Functions and Divisions of the Nervous System

- 3 overlapping functions:
  - Sensory Input
  - Integration
  - Motor Output
Functions and Divisions of the Nervous System

- The Nervous System is highly integrated and divided into two principal divisions:
  - The Central Nervous System
  - The Peripheral Nervous System
Divisions of the Peripheral Nervous System

Two Functional Divisions

- Sensory (Afferent) Division
  - Somatic sensory fibers
  - Visceral sensory fibers
- Motor (Efferent) Division
  - The somatic nervous system
  - The autonomic nervous system
Check Your Understanding

• What is meant by “integration” and does it primarily occur in the CNS or PNS

• Which subdivision of the PNS is involved in (a) relaying the feeling of a full stomach after a meal (b) contracting the muscles to lift your arm (c) increasing your heart rate
Histology of Nervous Tissue

- 80% Cellular
- Two principal cell types
  - Neurons
  - Neuroglia (or glial cells)
Neuroglia

- There are 6 types of glial cells
  - 4 in the CNS
  - 2 in the PNS
Neuroglia in the CNS

- Astrocytes
- Microglial Cells
- Ependymal Cells
- Oligodendrocytes
Neuroglia in the PNS

- Satellite Cells
- Schwann Cells

(e) Satellite cells and Schwann cells (which form myelin) surround neurons in the PNS.
Check Your Understanding

• Which type of Neuroglia controls the extracellular environment around neuron cell bodies in the CNS? in the PNS?

• Which two types of neuroglia form insulating coverings called myelin sheaths?
Neurons

• Structural units of the nervous system
• 4 special characteristics
  • ability to conduct nerve impulses
  • extreme longevity
  • neurons are amitotic
  • exceptionally high metabolic rate
Neuron Structure

- Neuron Cell Body
Neuron Structure

Neuron Processes

- Dendrites
- Axons
  - hillock
  - axon collaterals
  - terminal branches
  - axon terminals
The Axon: Functional Characteristics

- The conducting region
  - Axon Hillock (trigger zone)
  - Axon Terminals (secretory zone)
- Cell membrane = axolemma
- Lacks GA and ER
Transport Along the Axon
Myelination

- The Myelin Sheath
- Myelination in the CNS
- Myelination in the PNS
Myelination in the PNS Video

The Schwann Cell and Action Potential
Check your understanding

• Which part of the neuron is its fiber? How do nerve fibers differ from the fibers of connective tissue, and the fibers in muscle tissue?

• How does a nucleus within the brain differ from a nucleus within a neuron?

• How is a myelin sheath formed in the CNS, and what is its function?
Classifications of Neurons

• **Structural Classifications**
  - Multipolar, Bipolar, Unipolar

• **Functional Classifications**
  - Sensory (afferent) neurons
  - Motor (efferent) neurons
  - Interneurons
Check your understanding

• Which structural and functional type of neuron is activated first when you burn your finger?

• Which type is activated last to move your finger away from the source of heat?
Membrane Potentials

- Role of membrane ion channels
- Leakage Channels
- Gated Channels
  - Chemically gated channels
  - Voltage-gated channels
  - Mechanically gated channels
The Resting Membrane Potential

- The Charge difference across the membrane in a resting neuron
- Differences in Ionic Composition
- Differences in Plasma Membrane permeability
Check Your Understanding

• In an open channel, which factors determine which direction ions will move through that channel?

• For which cation is there the greatest amount of leakage across the plasma membrane?
Membrane Potentials That Act as Signals

Objectives

• Compare and contrast graded potentials and action potentials
• Explain how action potentials are generated and propagated along neurons
• Define absolute and relative refractory periods
• Define saltatory conduction and contrast it with continuous conduction
Membrane Potentials That Act As Signals

- Two types of membrane potentials that act as signals
  - Graded Potentials
  - Action Potentials
Membrane Potentials That Act As Signals

- Depolarization
- Hyperpolarization
Membrane Potentials

- Grade d Potentials
  - short lived
  - localized
  - decreased magnitude with distance