

CHAPTER 7

Control and Coordination

7.1 ANIMALS - NERVOUS System

- Control and coordination in the organism is achieved by nervous and muscular system.
- Organisms can detect and respond to the stimulation in their surroundings.
- It can be done by receptors present on various sense organs of the body.

For eg:

- Thermoreceptors : Detects temperature
- Gustatory receptors : Detects taste
- Osmoreceptors : Detects osmotic pressure
- Olfactory receptors : Detects smell
- Photoreceptors : Detects light.
- Chemoreceptors : Senses chemicals.

- The above receptors sense their surroundings and send a nerve impulse to the target organ.

Flow of nerve impulse across the body.

- ① Receptors send a signal to the dendrite tip of neuron.
- ② Here, it sets off a chemical reaction to create a nerve impulse.
- ③ The impulse travels from dendrite to cell body and then to axon.

④ At the end of axon, this electrical impulse sets off a chemical reaction which is released to the other neuron through synapse.

7.1.1 What happens in Reflex Actions?

- Reflex action: A sudden response to something in the environment.

Reflex action is caused due to signal sent by neurons to various body organs through reflex arc.

- Reflex arc: It is a bundle of neurons present at the region of spinal cord with connections to all the body parts.

Reflex action is done through reflex arc which has evolved over time to react faster to environmental stimuli.

Sequence of events during Reflex arc.

Receptors in body sense the stimuli (eg heat).

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They send this signal through sensory neuron

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This information reaches the spinal cord and then to brain.

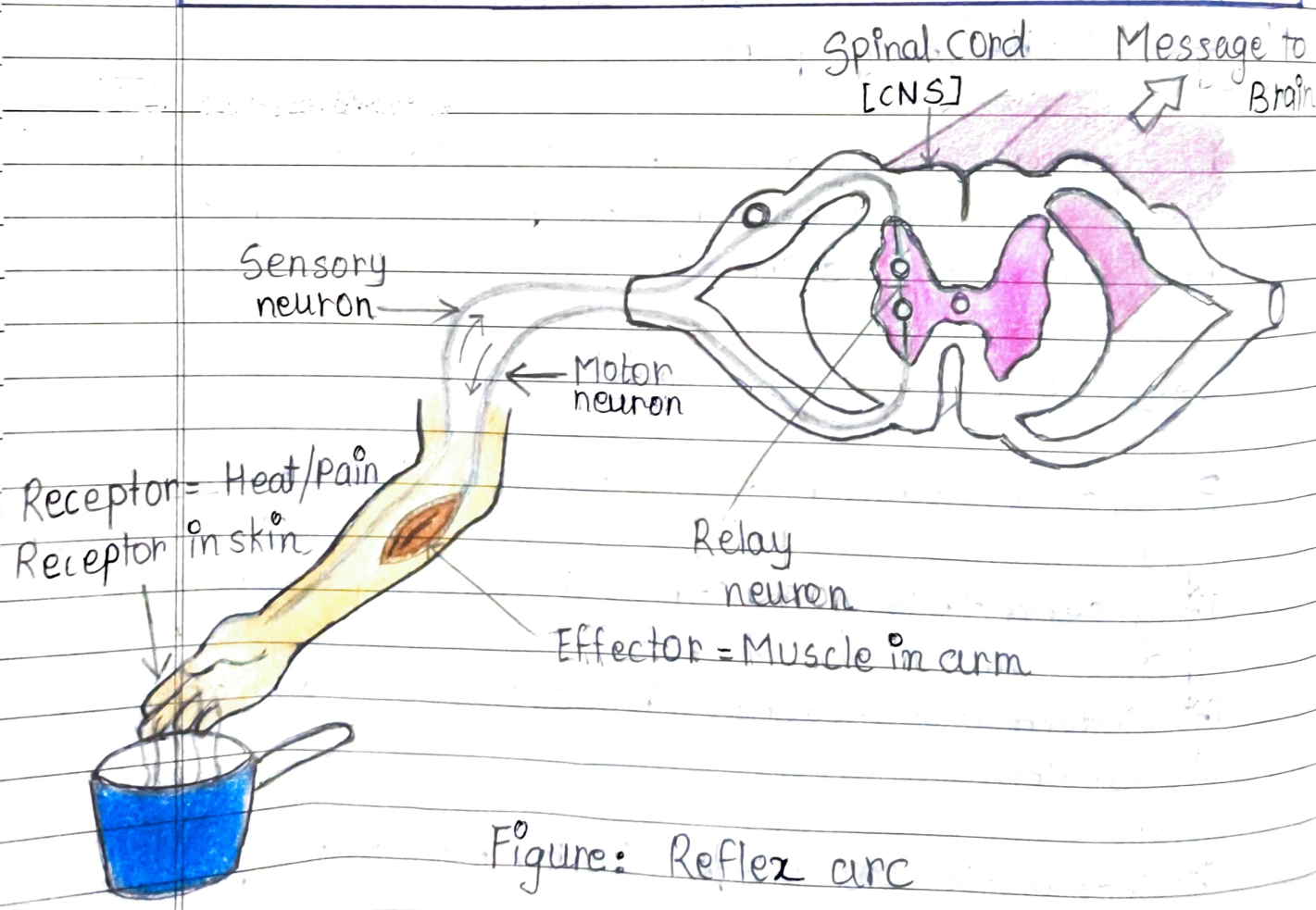
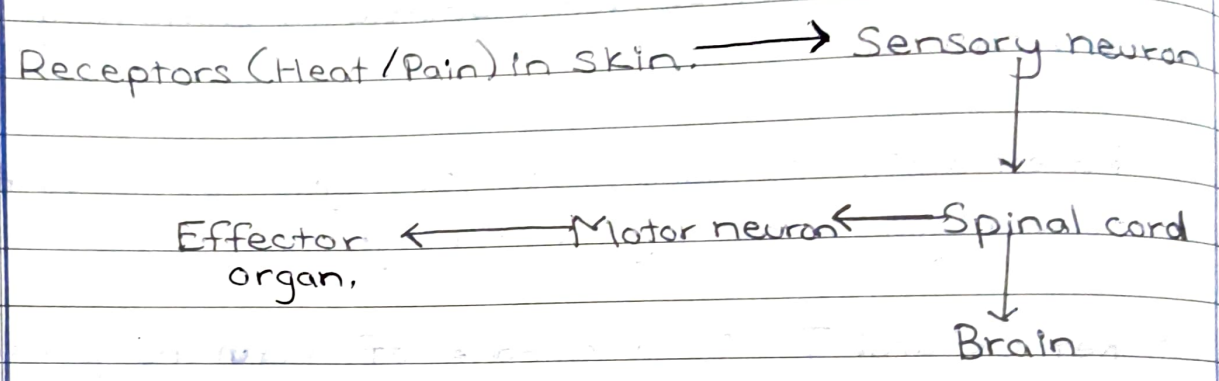
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The information is processed by reflex arc present in spinal cord.

This information is sent back to the effector organ via motor neuron.

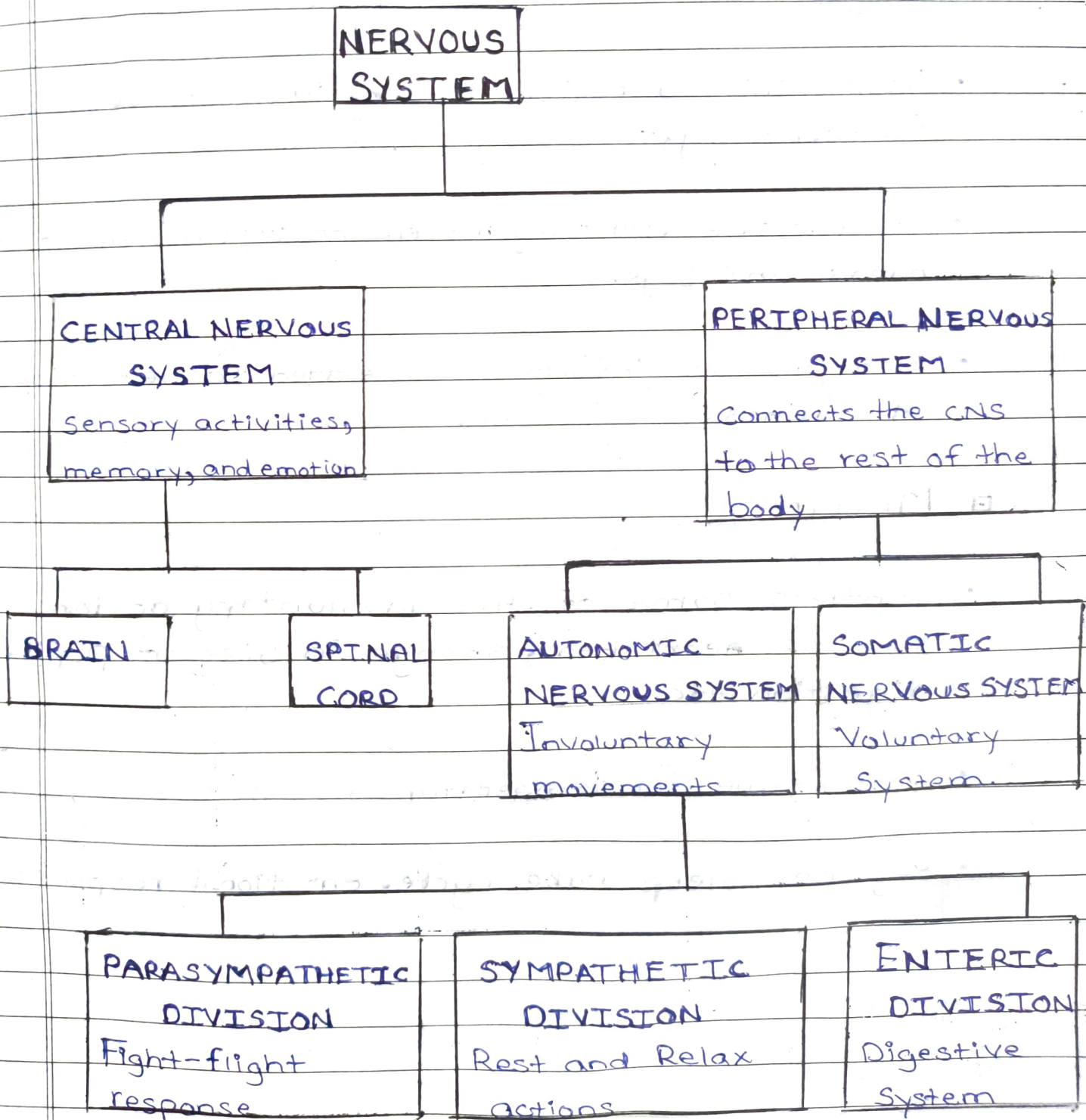
The effector organ responds to the stimulus.

Overview



7.1.2 Human Brain

- Brain is a complex organ that controls various body functions such as thought, memory, motor skills and all the other body parts.



- The Human brain is divided into **3** main parts.

▣ Forebrain

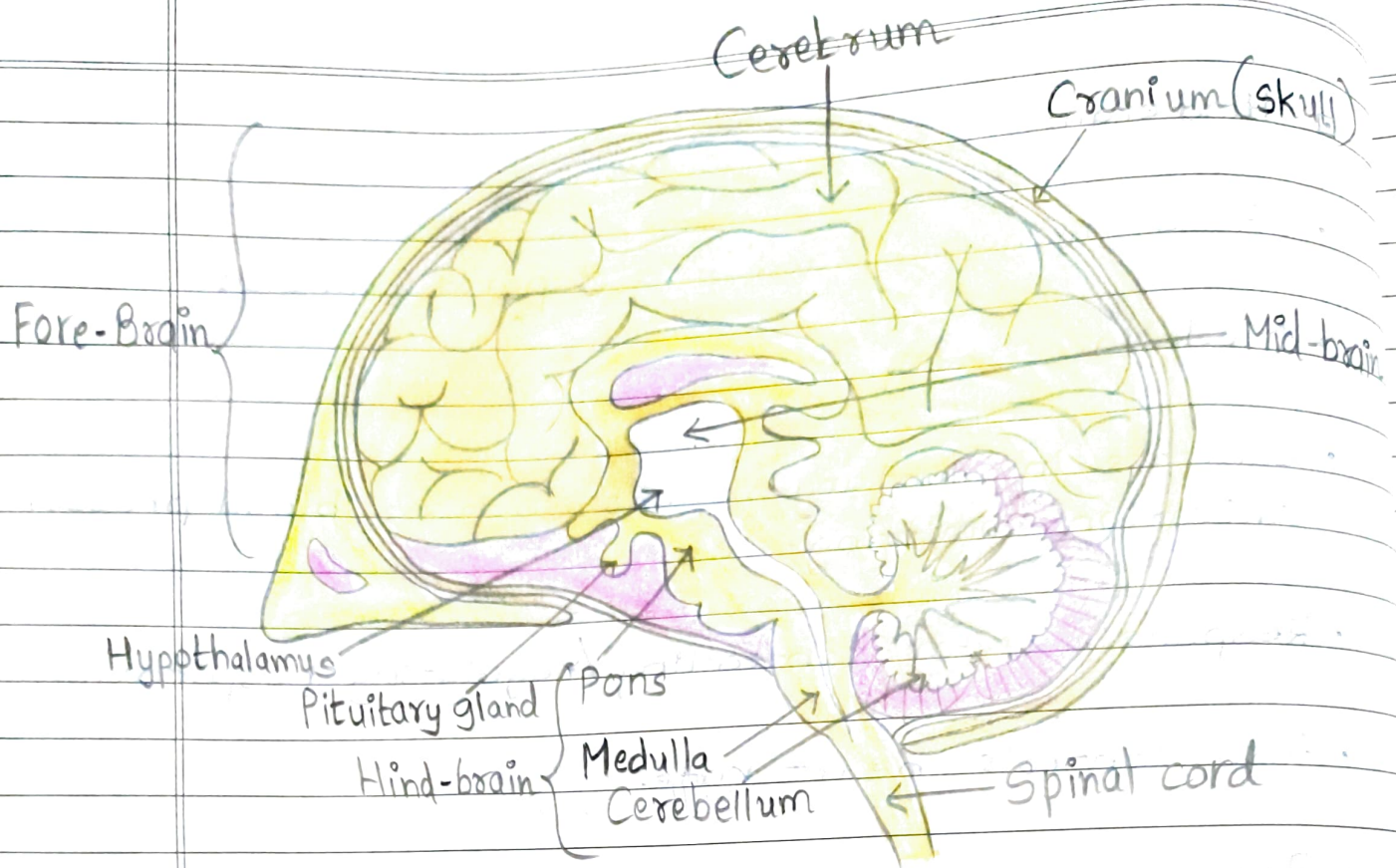
- It is the main thinking part of the brain.
- Largest part of the human brain.
- Responsible to receive sensory impulses such as taste, hearing, smell, sight etc..
- Controls the Voluntary movements; eg: movement of hands and legs.
- Also provides information related to Sensation of fullness i.e hunger.

▣ Midbrain

- Controls some of the Involuntary actions such as heart-beat, change in size of pupil, digestion etc.
- Responsible for temperature regulation.
- Regulates Sleep-wake cycle, Emotional responses etc.

▣ Hind brain

- It is further divided into 3 parts namely:
- Medulla.
 - Controls involuntary actions such as blood pressure, salivation, vomiting.
 - Responsible for controlling/regulating respiration.
 - Also controls heart rate.
- Pons.
 - Responsible for regulating breathing.
 - Regulates sleep.
- Cerebellum.
 - Helps to perform precise voluntary actions such as walking in a straight line, riding a bicycle etc.
 - Helps in maintaining proper body posture and balance of the body.



7.1.3 How are these tissues protected?

- Brain can get damaged if not protected properly.
- Therefore it is protected in a bony structure known as **cranium**.
- The cranium (inside which brain is present) also contains **Cerebro Spinal fluid** which **absorbs the shock** during injury.
- Spinal Cord is also protected by the **vertebral column / backbone**.

7.2 COORDINATION IN PLANTS

- Plants show movement in response to stimulus.
- Movement of plants is of two types.
 - one is dependent on growth
 - The other is independent of growth.

7.2.1 Immediate Response to Stimulus - movement independent of growth.

- Plants can show movement in response to stimulus - for eg: touch.
 - How does this movement occur?
- Plant movement happens at point different from the point of touch.
- Plants use - chemical - electrical signal to convey this information of touch.
- Finally, the plants change their shape by changing the amount of water in them.

7.2.2 Movement due to growth.

- Some plants: for eg pea plants can climb up other plants by means of tendrils.
- These tendrils are sensitive to touch.

- The part of tendril away from the support grows more rapidly than the part which is in contact with the support.
- As this growth is directional, it appears as if the plant is moving.

▣ Tropism.

It is the movement of plant in response to environmental triggers.

Types of tropism.

- **Phototropism:** Movement of plants in response to light.
- Usually, the shoots respond by bending towards light whereas the roots respond by bending away from the light.
- **Geotropism:** Movement of plants in response to gravity.
- Here, the roots always grow downwards while the shoot always grows upward.
- **Hydrotropism:** Movement of plants in response to water.
- **Chemotropism:** Movement of plants in response to chemicals eg: growth of pollen tubes towards ovules.

NOTE: Movement of plants in response to touch is quick.

: Growth related movements are usually very slow.

□ Plant Hormones.

Hormones: They are chemicals produced in trace amounts and perform a specific function.

- There are different types of plant hormones which help the plant to perform various functions.

• **Auxin:**

- **Location:** Produced at the tips of roots, shoots, leaves.

- **Function:** Increases the length of different parts of plants; especially shoot.

: Helps the plant to bend towards light.

: Plays an important role in fruit development.

• **Gibberellins:**

- **Location:** Produced in shoot and root tips, young leaves and developing seeds.

- **Functions:** Helps in growth of stem.

- Regulates fruit growth and development.

- Promotes development of flowers.

- Cytokinins:

- Location: Produced in areas of rapid cell division such as fruits and seed.

- Functions: Promotes cell division.

- : Delays aging (senescence).

- Abscissic acid:

- Location: In older seeds, leaves and stem.

- Function: Inhibits growth.

- : Induces seed dormancy.

- : Inhibits shoot growth during drought conditions.

- Ethylene:

- Location: Ripening fruits, aging flowers and nodes of stems and roots.

- Functions: Stimulates fruit ripening

- : Promotes senescence (aging).

7.3 HORMONES IN ANIMALS

- Like plants, there are many hormones produced in animals that help them to perform various functions. These hormones are listed below.

▣ Adrenaline - Flight or Fight hormone.

- Gland: Adrenal gland.

- Target organ: Various organs including the heart, blood vessels, liver, and adipose tissue.

- Function of adrenaline:

- Adrenaline acts on heart muscles which causes heart to contract.



- Heart beats rapidly and pumps more blood which delivers more nutrients and O_2 to the body organs (specifically muscles).
- Also the blood from digestive system and skin is diverted towards skeletal muscles to provide more energy.
- All the above responses help the organism to get prepared for emergency situation, hence it is also known as 'flight or fight hormone'.

▣ Thyroxine

- Gland: Thyroid gland.
- Target organ: Liver and adipose tissue.
- Functions: Regulates carbohydrate, protein and fat metabolism.
 - : Promotes growth and development.
 - : Influences protein synthesis.
- NOTE: Iodine is very essential for the normal functioning of thyroid gland. Deficiency of iodine causes 'goitre' (swollen neck).

▣ Growth Hormone

- Gland: Pituitary Gland.
- Target organs: Liver, bones, muscles and other tissues.
- Functions: Stimulates growth and development, particularly during childhood and adolescence.
- NOTE: Deficiency of ^{growth hormone} iodine during childhood causes 'Dwarfism', and oversecretion of growth hormone causes 'Gigantism'.

□ Insulin

- Gland: Pancreas.
- Target organs: Liver, muscle cells, adipose tissue.
- Functions: Promotes uptake of glucose by cells.

: Stimulates glycogen synthesis in liver and muscle cells.

□ NOTE: Deficiency of insulin causes diabetes.

□ Testosterone

- Gland: Testis.
- Target organs: Reproductive organs (testes), (Prostate), muscles, bones.
- Functions: Regulates production of sperm.

: Stimulates development of male secondary sexual ~~org~~ characters eg: growth of hair on genitals, legs, hands, change in voice etc.

□ Estrogen

- Gland: Ovaries.
- Target organs: Reproductive organs (uterus, breasts), bone, skin.

- Functions: Regulates menstrual cycle.

: Promotes development of secondary sexual characters: growth of breasts, change in voice etc.

