

# Nervous system

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# Learning objectives

- Introduction
- Subdivision of nervous system
- Classification of nervous tissue
- Structure of neuron
- Classification of neurons with examples
- Synapse and types
- Classification of neuroglia
- Nerve ganglion
- Nucleus
- Blood –brain barrier
- Spinal segment and course of typical spinal nerve

- Formation of nerve plexus
- Reflex arc components
- Process of myelination
- Structure of peripheral nerve
- And its functional components
- ANS autonomic nervous system

# Introduction

- Master system integrates and controls the activity of all other system.
  - **Functions**
    1. Reception of stimuli
    2. Integration
    3. Initiation and execution
    4. Assimilation of experience
- |                         |
|-------------------------|
| <b>1</b> sensitivity    |
| <b>2</b> conductivity   |
| <b>3</b> responsiveness |

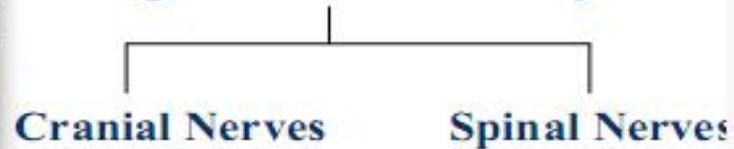
# Subdivision of nervous system

## ANATOMY

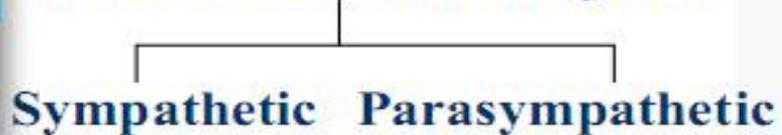
### Central Nervous System



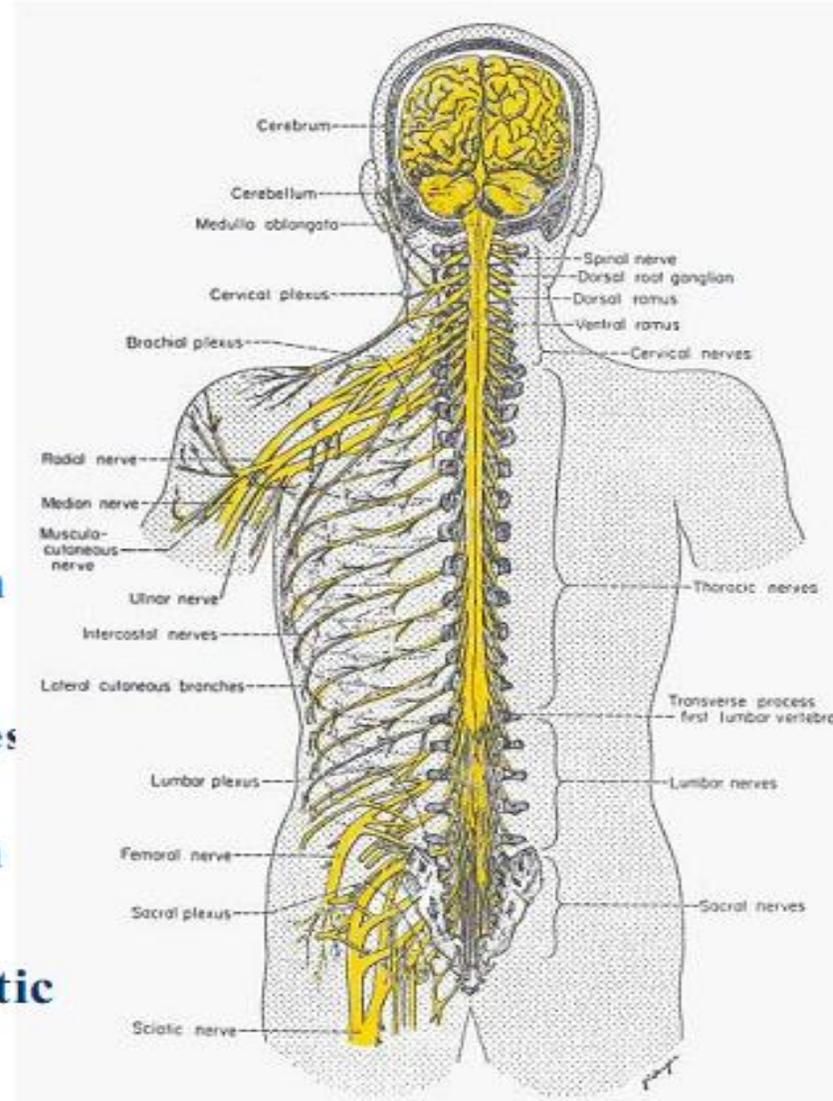
### Peripheral Nervous System



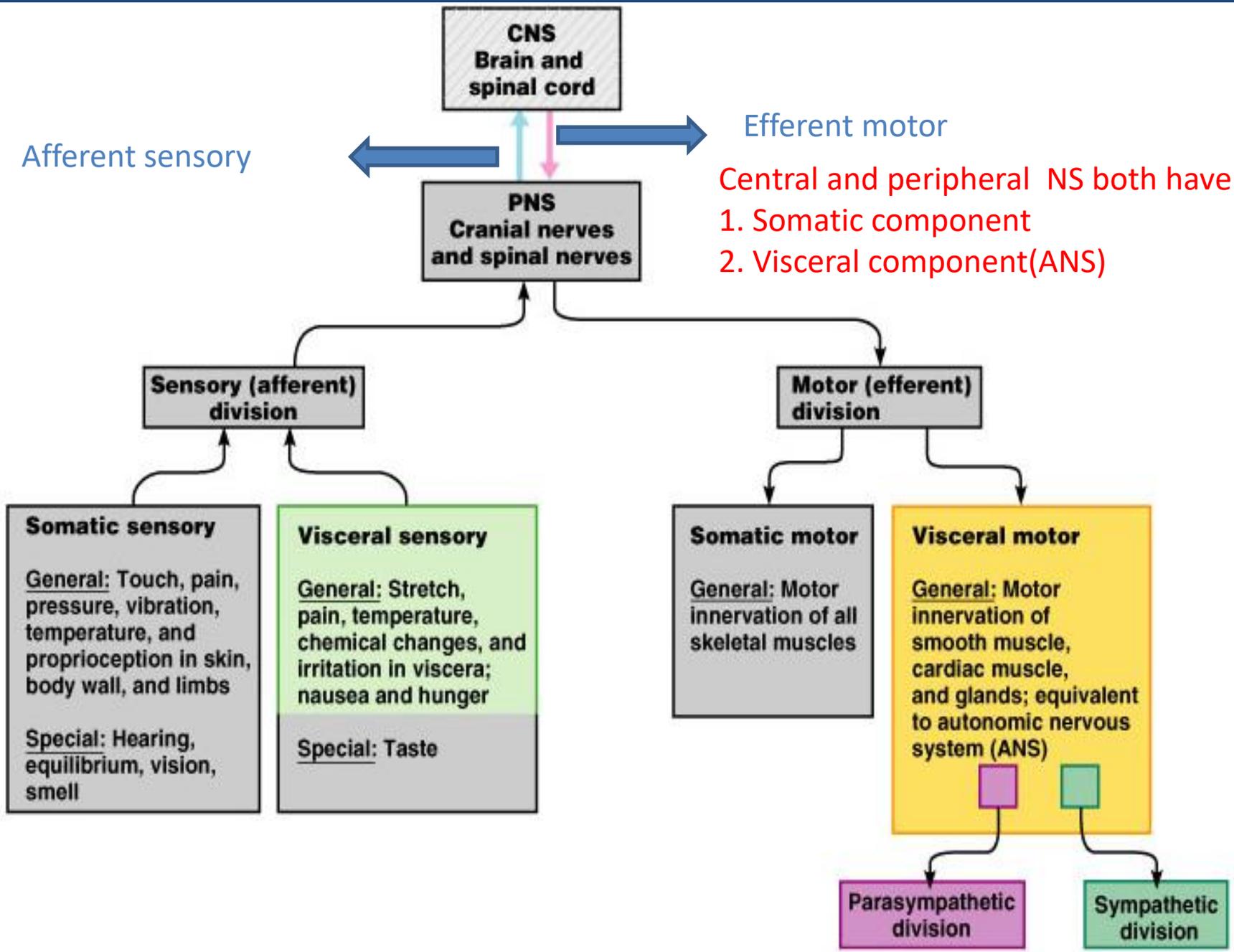
### Autonomic Nervous System



FUNCTIONAL SUBDIVISION



- Funct



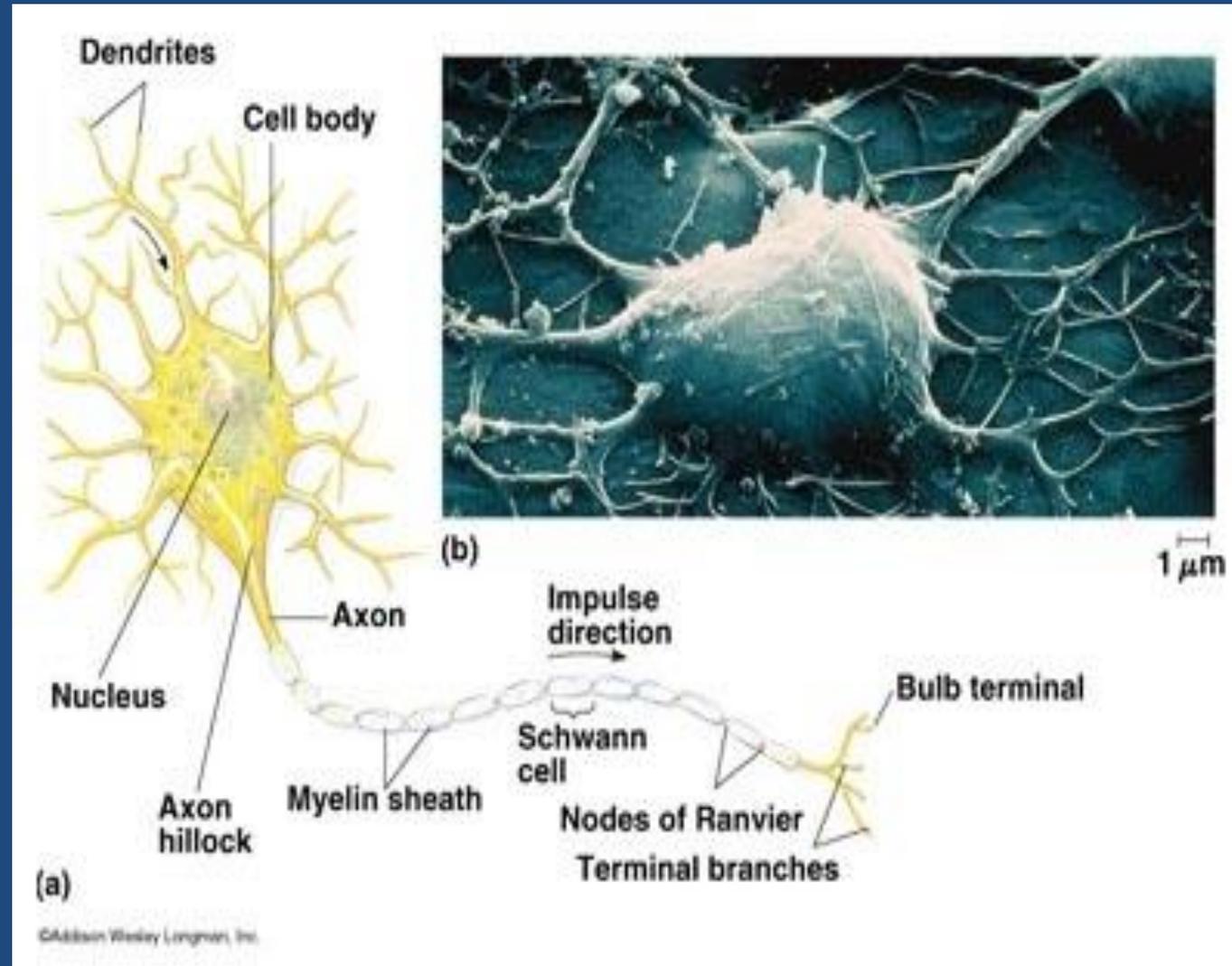
## Structural organization of nervous system

- Is very simple
- Consist of two types of cell-neuron and neuroglia
- Neurons –characteristics
  - do not divide by mitosis
  - no. constant since birth
  - in intrauterine life nerve cell proliferate from neuroblast
  - 10,000million neuron in cerebral cortex of human brain
- Neuroglia cells –

# Neurons

1. Body    2. Processes    a. Dendrites    b. Axon

Nucleus  
Nissl substance  
Lysosomes  
Neurofilaments  
Lipofuscin



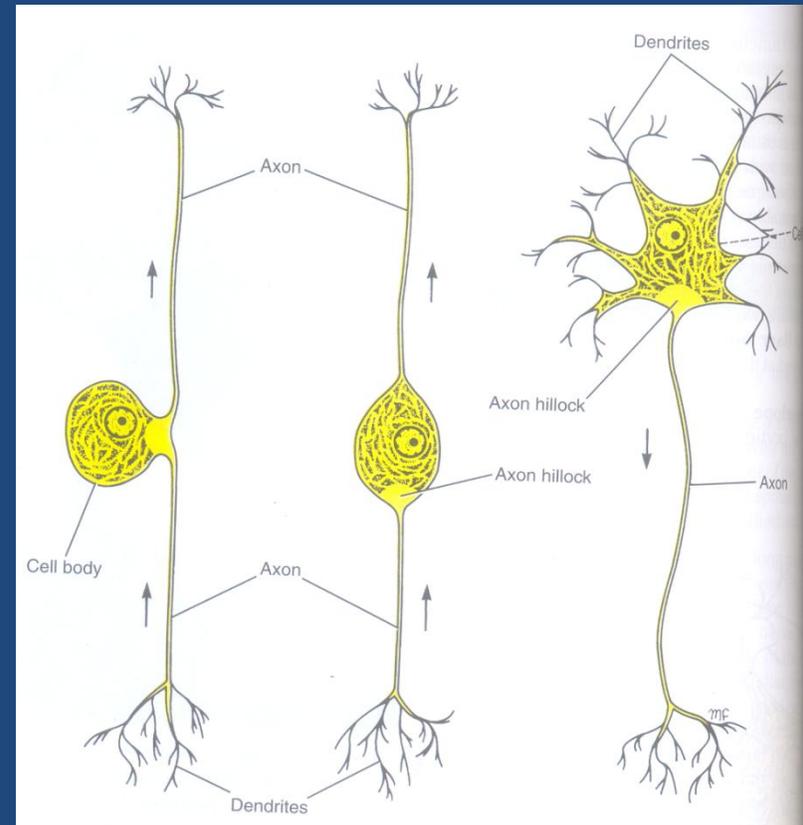
- Nucleus-- collection of cell body within CNS
- Ganglion -- collection of cell body out side CNS
  - Cerebro spinal ganglia
  - Autonomic ganglia
- Nerve fibre
  - Tract –within CNS
  - Peripheral nerve- out side CNS
- Grey matter
- White matter

# Classification of neurons

## According to polarity

1. unipolar
2. Bipolar
3. Pseudounipolar
4. Multipolar

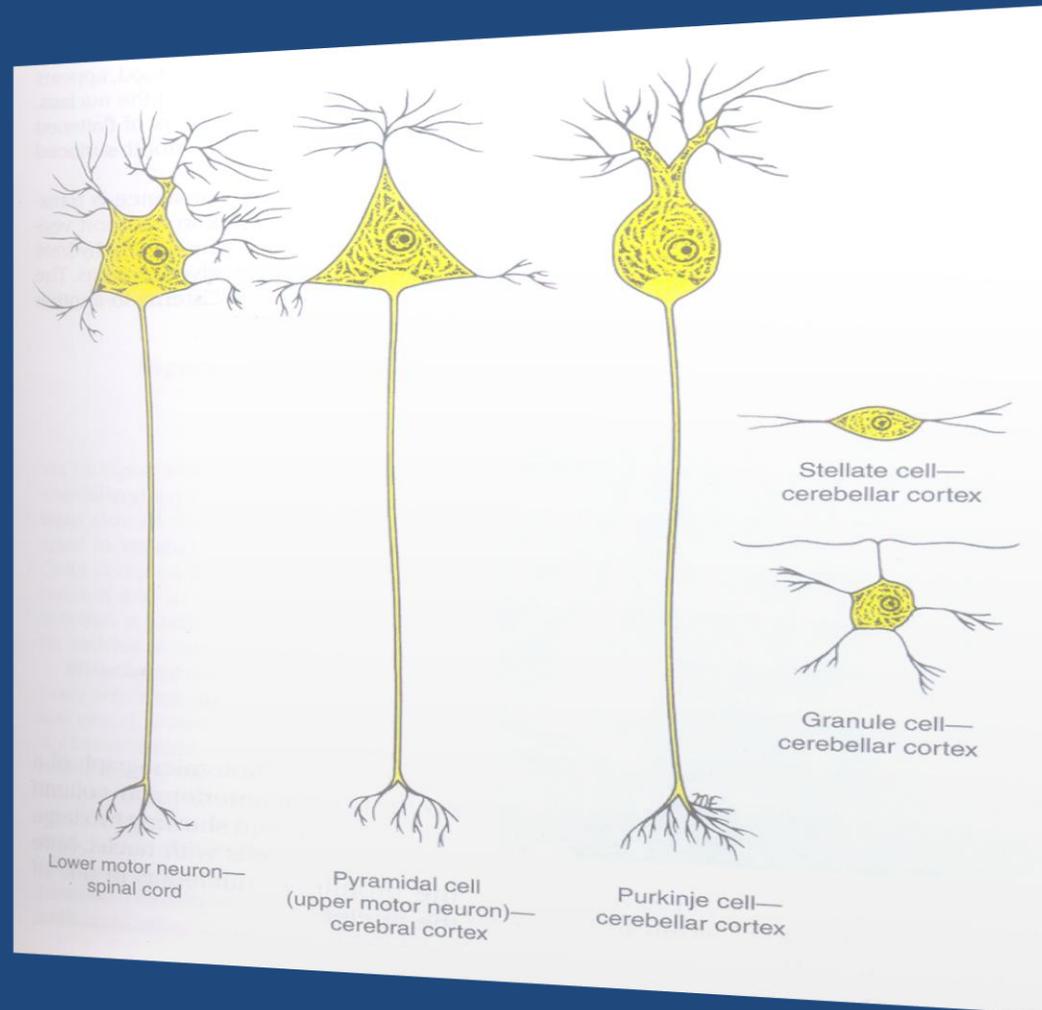
eg.



# Classification of neurons

## Shape of body

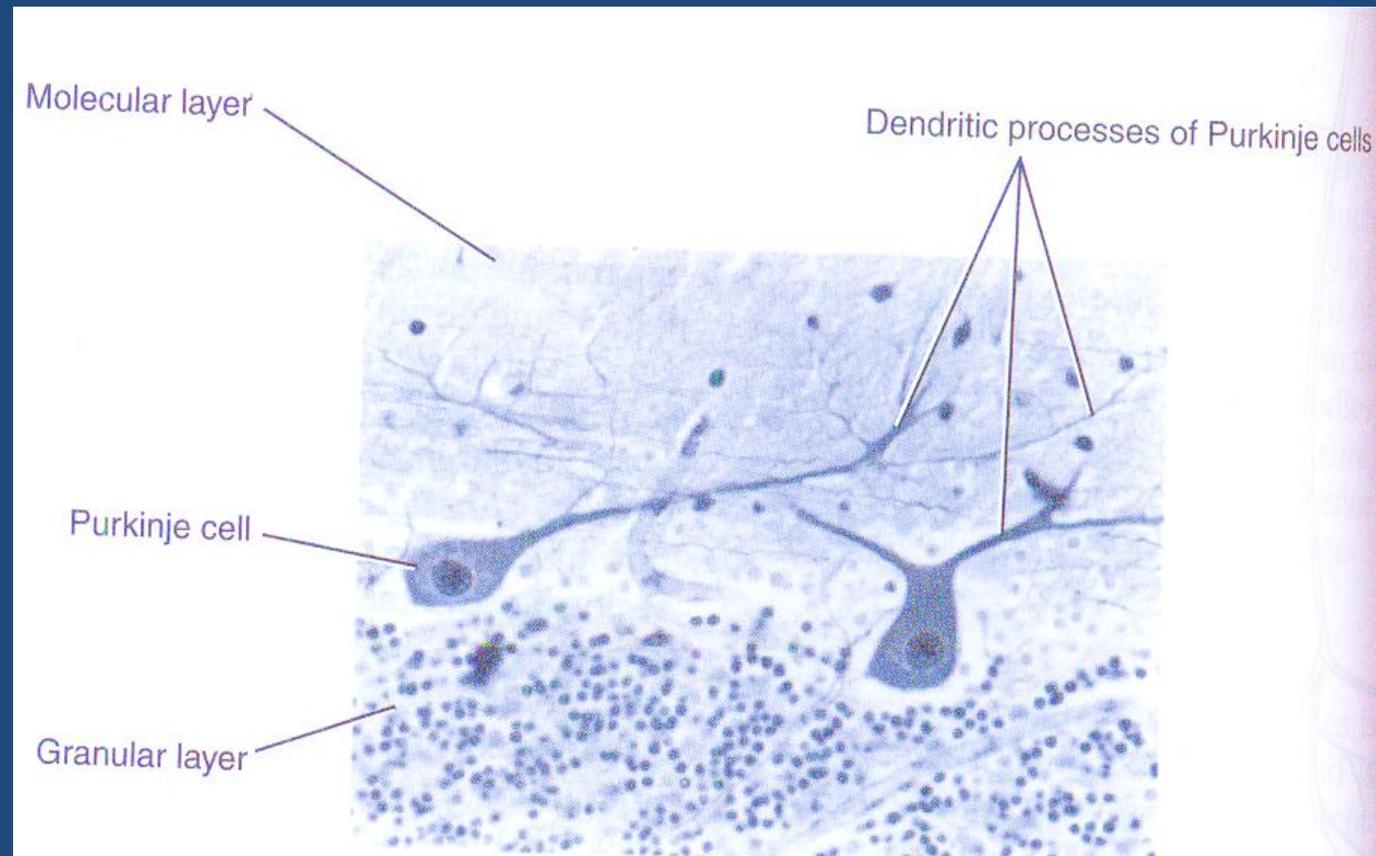
1. Pyramidal
2. Fusiform
3. Pyriform



# Classification of neurons

## According to length of processes

- Golgi type I
- Golgi type II



# Classification of neurons

## Functional classification

- Sensory neuron
- Motor neuron
  - a) upper motor
  - b) lower motor

# Autonomic neurons

- Arranged in two sets

## 1. Preganglionic neurons-

Located in CNS and arranged as

- Craniosacral (parasympathetic

Preganglionic neurons located

in brain stem (cranial part)

& sacral seg of spinal cord

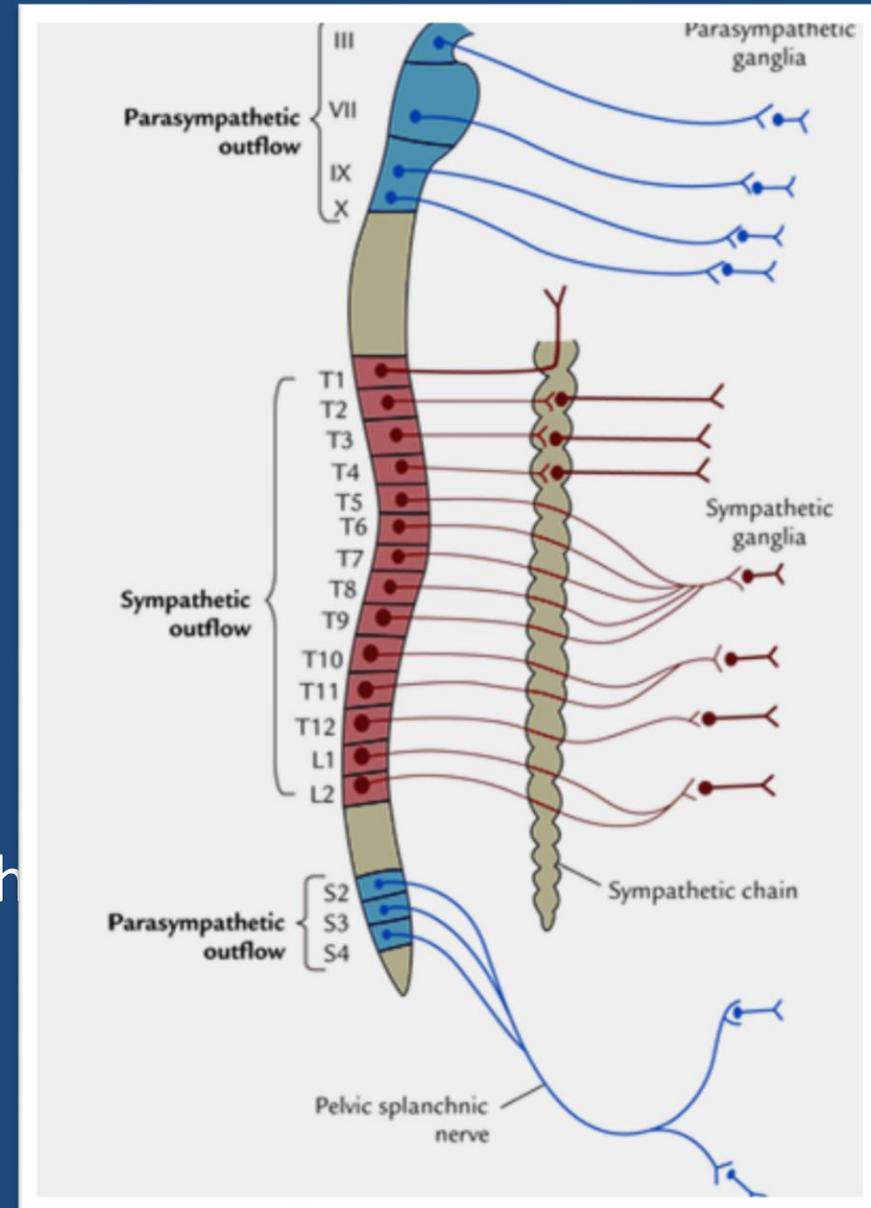
(Sacral part)

-Thoracolumbar (sympathetic )

Preganglionic neurons located in the  
spinal cord

## 2. Postganglionic neuron –

-situated outside CNS

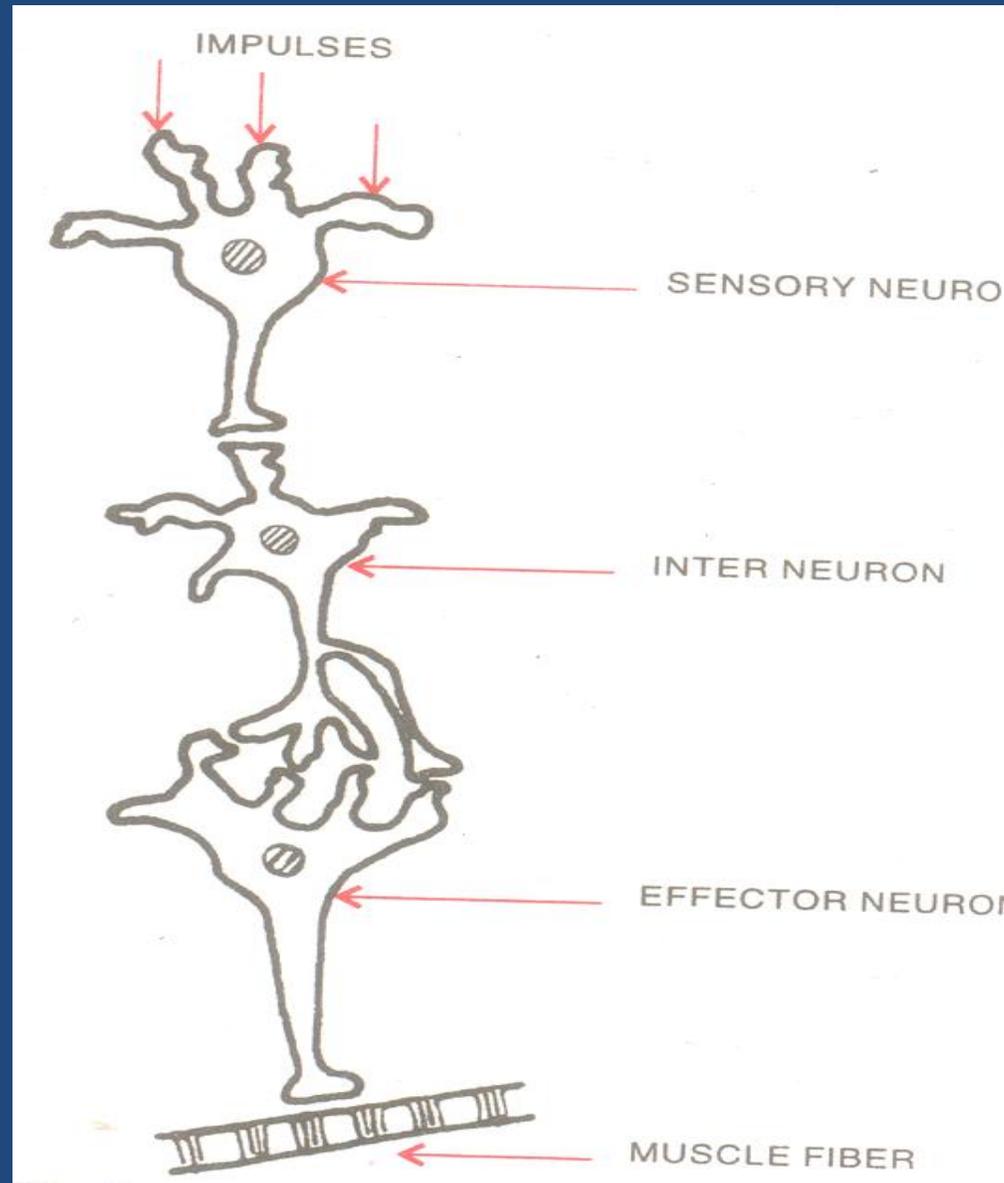


# Synapses

The junction at which the nerve impulse passes from one neuron to another is called the synapse.

- **Types of synapses:**

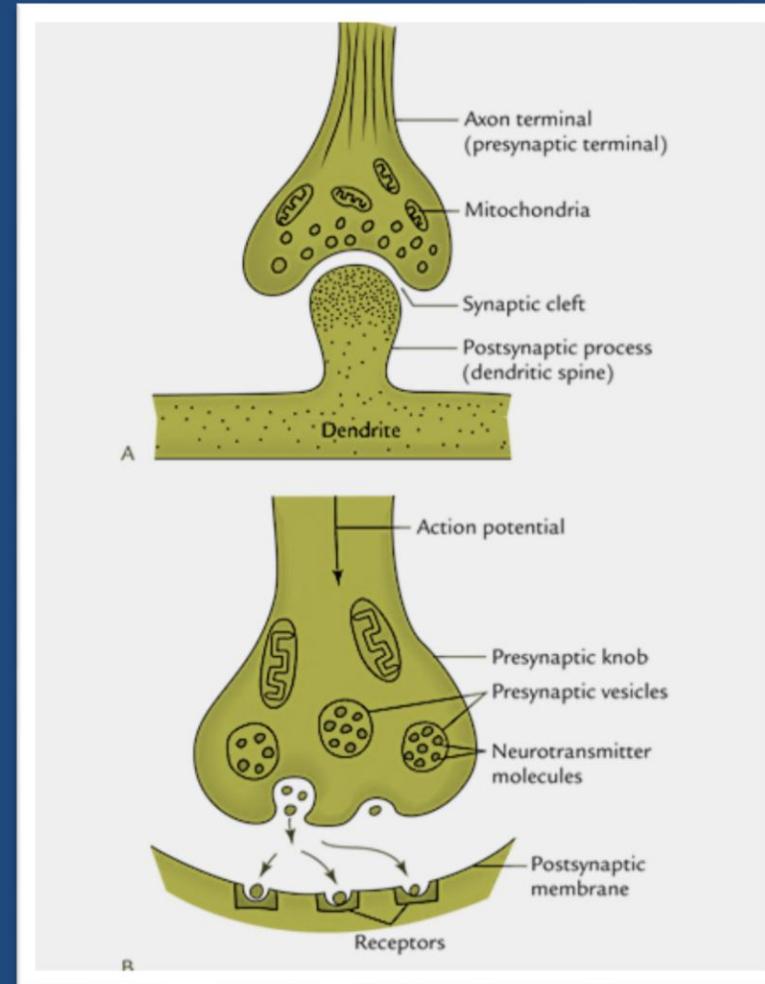
1. Axo-dendritic
2. Axo-somatic
3. Axo-axonic



# Components of synapse

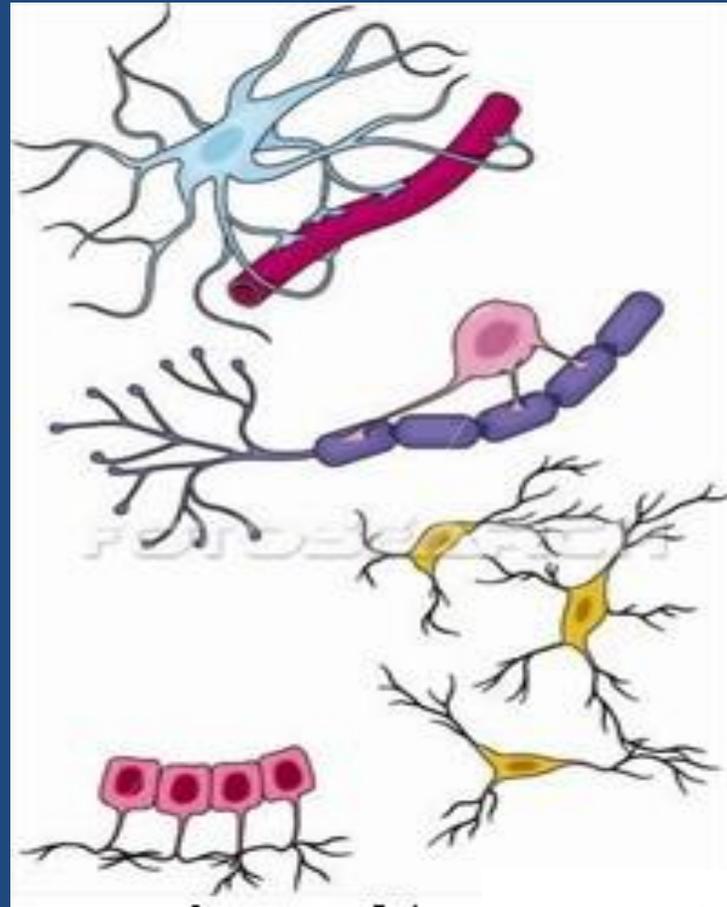
Synapse has three components –

- Presynaptic membrane
- Synaptic cleft
- Postsynaptic membrane

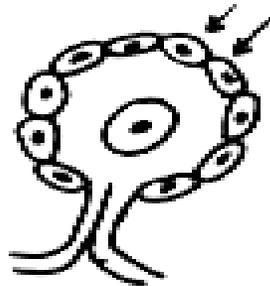


# Neuroglia

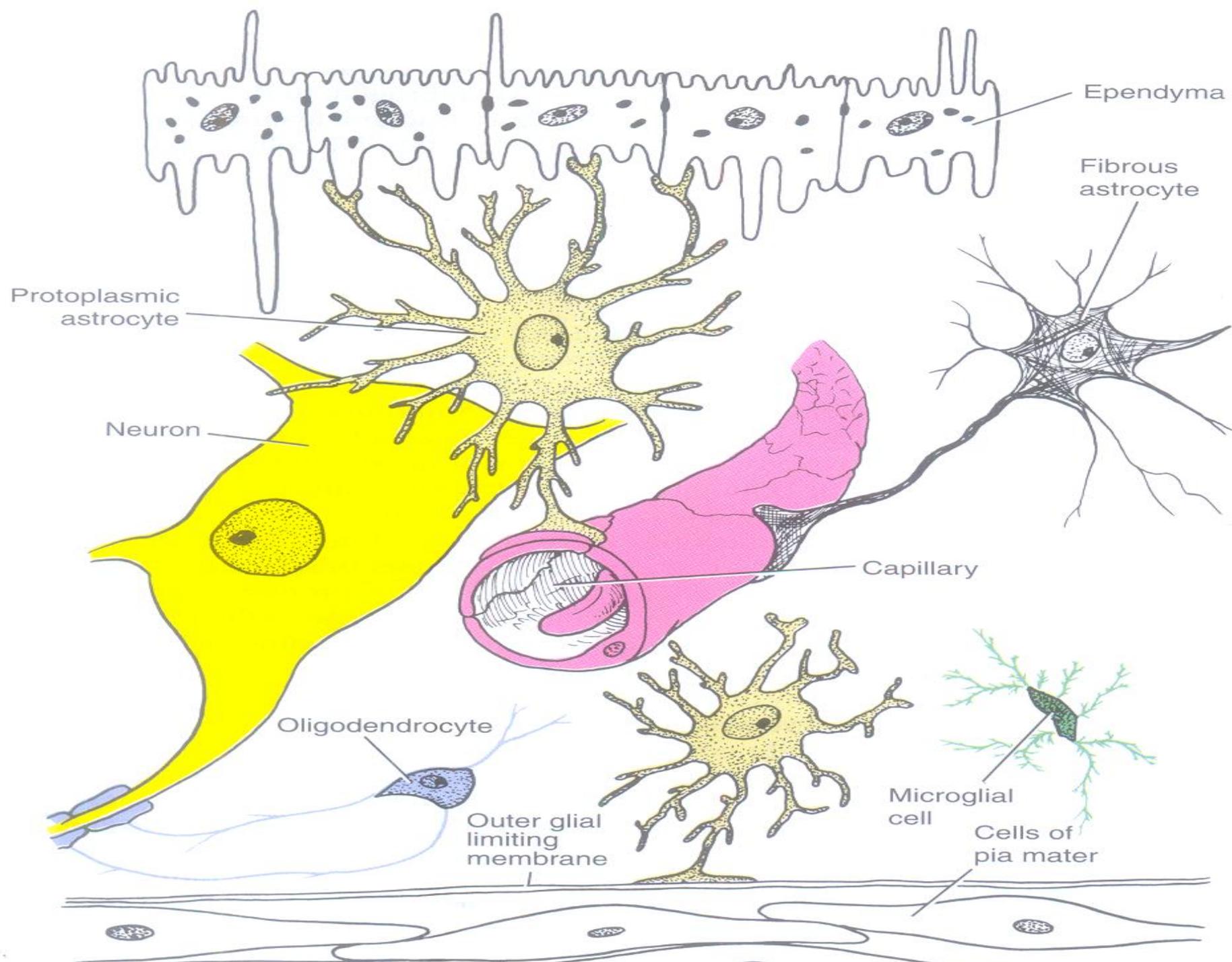
- In CNS
  - **Macroglia**
    - Astrocyte(only in CNS)
    - Oligodendrocyte
    - **Microglia**
    - Ependymal cell
  - In PNS
    - Satellite cell
    - Schwann cell
    - **functions**



Satellite Cells



*Pseudo unipolar*

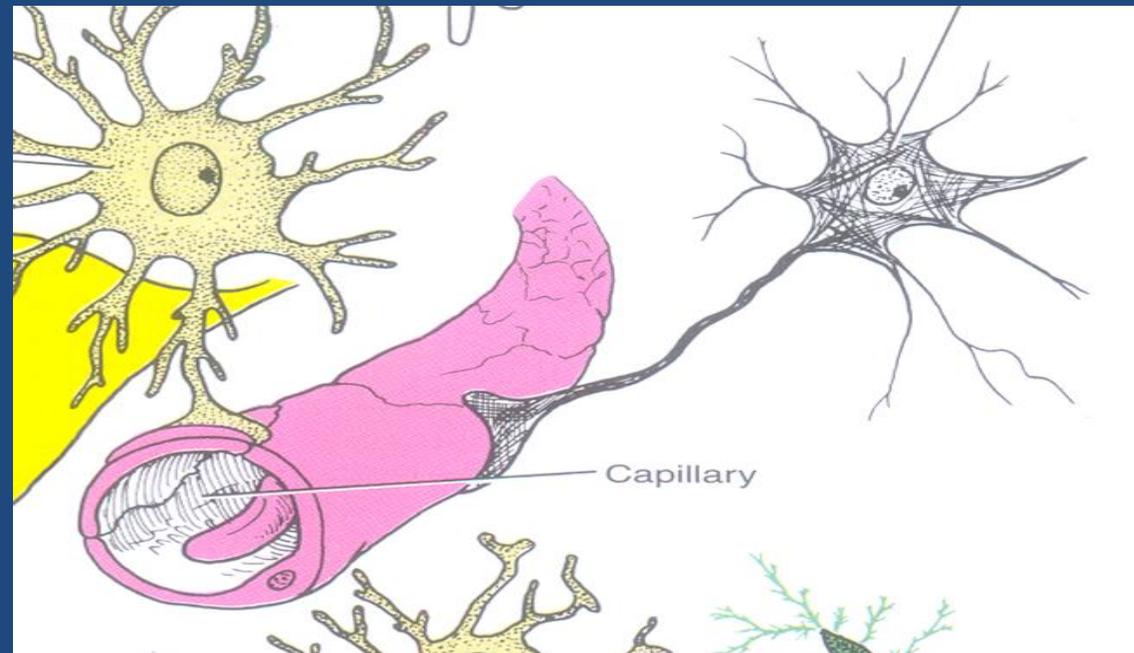


# Functions of neuroglia cells

- Provide structural and functional support to neuron
- Phagocytise foreign substance
- Produce CSF
- Forms myelin sheath around axon
- Helps to form **blood brain barrier-**

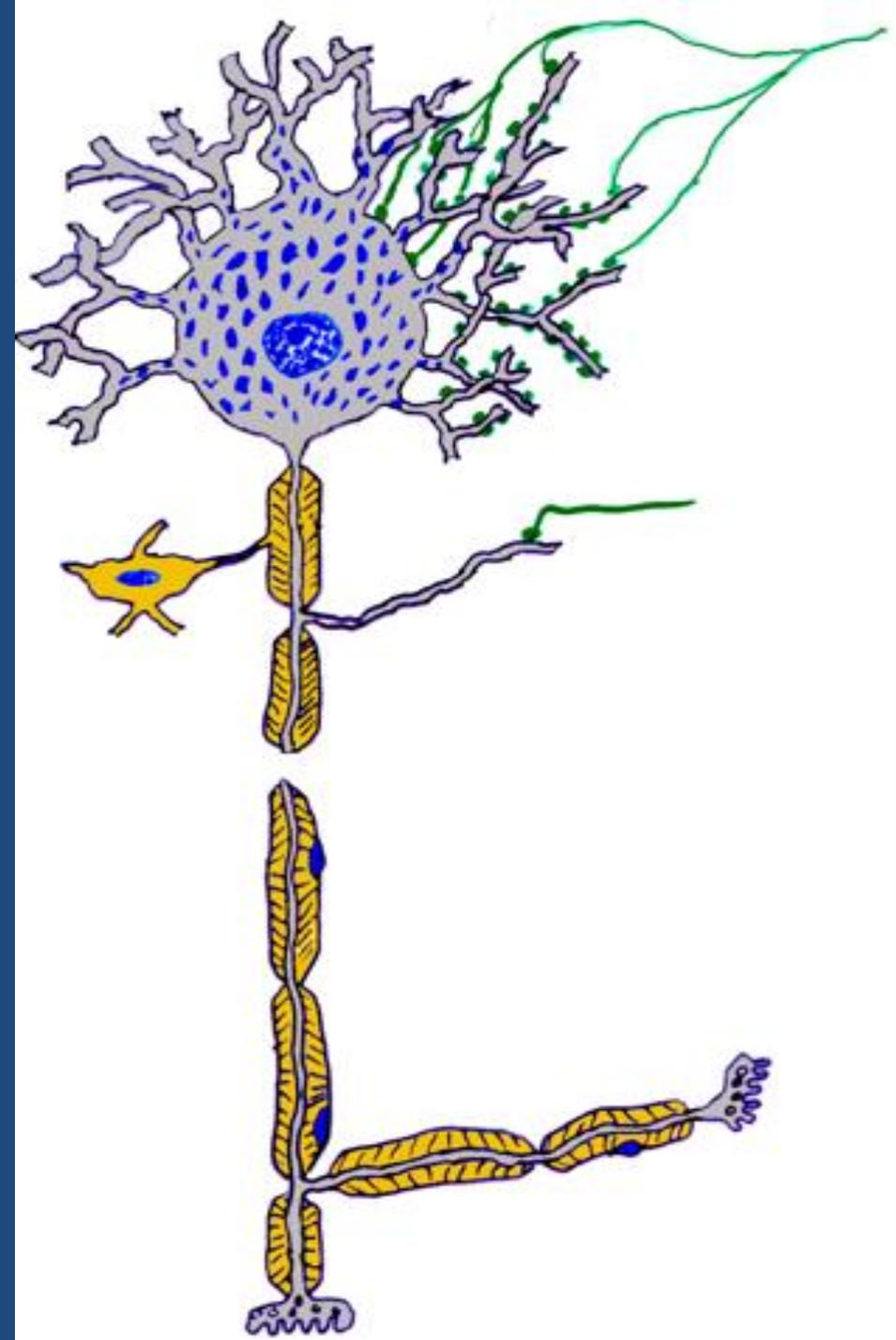
it is selective semipermeable membrane

at the capillary level  
that separate the  
circulating blood from  
the brain

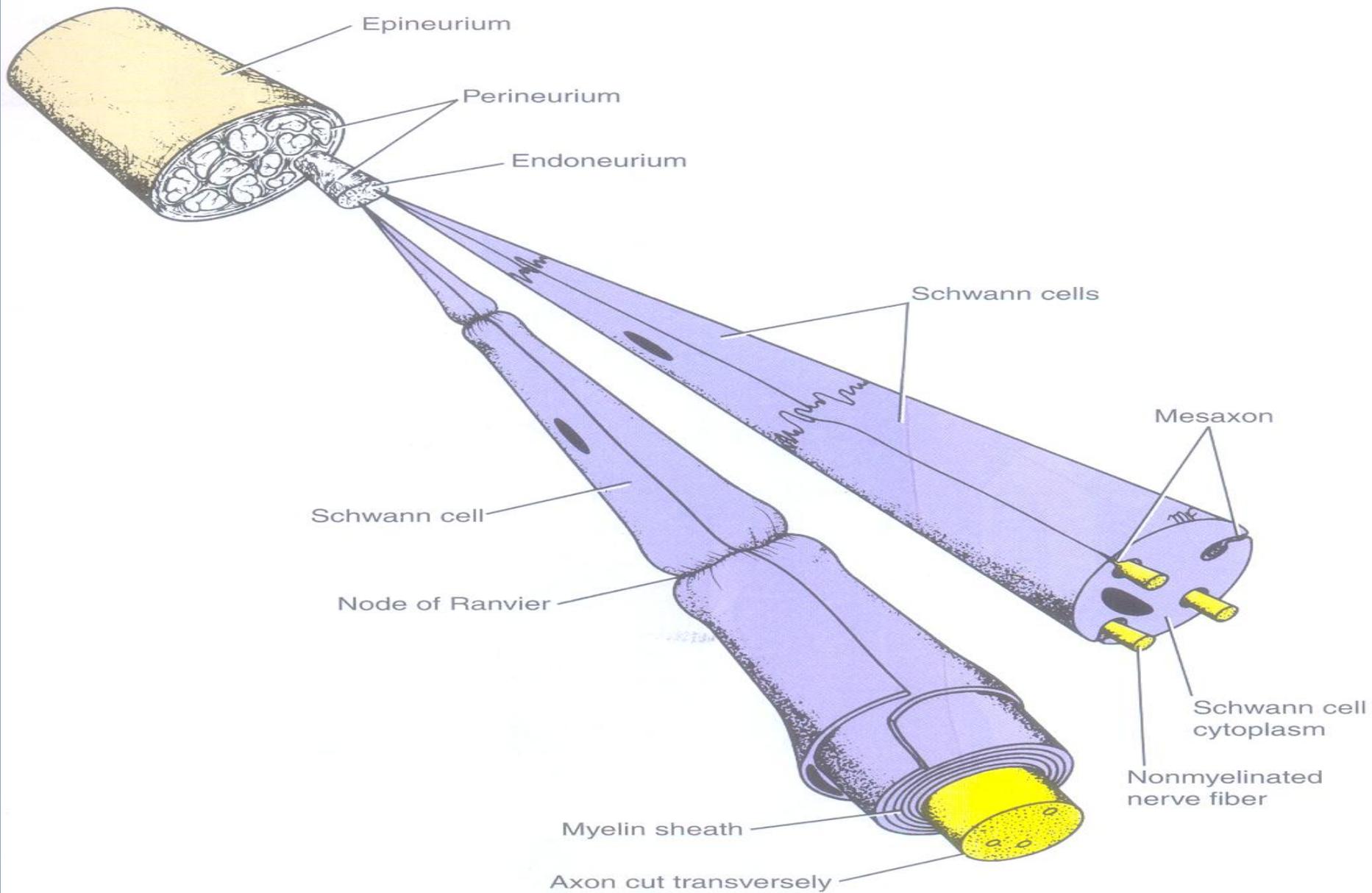


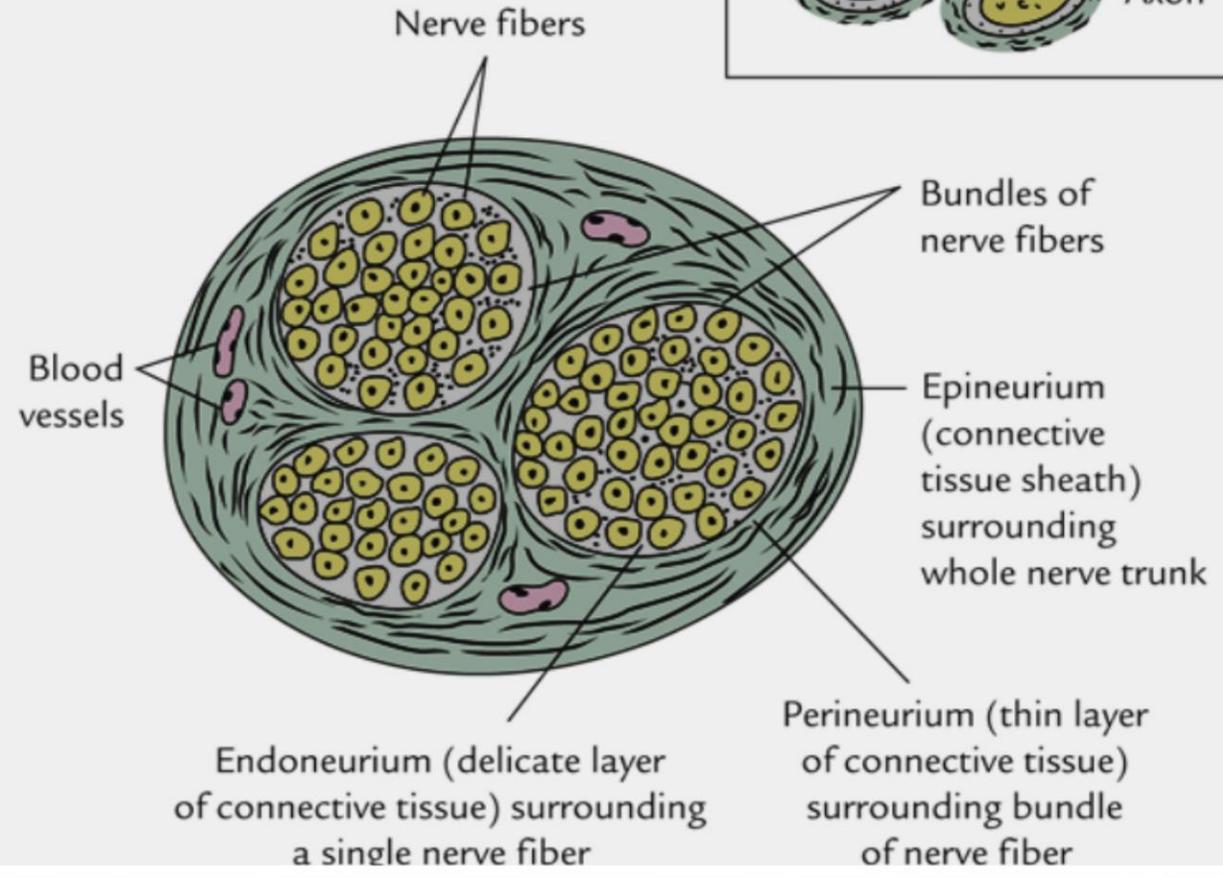
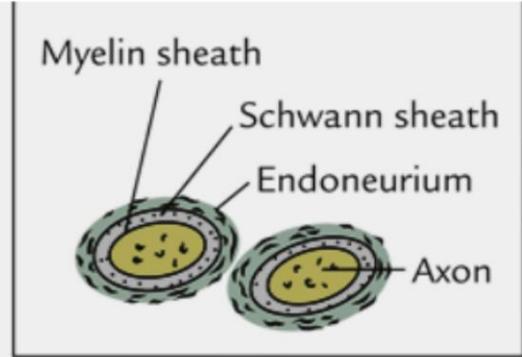
# Nerve fibres

- Axon of nerve cell is nerve fiber
- CNS- tracts
- PNS- peripheral nerve
- II type of nerve
  1. Myelinated
  2. Non myelinated

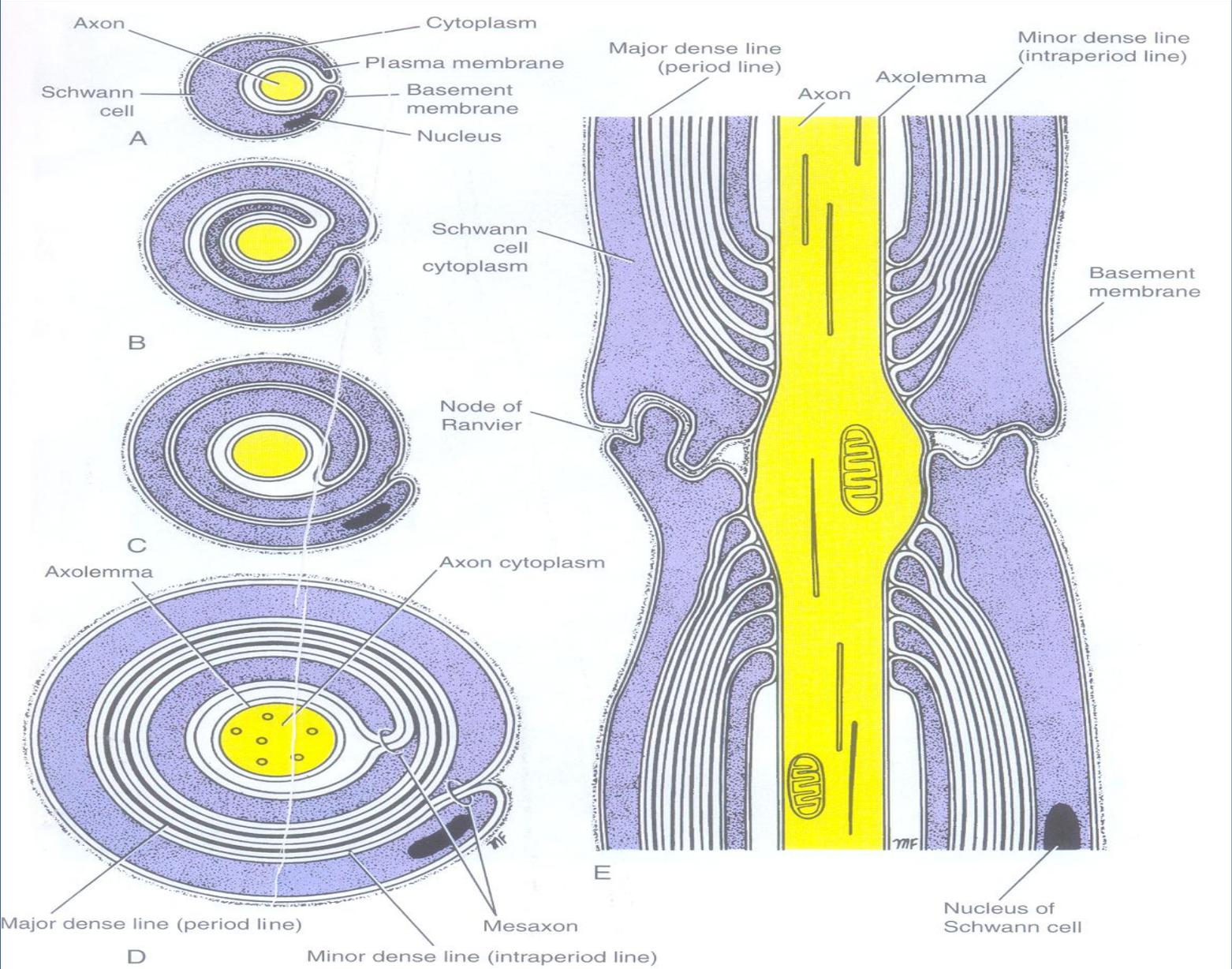


# structure of nerve

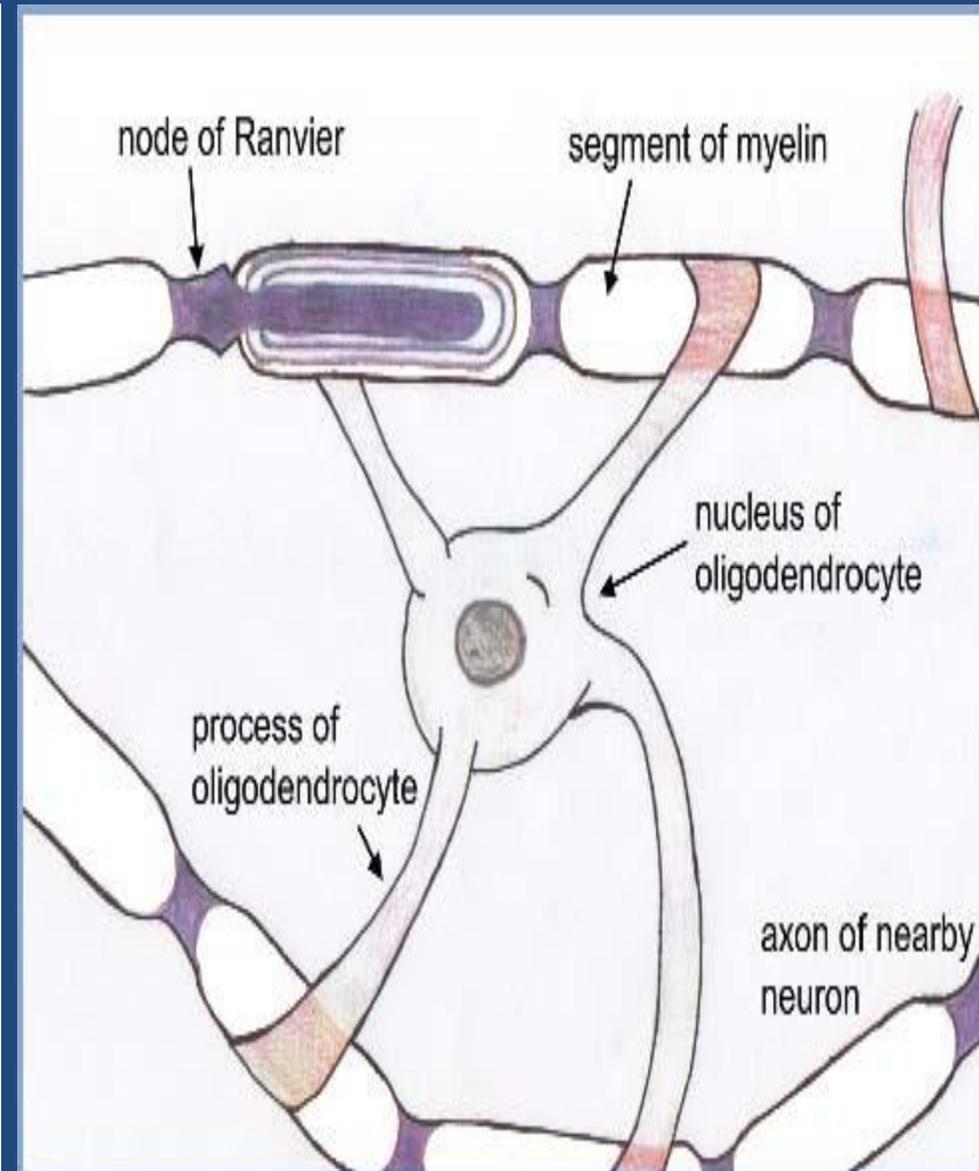
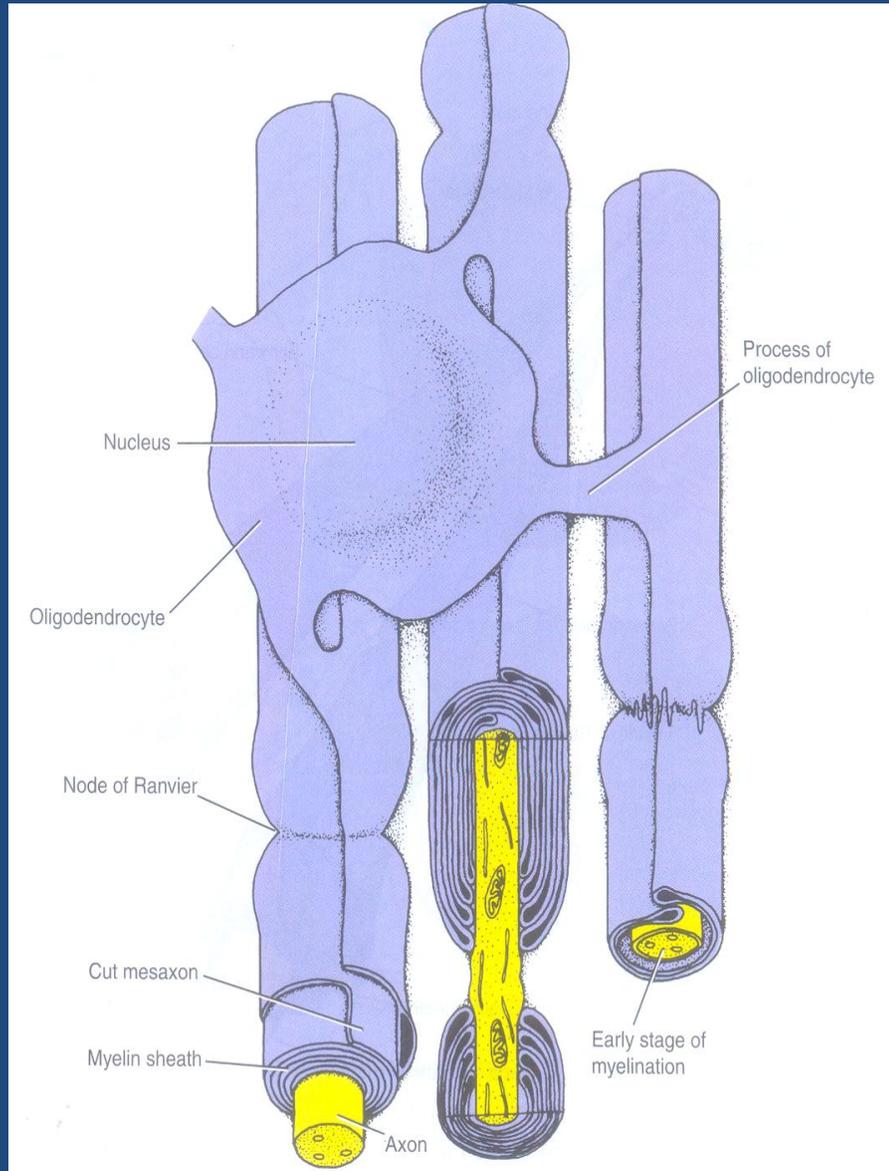




# Myelination of peripheral nerve fibers



# Myelination of nerve fiber in CNS

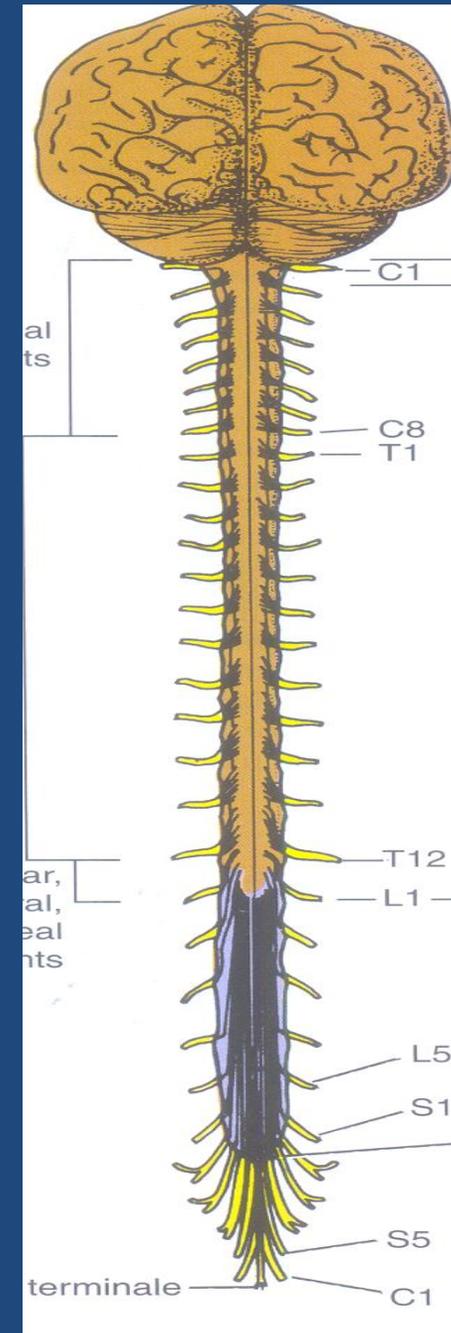


# Classification of nerves

- Motor nerve
- Sensory nerve
- Mixed nerve

# Spinal cord and spinal segment

- Spinal cord has 31 segment .
- Pair of spinal nerve leaves each segment of spinal cord

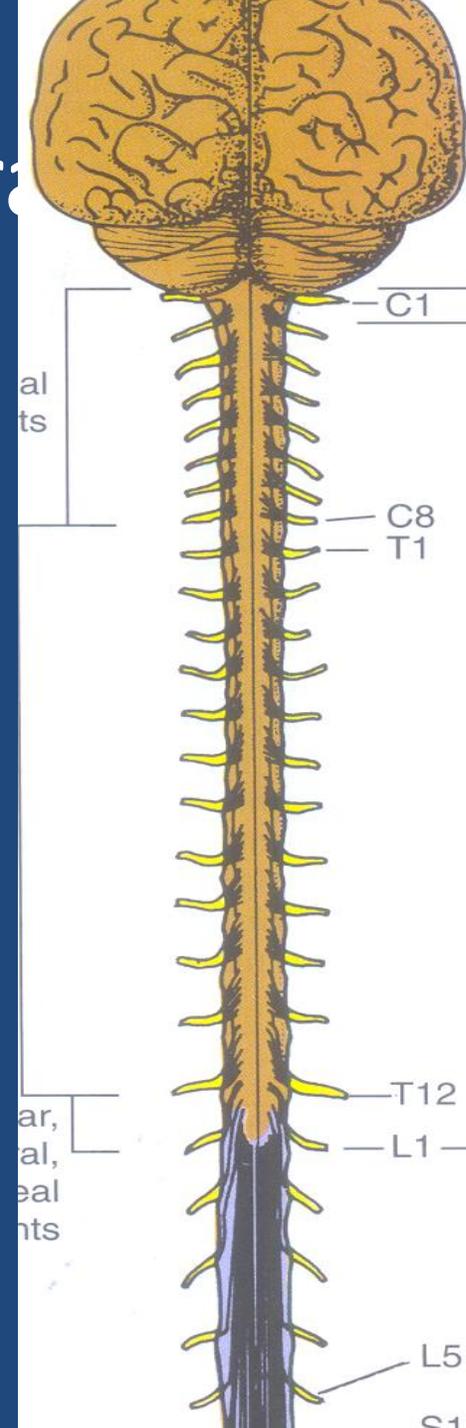


# Types of peripheral

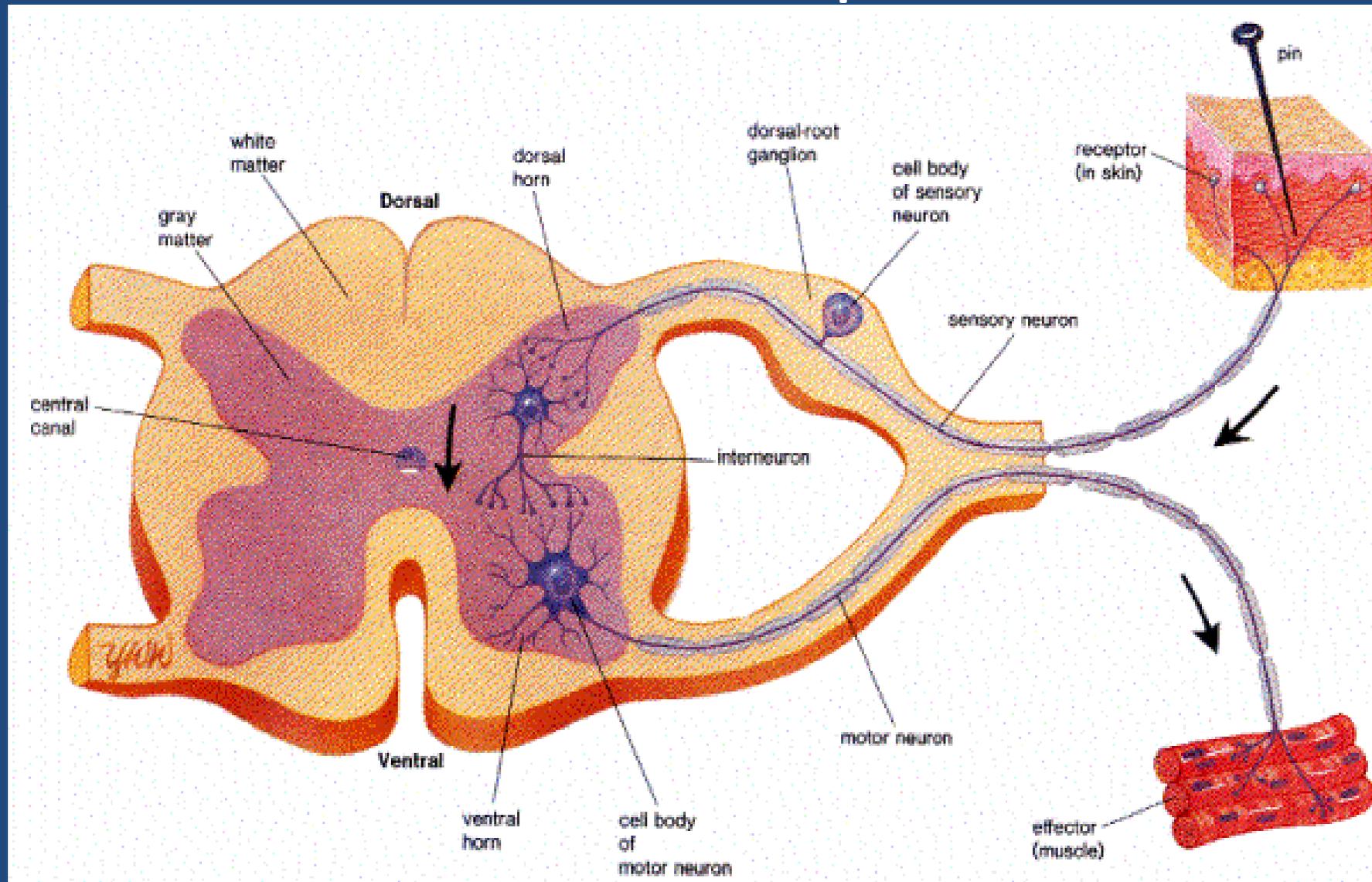
Cranial - 12 nerves

Spinal - 31 pairs of nerve-

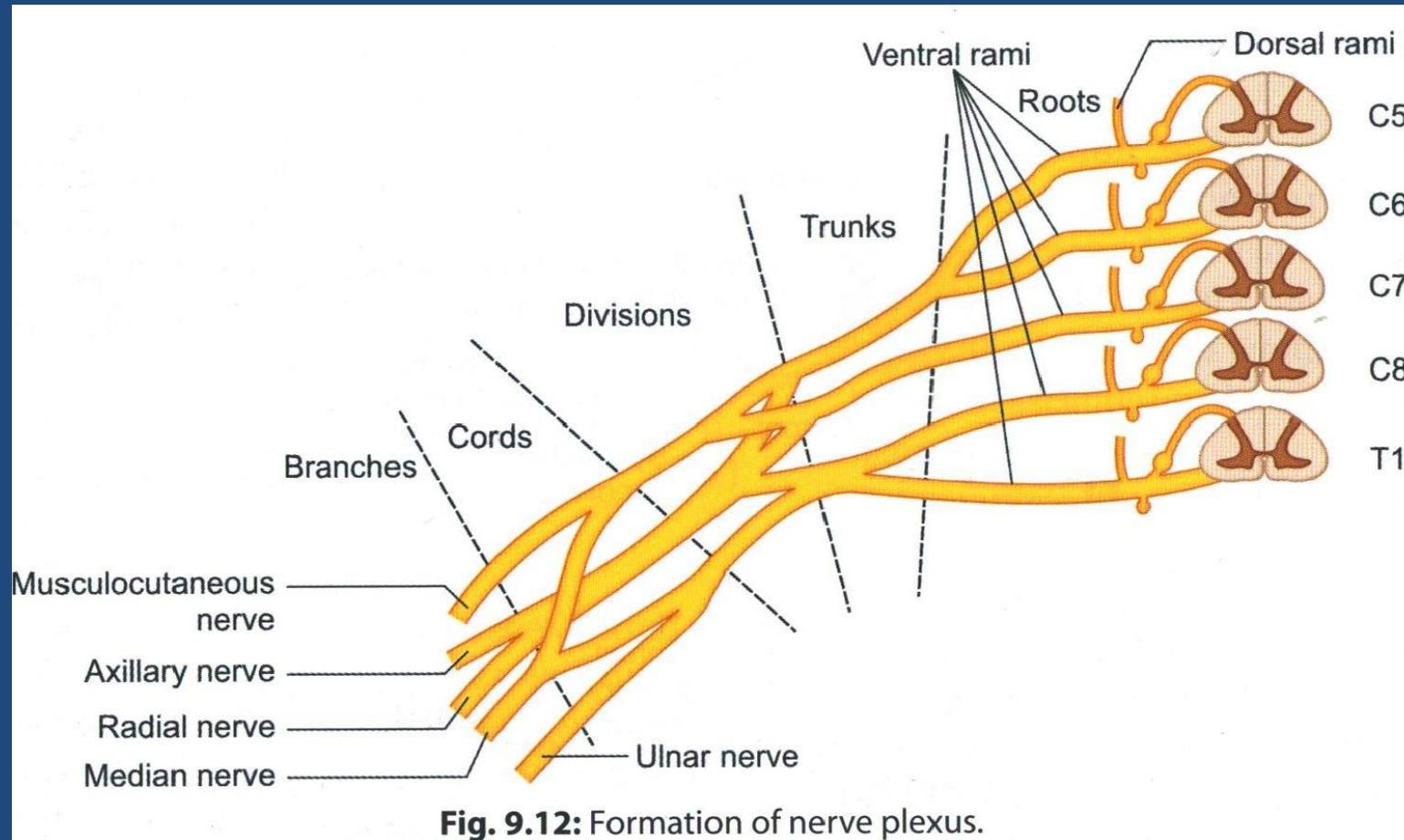
- 8 cervical
- 12 thoracic
- 5 lumbar
- 5 sacral
- 1 coccygeal



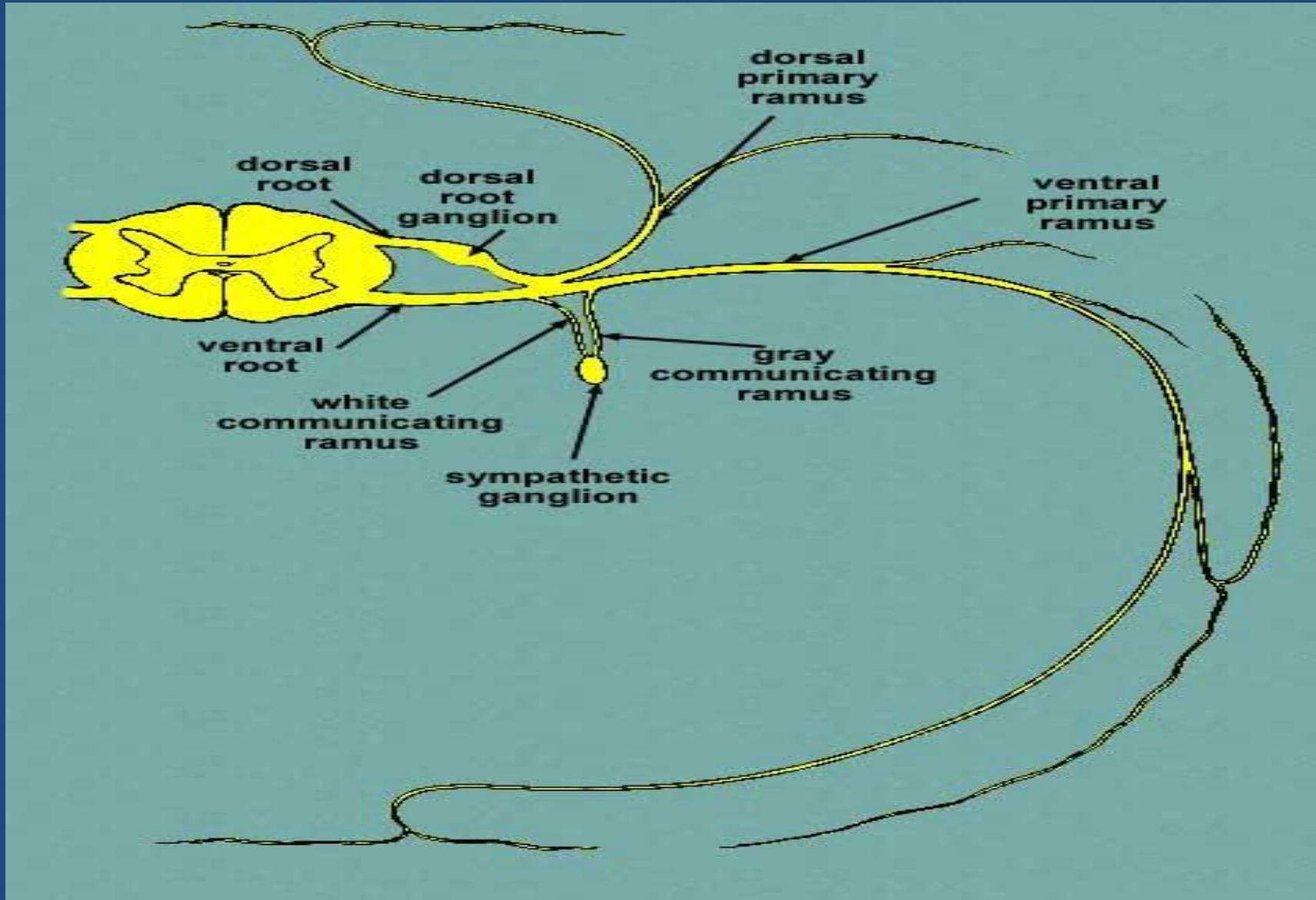
# Cross section of spinal cord

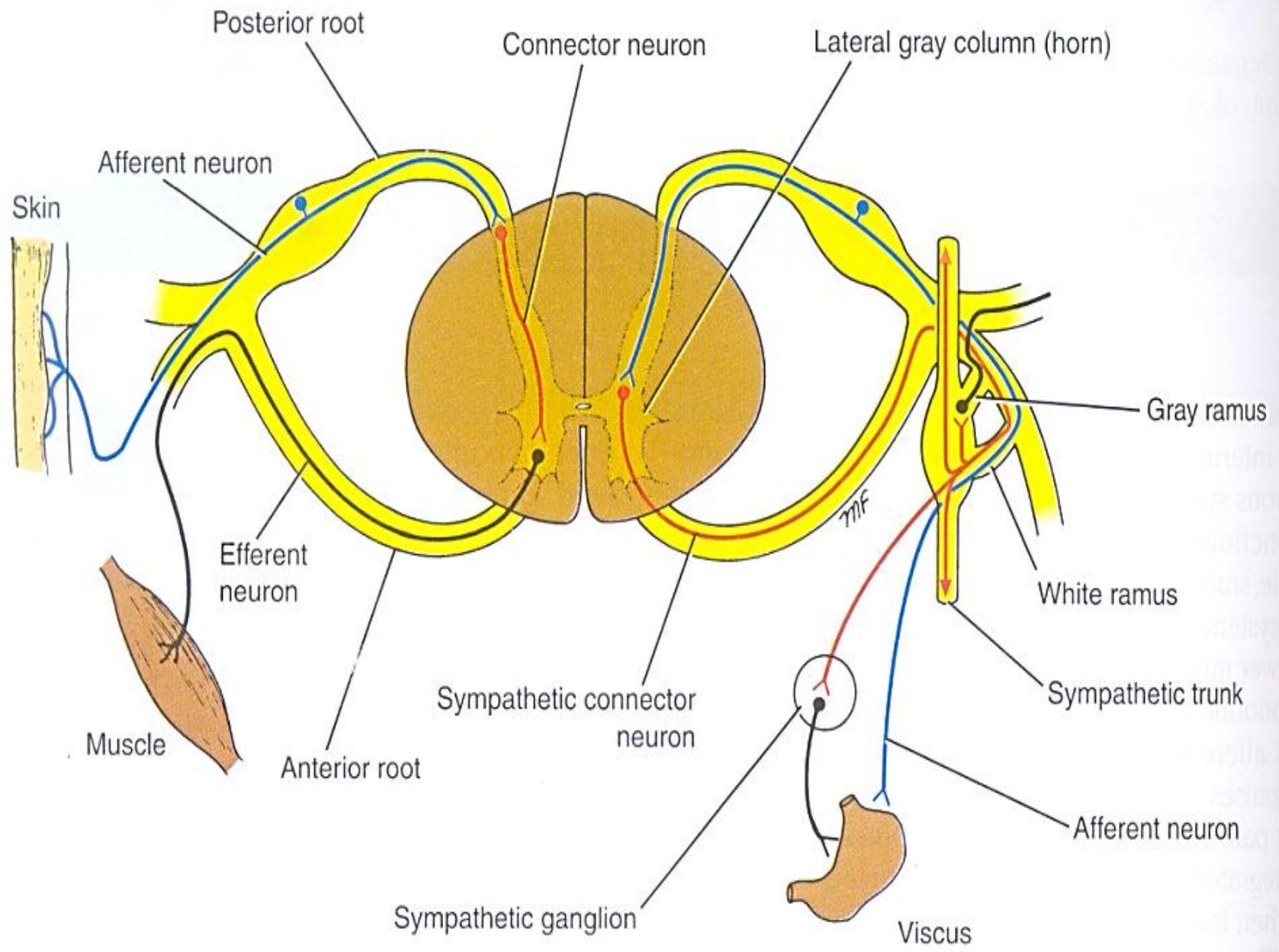


# Nerve plexus

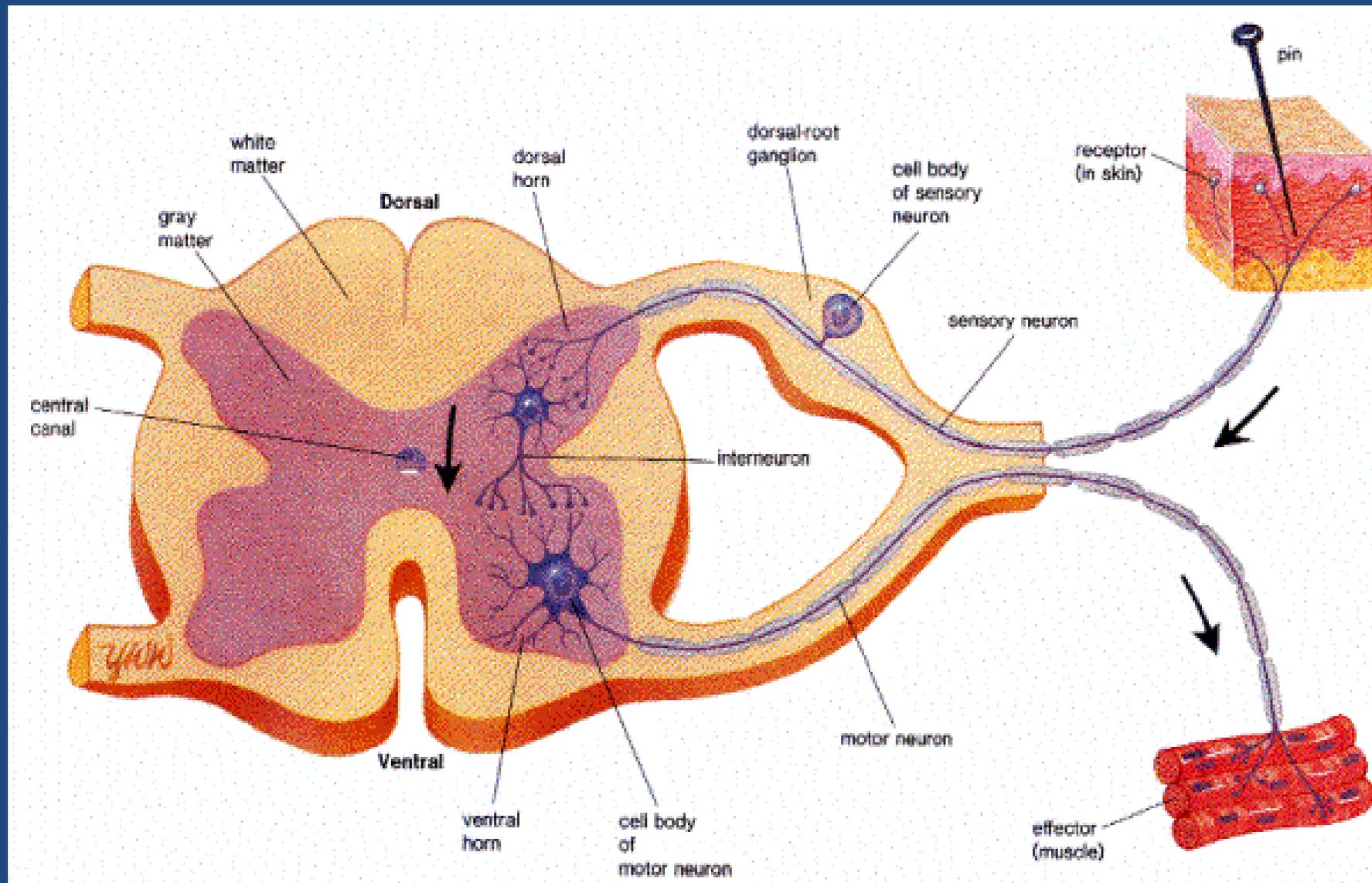


# Course of typical spinal nerve

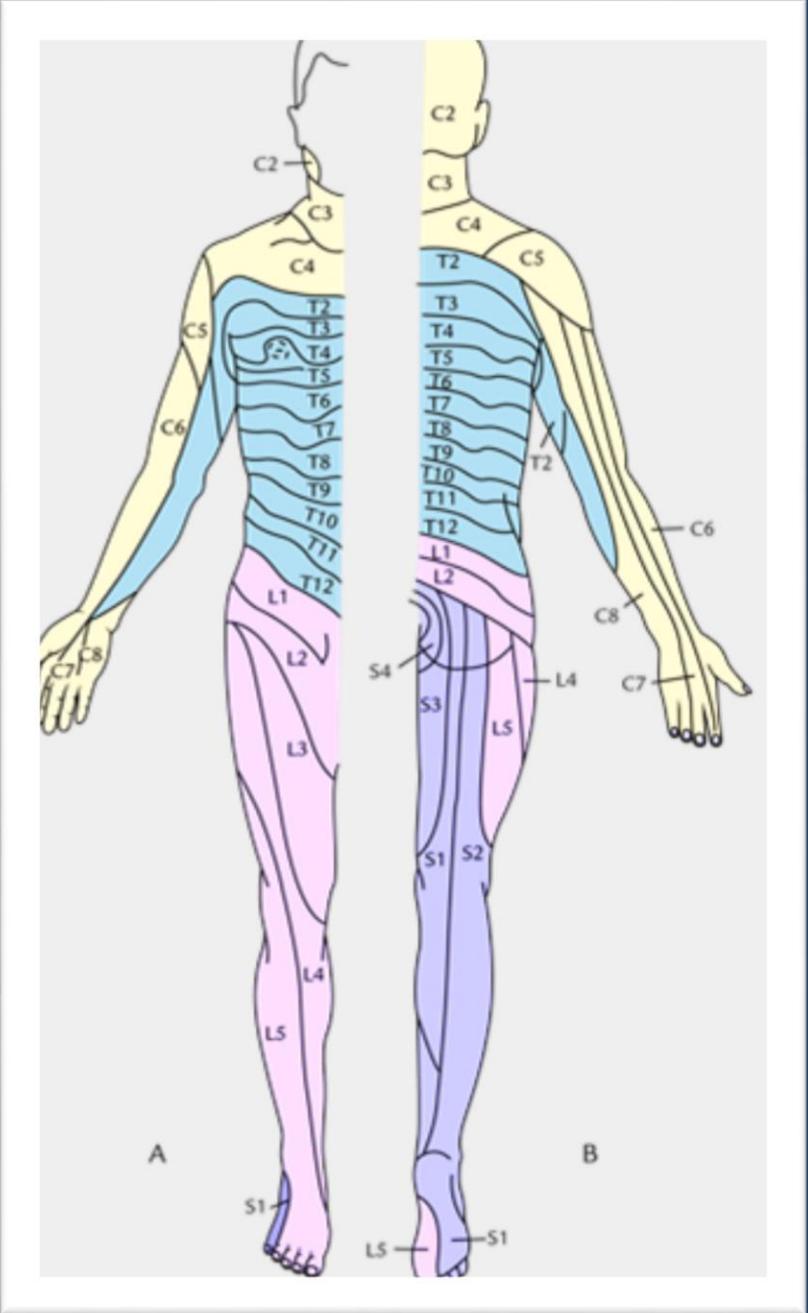




# Reflex Arc - basic functional unit of nervous system



# Dermatome



# Parasympathetic Nervous System: Cranial Outflow

- Preganglionic fibers run via:
  - Oculomotor nerve (III)
  - Facial nerve (VII)
  - Glossopharyngeal nerve (IX)
  - Vagus nerve (X)
- Cell bodies located in cranial nerve nuclei in the brain stem

# Parasympathetic Nervous System: Sacral Outflow

- Emerges from S<sub>2</sub>-S<sub>4</sub>
- Innervates organs of the pelvis and lower abdomen
- Preganglionic cell bodies
  - Located in visceral motor region of spinal gray matter
- Form splanchnic nerves

# Functions of sympathetic and parasympathetic

- Sympathetic stimulation –mobilizes body energy for flight and fright
- Parasympathetic –slow down body processes and conserve energy

## Sympathetic over activity

- Rise in Blood pressure
- Increase in heart rate
- Increase respiratory rate
- Sweating
- Dryness of mouth
- Dilatation of pupil
- Loss of appetite
- Constipation

## Parasympathetic overactivity

- Constriction of pupil
- Decrease in heart rate
- Increase in mobility of gut

# Anatomical Differences in Sympathetic and Parasympathetic Divisions

- Length of postganglionic fibers
  - Sympathetic – long postganglionic fibers
  - Parasympathetic – short postganglionic fibers
- Branching of axons
  - Sympathetic axons – highly branched
    - Influences many organs
  - Parasympathetic axons – few branches
    - Localized effect

# Neurotransmitters of Autonomic Nervous System

- Neurotransmitter released by preganglionic axons
  - Acetylcholine for both branches (cholinergic)
- Neurotransmitter released by postganglionic axons
  - Sympathetic – most release norepinephrine (adrenergic)
  - Parasympathetic – release acetylcholine

## A Map of Referred Pain

- Pain arising from diseased viscera is referred to area of skin which is supplied by same segment of spinal cord

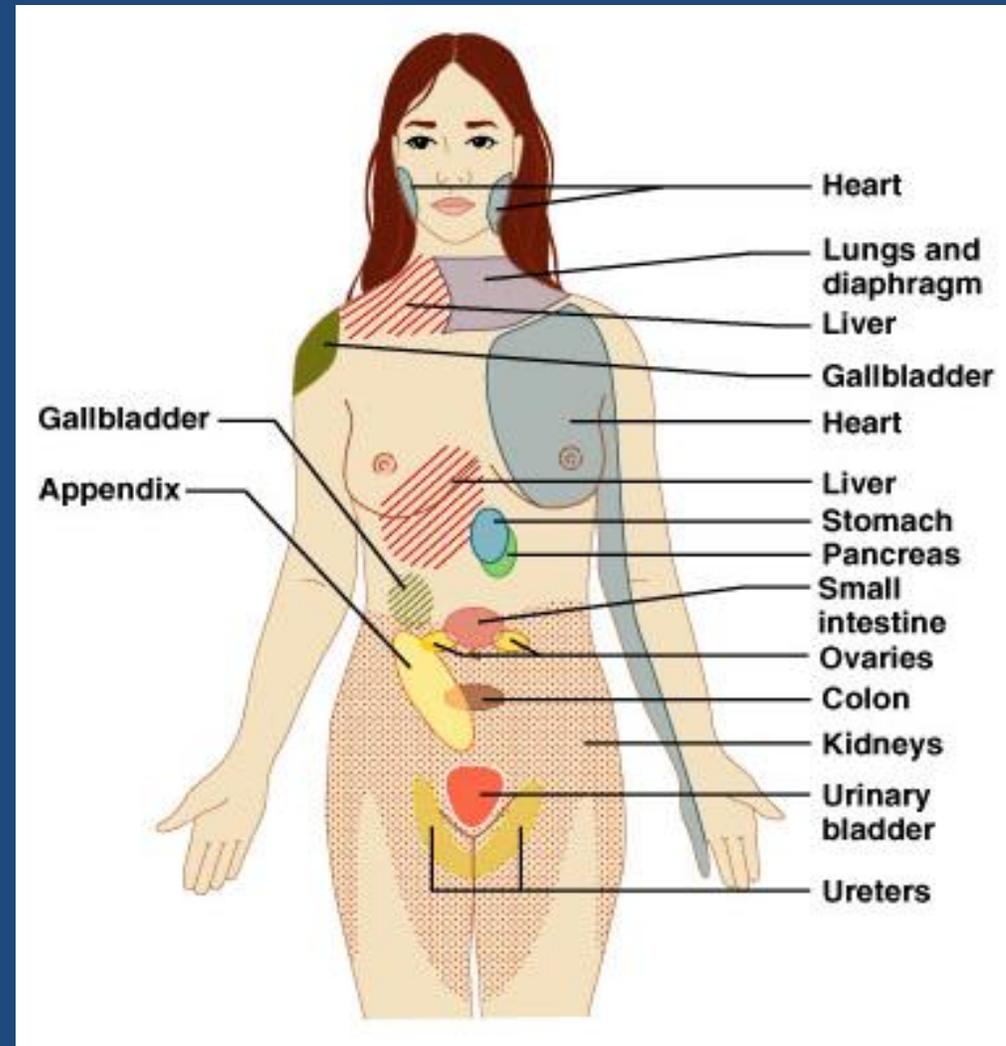


Figure 15.15

1. Glial cell which acts as a phagocyte is -----
2. commonest type of synapse is-----
3. All neuroglia are derived from neural crest except-----
4. Nucleus is collections of neurons outside/inside CNS
5. outer covering of peripheral nerve is called peripheral nerve.

END