A neuron is a specialized cell in the nervous system designed to transmit information. It is the fundamental communication unit of the brain, spinal cord, and peripheral nerves. Every thought, movement, memory, sensation, and emotion depends on neurons sending signals.

A cell is the basic structural and functional unit of life. A neuron is a highly specialized type of cell built specifically for rapid communication.

Neurons communicate using electrical and chemical signals. Electrical signals travel within the neuron. Chemical signals travel between neurons.

There are three major structural parts of a neuron: the cell body, dendrites, and the axon.

The cell body is also called the soma. The soma contains the nucleus. The nucleus holds DNA, which contains genetic instructions for how the cell functions. The cell body keeps the neuron alive by producing proteins and maintaining cellular processes.

Dendrites are branch-like extensions that receive incoming signals. They act like antennas. When other neurons send signals, dendrites detect them.

The axon is a long, cable-like extension that carries signals away from the cell body. Some axons are very short. Others can be over three feet long, such as those running from the spinal cord to the foot.

At the end of the axon are axon terminals. These are small branches that connect to other neurons.

The small gap between one neuron and another is called a synapse. A synapse is not a direct physical fusion. It is a microscopic space where communication occurs.

Inside a neuron, communication is electrical. Between neurons, communication is chemical.

Let’s break that down.

Neurons maintain a voltage difference across their membrane. A membrane is the outer boundary of the cell. Voltage means electrical charge difference.

At rest, a neuron has a resting potential of about -70 millivolts. Millivolts measure electrical potential. The inside of the neuron is slightly negative compared to the outside.

This difference exists because of ion distribution. Ions are charged particles such as sodium (Na+) and potassium (K+). The neuron membrane controls the movement of these ions.

When a neuron receives enough stimulation from dendrites, it reaches a threshold. Threshold is the minimum level of stimulation required to trigger a response.

When threshold is reached, an action potential occurs. An action potential is a rapid electrical impulse that travels down the axon.

During an action potential, sodium channels open and sodium rushes into the cell. This causes depolarization. Depolarization means the inside becomes more positive.

Then potassium channels open and potassium flows out. This restores the negative charge in a process called repolarization.

The action potential moves down the axon like a wave. It does not weaken as it travels. It is all-or-none. That means it either fully fires or does not fire at all.

Some axons are covered in myelin. Myelin is a fatty insulating substance. It wraps around the axon in segments.

Myelin increases conduction speed. It allows the electrical signal to jump between gaps called nodes of Ranvier. This jumping process is called saltatory conduction. Saltatory means “to leap.”

Without myelin, signals travel much slower.

When the electrical impulse reaches the axon terminal, it triggers the release of neurotransmitters.

Neurotransmitters are chemical messengers stored in small sacs called vesicles. When released, they cross the synapse and bind to receptors on the next neuron.

Receptors are protein structures that detect specific neurotransmitters.

Different neurotransmitters have different effects.

Dopamine is involved in reward and motivation.

Serotonin influences mood and emotional stability.

Acetylcholine plays a role in muscle contraction and memory.

Glutamate is the main excitatory neurotransmitter. Excitatory means it increases the likelihood that the next neuron will fire.

GABA (gamma-aminobutyric acid) is inhibitory. Inhibitory means it decreases the likelihood of firing.

Neurons form networks. A network is an interconnected system. The human brain contains approximately 86 billion neurons. Each neuron can form thousands of synaptic connections.

That means the total number of connections in the brain reaches into the trillions.

Neurons are categorized by function.

Sensory neurons carry information from sensory organs to the brain. For example, they detect light, sound, or touch.

Motor neurons carry signals from the brain to muscles. They control movement.

Interneurons connect neurons within the brain and spinal cord. They process information and make decisions.

Plasticity refers to the brain's ability to change. Neural plasticity means neurons can strengthen or weaken connections over time.

When you learn something new, certain synaptic connections become stronger. This strengthening is called long-term potentiation.

Memory formation depends on repeated activation of specific neural circuits.

Damage to neurons can disrupt function. Unlike many other cells, most neurons do not easily regenerate. Conditions such as stroke, Alzheimer's disease, and multiple sclerosis involve neuronal dysfunction or death.

Multiple sclerosis involves damage to myelin. Without proper myelin insulation, signals slow down or fail.

Neurons require oxygen and glucose to function. Glucose is the brain's primary energy source.

The nervous system is divided into two major parts.

The central nervous system includes the brain and spinal cord.

The peripheral nervous system includes nerves outside the brain and spinal cord.

Neurons are the communication highways of both systems.

Every thought you have is a pattern of electrical activity among billions of neurons.

Every movement is a motor neuron sending a signal to muscle fibers.

Every memory is a strengthened neural pathway.

Neurons are not just wires. They are living, adaptive biological processors.

They receive, integrate, decide, and transmit information.

At their core, neurons are electrochemical signaling cells designed for speed, precision, and coordination.