

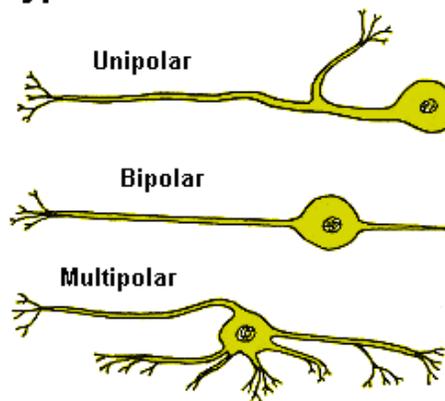
STRUCTURE AND FUNCTIONS OF NERVOUS SYSTEMS

The basic component in the nervous system is the nerve cell or neuron, composed of a cell body with two projections (fibres) - the dendrite that receives stimuli and the **axon** that transmits information, either to another neuron or to an effector organ such as a muscle. Axon may have lateral branches called **Collateral** and terminal **arborization** and **synapse**. Insect neurones release a variety of chemicals at synapses either to stimulate or to inhibit effector neurones or muscles. Acetylcholine and catecholamines such as dopamine are the important neurotransmitters involved in the impulse conduction. Neurones are of following types based on structure and function.

A. Structural basis

- i. Monopolar : neurone with a single axon
- ii. Bipolar : neurone with a proximal axon and a long distal dendrite.
- iii. Multipolar : neurone with a proximal axon and many distal dendrites.

Types of Neurons



B. Functional basis

- i. Sensory neurone: It conducts impulse from sense organs to central nervous system (CNS).
- ii. Motor neurones: It conducts impulse from CNS to effector organs
- iii. Inter neurones: (association neurone: It interlinks sensory and motor neurones.

The cell bodies of interneurons and motor neurons are aggregated with the fibres interconnecting all types of nerve cells to form nerve centres called ganglia.

Mechanism of impulse conduction

Impulses are conducted by the neurons by two means.

A. Axonic conduction: Ionic composition varies between inside and outside of axon resulting in excitable conditions, which leads to impulse conduction as electrical response.

B. Synaptic conduction: Neuro chemical transmitters are involved in the impulse conduction through the synaptic gap. Neuro transmitters and the type of reactions helping in the impulse conduction is as follows.



NERVOUS SYSTEM

- i. Central nervous system (CNS)
- ii. Visceral nervous system (VNS)
- iii. Peripheral nervous system (PNS)

I. Central nervous system

It contains double series of nerve centres (ganglia). These nerve centres (ganglia) are connected by longitudinal tracts of nerve fibres called **connectives** and transverse tracts of nerve fibres called **commissures**. Central nervous system is made up of the following.

(i).Brain: Formed by the fusion of first three cephalic neuromeres.

Protocerebrum : Large, innervate compound eyes and ocelli.

Deutocerebrum : Found beneath protocerebrum, innervate antennae.

Tritocerebrum : Bilobed, innervate labrum.

Functions: i. Main sensory centre controls insect behaviour.

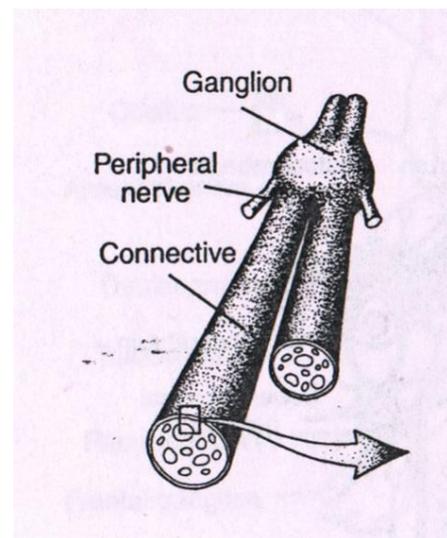
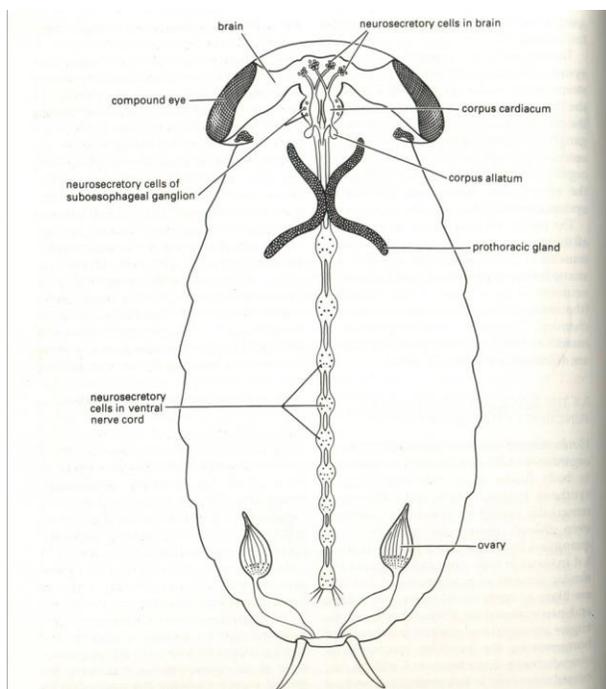
ii. **Ventral nerve cord:** Median chain of segmental ganglia beneath oesophagus.

iii. **Sub esophageal ganglia:** Formed by the last three cephalic neuromeres. Innervates mandible, maxillae and labium.

iv. **Thoracic ganglia:** Three pairs found in the respective thoracic segments, largest ganglia, innervate legs and muscles.

v. **Abdominal ganglia:** 8 pairs, number varies due to fusion of ganglia, innervate spiracles.

vi. **Thoraco abdominal ganglia:** Thoracic and abdominal ganglia are fused to form single compound ganglia. Innervate genital organs and cerci.



II. Visceral nervous system

The **Visceral (sympathetic)** nervous system consists of three subsystems: (i) the **stomodeal** or **stomatogastric**, which includes the frontal ganglion; (ii) **Ventral visceral** and (iii) the **caudal visceral**. Together the nerves and ganglia of these subsystems innervate the anterior and posterior gut, several endocrine organs (Corpora cardiaca and Corpora allata), the reproductive organs, and the tracheal system including the spiracles.

III. Peripheral nervous system

The peripheral nervous system consists of all the motor neurone axons that radiate to the muscles from the ganglia of the CNS and stomodeal nervous system plus the sensory neurones of the cuticular sensory structures (the sense organs) that receive mechanical, chemical, thermal or visual stimuli from an environment.

