

# CONTROL AND COORDINATION

## 1. INTRODUCTION ::

Control and co-ordination is essential in maintaining a stage of stability and a steady state between the internal conditions of an organism and the external environment.

In animals control and coordination takes place by neural control as well as chemical control while in plants it takes place by chemical control only.

## 2. PLANT HORMONES ::

### 2.1 Auxins

Auxins take part in a number of plants processes. Some are as follow :

- Auxin Promote apical daninance.
- Auxin participates in molecular reaction
- Affects osmotic pressure by increasing solutes
- Affects enzyme action
- Affects nucleic acid activities
- Stimulates respiration
- Promotes root formation
- Helps in inhibition of leaf and fruit abscission

### 2.2 Gibberellins :

- These hormones were first identified in studies of a disease of rice in Japan, the bakanal (foolish seedling) disease caused by *Gibberella fujikuroi*.
- These are second important growth hormones found in plants. Normally gibberellins causes increased growth, especially in height of stem. So gibberelline are defined as the growth hormones which causes cell elongations.

### 2.3 Cytokinins :

- Cytokinins are defined as compounds having a highly specific hydrophilic group or adenine and one nonspecific lipophilic group.
- Name of some cytokinins are :-
- Kinetin, dihydrozeation, methylthiozeation and riboxylzeatin.

### 2.4 Abscisc Acid (ABA) :

- Acts as growth inhibitor and induces dormancy of buds towards the approach of winter.
- **Inhibition of cambium activity** - Towards the approach of winter, the activity of combium is inhibited due to the formation of abscisic acid.
- **Abscission** - Absciscic acid promotes discission of flowers and fruits.
- **Senescence** - It stimulates senescence of leaves.
- **Closure of stomata** - The normal causes closure of stomata (by inhibuiting  $K^+$  uptake).
- **Inhibition of germination** - Absciscic acid inhibits sprouting of cereal grains.

- **Resistance** - Absciscic acid increases resistance of plant to cold.
- **Flowering** - ABA delays flowering in long day plants.
- **Tubarization in potato** - ABA helps in tuber formation in potato.
- **Rooting** - ABA promotes not initiation in stem cutings of some plants e.g. Ivy, Poinsettia.

## 2.5 Ethylene ( $\text{CH}_2 = \text{CH}_2$ )

- Ethylene is a gaseous hormone which stimulates transverse growth but retards the longitudinal one.
- ❑ **Transverse growth** - Stimulates transverse growth sothat stem looks swollen.
- ❑ **Inhibition of geotropism** - Ethylene nullifies geotropism.
- ❑ **Fruit ripening** - Ethylene is a ripening agent, such fruits as apple, banana, mango, citrus etc, Ethylene is used for artificial ripening of these fruits.
- ❑ **Apical dominance** - Ethylene inhibits the growth lateral buds and thus cause apical dominance.
- ❑ **Root initiation** - In low concentration, ethylene stimulates root initiations.
- ❑ **Abscission** - Ethylene acclerates abscission of leaves, flowers and fruits.
- ❑ **Senescence** - Ethylene is associated with the process of senescence (ageing) of leaves and flowers.
- ❑ **Breaking of dormancy** - Ethylene breaks dormancy of storage organs

### 2.4.2 Uses of Ethylene :

- ❑ **Ripening of Fruits :**  
Ethylene lamps are used for colour development and ripening of certain flashy fruits (e.g.- apple, banana, mango etc)
- ❑ **Sprouting of Storage :**  
The sprouting of storage organs as rhizomes, corms, tubers can be enhanced by exposing them to ethylene.

## 3. NERVOUS SYSTEM ::

This system is the chief coordinating agency in animal body. Nervous system in man is composed of 3 main subdivision.

### 3.1 Central Nervous System (CNS) :

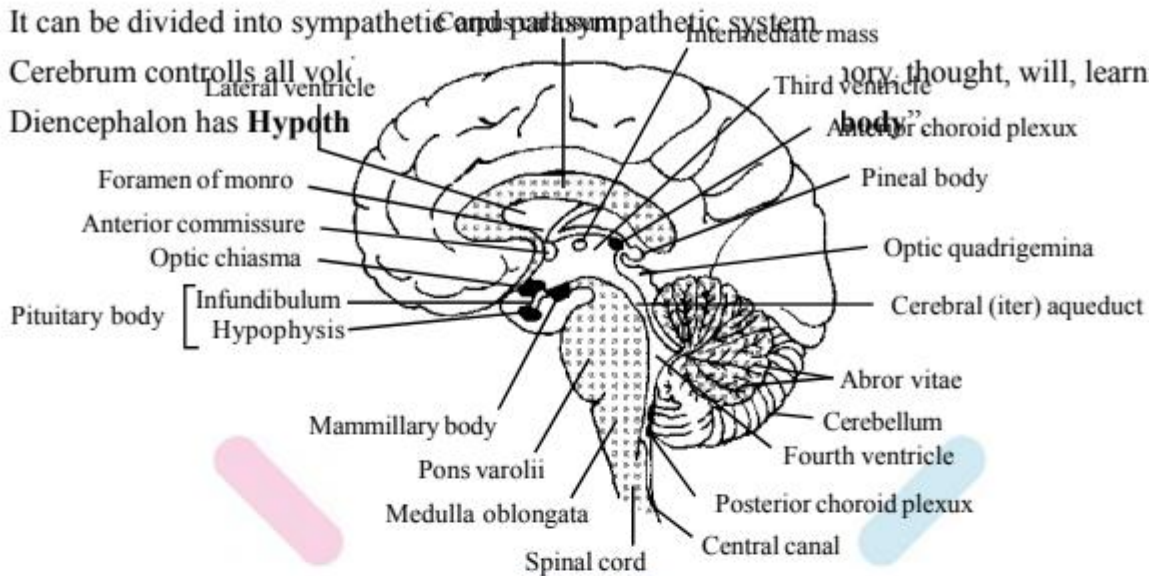
- Includes brain and spinal cord

### 3.2 Paripheral Nervous System (PNS) :

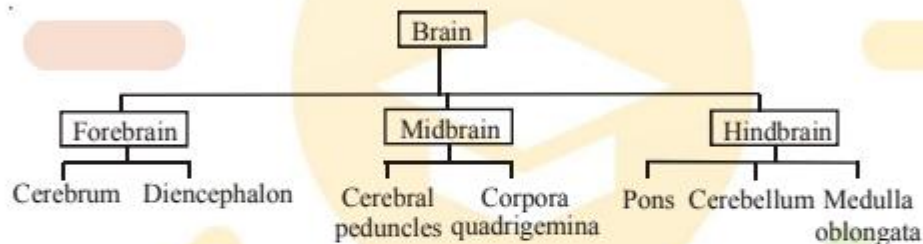
- It can be divided into sympathetic and parasympathetic system.

### 3.3 Autonomic Nervous System (ANS) :

- It can be divided into sympathetic and parasympathetic system.
- Cerebrum controls all voluntary thought, will, learning etc.
- Diencephalon has Hypothalamus.



**FIG. HUMAN BRAIN IN LATERAL SECTION, SHOWING INTERNAL DETAILS**



- Mid brain connects fore brain and hind brain.
- Cerebellum maintains equilibrium.
- Medulla has respiratory, cardiac and reflex centre.
- Cranial nerves are 12 pairs in humans.
- Spinal nerves are 31 pairs.
- Sympathetic ANA works in emergency conditions.
- Parasympathetic ANA works in routine conditions.

#### 4. REFLEX ACTION ::

- Reflex action is a elementary function discharged by the nervous system. A reflex may be defined as an immediate and rapid response given without our awarness by an effector organ on the arrival of some external or internal stimulus. Reflex may be of two types :

##### 4.1 Simple Reflex :

- It is an in born, inherited or unlearned response to a stimulus Ex. **Knee Jerk Reflex, Blinking Reflex.**

##### 4.2 Conditioned Reflex :

- It is the response acquired as a result of training or experience to a stimulus that originally failed to evoke the reaction. **Father is I.P. Pavlov**  
Ex. Writing, Drinving etc.

#### 5. ELECTRO-ENCEPHALOGRAM (EEG)

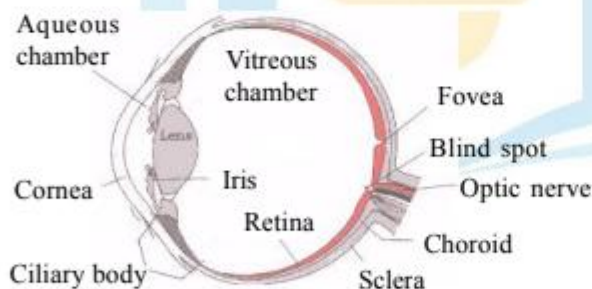
- It is a record of brain waves.

#### 6. SENSE ORGANS ::

Every organism has little or more awareness to the different factors of the environment mainly due to the presence of certain sensitive structures in the body called sense organs or receptors.

The sense organs are generally destined to receive only one kind of stimulus and not any other. The most common receptors are

- Photoreceptor** : **Eye**
- Phonoreceptor** : **Ear**
- Gustatoreceptor** : **Tongue**
- Tangoreceptor** : **Skin**
- Olfactoreceptor** : **Nose**



**FIGURE OF EYE**

##### 6.1 Defects of Vision :

- Myopia, Hypermetropia, colourblindness.
- Myopia :**
- It is also called long sightedness. Eyeball longer, focal point in front of retina, correction **concave lens.**

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**❑ Hypermetropia :**

- It is also called long sightedness, Eyeball shorter in anterior-posterior direction. Clearly see distant object, focal point behind retina, correction **convex lens**.
- Colour blindness (also called daltonism) is caused by the absence of one of these types of cones.
- Colour vision in man is **trichromatic**.
- Human beings, apes, monkeys, birds, lizards, turtles and some fishes possess colour vision.

**7. ENDOCRINE SYSTEM ::**

In humans the various physiological activities of the body are controlled by two main systems such as nervous and endocrine systems.

The endocrine glands (ductless) are pituitary, thyroid, parathyroid, adrenals, pineal and thymus etc.

**ENDOCRINE GLANDS, THEIR SECRETION AND EFFECT**

<i>Glands</i>	<i>Secretion</i>	<i>function</i>
<b>1. Pituitary</b>		
(A) Adenohypophysis (Anterior lobe)	(i) GH or STH	Controls growth
	(ii) TSH	Regulates secretion of thyroxine
	(iii) ACTH	Stimulates adrenal cortex to secrete its hormones
	(iv) FSH	Growth of ovarian folds in ovary spermatogenesis in males
	(v) ICSH or LH	Stimulates ovary to produce estrogen and testes to produce testosterone.
	(vi) Prolactin	Milk production
(B) Neuro hypophysis (Posterior lobe)	(i) Oxytocin	Controls uterine contraction during parturition stimulates lactation to increase milk ejection.
	(ii) Vasopressin (ADH)	Controls tubular reabsorption of water in DCT
(C) Hypothalamus	Releasing hormones Ex TSH-RH	Stimulate release of trophic hormones from anterior pituitary.
(D) Pancreas	Insulin	Decrease blood sugar
	Glucagon	Increase blood sugar

<b>Glands</b>	<b>Secretion</b>	<b>function</b>
<b>2. Thyroid</b>		
	(i) Thyroxine	Controls metabolism
	(ii) Thyrocalcitonin	Deposit calcium over bones.
<b>3. Parathyroid</b>	PTH	Maintain blood calcium
<b>4. Adrenal</b>		
(A) Cortex	Mineralocorticoid (Aldosterone)	Salt retention
(B) Medulla	Adrenaline	Emergency hormone
<b>5. Gonads</b>		
(A) Testis (Cells of leydig)	Androgens (Testosteron)	Controls spermatogenesis and development of secondary sexual charaters of males
(B) Ovaries		
(a) Graafian follicle	(i) Estrogen	Development of female sexual organs.
(b) Corpus luteum	(i) Progesterone	Maintain pregnancy
<b>6. Thymus</b>	Thymosin	Strenthens immune system
<b>7. Pineal</b>	Melatonin	Control skin colour.

**Effect of Hyper and Hyposecretion of Some Important Endocrine Glands and Disease Caused Due To Them.**

	<i>Gland and hormones</i>	<i>Hyper secretion</i>	<i>Hyposecretion</i>
1	Pituitary-G.H.	Gigantism in child. Acromegaly in adulthood	Dwarfism in child
2	Thyroid-Thyroxine	Exophthalmic goiter	Cretinism in young Myxedema in adults
3	Parathyroid - PTH	Decalcification of bones increase calcium level	Tetany - low calcium and high phosphatic levels
4	Pancreas Insulin	Decrease in blood glucose level	Increase in blood glucose level- hyperglycemia, diabetes mellitus
5	Adrenal, Adrenaline, Noradrenaline	Hypertension	Low blood pressure
6	<b>Gonads (ovaries)</b>		
	(i) Estrogen	Disturbs menstrual cycle	Menstrual cycle failure genital tracts ill-developed
	(ii) Progesterone		Pregnancy does not stand
	(iii) Androgens	Aggressive behavior	Secondary sexual characters fail to develop

## EXERCISE - 1

### A. VERY SHORT ANSWER TYPES QUESTIONS

- Q.1 Which plant hormone helps in overcoming genetic dwarfism ?
- Q.2 What is the full form of IAA ?
- Q.3 Give the number of cranial and spinal nerves in man ?
- Q.4 Give the full form of (i) NAA (ii) IBA.
- Q.5 Name the male and female sex hormones.
- Q.6 What causes gigantism ?

### B. SHORT ANSWER TYPES QUESTIONS

(About 30–40 words)

- Q.7 Give the role of testosterone. Mention its source also.
- Q.8 What is the role of estrogens in the female's body ? Where are they produced ?
- Q.9 Name two hormones secreted by the thyroid. Give their function ?

### C. LONG ANSWER TYPES QUESTIONS

(More than 60–70 words)

- Q.10 Write a brief account of abscisic acid.
- Q.11 Describe the role of thyroid gland in human body.
- Q.12 List the parts of brain and give their functions ?
- Q.13 What is reflex action. Give its significance ?

### D. FILL IN THE BLANKS

- Q.14 Aldosterone is produced by ..... Gland.
- Q.15 Deficiency of insulin causes ....., while that of ADH causes .....



- Q.16** Thyroid secretes two hormones : thyroxine and .....
- Q.17** Secretion of milk is stimulated by ....., while ejection of milk is stimulated by .....
- Q.18** Diabetes insipidus results from a deficiency of ....., while diabetes mellitus is caused by a deficiency of .....
- Q.19** Growth of female secondary sex organs is stimulated at puberty by ....., while growth of male secondary sex organs is stimulated by .....
- Q.20** ..... is a gaseous hormone and involved in abscission organs and acceleration of fruit ripening.

#### **E. TRUE OR FALSE**

- Q.21** The phenomenon of breaking of leaves and the fruits from the plant is known as abscission.
- Q.22** A growth regulator concerned with stimulation of cell division, nucleic acid metabolism is cytokinin.
- Q.23** Response of a plant to the changing relative length of the day and night is called phototropism.
- Q.24** All nerves arising from spinal cord are mixed.
- Q.25** Nerve impulses travel slower in a myelinated nerve fibre than in a non-myelinated nerve fibre.
- Q.26** The sympathetic nervous system accelerates the heart rate, while parasympathetic nervous system decreases the heart rate.

#### **F. SINGLE CHOICE QUESTIONS**

- Q.27** Select out the growth inhibitor–  
(A) IAA                      (B) GA  
(C) Auxins                  (D) Abscisic acid
- Q.28** The hormone found in the form of gas is–  
(A) Ethylene                (B) Zeatin  
(C) GA                        (D) IAA

**Q.29** The growth regulator that retards ageing of plant organ is—  
 (A) Absciscic acid (B) Auxin  
 (C) Cytokinin (D) Gibberellin

**Q.30** Conditioned reflex is—  
 (A) Salivation of mouth on seeing food  
 (B) Sneezing  
 (C) Closing of eyelid when an object comes near it  
 (D) None of these

**G. MATCH THE COLUMNS**

**Q.31** Match the items of column A with those of column B.

<b>Column - I</b>	<b>Column - II</b>
1. Parathyroid	a. Acromegaly
2. Growth hormone	b. Cretenism
3. Parathormone maturity	c. Regulates sexual maturity
4. Thyroxine	d. ADH
	e. Aldosterone
	f. Adrenaline
	g. Islets of Langerhans
	h. Cortisone
	i. Tetany
	j. MSH

**H. ASSERTION-REASON TYPE QUESTIONS**

The following questions consist of two statement each : assertion (A) and reason (R). To answer these questions, mark the correct alternative as described below :

- (a) If both A and R are true and R is the correct explanation of A.
- (b) If both A and R are true but R is not correct explanation of A.
- (c) If A is false but R is true.
- (d) If both A and R are false.

**Q.32** **A :** A tadpole deprived of thyroid gland fails to metamorphose into adult.  
**R :** Thyroxine stimulates tissue differentiation and, therefore, affects metamorphosis of tadpole into an adult frog.

**Q.33** **A :** The hormone FSH stimulates R.B.C. formation.  
**R :** On reaching the red bone marrow, FSH stimulates mitosis to increase RBC formation.

- Q.34** **A :** Insulin and glucagon have the antagonistic effects on the blood-glucose level.  
**R :** Insulin lowers the blood-glucose level by causing its storage in the liver and consumption in the tissues. Glucagon raises the blood-glucose level by converting liver glycogen into blood-glucose and changing amino acids and fats into glucose.
- Q.35** **A :** Thymus gland is prominent at birth but gradually atrophies in the adult.  
**R :** Thymus hormone named thymosin causes growth in early life by accelerating cells division.

## EXERCISE - 2

### A. SINGLE CHOICE QUESTIONS

- Q.1** Which one of the following pairs is correctly matched ?  
(A) Auxin–cell division  
(B) Gibberellin–internodal elongation  
(C) Cytokinin–fruit ripening (D) Ethylene–apical dominance
- Q.2** Senescence of detached leaves can be delayed by the use of -  
(A) Auxin (B) Gibberellin  
(C) Cytokinin (D) Ethylene
- Q.3** Which one of the following hormones causes dwarf beans to grow to the same height as tall varieties -  
(A) Auxin (B) Gibberellin  
(C) Cytokinin (D) Ethylene
- Q.4** Mobilisation of stored food in germinating seeds is triggered by -  
(A) Auxins (B) Cytokinins  
(C) Gibberellins (D) Ethylene
- Q.5** Which of the following hormone is concerned chiefly with root initiation ?  
(A) IBA (B) GA<sub>3</sub>  
(C) ABA (D) Kinetin
- Q.6** Which of the following is a hormonal disease -  
(A) Scurvy (B) Malaria  
(C) Diabetes (D) Tuberculosis
- Q.7** Diabetes mellitus is caused by deficiency of -  
(A) ADH (B) Adrenaline  
(C) Insulin (D) Prolactin
- Q.8** Which of the following is not an endocrine gland ?  
(A) Pituitary (B) Pancreas  
(C) Sebaceous (D) Thyroid

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**B. PASSAGE BASED QUESTIONS****PASSAGE 1 (Q.9 TO Q. 11)**

Brain is located in Cranium. It can be divided into 3 parts as fore brain, mid brain and hind brain each performing their functions.

**Q.9** What parts are included in fore brain. Give their functions ?

**Q.10** List parts of hind brain and state their functions ?

**Q.11** Give the number of nerves arising from brain in humans ?

# ANSWER

## EXERCISE -1

### A. VERY SHORT ANSWER TYPE QUESTION

1. Gibberlin
2. Indole acetic acid
3. 12 pairs and 31 pairs.
4. (i) Napthalene acetic acid  
(ii) Indole butyric acid
5. Testosteron, Estrogens
6. Hypersecretion of GH.

### D. FILL IN THE BLANKS

14. Adrenal cortex, Salt, Water
15. Diabetes mellitus, Diabetes incipidus
16. Calcitonin
17. Prolectin, Oxytocin
18. ADH, Insulin
15. Estrogen, Testosterone
20. Ethylene

### E. TRUE OR FALSE

21. True
22. True
23. False
24. True
25. False
26. True

### F. SINGLE CHOICE QUESTIONS

27. D
28. A
29. C
30. A

### G. MATCH THE COLUMNS

31. 1-i, 2-a, 3-i, 4-b

### H. ASSERTION & REASON TYPE

32. A
33. D
34. A
35. A

## EXERCISE -2

### A. SINGLE CHOICE QUESTIONS

- |      |      |      |
|------|------|------|
| 1. B | 2. C | 3. B |
| 4. C | 5. A | 6. C |
| 7. C | 8. C |      |

### B. PASSAGE BASED QUESTIONS

#### PASSAGE 1 (Q.9 TO Q. 11)

9. Cerebrum - Voluntary action.  
Diencephalon - Temperature regulation.
10. Cerebellum - Maintain equilibrium  
Medulla oblongta - Reflex, Cardiac & Respiratory centre.
11. Cranial nerves 12 pairs

