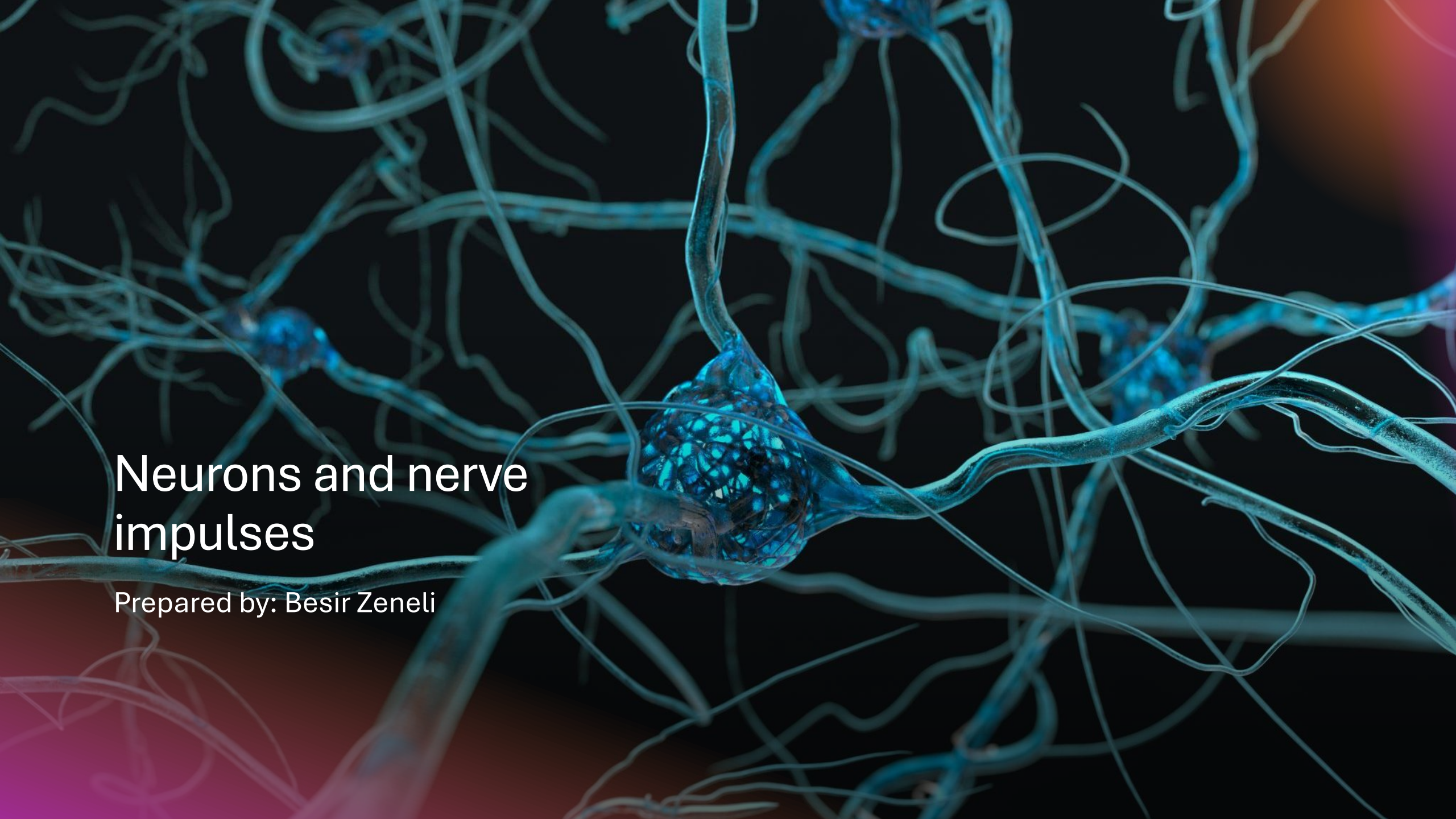
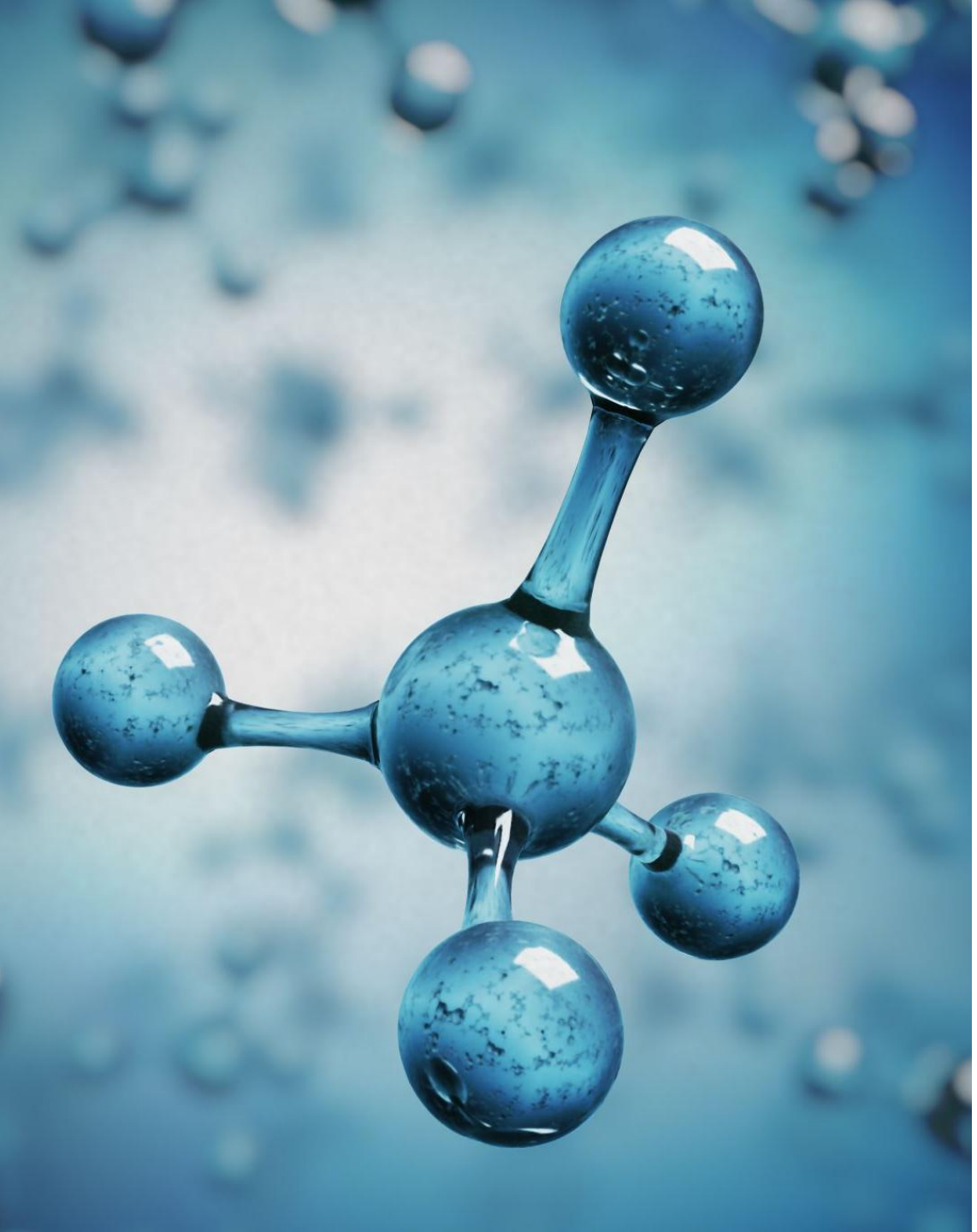


# Neurons and nerve impulses

Prepared by: Besir Zeneli



# Objectives

- Describe the structure of a neuron.
- Summarize the electrical and chemical conditions that characterize a resting potential.

# Introduction to Neurons

**Neurons: Basic Building Blocks of the Nervous System**

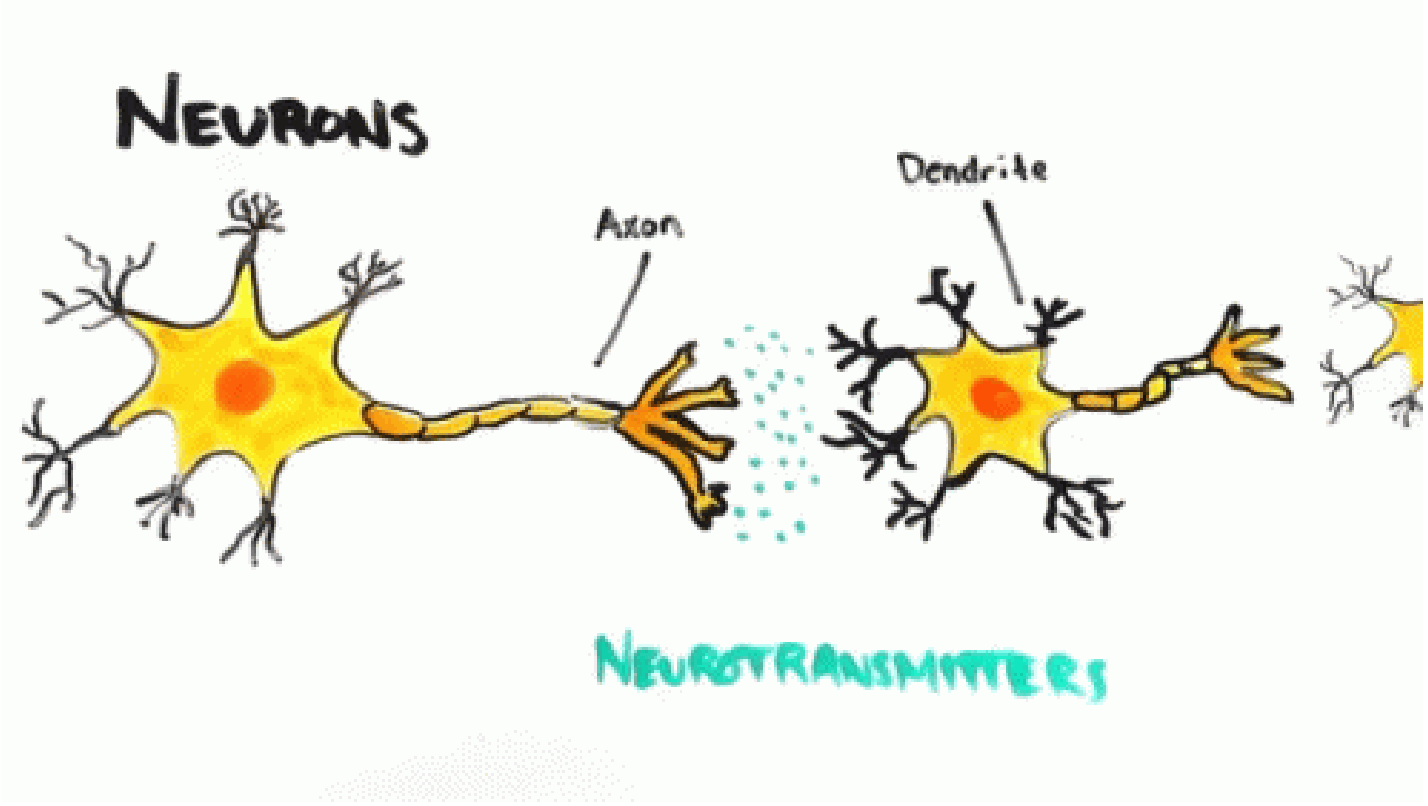
- Neurons are specialized cells responsible for transmitting information throughout the body.
- They form the communication network of the nervous system.

**Structure of Neurons:**

- Each neuron consists of a **cell body** (**soma**), **dendrites**, and an **axon**.
- Dendrites receive signals from other neurons or sensory receptors.
- Axons transmit electrical impulses away from the cell body.

**Communication:**

- Neurons communicate with each other through electrical impulses and chemical signals.
- This communication allows for coordination of various body functions and responses.



# Structure of a Neuron

**Neurons consist of three main parts:**

**Cell Body (Soma):**

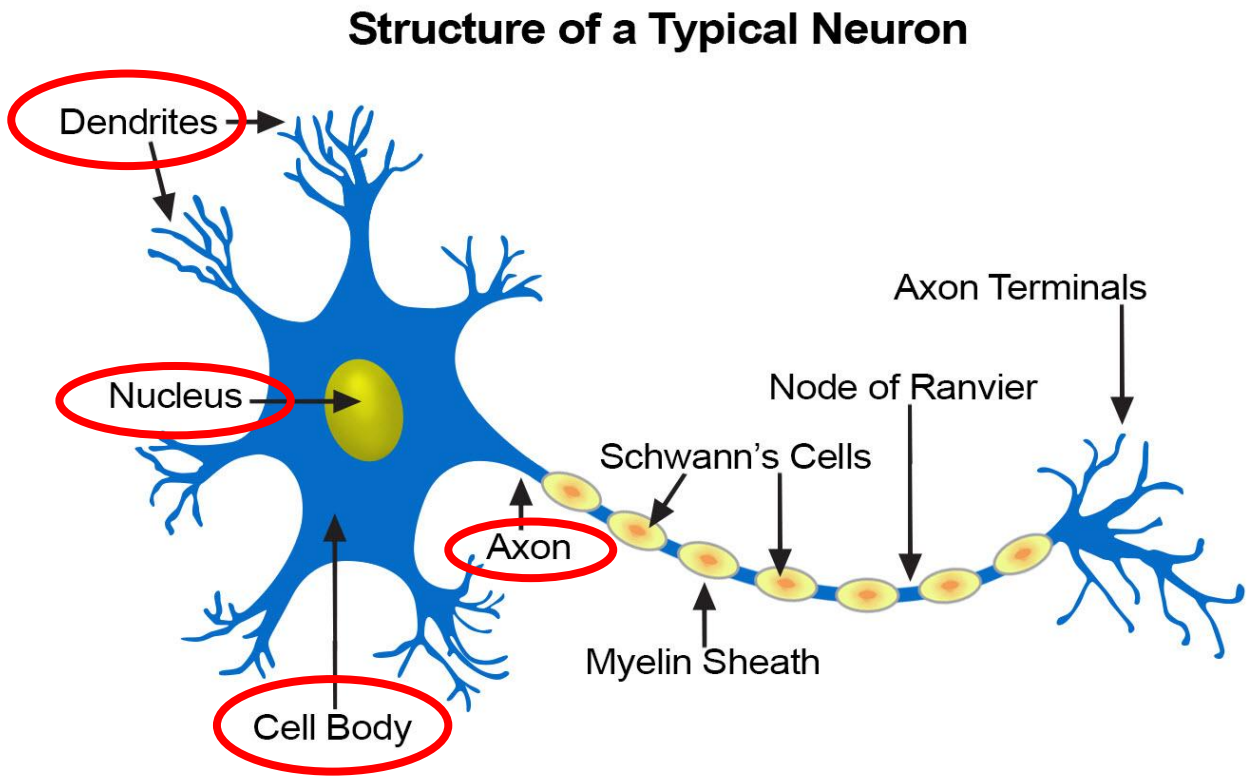
- Contains the **nucleus** and other organelles essential for cell function.
- Integrates incoming signals and determines whether to transmit the signal further.

**Dendrites:**

- Branch-like structures extending from the cell body.
- Receive **signals (electrical impulses)** from other neurons or sensory receptors.

**Axon:**

- Long projection extending from the cell body.
- Transmits electrical impulses away from the cell body toward other neurons, muscles, or glands.



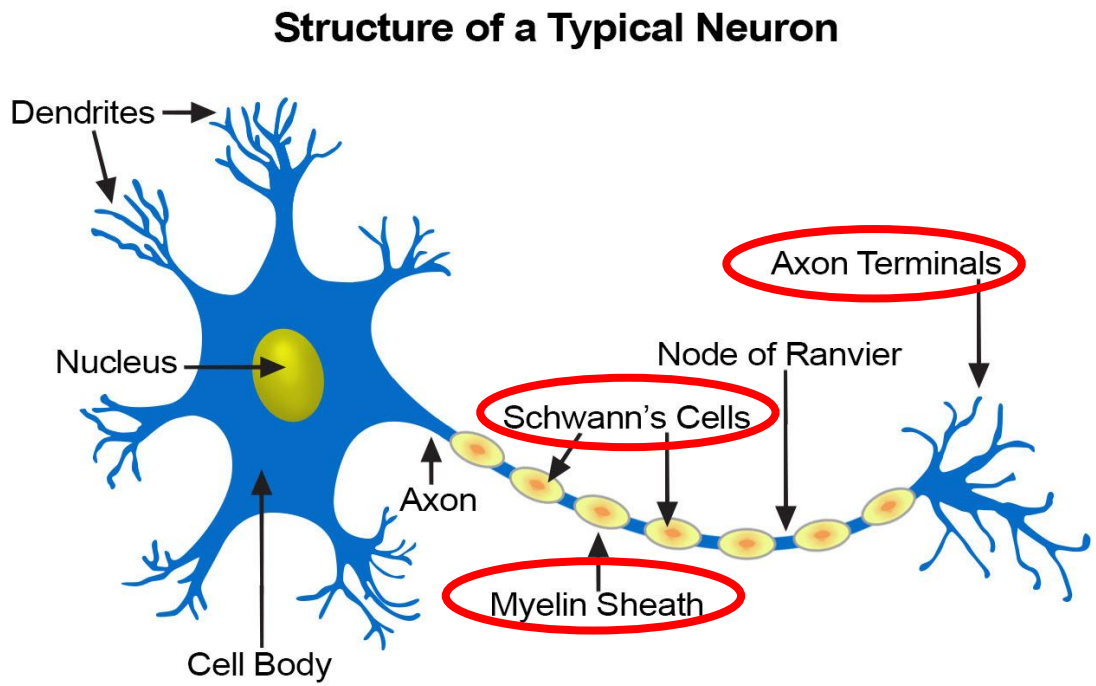
# Structure of a Neuron

**Myelin Sheath:**

- Insulating layer surrounding the axon, formed by specialized called **Schwann's cells**.
- Increases the speed of signal transmission along the axon by preventing signal loss or leakage.

**Terminal Buttons (Axon Terminals):**

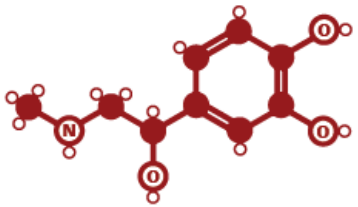
- Located at the end of the axon.
- Store and release **neurotransmitters**, which are **chemical messengers**, to communicate with other neurons across the synapse.



# THE STRUCTURES OF NEUROTRANSMITTERS

**STRUCTURE KEY:** Carbon atom · Hydrogen atom · Oxygen atom · Nitrogen atom · Rest of molecule

## ADRENALINE
Fight or flight neurotransmitter



Produced in stressful or exciting situations. Increases heart rate & blood flow, leading to a physical boost & heightened awareness.

## NORADRENALINE
Concentration neurotransmitter

Affects attention & responding actions in the brain, & involved in fight or flight response. Contracts blood vessels, increasing blood flow.

## DOPAMINE
Pleasure neurotransmitter

Feelings of pleasure, and also addiction, movement, and motivation. People repeat behaviours that lead to dopamine release.

## SEROTONIN
Mood neurotransmitter

Contributes to well-being & happiness; helps sleep cycle & digestive system regulation. Affected by exercise & light exposure.

## GABA
Calming neurotransmitter

Calms firing nerves in CNS. High levels improve focus; low levels cause anxiety. Also contributes to motor control & vision.

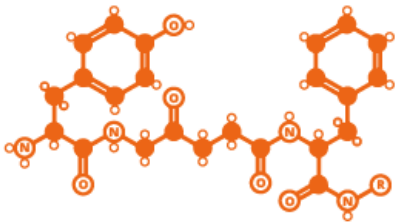
## ACETYLCHOLINE
Learning neurotransmitter

Involved in thought, learning, & memory. Activates muscle action in the body. Also associated with attention and awakening.

## GLUTAMATE
Memory neurotransmitter

Most common brain neurotransmitter. Involved in learning & memory, regulates development & creation of nerve contacts.

## ENDORPHINS
Euphoria neurotransmitters



Released during exercise, excitement, & sex, producing well-being & euphoria, reducing pain. Biologically active section shown.



https://youtu.be/cNaFnRKwpFk

# Resting Potential

**Resting Potential:**

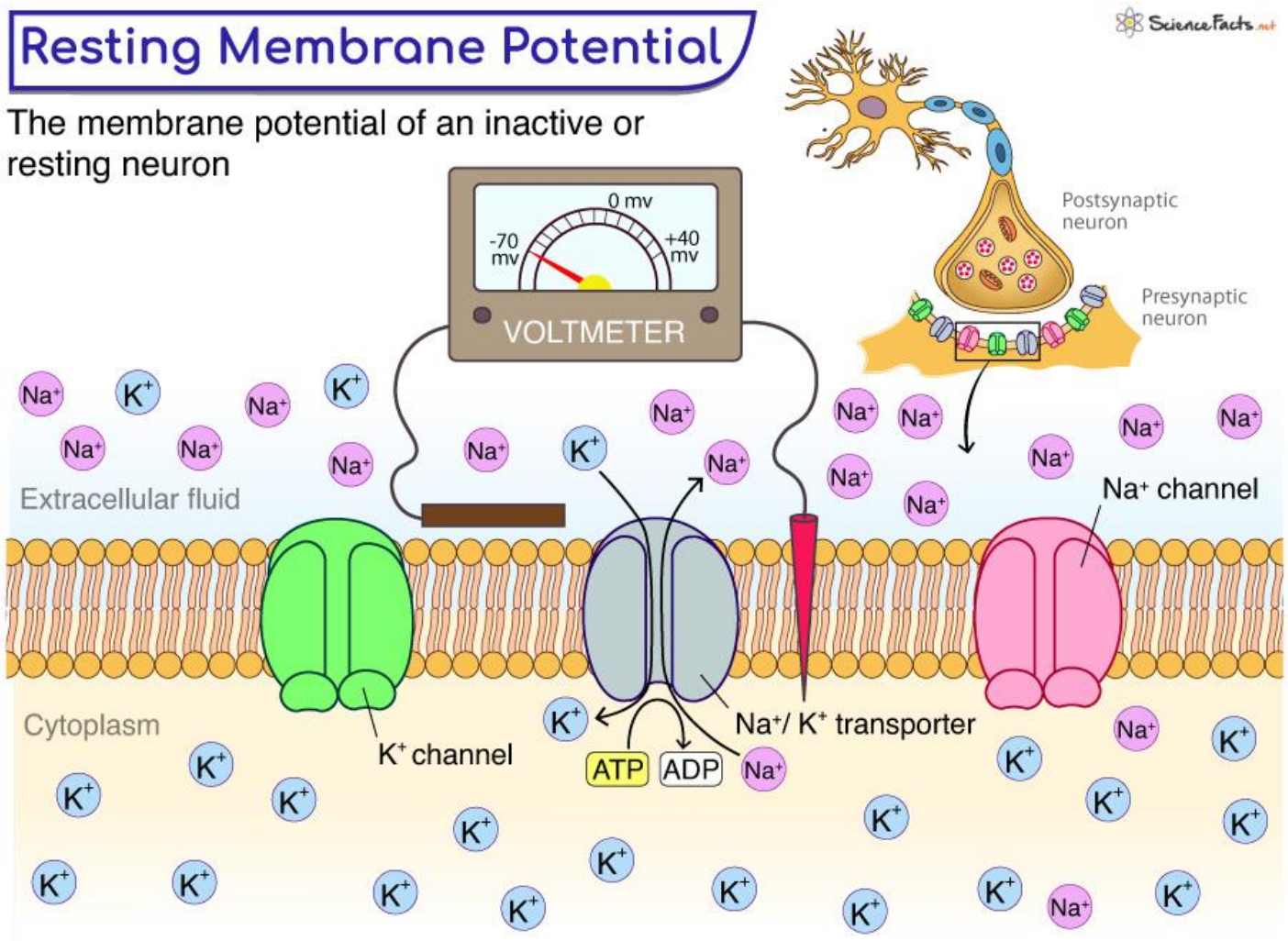
- Refers to the **electrical charge** across the cell membrane of a resting neuron.
- It is essential for the neuron's ability to transmit signals.

**Negative Charge Inside:**

- Inside the neuron, the charge is **negative** compared to the outside.
- This negative charge is around **-70 millivolts (mV)** in typical neurons.

**Sodium-Potassium Pump:**

- Key mechanism maintaining resting potential.
- Actively transports:
  - **Sodium ions ($Na^+$)** out of the cell.
  - **Potassium ions ($K^+$)** into the cell.
- This process requires energy in the form of **ATP**.



# Resting Potential

**Ion Distribution:**

At rest, there are:

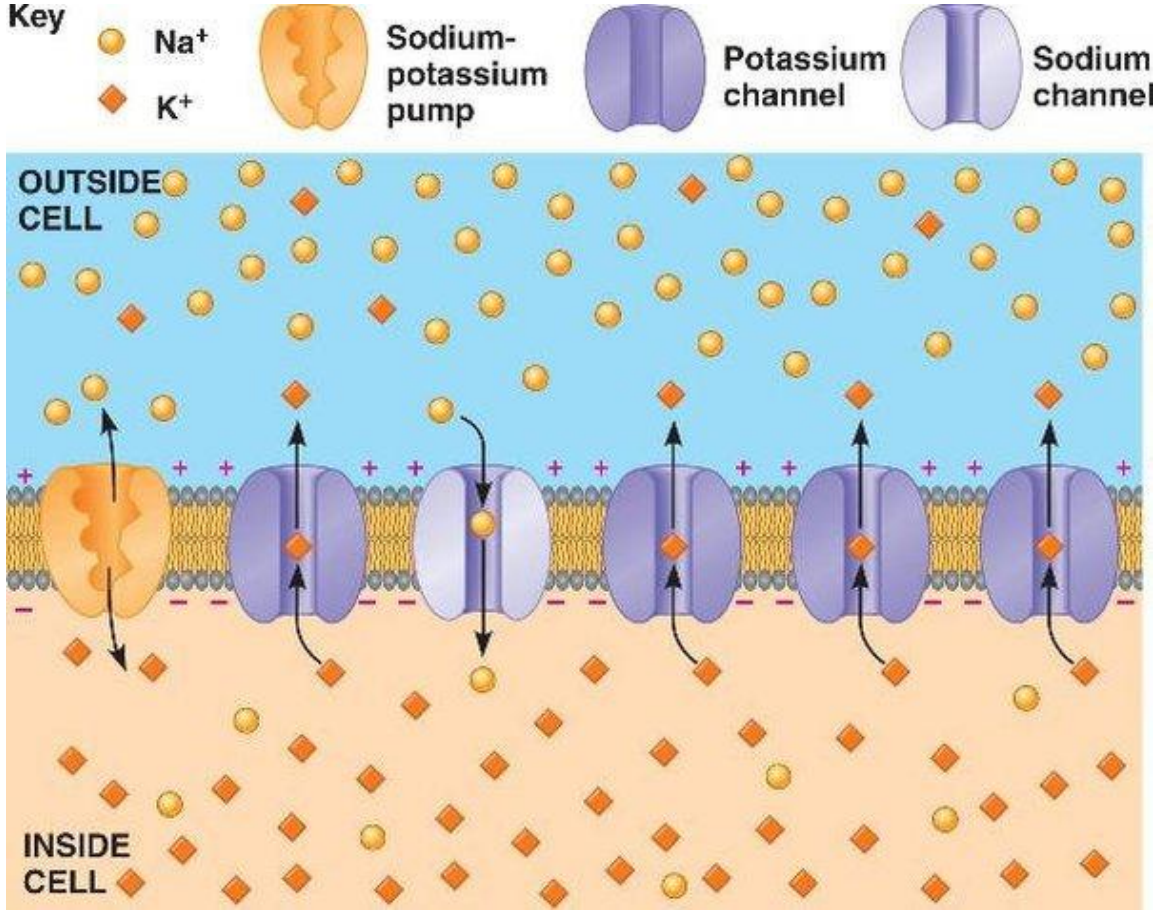
More **sodium ions outside** the neuron.

More **potassium ions** inside the neuron.

Creates an **electrical potential difference across the membrane**.

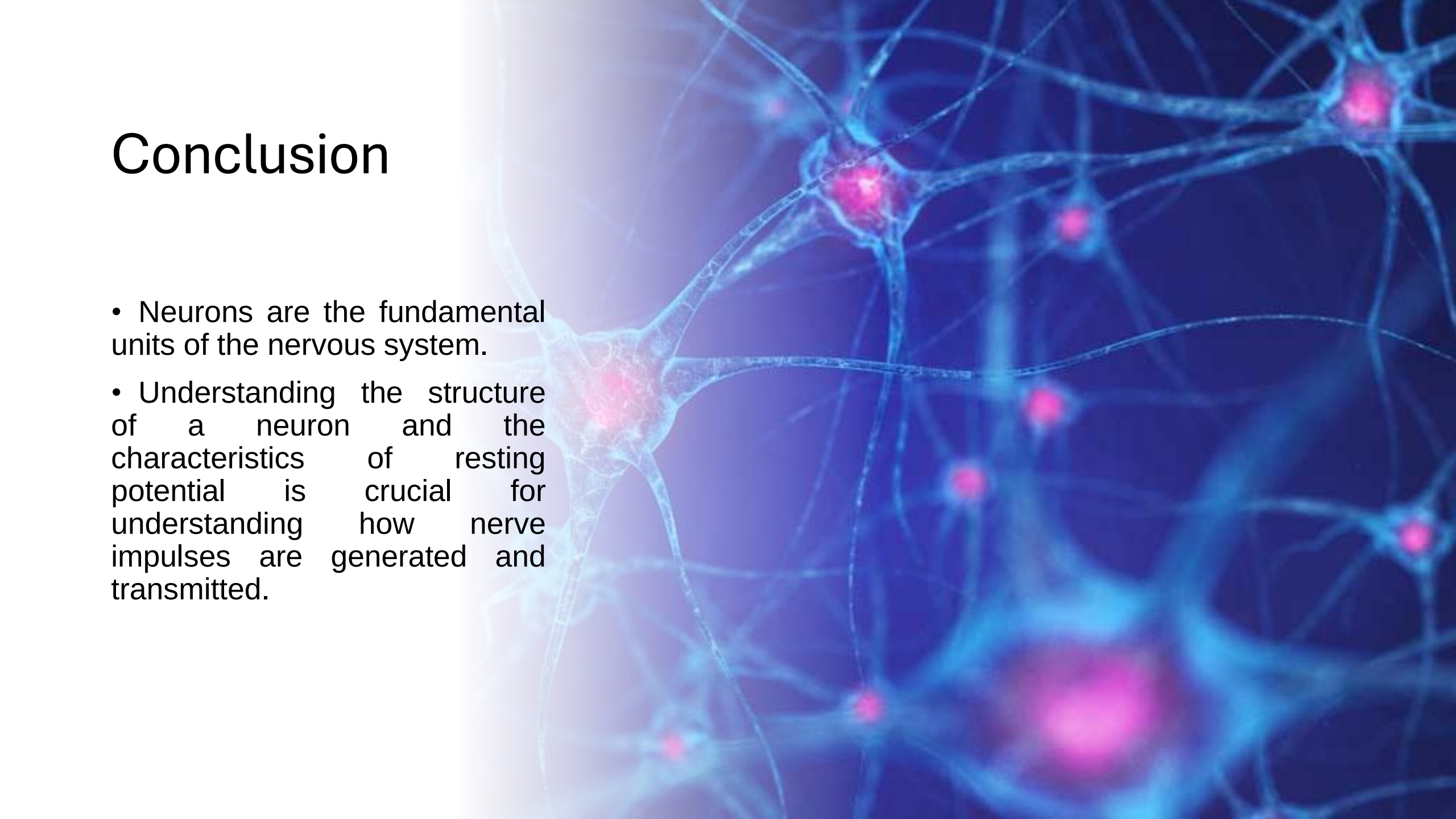
**Resting Membrane Potential:**

Imagine a neuron at rest is like a phone on standby. The resting potential, with its negative charge inside the cell, acts as a baseline ready state. **When a stimulus arrives, it can trigger changes in the cell membrane, leading to an action potential – like dialing a number**. This action potential is a wave of electrical activity that travels down the neuron's axon, allowing it to communicate with other cells. Without the resting potential, the neuron wouldn't have a clear starting point to generate these action potentials.



# Conclusion

- Neurons are the fundamental units of the nervous system.
- Understanding the structure of a neuron and the characteristics of resting potential is crucial for understanding how nerve impulses are generated and transmitted.



# Labxchange – neuron stimulation

https://www.labxchange.org/library/items/lb:LabXchange:231cc3f0:lx_simulation:1?fullscreen=true