

## ORGANIZATION OF THE NERVOUS SYSTEM

- Nervous system is a well organized system of communication
  - That allows the individual to interact with his external environment
  - It is a system of integration that coordinates functions of various internal organ systems of the body e.g. gastrointestinal functions, secretions of hormones, functions of heart, lungs, kidney and musculoskeletal system and so many
- The nervous system can be **divided** into two parts—
  1. **Central nervous system (CNS)** consists of **brain** and **spinal cord**
  2. **The peripheral nervous system (PNS)** consists of **sensory (or afferent)** neurons and **motor (or efferent)** neurons
- **Sensory receptors** ,present throughout the body, continuously monitor conditions in the internal and external environments. These sensors when stimulated send information, via sensory/afferent neurons , from PNS to the CNS ----- CNS integrates information and determines whether a response is needed, if needed, what type of response is needed-----then CNS send output signals via efferent / motor neurons to their targets which are mostly muscles and glands.
- Cells of nervous system –

The nervous system is composed of primarily **two types of cells**

  1. **Neurons** – the basic signaling units ,the structural and functional unit of the nervous system and
  2. Support cells known as **glial cells** (glia /neuroglia)

## NEURONE

The term neurone is used to describe –

- i) Nerve cell (**cell body** /soma/ perikaryon) and
- ii) Its processes – i) the **dendrites** & ii) the **axon** (axis cylinder, nerve fiber)

### Structure of neurone

- Neurons vary considerably in shape and size in different parts of the body
- neurone is enclosed by a **unit membrane** which contains receptors, ion channels and pumps ,necessary for the activities of the neurons

### The Cell Body (Soma)

- consists of centrally /eccentrically placed **nucleus** with nucleolus & cytoplasm
- cytoplasm contains many **organelles** like rough endoplasmic reticulum, Golgi apparatus , free ribosome , many mitochondria, cytoskeletal elements etc. –all having usual functions as in other cells
- there are sufficient **mitochondria** to run TCA cycle and for generation of required ATP
- The **Nissl granules** ,found more in motor neurons than in sensory neurons, are present only in soma ,not in axon hillock/ axon. These granules contain ribonucleoprotein and are involved in protein Synthesis.

--**cytoskeletal elements** (include microfilaments / neurofilaments, microtubules)  
provide supports

## **Dendrites**

--numerous short **extensions/processes from the soma**

--processes usually many, sometimes single/absent

--Nissl granules are present only in **proximal dendrites**, not in **distal dendrites**

--contain mainly microfilaments and microtubules

--**receive information from neighboring cells** forming receiving /receptor

zone, provide input **towards the cell body**, not in the form of AP but as local electrotonic potential

--increase the surface area of receiving zone many fold, presence of **dendritic spines** (thin spikes to knobby projections in cerebellum and cerebral cortex) can expand the surface area more. These spines can make their own proteins. Changes in spine morphology are associated with learning , memory as well as with various pathologies like genetic disorders (leading to mental retardation), degenerative diseases (e.g. Alzheimer's disease)

## **Axon**

--it is axis cylinder, **a long tubular process** that extends **away from the cell body** ( as peripheral nerves and nerve tracts in CNS )

--**transmits outgoing signals** to the target organs

--**axoplasm**, cytoplasm of axon, contains many organelles like mitochondria, Golgi apparatus, cytoskeletal proteins

--the axon arises from a thickened tapered area of the soma called **axon hillock**

--action potential is produced from **initial segment**, initial portion of axon (unmyelinated) after axon hillock where membrane threshold is lowest

--before termination of axon, it loses its myelin sheath and divides into branches called telodendria or **axon terminals** which have swollen button like ends called **terminal buttons or terminal knobs** which contain neurotransmitter vesicles