

L1

अभय

CLASS X - SCIENCE



# CONTROL AND COORDINATION - I

PRASHANT KIRAD



# PK HITS

✓ Neuron (function + Diagram)

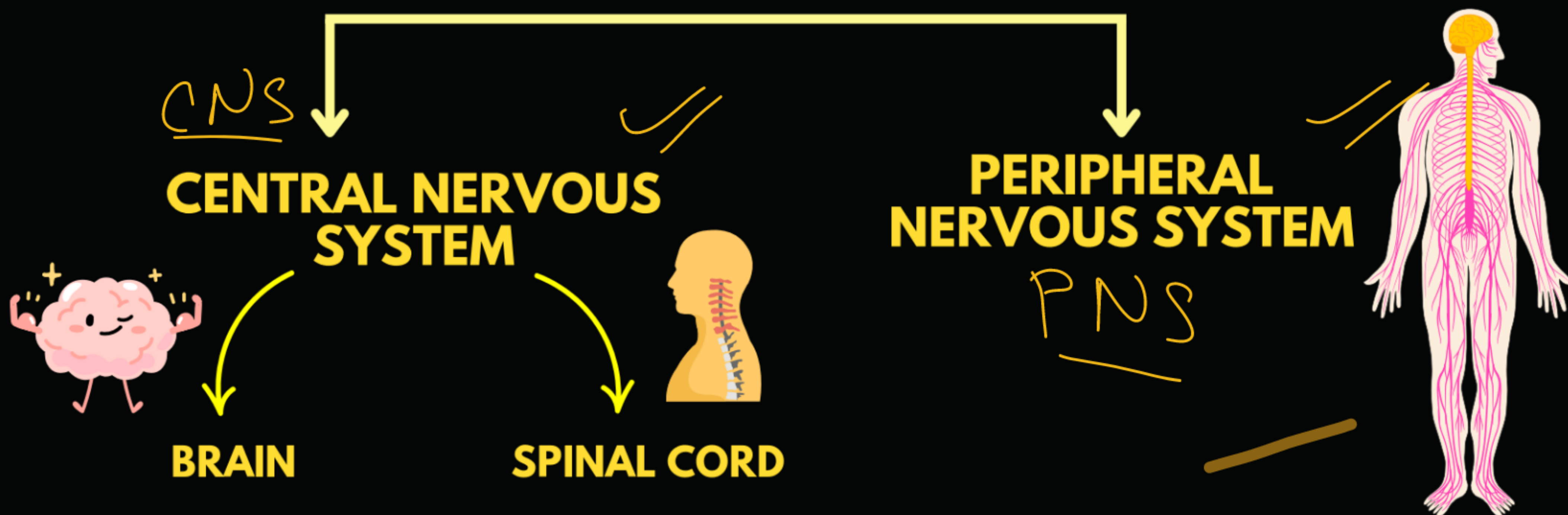
1101 ✓ Reflex arc (diagram)

MCO ✓ Hormone topic is very important

• Function of brain

# HUMAN NERVOUS SYSTEM

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





# 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.

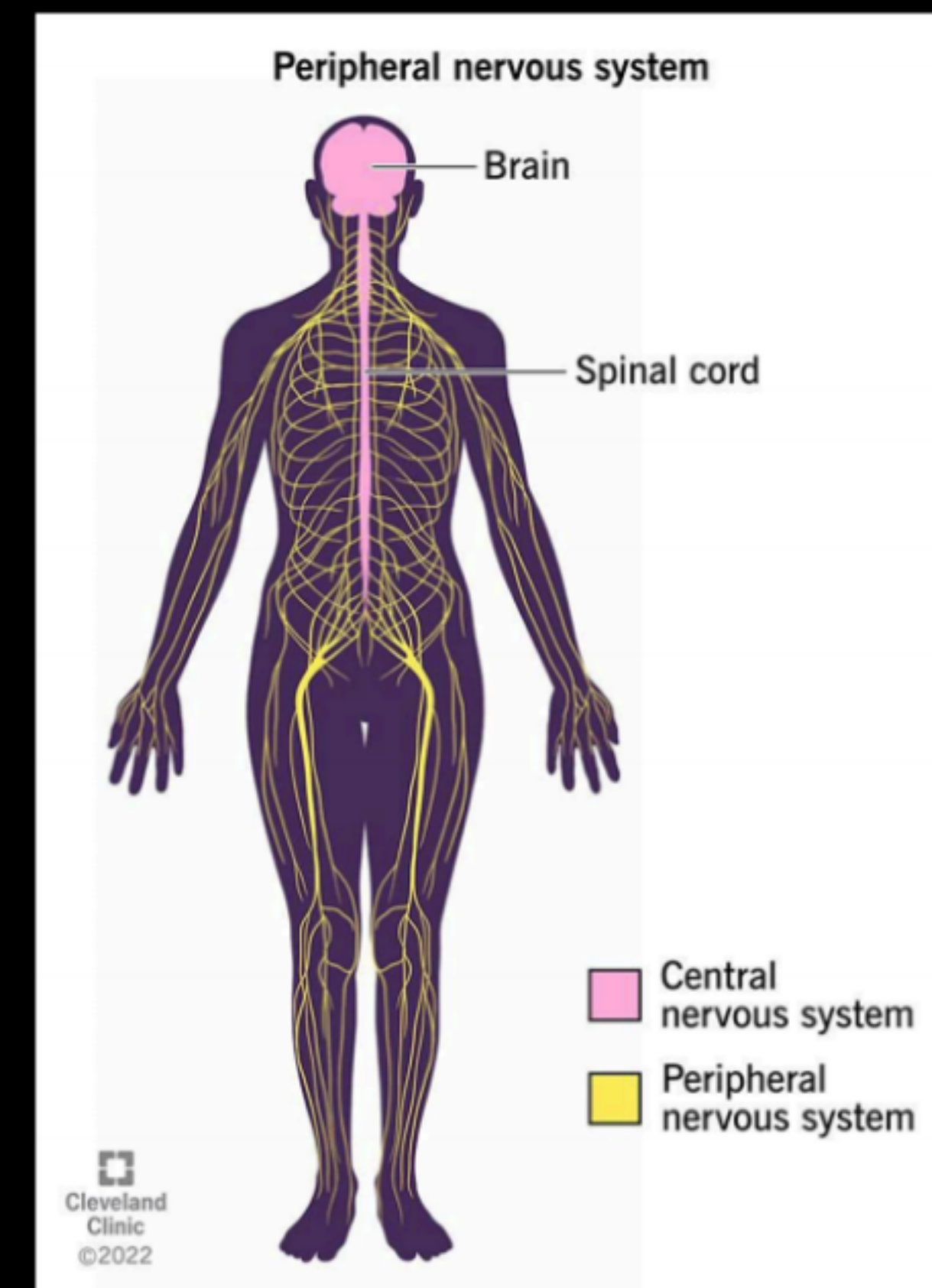
## Main Functions of the PNS

### 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.





# PARTS OF THE PNS

## **Somatic Nervous System:**

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



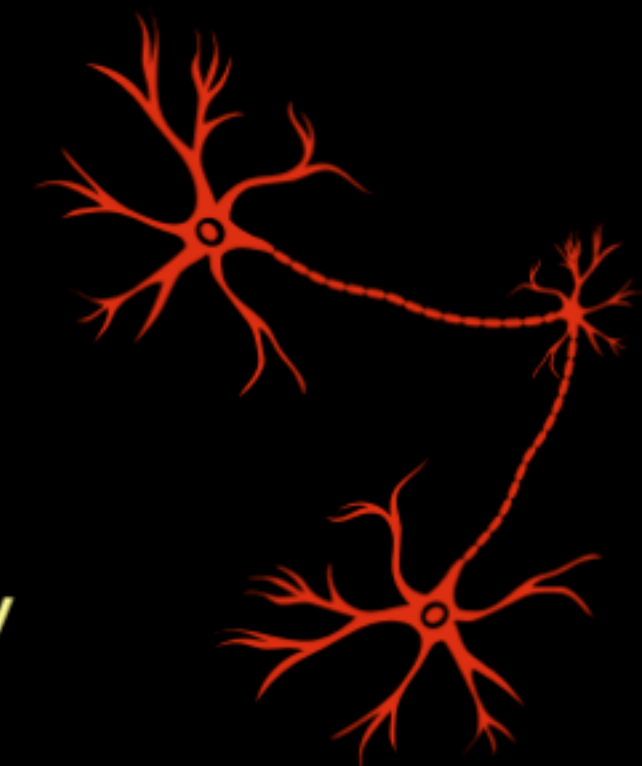
## **Autonomic Nervous System (ANS):**

- 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").



# 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.





# STIMULI

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

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



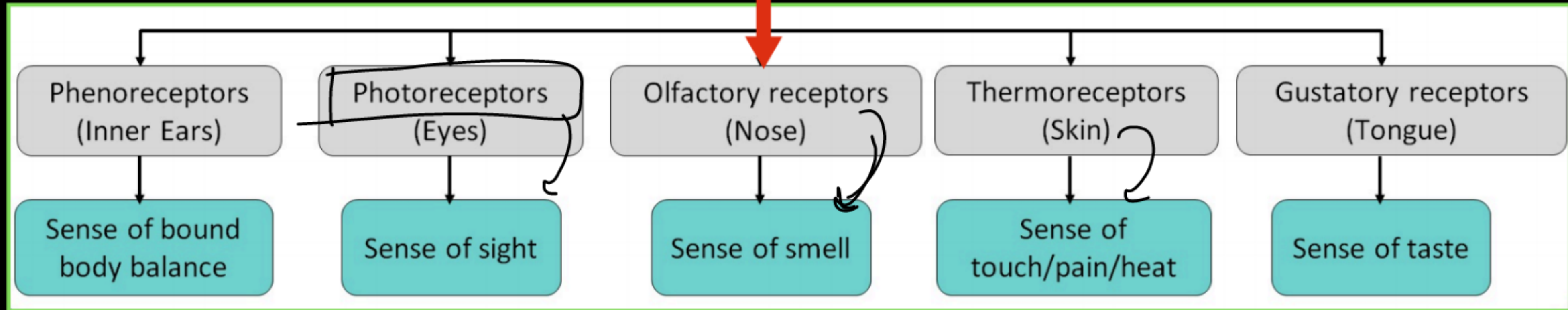
## RECEPTORS AND EFFECTORS

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.*



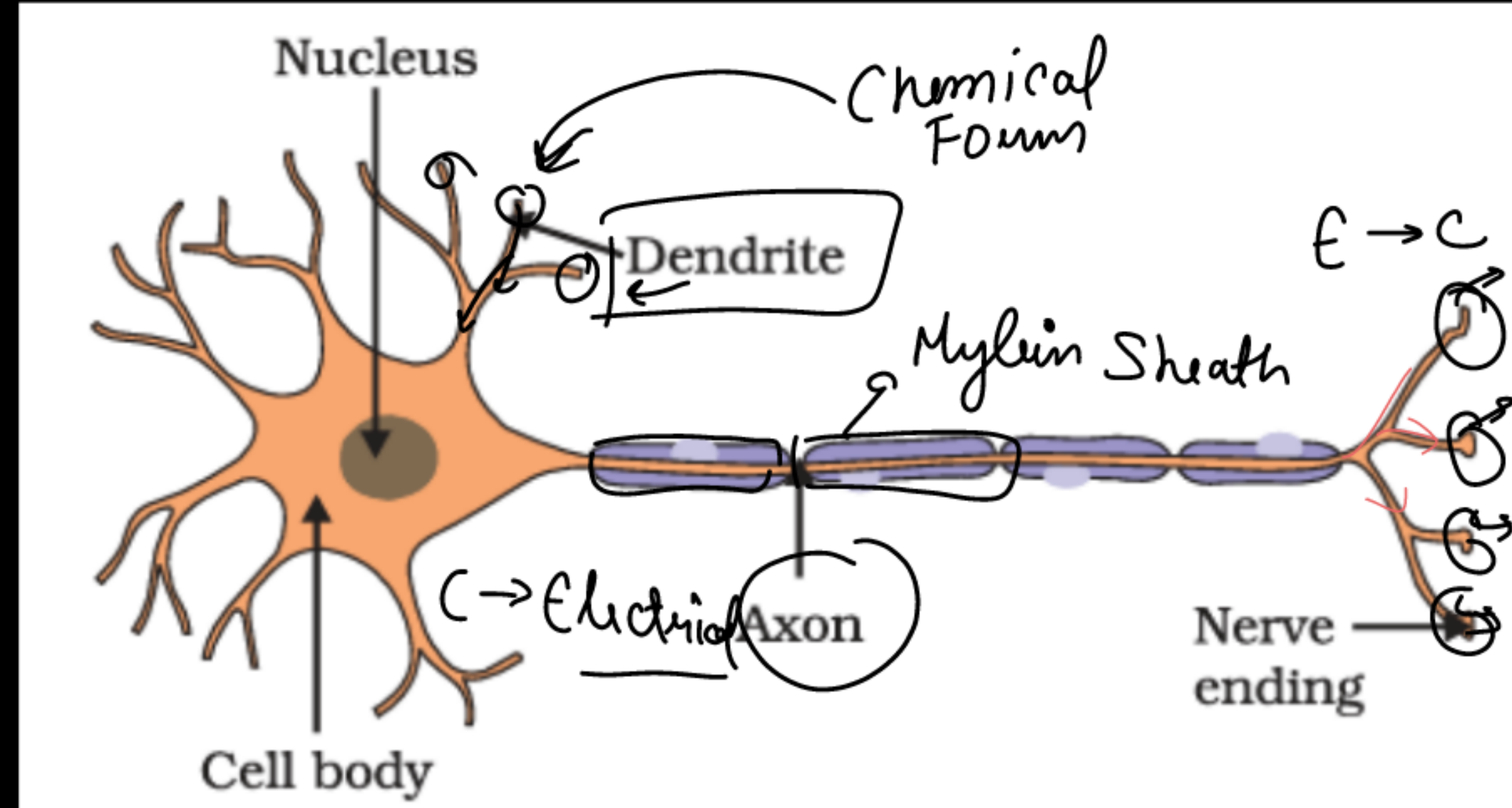
# RECEPTORS



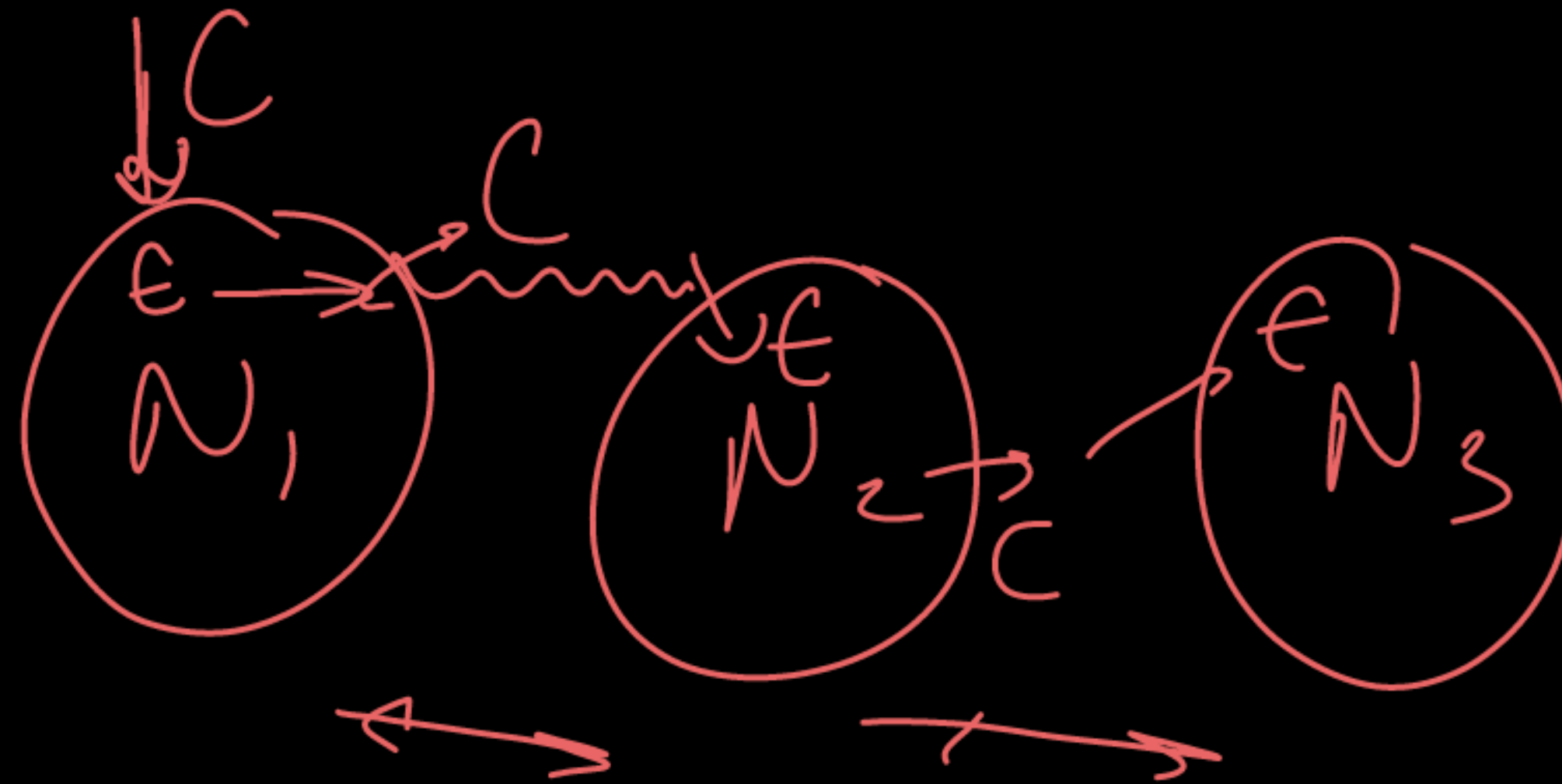


# NEURON

- 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.







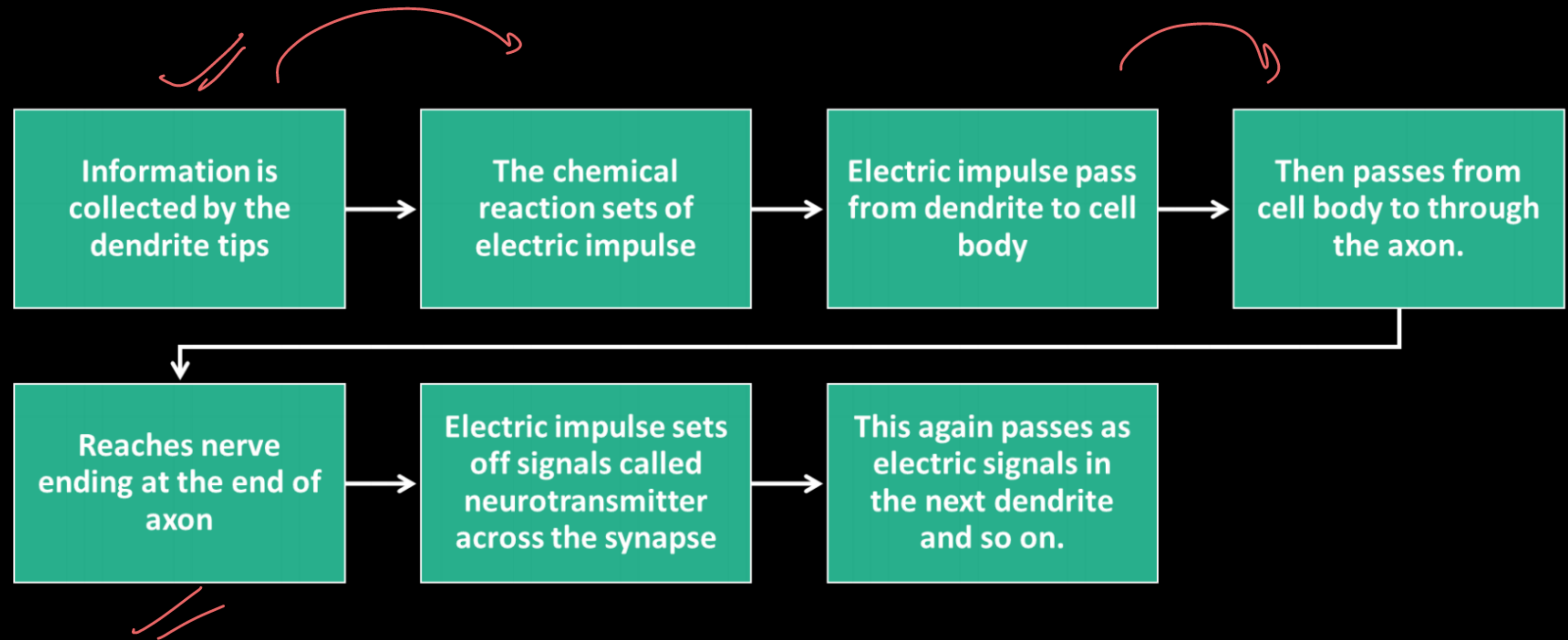
Synapse



Part of Neuron	Function
<b>Cell Body (Cyton)</b>	<ul style="list-style-type: none"> <li>- Contains the nucleus and cytoplasm and its also called Soma.</li> <li>- Controls the functioning of the neuron.</li> </ul>
<b>Dendrites</b>	<ul style="list-style-type: none"> <li>- Look like branch-like structures extending from the cell body.</li> <li>- Receive signals from other neurons or sensory organs. - Pass these signals to the cell body.</li> </ul>
<b>Axon</b>	<ul style="list-style-type: none"> <li>- Long, thin, and cable-like structure.</li> <li>- Transmits electrical signals away from the cell body.</li> </ul>
<b>Axon Terminals</b>	<ul style="list-style-type: none"> <li>- Chemical signals (neurotransmitters) are released here to bridge the gap (synapse) between two neurons.</li> <li>- Help in transmitting signals to the next neuron or an effector (muscle/gland).</li> </ul>
<b>Nerve Endings</b>	Specialized structures at the end of axon terminals that detect stimuli (sensory neurons) or activate muscles/glands (motor neurons).
<b>Synapse</b>	<ul style="list-style-type: none"> <li>- Impulses cross the synapse via chemical means.</li> <li>- Junction between two neurons where nerve impulses are transmitted.</li> </ul>



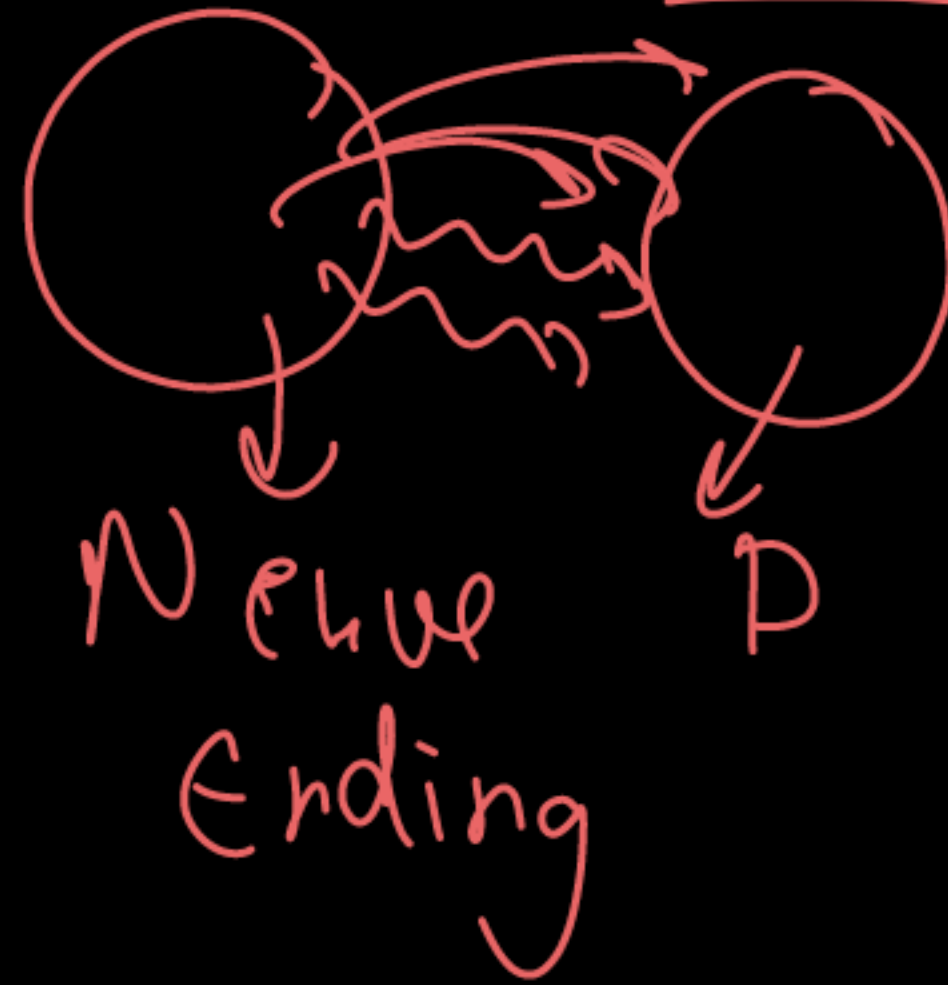
# HOW DO THESE SIGNALS PASS THROUGH AND BETWEEN NEURONS



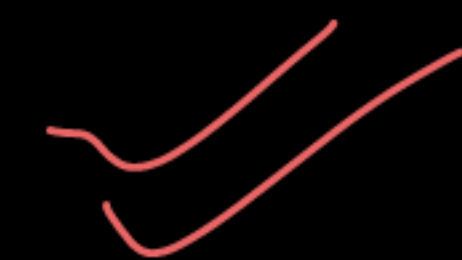


# Neuro-Transmitter

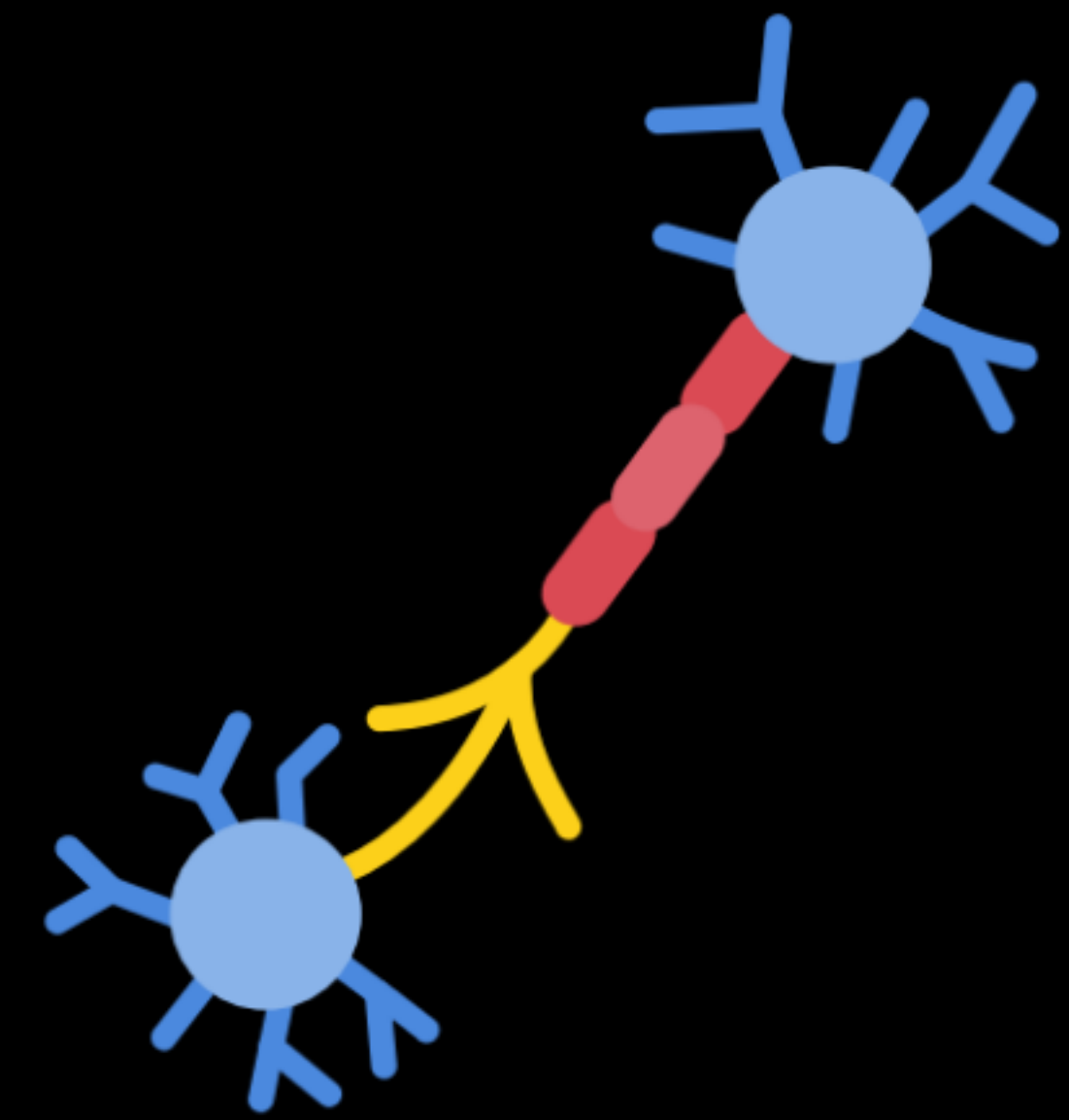
Chemical



# NERVE IMPULSE

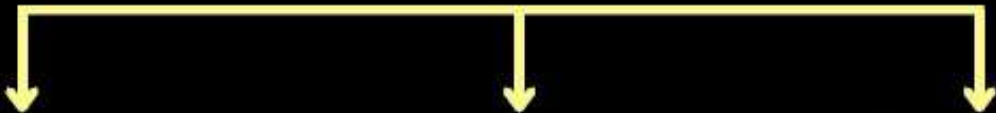


- A nerve impulse is an electrical signal that travels along a nerve fiber, carrying information throughout the nervous system.
- They initiated at receptor cells as a result of stimuli from the environment.





## TYPES OF NEURON



### **SENSORY NEURONS (AFFERENT NEURON)**

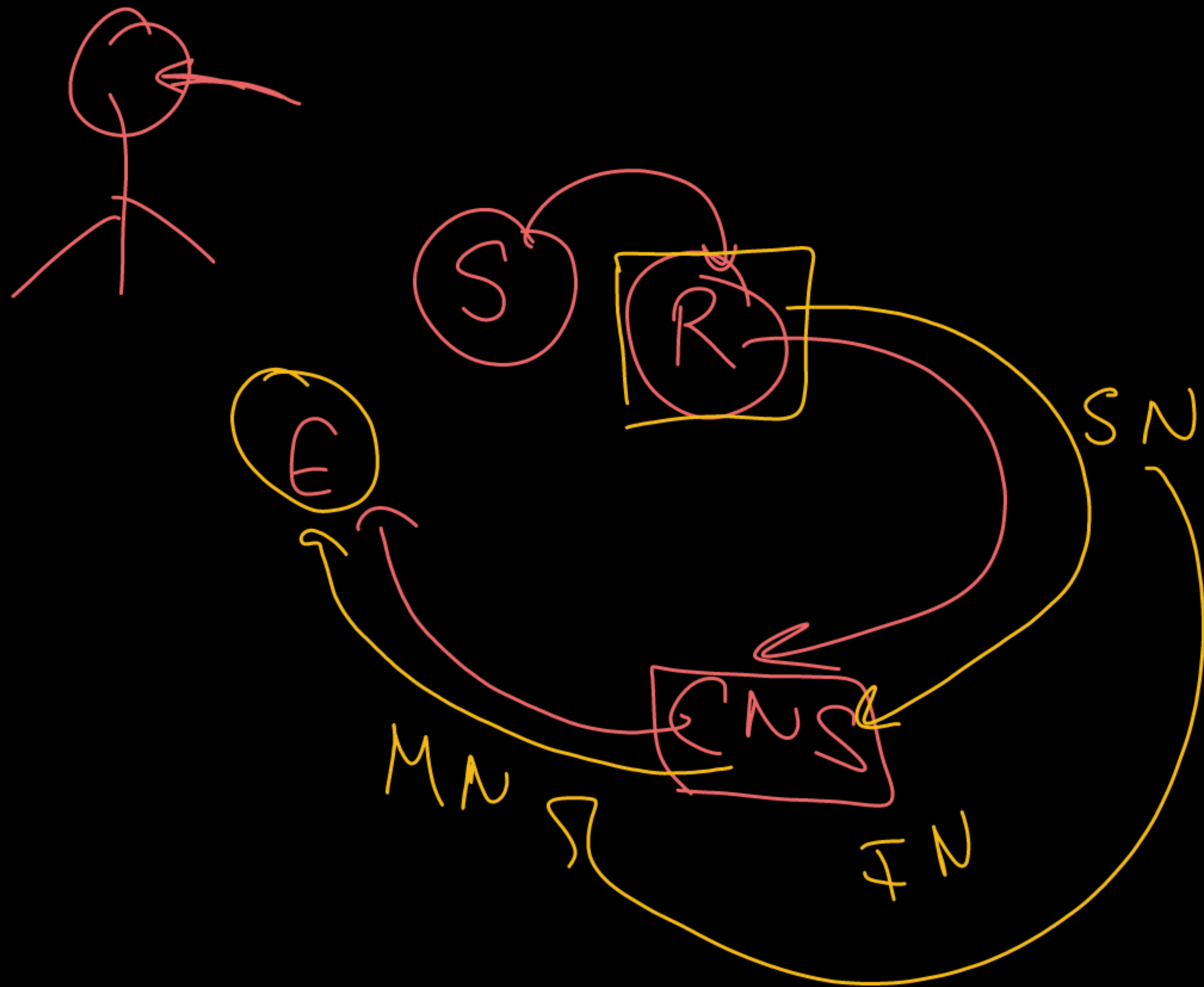
Carry signals from sensory organs to the brain and spinal cord.

### **MOTOR NEURONS (EFFERENT NEURONS)**

Transmit signals from the brain and spinal cord to muscles or glands.

### **INTERNEURONS (RELAY OR ASSOCIATED NEURON)**

Connect sensory and motor neurons, processing and relaying information.

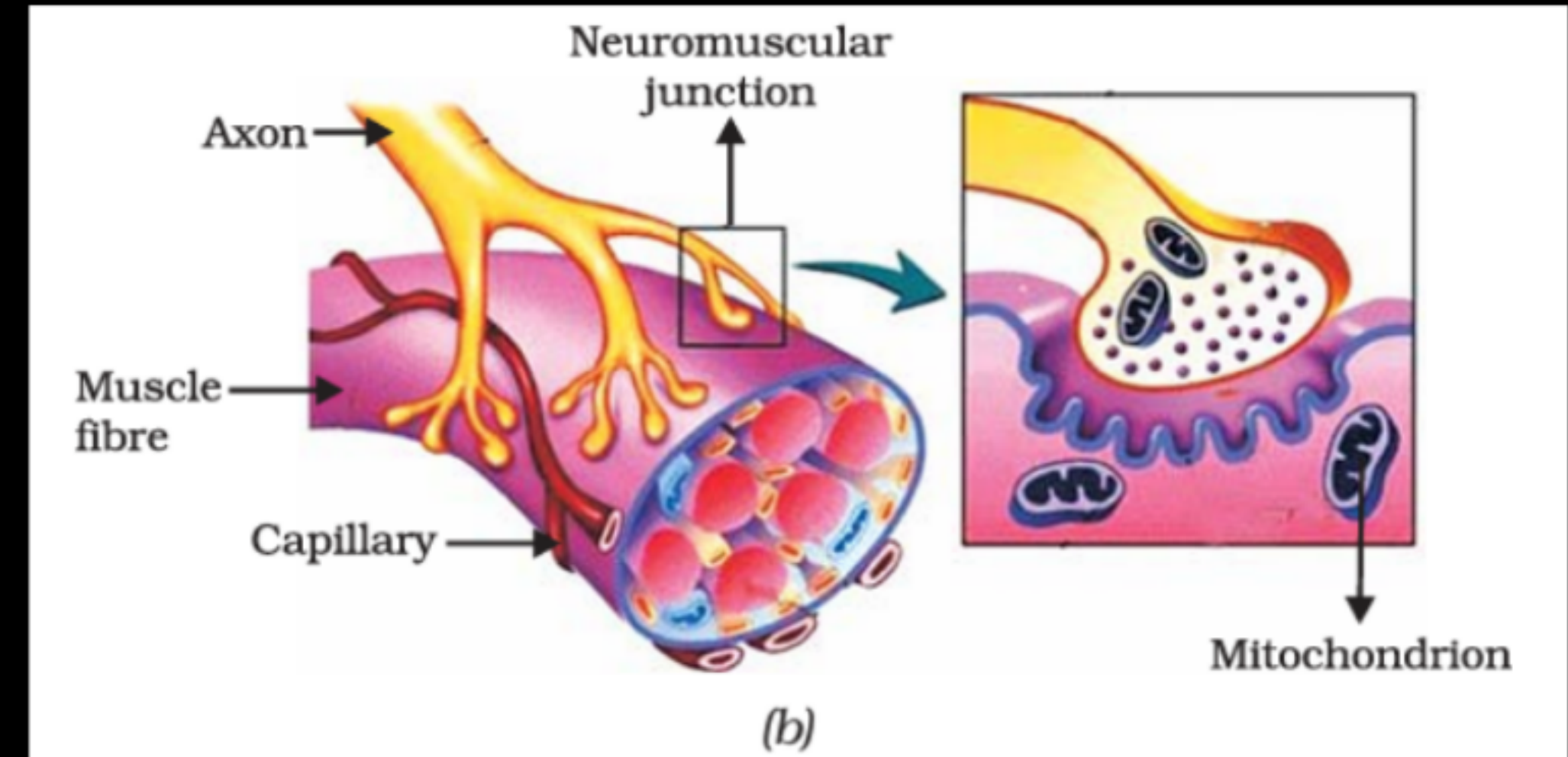




# ✓ NEUROMUSCULAR JUNCTION

NMJ

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



# 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.



# 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)



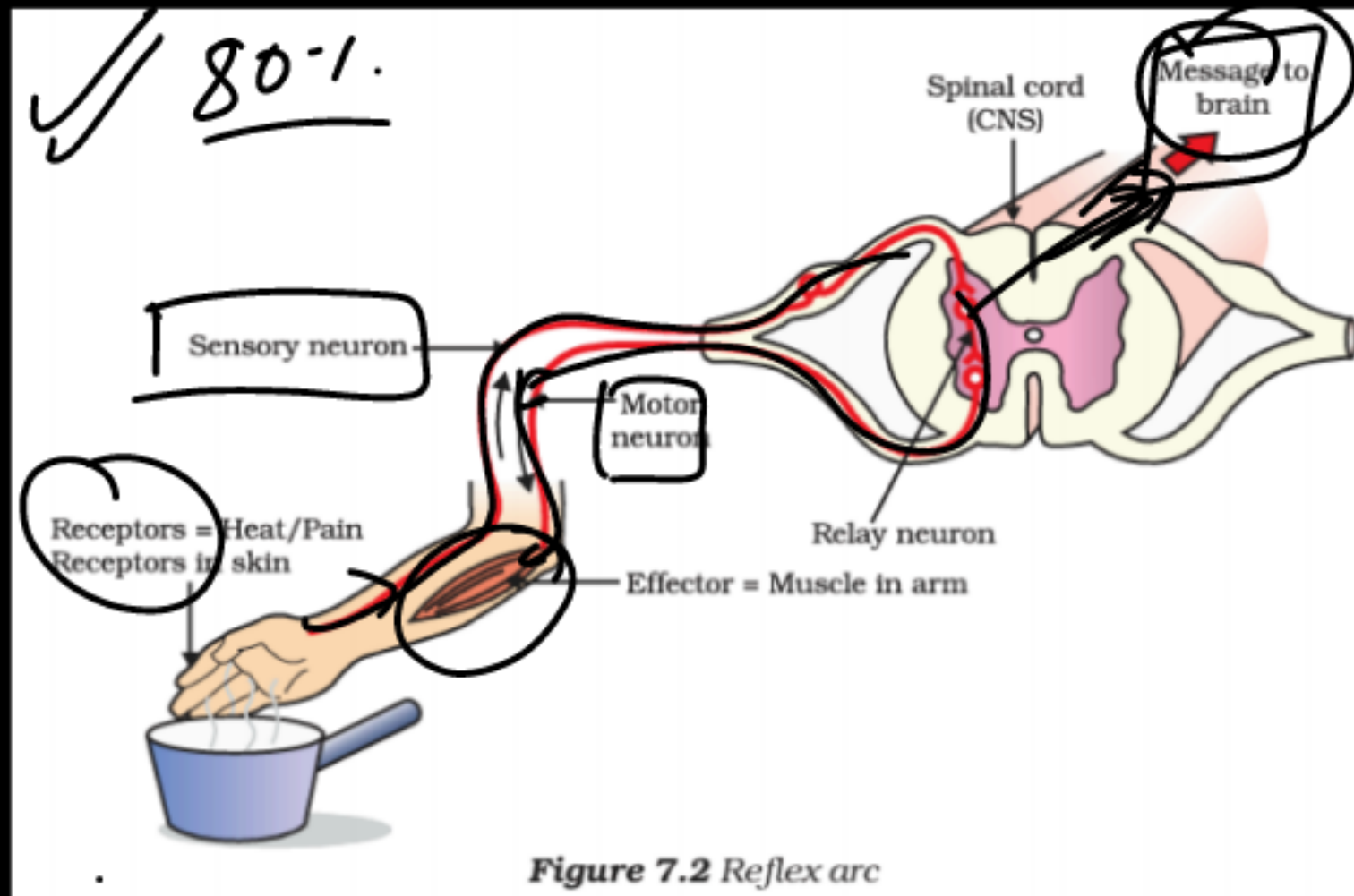
Spinal cord



Response (Hand Withdrawal)



Effector organ (muscle)



# 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.

CSF





# THREE PARTS OF BRAIN

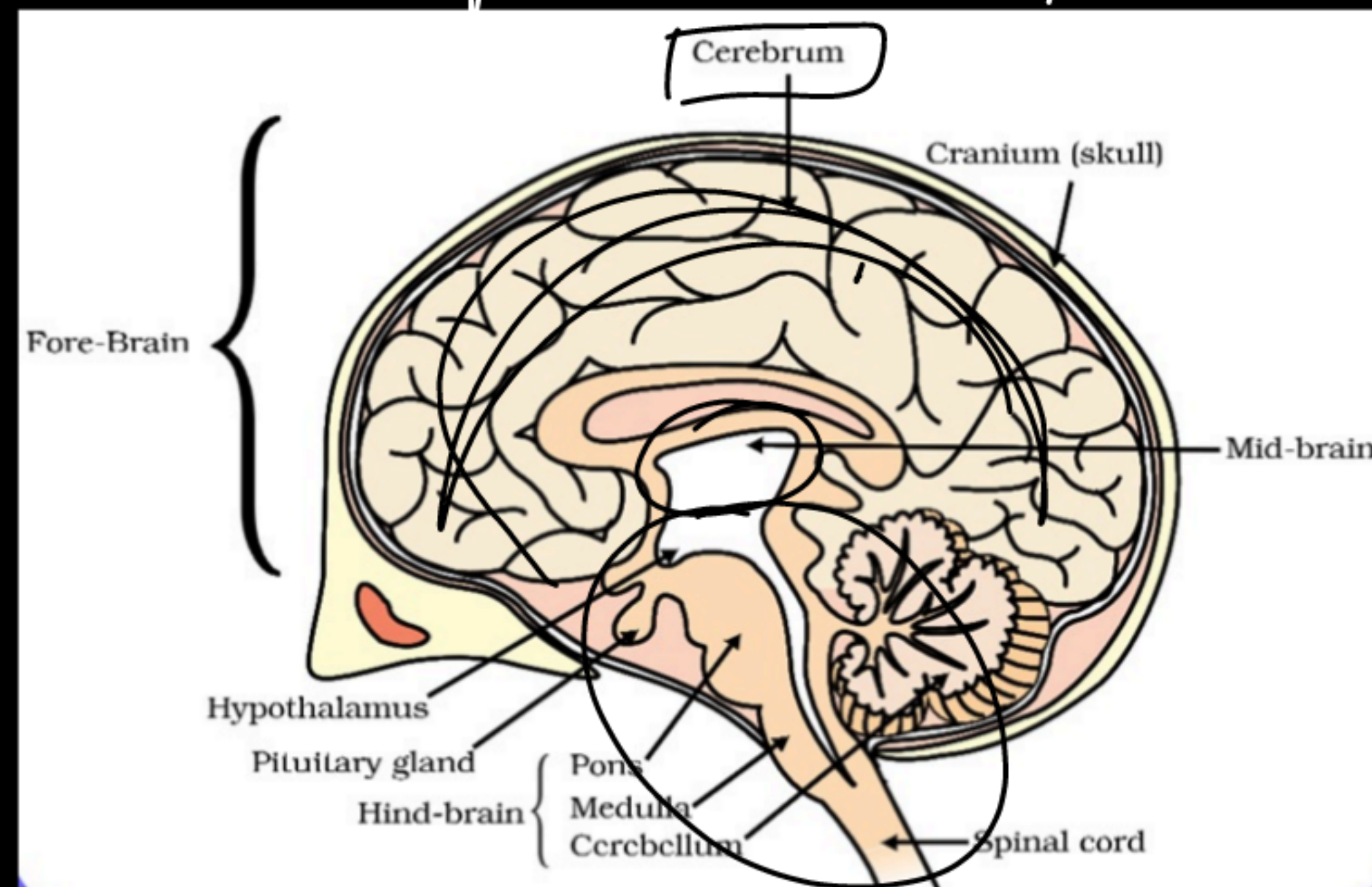
20%

**FORE BRAIN**

**MID BRAIN**

80%

**HIND BRAIN**



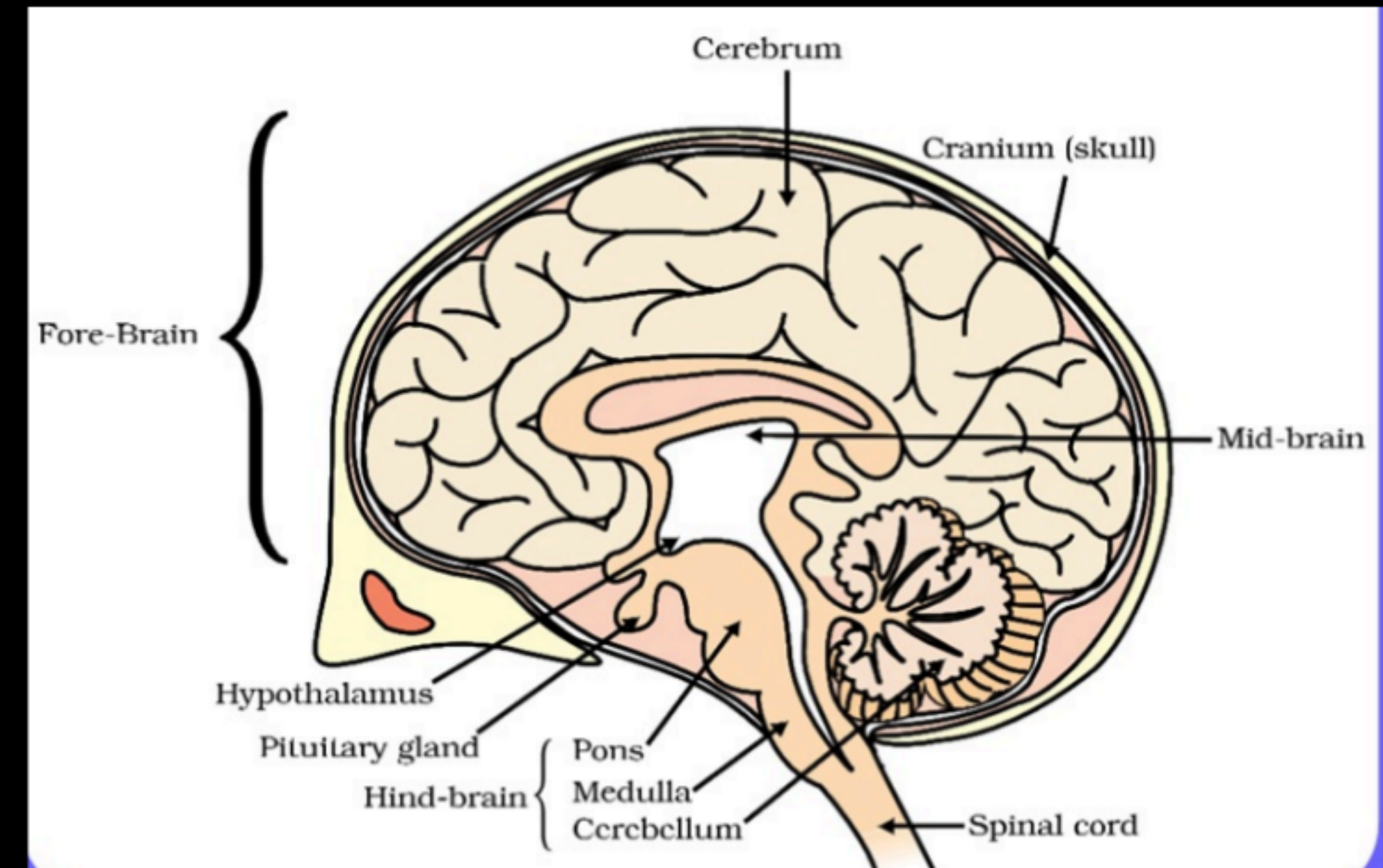




# FORE BRAIN



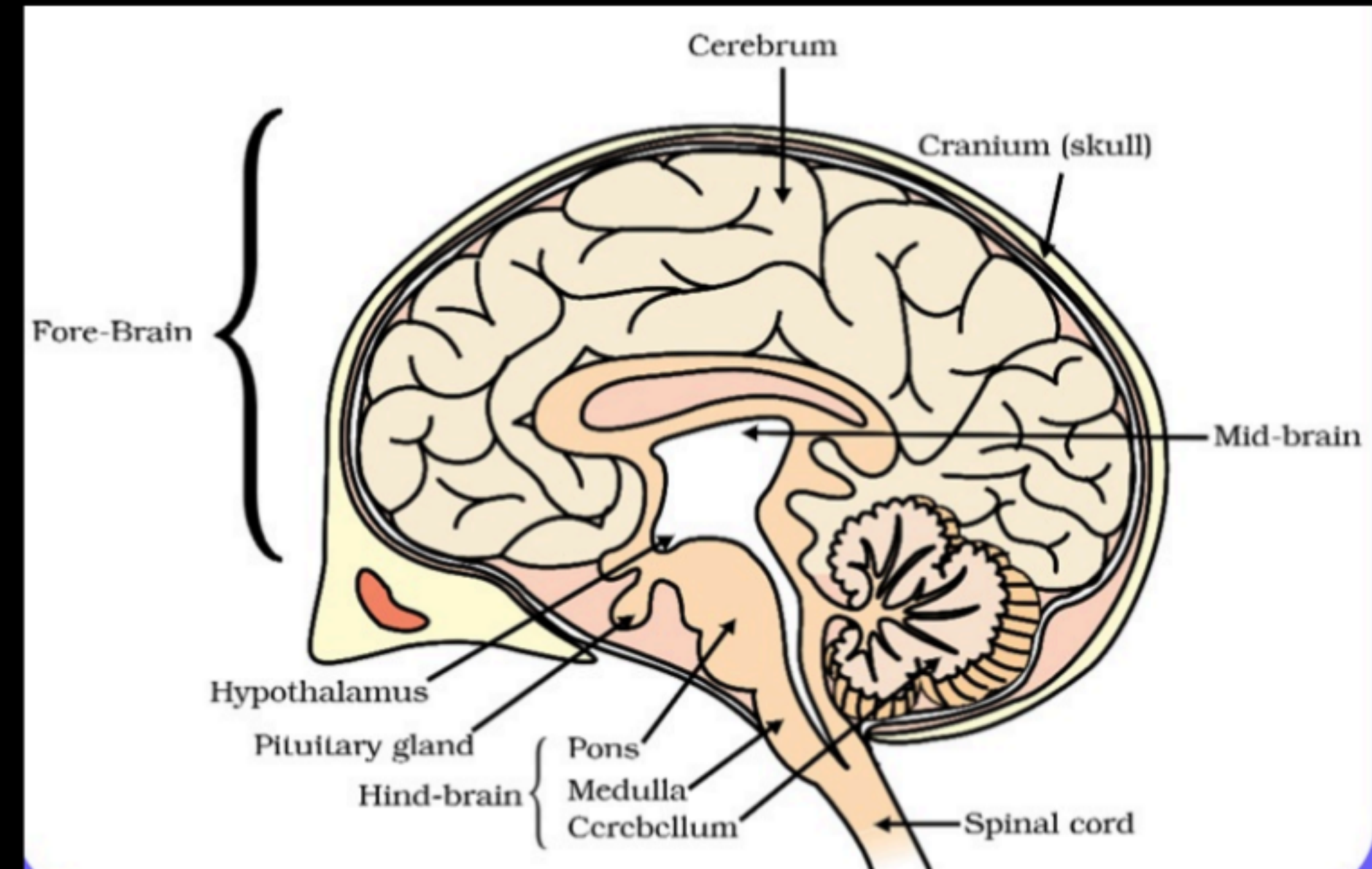
- It is the most complex and specialized part of the brain.
- Consists of the cerebrum.
- Responsible for higher-order thinking and reasoning.
- Controls voluntary actions.
- Stores information (memory).
- Receives sensory impulses from different parts of the body and integrates them.
- Functions as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





# 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.





## 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.

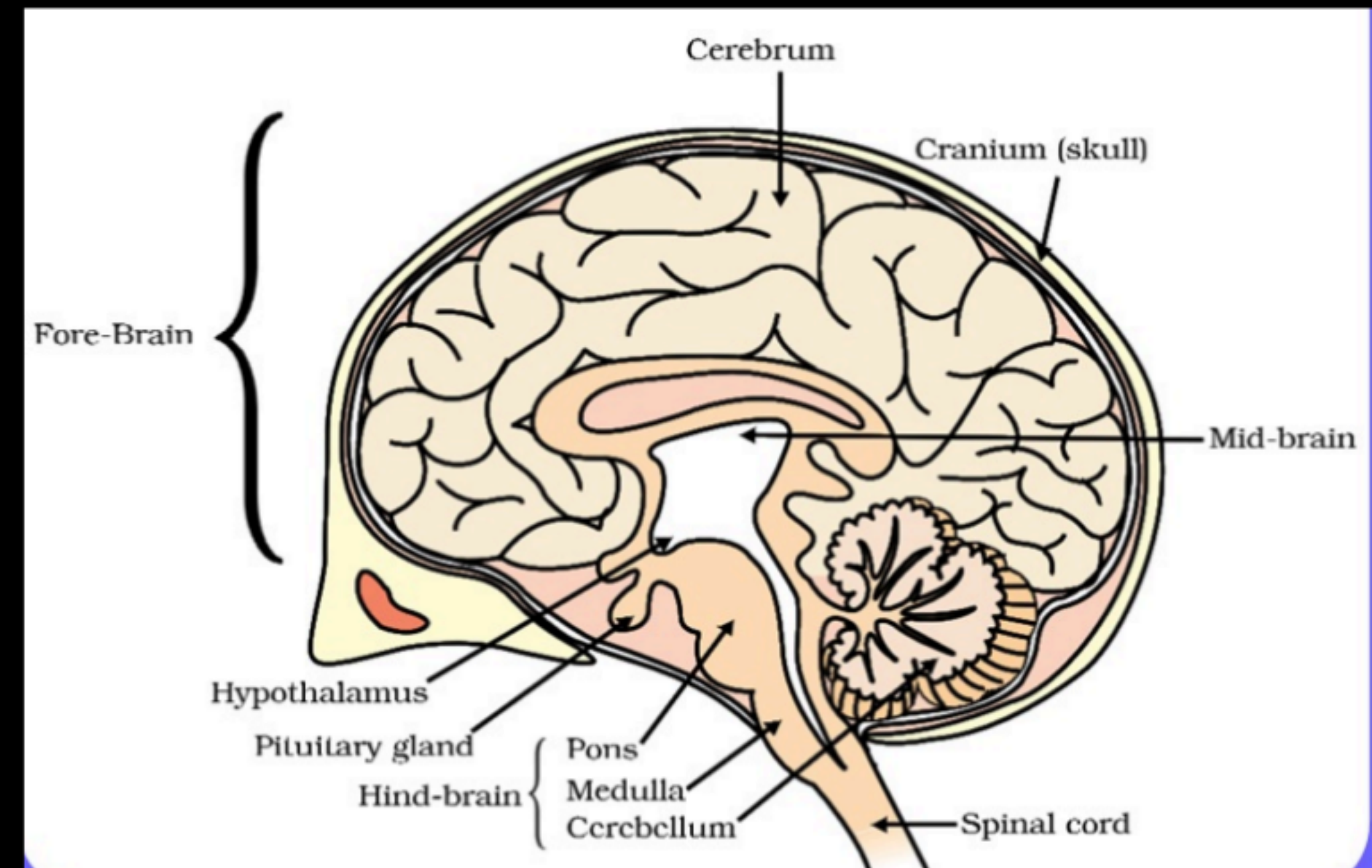
**4. White Matter:** Lies beneath the cerebral cortex and consists of nerve fibers that connect different regions of the brain.

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



# MID BRAIN

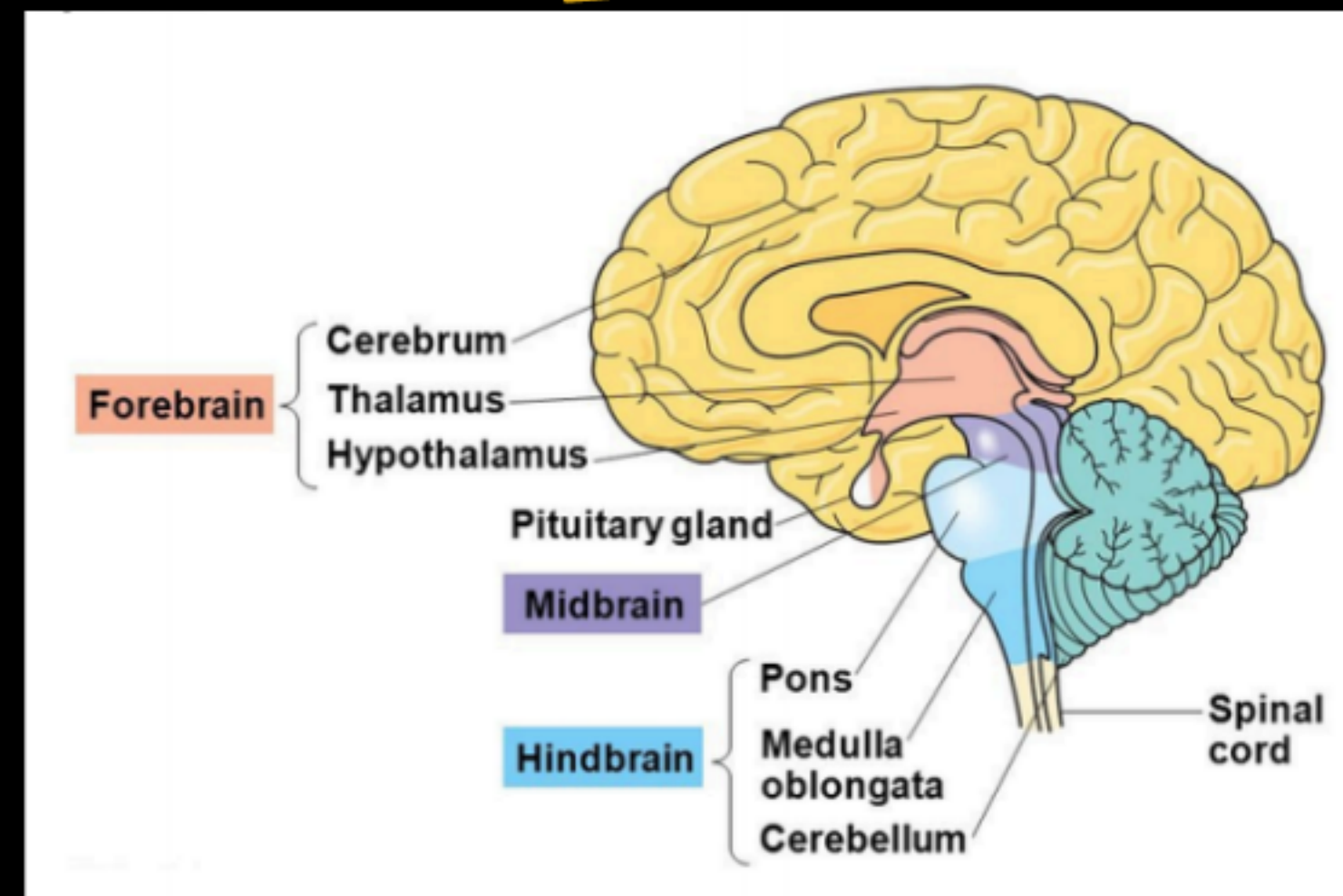
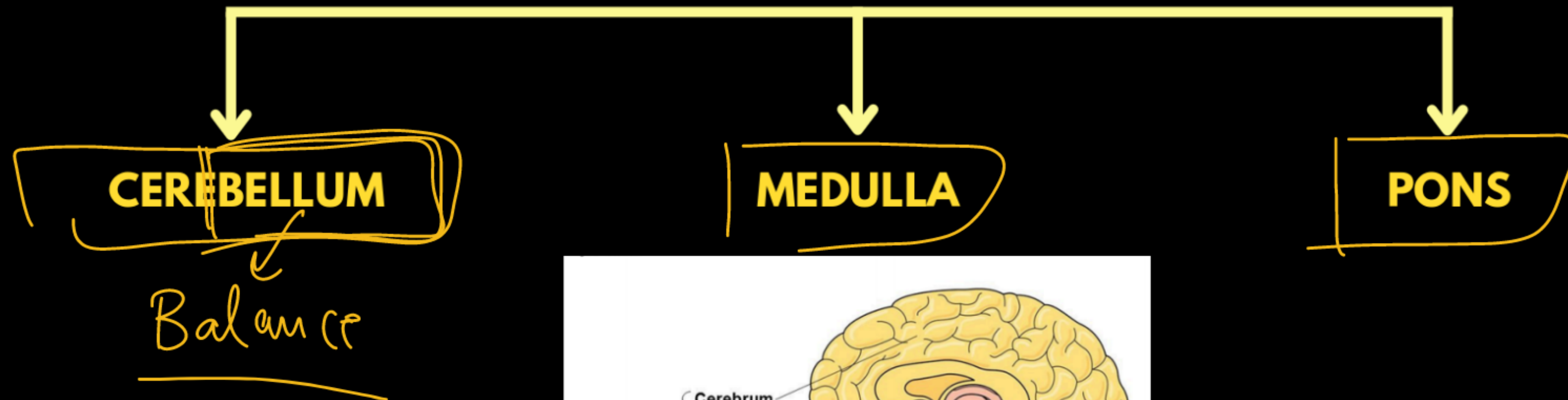
- **The midbrain is a part of the brainstem located between the forebrain and hindbrain.**
- It helps in controlling involuntary actions, such as:
- Adjusting the size of the pupil in response to light intensity.
- Reflex movements of the head, neck, and trunk in response to sudden sounds or sights.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





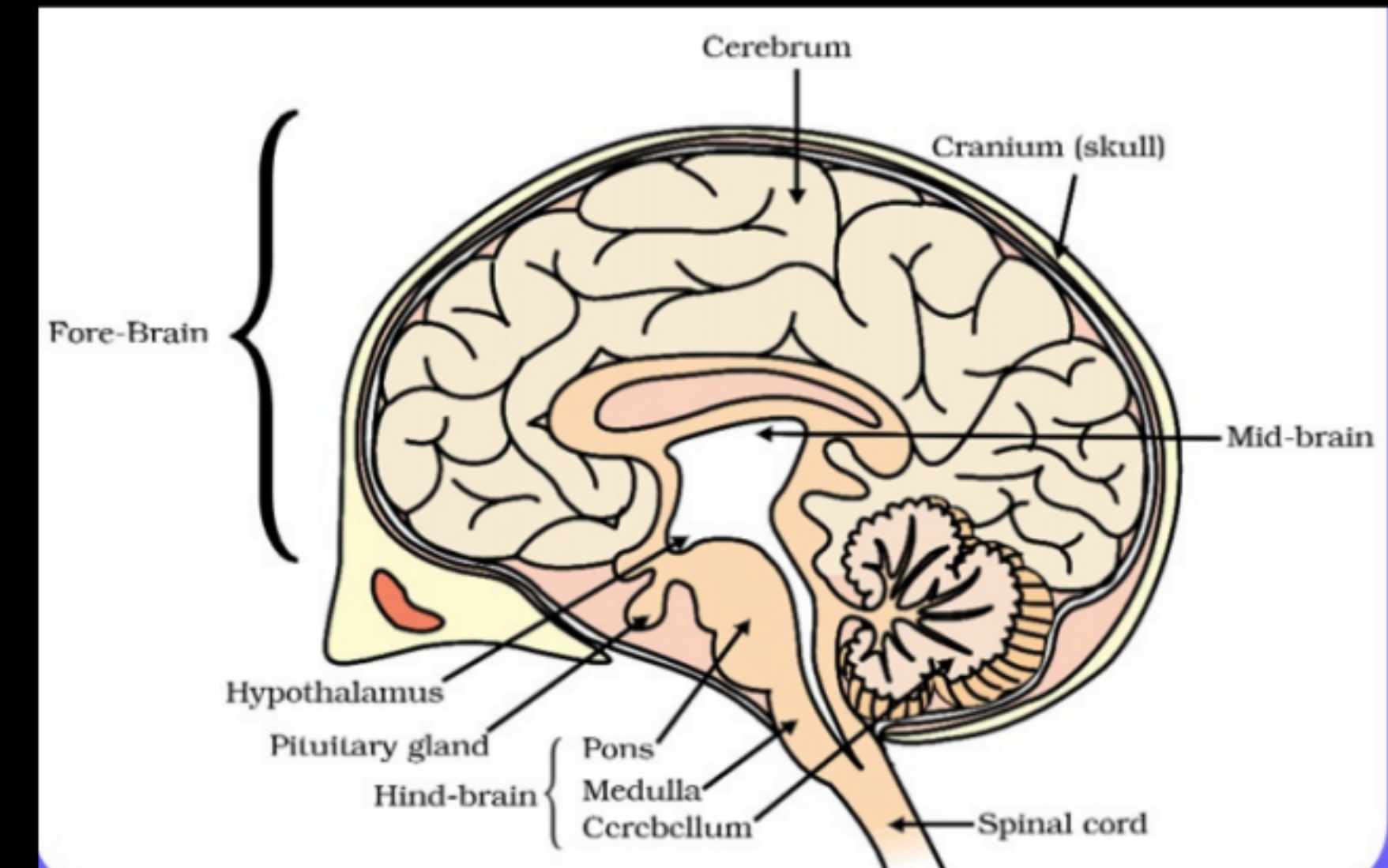
# HIND BRAIN

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



# 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.

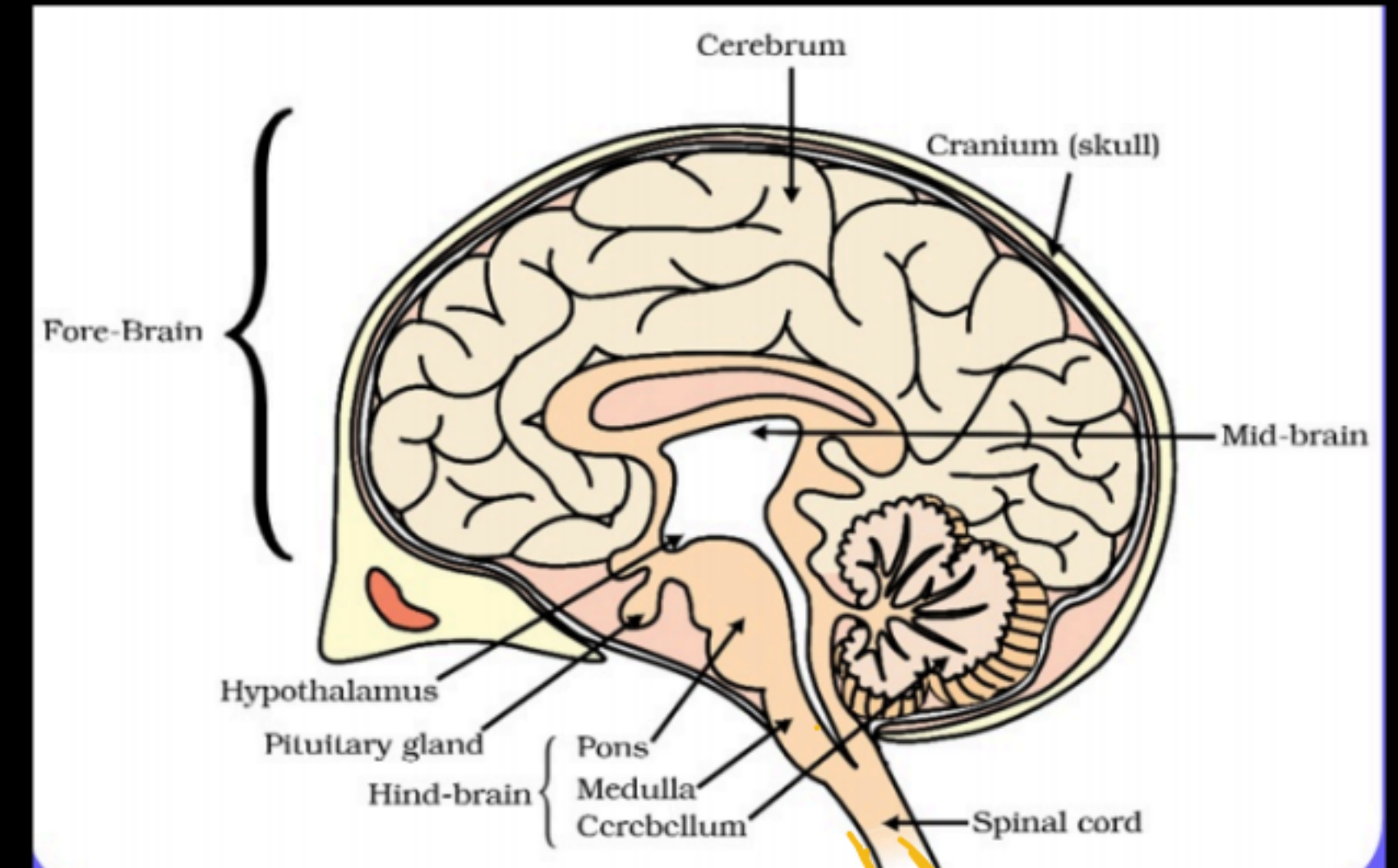




## 2. MEDULLA

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  
+ Vomiting
- 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.



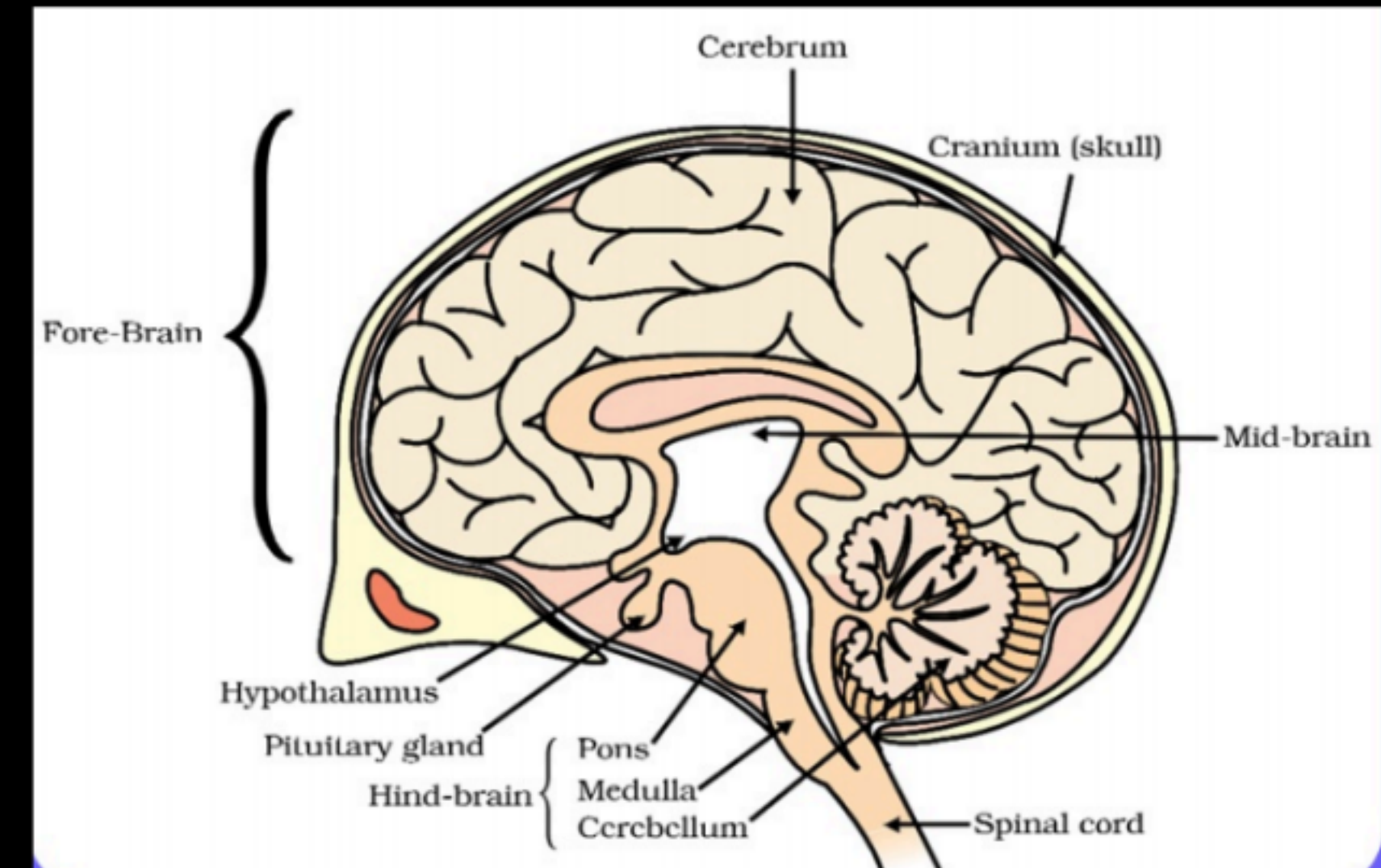


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## 3. PONS ⇒ Involuntary

**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.

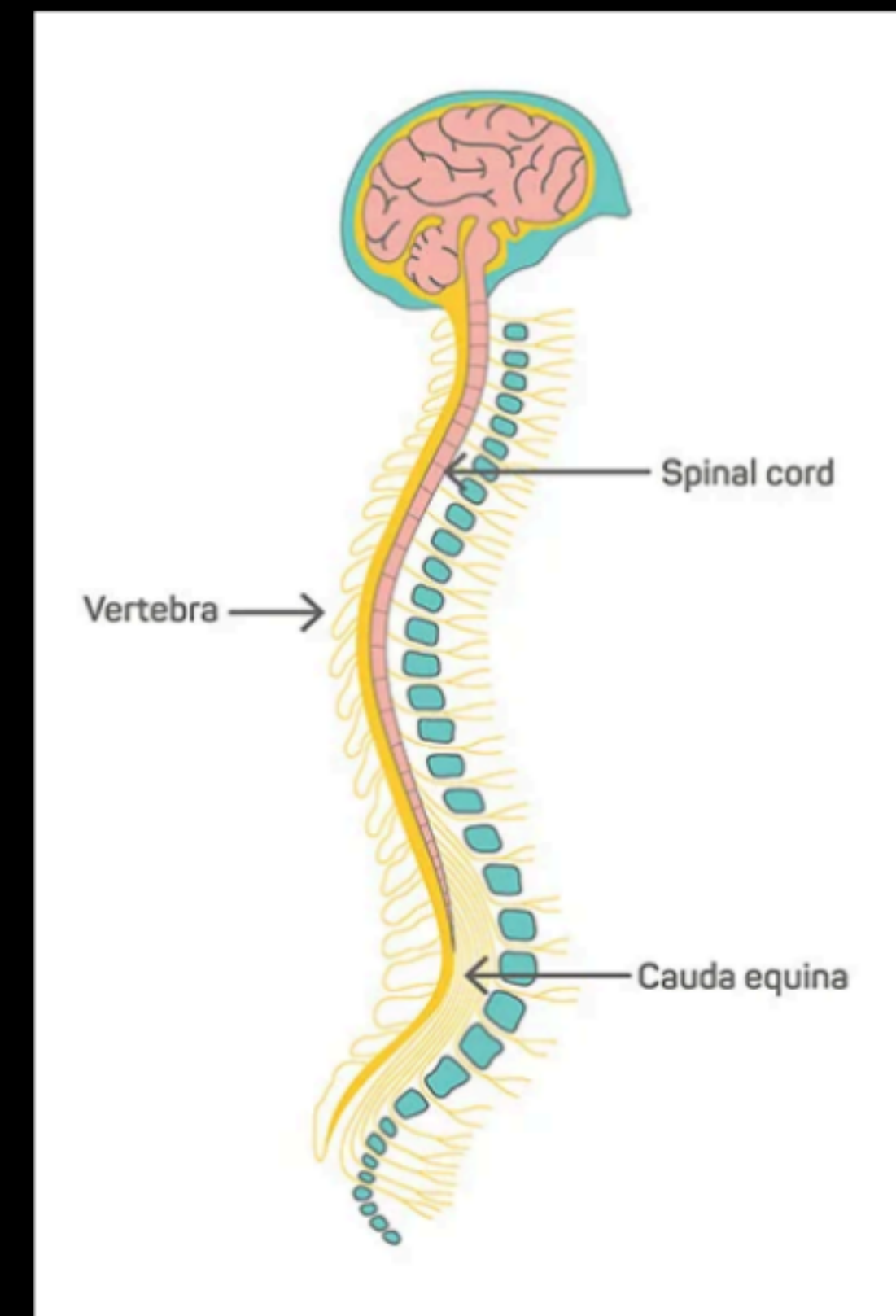




# SPINAL CORD



- 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.



## 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

## 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



Exocrine glands



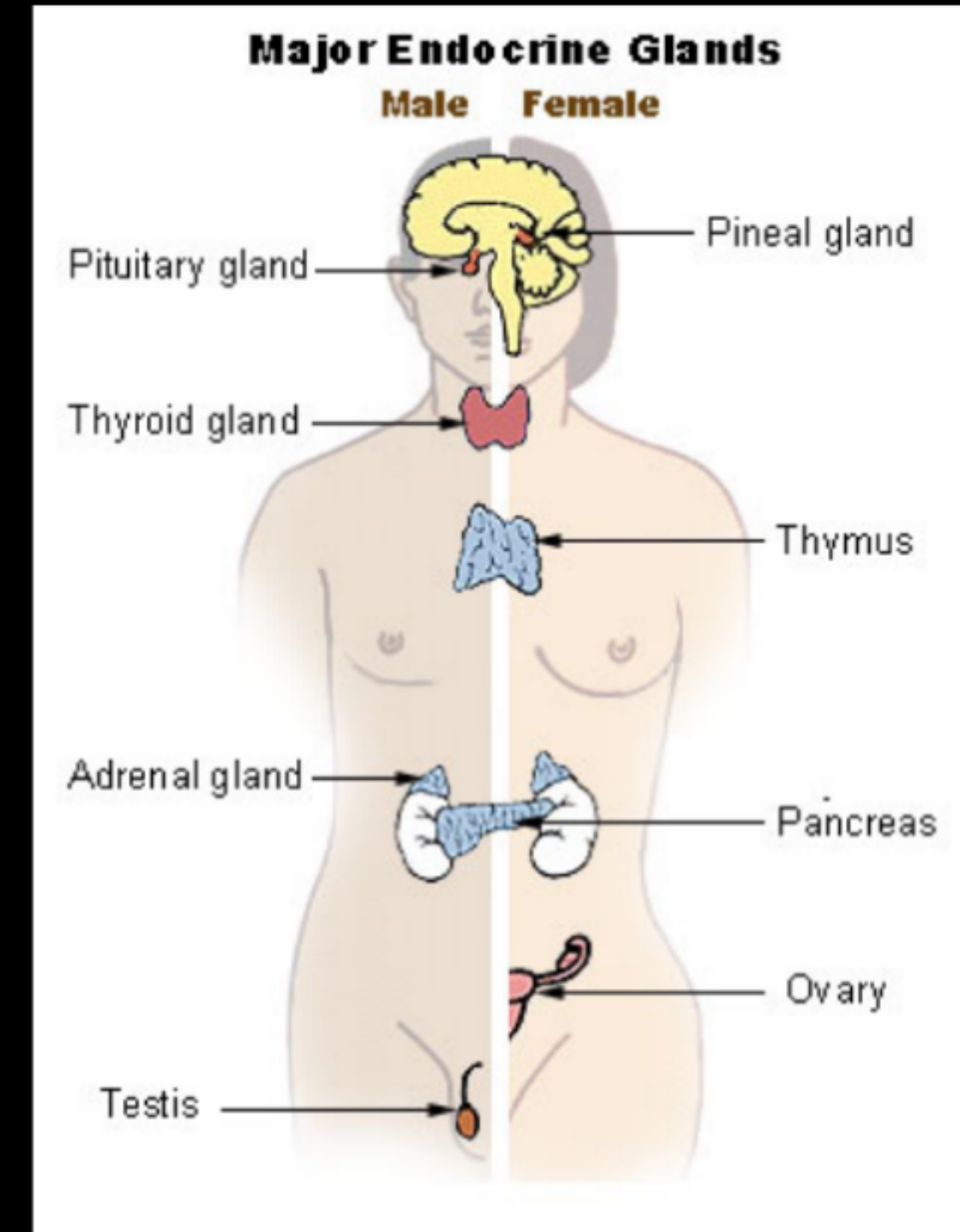
Endocrine glands

# HORMONES

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

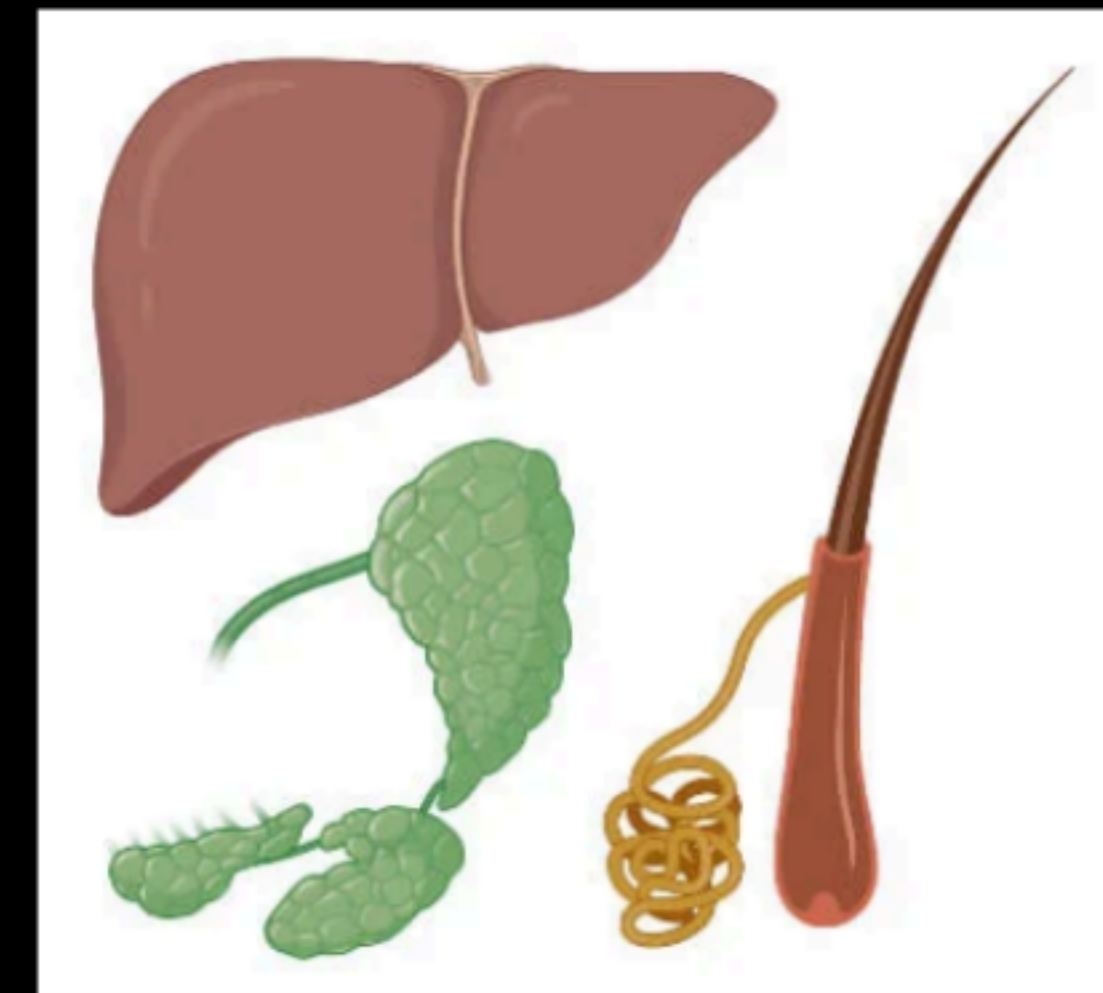
They regulate various physiological processes like growth, metabolism, reproduction, and mood.

Example: Insulin controls blood sugar levels.





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



# Abhay Premier League



**Q1. A part of the body which responds to the instructions sent from nervous system is called**

- (a) receptor
- (b) ☒ effector
- (c) nerves
- (d) muscles



# Abhay Premier League



**Q2. Posture and balance of the body is controlled by**

- (a) Pons
- (b) Medulla oblongata
- ☒ (c) Cerebellum
- (d) Cerebrum

# Abhay Premier League



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

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



# Abhay Premier League



## 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

# Abhay Premier League



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

- (a) Cerebrum
- (b) Cerebellum
- (c) Medulla oblongata
- ☒ (d) Hypothalamus



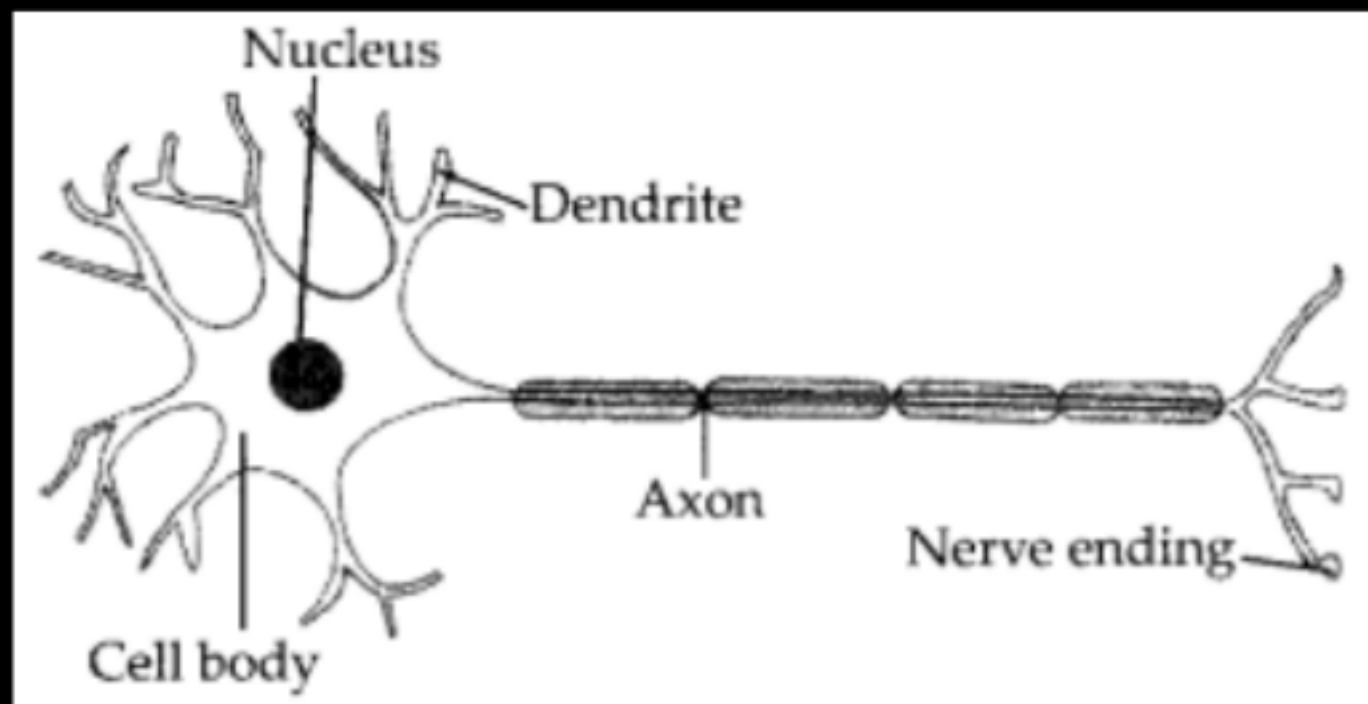
# Abhay Premier League



**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.

# Abhay Premier League



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.**



# Abhay Premier League



**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.

# Abhay Premier League



2022/2017:

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

**Answer:**

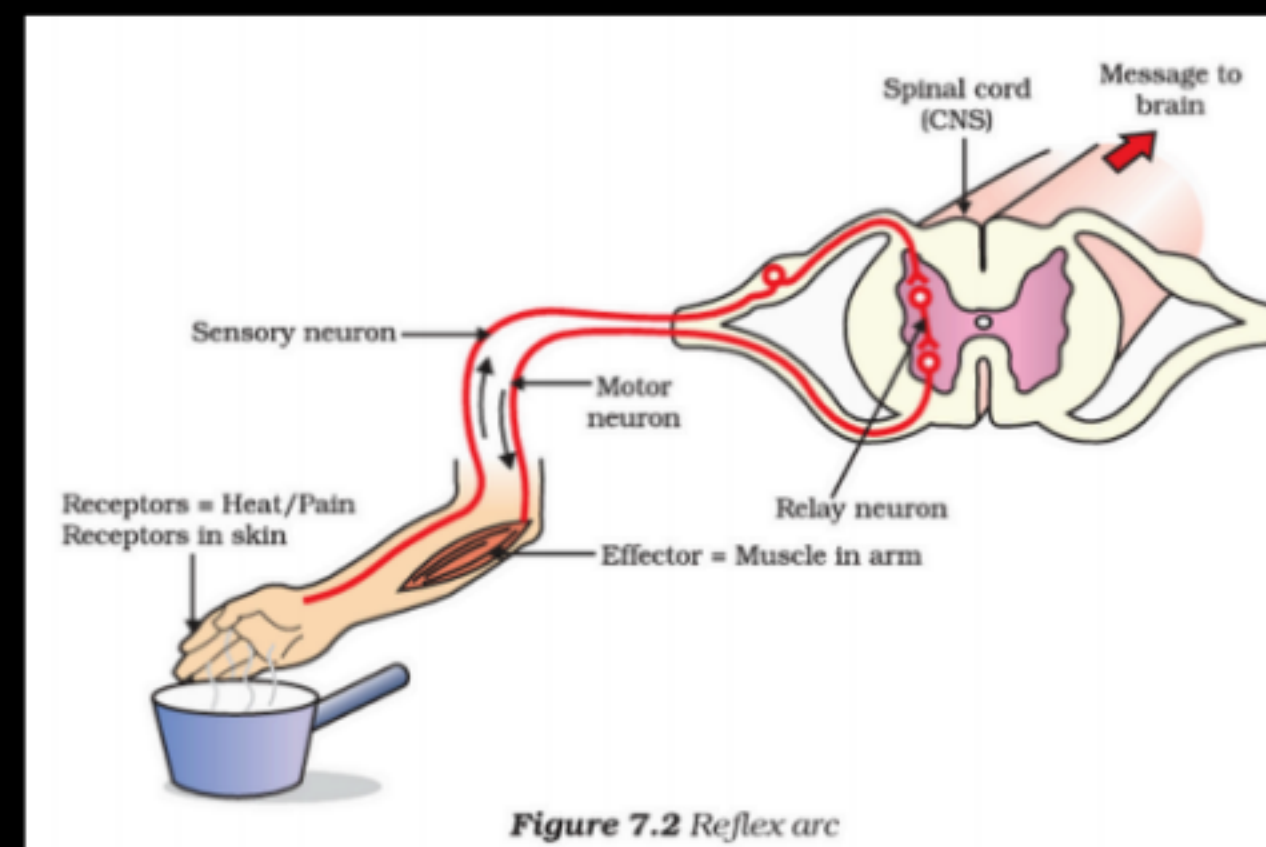


Figure 7.2 Reflex arc

- **Pathway:**

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