

Phototropism:  
Growth towards light

Auxin Hormone  
Distribution

# Control and Coordination

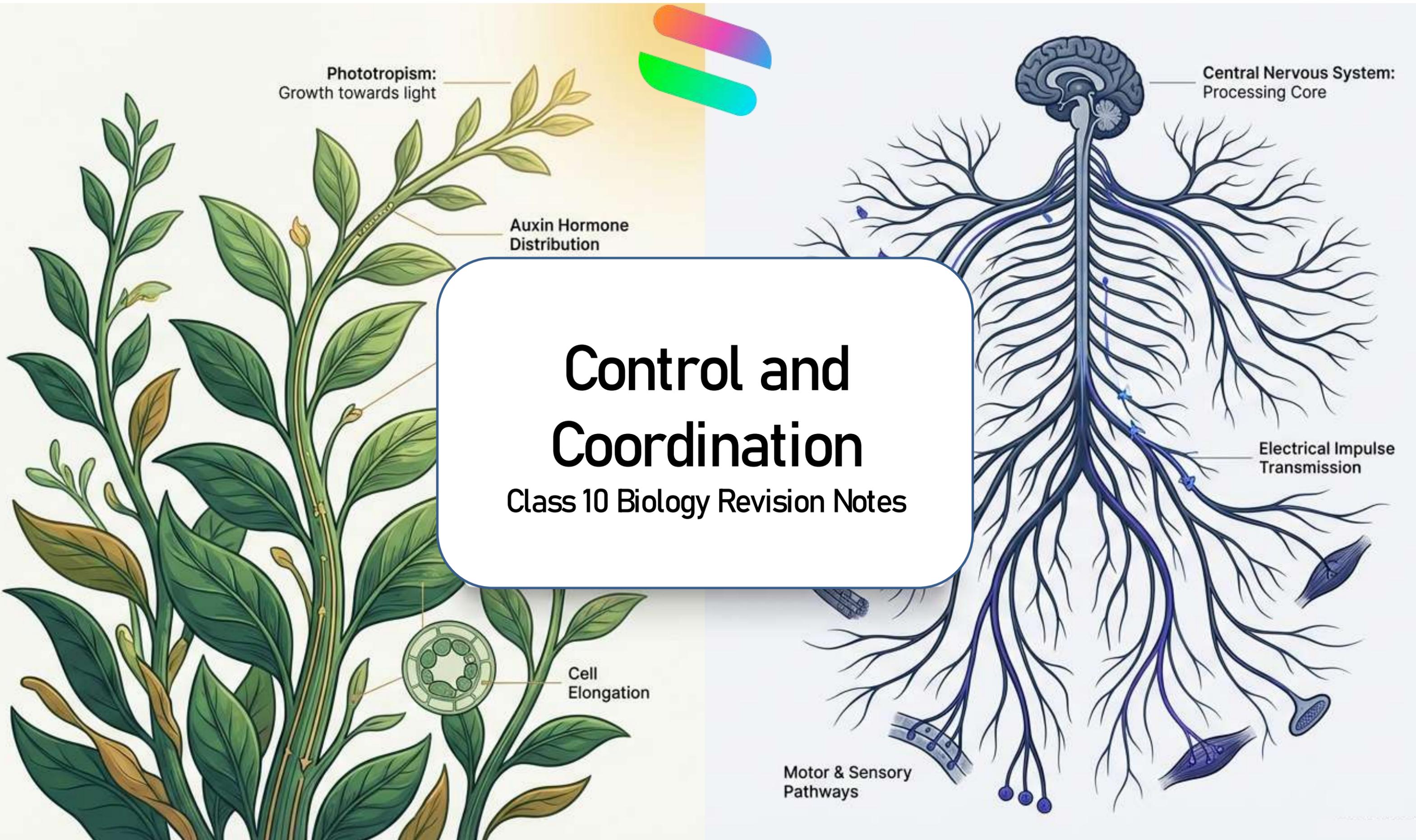
Class 10 Biology Revision Notes

Cell  
Elongation

Central Nervous System:  
Processing Core

Electrical Impulse  
Transmission

Motor & Sensory  
Pathways

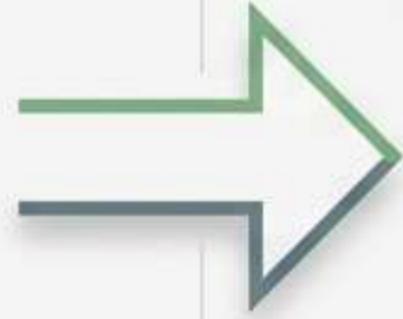


# The Challenge of a Changing Environment



## Stimulus

A change in the external or internal environment (light, heat, sound, chemicals) that provokes a reaction.



## Coordination

The working together of various organs in a systematic manner to produce the proper response.



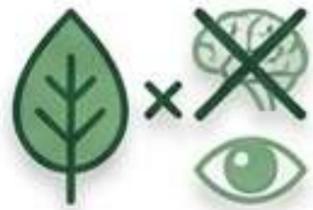
## Response

The physical or chemical reaction to the stimulus (e.g., stepping on a nail -> withdrawing the foot).

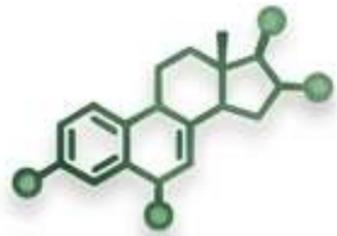
# Two Distinct Evolutionary Solutions



## Plants



No nervous system, muscles, or sense organs.



**Mechanism:** Phytohormones (Chemical messengers).



**Speed:** Slow.

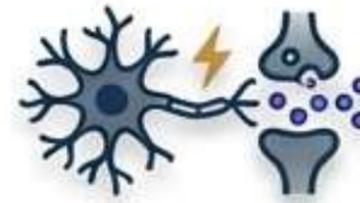


**Response Type:** Growth-dependent (Tropisms) and turgor-driven (Nastic movements).

## Animals



Complex nervous and endocrine systems.



**Mechanism:** Electrical impulses and neurotransmitters.



**Speed:** Immediate / Speedy.



**Response Type:** Muscular movement and glandular secretion.

# Phytohormones: The Chemical Messengers



## Promoters



- **Auxins (IAA):** Promotes cell enlargement, stem/fruit growth, and tropic movements.
- **Gibberellins:** Promotes cell enlargement and stem growth in the presence of auxins.
- **Cytokinins:** Promotes cell division, breaks seed dormancy, and opens stomata.

## Inhibitors



- **Abscissic Acid (ABA):** Promotes seed dormancy, closing of stomata (wilting), and leaf fall (abscission).
- **Ethene (Ethylene):** A gaseous hormone that promotes fruit ripening.

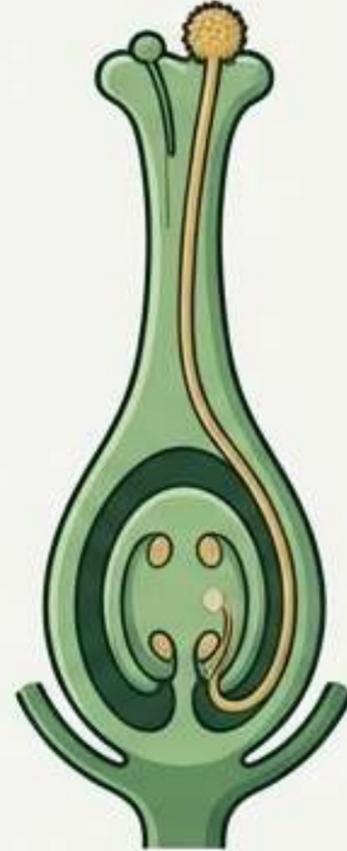
# Tropisms: Directed Growth Responses



**Phototropism (Light):**  
Shoots bend towards light (Positive).



**Geotropism (Gravity):**  
Roots grow downward (Positive), shoots grow upward (Negative).



**Chemotropism (Chemicals):** Pollen tubes grow downward into the style toward the ovule.



**Hydrotropism (Water):**  
Roots bend sideways or upwards to reach water.

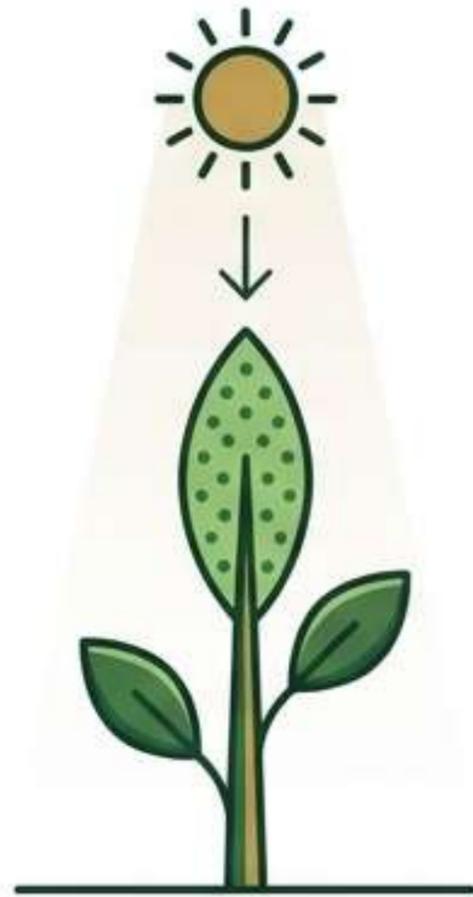


**Thigmotropism (Touch):**  
Tendrils circle around and cling to physical supports.

# The Mechanics of Phototropism

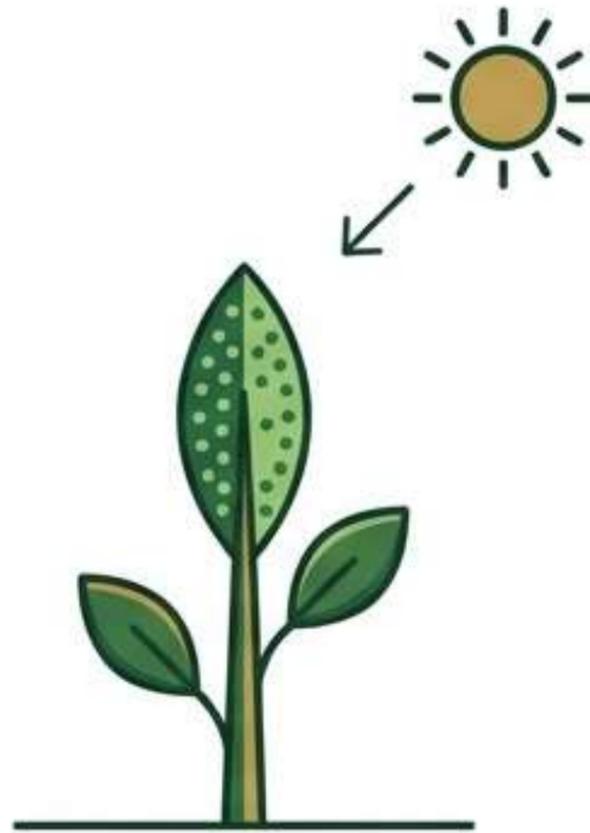


Step 1: Uniform Light



Sun is directly above. Auxin is distributed uniformly. The stem grows straight up.

Step 2: Directional Light



Sun is on the right. Auxin diffuses from the tip and collects on the shady side (away from light).

Step 3: Bending



The higher concentration of Auxin causes the shady side to grow and elongate faster than the lit side, forcing the stem to bend toward the light.

# Nastic Movements: Non-Directional Responses



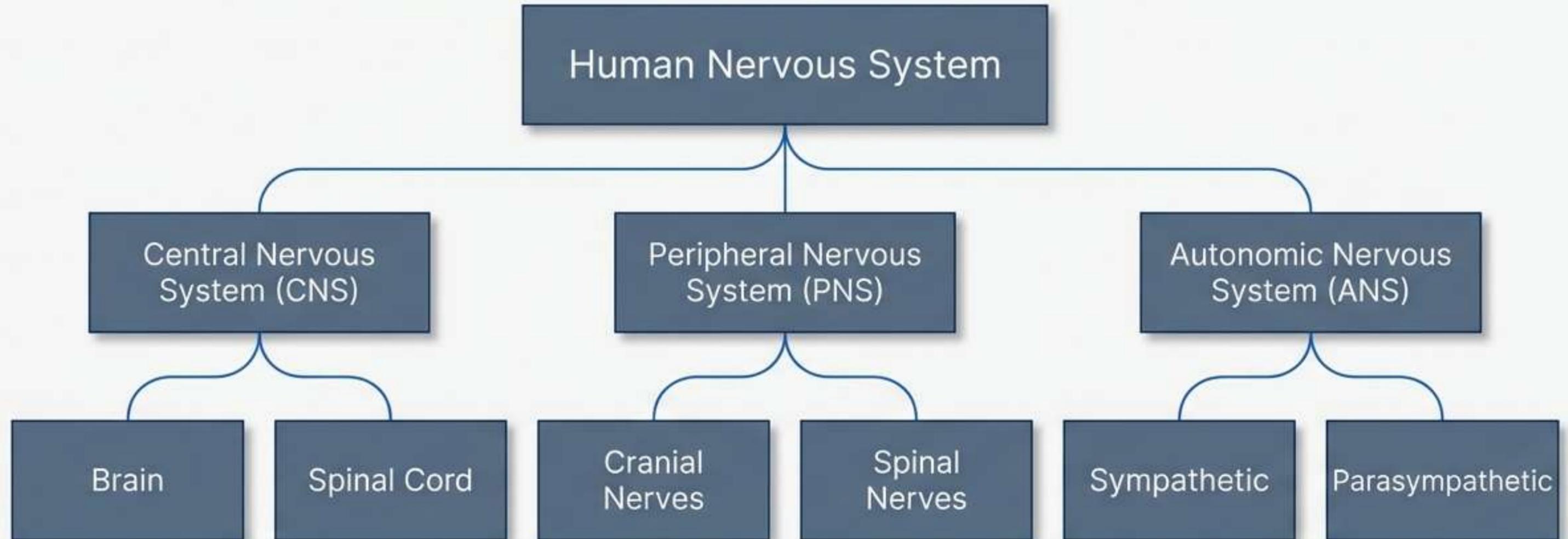
Unlike tropisms (which are slow and growth-dependent), nastic movements are immediate and independent of the stimulus direction.

## Thigmonasty (Response to touch)

Touching the Mimosa causes a sudden loss of water from pad-like swellings called pulvini at the base of the leaves. This rapid loss of turgor pressure causes the leaves to instantly droop and fold.



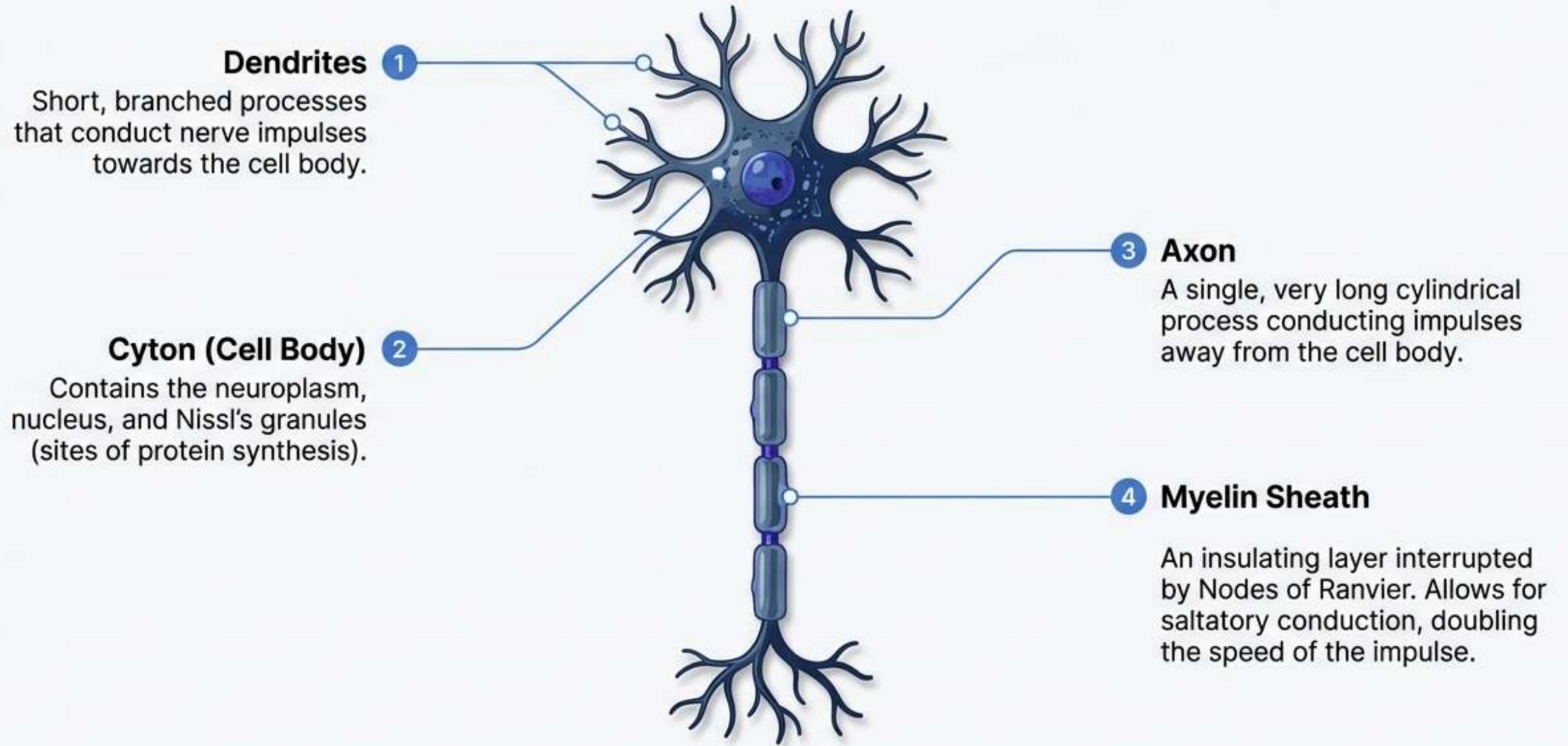
# The Human Nervous System



**Animal coordination is highly centralized, exceptionally fast, and localized compared to plants.**

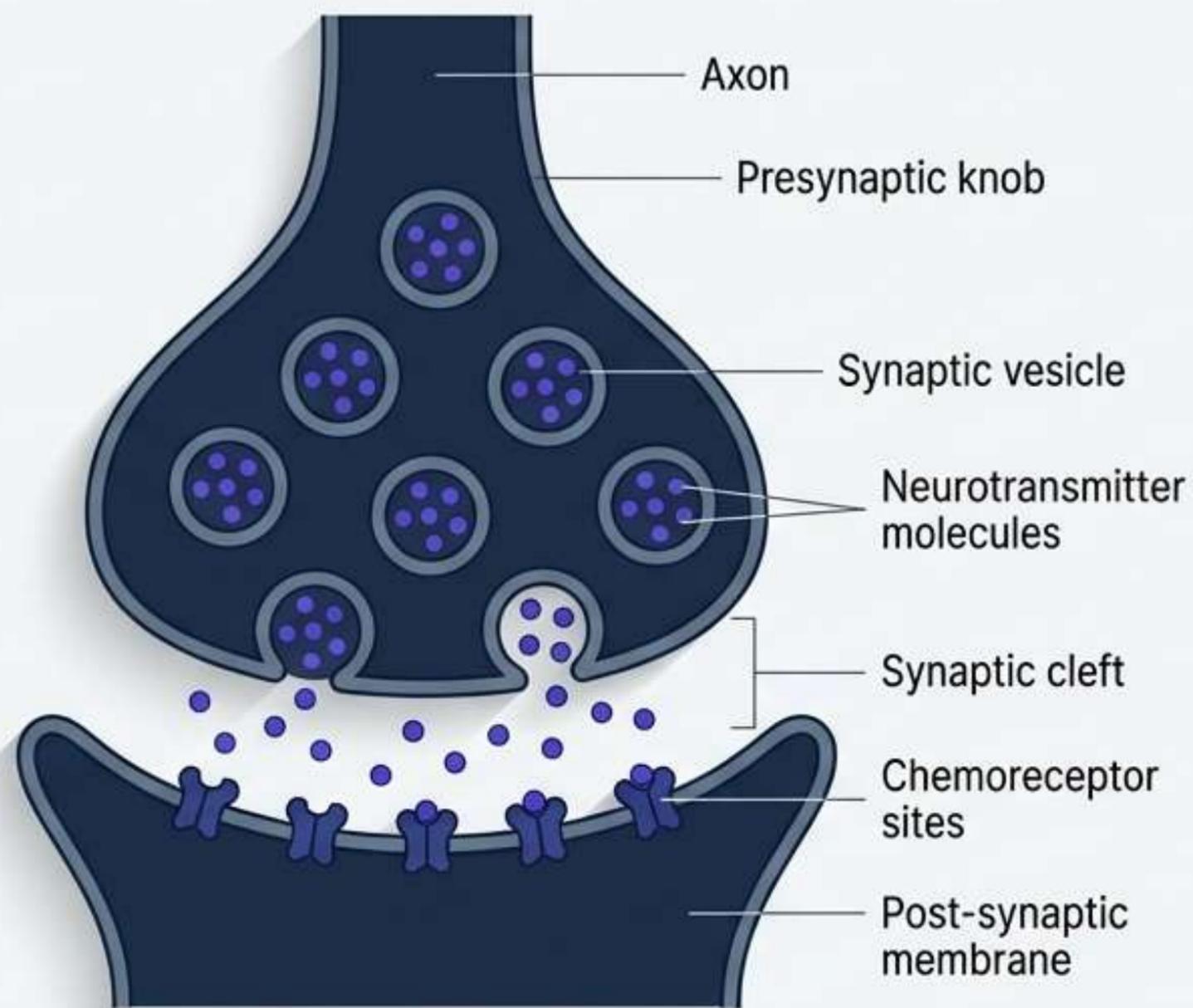


# The Neuron: The Functional Unit





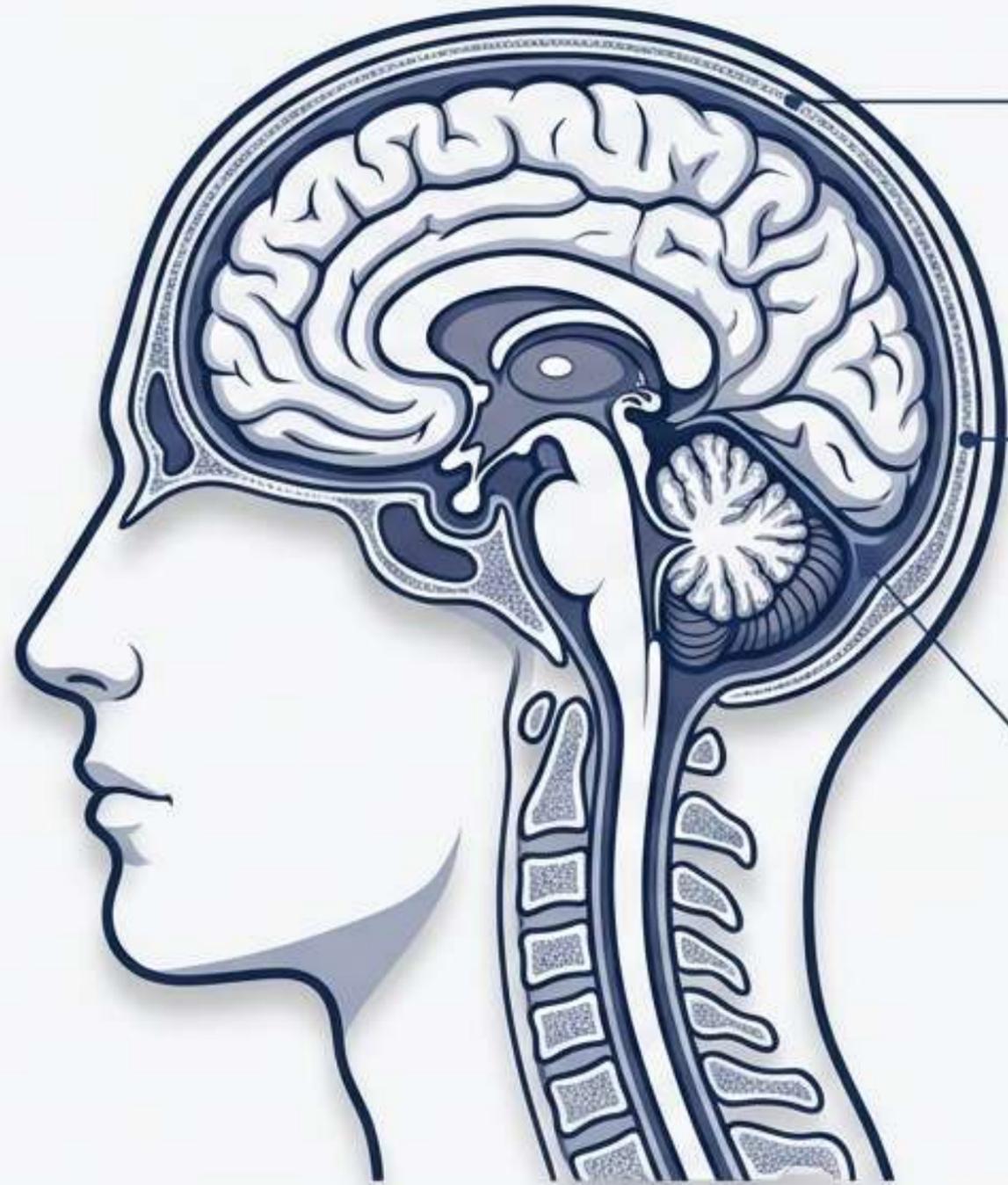
# The Synapse: Crossing the Microscopic Gap



1. Electrical impulse reaches the presynaptic knob at the axon terminal.
2. Synaptic vesicles release chemical neurotransmitters (e.g., Acetylcholine, Adrenaline).
3. Transmitter molecules cross the fluid-filled synaptic cleft (neurons do not physically touch).
4. Chemicals bind to chemoreceptor sites on the post-synaptic membrane, triggering a new electrical impulse in the next neuron.



# Architecture and Protection of the CNS



## Cranium (Brain Box)

The solid bone structure protecting the brain from mechanical injury.

## Meninges

Three protective membranes surrounding both the brain and the spinal cord.

## Cerebrospinal Fluid (CSF)

A clear, alkaline fluid filling the ventricles and subarachnoid space. It acts as a shock absorber, supplies nutrients, removes waste, and reduces the brain's effective weight via buoyancy.

# Processing Reality: Forebrain & Midbrain

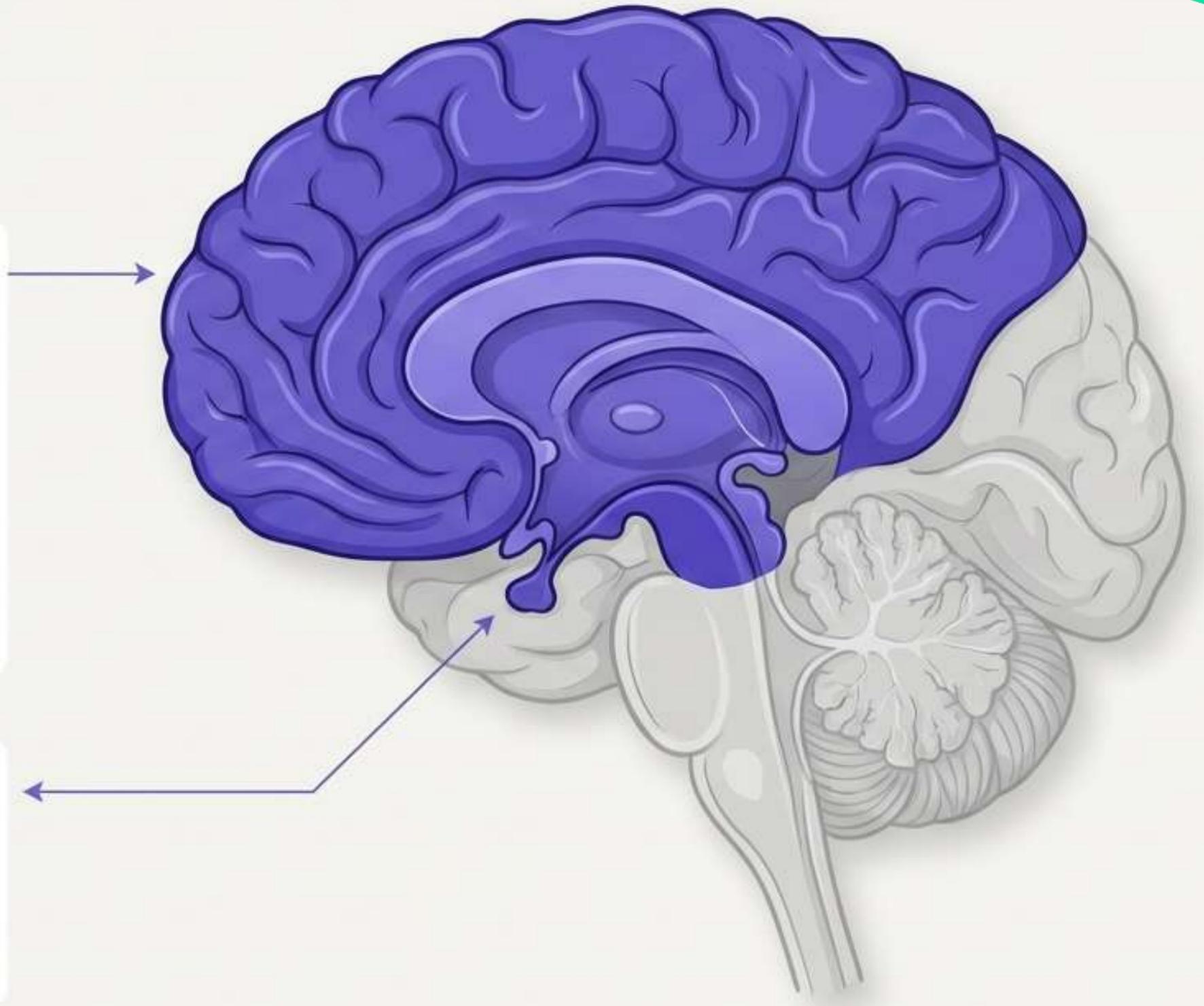


## Forebrain:

- **Cerebrum:** The largest part. Highly folded to increase surface area. Controls memory, intelligence, personality, and voluntary actions.
- **Diencephalon:** Contains the Thalamus (sensory relay) and Hypothalamus (controls thirst, hunger, body temperature, and sleep).

## Midbrain:

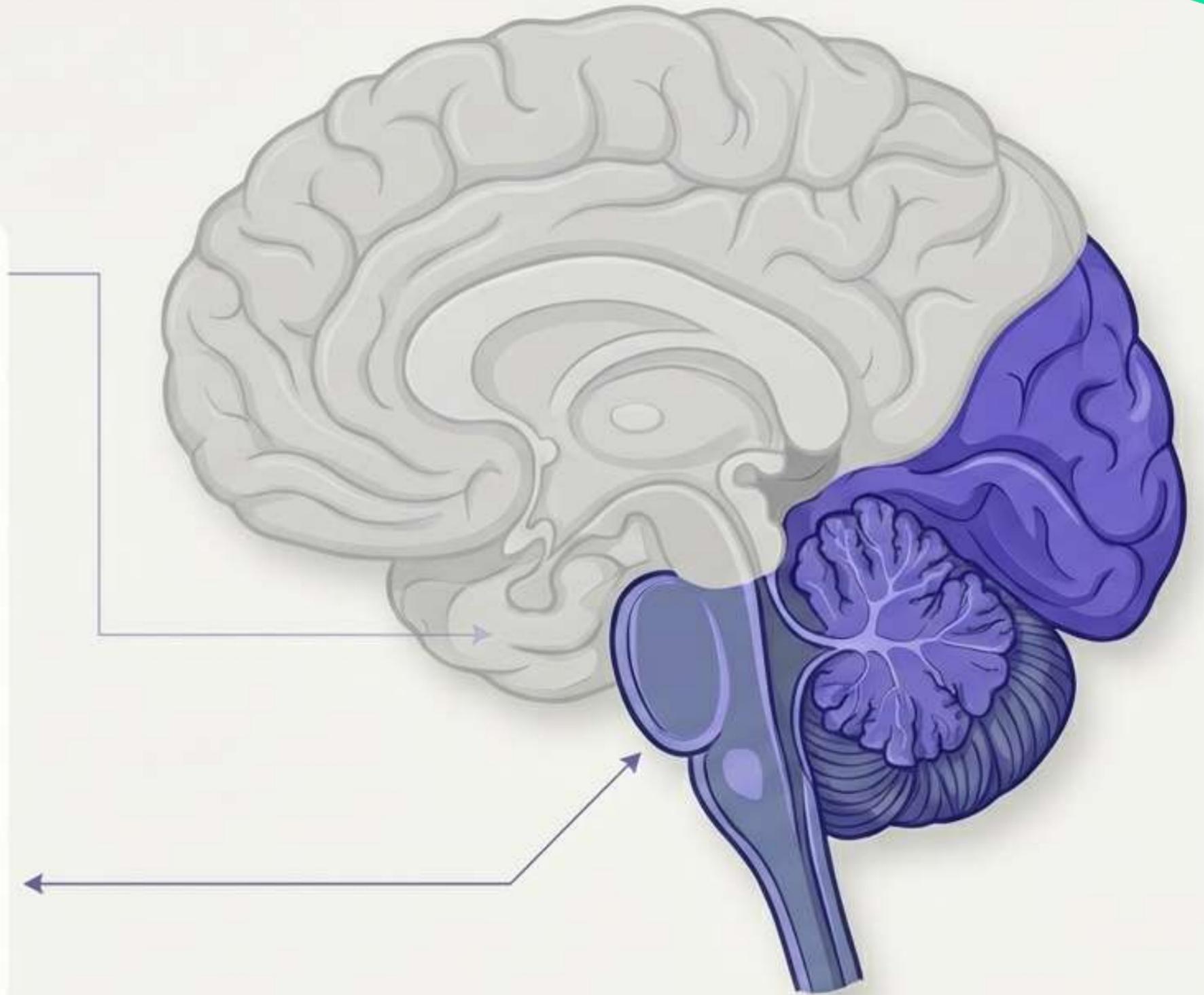
Connects forebrain to hindbrain. Controls reflex movements of the head, neck, and eyes in response to visual and auditory stimuli.



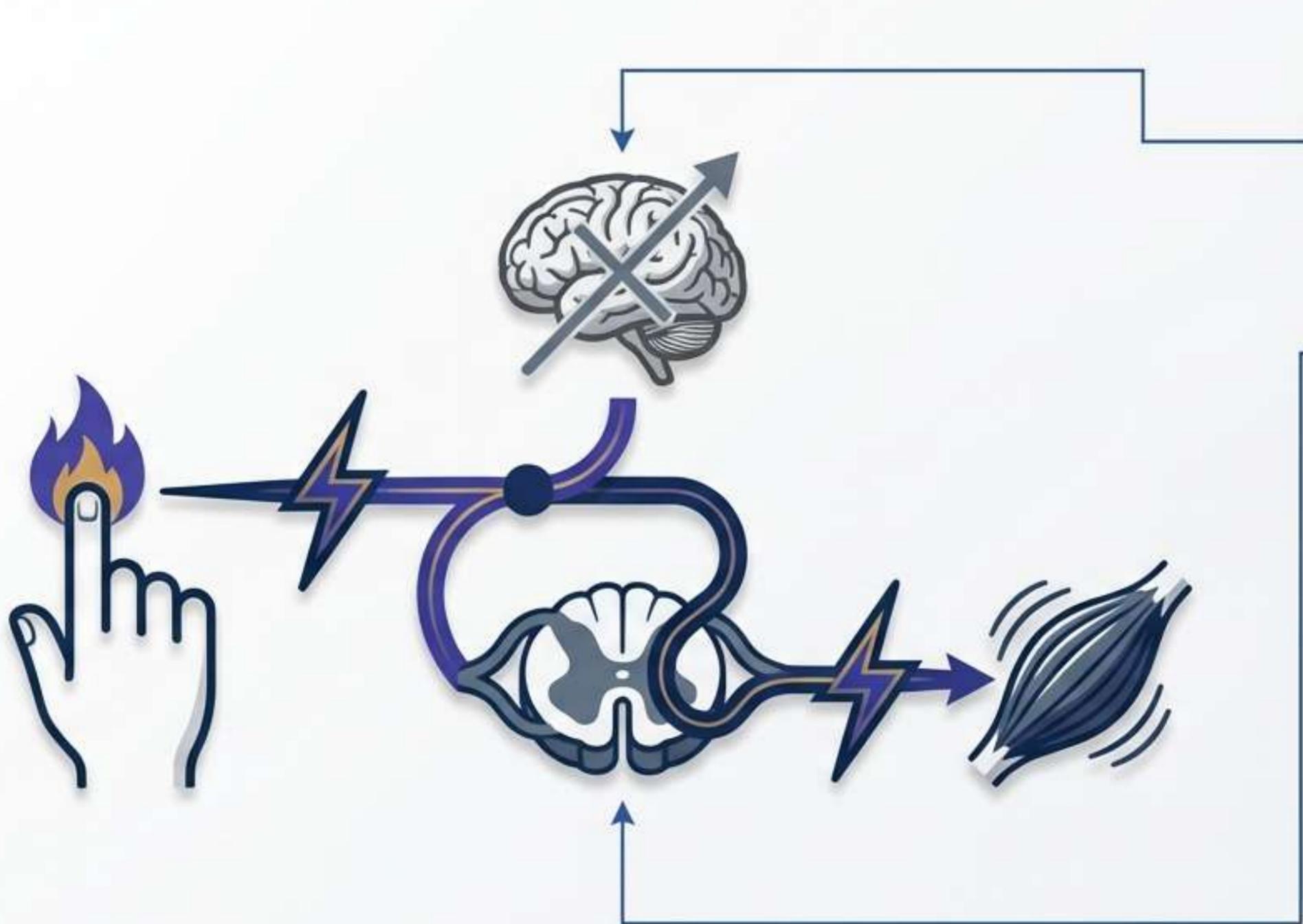
# The Engine Room: The Hindbrain

## Hindbrain Components:

- **Cerebellum:** The second largest part. Features the arbor vitae (tree of life) structure. Controls posture, balance, and rapid/smooth muscular activities (e.g., walking, riding a bicycle).
- **Pons:** Regulates the respiratory rate.
- **Medulla Oblongata:** Controls crucial involuntary actions like heartbeat, blood pressure, and peristalsis. Also the center for reflexes like swallowing, vomiting, and sneezing.



# Bypassing the Brain: Reflex Actions



A **reflex action** is a spontaneous, automatic, and mechanical response to a stimulus, controlled entirely by the spinal cord. It bypasses the brain to save critical milliseconds.

## Examples:

- Withdrawing a hand after touching a hot plate.
- Blinking when a foreign particle approaches the eye.
- Sneezing or coughing to expel unwanted particles.
- Withdrawing a foot after stepping on a nail.

# The Reflex Arc: A Survival Flowchart

