HUMAN ANATOMY AND PHYSIOLOGY 1(BP101T)

UNIT: 4 PERIPHERAL NERVOUS SYSTEM

CLASS: 4

TOPIC: ORIGIN AND FUNCTIONS OF SPINAL AND CRANIAL NERVES

CRANIAL NERVES

There are 12 pairs of cranial nerves originating from the nuclei in the inferior surface of the brain. Some are sensory, some are motor and some are mixed. Their names and numbers are as follows:

OLFACTORY NERVES: It is sensory type of nerve with afferent fiber. It originates in the olfactory lobe i.e. root of nose and terminates in the temporal lobe of cerebrum. It is associated with sense of smell.

OPTIC NERVES: It is sensory type of nerve with afferent fibre. It originates in the retina of eyes and terminates in the vision area of occipital lobe of cerebrum. It is related with sense of vision.

OCULOMOTOR NERVES: It is mixed type of nerve with efferent as well as afferent fiber, but primarily it is motor originates in the mid-brain.

Efferent (motor) portion: It innervates skeletal muscles it moves the eyeball and innervates smooth muscles that constrict pupil and lens shape for far and near vision.

Afferent (sensory) portion: It is related to movement of eyeball and regulating the size of pupil.

TROCHLEAR NERVES: It is mixed type of nerve but primarily motor and originates in the midbrain. It is the smallest of the 12 cranial nerves. The motor

portion is related to movement of eyeball and sensory vision carries information from muscles of eye to midbrain.

TRIGEMINAL NERVES: It is a mixed type of nerve fibre. It is the largest among all the cranial nerves. The motor portion originates from pons and innervates the muscles of mastication (skeletal chewing muscles).The sensory portion consists of three branches:

Ophthalmic nerve: It contains axons from skin of eyelids, eyeball, lacrimal glands, nasal cavity, nose, and forehead.

Maxillary nerve: It contains axons from the mucosa of nose, parts of pharynx, upper teeth, upper lip, and lower eyelid.

Mandibular nerve: It contains axon from tongue, lower teeth, skin over mandible, cheek.

Motor function: Chewing. Sensory function: Conveys impulses for touch, pain and temperature.

ABDUCENS NERVE: A mixed type of nerve, but 1° motor that originates in the pons. The motor portion innervates the skeletal muscles that move eyeball. The sensory portion transmits information from proprioceptors in muscles. It is related to the movement of eyeball and muscles sense (proprioception).

Motor function: Movement of eyeball

Sensory function: Proprioception(Proprioception, otherwise known as kinesthesia, is your body's ability to sense movement, action, and location.)

FACIAL NERVE: It is a mixed type of nerve. The motor fibre originates from pons and innervates skeletal muscle of face, nose, palate, lacrimal and salivary gland. The sensory fibre transmits information from taste buds in the tongue and mouth.

Motor function: Facial expression.

Sensory function: Proprioception and taste.

VESTIBULOCOCHLEAR NERVE: It is sensory type of nerve transmits information from receptor in ear. It consists of two nerves:

Vestibular nerve: It arises from semicircular canals of the inner ear and conveys impulses to the cerebellum. They are associated with maintenance of posture and balance.

Cochlear nerve: It originates in the spiral organ in the inner ear and conveys impulses to the hearing area of cerebral cortex. Cochlear nerve is responsible for hearing.

GLOSSOPHARYNGEAL NERVE: It is a mixed type of nerve. The motor fibres originate from medulla oblongata and innervate the tongue andpharynx. The sensory fibres originate from salivary glands and terminate in medulla oblongata.

Motor function: Elevates the pharynx during swallowing and speech.

Sensory function: Taste sensations, touch, pain and temperature sensations, monitoring of blood pressure.

VAGUS NERVE: It is a motor type of nerve. The motor fibres originates in the medulla and innervates the smooth muscles of pharynx, larynx, trachea, heart oesophagus, stomach, intestine, pancreas, gall bladder, bile duct, spleen, kidney,

ureter, blood vessels in thoracic and abdominal cavities. The sensory fibres convey impulses from same organs to brain.

Motor function: Swallowing, coughing and voice production.

Sensory function: Taste, touch, pain and temperature sensations, monitoring of blood pressure.

ACCESSORY NERVE: It is mixed type of nerve, primarily motor nerve. It originates from medulla oblongata and in the spinal cord. It originates from medulla oblongata and innervates the voluntary muscles of pharynx and skeletal muscle of neck.

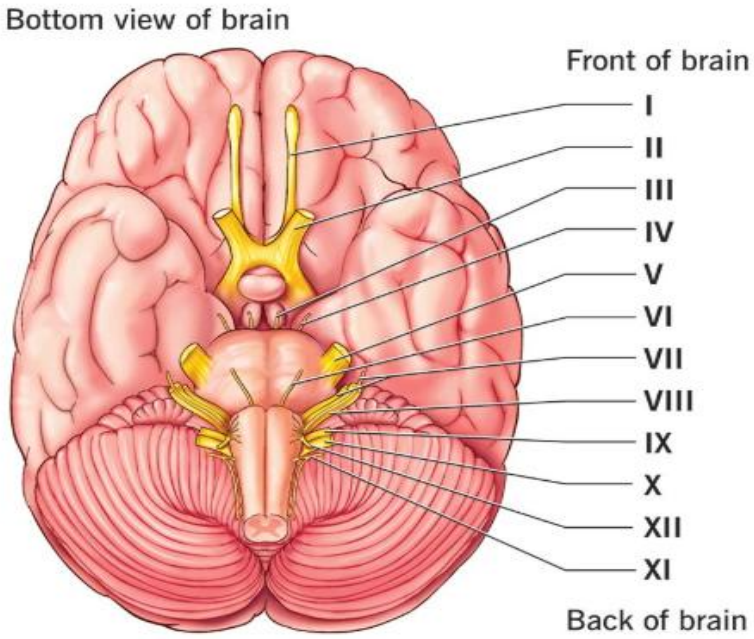
Motor function: Neck controls swallowing movements and movement of head and shoulders.

HYPOGLOSSAL NERVE: It is mixed type of nerve but primarily motor nerve. It originates in the medulla and supplies to the muscle of tongue. The sensory function gives sensation to tongue.

Sensory function: Proprioception(body's ability to sense movement, action, and location)

Motor function: Movement of tongue during speech and swallowing.

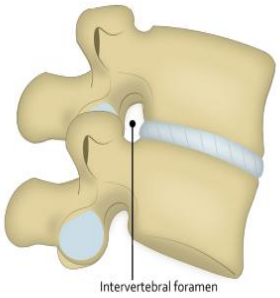
Cranial nerves



I	Olfactory nerve	VII	Facial nerve
II	Optic nerve	VIII	Vestibulocochlear nerve
III	Oculomotor nerve	IX	Glosspharyngeal nerve
IV	Trochlear nerve	X	Vagus nerve
V	Trigeminal nerve	XI	Accessory nerve
VI	Abducens nerve	XII	Hypoglossal nerve

SPINAL NERVES

There are 31 pairs of spinal nerves that leave the vertebral canal by passing through the intervertebral foramina formed by adjacent vertebrae. They are named and grouped according to the vertebrae with which they are associated.



- 8 Cervical
- 12 Thoracic
- 5 Lumbar
- 5 Sacral
- 1 Coccygeal

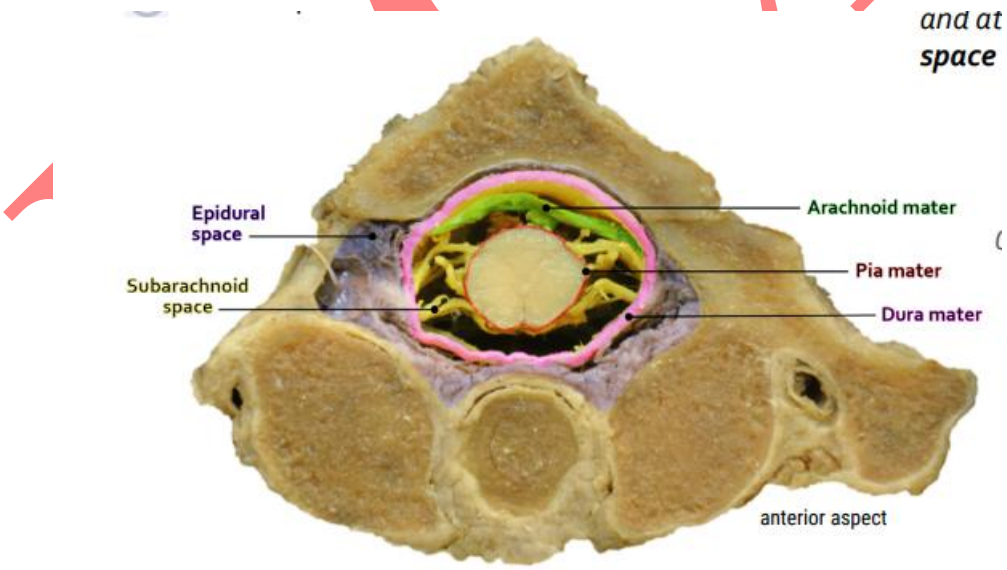
A typical spinal nerve has two connections to the cord: Posterior root and anterior root.

ANTERIOR NERVE ROOT: It consists of ***motor nerve fibres*** which are the axons of the nerve cells in the ***anterior column of grey matter*** in the spinal cord and, in the thoracic and lumbar regions, sympathetic nerve fibres which are the axons of cells in the lateral columns of grey matter.

POSTERIOR NERVE ROOT:

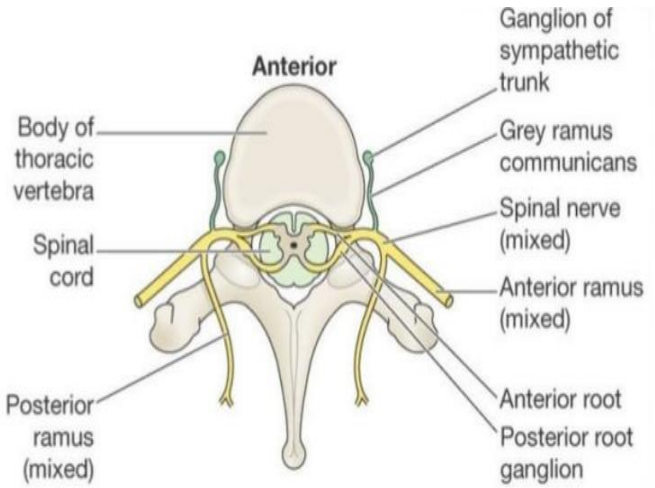
- It consists of ***sensory nerve fibres.*** Just outside the spinal cord there is a spinal ganglion (posterior root ganglion), consisting of a ***little cluster of cell bodies.*** *Sensory nerve fibres pass through these ganglia before entering the spinal cord.*

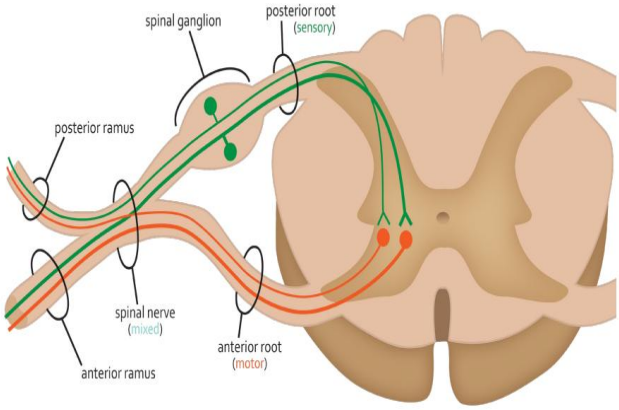
- The posterior and anterior roots unite to form a spinal nerve at the ***intervertebral foramen.*** Because the posterior root contains sensory axons and the anterior root contains motor axons, as spinal nerve is classified as a ***mixed nerve.***
- The posterior root contains a posterior root ganglion in which cell bodies of *sensory neurons are located*. After leaving the spinal cord the nerve roots have a covering of dura and arachnoid matters.
- These terminate before the two roots join to form the mixed spinal nerve. The nerve roots do not have the pia matter covering. After emerging from the intervertebral foramen each spinal nerve divides into a ramus communicans, a posterior ramus and an anterior ramus.
- The rami communicans are part of preganglionic sympathetic neurons of the autonomic nervous system.

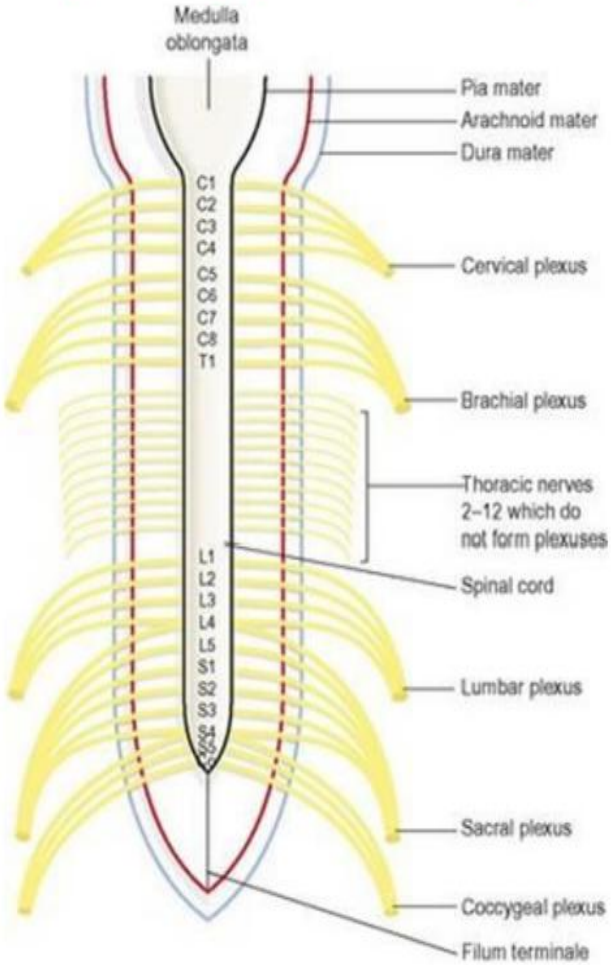


- The posterior rami pass backwards and divide into medial and lateral branches to supply skin and muscles of relatively small areas of the posterior aspect of the head, neck and trunk.

- The anterior rami supply the anterior and lateral aspects of the neck, trunk and the upper and lower limbs.
- In the cervical, lumbar and sacral regions the anterior rami unite near their origins to form plexuses (large masses of nerves), where nerve fibres are regrouped and rearranged before proceeding to supply skin, bones, muscles and joints of a particular area.
- There are five large plexuses of mixed nerves formed on each side of vertebral column.
- They are as follows;
- **CERVICAL PLEXUSES:** It is formed by the anterior rami of the first four cervical nerves.
- **BRACHIAL PLEXUSES:** The anterior rami of the lower four cervical nerves and a large part of the first thoracic nerve form the brachial plexus.
- **LUMBAR PLEXUSES:** It is formed by the anterior rami of the first three and part of the fourth lumbar nerves.
- **SACRAL PLEXUSES:** It is formed by the anterior rami of the lumbosacral trunk and the first, second and third sacral nerves.
- **COCCYGEAL PLEXUSES**: The coccygeal plexus is a very small plexus formed by part of the fourth and fifth sacral and the coccygeal nerves.


Anterior
Body of thoracic vertebra
Spinal cord
Posterior ramus (mixed)
Ganglion of sympathetic trunk
Grey ramus communicans
Spinal nerve (mixed)
Anterior ramus (mixed)
Anterior root
Posterior root ganglion


spinal ganglion
posterior root (sensory)
posterior ramus
spinal nerve (mixed)
anterior root (motor)
anterior ramus


Medulla oblongata
Pia mater
Arachnoid mater
Dura mater
C1
C2
C3
C4
C5
C6
C7
C8
T1
Cervical plexus
Brachial plexus
Thoracic nerves 2–12 which do not form plexuses
L1
L2
L3
L4
L5
S1
S2
S3
Spinal cord
Lumbar plexus
Sacral plexus
Coccygeal plexus
Filum terminale