# Neurons and Nerve fibres

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# definition

- A neuron is the basic structural and functional unit of the nervous system.
There are about 100billions of neurons in the central nervous system.

- neuron= nerve fibre= nerve cell

- Neurons are similar to other types of cell in the body except for some few distinguishing features.

# division

1. Cell body

- Also known as soma or perikaryon
- The shape is irregular and contains a large nucleus.
- Contents like any other cell types except for the presence of Nissil bodies and neurofibrils in its neuroplasm.

2. Neuronal processes

- Dendrite

  short repeatedly branched processes of the neuron

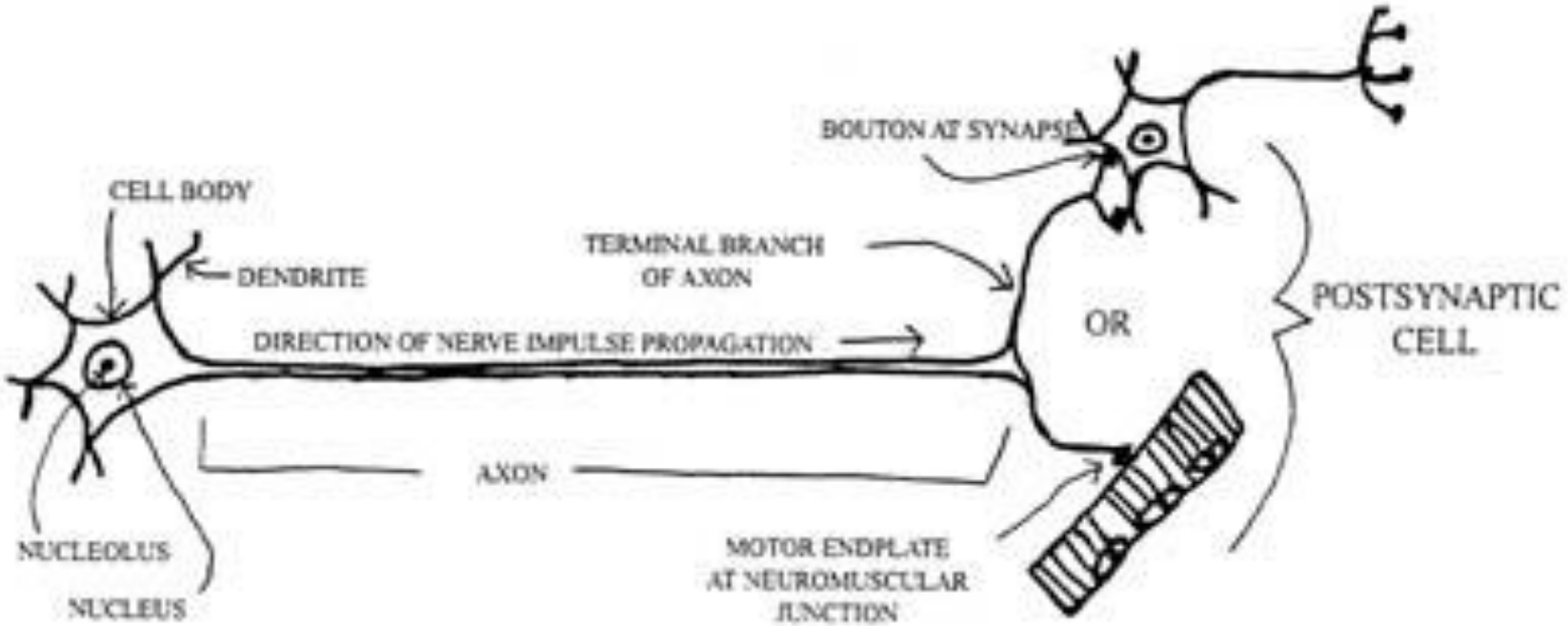
  Transmits impulses towards the nerve body

- Axon

  Long single process of the neuron.

  Arises from the Axon Hillock

  *Transmit impulses away from the nerve cell body


BOUTON AT SYNAPSE
CELL BODY
DENDRITE
TERMINAL BRANCH
OF AXON
OR
POSTSYNAPTIC
CELL
DIRECTION OF NERVE IMPULSE PROPAGATION
AXON
NUCLEOLUS
NUCLEUS
MOTOR ENDPLATE
AT NEUROMUSCULAR
JUNCTION

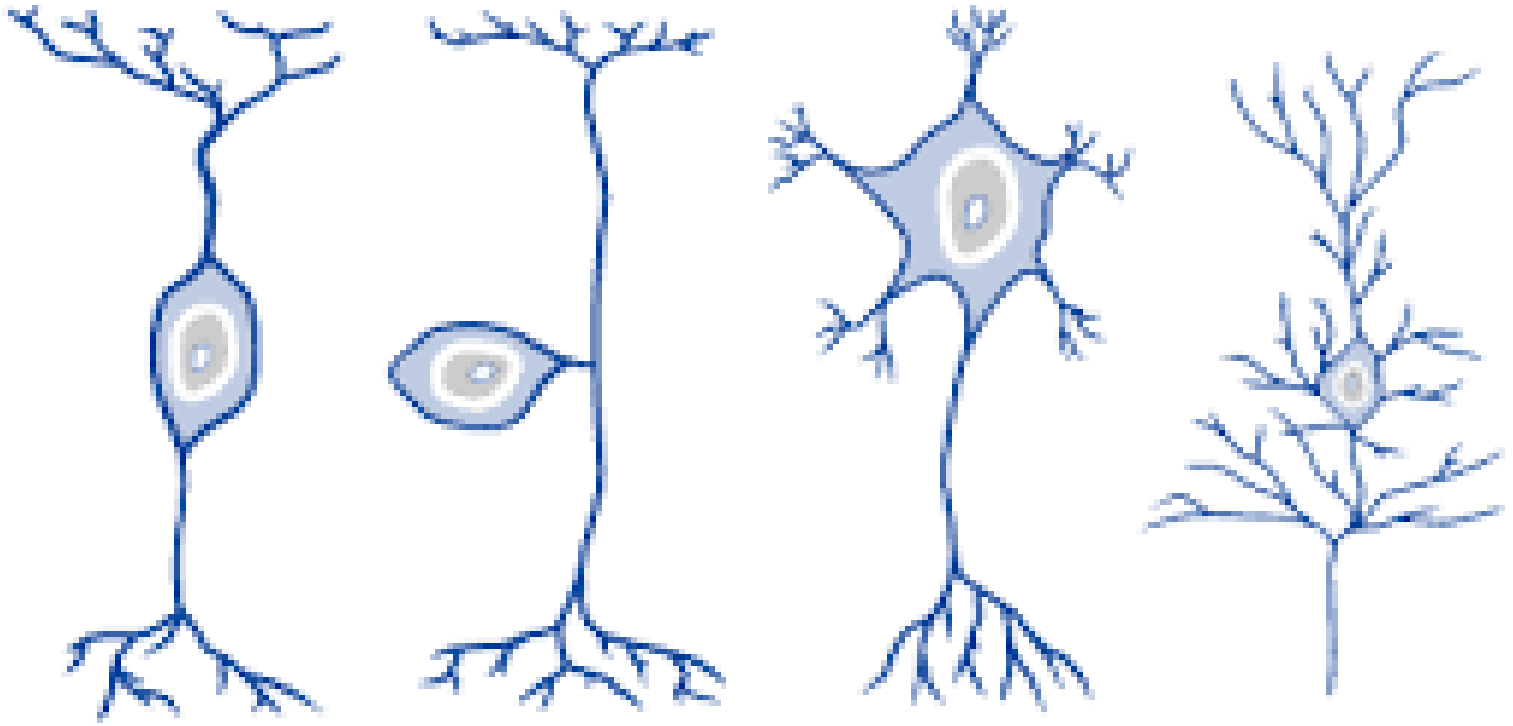
# Classification of neurons

- They can be classified on the basis of number of poles and their functions

- Unipolar , Bipolar and Multipolar neurons

- Motor neurons , interneurons and sensory neurons

# Basic Neuron Types



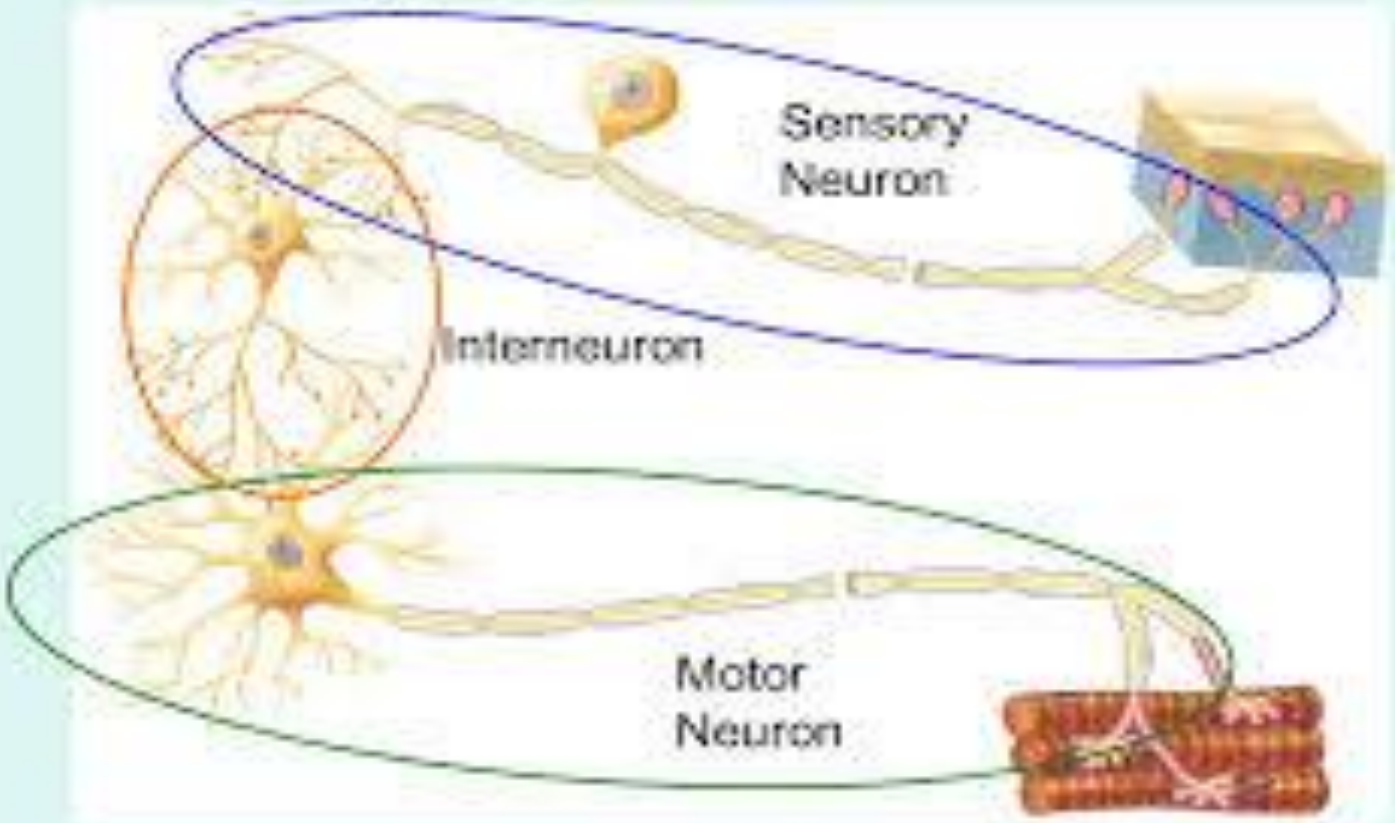
Bipolar (Interneuron)

Unipolar (Sensory Neuron)

Multipolar (Motoneuron) (Interneuron)

Multipolar (Pyrimidal Cell)

# Types of Neurons



## PROPERTIES OF NERVE FIBRES

1. Excitability:

- nerve fibres are highly excitable tissues
- Low threshold for excitability when compared with other excitable tissues

- Ability to respond to changes in its surrounding(Stimuli) leading to alteration in the resting membrane potential (electrical impulse).

2. Conductivity:

- Conduct nerve impulse along its entire length to the axon terminal

# Properties of Nerve Fibers

**Respond to Changes surrounding them**

**Conduct nerve impulses Along their length**

1 **Detect the changes**

**From receptors to CNS "Sensory Nerves"**

2 **Convert the changes into electrical change called "nerve impulse"**

**From CNS to Effector organs "Motor Nerves"**

**Excitability**

**Conductivity**

## Conductivity: Propagation of the action potential

❑***Definition:*** It is the propagation (transmission) of action potential along the axon from the region of the initial segment down to the terminal ending.

❑***Significance:*** The action potential must be propagated in order to transfer information from one place in the nervous system to the other.

❑ ***Direction:***

- Inside the body (in vivo): in one direction (unidirectional)

  * mostly: away from the cell body (orthodromic)

- Outside the body (in vitro): in both directions (bidirectional).

❑Mechanism:

➢The action potential generated at one site on the axon, acts as a stimulus for the production of another action potential in the adjacent sites of the axon.

➢Each action potential, in its rising phase reflects a reversal in membrane polarity(depolarization)

➢Positive charges due to influx of sodium ions depolarize the adjacent region to threshold

➢The next region is depolarize

❑Types:

Saltatory and continous conduction

## 3. Refractive period

- During action potential in a nerve fiber, its excitability become reduced
- Generation of impulse becomes reduced and difficult
- Types: Absolute and refractory period

| Absolute refractory period (ARP) | Relative refractory period (RRP) |
| --- | --- |
| - the excitability of the nerve fiber is completely lost.<br>i.e., the nerve is refractory to further stimulation | - the excitability of the nerve is partially recovered (but still below normal) |
| - no other stimulus whatever its strength can excite the nerve. | - Stronger stimuli are needed to excite the nerve. |
| - corresponds to: the ascending limb of the spike potential (after the firing level) and the early part of the descending limb (initial 1/3 of repolarization). | - corresponds to the late part of the descending limb of the spike potential till the start of the negative after potential. |

## 4. All or none response

- Either all of the action potential is seen or none at all

- If a stimulus of threshold strength is applied action potential will be generated

- Further increase in strength(magnitude) of the stimulus or duration has no effect on amplitude of an AP but can affect the frequency

5. Summation:

- Application of a sublimal stimulus does not elicit an action potential. They rather evoke a non propagated/local response (EPSP or IPSP)

- However if the sub threshold stimuli are applied in rapid succession, local responses can add up (summate) to produce a single full fledge action potential

- Types: Spatial and Temporal summation

- Spatial summation is summation of postsynaptic potentials in response to stimuli that occur at DIFFERENT LOCATIONS in the membrane of a postsynaptic cell at the SAME TIME

- Temporal summation is summation of postsynaptic potentials in response to stimuli that occur at the SAME LOCATION in the membrane of a postsynaptic cell but at DIFFERENT TIMES.

6. Accomodation:

- the property of a **nerve** by which it adjusts to a slowly increasing strength of stimulus, so that its threshold of excitation is greater than it would be were the stimulus strength to have risen more rapidly.