



CH-7

CONTROL AND COORDINATION

INTRODUCTION

- ▶ As the complexity of the individuals, plants or animals increases the different cells and organs become separated from each other by greater distance. Thus it becomes necessary to have a system by which the different parts of the organisms can function as a single unit. This is possible only if the different parts can coordinate with each other and carry out a particular function

CONTROL AND COORDINATION IN ANIMALS

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

- ▶ Nervous System
- ▶ Endocrine System

NERVOUS SYSTEM

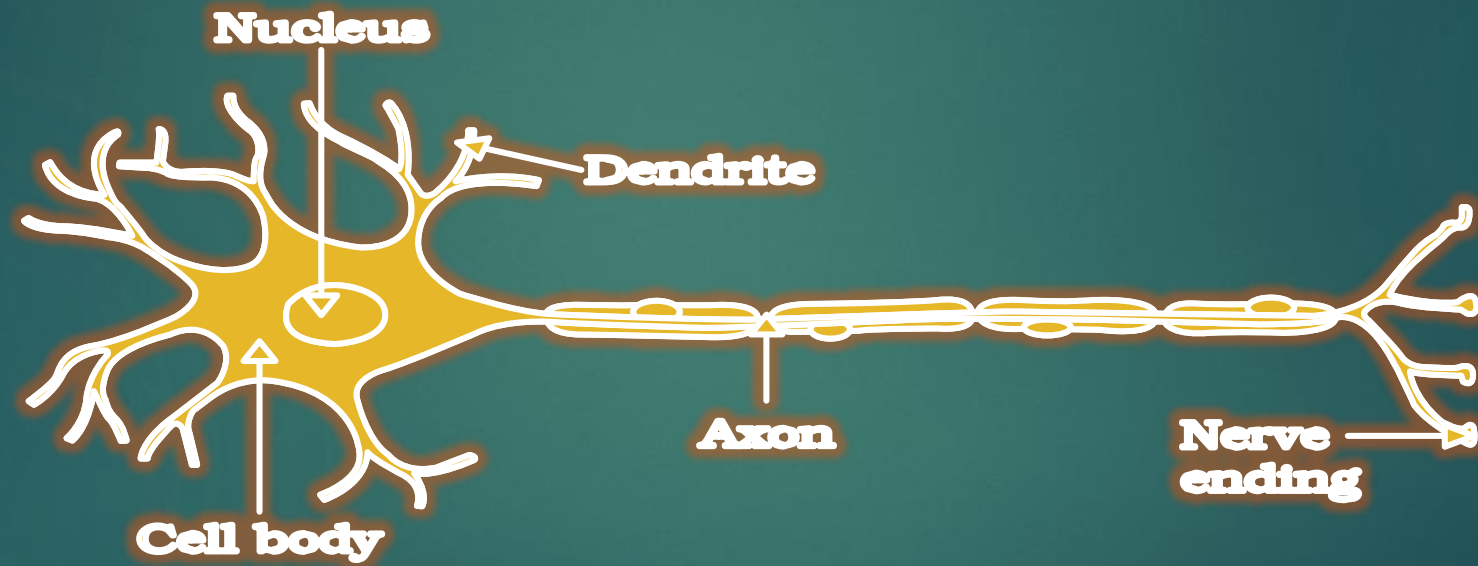
The nervous system of an animal is composed of specialized cells called neurons or nerve cells which can detect, receive and transmit different kinds of stimuli. Functions:

- ▶ To receive the information from environment.
- ▶ To receive the information from various body parts.
- ▶ To act accordingly through muscles and glands.

NERVE CELL

- ▶ Nerve cells or neurons are the structural and functional unit of the nervous system. Billions of nerve cells make up our brain. A nerve cell is a microscopic structure consisting of three major parts namely cell body, dendrites and axon.

NERVE CELL



NERVE IMPULSE

- ▶ The conduction of stimuli by the nerve cells is called nerve impulse. The dendrites will receive the stimuli from the receptor (sense organ) and conduct the same as electrical impulse to the axon through the Cyton. At the synapse, the synaptic knobs release out chemical substances called neuro transmitters which convert the electrical impulse into chemical impulse and pass it to the neighboring neuron.
- ▶ Synapse: The point of contact between the terminal branches of axon of one neuron with the dendrite of another neuron is called synapse.
- ▶ Reflex Arc: The path through which nerves signals; involved in a reflex action; travel is called the reflex arc.

REFLEX ACTION

- ▶ Reflex action is a special case of involuntary movement in voluntary organs. When a voluntary organ is in the vicinity of a sudden danger, it is immediately pulled away from the danger to save itself.
- ▶ For example; when your hand touches a very hot electric iron, you move away your hand in a jerk. All of this happens in flash and your hand is saved from the imminent injury.

REFLEX ARC

- It is the pathway taken by the nerve impulses and responses in a reflex action i.e from the receptor organs like skin to the spinal cord and from spinal cord to the effector organ like muscles .

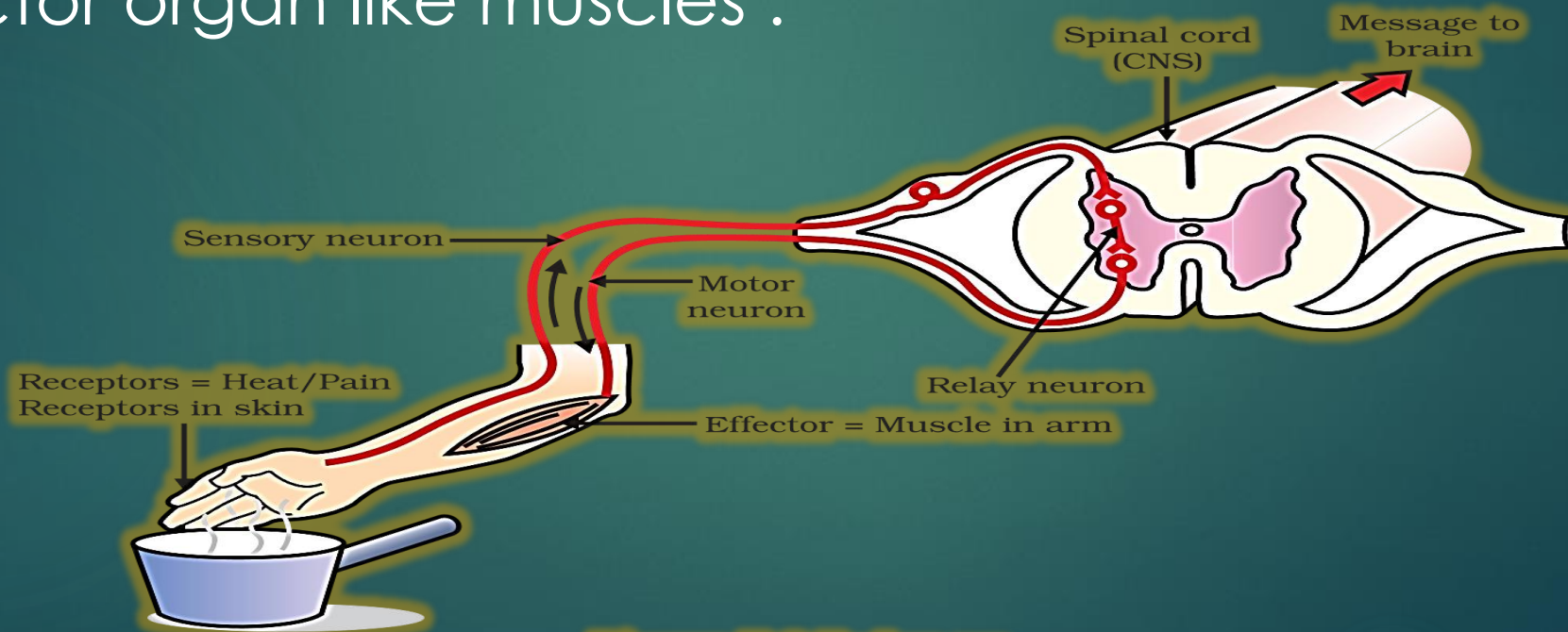


Figure 7.2 Reflex arc

HUMAN BRAIN

- ▶ Human brain is a highly complex organ; which is mainly composed of the nervous tissue. The tissues are highly folded to accommodate a larger surface area in less space. The brain is covered by
- ▶ A three layered system of membranes; called meninges.
- ▶ Cerebrospinal fluid is filled between the meninges.
- ▶ The CSF provides cushion to the brain against mechanical shocks. Furthermore, the brain is housed inside the skull for optimum protection. The human brain can be divided into three regions,
- ▶ viz. forebrain, midbrain and hindbrain.

HUMAN BRAIN

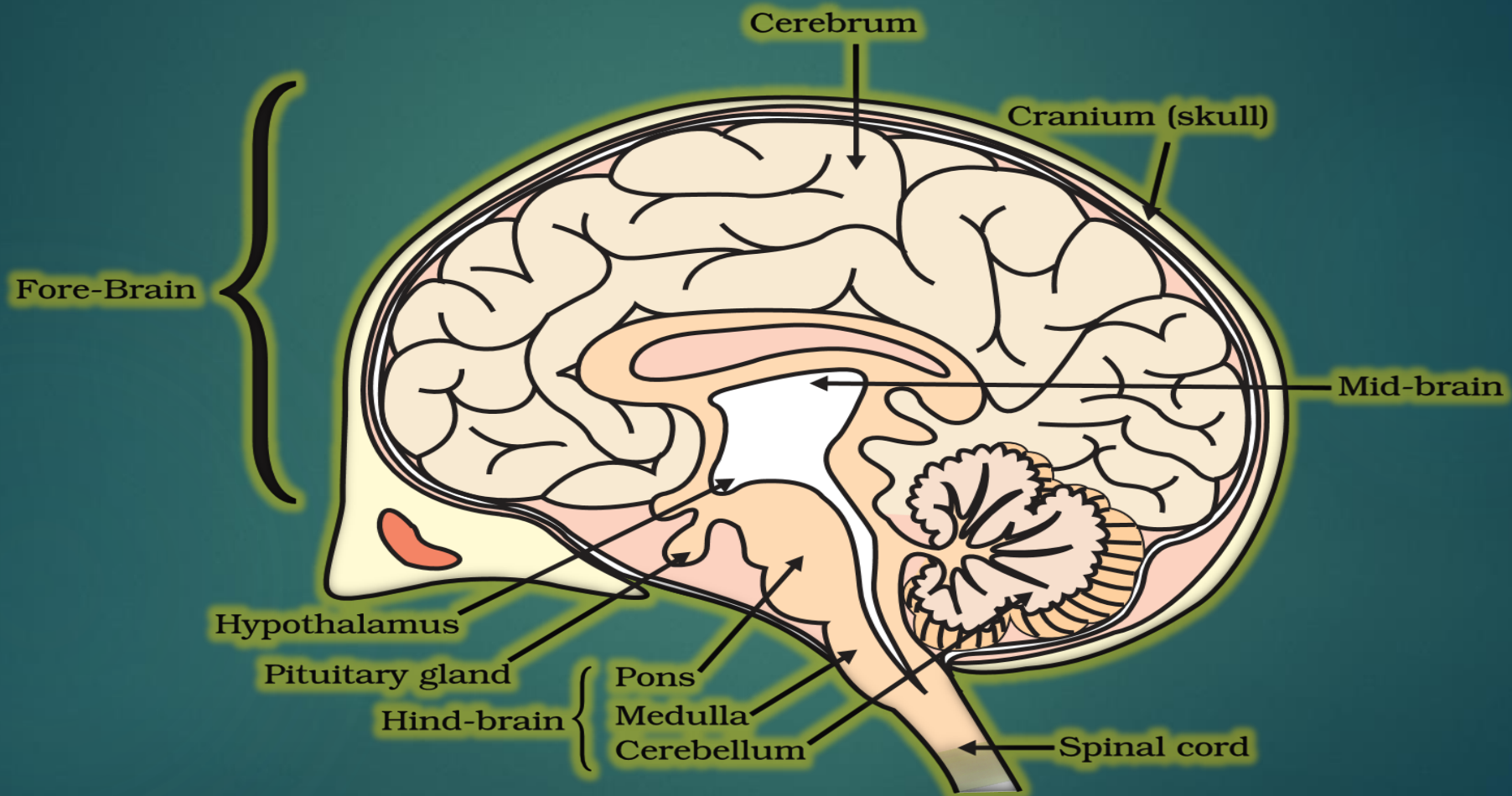


Figure 7.3 Human brain

FUNCTION OF FORE BRAIN

Fore Brain(Cerebrum)

FUNCTIONS:

1. Thinking part of the brain
2. Control the voluntary actions.
3. Store information (Memory)
4. Receives sensory impulses from various body parts and integrates it .

Hypothalamus:

FUNCTIONS:

1. It controls sleep and wake cycle (circadian rhythm) of the body.
2. It also controls the urge for eating and drinking.

FUNCTION OF MID BRAIN

Midbrain connects the Forebrain and Hindbrain

- ▶ Control Motor Movement-particularly movement of the eye
- ▶ Help in auditory and visual processing.

FUNCTION OF HIND BRAIN

Hind brain has three parts which are as follows:

- a) **Medulla** – Responsible for involuntary function such as breathing ,vomiting, sneezing etc.
- b) **Pons** – Helps in swallowing , bladder control and facial expression etc.
- c) **Cerebellum** – responsible for voluntary actions such as posture , balance coordination in speech etc.

TWO TYPES OF TRANSMISSIONS

Electrical transmission	Chemical transmission
No need of neurotransmitter	Neurotransmitter is needed
Fast mode of nerve impulse transmission	Slow mode of nerve impulse transmission
Impulse are directly transmitted from one neuron to another neuron	Impulse are not directly transmitted from one neuron to another neuron

COORDINATION IN PLANTS

Unlike animals, plants do not have a nervous system. Plants use chemical means for control and coordination. Many plant hormones are responsible for various kinds of movements in plants. Movements in plants can be divided into two main types,

- ▶ Tropic movement
- ▶ Nastic movement.

TROPIC MOVEMENT

The movements which are in a particular direction in relation to the stimulus are called tropic movements. Tropic movements happen as a result of growth of a plant part in a particular direction. There are four types of tropic movements,

- ▶ **Phototropism**

Movement due to light

- ▶ **Geotropism**

- ▶ Movement due to gravity

- ▶ **Hydrotropism**

Movement due to water

- ▶ **Chemotropism**

Movement due to some chemicals

NASTIC MOVEMENT

- ▶ Nastic movements are non directional movements to the stimuli .
- ▶ For example, when we touch *Mimosa pudica* (touch-me-not plant), its leaves fold up and droop.



PLANT HORMONES

- ▶ Plant hormones are also known as phytohormones they are responsible for all aspects of growth and development in plants
- a) **Auxin**: Synthesized at shoot tips and root tips and helps in growth of roots and shoots
- b) **Gibberellin**: Helps in germination , flowering and fruit ripening
- c) **Cytokinins**: Promotes cell division
- d) **Abscisic acid**: Inhibits growth, causes wilting of leaves. (Stress hormone)
- e) **Ethylene**: A gaseous hormone, essential for ripening of fruits.

ENDOCRINE GLANDS

- ▶ Endocrine glands are ductless glands which secrete chemicals called hormones .
- ▶ Following table shows the endocrine glands with their secretion and functions –

Endocrine Gland	Function
Thyroid gland	Produces thyroxine that regulates carbohydrate, protein and fat metabolism
Adrenal gland	Produces adrenaline and it is secreted at the time of fear, fight or flight
Pancreas	Produces insulin and glucagon which regulate glucose metabolism in our body.
Testis	Produces male hormone known as testosterone required male secondary sexual characteristics such as beard and moustaches.
Pituitary gland	Secretes growth hormone that regulates the growth and development of an organism
Ovaries	Produces oestrogen needed for female sexual development

FEEDBACK MECHANISM

- ▶ Feed back mechanism is required to regulate the timing and precise release of hormones.
- ▶ For example – If the sugar level in blood rise , it is detected by cells of pancreas which respond by producing more insulin . As the blood sugar level falls insulin secretion is reduced.

LEARNING OUTCOMES

- ▶ : Students will be able to:
- ▶ Understand that the control and coordination are the outcome of the hormones and nervous system.
- ▶ Know the responses of Nervous system as Reflex action , Voluntary action and Involuntary action.
- ▶ Functionally understand that Chemical coordination is found both in plants and animals.
- ▶ Draw structure of neuron , reflex arc and Human brain.
- ▶ Understand that the Feedback mechanism regulates the action of the hormones.