

# PERIPHERAL NERVOUS SYSTEM

# NERVOUS SYSTEM

The nervous system detects and responds to changes inside and outside the body.

It is quicker than other control system in the body, namely endocrine system.

Nervous system is divided into two parts:

1. Central nervous system
2. Peripheral nervous system.

# CLASSIFICATION OF NERVOUS SYSTEM

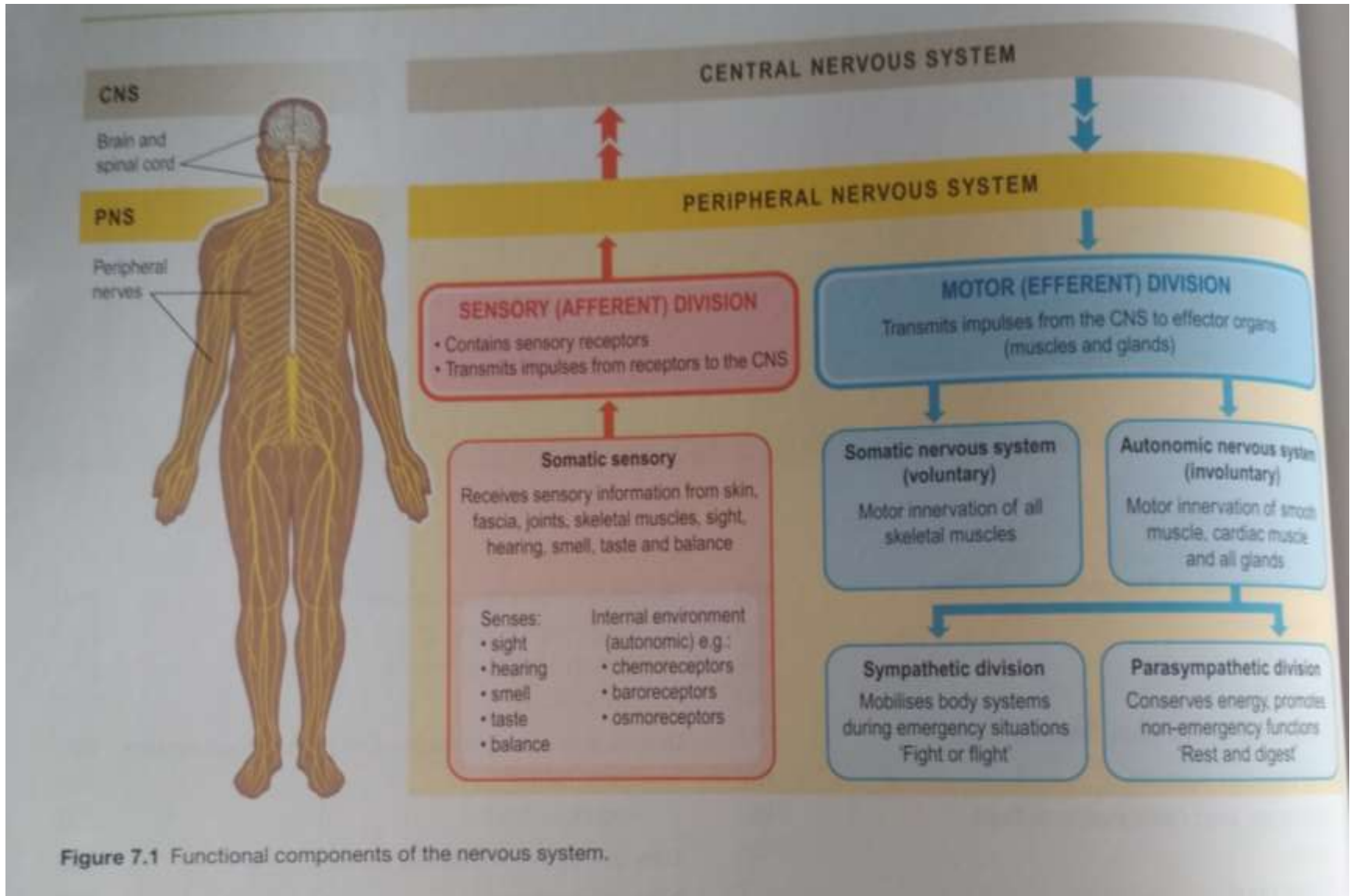
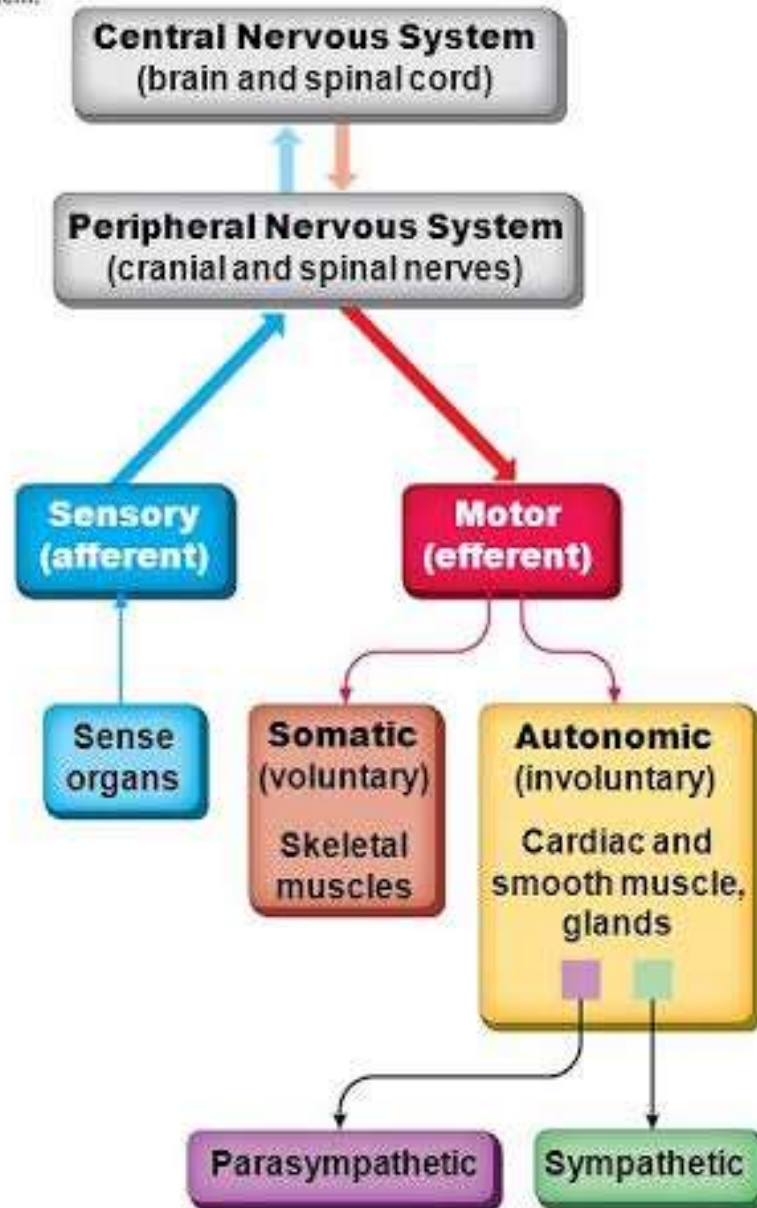


Figure 7.1 Functional components of the nervous system.

Figure 7.2 Organization of the nervous system.

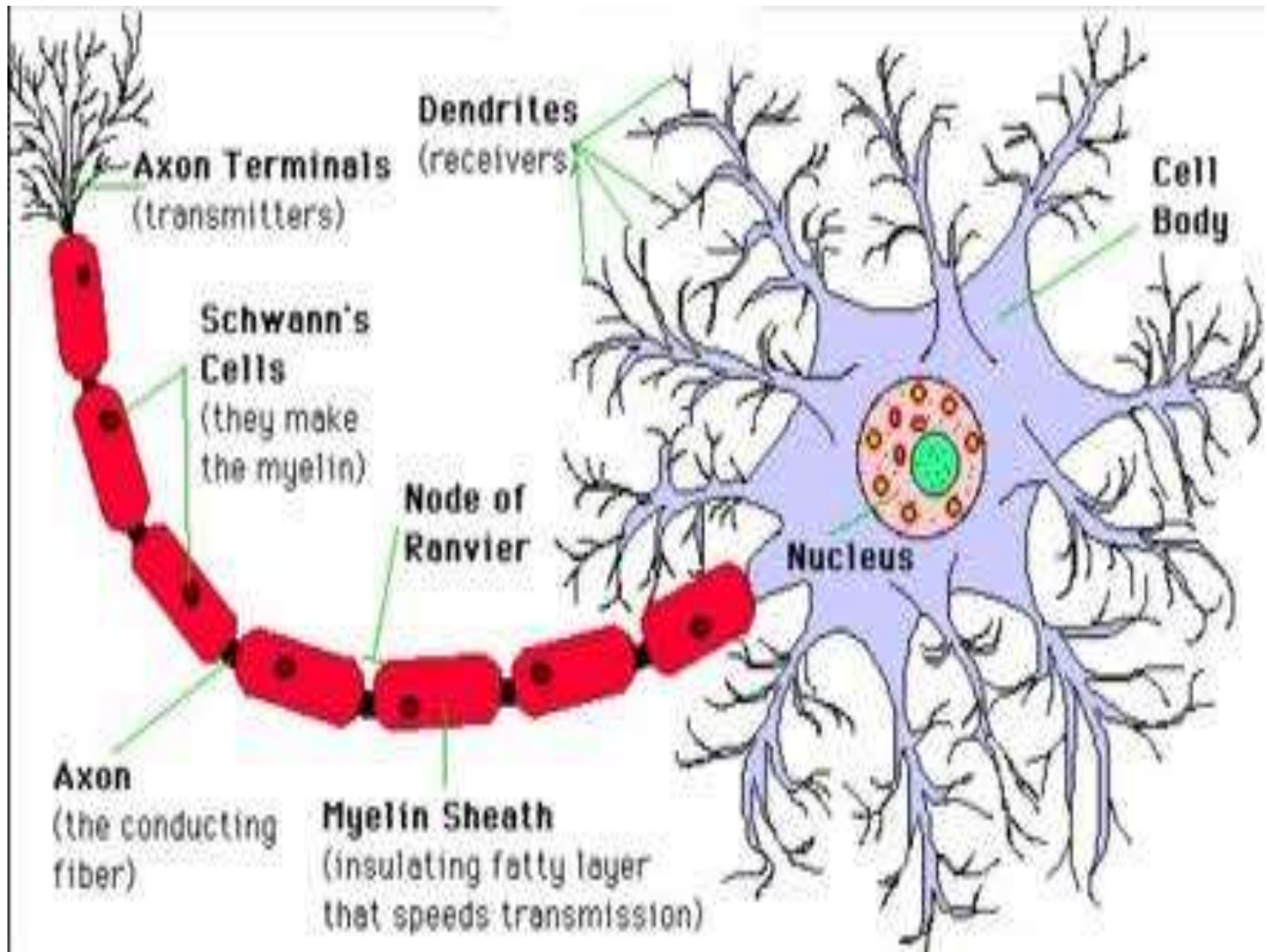


# NEURONS

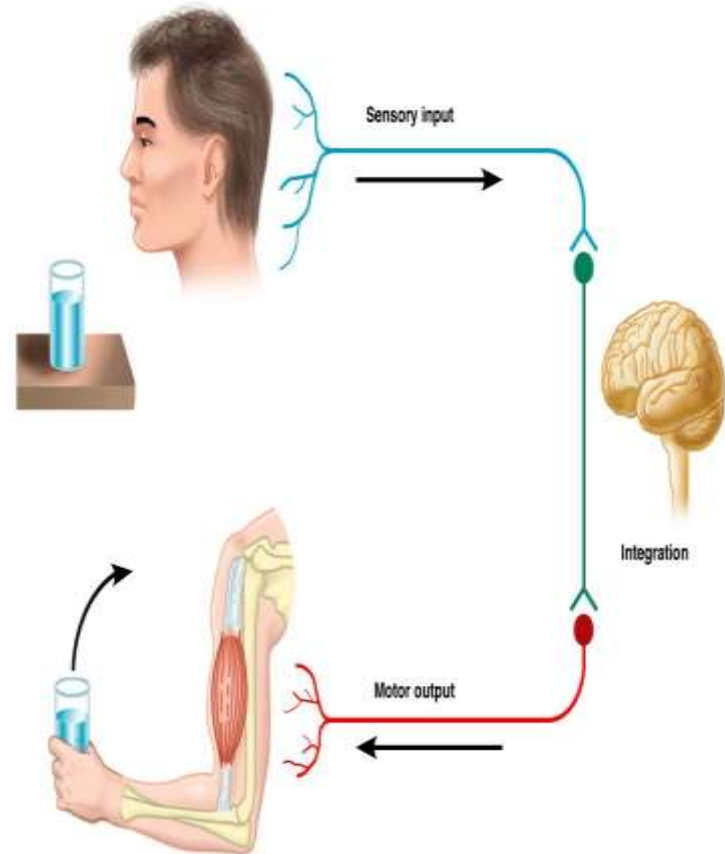
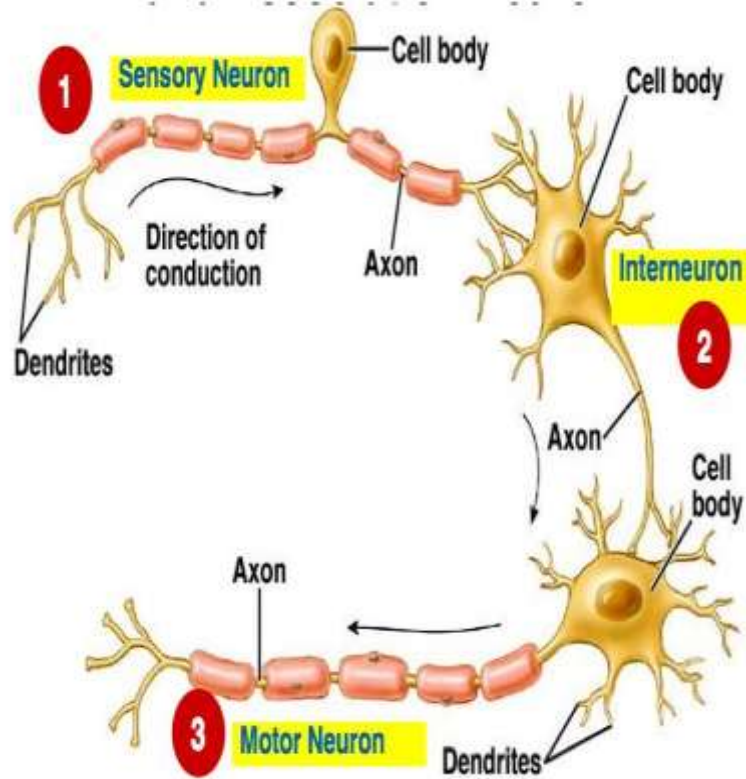
It is the basic unit cell of nervous system. These act as a information conducting units of the nervous system

Neuron components:

- Dendrites
- Soma/cell body
- Axons
- Pre synaptic terminals



# Three Types of Neurons



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# NEUROTRANSMITTER

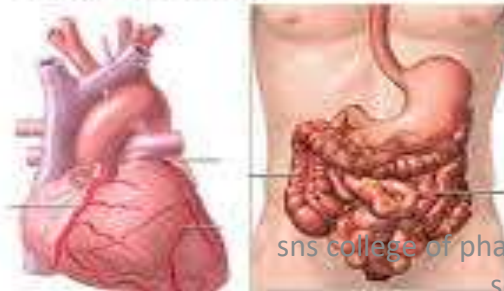
Neurotransmitter also called as chemical transmitter or chemical messenger is a group of chemical agents released by neurons to stimulate neighbouring neurons or muscle or gland cells, thus allowing impulses to be passed from one cell to the next throughout the nervous system.



# AUTONOMIC NERVOUS SYSTEM(ANS)

ANS is the part of peripheral nervous system that regulates involuntary functions of the body eg:heart beat,digestive functions of the intestine,control of respiration and secretion of glands.ANS is the portion of nervous system that controls visceral functions of the body

**What are involuntary muscles?**



Cardiac and Smooth muscle is involuntary muscle because we do NOT have the ability to control it.

**Examples:**

Heart Beat  
Digesting Food

# MECHANISM OF ANS

The *efferent (motor) nerves* of the autonomic nervous system arise from nerve cells in the brain and emerge at various levels between the midbrain and the sacral region of the spinal cord. Many of them travel within the same nerve sheath as the peripheral nerves of the central nervous system to reach the organs which they innervate.

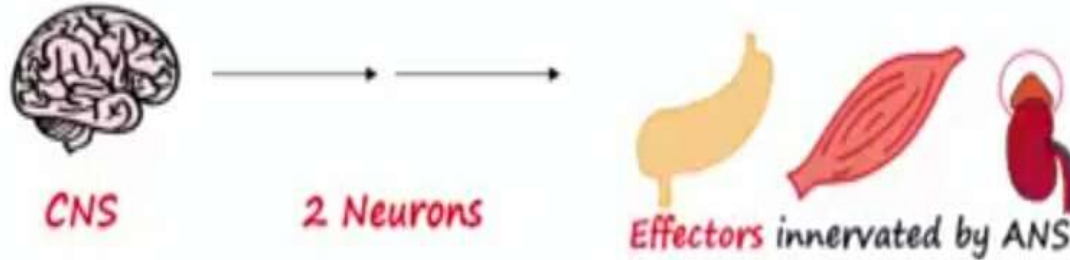
The autonomic nervous system is divided into two divisions:

- *sympathetic* (thoracolumbar outflow)
- *parasympathetic* (craniosacral outflow).

The two divisions have both structural and functional differences.

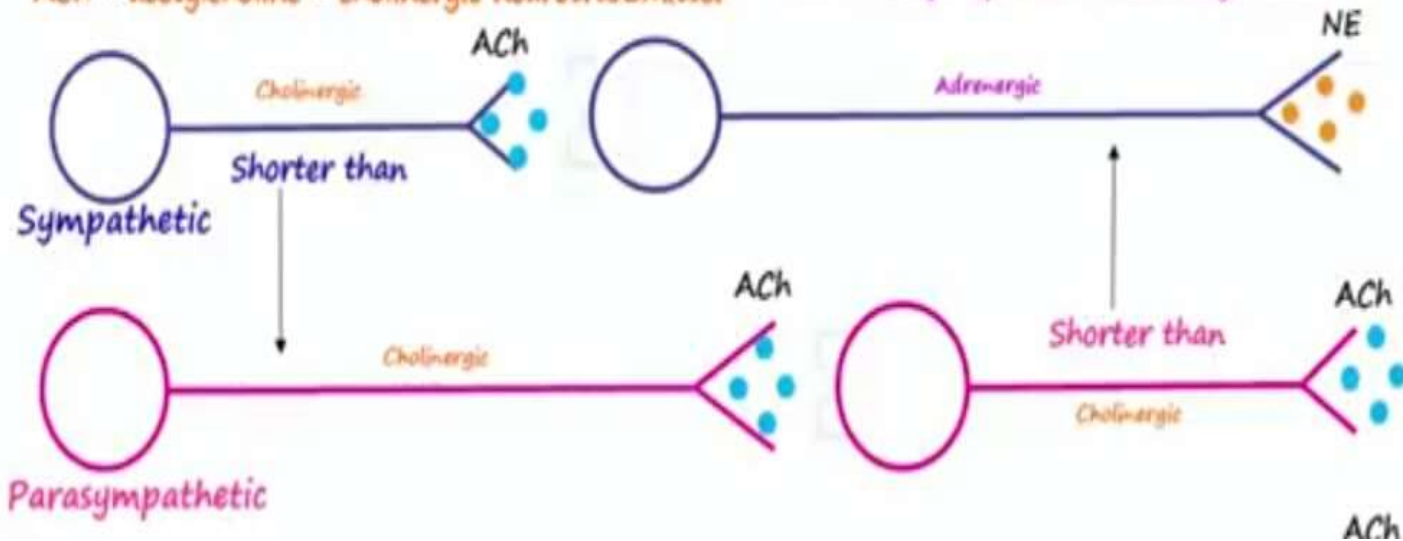
- Each division has two efferent neurones in its peripheral pathways between the central nervous system and effector organs. These are:
  - the preganglionic neurone
  - the postganglionic neurone.
- The cell body of the preganglionic neurone is in the brain or spinal cord. Its axon terminals synapse with the cell body of the postganglionic neurone in an *autonomic ganglion* outside the central nervous system.
- The postganglionic neurone conducts impulses to the effector organ

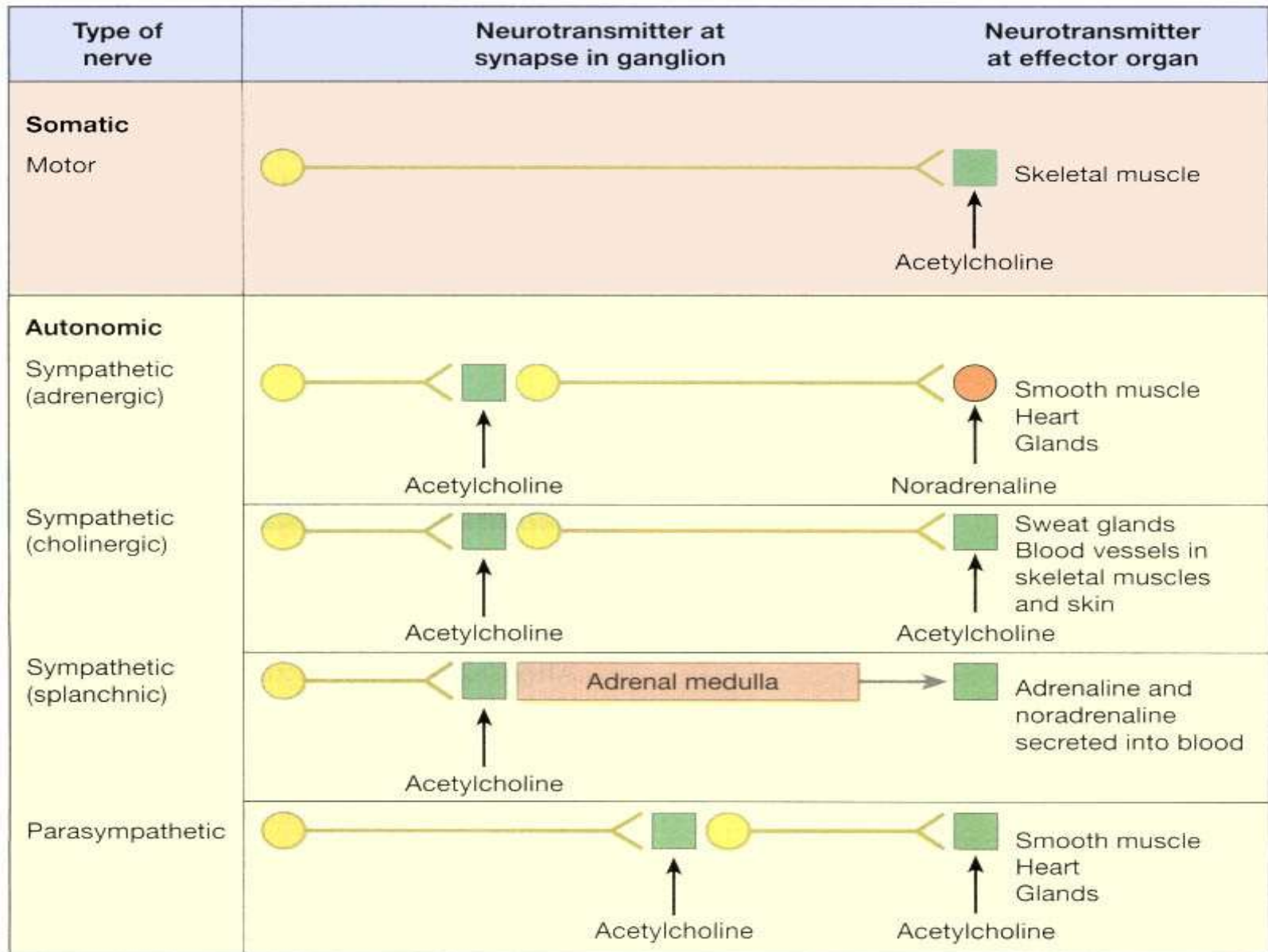
# DIVISIONS OF ANS



First neuron = Preganglionic  
ACh = acetylcholine = cholinergic neurotransmitter

Second neuron = Postganglionic  
NE = norepinephrine = adrenergic neurons





# AUTONOMIC NERVOUS SYSTEM

- **SYMPATHETIC**

– *Fight or Flight*



- **PARASYMPATHETIC**

– *Rest and Digest*

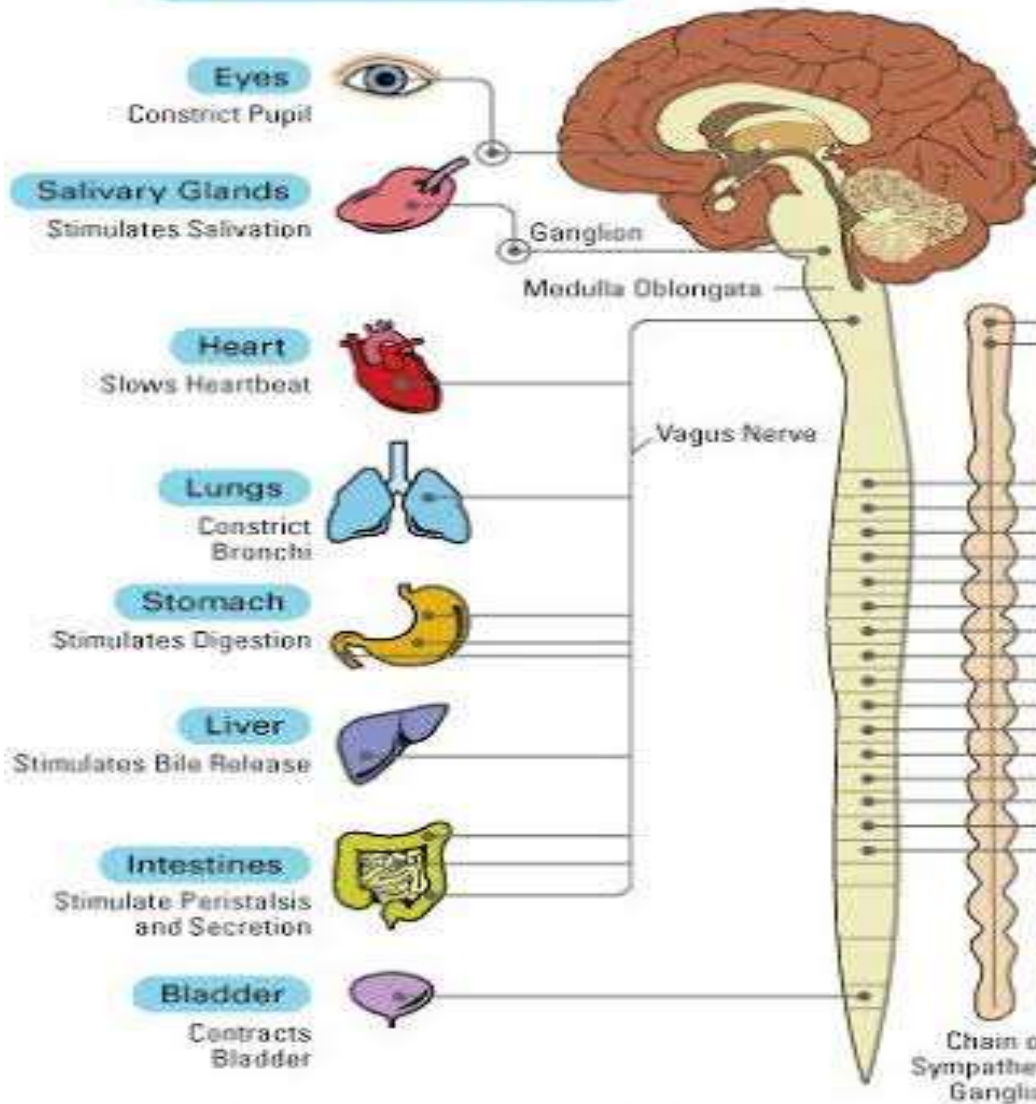


## SYMPATHETIC AND PARASYMPATHETIC SYSTEM

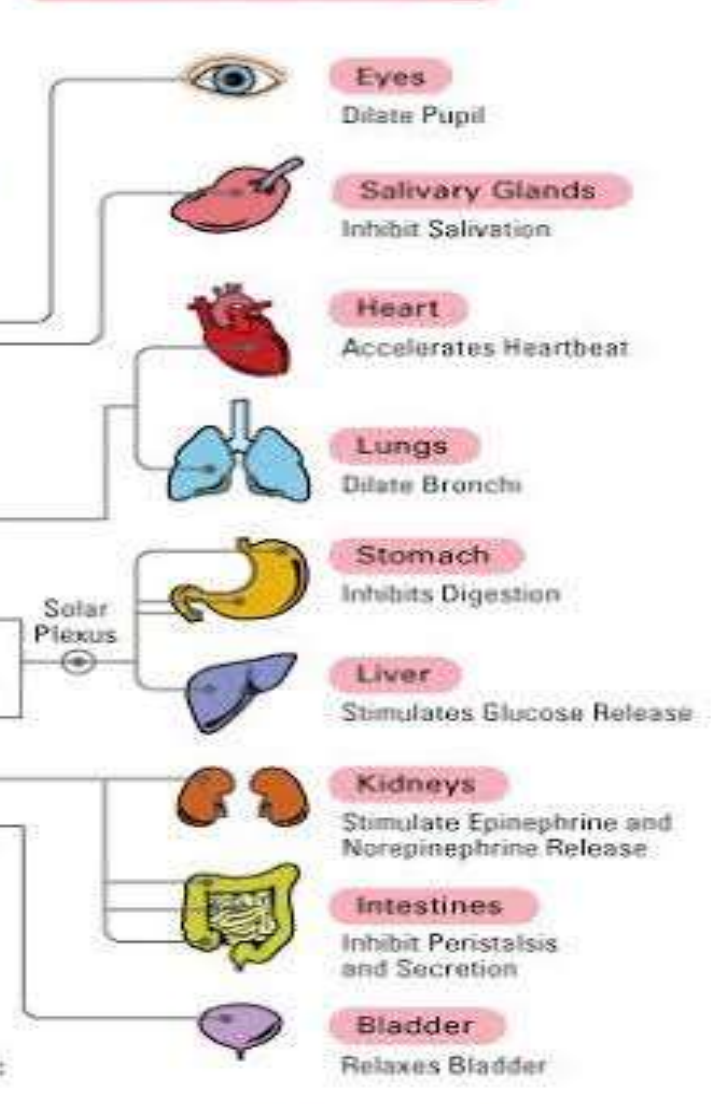
ORGAN AND FUNCTION	SYMPATHETIC SYSTEM	PARASYMPATHETIC SYSTEM
Origin	Thoraco -lumbar	Cranio -sacral
Distribution	Wider in nature	Limited
Neurotransmitter	Major-nor adrenaline Minor-acetylcholine	Acetylcholine
Heart rate	Increased heart rate and increased force of contraction	Decreased heart rate and decreased force of contraction
Bronchi (Lungs)	bronchodialation	bronchoconstriction
Eye	Pupil dialation	Pupil constriction
GIT	Increased motility	Decreased motility
Urinary bladder	Bladder relaxes	constriction
Blood vessels	Constriction of blood vessels	dialation
Sweat gland	Increased sweat secretion	No effect
Lacrimal and salivary gland	Decresed secretion tear and saliva	Increased secretion of tear and saliva



## Parasympathetic



## Sympathetic

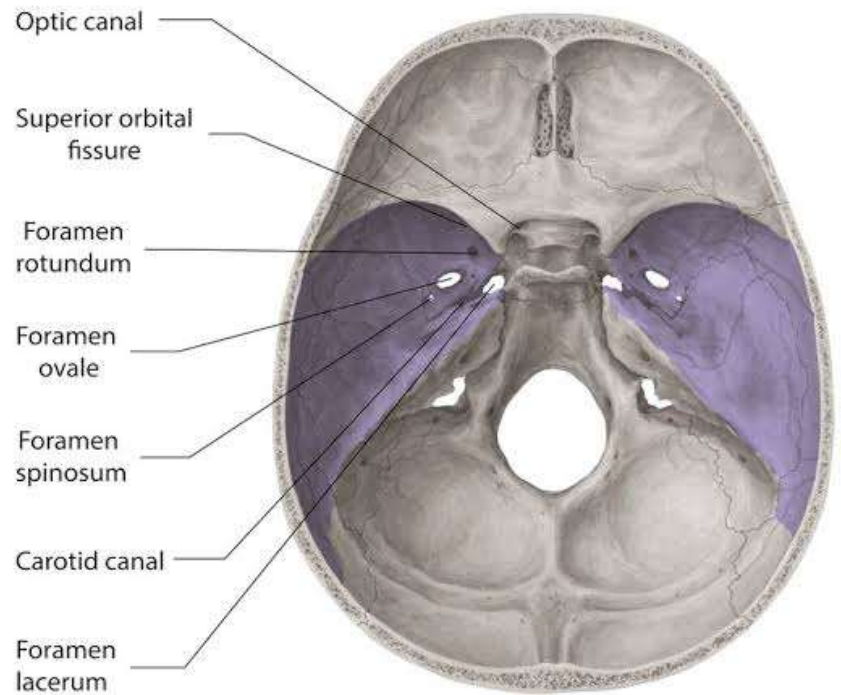
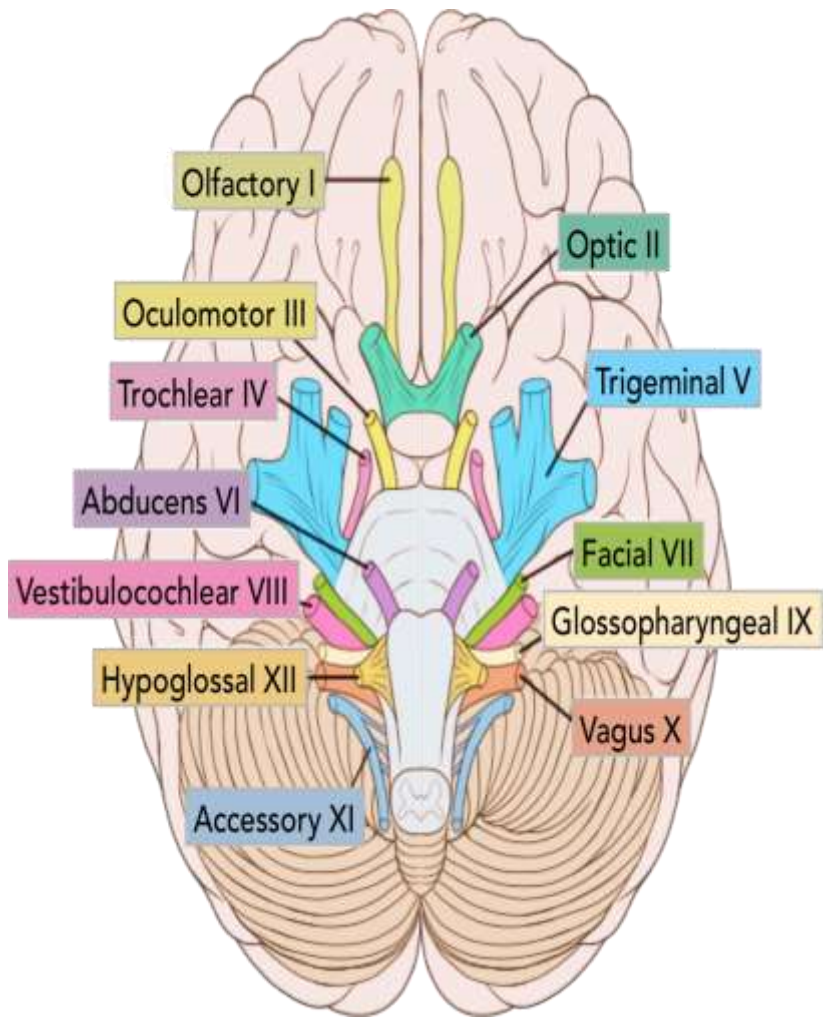


**Schema Explaining How Parasympathetic and Sympathetic Nervous Systems Regulate Functioning Organs**

# ORIGIN AND FUNCTION OF CRANIAL AND SPINAL NERVES

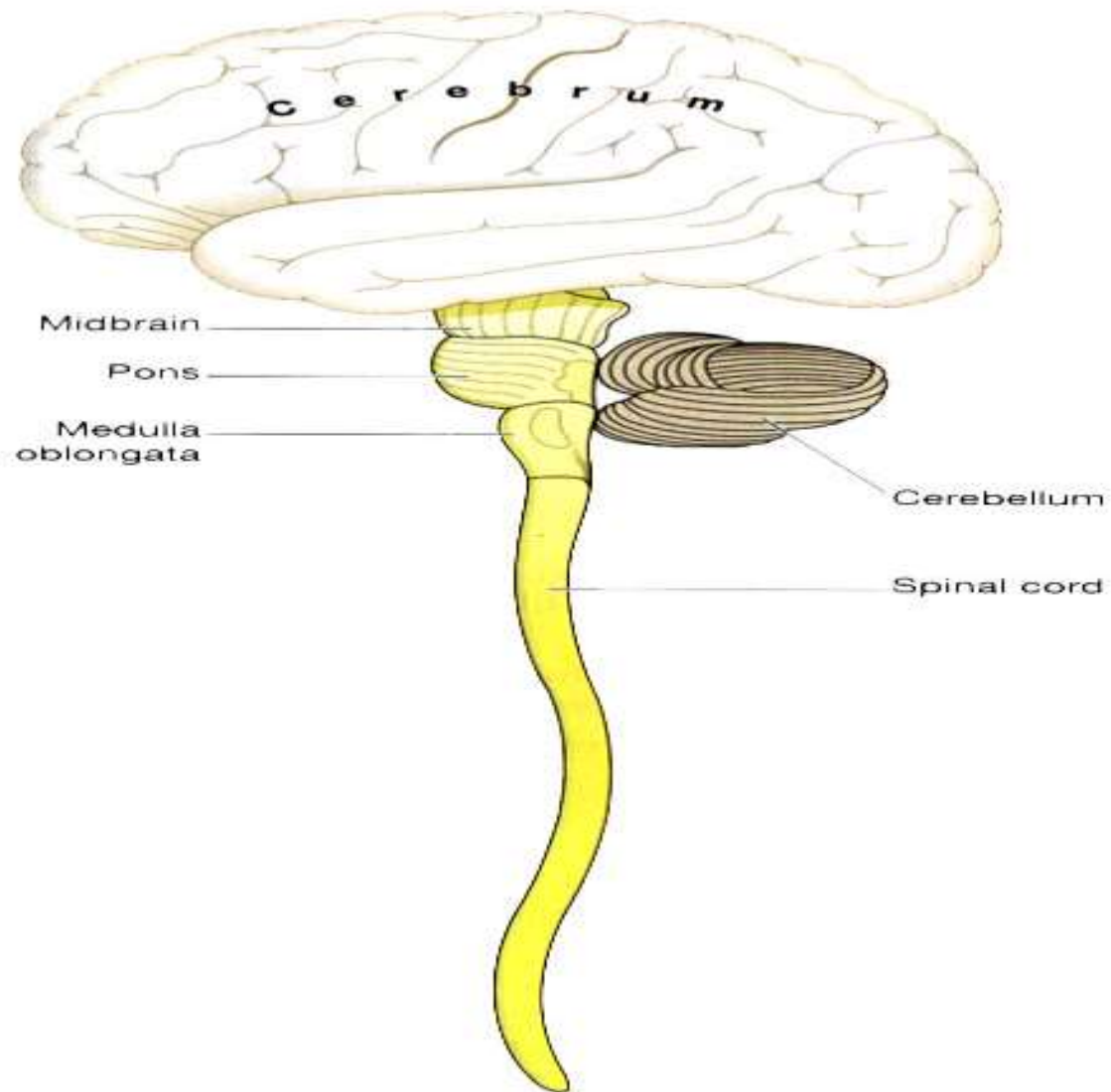
Cranial nerve:

- Cranial nerves attached to the brains, they perform bundles of processes of neurons that innervate muscles or glands or carry impulses from sensory areas. they are called cranial nerves because they emerge through foramina or fissure in the cranium or skull and are covered by sleeves of meninges .
- There are 12 pairs of cranial nerves they pass through the foramina in the skull and the main supply to the peripheral tissues of the head.
- ✓ III,IV – Originate from mid brain
- ✓ Remaining cranial nerves-originate from brain stem

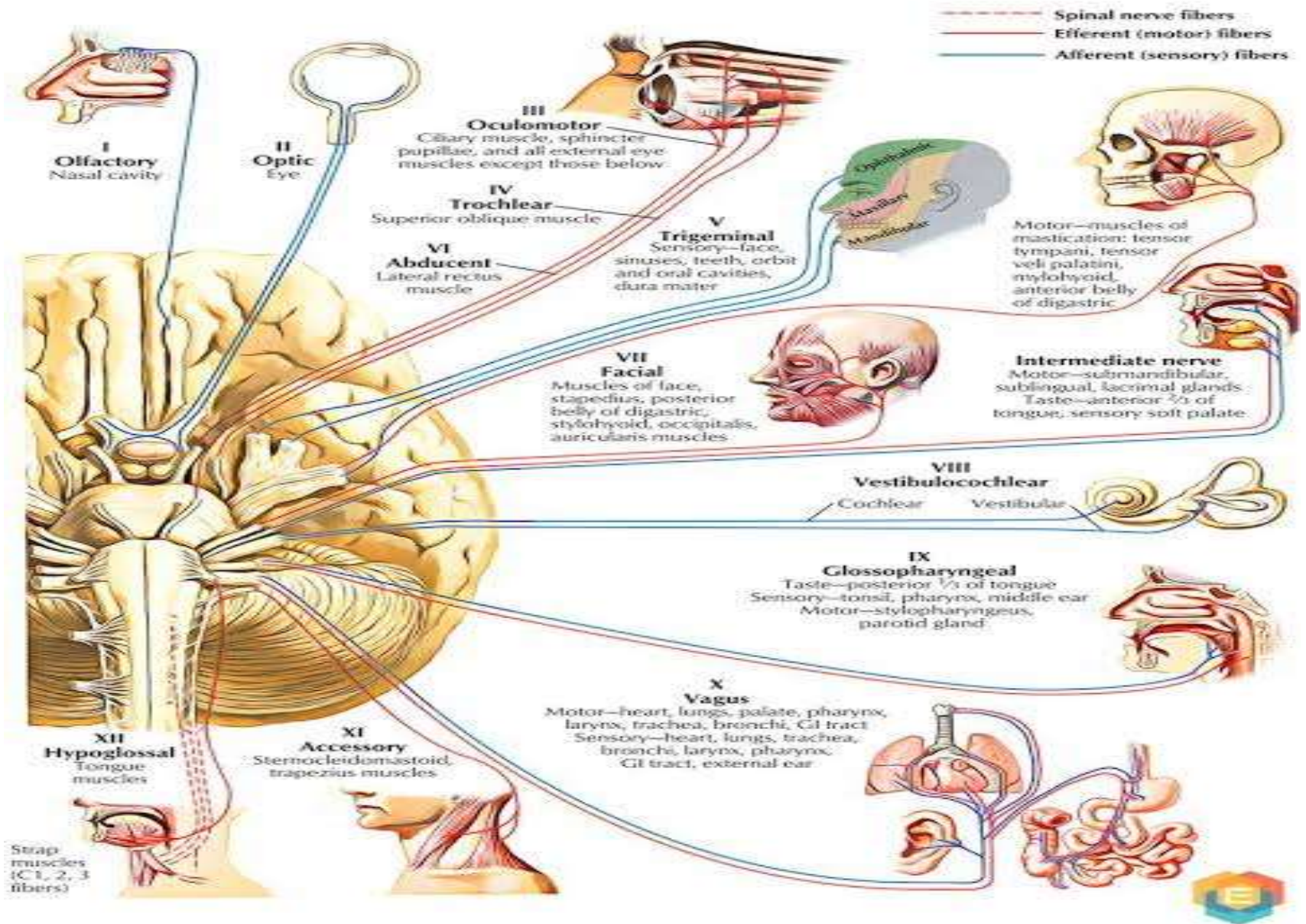


# CRANIAL NERVES

NO	CRANIAL NERVES	NO	CRANIAL NERVES
I	Olfactory nerve	VII	Facial nerve
II	Optic nerve	VIII	Vestibulocochlear nerve
III	Oculomotor nerve	IX	Glossopharyngeal nerve
IV	Trochlear nerve	X	Vagus nerve
V	Trigeminal nerve	XI	Accessory nerve
VI	Abducent	XII	Hypoglossal nerve







# **I. OLFACTORY NERVE**

Nature: sensory

Function: sense of smell

Origin: olfactory receptor nerve cells

Innervation: olfactory lobe of brain

# **II. OPTIC NERVE**

Nature: sensory

Function: vision

Origin: back of the eye ball

Innervation: Diencephalon



### **III. OCCULOMOTOR NERVE**

Nature: motor

Function: (i) movement of eye ball

(ii) Accommodates the eye

Origin: anterior surface of midbrain

Innervation: 4 eye muscles of ciliary body, iris and tear gland

### **IV. TROCHLEAR NERVE**

Nature: motor

Function: rotation of eyeball

Origin: posterior surface of mid brain

Innervation: superior oblique muscles of eyeball

# **V. TRIGEMINAL NERVE**

V1-Ophthalmic nerve

V2-Maxillary nerve

V3-Mandibular nerve

## **V1-OPHTHALMIC NERVE**

Nature: sensory

Function: a) cornea

b) Skin of forehead

c) Scalp

d) Eyelids and nose

Origin: anterior aspect of pons

Innervation: skin receptors of nose, forehead and iris

## **V2. MAXILLARY NERVE**

Nature: sensory

Function: movement of cheek

Origin: anterior aspect of the pons

Innervation: skin receptors of cheek, lower eyelid, upper lip, teeth and gums of upper jaw

## **V3. MANDIBULAR NERVE**

Nature: motor

Function: movement of lower jaw

Origin: mandibular

Innervation: skin receptor of lower lip, teeth and gums of lower jaw

# **VI.ABDUCENT**

Nature: motor

Function: rotation of eye ball

Origin: medulla oblangata

Innervation: external rectus eye muscle

## **VII. FACIAL BONE**

Nature:mixed

Function: tasting of food, facial expression, saliva secretion, movement of neck

Origin: anterior lateral side of medulla oblongata

Innervation: sensory fibres- taste bud on posterior 2/3 part of tongue

Motor fibres-muscles of face, salivary gland, neck

## **VIII. VESTIBULAR COCHLEAR NERVE**

Nature: sensory

Function: hearing and equilibrium

Origin: medulla oblongata

Innervation: anterior lateral side of medulla oblongata

## **IX. GLOSSOPHARYNGEAL NERVE**

Nature: mixed

Function: tasting of food, salivation and swallowing

Origin: lateral side of medulla oblongata

Innervation: sensory fibre - to taste bud on anterior 1/3 part of tongue

Motor fibre - muscles of pharynx, salivary glands

## **X.VAGUS**

Nature: mixed

Function: visceral functions like sensation and movement

Origin: lateral side of medulla oblongata

Innervation: sensory fibres-to receptor present in wall of visceral organ

Motor fibres-muscles in the walls of visceral organs like alimentary canal, heart, trachea, lungs, kidney and genital tract

## **XI.ACCESSORY NERVES**

Nature: mixed

Function: movement of larynx, pharynx, neck and shoulder

Origin: lateral side of medulla oblongata

Innervation: muscles of larynx, pharynx, neck and shoulder



## **XII. HYPOGLOSSAL NERVE**

Nature: motor

Function: movement of tongue

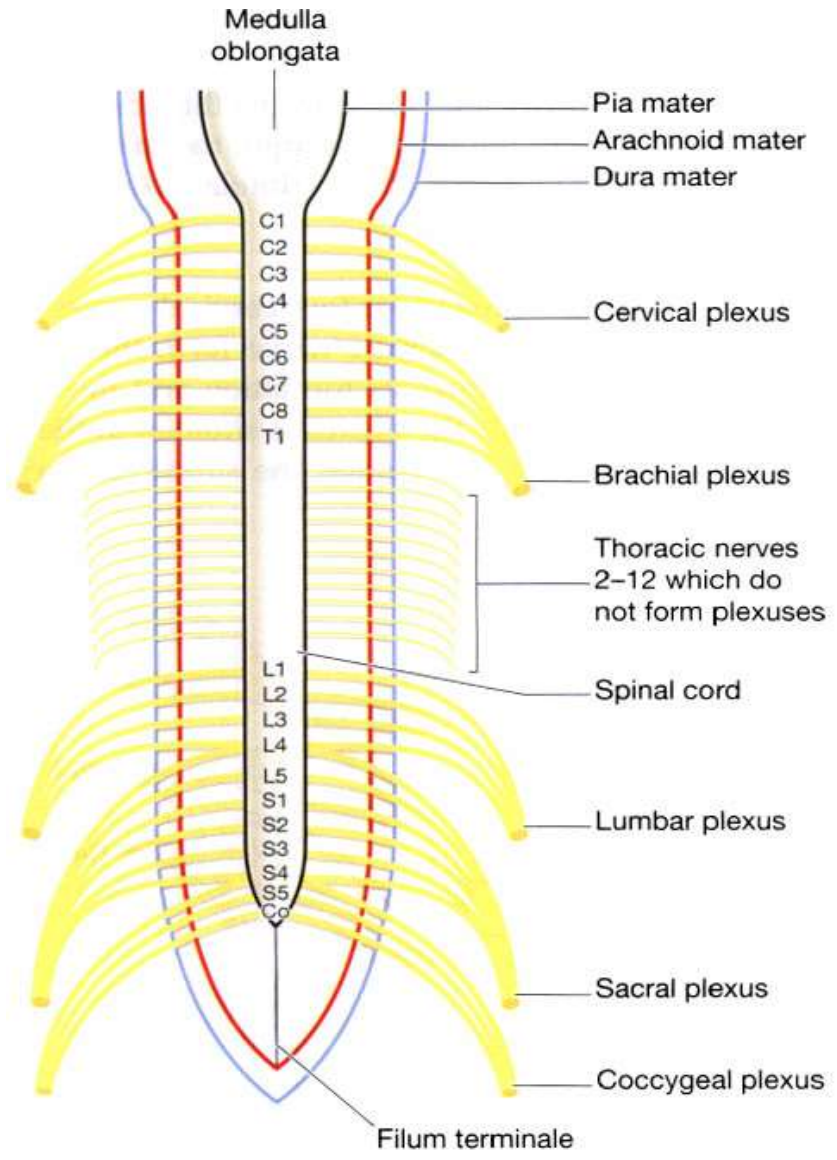
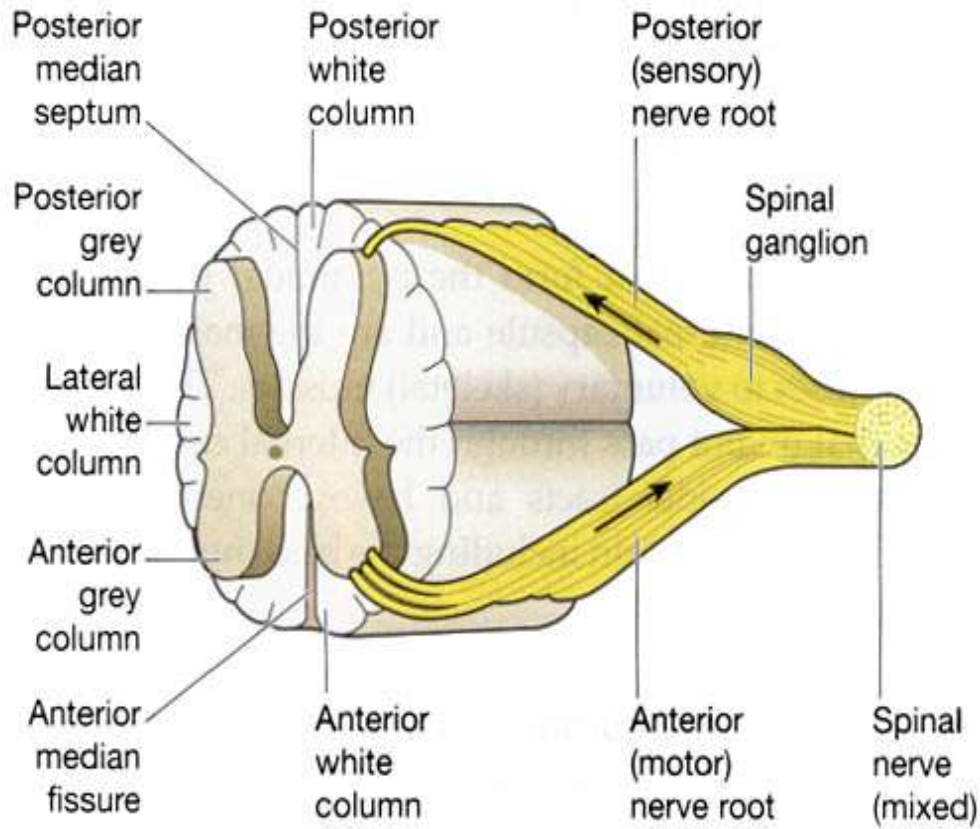
Origin: medulla oblongata

Innervation: hypoglossal muscle in below tongue

# SPINAL NERVES

## Spinal cord:

- The spinal cord is the elongated, almost cylindrical part of the central nervous system, which is suspended in the vertebral canal surrounded by the meninges and cerebrospinal Fluid
- Except for the cranial nerves, the spinal cord is the nervous tissue link between the brain and the rest of the body
- The spinal cord is incompletely divided into two equal parts, anteriorly by a short, shallow *median fissure* and posteriorly by a deep narrow septum, the *posterior median septum*.
- A cross-section of the spinal cord shows that it is composed of grey matter in the centre surrounded by white Matter
- The nature of spinal nerves is mixed(sensor and motor function).



# Spinal nerves

There are *31 pairs of spinal nerves* that leave the vertebral canal by passing through the intervertebral foramina formed by adjacent vertebrae.

- Cervical nerve=C1-C8 (innervates neck region)
- Thoracic nerve=T1-T12(innervates the thoracic region)
- Lumbar nerve=L1-L5(Innervates upper part of abdomen)
- Sacral nerve=S1-S5 (innervates lower part of abdomen)
- Coccygeal nerve= 1 represent tail nerve

## Plexuses

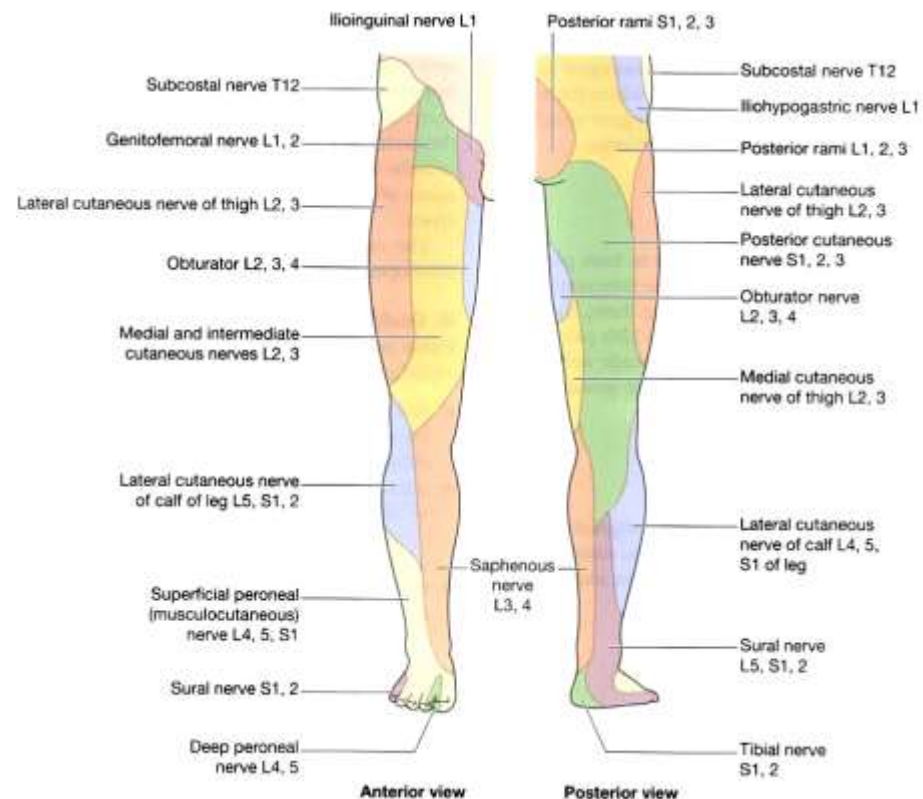
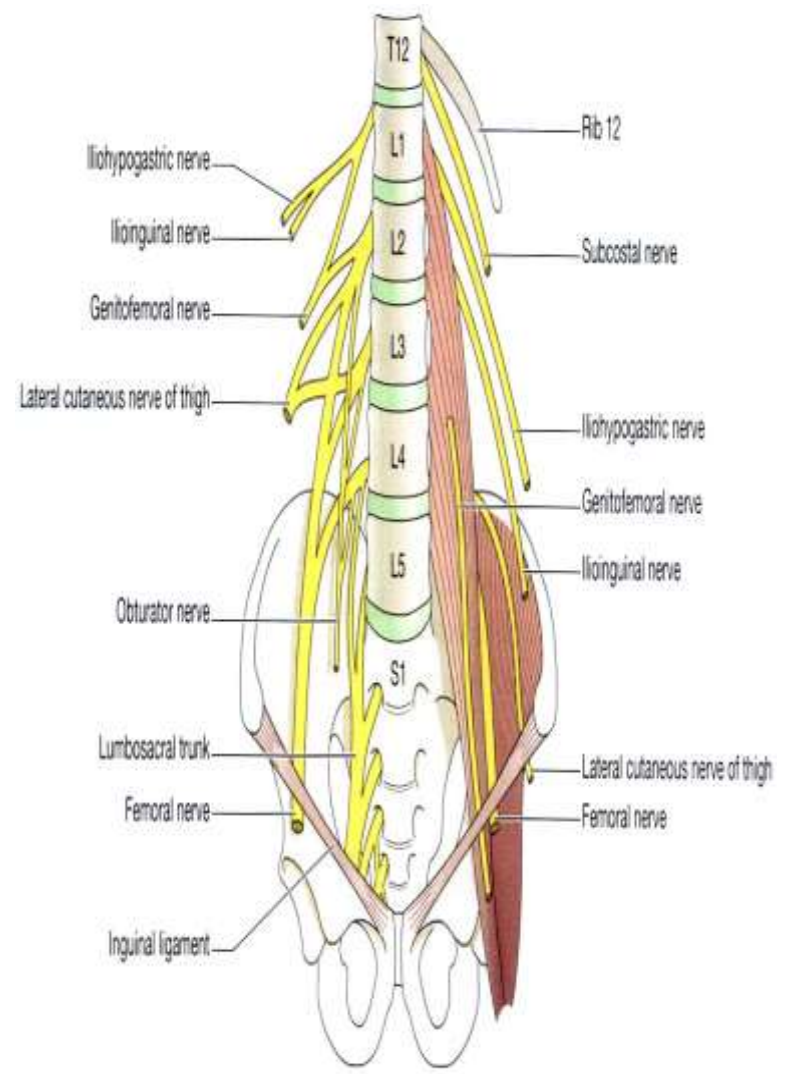
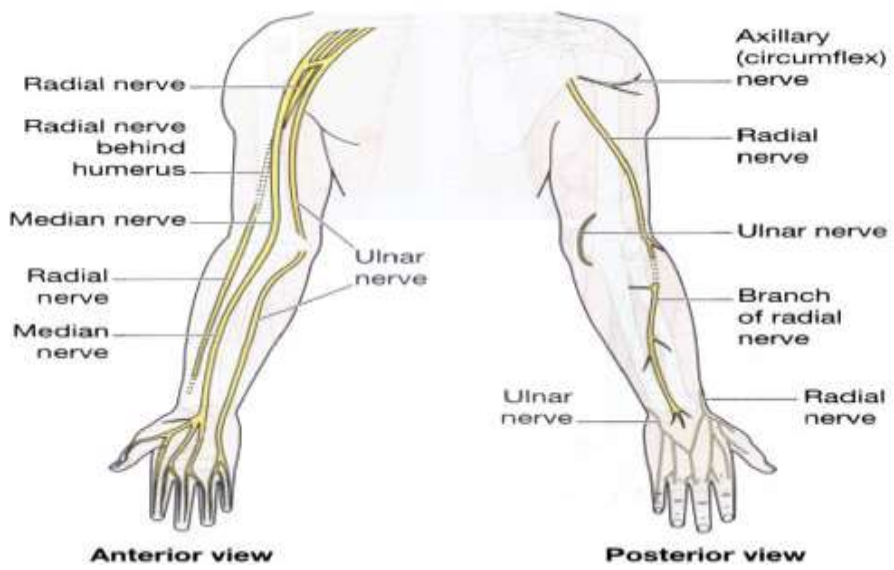
- In the cervical, lumbar and sacral regions the anterior rami unite near their origins to form large masses of nerves or plexuses

## SPINAL NERVES

PLEXUSES	ORIGIN	IMPORTANT NERVES	BODY AND SERVED
cervical	C1-C5	Phrenic nerve	Diaphragm and muscles of shoulder and neck
Brachial	C5-C8 T1	axillary nerve(C5,C6)	Deltoid muscles,shoulder joint and overlying skin
		Radial nerves(C6,C7,C8,T1)	Muscles of wrist and finger joints
		Musculocutaneous nerve (C5,C6,C7)	Muscles of upper arm and the skin of the forearm
		median nerve: C5, 6, 7, 8, T1	small muscles and the skin of the front of the thumb, the first two fingers and the lateral half of the third finger.
		ulnar nerve: C7, 8, T1	arm of the hand and the skin of the whole of the little finger and the medial half of the third finger

<b>Lumbar plexus</b>	L1,L2	Genitoformal	lower abdomen, upper and medial aspects of the thigh and the inguinal region.
	L2,L3	lateral cutaneous nerve	lateral aspect of the thigh
	L2,L3,L4	Femoral nerve	supply the skin and the muscles of the front of the thigh.
	L2,L3,L4	obturator nerve	adductor muscles of the thigh and skin of the medial aspect of the thigh
	L4,L5	lumbosacral trunk	pelvis

Sacral plexus	L4,L5 S1-S3	Sciatic nerve	buttock then descends through the posterior aspect of the thigh
		tibial nerve	muscles and skin of the sole of the foot and toes
		Fibular nerve	Lateral aspects of leg and foot
Coccygeal plexus	S4,S5,C1	Coccygeal plexus	supply the skin in the area of the coccyx and anal area



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## **Functions of spinal nerve:**

### Sensory function:

sensory information are carried by the posterior or dorsal root of the spinal nerves from the areas innervated by them back to the brain

### Motor function:

Motor impulses are carried from the brain to the muscles by anterior root to the spinal nerves thus responding to the stimulus

### Automatic function:

A proper functioning of internal organs is regulated by spinal nerves