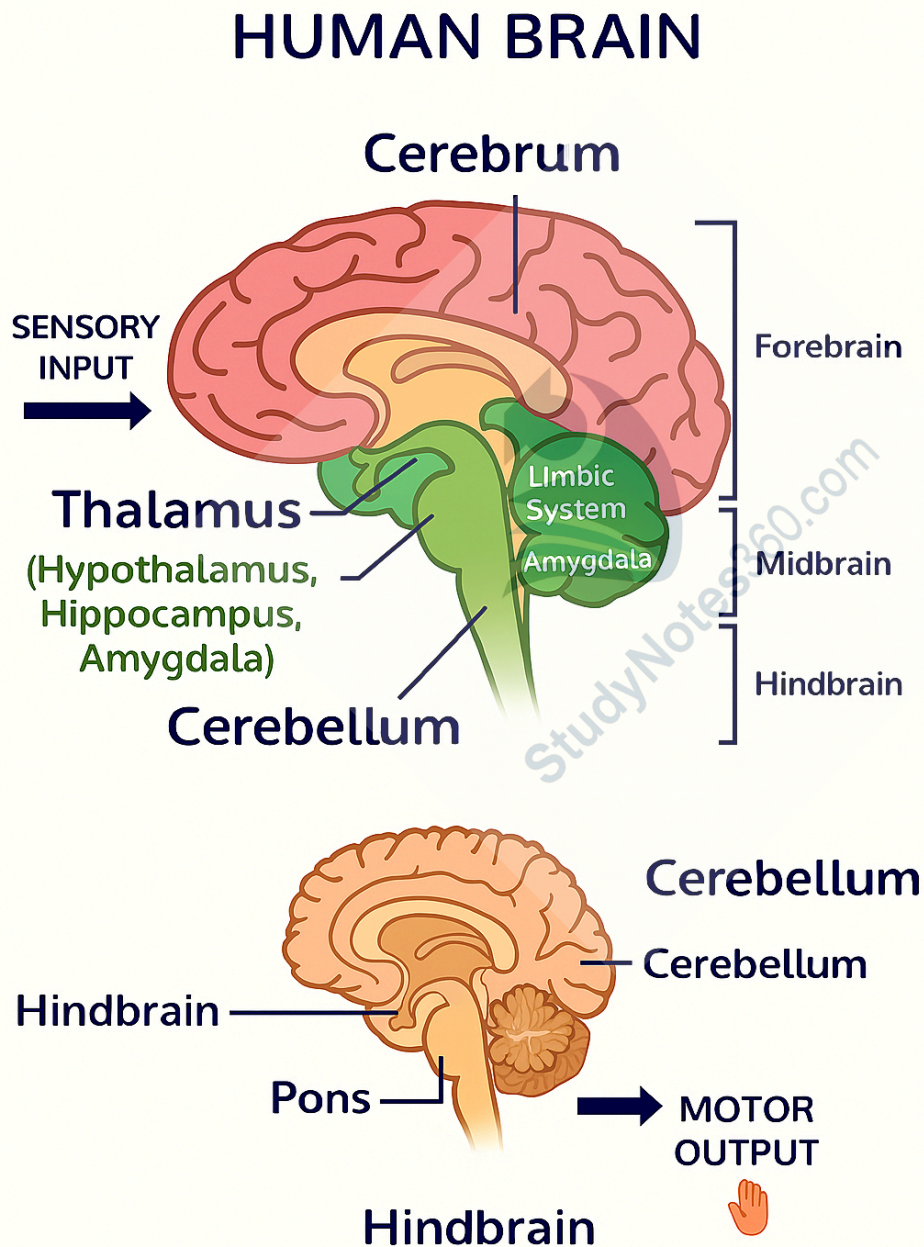
- Largest part, divided into left and right hemispheres.
- **Cerebral cortex:** outer folded layer; responsible for thinking, reasoning, voluntary movements, sensory interpretation, and speech.
- **Corpus callosum:** connects two hemispheres.

#### Thalamus:

- Relays sensory information to cerebrum and limbic system.

#### Limbic System:

- Includes hypothalamus, amygdala, hippocampus.
- Controls emotions, basic drives (hunger, thirst, fear, rage), hormonal coordination, body temperature, and memory formation.



## 2. Midbrain

- Small in humans.
- Contains auditory relay centers and controls reflex movements of eyes.
- Contains reticular formation, which filters and prioritizes sensory information before it reaches higher brain centers.

## 3. Hindbrain

- **Cerebellum:** Coordinates body movements, posture, balance, and stores motor learning.
- **Pons:** Connects medulla with higher brain; influences sleep-wake cycles and breathing patterns.
- **Medulla oblongata:** Controls involuntary functions such as breathing, heart rate, blood pressure, and swallowing.

## 4. Key Features

- **Protection:** Skull, vertebral column, meninges, cerebrospinal fluid.

### Functional Specialization:

- Sensory areas receive input.
- Association areas process and interpret.
- Motor areas send commands to muscles.

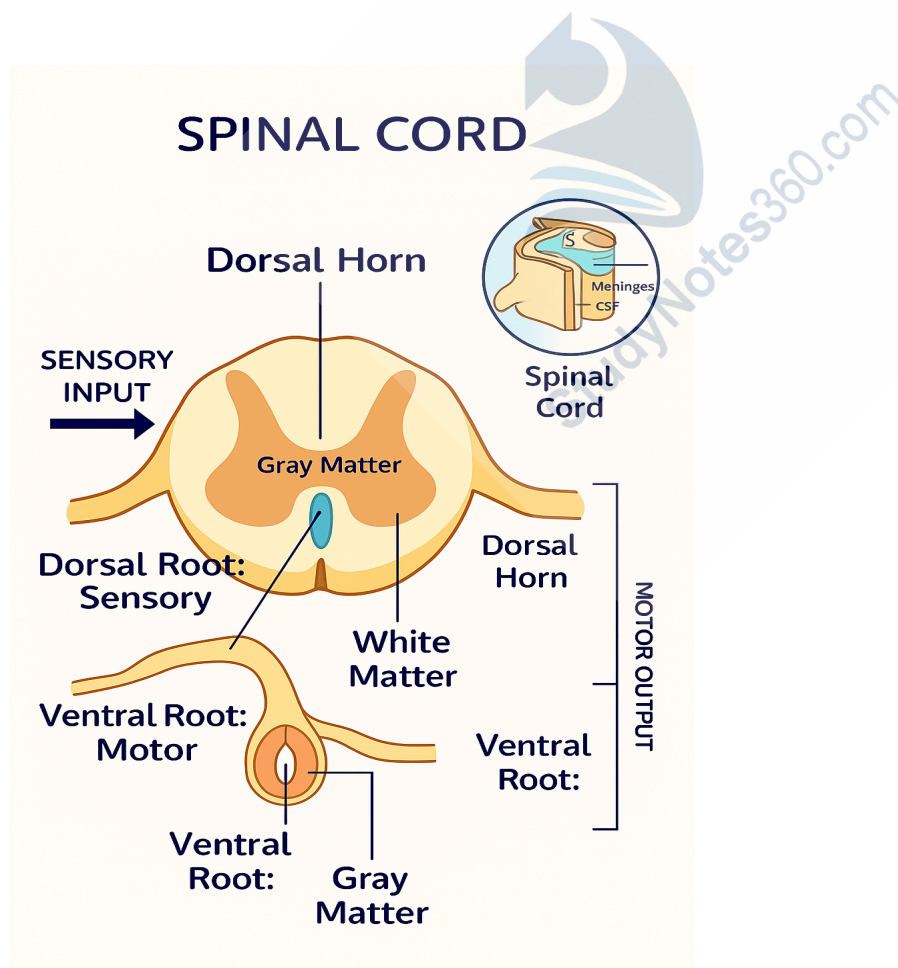
### Hemispheric Control:

- Left hemisphere controls right body side; right hemisphere controls left body side.

☀ Q10: Describe the structure and functions of the human spinal cord.

❖ Definition:

The spinal cord is a cylindrical, hollow structure of the central nervous system (CNS) that extends from the medulla oblongata down the vertebral column. It conducts impulses between the brain and the body and serves as the center for many reflex actions.



## 1. Structure of the Spinal Cord

### Protection:

- Enclosed in the vertebral column.
- Covered by meninges (dura mater, arachnoid mater, pia mater).
- Bathed in cerebrospinal fluid (CSF) for cushioning.

### Hollow Cylinder:

- Contains central canal, filled with CSF.

### Gray Matter:

- Butterfly-shaped or H-shaped in cross-section.
- **Composed of:** neuron cell bodies, dendrites, and unmyelinated fibers.

### Forms dorsal and ventral horns:

- **Dorsal horn:** Receives sensory input from body.
- **Ventral horn:** Sends motor output to muscles.

### White Matter:

- Surrounds gray matter.
- Composed of myelinated nerve fibers (tracts).
- Tracts carry sensory information to the brain and motor commands from the brain.

---

## 2. Functions of the Spinal Cord

### 1. Conduction of Impulses:

- Connects brain with the peripheral nervous system (PNS).
- Sensory neurons → CNS → Motor neurons.

### 2. Reflex Actions:

- Acts as a center for automatic, rapid responses to stimuli without involving the brain.

**Examples:** Knee-jerk reflex, withdrawal from pain.

### 3. Coordination:

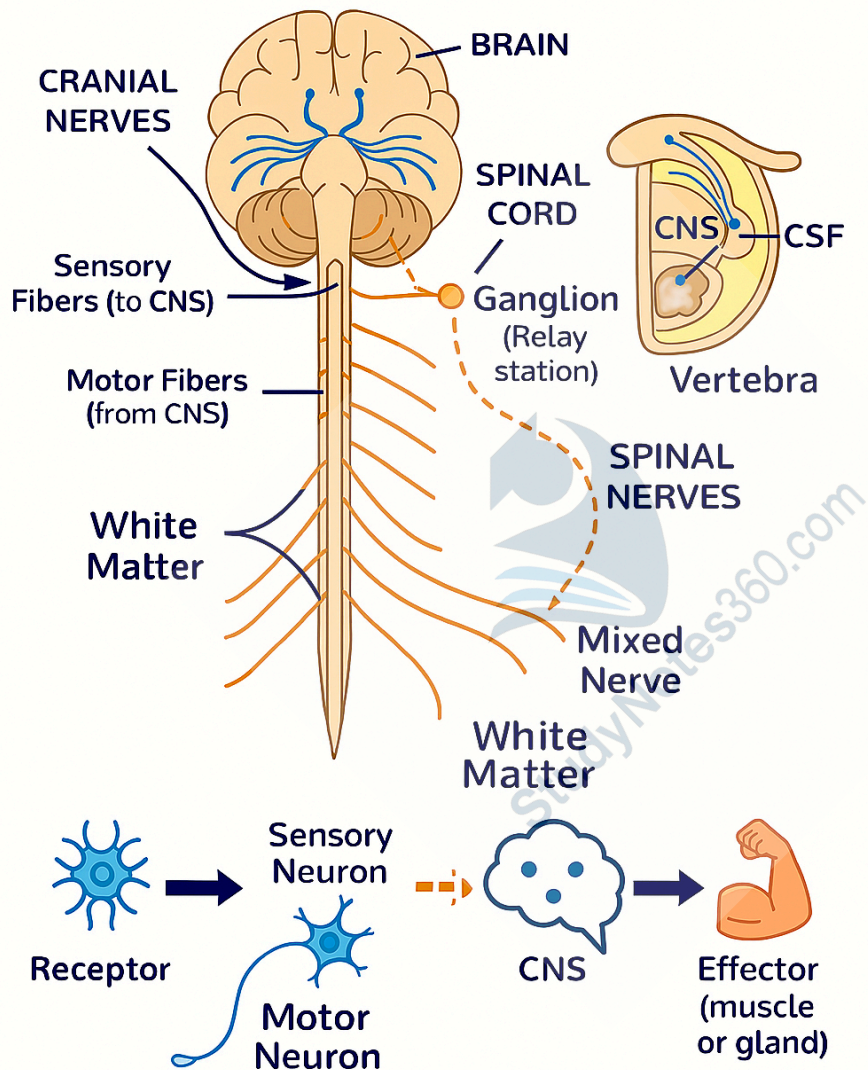
- Integrates information from different parts of the body.
- Controls simple motor patterns and supports voluntary movements.

★ **Q11: Explain the organization and functions of the Peripheral Nervous System (PNS).**

❖ **Definition:**

The Peripheral Nervous System (PNS) is the part of the nervous system outside the brain and spinal cord. It links the central nervous system (CNS) with sensory organs, muscles, and glands, enabling the body to respond to internal and external stimuli.

# PERIPHERAL NERVOUS SYSTEM



## 1. Organization of PNS

### 1. Neurons

### Sensory (afferent) neurons:

- Carry impulses from receptors (skin, eyes, ears, etc.) toward the CNS.
- Responsible for detecting stimuli like touch, pain, temperature, light, and sound.

### Motor (efferent) neurons:

- Carry impulses from CNS to effectors (muscles and glands).
- Responsible for movement and secretion.

### Mixed neurons:

- Contain both sensory and motor fibers.
- Can transmit impulses in both directions.

## 2. Cranial Nerves

- 12 pairs arise from the brain.

**Types:** sensory, motor, or mixed.

### Examples:

- Optic nerve (sensory) → vision
- Facial nerve (mixed) → facial muscles & taste

## 3. Spinal Nerves

- 
- 31 pairs arise from the spinal cord.
  - All are mixed nerves containing sensory and motor fibers.
  - Transmit impulses between CNS and limbs or body parts.

#### 4. Ganglia

- Clusters of neuron cell bodies outside the CNS.
- Serve as relay stations, processing and transmitting impulses to the correct pathways.

### 2. Functions of the PNS

#### 1. Transmission of Sensory Information:

- Receptors detect environmental and internal stimuli.
- Sensory neurons carry the information to CNS for processing.

#### 2. Transmission of Motor Commands:

- CNS processes information and sends instructions to muscles or glands.
- Motor neurons enable movement, gland secretion, and reflex responses.

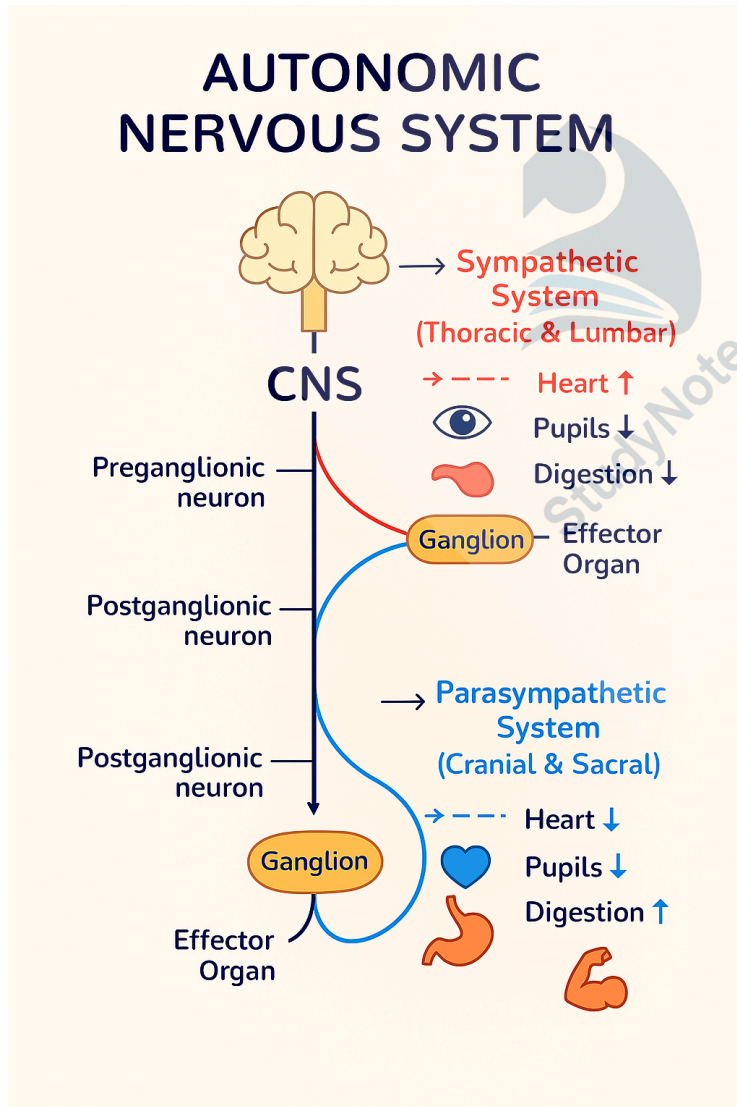
#### 3. Coordination of Body Functions:

- PNS works with CNS to coordinate voluntary and involuntary actions.
- Ensures smooth communication between the brain, spinal cord, and body.

## ☀ Q12: Describe the Autonomic Nervous System (ANS) and its divisions

### ❖ Definition:

The Autonomic Nervous System (ANS) is a part of the Peripheral Nervous System (PNS) that controls involuntary actions of internal organs, smooth muscles, and glands. It maintains homeostasis and regulates bodily functions without conscious control.



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## 1. Structure of ANS

- ANS consists of motor neurons connecting the CNS to internal organs.

### Each nerve impulse involves:

1. Preganglionic neuron → from CNS to ganglion
2. Postganglionic neuron → from ganglion to effector organ

Functions automatically, unlike the somatic nervous system.

## 2. Divisions of ANS

### A) Sympathetic Nervous System

- **Function:** Prepares body for emergencies or stressful situations (“fight or flight”).
- **Origin:** Thoracic and lumbar regions of spinal cord.

### Key Actions:

- Increases heart rate
- Dilates pupils
- Relaxes airways
- Inhibits digestion
- Stimulates adrenaline secretion

**Examples:** Running from danger, sudden fear, heavy exercise

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## B) Parasympathetic Nervous System

- **Function:** Promotes resting and maintenance functions (“rest and digest”).
- **Origin:** Cranial nerves (e.g., vagus nerve) and sacral region of spinal cord.

### Key Actions:

- Slows heart rate
- Constricts pupils
- Stimulates digestion
- Promotes energy storage and tissue repair

**Examples:** Sleeping, relaxing, digesting food

## 3. Key Features

Sympathetic and parasympathetic systems usually act antagonistically.

- **Sympathetic:** Excites body for action
- **Parasympathetic:** Calms body for recovery

Ensures balance and stability in physiological functions.

🌟 **Q13: Define instincts. Explain Darwin’s concept of instincts in animals.**

❖ **Definition of Instincts:**

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Instincts are inborn, inherited patterns of behaviour in animals that enable them to respond to specific stimuli in a species-specific manner. These behaviours are automatic, not learned, and equip animals with the ability to survive and reproduce in their environment.

◆ **Darwin's Concept of Instincts (1859):**

- Darwin proposed that instincts are complex reflexes made up of smaller units compatible with inheritance mechanisms.
- He considered instincts as a product of natural selection, evolving along with other aspects of an animal's life.

**According to Darwin:**

1. Instinctive behaviours are inherited and form part of an animal's genetic structure.
2. The responses to specific stimuli are similar across members of a species.
3. Instincts equip animals with basic survival abilities like walking, running, feeding, and moving.

**Role in Adaptation and Survival:**

- Instincts enable animals to adapt to their environment without prior experience.
- They are especially important for animals with short life spans or minimal parental care.

**Example:**

- A female digger wasp instinctively prepares a nest, hunts and kills caterpillars, lays eggs on them, and closes the nest.
- The larvae, after hatching, feed on the stored prey and grow into adult wasps.
- This series of instinctive actions ensures survival without learning from the mother.

**Key Points:**

- Instinctive behaviour is species-specific.
- It does not require learning or prior experience.
- Provides quick and effective responses to stimuli for survival.
- Forms the foundation for further learning in higher animals.

**Note:**

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

**Author: Muhammad Asghar**

**Purpose:** To contribute to education by offering insightful, valuable content that enhances learning and understanding.

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