



*Second lecture*

# Nerve Fiber Structure

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## Nerve Fiber Structure

The electricity generated inside the body serves for the control and operation of nerves, muscles, and organs. Essentially all functions and activities of the body involve electricity in some way. The forces of muscles are caused by the attraction of opposite electrical charges. The action of the brain is basically electrical. All nerve signals to and from the brain involve the flow of electrical currents.

In carrying out the special functions of the body, many electrical signals are generated. These signals are the result of the electrochemical action of certain types of cells.

By selectively measuring the desired signals (without disturbing the body) we can obtain useful clinical information about particular body functions, for example ECG (Electrocardiogram), EEG (Electroencephalogram), EMG (Electromyogram).

The central nervous system consists of the brain, the spinal cord, and the peripheral nerves. Nerves are made up of a bundle of nerve fibres (*neurons*) which transmit in only one direction. Nerves that transmit sensory information to the brain or spinal cord are referred to as *afferent nerves* and nerves that transmit information from the brain or spinal cord to the appropriate muscles and glands are referred to as *efferent nerves*.

The autonomic nervous system controls various internal organs such as the heart, intestines, and glands.

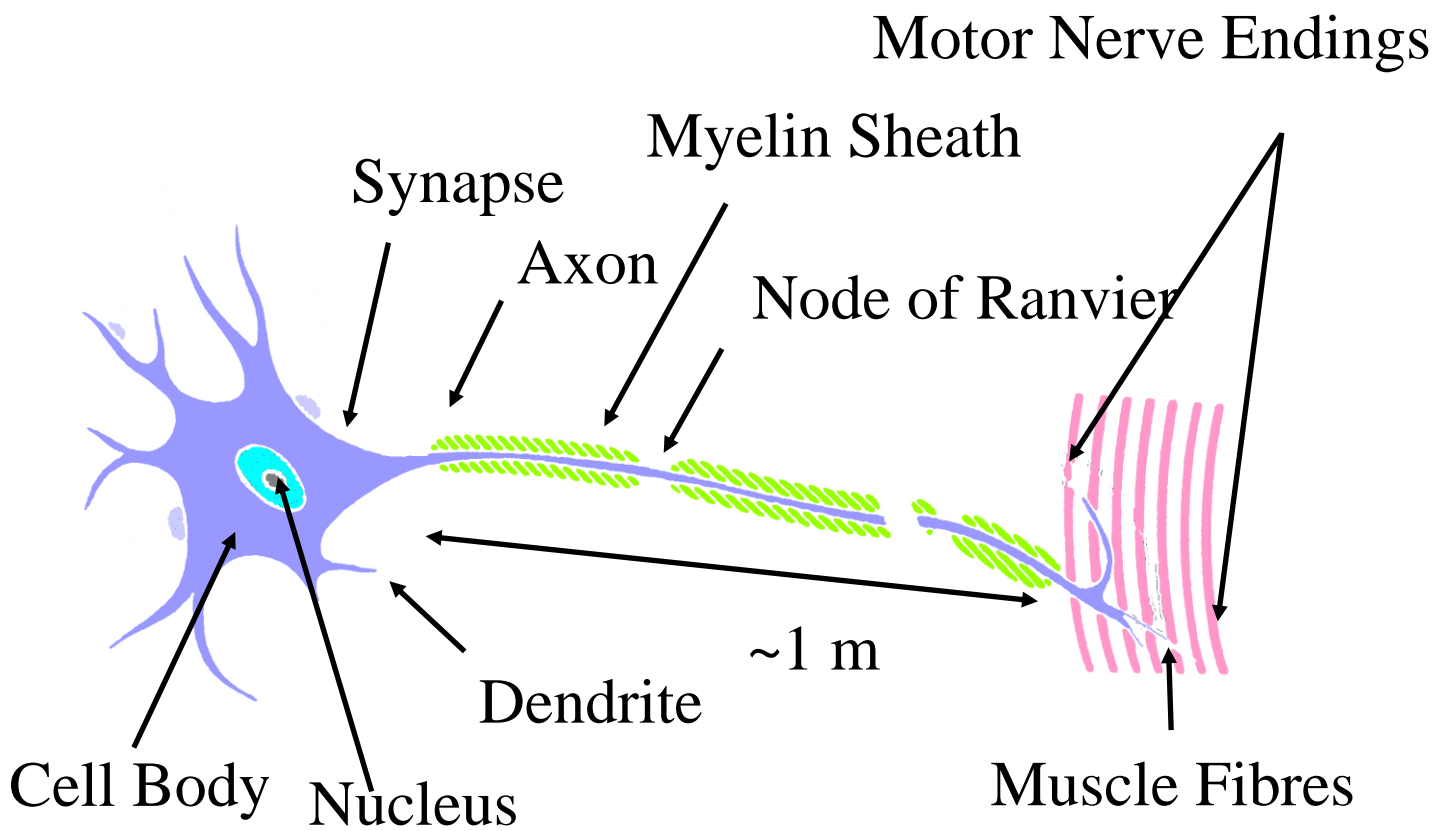
The control of the autonomic nervous system is essentially involuntary.

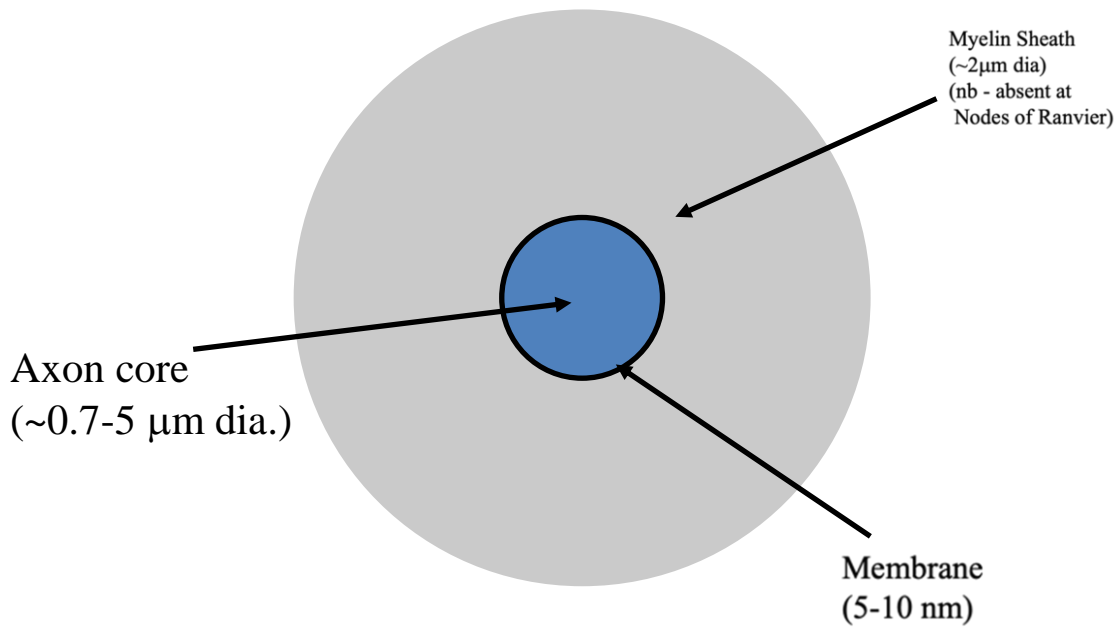
The basic structural unit of the nervous system is the neuron, a nerve cell specialized for the reception, interpretation, and transmission of electrical messages. There are many types of neurons. Basically, a neuron consists of a cell body that receives electrical messages from other neurons through contacts called *synapses* located on the dendrites or on the cell body. The *dendrites* are the parts of the neuron specialized for receiving information from stimuli or from other cells. The dendrite

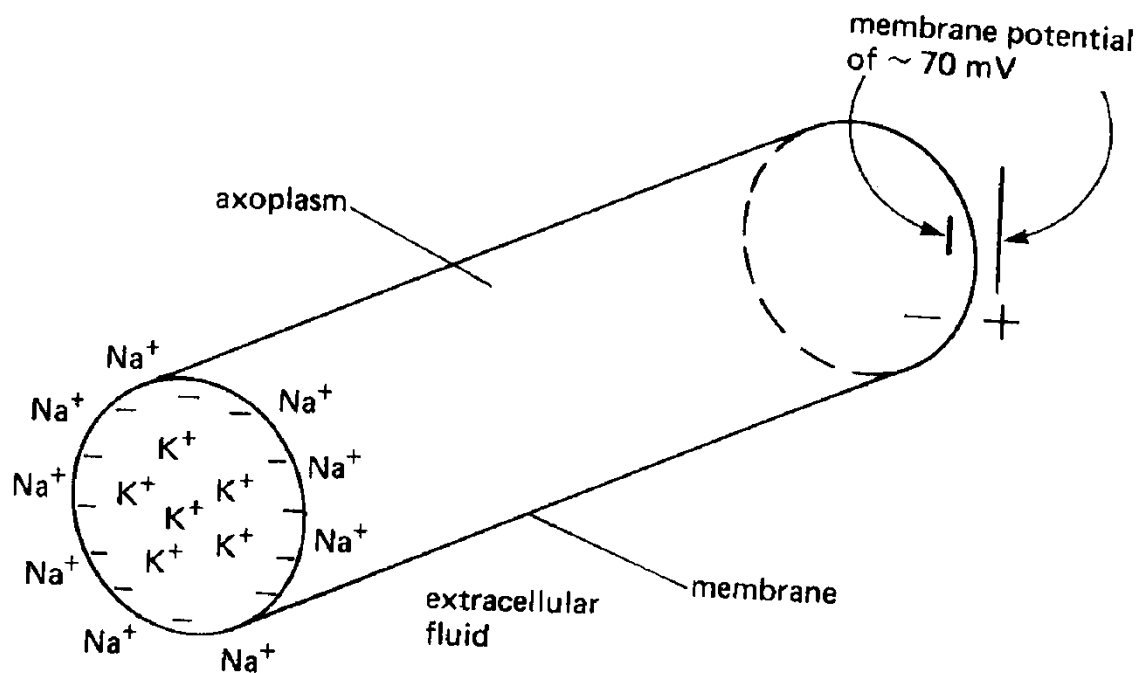
may be a transducer (stretch receptor, temperature receptor, etc).

# Nerve Fibre Structure

## ► Efferent (or Motor) Neuron







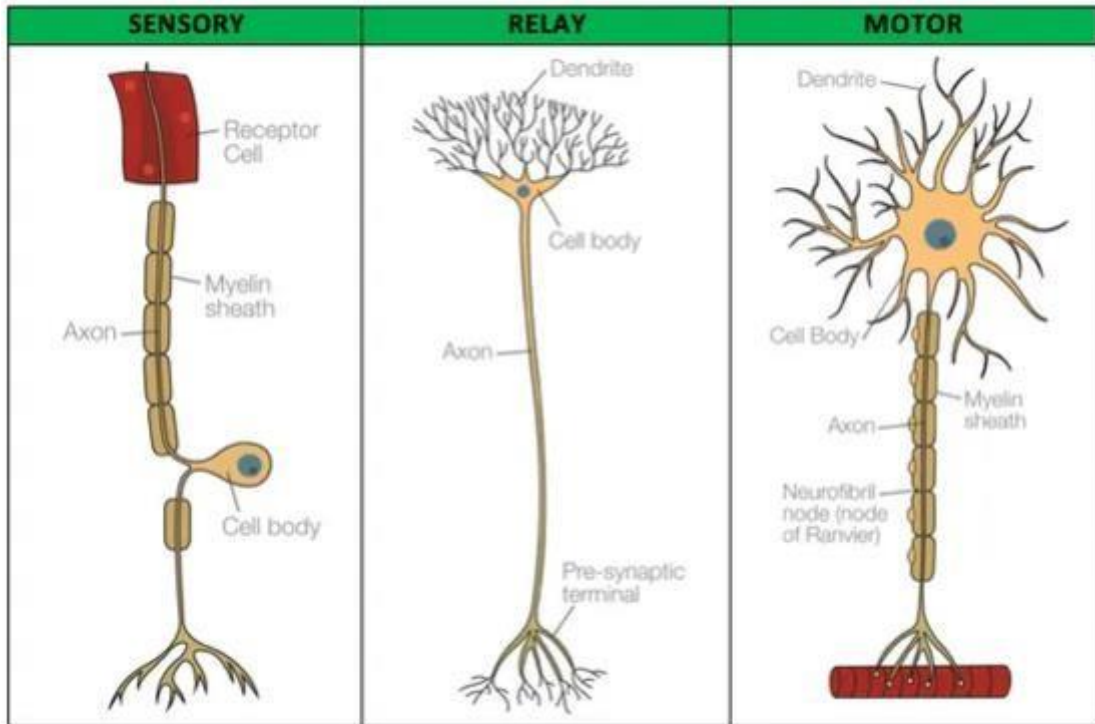
## Types of Neurons ( Nerve Cells) :

Neurons are the information processing units of the brain which have a responsibility for sending, receiving, and transmitting electrochemical signals throughout the body .

Neurons are the primary components of the nervous system, along with the glial cells that give them structural and metabolic support, The nervous system is made up of the central nervous system, which includes the brain and spinal cord, and the peripheral nervous system, which includes the autonomic and somatic nervous systems

Although there are billions of neurons and vast variations, neurons can be classified into three basic groups depending on their function :

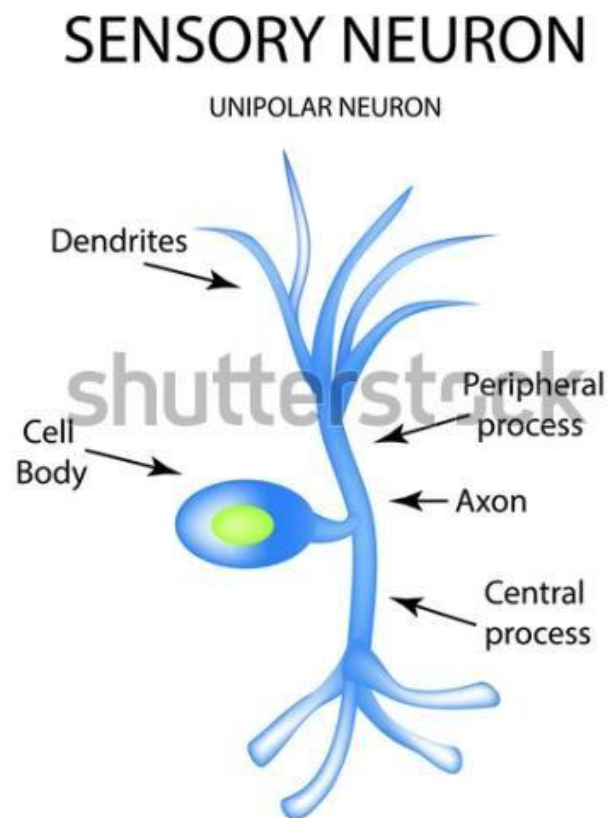
- 1- **Sensory Neurons** (long dendrites and short axons).
- 2- **Motor Neurons** (short dendrites and long axons) .
- 3- **Relay Neurons** (short dendrites and short or long axons ) .



**Sensory Neurons :**

(sometimes referred to as afferent neurons) are nerve cells which carry nerve impulses from sensory receptors towards the central nervous system and brain. When these nerve impulses reach the brain, they are translated into 'sensations', Sensory neurons help you :

- Taste .
- Smell .
- Hear .
- See (vision) .
- Feel things around you .



This sensory information can be either physical – through sound, heat, touch, and light, or it can be chemical – through taste or smell. An example of this can be when touching an extremely hot surface.

Once this happens, the sensory neurons will be sending signals to the central nervous system about the information they have received

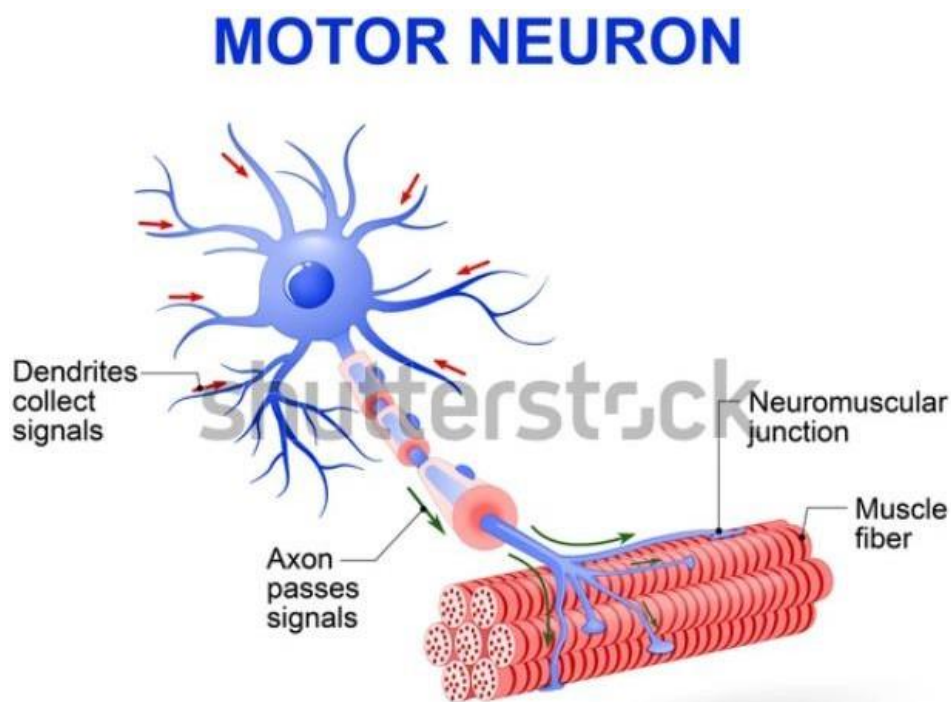
Most sensory neurons are characterized as being pseudounipolar. This means that they have one axon which is split into two branches .

**Motor Neurons :**

Motor neurons are the nerve cells responsible for carrying signals away from the central nervous system towards muscles to cause movement. They release neurotransmitters to trigger responses leading to muscle movement .

Motor neurons are located in the brainstem or spinal cord (parts of the central nervous system) and connect to muscles, glands and organs throughout the body .

**Function :** These types of neurons transmit signals from the spinal cord and brainstem to skeletal and smooth muscle to either directly or indirectly control muscle movements .



**For example:** after touching a hot surface with your hand, the message has been received from the sensory neurons. The motor neurons then cause the hand to move away from the hot surface .



There are two types of motor neurons :

**1- Lower motor neurons** : These are neurons which travel from the spinal cord to the muscles of the body .

**2- Upper motor neurons**: These are neurons which travel between the brain and the spinal cord .

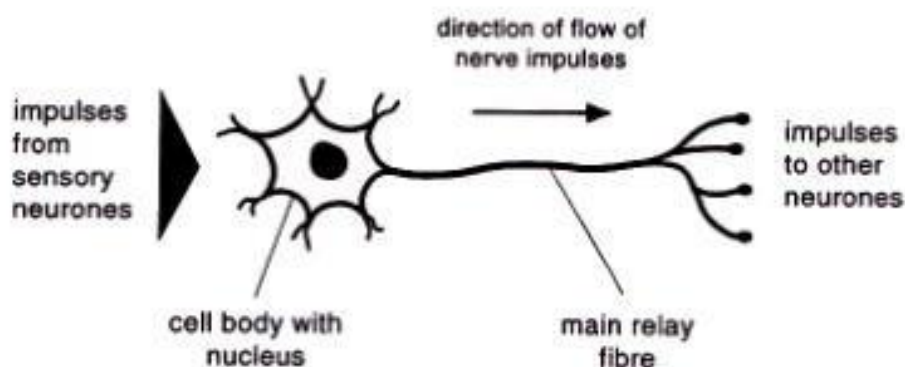
Motor neurons are characterized as being multipolar. This means that they have one axon and several dendrites projecting from the cell body .

### Relay Neurons :

A relay neuron allows sensory and motor neurons to communicate with each other. Relay neurons connect various neurons within the brain and spinal cord, and are easy to recognize, due to their short axons .

Alike to motor neurons, interneurons are multipolar. This means they have one axon and several dendrites . As well as acting as a connection between neurons, interneurons can also communicate with each other through forming circuits of differing complexities .

## Relay neuron



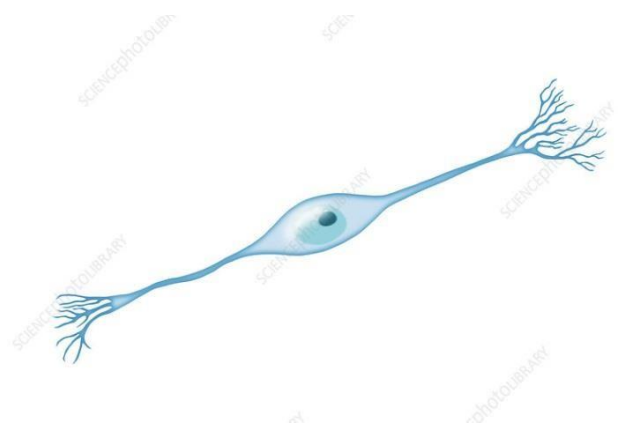
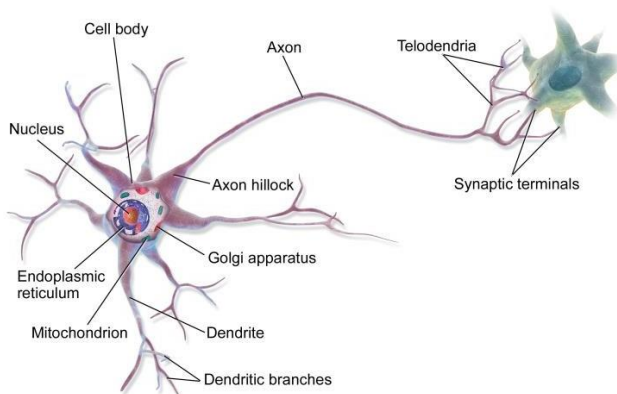
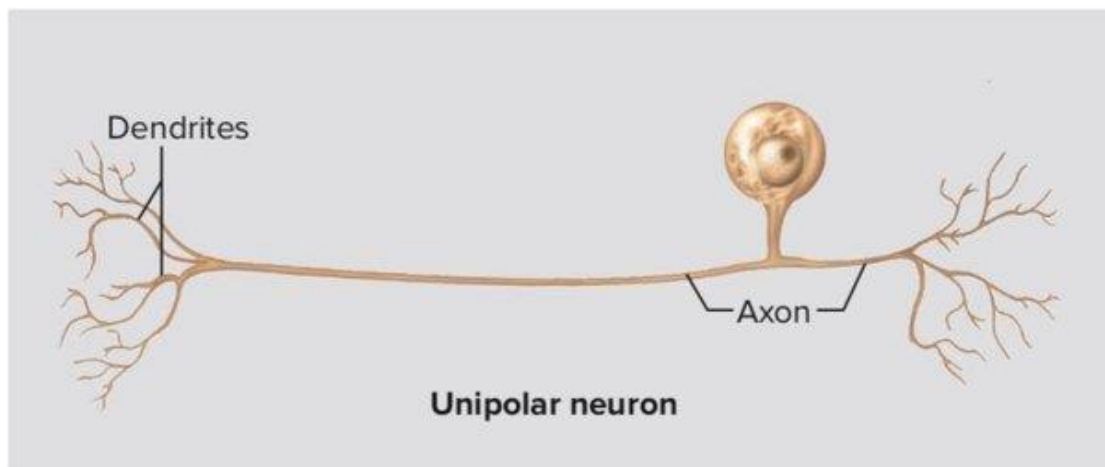
**Function :**

The communication between interneurons assists the brain to complete complex functions such as learning and decision-making, as well as playing a vital role in reflexes and neurogenesis – which means the regeneration of new neurons.

**Structural Classification :**

Most neurons can be anatomically characterized as :

- 1- **Unipolar:** Single process .
- 2- **Bipolar :** One axon and one dendrite .
- 3- **Multipolar :** One axon and two or more dendrites .



**QUATIONS**

**Q<sub>1</sub>** Nerves that transmit sensory information to the brain or spinal cord are referred to as.....

- A. afferent nerves      B. conductivity      C. efferent nerves      D. reception      E. myelin Sheath

**Q<sub>2</sub>** Nerves that transmit information from the brain or spinal cord to the appropriate muscles and glands are referred to as .....

- A. afferent nerves      B. conductivity      C. efferent nerves      D. reception      E. myelin Sheath

**Q<sub>3</sub>** After touching a hot surface with your hand, the message has been received from the neurons. The .....neurons then cause the hand to move away from the hot surface .

- A. sensory      B. relay      C. taste      D. vision      E. motor

**Q<sub>4</sub>** like a lightning strike, is an electrical phenomenon. A .....occurs because of a difference in electrical charge across the plasma membrane of a neuron .

- A. reception      B. myelin Sheath      C. nerve impulse      D. excitability      E. conductivity

**Q<sub>5</sub>** Neurons have evolved a ..... that allows them to conduct electrical signals over great distances despite their intrinsically poor electrical characteristics.

- A. axons      B. spikes      C. synapses      D. booster system      E. dendrites