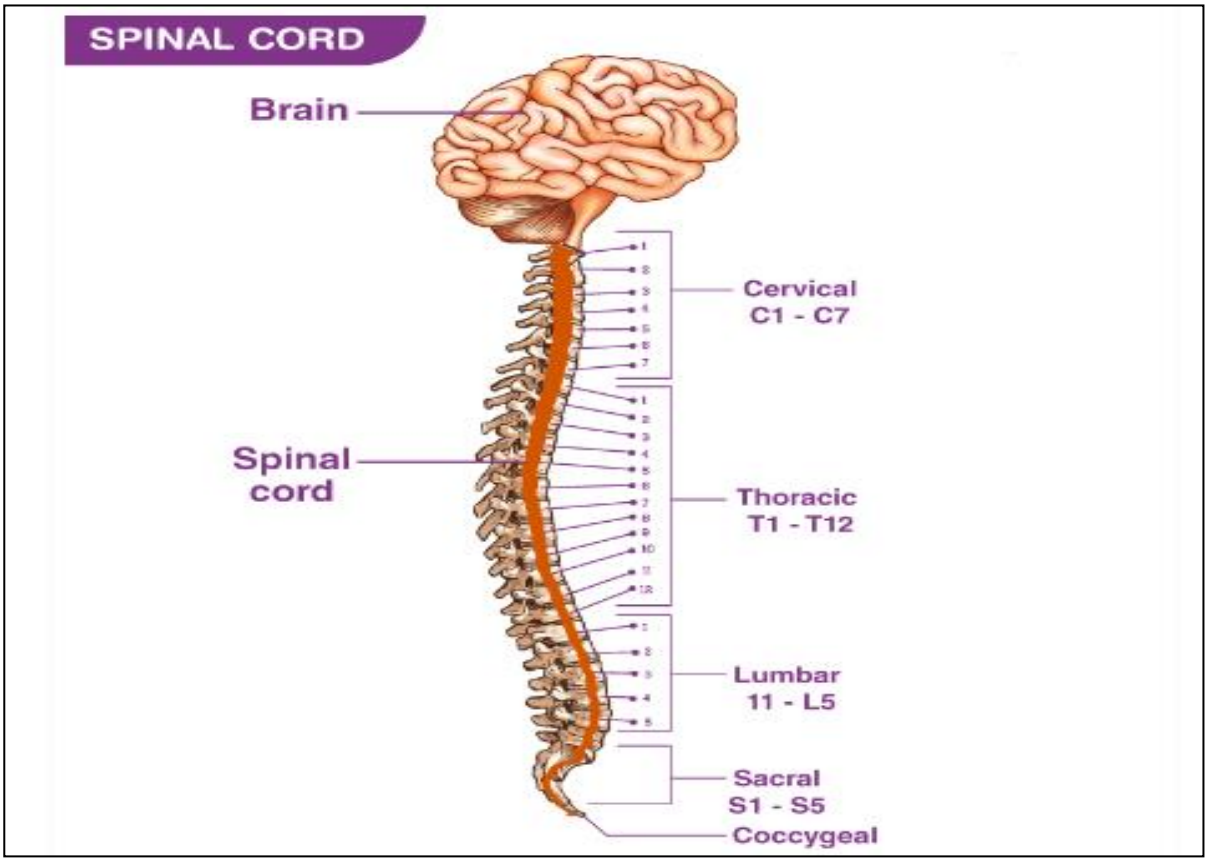
Spinal cord

The spinal cord is a part of the central nervous system. It is a long pipe-like structure arising from the medulla oblongata, part of the brain consisting of a collection of nerve fibres, running through the vertebral column of the backbone. It is segmented with a pair of roots (dorsal and ventral roots) consisting of nerve fibres joining to form the spinal nerves.

It is the elongated and almost cylindrical part extending from brain just below medulla oblongata. It is suspended in the vertebral canal and is surrounded by meninges and cerebrospinal fluid. It extends from the first cervical vertebra to the lower border of first lumbar vertebra. It is approximately 45 cm long and about the thickness of the little finger. Except for the cranial nerves, the spinal cord is the nervous tissue link between the brain and the rest of the body. Motor nerves originating from the brain descends through the spinal cord and supply to various organs and tissues at appropriate levels of the cord. Sensory nerves from different organs and tissues enter and pass upwards to the brain via the spinal cord. Some activities like spinal reflexes are independent of the brain. In such cases motor action is decided and implemented at the level of spinal cord itself. In order to facilitate spinal reflexes, there are extensive neuron connections between sensory and motor neurons at the same or different levels in the spinal cord.



Spinal Cord Anatomy

In adults, the spinal cord is usually 40cm long and 2cm wide. It forms a vital link between the brain and the body.

The spinal cord is divided into five different parts.

- Sacral cord
- Lumbar cord
- Thoracic cord
- Cervical cord
- Coccygeal

Several spinal nerves emerge out of each segment of the spinal cord. There are 8 pairs of cervical, 5 lumbar, 12 thoracic, 5 sacral and 1 coccygeal pair of spinal nerves

It performs the primary processing of information as it carries sensory signals from all parts of the body to the Central Nervous System through afferent fibres.

Nerve tissue consists of the grey and white matter spread across uniformly.

The smooth muscles and the skeletal system carrying nerve fibres liaise different reflexes when ventral horn projects axons which carry motor neurons.

It also helps intercede autonomic control for visceral functions which consist of neurons with descending axons. It is a sensitive site, which is severely affected in case of a traumatic injury.

Understanding the physiology of the spinal cord helps in detecting and determining the various methods to deal with diseases and damage related to the spinal cord.

Structure of Spinal Cord

The Spinal cord runs through a hollow case from the skull enclosed within the vertebral column. Spinal nerves arise from different regions of the vertebral column and are named accordingly, the regions are – Neck, chest, pelvic and abdominal.

Cross-section of spinal cord displays grey matter shaped like a butterfly surrounded by a white matter.

Grey matter consists of the central canal at the center and is filled with a fluid called CSF (Cerebrospinal fluid). It consists of horns (four projections) and forms the core mainly containing neurons and cells of the CNS. There are two dorsal and two ventral horns.

The white matter consists of a collection of axons permitting communication between different layers of CNS. A tract is a collection of axons and carries specialized information. Ascending tracts and descending tracts send and transmit signals from the brain respectively to various nerve cells across the body.

Spinal nerves act as mediators, communicating information to and from the rest of the body and the spinal cord. We have 31 pairs of spinal nerves.

Three layers of meninges surround the spinal cord and spinal nerve roots.

- Dura mater
- Arachnoid mater
- Pia mater

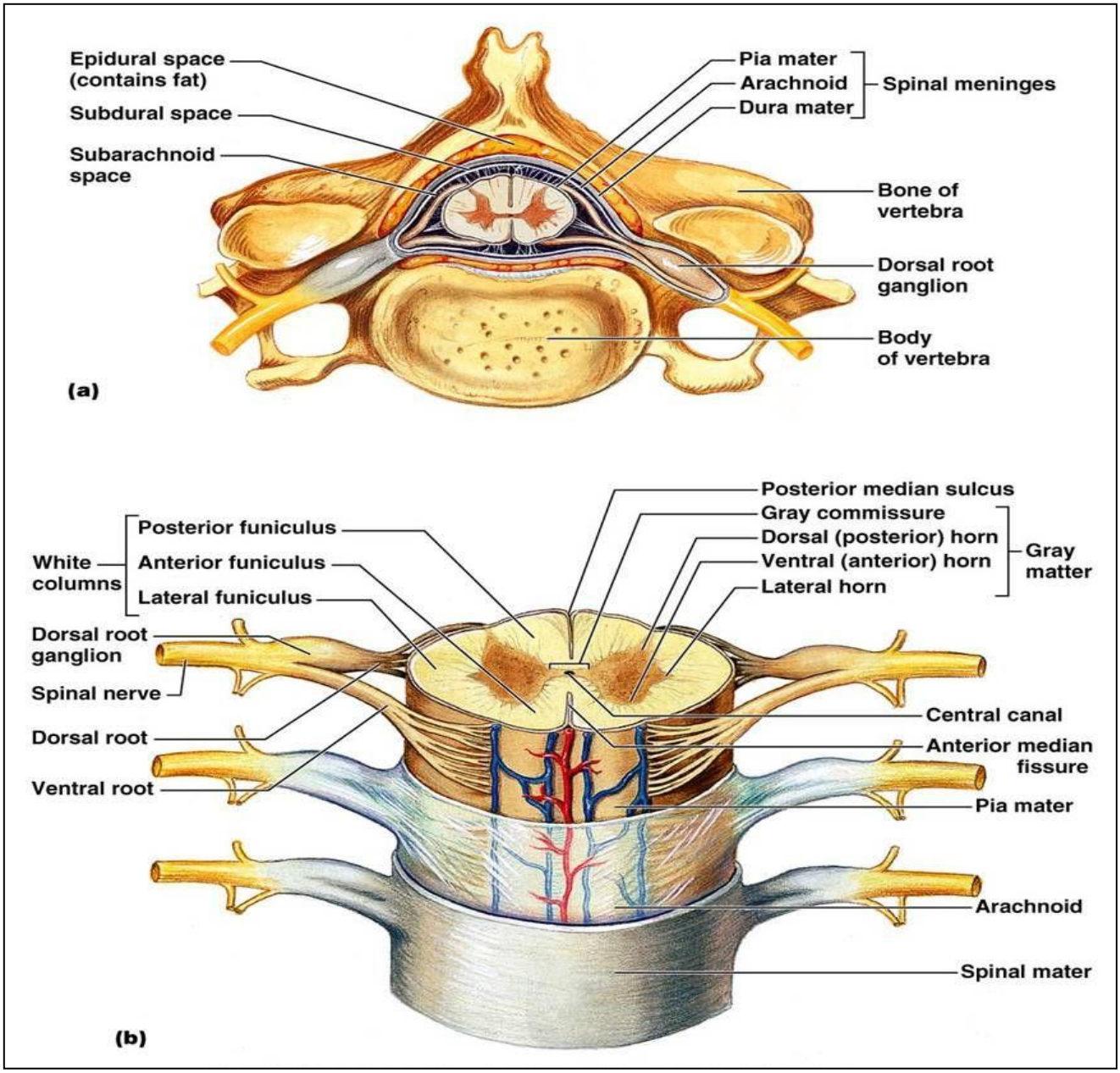


Fig: Gross structure of spinal cord

Dura mater consists of two layers- periosteal and meningeal. Epidural space is present between the two layers.

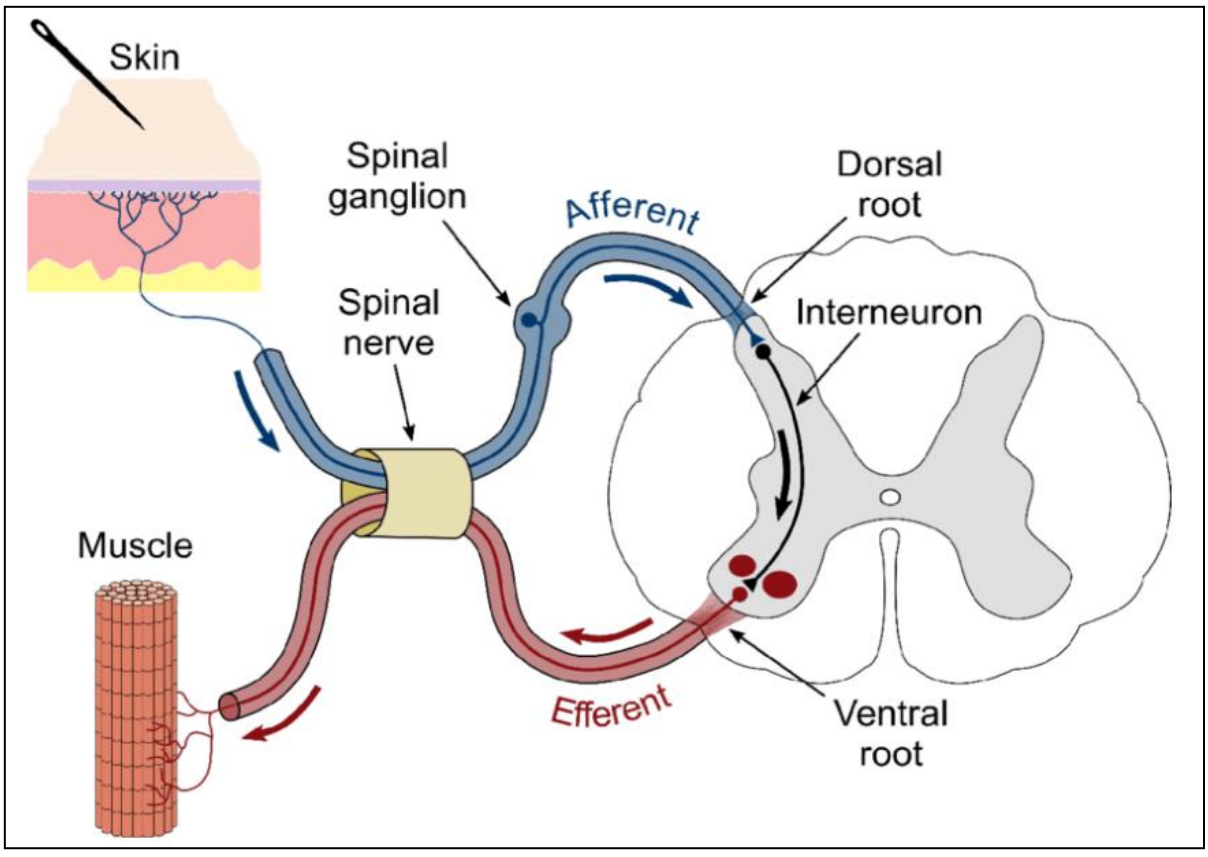
Subarachnoid space lies between the arachnoid mater and pia mater. It is filled with cerebrospinal fluid.

Reflex action:

Upper motor neurons have their cells in the brain at level below the cerebrum that is in the midbrain, brainstem, and cerebellum or spinal cord. They influence muscle activity in relation to the maintenance of posture and balance, the co-ordination of muscle movement and the control of muscle tone. Spinal reflexes consist of three elements:

1. Sensory neurons.
2. Connector neurons.
3. Lower motor neurons.

In the reflex arc only one of the elements exists. A reflex action is an immediate motor response to a sensory stimulus. Many connector and motor neurons may be stimulated by afferent impulses from a small area of skin. These in turn, stimulate many connector and lower motor neurons in the cord which results in



the contraction of many skeletal muscles of different organs. Reflex action takes place very quickly. It is of protective type; they may be inhibited occasionally.

In stretch reflexes only two neurons are involved. The cell of the lower motor neuron is stimulated by the sensory neuron. There is no connector neuron involved in it, e.g., knee jerk.

By tapping the tendon just below the knee when it is bent, the sensory nerve endings in the tendon, and in the thigh, muscles are stretched. This initiates a nerve impulse which passes into the spinal cord to the cell of the lower motor neuron in the anterior column of grey matter on the same side. As a result, the thigh muscles suddenly contract and the foot kicks forward.