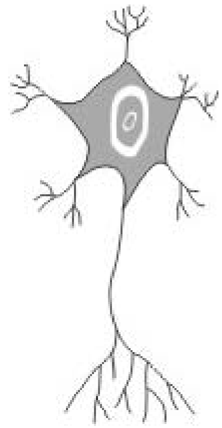
## The Lecture Contains:



Previous Next

## Neuron: Structure and Function

Nerve cells or neurons are especially adapted to receive and transmit signals. They play equally important role in the transmission of information. Figure 3.1 illustrates the basic structure of a neuron



Structure of neuron

All neurons share three fundamental components- soma, dentrites and axon. Structurally soma or the cell body contains nucleus and other structures present in other cells of our body. Most of the cytoplasm of the neuron is contained in the soma. Dentrites come out from the soma and carry message into the neurons. Dendrites have small bumps known as dendritic spines which can receive signals from other neurons. Axon is the extension carrying signals from cell body to the terminal buttons at the end of the neurons. These terminal buttons contain neurotransmitters which plays important role in conduction at synapse. Synapse is the junction where one neuron ends and the other begins. Any two neurons are not directly connected to each other; rather they are separated by about $\frac{2}{100}$ of a micron. These gaps are called synaptic cleft. The part of axon nearest to the soma is called axon hillock. Thereafter, it branches into telodendria and finally translates to end feet or terminal buttons. Few neurons have a fatty insulation through out the axon called myelin sheath. This insulation is segmented at 1-2 mm interval such that it looks like disjointedly arranged divisions. These spaces are called nodes of Ranvier (Fig. 3.2). The rate of conduction of impulses in myelinated neurons is higher than the unmyelinated ones.

.

Previous Next

Module 3:Neural conduction and transmission

Lecture 13:Structure of the neuron

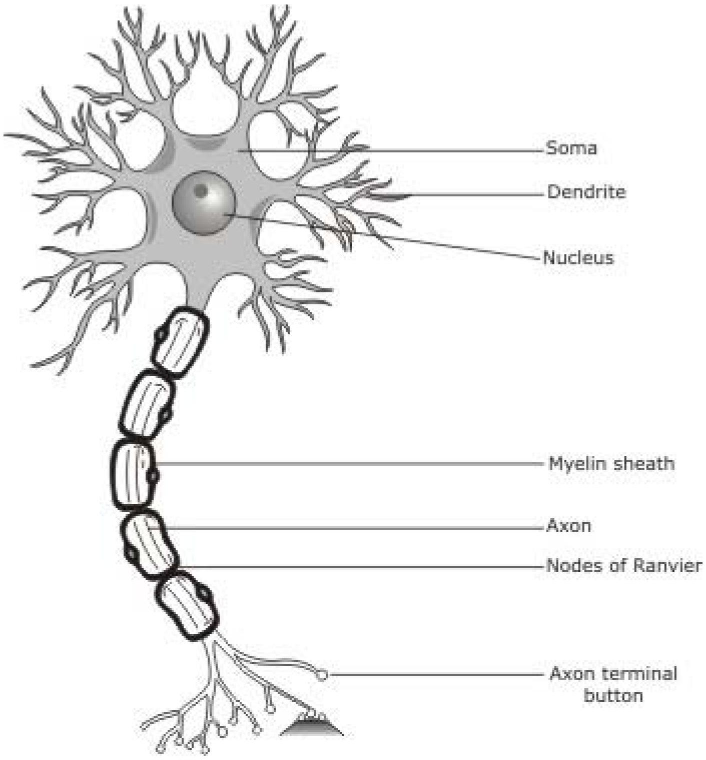
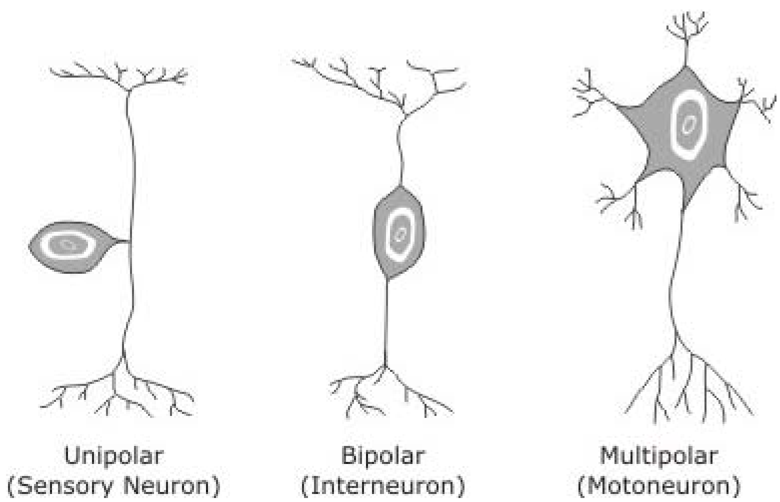



Illustration of axon with myelin sheath and nodes of Ranvier.

## Types of neurons

Based on the number of processes extending from the soma, neurons are classified as unipolar, bipolar and multipolar neurons. Figure 3.3 illustrates the types of neurons.




Types of neurons.

As shown in figure 3.3, shows the unipolar, bipolar, and multipolar neurons. Unipolar neurons are sensory nerve cells with a single process connecting axon and dendrite. Most of the neurons conducting signals from skin to the brain and spinal cord are unipolar. The direction of conduction is from the dendrites to the axon. Bipolar neurons have a single axon and dendrite and hence are supposed to be primitive form of nerve cells. The direction of conduction in bipolar neuron is from the dendrite to the cell body and then to the axon. Multipolar neurons have many short dentrites and an axon. They are found throughout the central nervous system. As they are motor neurons, they constitute tracts of the brain. Multipolar neurons are further classified as Golgi type I and type II on the basis of their length and branching of the axons. Golgi type I neurons have long axons and few branches and they conduct excitation to some distance. Golgi type II neurons have short axons and multiple branches. They primarily extend excitation to nearby neurons.

Previous Next

## Nerve Impulse

The membranes of the nerve cells have electrical potentials. Due to ionic changes it might become polarized. These changes in the electrical potential of the membrane of the nerve cell results into generation of nerve impulse. It begins with change in the permeability of the membrane and give rise to electrochemical events. These are known as nerve impulses. Normally these impulses start off in the axon hillock instead of dendrites or soma as the membrane is not excitable in these regions. With the generation of impulse in the axon hillock the surrounding membrane gets depolarized thus generating impulse in the adjacent part of the axon. These impulses do not travel backward because the membrane of soma is not excitable. The magnitude of these impulses do not depend upon the magnitude of the sensation, rather they follow all-or-none principle. This principle states that the nerve fibers either respond to the limit of their capability or do not get excited at all. A weak stimulation not capable of generating an impulse might end up resulting into local excitatory process.

The nature of nerve impulse is chemical. It consists of sodium-potassium ($Na^+$-$K^+$) pump, ion size, and diffusion pattern. In the resting state more sodium ions ($Na^+$) are located outside the membrane. Potassium ($K^+$) ions available in the fluid environment are actively transported into the neuron. However, they are insufficient to affect other ions. So, the outer membrane remains positively charged. Many negatively charged acid molecules (acid anions) are also present inside the cell. They are large enough to pass through the cell membrane. This also contributes in making the inner membrane negatively charged. The principle of diffusion is evident in the flow of ions and hence substances move from region of high concentration towards low concentration zone. Chlorine ions ($Cl^-$) which carry negative charge freely move back and forth through the membrane.

Previous Next