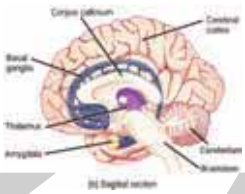
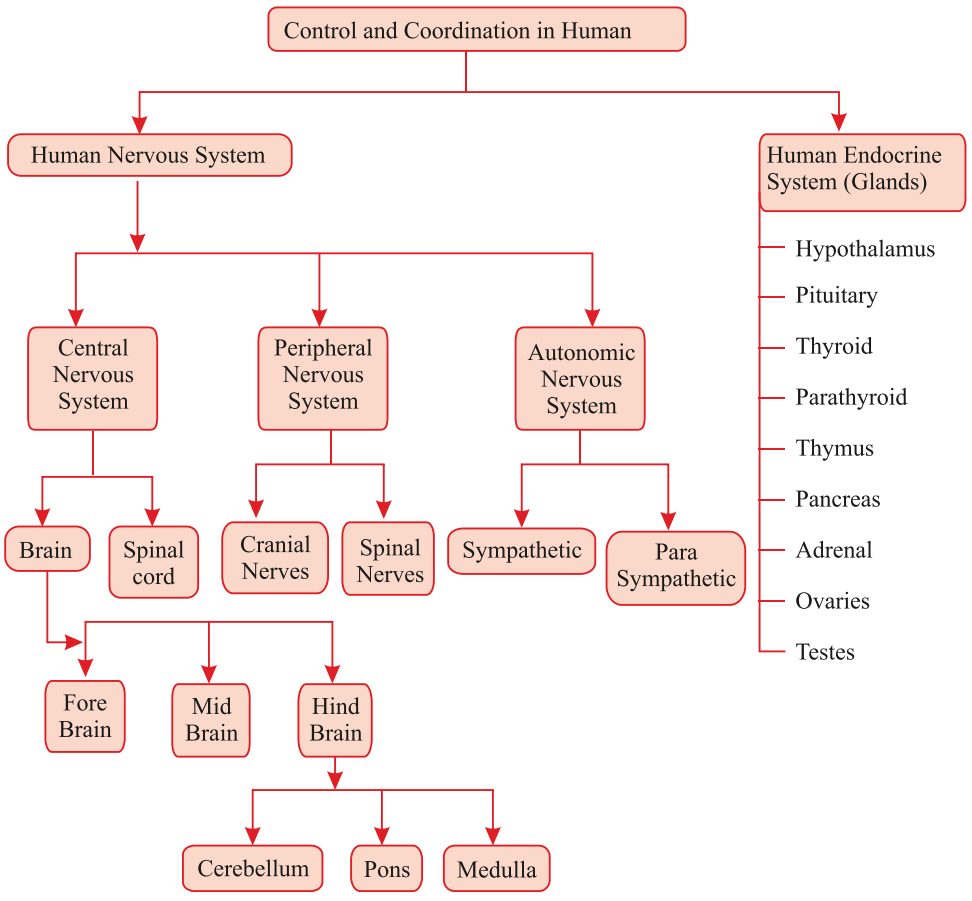
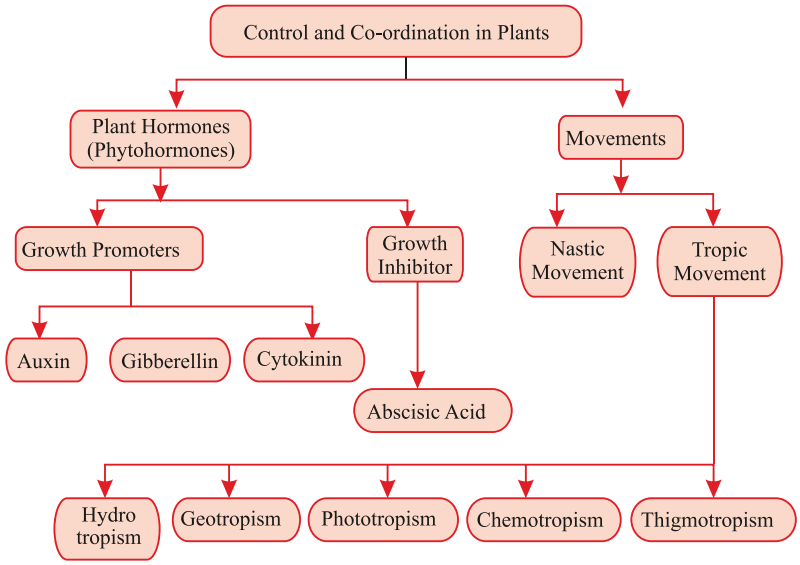


Chapter-6

Control And Coordination





- All the living organisms respond and react to changes in the environment around them.
- The changes in the environment to which the organisms respond and react are called stimuli such as light, heat, cold, sound, smell, touch etc.
- Both plants and animals respond to stimuli but in a different manner.

Control and Coordination in Animals

It is brought about in all animals with the help of two main systems :

(a) Nervous system

(b) Endocrine system

NERVOUS SYSTEM

- Control and coordination are provided by nervous and muscular tissues.
- Nervous tissue is made up of an organized network of nerve cells or neurons, and is specialized for conducting information via electrical impulses from one part of the body to another.

Receptors : Are specialized tips of some nerve cells that detect the information from the environment. These receptors are located in our sense organs.

(a) Ear :
- Phonoreceptors
- Hearing
- Balance of the body

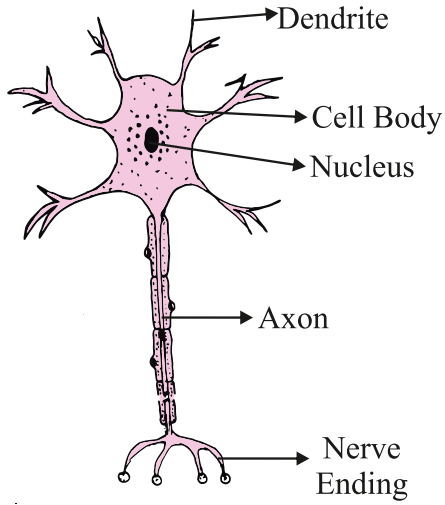
(b) Eyes :
- Photoreceptors
- Seeing

(c) Skin :
- Thigmoreceptors
- Heat or cold
- Touch

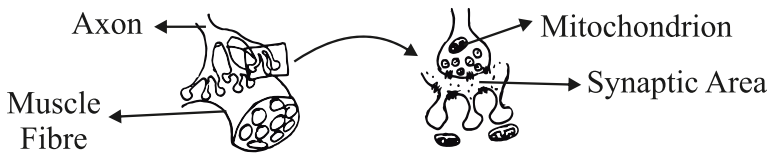
(d) Nose :
- Olfactory receptors
- Smell detection

(e) Tongue :
- Gustatory receptors
- Taste detection

Neuron : It is the structural and functional unit of nervous system.



(a) Structure of Neuron



(b) Neuromuscular Junction

Parts of Neuron :

(a) Dendrite : Acquires information.

(b) Cell body : Acquired information travels as an electrical impulse.

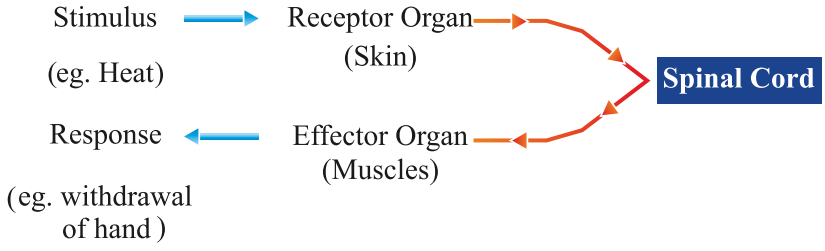
(c) Axon : Longest fibre on the cell body is called axon. It transmits electrical impulse from cell body to dendrite of next neuron.

Synapse : It is the gap between the nerve ending of one neuron and dendrite of the other neuron. Here electrical signal is converted into chemical signal for onward transmission.

REFLEX ACTION

Reflex action is quick, sudden and immediate response of the body to a stimulus. *E.g.,* Knee jerk, withdrawal of hand on touching hot object.

Reflex arc : The pathway through which nerve impulses pass during reflex action is called reflex arc.



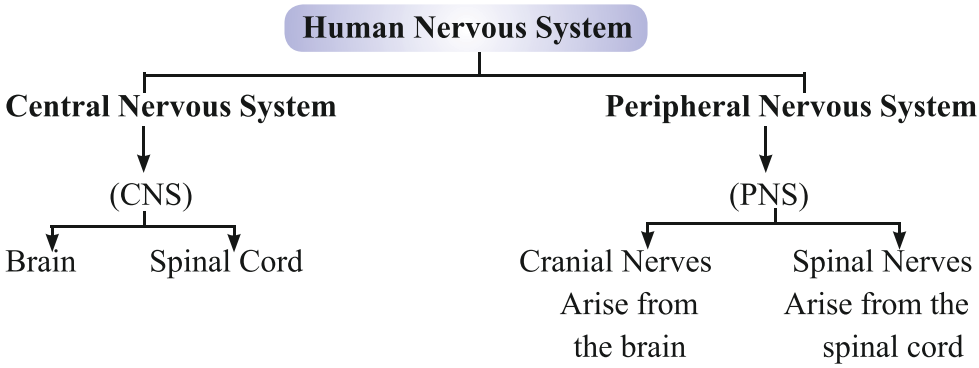
Response : Responses are of three main types :

(a) Voluntary : Controlled by fore brain. *E.g.,* talking, writing.

(b) Involuntary : Controlled by mid and hind brain. *E.g.,* heart beat, vomiting, respiration.

(c) Reflex action : Controlled by spinal cord. *E.g.,* withdrawal of hand on touching a hot object.

Need of Reflex Actions : In some situations such as touching a hot object, pinching etc. we need to act quickly, otherwise our body would be harmed. Here response is generated from spinal cord instead of brain.



HUMAN BRAIN

Brain is the main coordinating centre of the body. It has three major parts :

(a) Fore-brain (b) Mid-brain (c) Hind-brain

(a) Fore-brain : It is the most complex or specialized part of the brain. It consists of cerebrum.

Functions :

(i) Thinking part of the brain.

(ii) Controls the voluntary actions.

(iii) Stores information (Memory).

(iv) Receives sensory impulses from various parts of the body and integrates it.

(v) Centre associated with hunger.

(b) Mid-brain :

Controls involuntary actions such as :

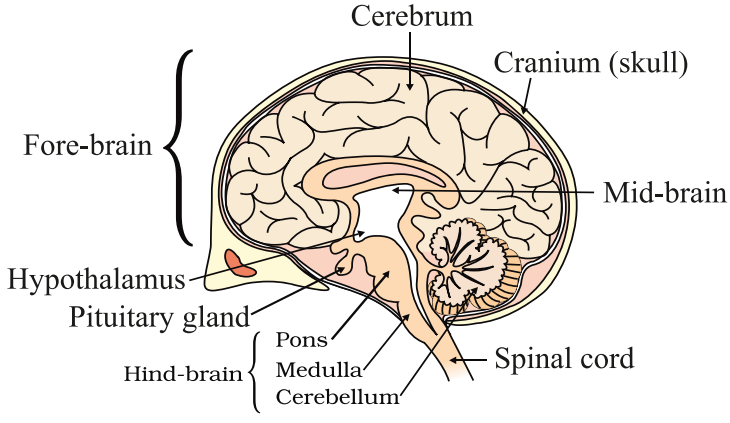
- Change in pupil size.
- Reflex movements of head, neck and trunk.

(c) Hind-brain : It has three parts :

(i) Cerebellum : Controls posture and balance. Precision of voluntary actions *e.g.,* picking pen.

(ii) Medulla : Controls involuntary actions *e.g.,* blood pressure, salivation, vomiting.

(iii) Pons : Involuntary actions *e.g.,* regulation of respiration.



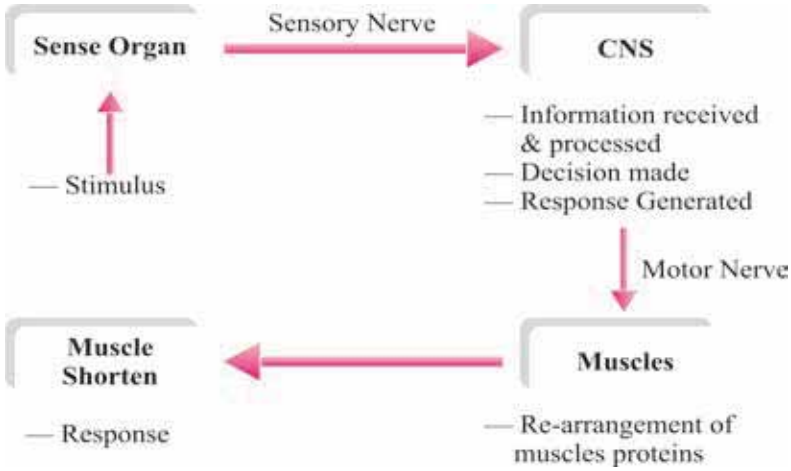
Human Brain

Protection of Brain and Spinal Cord

(a) Brain : Brain is protected by a fluid filled balloon which acts as shock absorber and is enclosed in cranium (skull or brain box).

(b) Spinal Cord : Spinal cord is enclosed in vertebral column.

Coordination between Nervous and Muscular Tissue



Limitations of Electric communication/Nervous system :

(a) Electric impulse will reach only to those cells that are connected by nervous tissue.

(b) After generation and transmission of an electrical impulse, the cell takes some time to reset its mechanism before transmitting another impulse. So cells cannot continually create and transmit impulse.

(c) Plants do not have any nervous system.

Chemical communication : To overcome the limitations of electric communication.

COORDINATION IN PLANTS

Movements in plants :

(i) Independent of growth

(ii) Dependent on growth

(i) Independent of growth : Immediate response to stimulus. (Nastic Movement)

- Plants use electrical-chemical means to convey information from cell to cell.
- For movement to happen, cells change their shape by changing the amount of water in them, resulting in swelling or shrinking of cells.

E.g., Drooping of leaves of 'Touch-me-not' plant on touching it.

(ii) Dependent on growth : These movements are tropic movements i.e., directional movements in response to stimulus.

- **Tendrils :** The part of tendril away from the object grows more rapidly as compared to the part near the object. This causes circulation of tendril around the object.
- Phototropism : Movement towards light, e.g. growth of a shoot towards light.
- Geotropism : Movement towards/away from gravity, e.g. growth of roots in soil
- Chemotropism : Movement towards/away from Chemical e.g. Growth of pollen tube towards ovule.
- Hydrotropism : Movement towards water. e.g. growth of a roots towards water

Plant Hormones : Are chemical compounds which help to coordinate growth, development and responses to the environment.

Main plant hormones are :

(a) Auxin :	• Synthesized at shoot tip
	• Helps the cells to grow longer
	• Involved in phototropism
(b) Gibberellin :	• Helps in the growth of the stem
(c) Cytokinins :	• Promotes cell division
	• Present in greater concentration in fruits and seeds
(d) Abscisic Acid :	• Inhibits growth
	• Cause wilting of leaves
	• Stress hormone

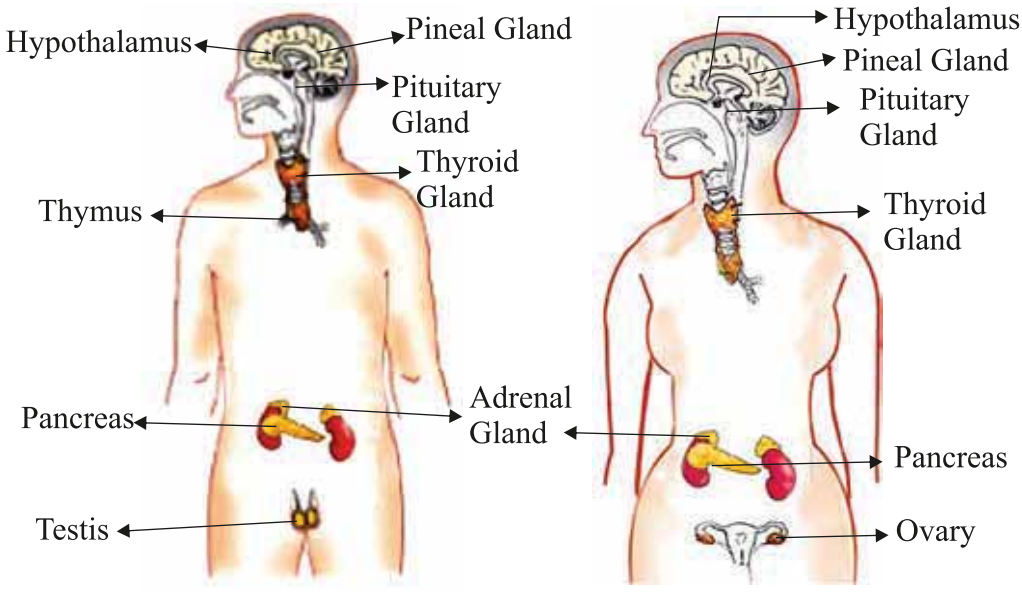
Hormones in Animals :

Hormones : Hormones are the chemical substances which coordinate the activities of living organisms and also their growth.

Endocrine glands : These glands secrete their product (hormone) into the blood.

Endocrine Gland, Hormones and their Functions

S. No.	Hormone	Endocrine Gland	Location	Functions
1.	Thyroxine	Thyroid	Neck/Throat region	Regulation of metabolism of carbohydrates, fats and proteins.
2.	Growth hormone	Pituitary (master gland)	Mid brain	Regulates growth and development.
3.	Adrenaline	Adrenal	Above both kidneys	Regulation (increasing) of blood pressure, heart beat, carbohydrate metabolism (during emergency)
4.	Insulin	Pancreas	Below stomach	Reduces and regulates blood sugar level
5. Sex Hormone	(a)Testosterone in males (b)Estrogen in females	Testis Ovaries	Genital/lower abdomen area	Changes associated with puberty (Sexual maturity)
6.	Releasing Hormone	Hypothalmus	Mid brain	Stimulates pituitary gland to release hormones



Human Endocrine Glands

Iodised salt is necessary because iodine mineral is essential part of thyroxine hormone secreted by thyroid gland. Thyroxine regulates metabolism of carbohydrates, fats and proteins. So, we must consume iodised salt which is necessary for proper working of thyroid gland. Its deficiency causes a disease called goitre (Swollen neck).

Diabetes

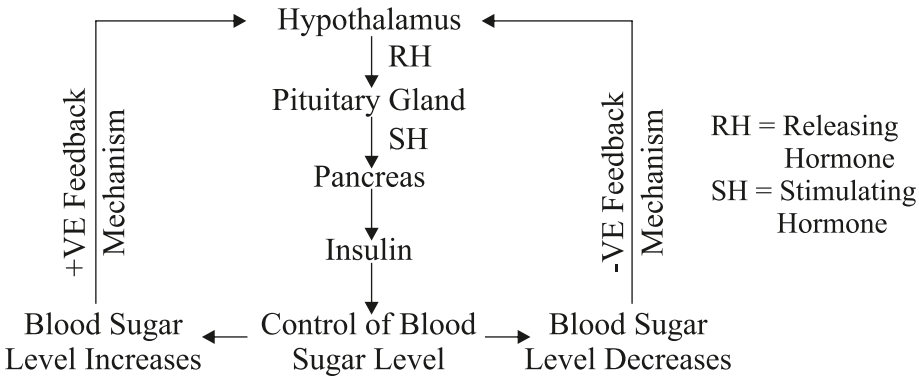
Disease in which blood sugar level increases.

Cause : Due to the deficiency of insulin hormone secreted by pancreas that is responsible to control blood sugar levels.

Treatment : Injections of insulin hormone.

Feedback Mechanism

The excess or deficiency of hormones has a harmful effect on our body. Feedback mechanism makes sure that hormones should be secreted in precise quantity and at right time.



Feedback Mechanism to Control the Sugar Level in Blood

Very Short Answer Type Questions (1 Mark)

MCQs

1 Centre for hunger is situated in-

a) Fore-Brain b) Mid-Brain

c) Hind-Brain d) All of the above

2 Which is the main co-ordinating centre of the body.

a) Nerves b) Spinal Card

c) Brain d) Heart

3. Spinal cord originates from-

(a) Cerebrum (b) Medulla

(c) Pons (d) Cerebellum

4. The movement of shoot towards light is

(a) Geotropism (b) hydrotropism

(c) Chemotropism (d) Phototropism

5. Choose the incorrect statement about insulin

(a) It is produced from pancreas

(b) It regulates growth and development of the body

(c) It regulates blood-sugar level

(d) Insufficient secretion of insulin will cause diabetes

6. Which phytohormone is responsible for wilting of leaves-

(a) Auxin (b) Abscisic acid

(c) Cytokinin (d) Gibberellin

7. Which of the following is not an effect produced after secretion of adrenalin into the blood-
   (a) Blood supply to the digestive system & skin is reduced
   (b) Heart beats faster
   (c) Breathing rate increses
   (d) Blood supply to skeletal muscles is reduced
8. Which part of the brain is responsible for involuntary actions like blood-pressure, vomitting etc.
   (a) Pons (b) Cerebrum
   (c) Medulla (d) Cerebellum
9. Dwarfism results due to
   (a) Less secretion of growth hormone
   (b) Less secretion of adrenaline
   (c) Excess secretion of growth hormone
   (d) Less secretion of thyroxin
10. Which of the following endocrine gland is unpaired-
   (a) Adrenal (b) Testes
   (c) Pituitary (d) Ovary

Answer :

1. (a)	2. (c)	3. (b)	4. (d)	5. (b)
6. (b)	7. (d)	8. (c)	9. (a)	10. (c)

11. In a neuron, where is impulse converted into chemical signal for onward transmission?
12. Name the two parts of Human nervous syst em.
13. What is the basic structural and functional unit of nervous system?
14. Where is auxin synthesized in plants ?
15. Which gland is known as master gland ?
16. Name the hormone that regulates blood sugar level.
17. What is synapse ?
18. What are tropic movements ?

19. Which part of the brain is responsible for maintaining posture and balance of our body ?

20. Which hormone has inhibiting effects on growth of plants ?

21. What is phototropism ?

22. What are the components of central nervous system ?

23. What happens at synapse between two neurons ?

24. In following questions two statements are given one labelled Assertion (a) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

    (a) Both A and R are true, and R is correct explanation of the Assertion(A).

    (b) Both A and R are true, but R is not the correct explanation of the Assertion (A).

    (c) A is true, but R is false.

    (d) A is false, but R is true.

1. **Assertion :** It is imporatant to have iodised salt in our diet.
   Reason: Iodine is necessary for thyroid gland to make thyroxin hormone.
2. **Assertion :** Reflex arcs have evolved in animals
   Reason: The thinking process of the brain is not fast enough.
3. **Assertion :** The brain sits inside a bony box
   Reason: Brain, a delicate organ, is very important for organisms.
4. **Assertion :** Auxin helps the cells of stem grow longer
   Reason: Auxin is a growth inhibitor.
5. **Assertion :** The hormones should be secreted in precise quantities
   Reason: Feedback mechanism operates in body to control hormone secretion

Answer:

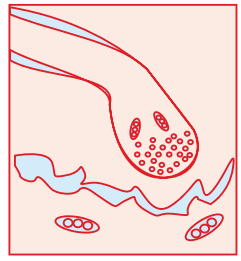
1. (a) 2. (a) 3. (a) 4. (c) 5. (a)

Case-Study

25. Read the following and answer the questions:

The nervous tissue is made up of an organised network of nerve cells or neurons and is specialized for conducting information via electrical impulses from one part of the body to another.

1. Which part of the neuron acquires the information
   (a) Dendrite (b) Cell body
   (c) Axon (d) Nerve ending
2. Junction between two neurons is called
   (a) Cell junction (b) Neuro-muscular junction
   (c) Neural joint (d) Synapse
3. Identify the diagram



   (a) Neural joint
   (b) Neuro-muscular junction
   (c) Cell junction
   (d) None of the above
4. In a neuron, conversion of electrical signal to a chemical signal occurs at/in
   (a) Cell body (b) Axonal end
   (c) Dendritic end (d) None of the above
5. The neurons that carry signals from spinal cord to muscles are
   (a) Sensory neuron (b) Motor neuron
   (c) Relay neuron (d) None of the above

Answer:

1. (a) 2. (d) 3. (b) 4. (b) 5. (b)

SHORT ANSWER TYPE QUESTIONS (2 AND 3 Marks)

1. Draw a labelled diagram of neuron.
2. What is reflex arc ? Explain with the help of flow chart.
3. What is the cause of diabetes ? How it can be controlled ?
4. Why is it advisable to use iodised salt ?
5. What are sensory and motor neurons ? Write their functions.
6. Why is Abscisic acid called as stress hormone ?
7. What is the need for a system of control and coordination in an organism?

8. List two different functions performed by pancreas (CBSE-2019)

9. What are plant hormones ? Name a plant hormone that promotes growth in plants.

10. What is the significance of tropic movements in plants ? Explain any two types of tropic movements.

11. Which hormone is known as emergency hormone in our body ? How it helps in coping during emergency ?

12. Where are different receptors present in our body ? What are their functions ?

13 Trace the sequence of events which occur when a bright light is focused on your eyes. (CBSE-2019)

MCQs

1. Which plant hormone promotes dormancy in seeds and buds?

   (a) Auxin (b) Gibberellin

   (c) Cytokinin (d) Abscisic acid

2. Roots of plants are:

   (a) Positively geotropic (b) Negatively geotropic

   (c) Positively phototropic (d) None of these

3. Response of plant roots towards water is called:

   (a) Chemotropism

   (b) Phototropism

   (c) Hydrotropism

   (d) Geotropism

4. Movement of sunflower in accordance with the path of sun is due to

   (a) Chemotropism (b) Geotropism

   (c) Phototropism (d) Hydrotropism

5. The main function of abscisic acids in plants is

   (a) To promote cell division

   (b) To inhibit growth

   (c) To promote growth of stem

   (d) To increase the length of cells

6. Fall of mature leaves and fruits from plants is triggered by which of the following substance?

   (a) Auxin (b) Cytokinin

   (c) Gibberellin (d) Abscisic acid

7. Any change in the environment to which an organism responds is called

   (a) Stimulus

   (b) Coordination

   (c) Response

   (d) Hormone

8. The longest fibre or extension from the cell body of a neuron is called

   (a) Sheath

   (b) Cytoplasm

   (c) Axon

   (d) Dendrites

9. A microscopic gap between a pair of adjacent neurons across which nerve impulses pass is called.

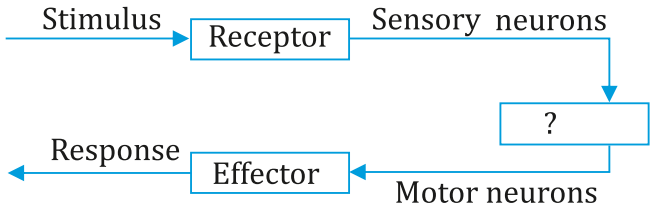
   (a) Neurotransmitter

   (b) Dendrites

   (c) Axon

   (d) Synapse

10.



Reflex arc

Give the missing term

(a) Spinal cord

(b) Brain

(c) Cranial nerves

(d) Relay nerves

Ans. (1) D (2) A (3) C (4) C

(5) B (6) D (7) A (8) C

(9) D (10) A