

CHAPTER-7: Control and Co-ordination

Stimuli and Response

The changes in the environment to which organisms respond and react are called stimuli.

Response is the reaction which is visible as an appropriate movement according to the stimulus which evokes

it. This is a controlled movement.

e.g. Closure of eyes on seeing object bright light.

Co-ordination – The working together of various organs of the body in a systematic manner in order to produce a proper response to a given stimulus is called co-ordination- 2 types are

Nervous Co-ordination

It is brought about by the nervous system

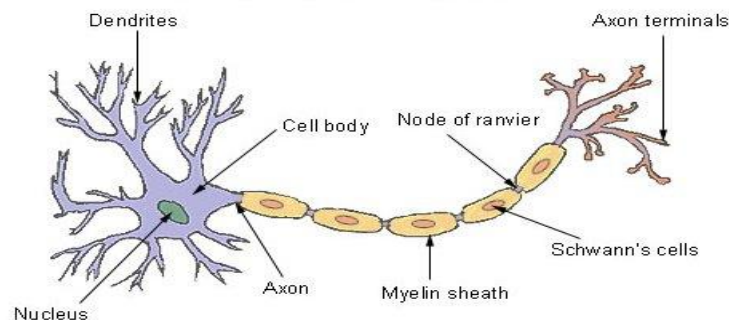
Chemical co-ordination

It is brought about by the endocrine system which releases certain chemicals called hormones in minute quantity.

Nervous System – Basic unit of Nervous system is NEURON. It consists of the following parts:

1. CYTON/ CELL BODY: Receives information through dendrites and conducts it further through axon.
2. DENDRITES: Finger-like projections from the cyton;
 - Through the dendrites a neuron is connected with the neighbouring neurons.
 - These conduct nerve **impulses towards the cell body**.
3. AXON:
 - It is the longest single extension arising from the cell body ending in swollen structures called nerve endings.
 - It **carries impulses away from the cell body** to the next neuron
 - Through axon, a neuron is connected to the other neurons or to muscle fibres.
 - Axon may be covered by **myelin sheath** which increases the rate of conduction of nerve impulse.

NEURON



Synapse – The functional junction between the axon of one neuron and dendrites of next neuron is called a synapse.

Conduction of messages along synapse – The nerve endings are not in physical contact with the dendrites of the next. Information acquired at the tip of dendrite creates an electrical impulse that travels along the cyton, reaches the nerve ending of axon. Here the impulse sets off release of chemical substance called neurotransmitter molecule that passes the messages to the next neuron across the impulse.

Impulse – The message travels across a nerve in the form of chemical and electrical signals is called impulse.

Information acquired at the end of the dendrite tip of a nerve cell

Electrical Impulse is created

Impulse travels from the dendrites to the cell body, and then along the axon to its end

At the end of the axon, the electrical impulse sets off some chemical reactions releasing some chemicals.

Chemicals cross the gap or the 'Synapse', and start a similar electrical impulse in the dendrite of the next neuron.

Nerve – It is made up of one or more neurons join end to end. There are two types

Sensory Nerve

It is made up of sensory neurons which carry messages from sense organs to the brain

Motor Nerve

It is made up of motor neurons which carry messages from brain to muscles and glands (effector)

There are two types of cells in our body

Receptors

The cell or groups of cells that receive the stimulus from the environment and initiate nerve impulse

Effectors

The cells or groups of cells bring out a response
It can be organs muscles and glands.

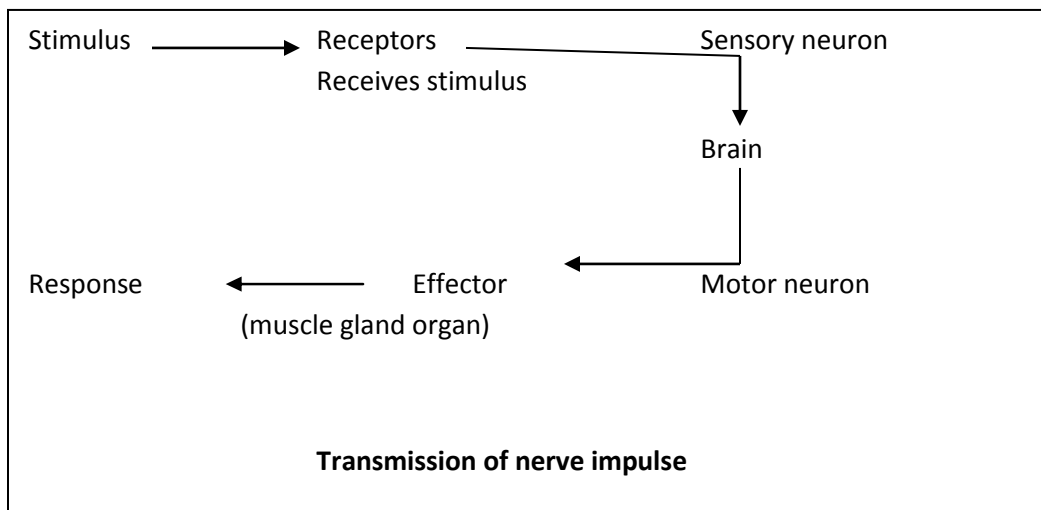
RECEPTORS	SENSE ORGANS (STIMULUS)
Photoreceptors	Eyes(light)
Phonoreceptors	ears (sound stimulus)
Gustatory receptors	tongue (taste stimulus)
Olfactory receptors	nose (smell stimulus)
Thigmo receptors	skin (touch stimulus)

TRANSMISSION OF NERVE IMPULSES

Action of Neurons tissue – When a nerve impulse reaches a muscle, it changes its shape and arrangement of special protein (contractile proteins) present in the muscle cells. This new arrangement of proteins causes movement. (Shortening and relaxation of muscle.)

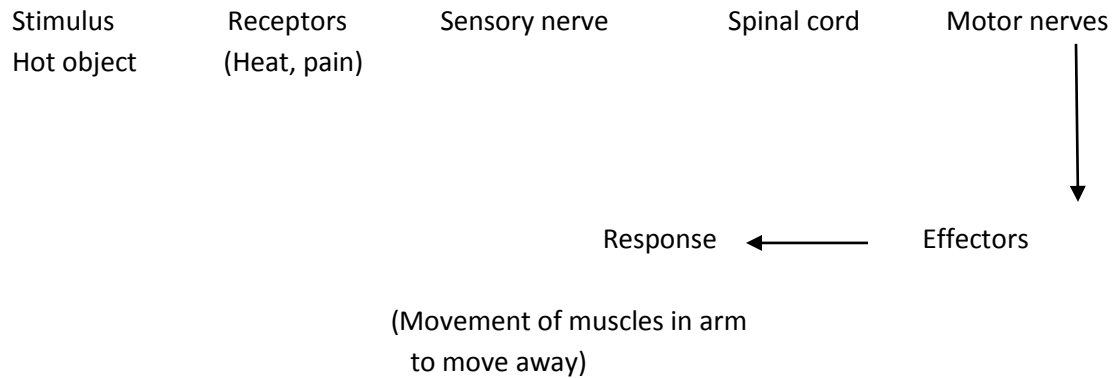
Transmission of Nerve impulse –

- 1) Sensory nerve transmit the (impulses) stimuli received by receptors to the brain.
- 2) Brain process the information and decides a response. This message is carried to the effectors (organ, muscle gland) through motor nerve.



Reflex action – Quick, spontaneous and involuntary response against a stimulus.

Reflex arc – It is the pathway of reflex action from the receptor. The impulse is relayed from receptors by sensory nerves to the spinal cord which processes the information for response and sends it to effectors via motor nerves.



Parts of Nervous system -

CNS –Central nervous system system

- 1) It includes brain & spinal cord nerves arising
- 2) It receives & integrate .Cranial/ information from all parts of body

ANS -Autonomic Nervous system

- 1)It involves brain & spinal cord
- 2)It controls all the involuntary activities

PNS – Peripheral nervous

Constitute a network of from brain and spinal cord spinal nerve.

BRAIN

Structure of Brain –

Fig

- 1) Protective bony cage – cranium
- 2) Three membrane called meninges filled by cerebro spinal fluid which acts as a shock absorber.
- 3) Protective cover for spinal cord – Vertebral column
- 4) Meninges filled with cerebrospinal fluid.

Parts of Brain

	PARTS		Function
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1.	Forebrain	Cerebrum	- has specialized areas for vision hearing, muscle activity and sanction. - separate association areas to interpret and co-relate the information received by receptors and already present in brain.
		Thalamus	-controls association areas
		Hypothalamus	-controls the feeling of hunger and thirst -has role in endocrine system
2.	Midbrain		Connects forebrain to hind brain - has reflex centre for eye movement and hearing response involuntary action
3.	Hindbrain	Cerebellum	Maintains posture, equilibrium - controls precise voluntary action
		Pons	controls the rate of respiration
		Medulla	controls involuntary activities like coughing, sneezing, heart beat, vomiting etc.

FUNCTIONS OF BRAIN –

- 1) Receives impulse from all the sensory organs of the body
- 2) Interprets the message brought by sensory nerve and cells, instructs the muscles and glands to functions (respond) accordingly.
- 3) In its association centers, it co-relates different stimulus, produce the most appropriate response.
- 4) Co-ordinates all body activities so that the body functions efficiently.
- 5) Stores information for modification of behaviour according to past experience.

CHEMICAL CO-ORDINATION – Second controlling mechanism

Co-ordination under the control of endocrine system (made up of endocrine glands which release chemicals, secretions called hormones.)

Hormones – These are chemical substances secreted by endocrine glands (duct less glands) and are directly

poured into the blood stream which transports these to the target organ to bring the response and to regulate physiological processes

Characteristics of hormones – Hormones are called “chemical messengers” as they show their effect at a site away from where they are produced.

ENDOCRINE GLANDS AND THEIR SECRETIONS

	Endocrine Gland	Hormones	Function	Disorder
1.	Pituitary	GH	Regulates growth and development of body.	Deficiency causes Dwarfism Excess causes gigantism
2.	Thyroid	Thyroxine	Regulates carbohydrates, protein, fat metabolism provides	Iodine necessary for formation of thyroxine deficiency causes Goitre.(Swollen neck)
3.	Hypothalamus	Releasing and Inhibiting Hormones	Regulation of secretions from Pituitary gland	
4.	Pancreas	Insulin	Lowers blood glucose levels	Deficiency causes rise in blood sugar leading to Diabetes
		Glucagon	Increase in blood glucose levels	
5.	Adrenal (Stress hormone)	Adrenalin	Regulates blood pressure, heart rate and carbohydrate metabolism.	
6.	Parathyroid	Parathyroid hormone	Regulation of blood calcium and phosphate	
7.	Testes	Testosterone	Regulation of male accessory sex organs and secondary sexual characters like moustache and beard	
8.	Ovary	Estrogen and Progesterone	Regulates formation of ova in ovary. Regulation of female accessory sex organs and secondary sexual characters like mammary glands	

Feed back mechanism – The mechanism by which hormone are secreted by endocrine glands in precise amounts .

Eg. If sugar level in blood rises they are detected by the cells of pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

Action of Adrenaline, stress hormone

- 1) Adrenaline is secreted in blood
- 2) Reaches to target organ – heart
- 3) Heart beats faster to supply more oxygen to our muscles.
- 4) Blood to digestive system and skin is reduced due to contraction of muscles around small arteries of these organs.
- 5) Blood is diverted to skeletal muscles.
- 6) Breathing rate increases due to contraction of diaphragm and rib muscles.
- 7) All these responses together enable the animal body to be ready to deal with situation.

CO-ORDINATION IN PLANTS –

a)Nastic—Independent of growth

- Seismonastic (touch)
- Photonastic (light)
- Thermonastic (Temperature)

b)Tropism –Dependent on growth

a)Nastic Movements–

eg: Seismonastic : Growth independent response to touch stimulus

When we touch the leaves of *Mimosa pudica* (touch me not plant), they fold up and droop.After some time the leaves regain their original state.

Plants cells change shape by changing the amount of water in them (turgor changes), resulting in swelling or shrinking or folding, therefore resulting in changing shapes and drooping. There is no growth involved in this movement.

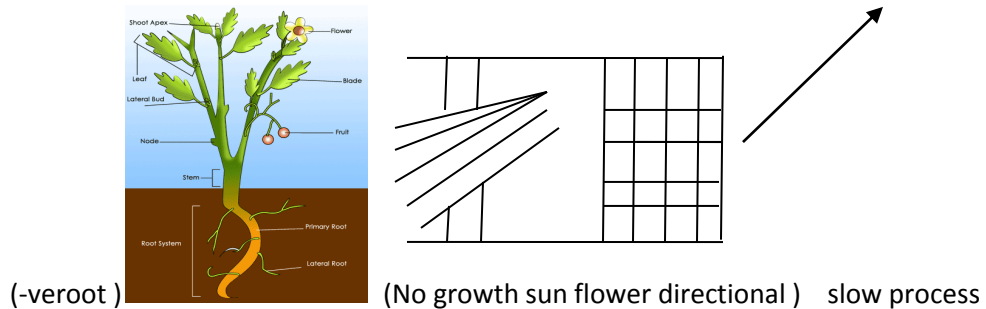
Tropism – Dependent on growth: Movement of plants can be due to growth

- 1) Phototropism stimulus – Growth associated movement in response to light –

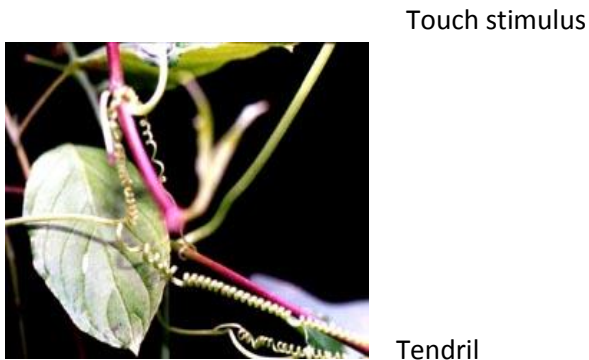
Eg: shoots respond by bending towards light shows +ve phototropism while roots respond by bending away from it shows –ve phototropism

(+ve shoot)

Sun light



- 2) Geotropism – Growth associated movement in response to gravity. The roots always grow downwards while shoot usually grow upwards showing (+ve) geotropism and (–ve) geotropism respectively.
- 3) Hydrotropism – Growth associated movement in response to water
Eg: growth of roots towards water and shoot away from water. (Germination)
- 4) Chemotropism – Growth associated movement in response to chemicals.
Eg: growth of pollen tube towards ovules. Growth related processes are slower.
- 5) Thigmotropism – Growth associated movement in response to touch stimulus
Pea plants climb up other plants by means to of tendrils which is sensitive to touch.



tendrils grow to circle around the object or plant and thus cling to it. This growth is directional as plants respond to stimuli slowly by growing in a particular directions.

Plant Hormones/ Phytohormones – They are chemical substances that are produced naturally in minute concentration in plants for regulating growth and other physiological processes. They are synthesized at places away from where they act and simply diffuse to the area of action. They help to co-ordinate growth, development and responses to environment.

- 1) Auxin – It is synthesized at shoot tip where growing plants detect light. They help to grow longer. When light is coming from one side of plant, auxin diffuses towards the shady side of the shoot which stimulates cells to grow longer. So plant appears to bend towards light.

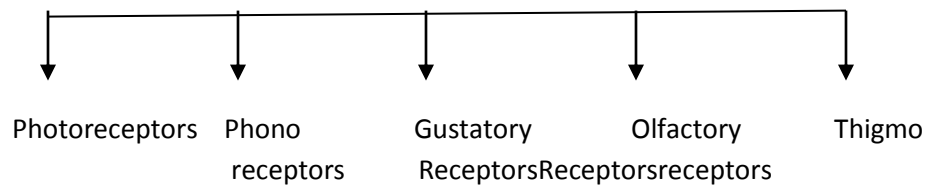
- 2) Gibberellin – helps in growth of the stem; stem elongation and leaf expansion.
- 3) Cytokinins – promotes cell division in fruits and seeds.
- 4) Absciscic acid – It inhibits growth, its effects include wilting of leaves.
- 5) Ethylene- It is responsible for ripening of fruits

FLOW CHART SUMMARY

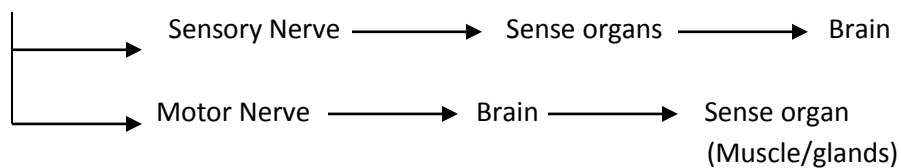
CO-ORDINATION



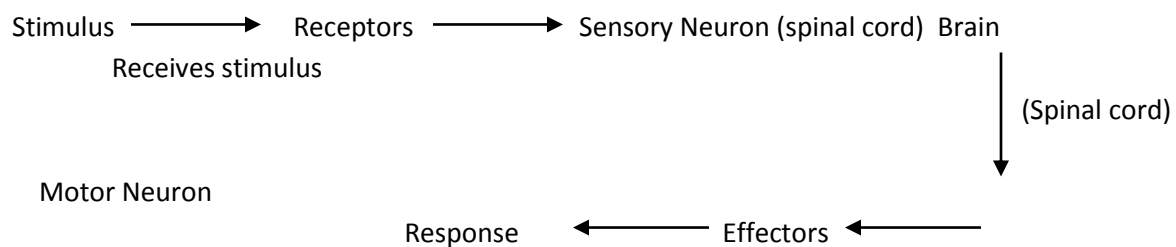
RECEPTORS



NERVES



TRANSMISSION OF NERVE IMPLUSE

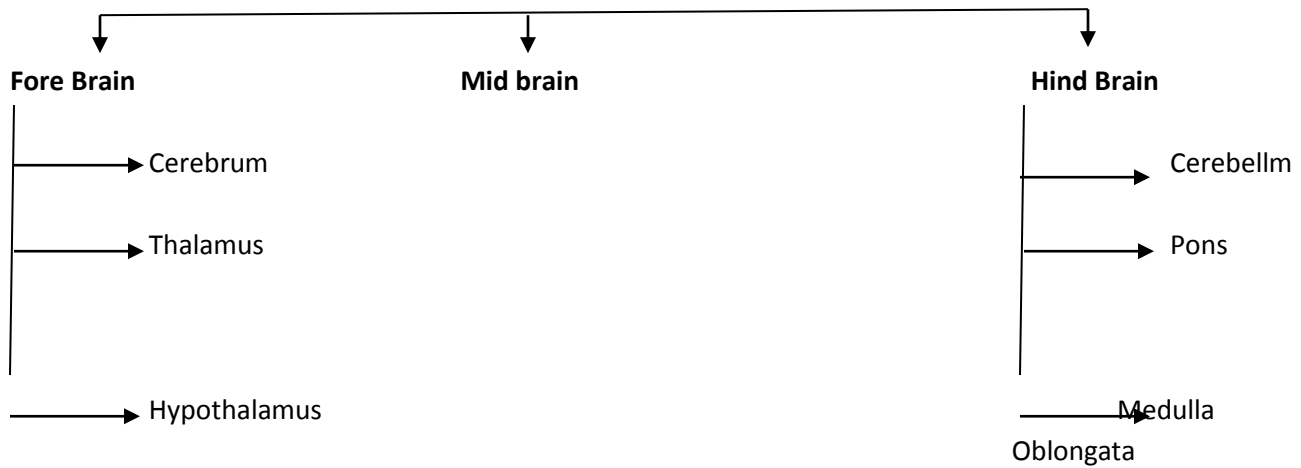


Muscle, gland organ

PARTS OF NERVOUS SYSTEM

- Central Nervous System (CNS)
- Autonomic Nervous System (ANS)
- Peripheral Nervous system (PNS)

BRAIN



Tropism

- Thigmo Tropism
- Photo tropism
- Geo tropism
- Hydrotropism
- Chemo tropism

Plant Hormones

Auxin
Gibberelline
Cytokinins
Absciscic acid

QUESTIONS

1. Nervous and Hormonal systems together control and coordinate the physiological processes.

Justify the statement.

Ans: Nervous control is done in humans by the Central and Peripheral Nervous system involving nerve impulses. The hormonal control involves use of chemicals (hormones) secreted by endocrine glands. The hypothalamus part of the brain secretes neurohormones which regulate the secretions of pituitary hormones which in turn regulate the growth and secretions of other endocrine glands, thus coordinating different processes.

2. What happens at the synapse between two neurons?

Ans: When the electrical signal (nerve impulse) reaches the axonal end of a neuron, it releases chemical substances called neuro-transmitters that diffuse across the synapse towards the dendritic end of the other neuron. These neurotransmitters stimulate chemoreceptor sites in the dendrites of the other neuron and generate another electrical signal.

3. How do auxins promote the growth of a tendril around a support?

Ans: When the tip of a tendril comes in contact with the support, more auxin is diffused from its site of synthesis (tip of tendril) towards the side of the tendril which is away from the support than the side in contact with the support. As a result, the side having more auxin grows faster than the one in contact with the support. This causes the tendril to bend (encircle) around the support.

4. Give the functions of Ethylene, Absciscic acid and auxins

- 1) **Ethylene:** promotes ripening of fruits
- 2) **Absciscic acid:** It inhibits growth and promotes wilting of leaves
- 3) **Auxin:** responsible for cell elongation and growth at stem and root tips

MCQ-

1. The gap between two neurons is called

- a) dendrite b) Synapse c) axon d) impulse

2. Which of the following is a part of hormone?

- a) Thyroxine b) Insulin c) Oestrogen d) Cytokinin

3) Plant hormone that helps in stem growth

- a) Auxin b) Cytokinins c) Gibberelline d) Absciscic acid

4) Diabetes is caused due to deficiency of

- a) Thyroxine b) Insulin c) Glucagon d) Growth hormone

5) Stress hormone is

- a) GH b) Insulin c) Adrenaline d) Thyroxine

6) Goitre is caused due to deficiency of

- a) GH b) Insulin c) Thyroxine d) Adrenaline

7) The part of brain which maintains posture and helps in balancing -

- a) Pons b) Medulla c) Cerebellum d) Cerebrum

8) Bending of plant towards sunlight is

- a) Geotropism b) Phototropism c) Thigmotropism d) Hydrotropism

9) The part of brain which has specialised areas for vision.

- a) forebrain b) Mid brain c) Hind brain d) Cerebellum

10) Growth inhibiting plant hormone is

- a) auxin b) Cytokinin c) Absciscic acid d) Gibberelins