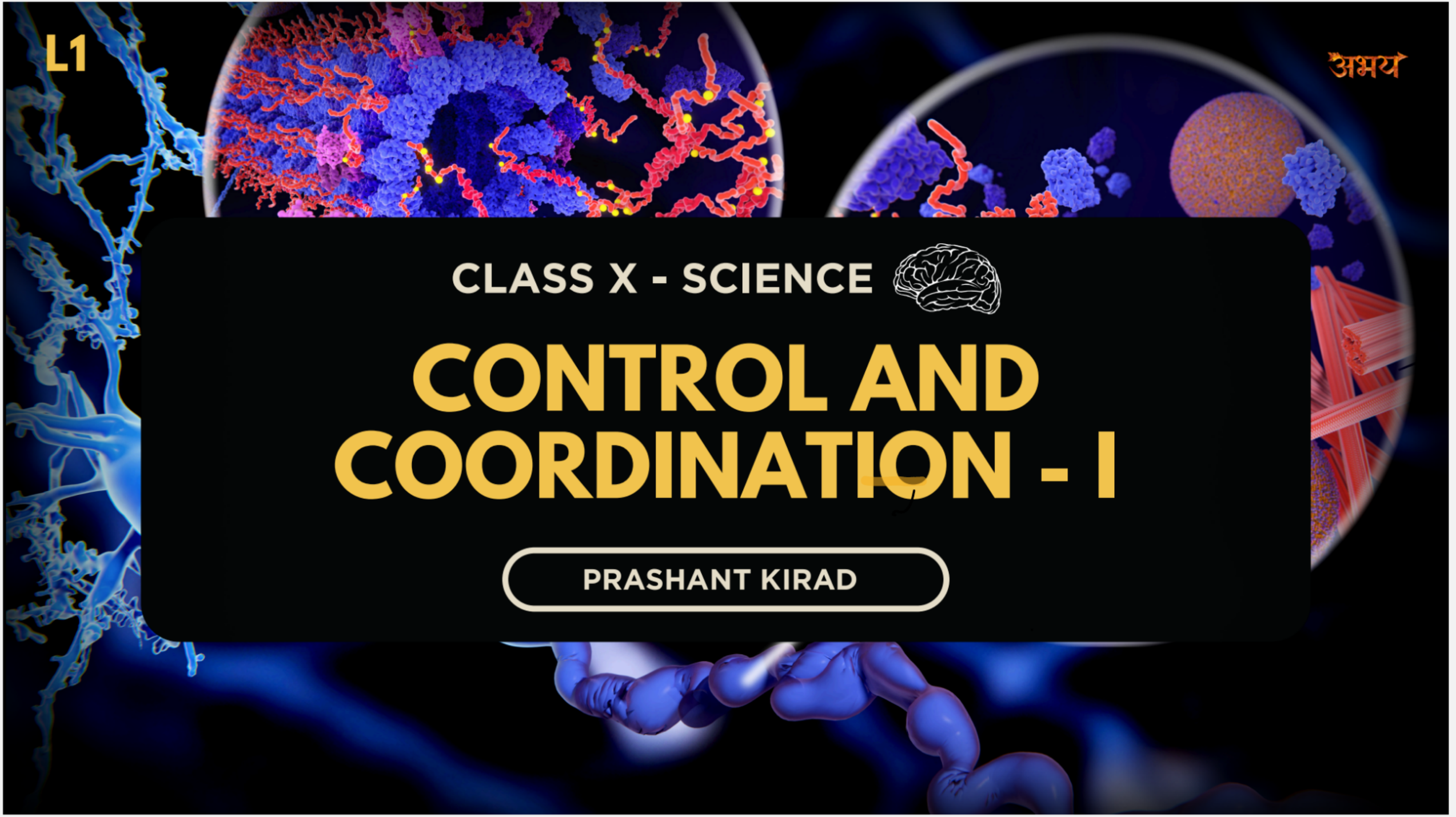
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CLASS X - SCIENCE
CONTROL AND COORDINATION - I
PRASHANT KIRAD

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PK HITS🔥

- Neuron (function + Diagram)
- Reflex arc (diagram)
- Hormone topic is very important
- Function of brain

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HUMAN NERVOUS SYSTEM

The human nervous system is a network of nerves and cells that coordinate body functions and responses.

CNS

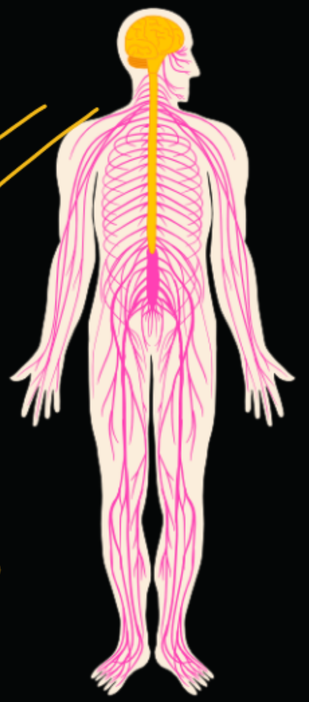
CENTRAL NERVOUS SYSTEM

BRAIN

SPINAL CORD

PERIPHERAL NERVOUS SYSTEM

PNS



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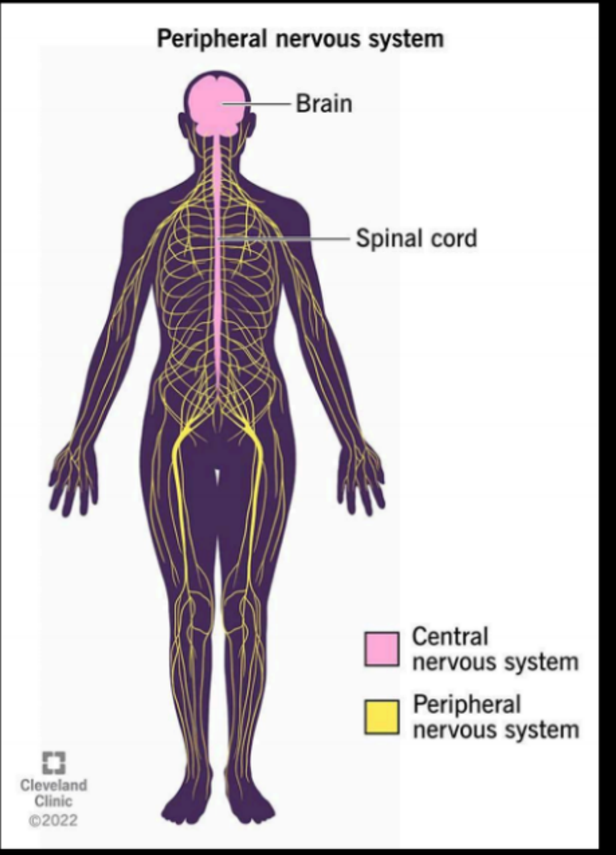
PERIPHERAL NERVOUS SYSTEM

The Peripheral Nervous System (PNS) is a part of the nervous system that includes all the nerves outside the Central Nervous System (CNS) (the brain and spinal cord). It acts as a communication network between the CNS and the rest of the body.

Main Functions of the PNS

1. **Connecting the Body to the CNS:**
   - The PNS connects different parts of the body like limbs, organs, and skin to the CNS.
2. **Carrying Messages:**
   - It carries sensory information from sense organs to the CNS.
   - It transmits motor commands from the CNS to muscles and glands.



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PARTS OF THE PNS

Somatic Nervous System:

- Controls voluntary actions, such as moving your hand or walking.
- It involves skeletal muscles.

Autonomic Nervous System (ANS):

- Controls involuntary actions, such as heartbeat, breathing, and digestion.
- It is further divided into:
- Sympathetic Nervous System: Prepares the body for emergencies ("fight or flight").
- Parasympathetic Nervous System: Helps the body relax and conserve energy ("rest and digest").

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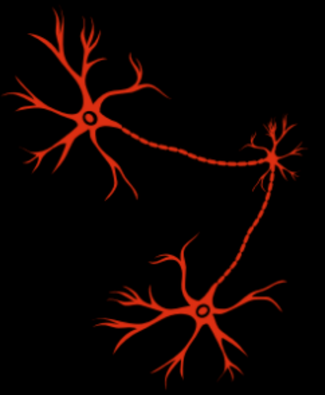
TYPES OF NERVES

- **Spinal nerves:** Originate from the spinal cord, carrying impulses between the spinal cord and the body.



- **Cranial Nerves:** Originate from the brain, responsible for sensory and motor functions of the head and neck. They carry both sensory and motor neurons.

- **Visceral Nerves:** Originate from the spinal cord and control involuntary functions of internal organs like the heart, lungs, and digestive system. They carry both sensory and motor neurons.

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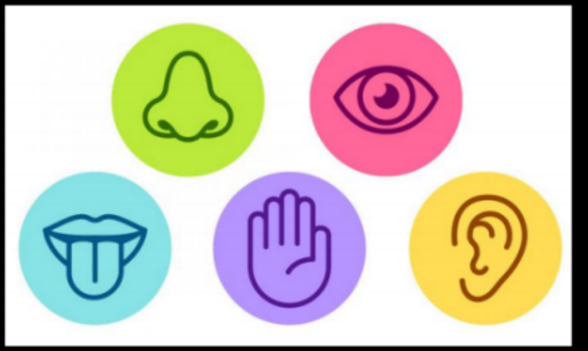
STIMULI

A stimulus is any change in the environment that triggers a response in an organism.

Example: Light, Cold, Sound, Smell, Touch, etc.



RECEPTORS AND EFFECTORS

A **receptor** is a cell or group of cells or an organ *that detects specific stimuli, such as the nose for smell or ears for sound.*

An **effector** is a body part that *responds to stimuli based on signals from the nervous system, like muscles for movement or glands for secretion.*

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RECEPTORS

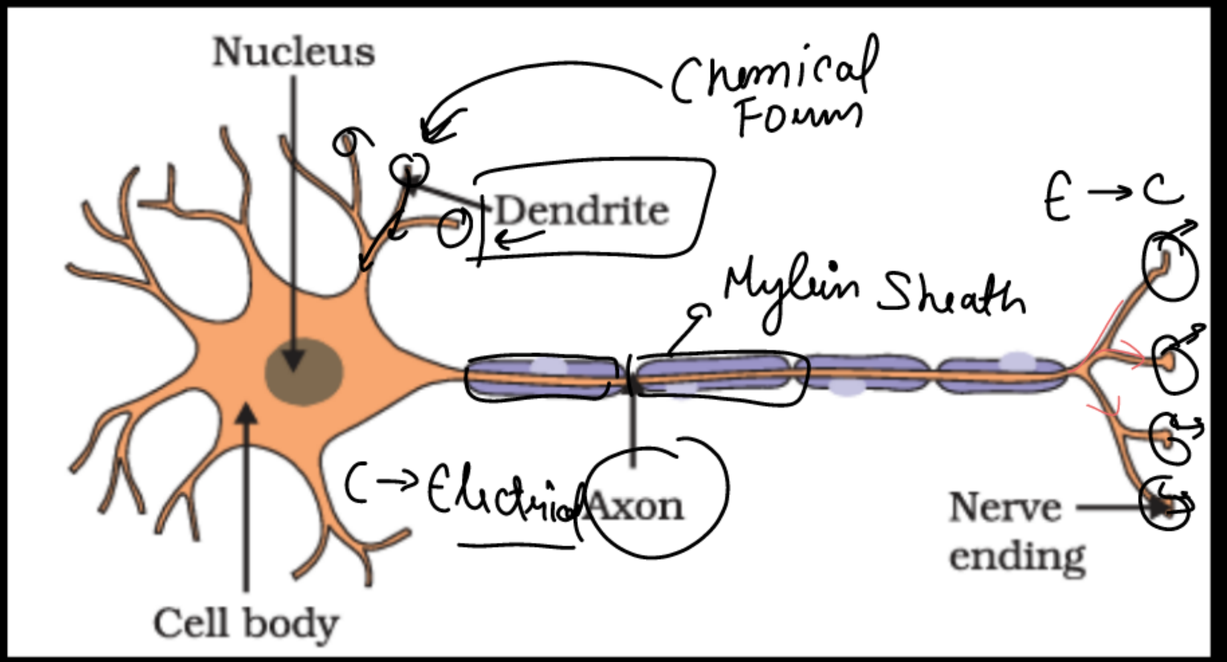
Phenoreceptors (Inner Ears)	Photoreceptors (Eyes)	Olfactory receptors (Nose)	Thermoreceptors (Skin)	Gustatory receptors (Tongue)
Sense of bound body balance	Sense of sight	Sense of smell	Sense of touch/pain/heat	Sense of taste

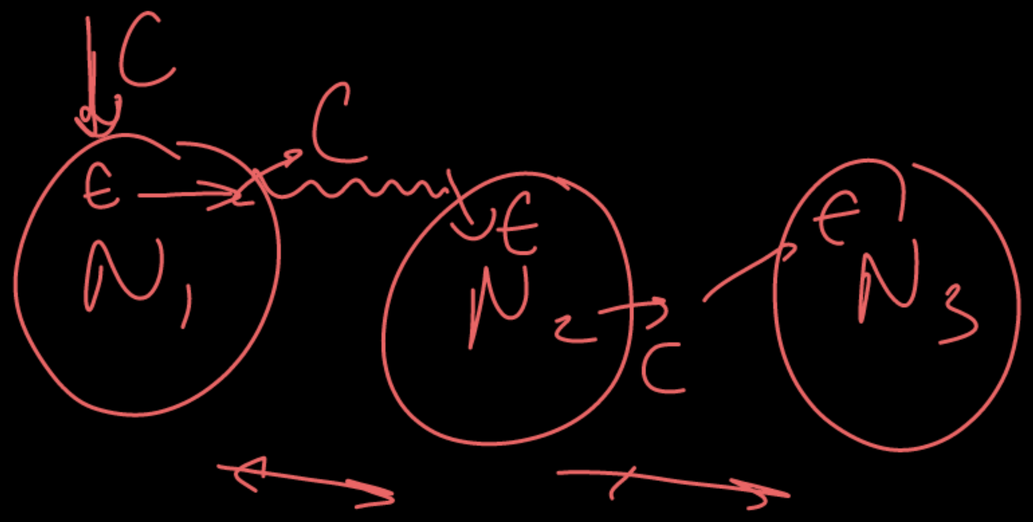




NEURON

- It is the **Structural and functional unit of Nervous System.**
- Neuron is a highly specialized cell.
- Responsible for the *transmission of signals to and from the different parts of the body.*
- *Longest cell in human body.*





Synapse

Part of Neuron	Function
Cell Body (Cyton)	- Contains the nucleus and cytoplasm and its also called Soma. - Controls the functioning of the neuron.
Dendrites	- Look like branch-like structures extending from the cell body. - Receive signals from other neurons or sensory organs. - Pass these signals to the cell body.
Axon	- Long, thin, and cable-like structure. - Transmits electrical signals away from the cell body.
Axon Terminals	- Chemical signals (neurotransmitters) are released here to bridge the gap (synapse) between two neurons. - Help in transmitting signals to the next neuron or an effector (muscle/gland).
Nerve Endings	Specialized structures at the end of axon terminals that detect stimuli (sensory neurons) or activate muscles/glands (motor neurons).
Synapse	- Impulses cross the synapse via chemical means. - Junction between two neurons where nerve impulses are transmitted.

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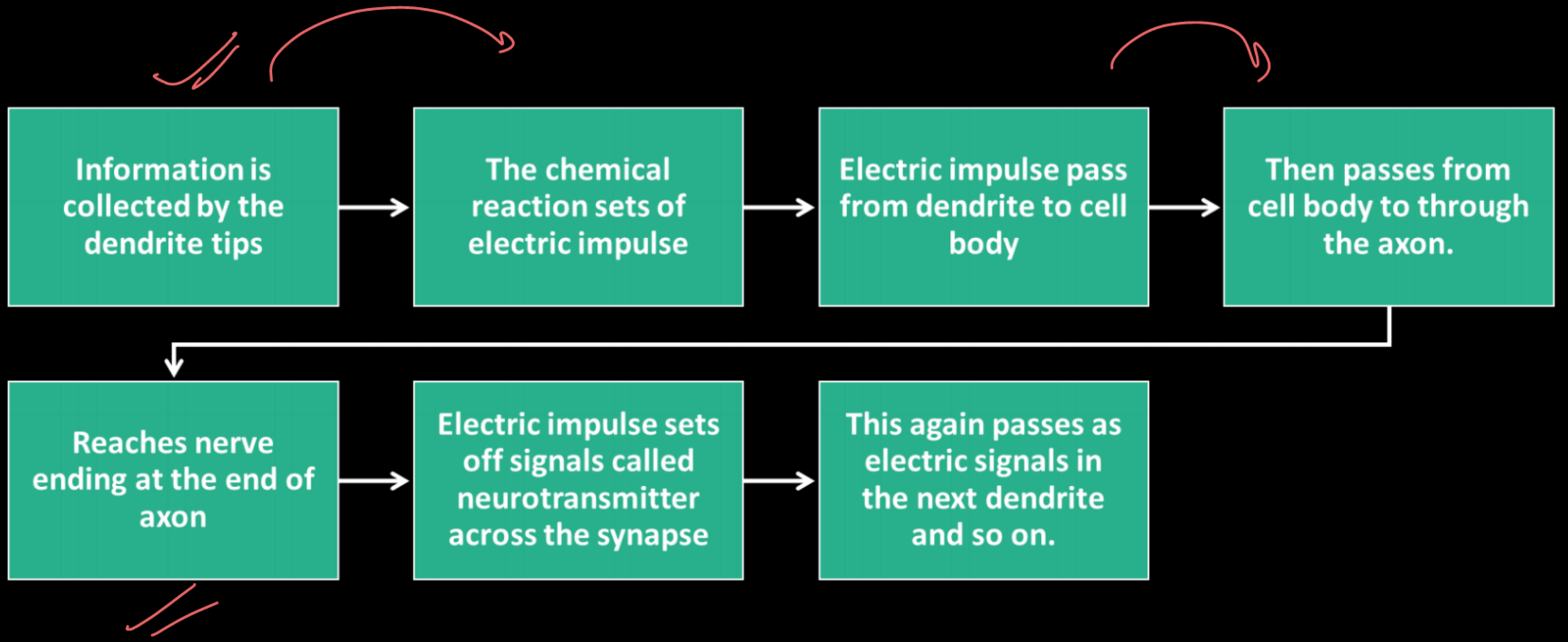
HOW DO THESE SIGNALS PASS THROUGH AND BETWEEN NEURONS



Neuro-Transmitters

↓ Chemical

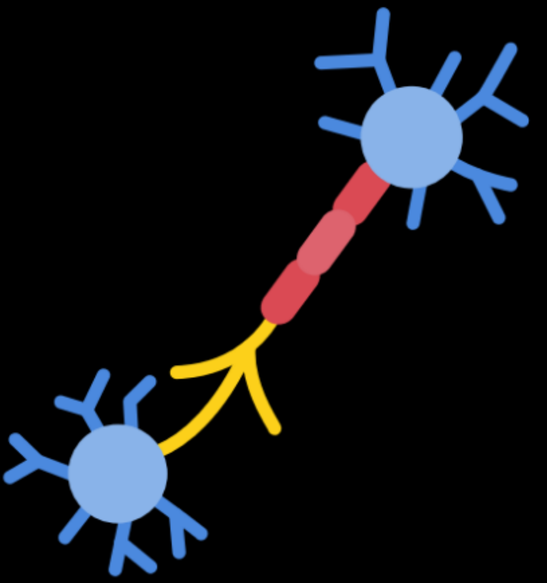
Nerve Ending

D

NERVE IMPULSE

- A nerve impulse is an electrical signal that travels along a nerve fiber, carrying information throughout the nervous system.

- They initiated at receptor cells as a result of stimuli from the environment.



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TYPES OF NEURON

SENSORY NEURONS (AFFERENT NEURON)

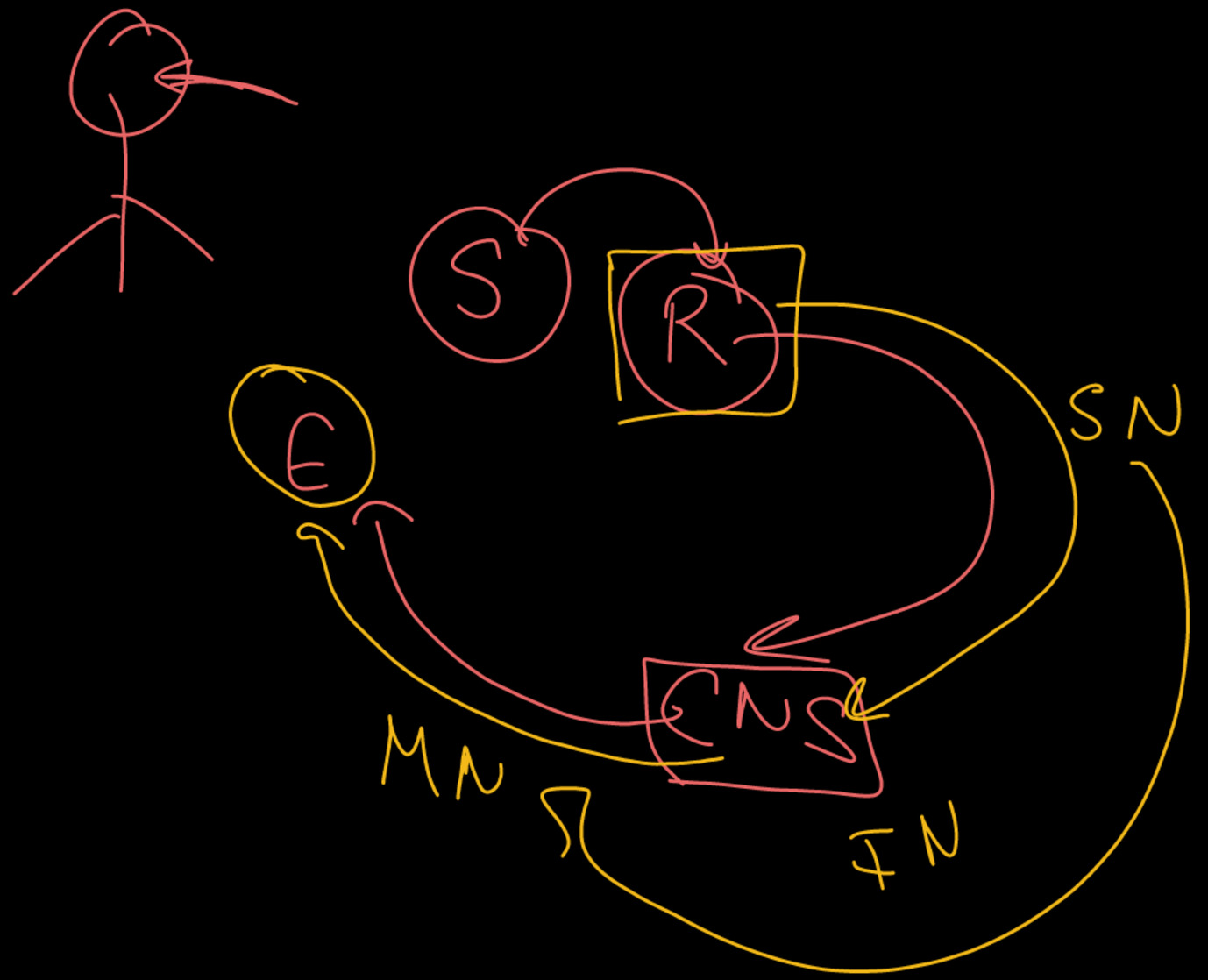
Help in transmitting nerve impulse from receptor to central nervous system.

MOTOR NEURONS (EFFERENT NEURONS)

Help in transmitting nerve impulse from receptor to central nervous system.

INTERNEURONS (RELAY OR ASSOCIATED NEURON)

They connect sensory and motor neuron.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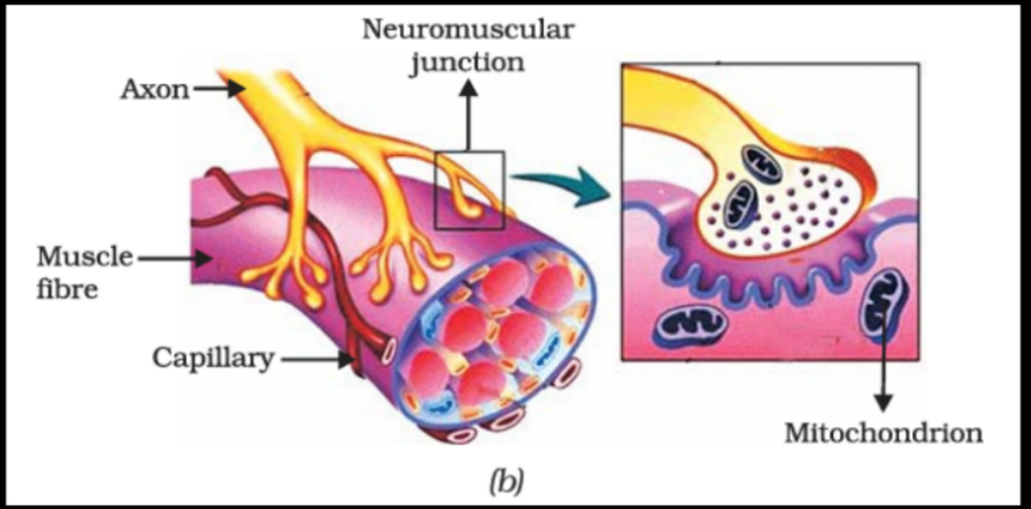
NEUROMUSCULAR JUNCTION

NMJ

A neuromuscular junction is the synapse where **a motor neuron connects to a muscle fiber**, transmitting nerve impulses to trigger muscles contraction.



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TYPES OF ACTIONS

4

VOLUNTARY ACTIONS

- These actions can be controlled by our own will.
- Thinking and Brain is involved.
- E.g. Walking, Dancing, Reading, Writing, Jumping

INVOLUNTARY ACTIONS

Slow

- These actions cannot be controlled by our own will.
- Thinking not involved.
- Brain is involved
- E.g. Pumping of Blood, Peristaltic movements, Contraction relaxation of blood vessels

REFLEX ACTIONS

Fast

- These actions can not be controlled by our own will.
- Thinking is not involved.
- Spinal Cord is involved
- E.g. Withdrawal of hand on touching an hot object.

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REFLEX ARC

The pathway through which nerve impulses pass during reflex action is called ***Reflex Arc.***

Response: It is final reaction after the reflex action.

Heat (Stimulus) → **Receptors (Skin)** → **Spinal cord** → **Effector organ (muscle)** → **Response (Hand Withdrawal)**

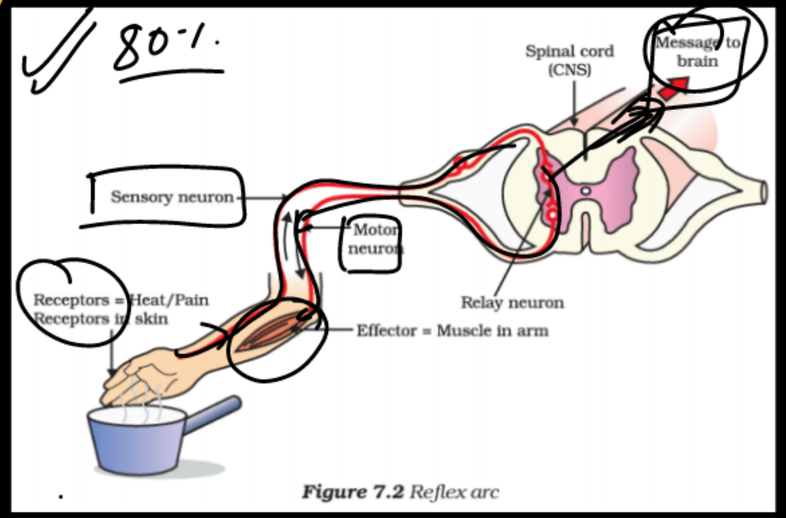

Figure 7.2 *Reflex arc*

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CENTRAL NERVOUS SYTEM

BRAIN:

How Brain is protected!

- The brain, located inside the skull, **is the body's main coordinating center.**
- It is protected by a bony structure called the **cranium.**
- Three membranes, called **meninges**, surround the brain, with **cerebrospinal fluid** filling the space between them.
- This fluid cushions the brain from mechanical shocks.

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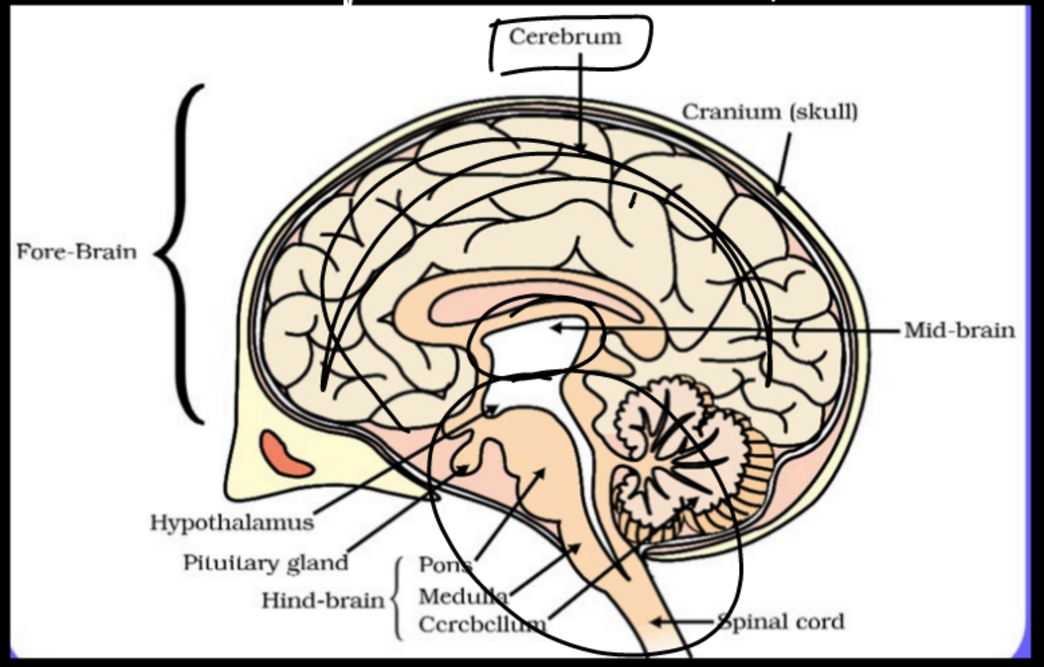
THREE PARTS OF BRAIN

FORE BRAIN

MID BRAIN

HIND BRAIN



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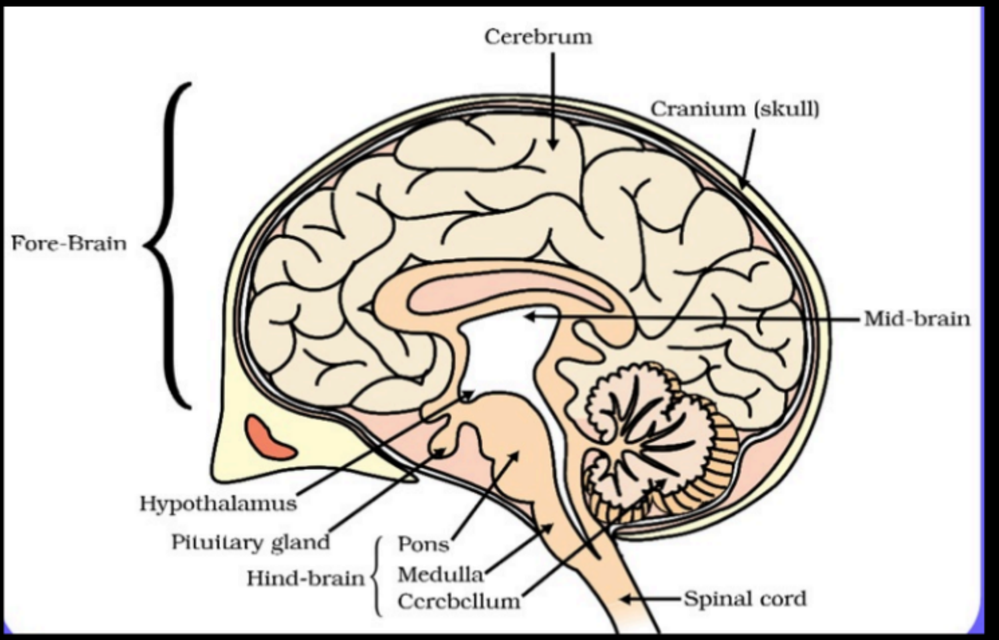
FORE BRAIN

- **It is the most complex and specialized part of the brain.**
- Consists of the cerebrum.
- Responsible for higher-order thinking and reasoning.
- Controls voluntary actions.
- Stores information (memory).
- Receives sensory impulses from different parts of the body and integrates them.
- Functions as the center associated with hunger, thirst, and emotions.



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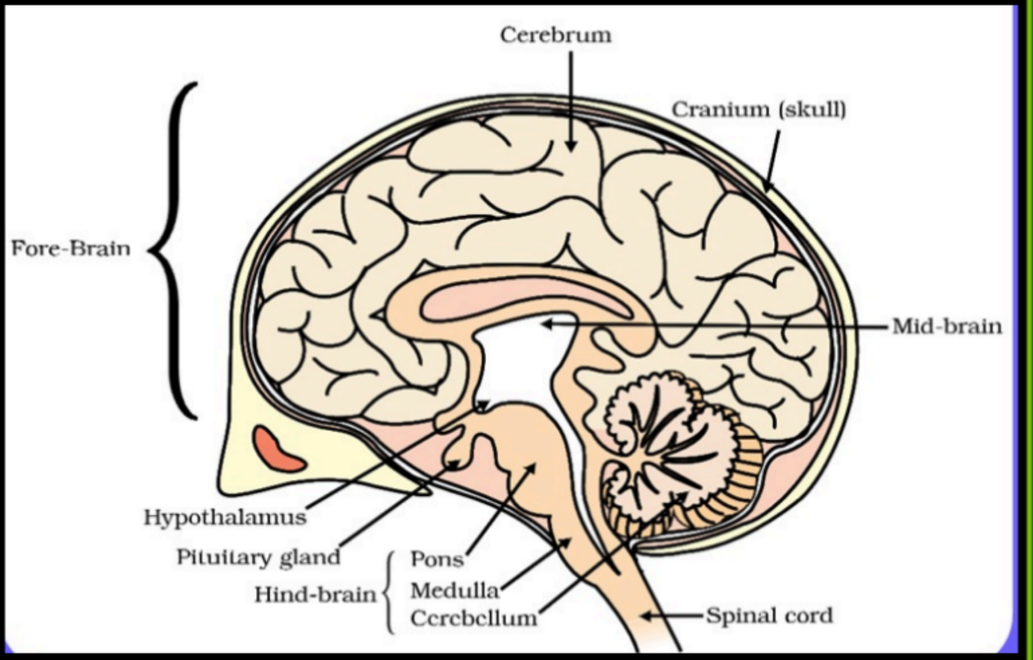
1.CEREBRUM

- **The largest and most prominent part of the brain.**
- Divided into left and right hemispheres, controlling opposite sides of the body.
- Responsible for thinking, reasoning, intelligence, and problem-solving.
- Controls voluntary actions like walking, speaking, and writing.
- Stores information and aids in learning and memory.



- Receives and processes sensory inputs like vision, hearing, and touch.
- Manages emotions, decision-making, and behavior.
- Contains specialized regions for speech, comprehension, and motor control.

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PARTS OF THE CEREBRUM

1.Cerebral Hemispheres: The cerebrum is divided into two halves called the left and right hemispheres. The two hemispheres are connected by a structure called the corpus callosum, which facilitates communication between them.

2. Cerebral Cortex: The outermost layer of the cerebrum, also called the "gray matter."

- Responsible for thinking, intelligence, memory, learning, and conscious actions.
- Contains sensory, motor, and association areas.

3. Lobes of the Cerebrum:

- **Frontal Lobe:** Controls reasoning, emotions, problem-solving, and voluntary muscle movements.
- **Parietal Lobe:** Processes sensory information such as touch, temperature, and pain.
- **Occipital Lobe:** Responsible for visual processing.
- **Temporal Lobe:** Involved in hearing, language understanding, and memory.

4. White Matter: Lies beneath the cerebral cortex and consists of nerve fibers that connect different regions of the brain.

- Facilitates communication between the cerebrum and other parts of the brain and body.

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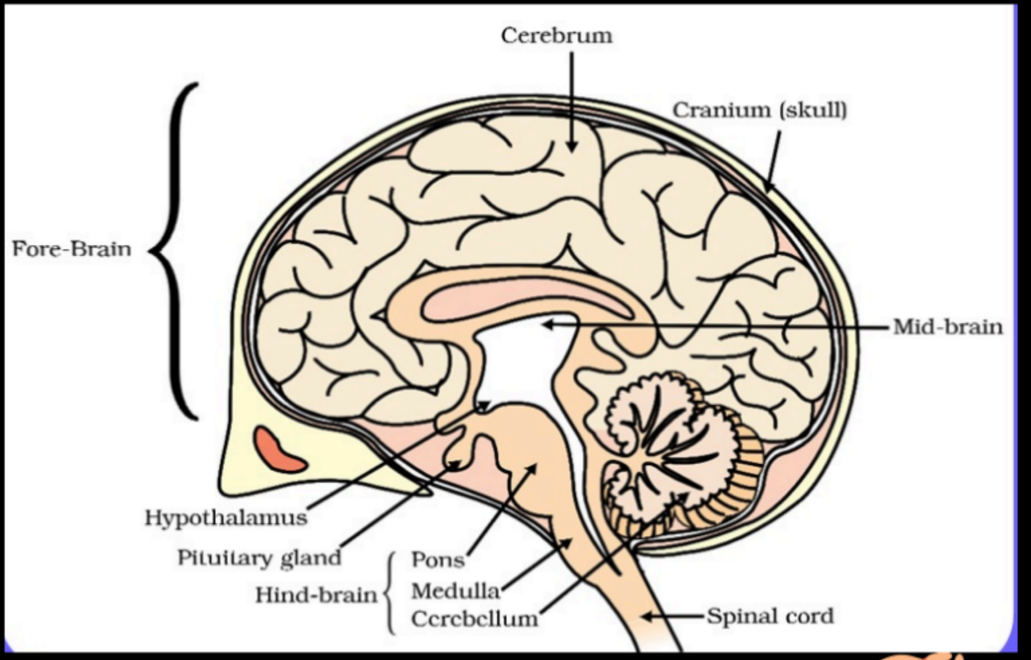
MID BRAIN

- **The midbrain is a part of the brainstem located between the forebrain and hindbrain.**
- It helps in controlling involuntary actions, such as:
- Adjusting the size of the pupil in response to light intensity.
- Reflex movements of the head, neck, and trunk in response to sudden sounds or sights.
- It serves as a relay center for visual and auditory information, passing signals to the forebrain.



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HIND BRAIN

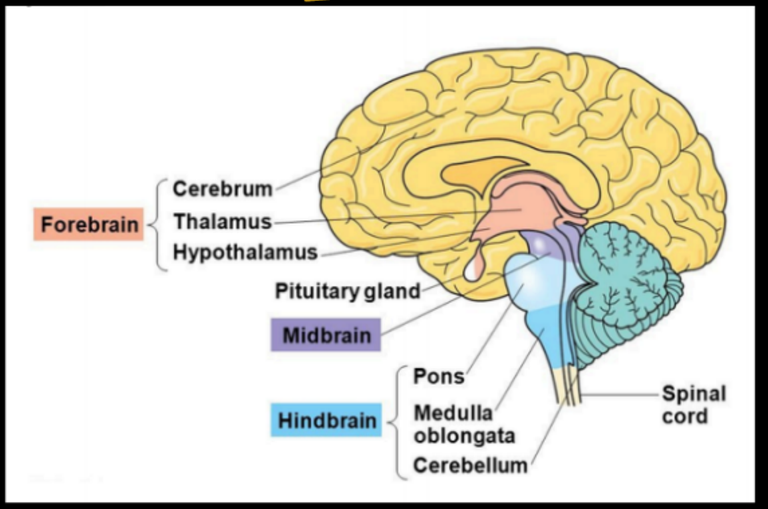
Located at the lower back part of the brain and is responsible for coordinating many vital and involuntary functions.

CEREBELLUM

Balance

MEDULLA

PONS



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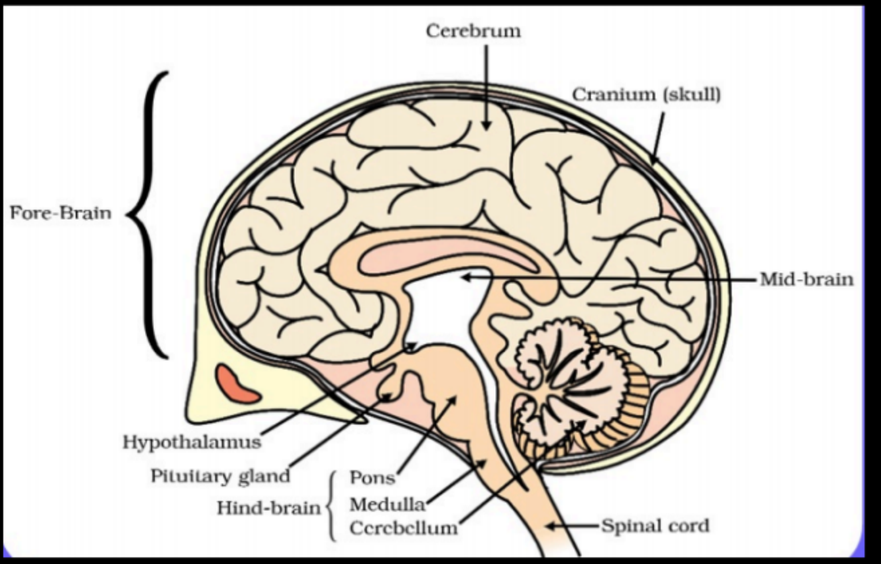
1.CEREBELLUM

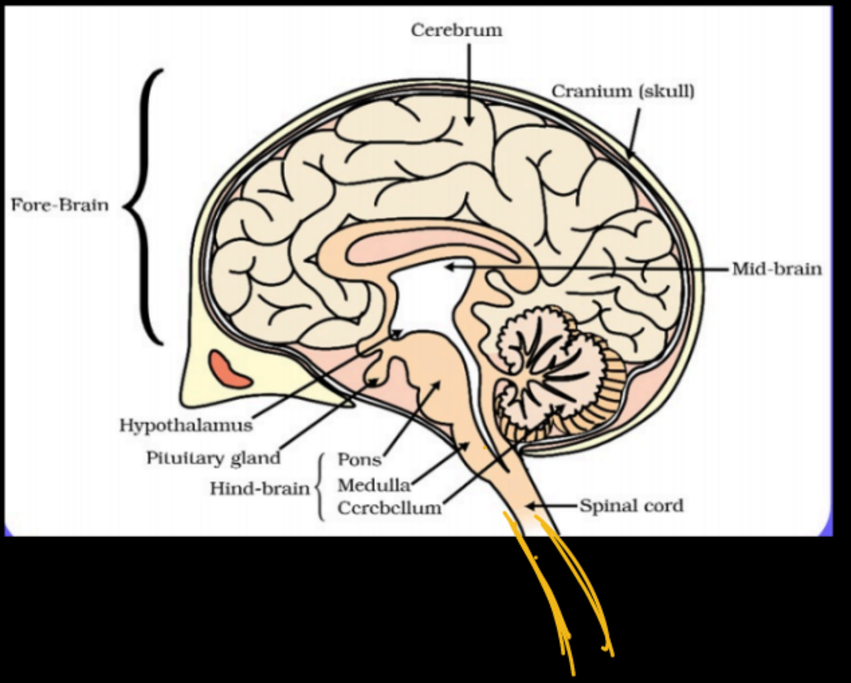
- **Located below the cerebrum at the back of the brain.**
- It is responsible for:
  - Maintaining posture and balance of the body.
  - Coordinating voluntary and precise movements, such as walking, running, or picking up objects.
- The cerebellum works in conjunction with sensory inputs from the eyes, ears, and muscles to maintain body equilibrium.
- It ensures that physical actions are smooth and not jerky or uncoordinated.



2. MEDULLA

The medulla, also known as the medulla oblongata, is a part of the hindbrain. It is located at the base of the brain and continues downward as the spinal cord.

- It controls involuntary actions essential for survival, such as: Breathing, Heartbeat regulation, Swallowing, Coughing, Sneezing
- The medulla acts as a relay center for transferring signals between the brain and the spinal cord.
- Damage to the medulla can disrupt critical life functions, as it governs many automatic processes of the body.



3. PONS ⇒ Involuntary

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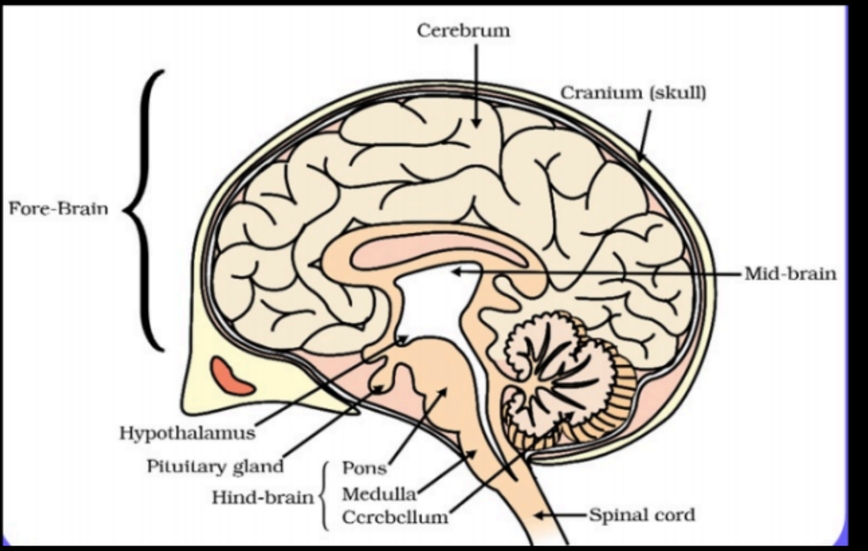
Part of the hindbrain, located above the medulla.

- Acts as a bridge connecting the cerebrum, cerebellum, and medulla.
- Helps in coordinating movements.
- Regulates respiration along with the medulla.
- Involved in sleep and arousal cycles.
- Transmits sensory and motor signals.



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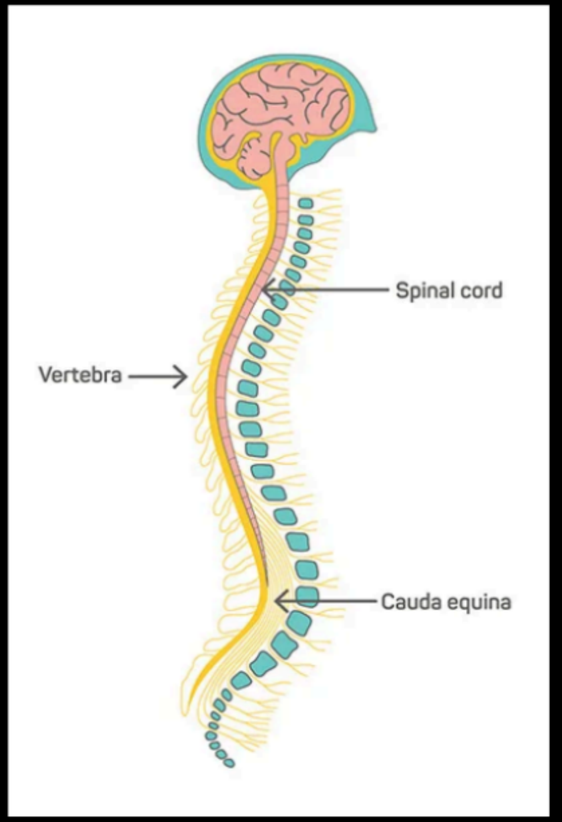
SPINAL CORD

- Spinal cord is a *cylindrical structure extending from the medulla.*
- It is enclosed by the vertebral column and surrounded by meninges.
- **31 pairs of nerves** arise from it.

- **Functions:**
  - Conducts nerve impulses to and from the brain.
  - Facilitates spinal reflexes.



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PROTECTION OF BRAIN

- Enclosed in a bony box called the **cranium**, part of the skull.
- Surrounded by three membranes called **meninges**.
- **Cerebrospinal fluid (CSF)** fills the space between meninges, acting as:
  - *A shock absorber*
  - *Cushioning to protect the brain from injuries and shocks.*

CSF

PROTECTION OF SPINAL CORD

- Like brain, spinal cord is also wrapped in **spinal meninges** and consist of **Cerebrospinal fluid.**
- The spinal cord is protected by the ***vertebral column or backbone.***
- The *vertebral column is formed by* ***33 individual bones called vertebrae.***

HORMONES IN ANIMALS

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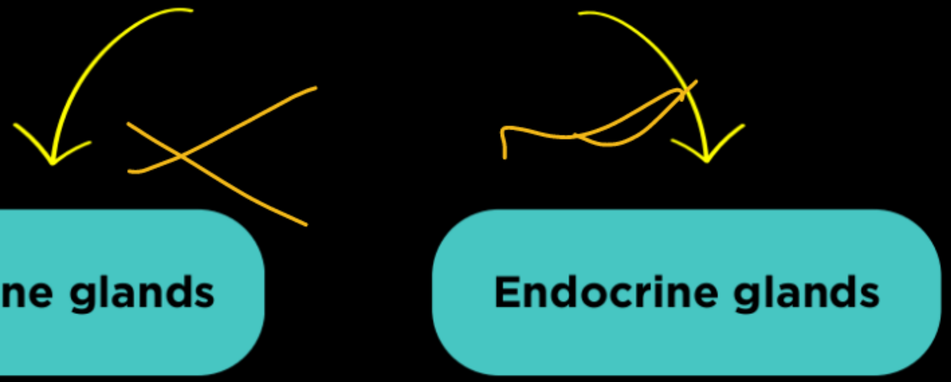
GLANDS:

A gland is a specialized organ in the body that *produces and releases substances such as hormones, enzymes, or other fluids for specific functions.*

TYPES OF GLANDS

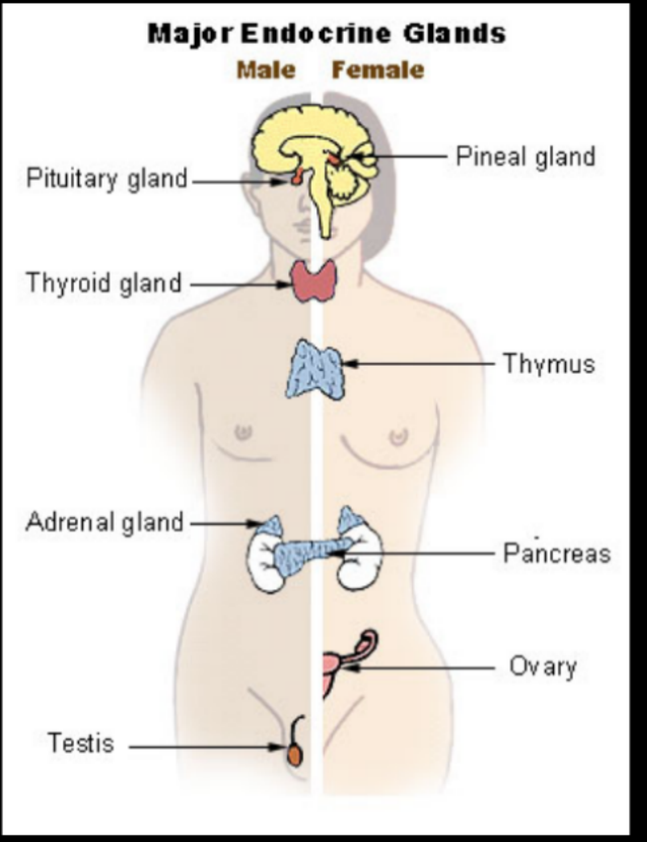


HORMONES

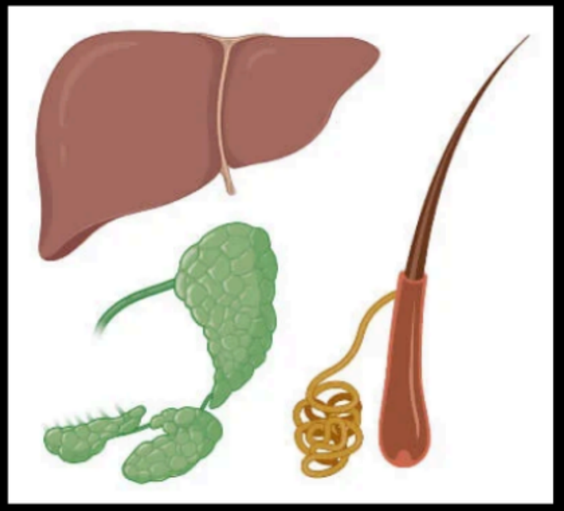
Hormones are **chemical messengers** secreted by endocrine glands.

They regulate various physiological processes like growth, metabolism, reproduction, and mood.

Example: Insulin controls blood sugar levels.



Endocrine Glands	Exocrine Glands
Ductless glands.	Have ducts.
Secrete hormones directly into the blood.	Secrete enzymes, sweat, etc., into ducts.
Example: Thyroid, Pituitary.	Example: Salivary, Sweat glands.



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Q1.A part of the body which responds to the in-structions sent from nervous system is called

(a) receptor

(b) effector

(c) nerves

(d) muscles

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Q2.Posture and balance of the body is controlled by

(a) Pons

(b) Medulla oblongata

(c) Cerebellum

(d) Cerebrum

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Q3.Which part of nervous system controls the re¬flex activities of the body?

(a) Brain
(b) Spinal cord
(c) Cerebrum
(d) Cerebellum

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Q.4 How will information travel within a neuron?

(a) Dendrite -> cell body -> axon -> nerve ending

(b) Dendrite -> axon -> cell body -> nerve ending

(c) Axon -> dendrite -> cell body -> nerve ending

(d) Axon -> cell body -> dendrite -> nerve ending

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Q.5 Which part of brain regulates body temperature,hunger and thirst?

(a) Cerebrum

(b) Cerebellum

(c) Medulla oblongata

(d) Hypothalamus

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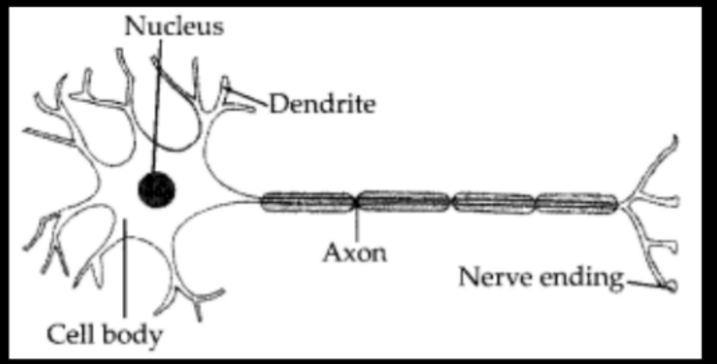
2023/ 2020:

Question (3 Marks): Draw a neat and labeled diagram of a neuron. Explain its function briefly.

Answer:



- **Function:**
  a. **Dendrites: Receive impulses from receptors or other neurons.**
  b. **Axon: Transmits impulses away from the cell body.**
  c. **Synapse: Transfers impulses to the next neuron or effector.**

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2021:

Question (2 Marks): What is a synapse? How does a nerve impulse travel across a synapse?

N → Nerve → dendrite

Answer:

- A synapse is a junction between two neurons.
- The nerve impulse travels chemically via neurotransmitters released from the axon terminal of one neuron, which bind to receptors on the next neuron, triggering an electrical impulse.

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2021 (3 Marks):

Q: Explain the two main parts of the human nervous system.

Answer:

1. **Central Nervous System (CNS):**
   - Includes the brain and spinal cord.
   - Processes information and generates responses.
2. **Peripheral Nervous System (PNS):**
   - Includes cranial and spinal nerves.
   - Connects the CNS to other parts of the body.

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2022/2017:

Question (3 Marks): With the help of a labeled diagram, describe the pathway of a reflex arc.

Answer:

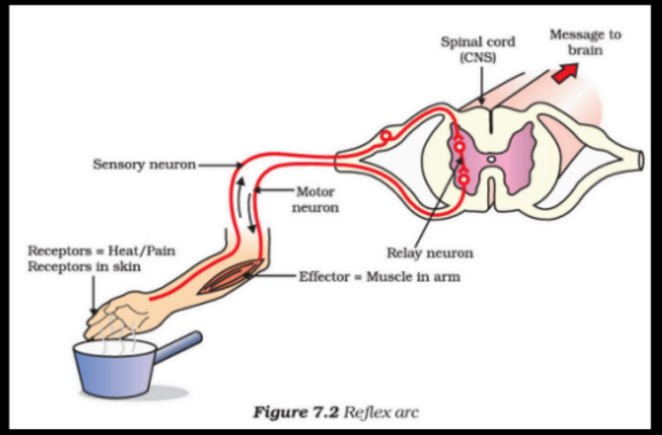

Figure 7.2 Reflex arc

- **Pathway:**
  a. **Receptor detects stimulus (e.g., touching a hot object).**
  b. **Sensory neuron transmits signal to the spinal cord.**
  c. **Spinal cord processes and sends a response via motor neuron.**
  d. **Effector (muscle) acts (e.g., withdraws hand).**