Nervous system

- Controlling & Coordinating System

Functions

- Regulates all activity (Voluntary & Involuntary)
- Adjust Acc. to changing external and internal environment

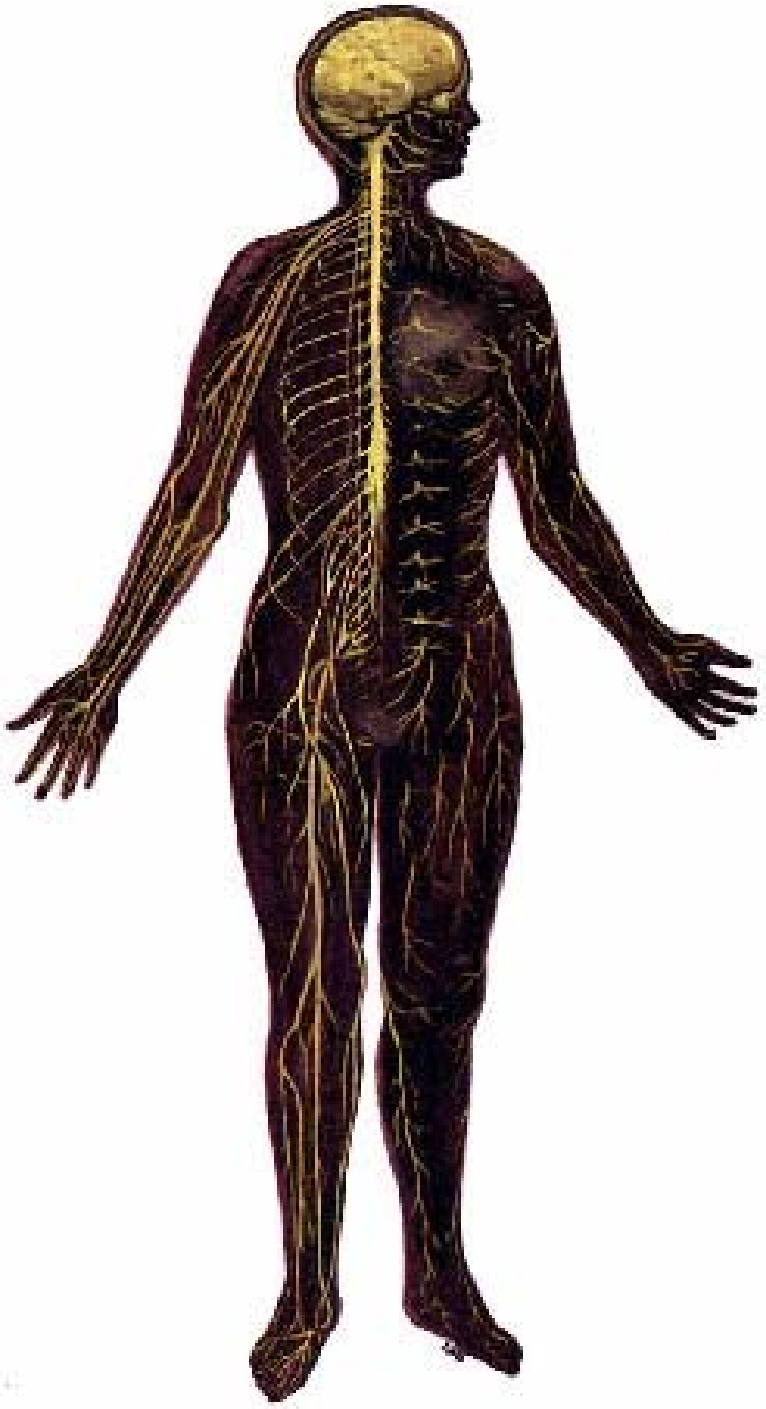
Nervous System

Subdivisions

CNS (Central Nervous System)

PNS(Peripheral Nervous System)

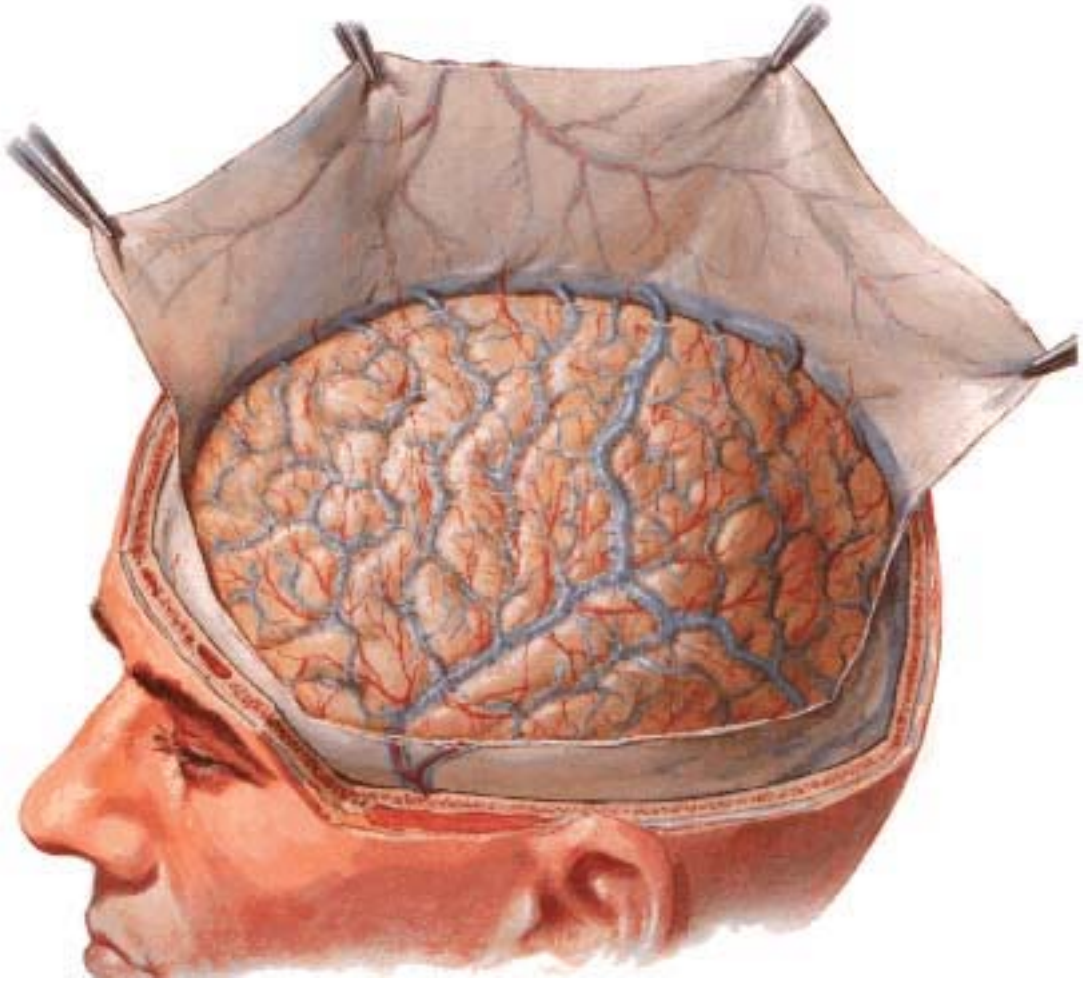
ANS (Autonomic Nervous system



CNS

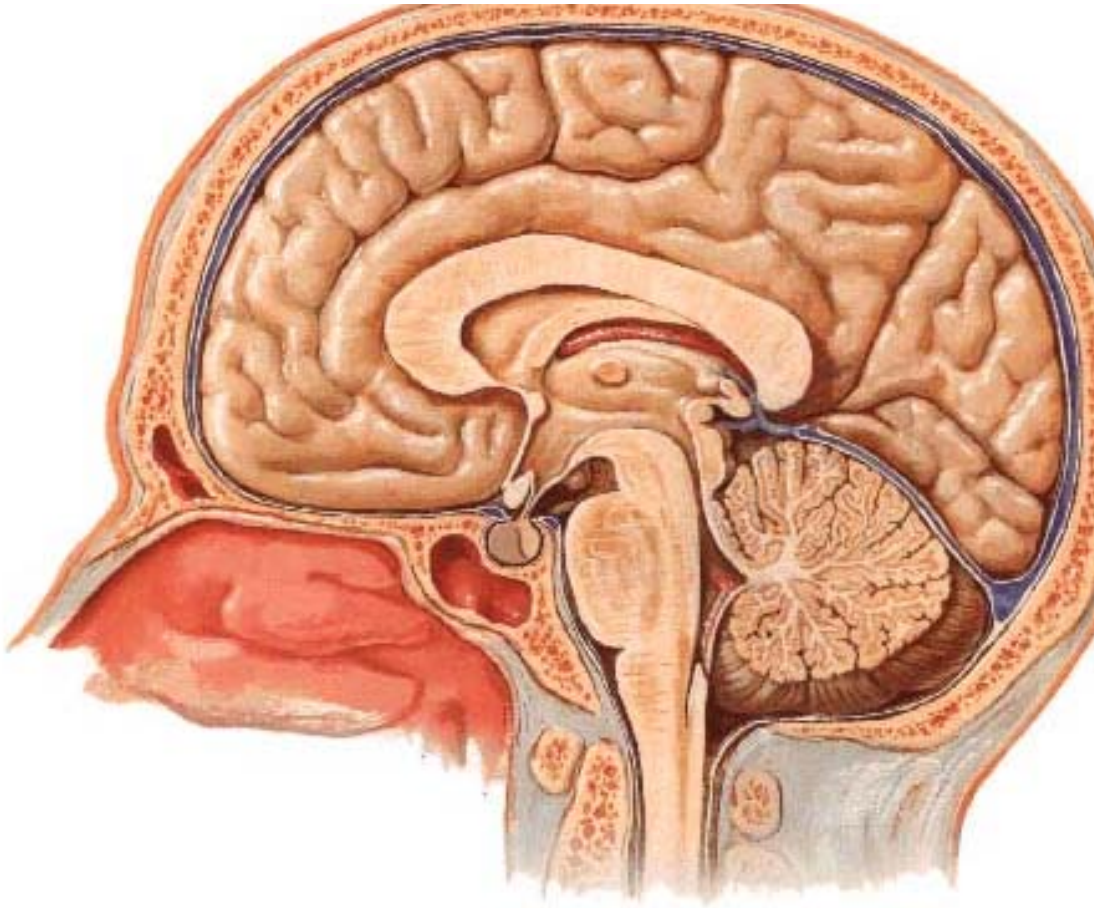
Brain (Encephalon)

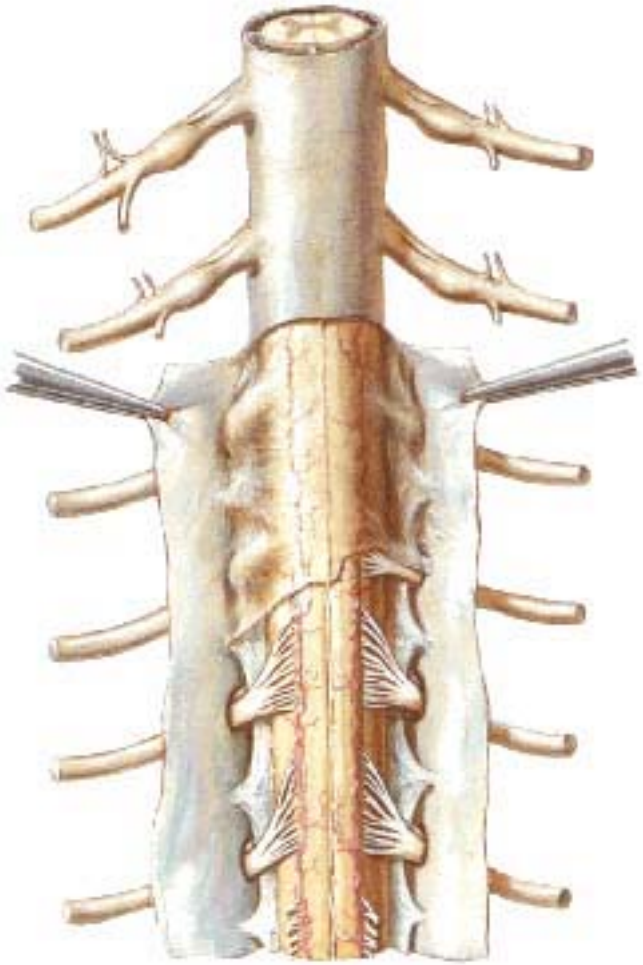
Spinal Cord (Sp. Medulla)



Parts

- Cerebrum
- Cerebellum
- Brain Stem
  - -Mid Brain
  - -Pons
  - -Medulla





PNS (Peripheral Nervous system)

Two Components

1. ***Somatic*** (Cerebrospinal)

---12 Pair Cranial Nerves

----31 pair Spinal Nerves

2. ***Visceral*** (Autonomic Nervous System – ANS)

----Visceral or Splanchnic nerves

two – subdivisions

i) Sympathetic

ii) Parasympathetic

Somatic Component

- Deals with any change in external environment – Extroceptive or Proprioceptive

General Sensations like

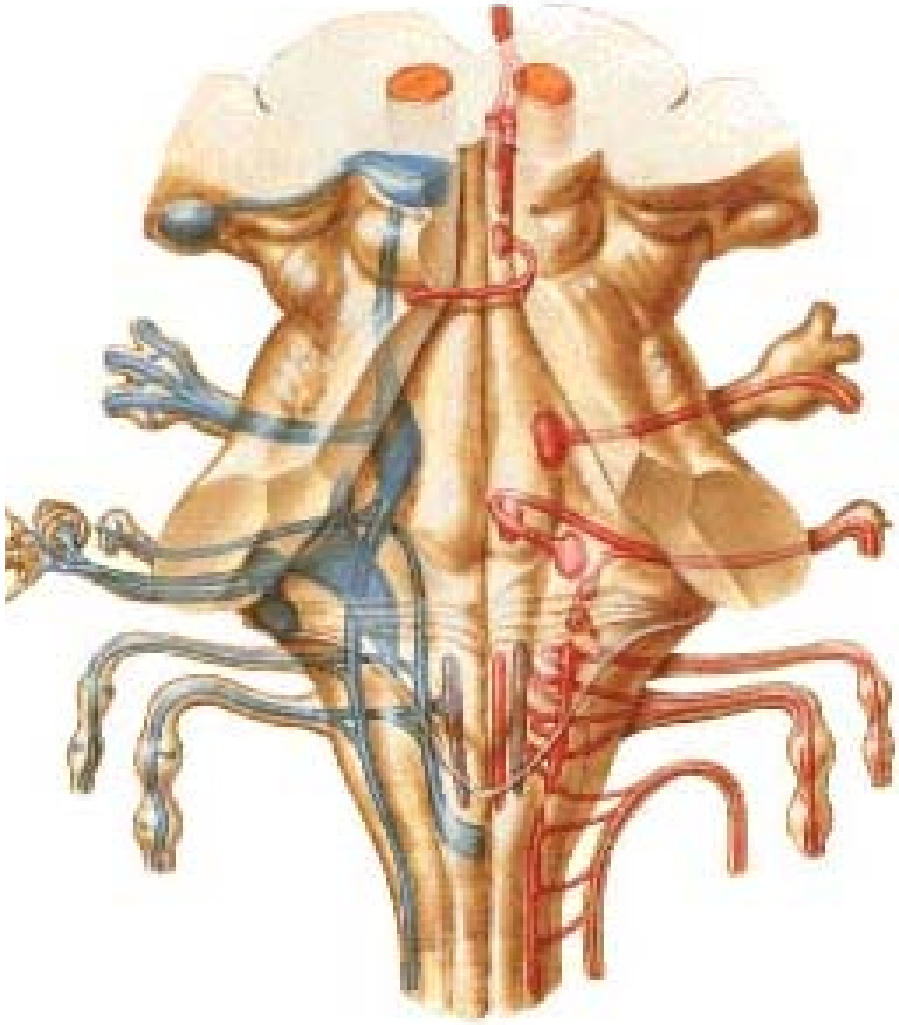
- Pain , Touch , Temp. --- From Skin
- Sensations from muscles , bones , joints, limbs

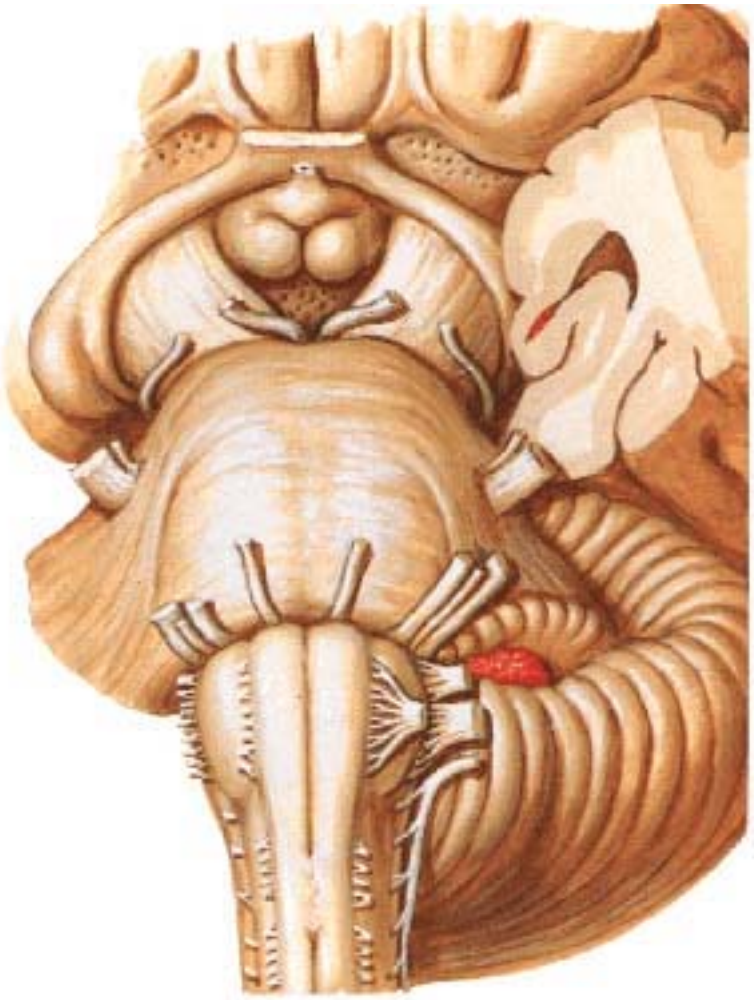
Special Sensations like

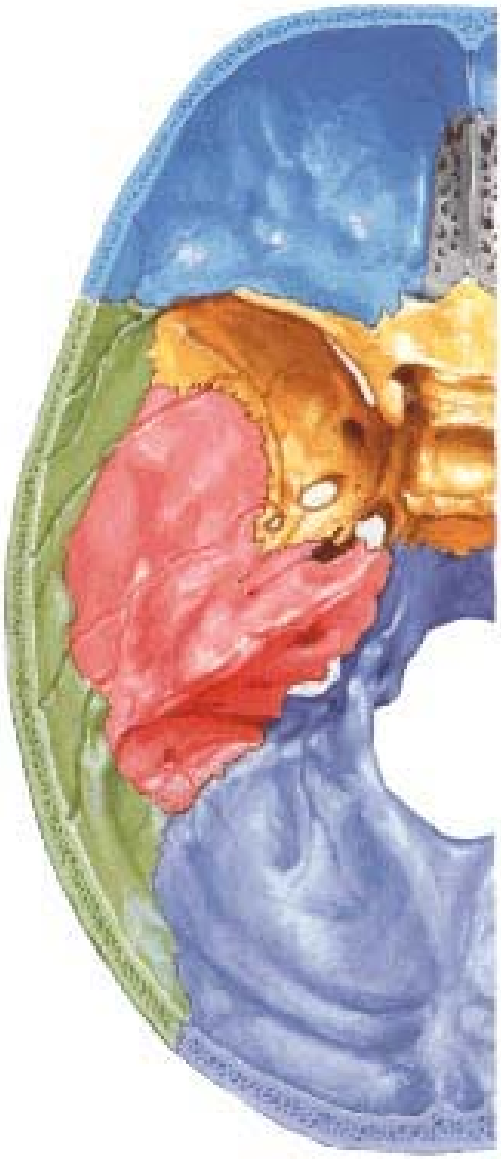
- Vision
- Hearing
- Balancing – Through vestibular receptors

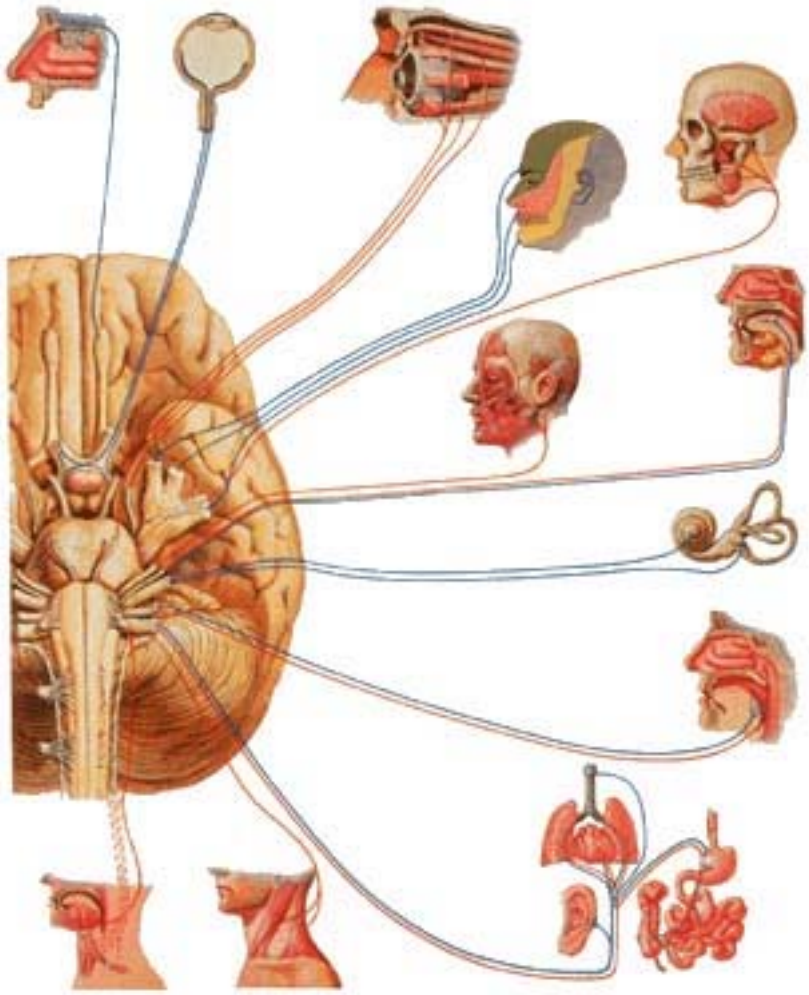
Cranial Nerves

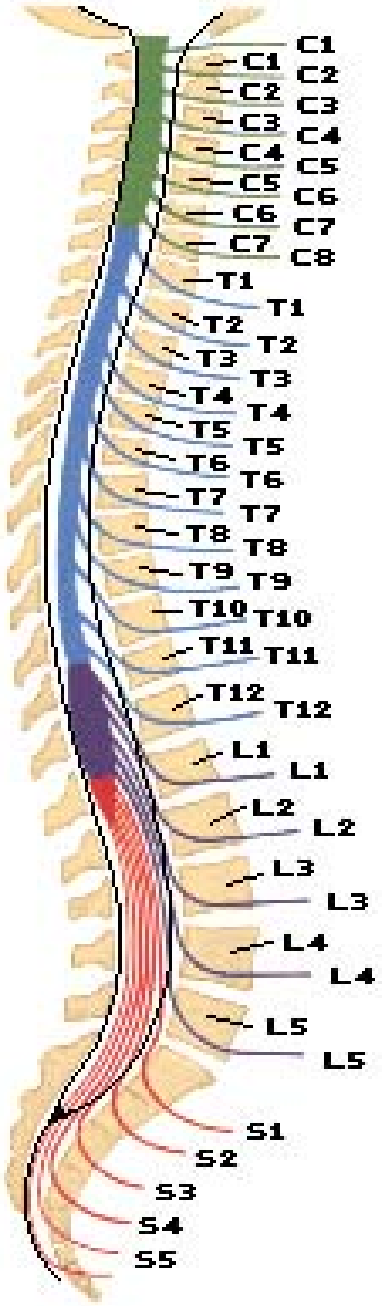
1. **OLFACTORY**
2. **OPTIC**
3. **OCCULOMOTOR**
4. **TROCHLEAR**
5. **TRIGERMINAL**
6. **ABDUCENT**
7. **FACIAL**
8. **VESTIBULO-COCLEAR**
9. **GLOSSOPHARYNGEAL**
10. **VAGUS**
11. **ACCESSORY**
12. **HYPOGLOSSAL**











31 Pairs Spinal Nerves

Includes

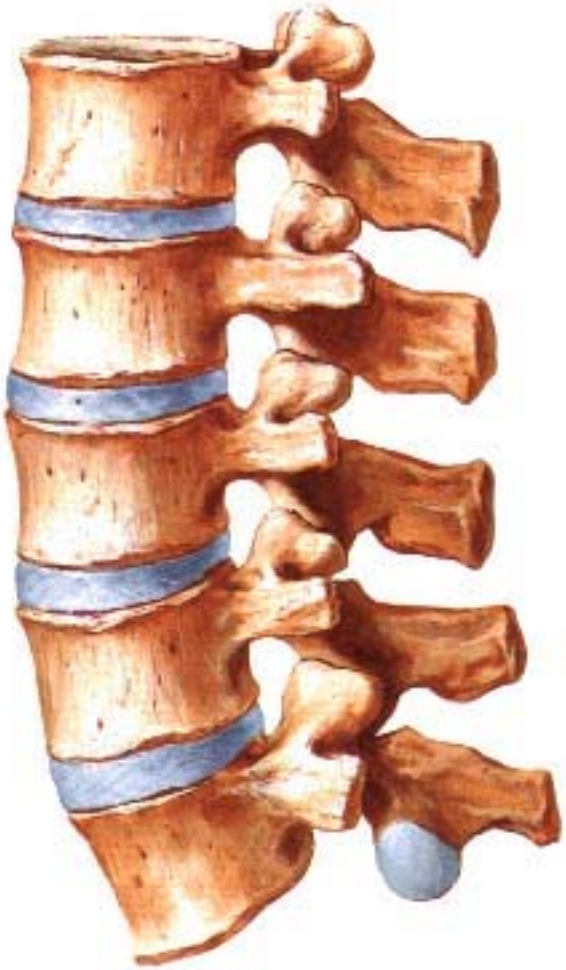
Cervical -8 (C1 ----C8)

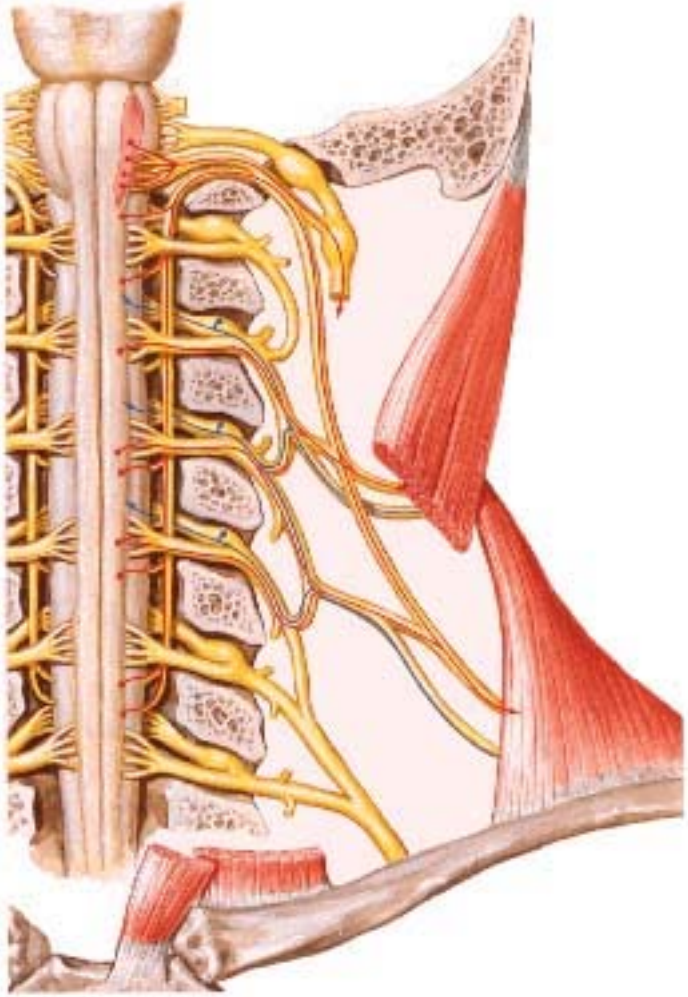
Thoracic -12 (T1-T12)

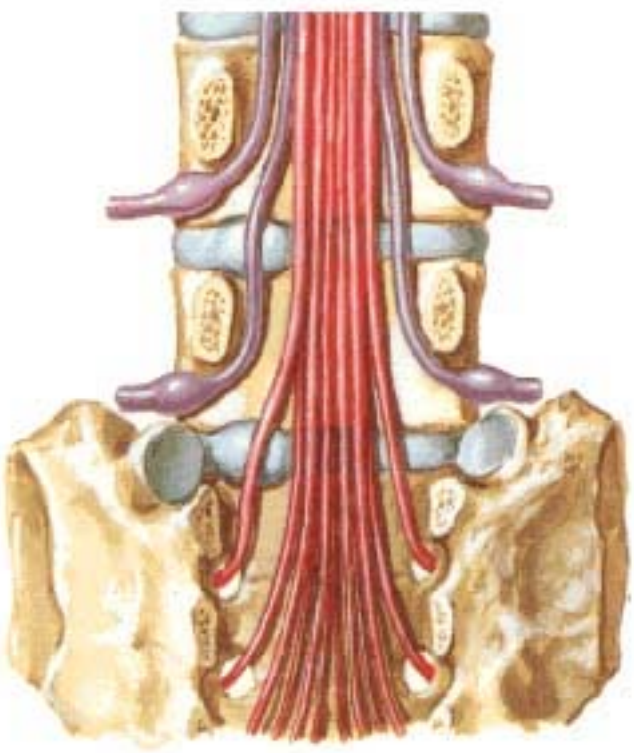
Lumbar – 5 (L1-L5)

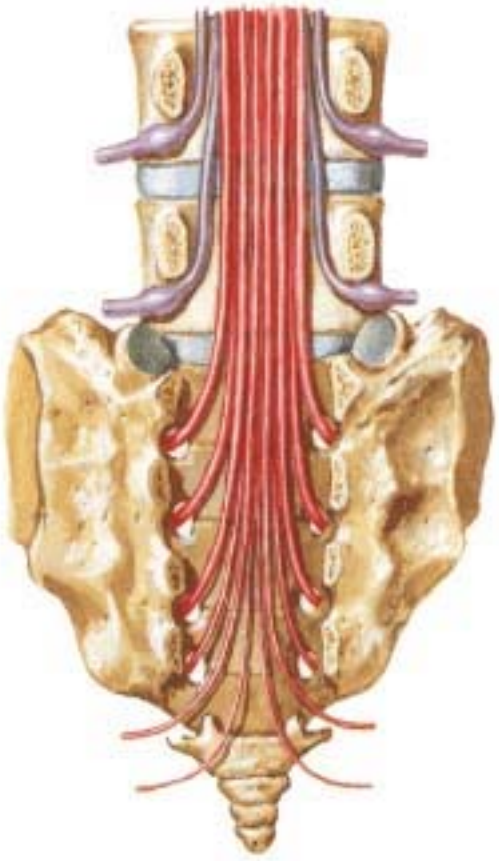
Sacral _ 5 (S1– S5)

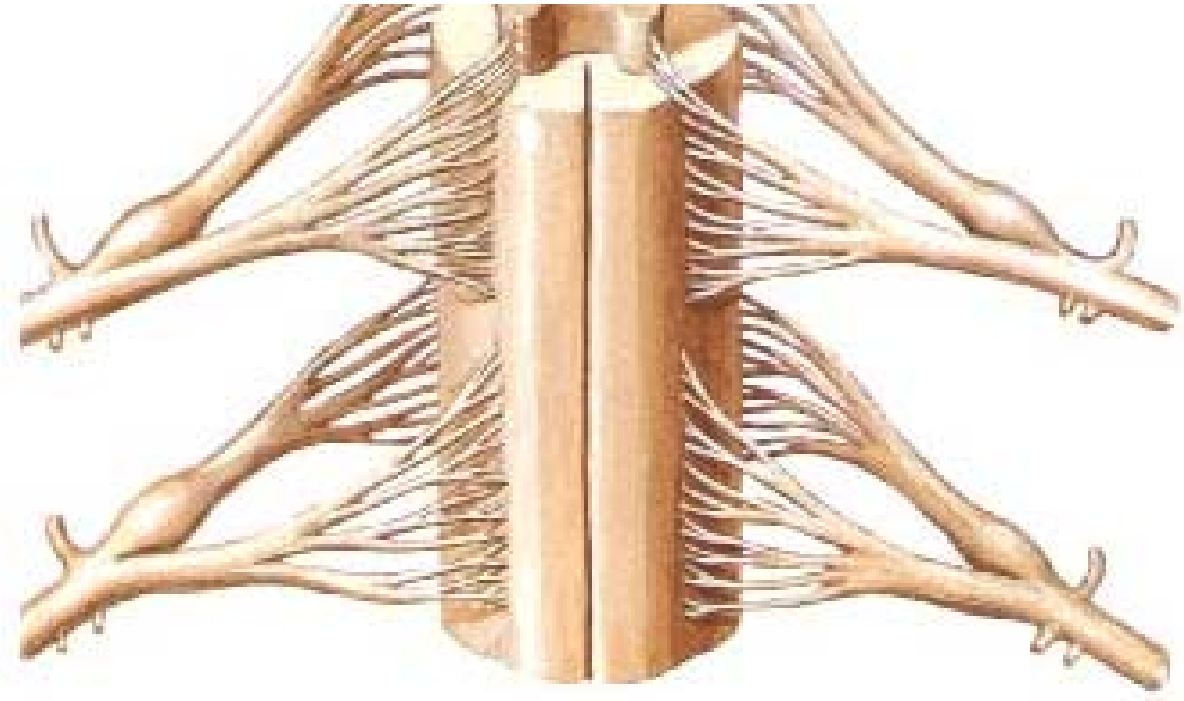
Coccyx – 1 (Co -1)











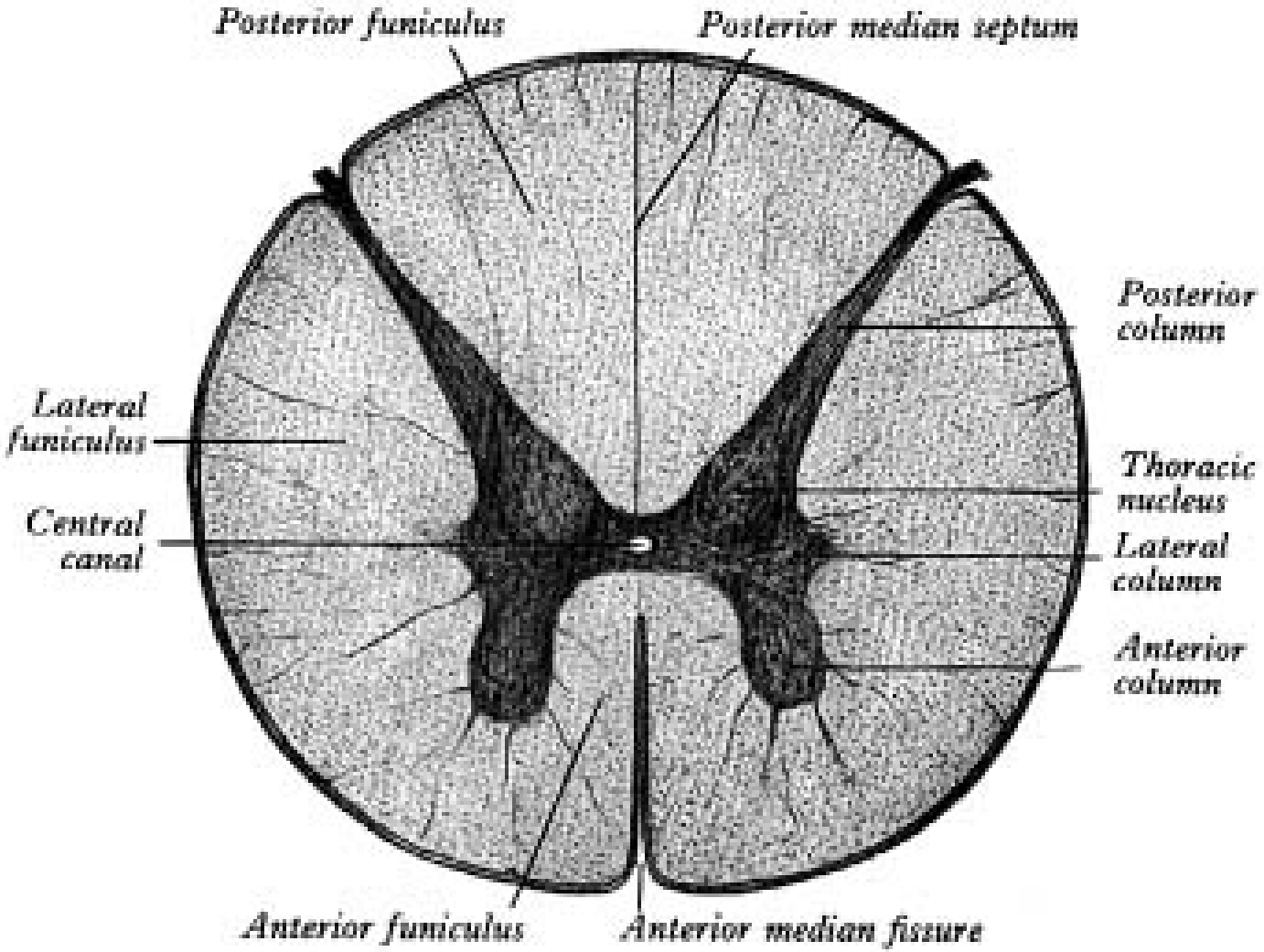
Spinal Nerve

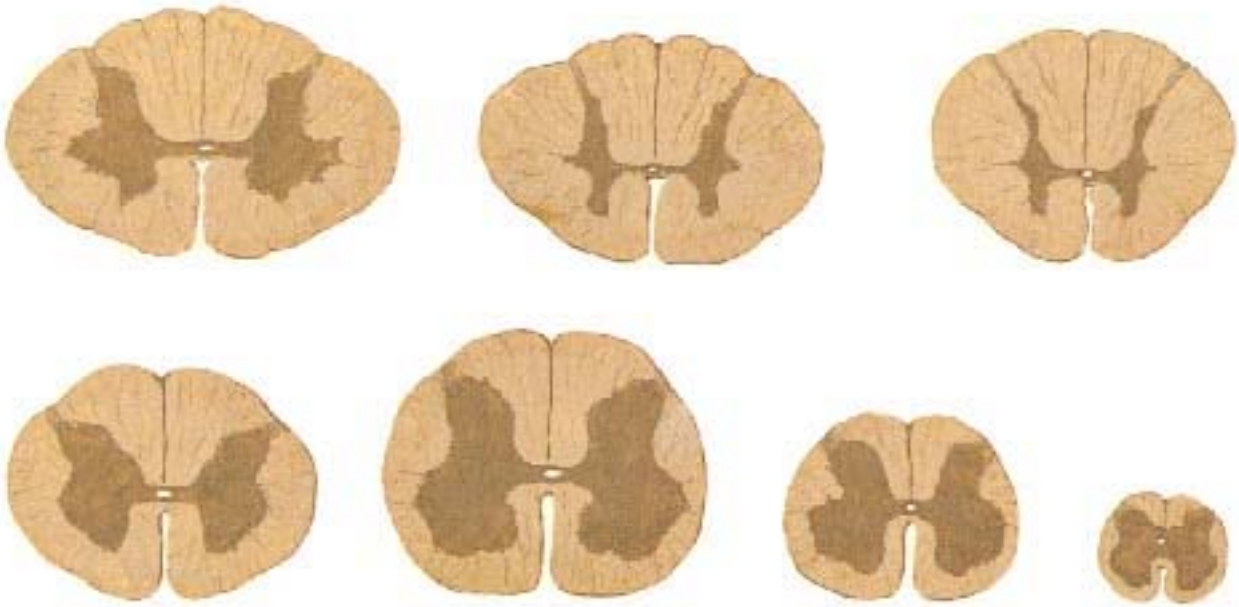
Joining of ant. and Post. nerve roots

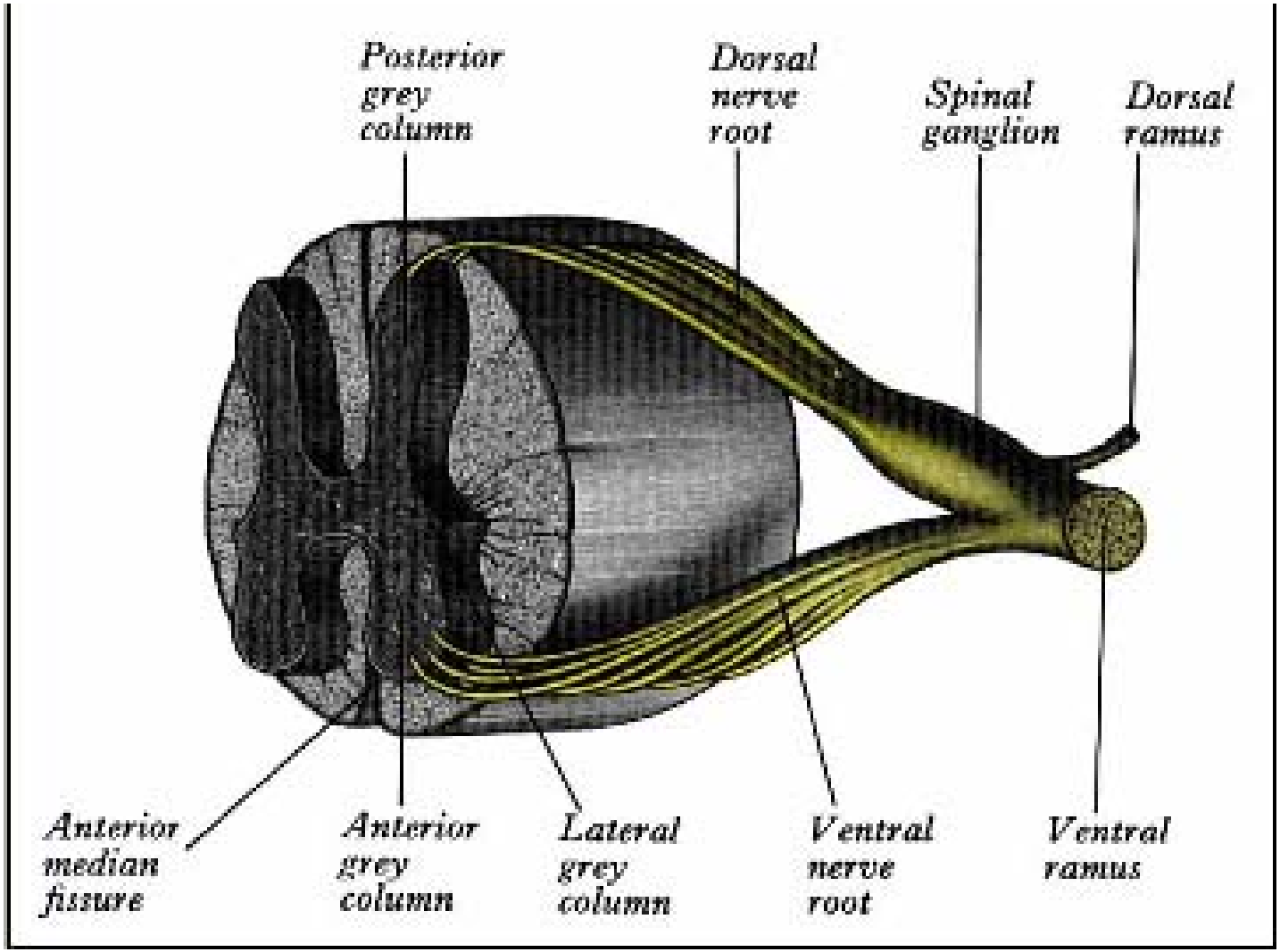
Spinal Segment

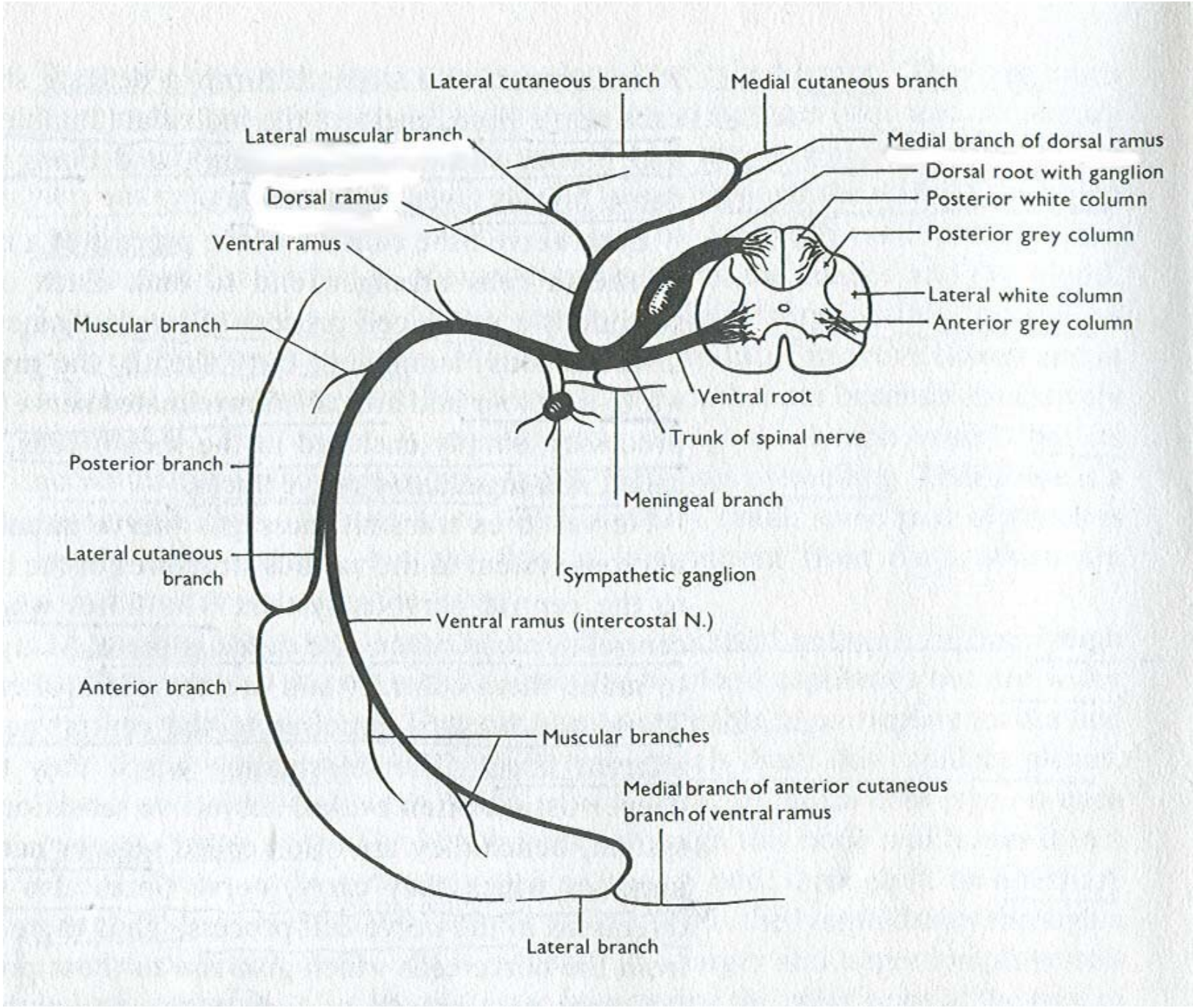
Length of the spinal cord originating rootlets of one

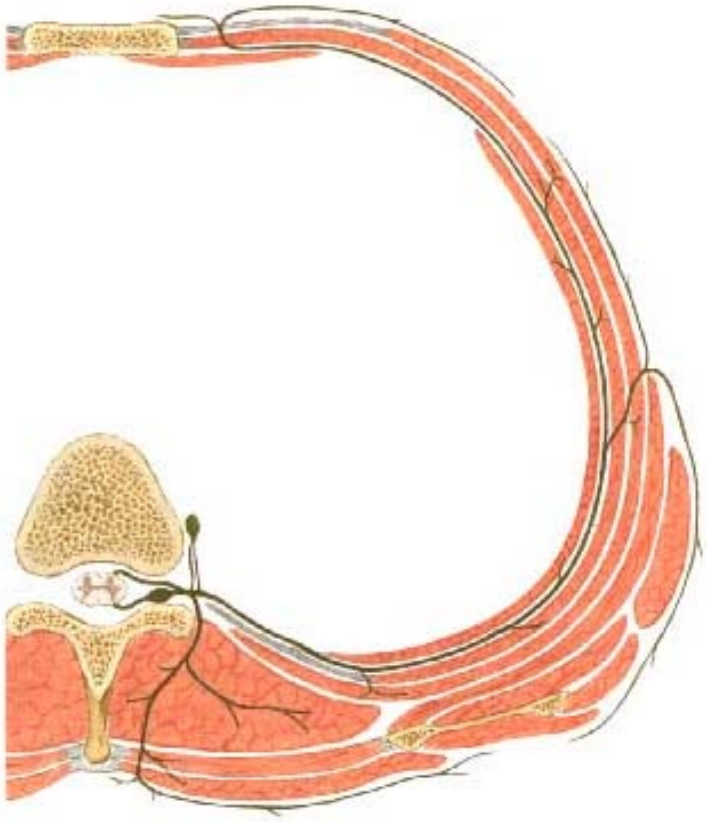
spinal nerve


Posterior funiculus
Posterior median septum
Posterior column
Lateral funiculus
Thoracic nucleus
Central canal
Lateral column
Anterior column
Anterior funiculus
Anterior median fissure




Posterior grey column
Dorsal nerve root
Spinal ganglion
Dorsal ramus
Anterior median fissure
Anterior grey column
Lateral grey column
Ventral nerve root
Ventral ramus


Lateral cutaneous branch
Medial cutaneous branch
Lateral muscular branch
Medial branch of dorsal ramus
Dorsal root with ganglion
Dorsal ramus
Posterior white column
Posterior grey column
Ventral ramus
Lateral white column
Anterior grey column
Muscular branch
Ventral root
Trunk of spinal nerve
Posterior branch
Meningeal branch
Lateral cutaneous branch
Sympathetic ganglion
Ventral ramus (intercostal N.)
Anterior branch
Muscular branches
Medial branch of anterior cutaneous branch of ventral ramus
Lateral branch



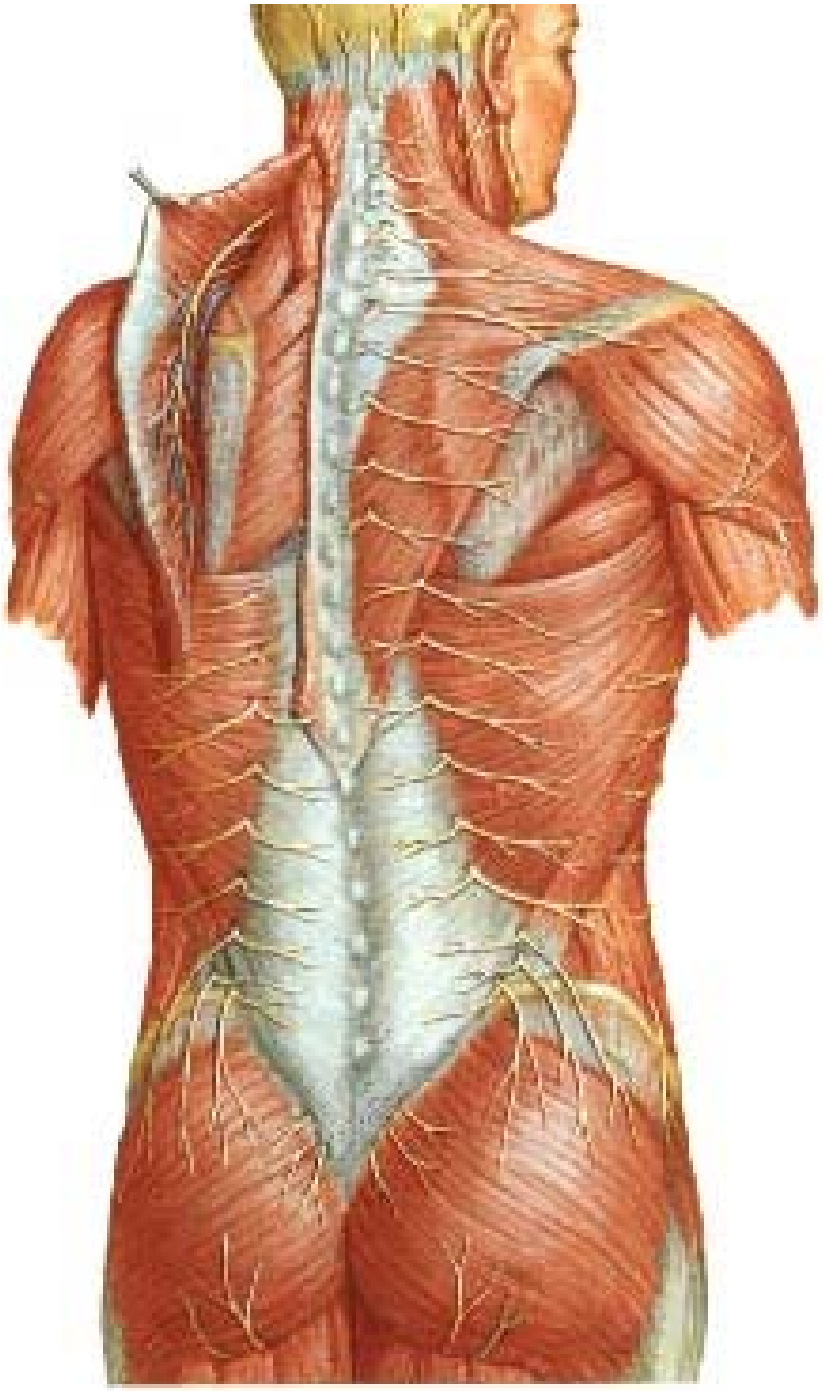
Spinal Nerve

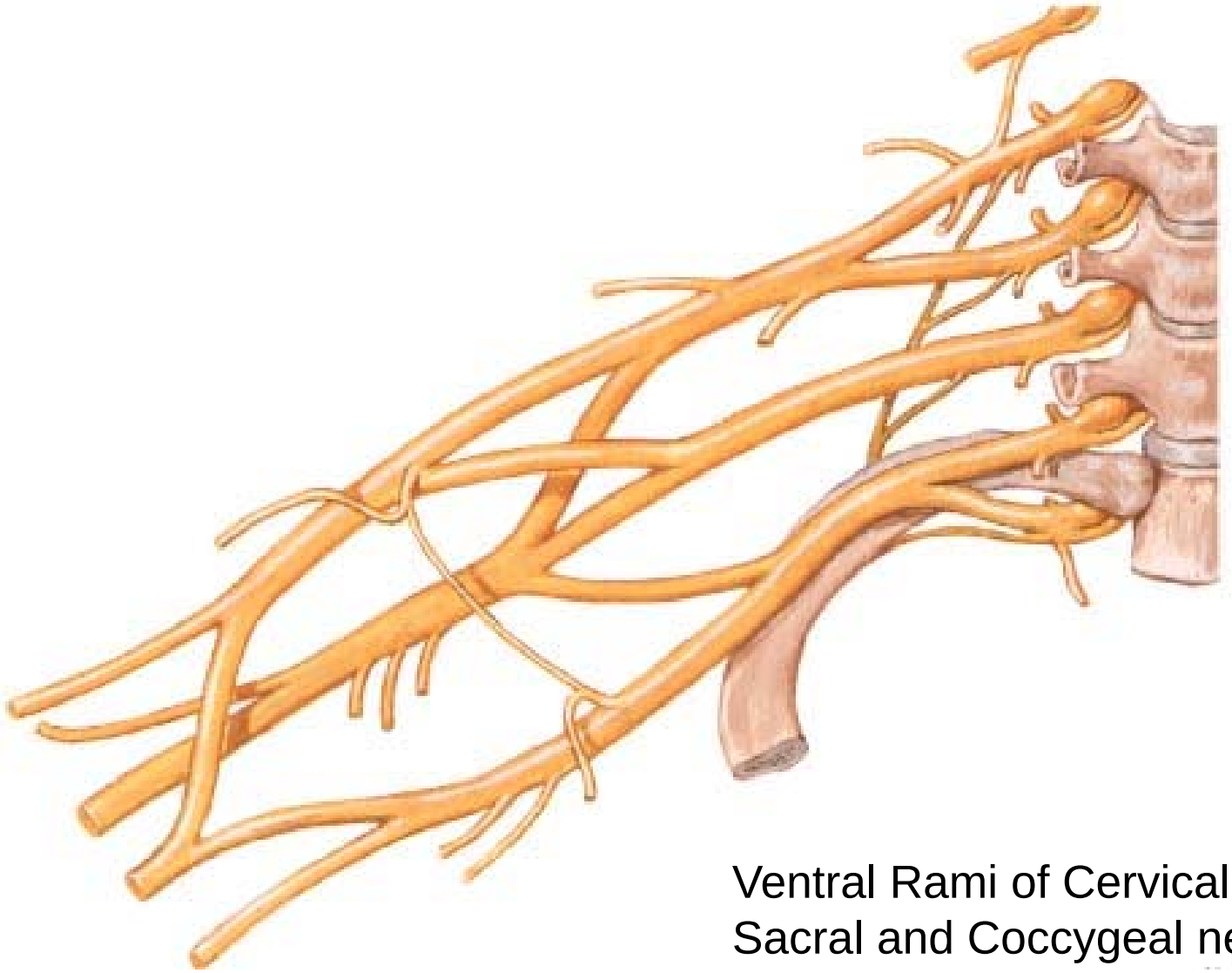
Dorsal Root & Ventral Root
Join to form trunk of spinal nerve
At intervertebral foramina

divide into Dorsal and ventral ramus

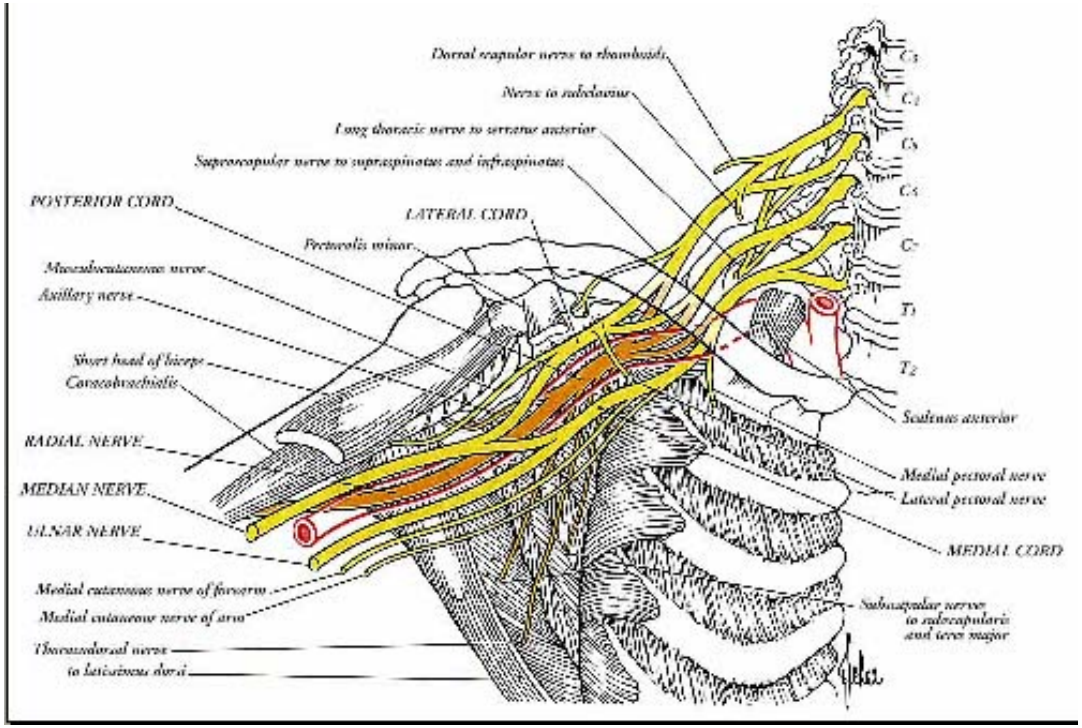
Dorsal ramus runs posteriorly and divide in Medial and Lateral Branches to supply muscles of back, and give cut. Branches

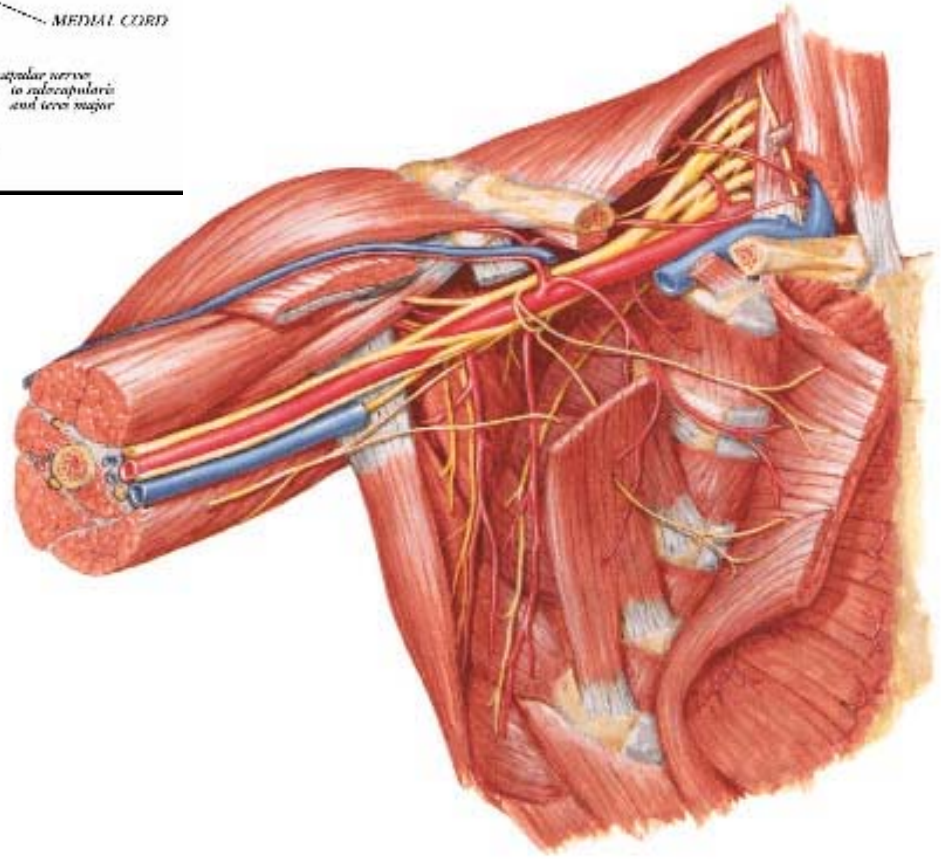
Ventral ramus runs anteriorly and give lateral cutaneous branch which further subdivide into:
Ant and post branches
Rest continue as ant. cutaneous Br.

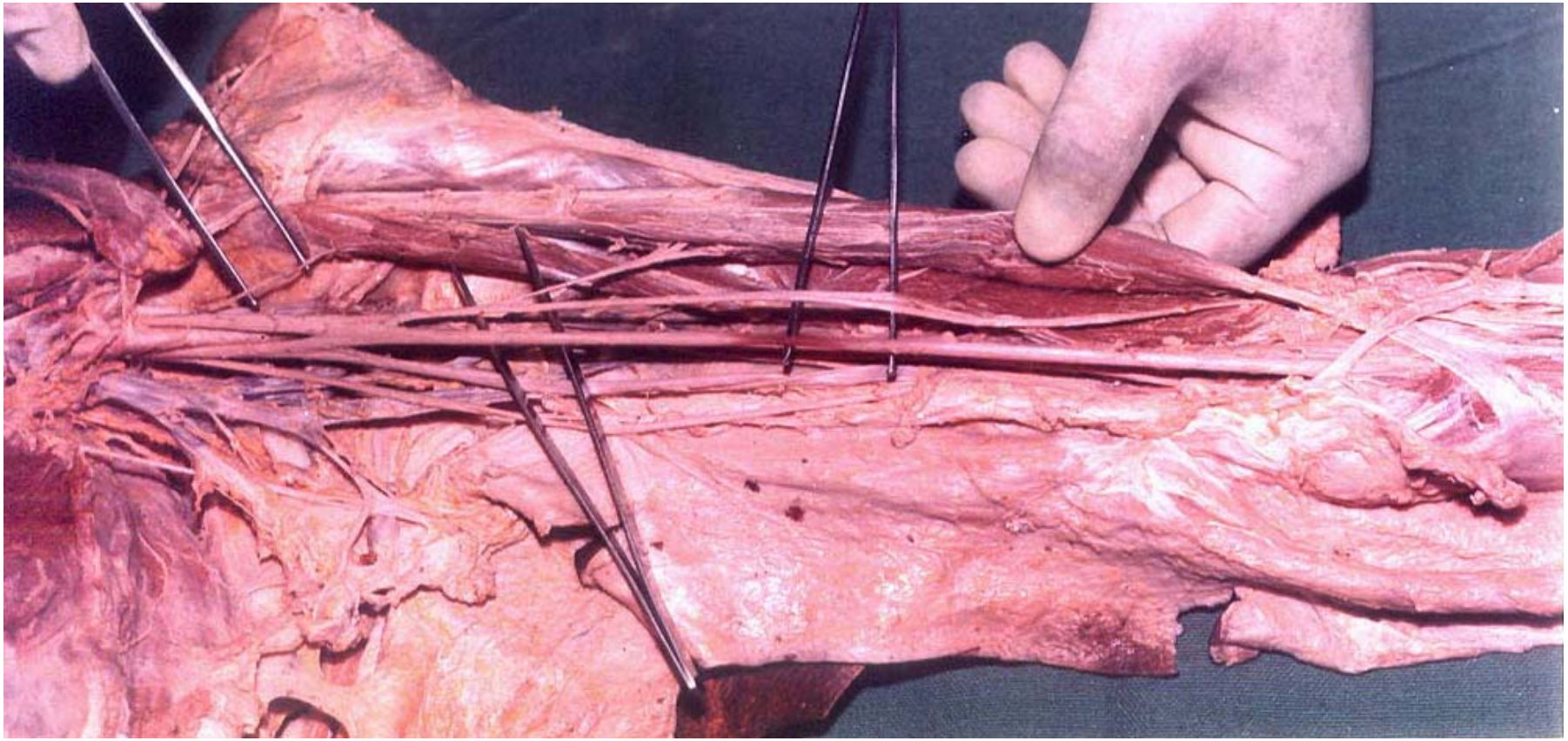


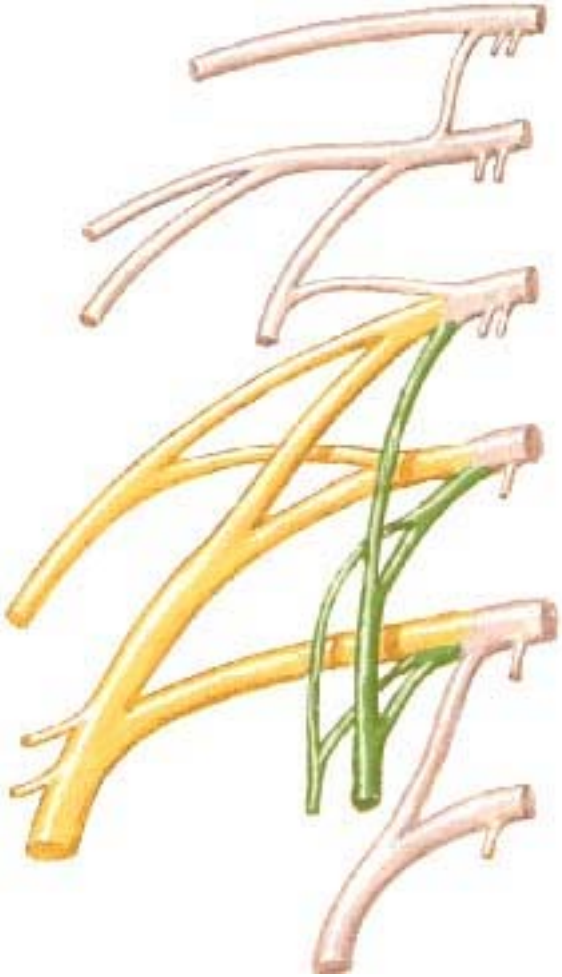


Ventral Rami of Cervical, Lumbar. Sacral and Coccygeal nerves join to form **Plexuses**

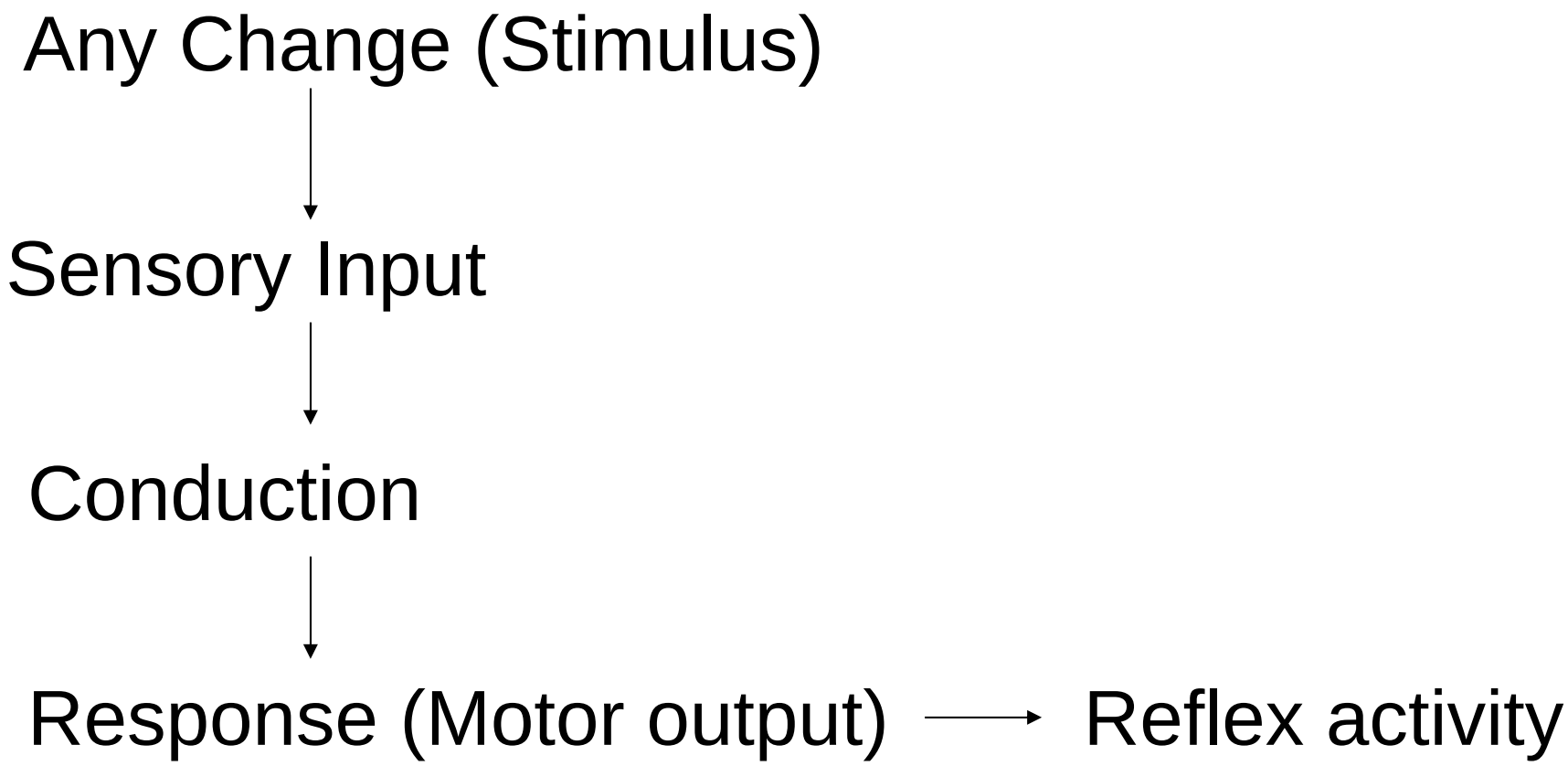

Dorsal scapular nerve to rhomboids
Nerve to subclavius
Long thoracic nerve to serratus anterior
Suprascapular nerve to supraspinatus and infraspinatus
POSTERIOR CORD
LATERAL CORD
Pectoralis minor
Musculocutaneous nerve
Axillary nerve
Short head of biceps
Coracobrachialis
RADIAL NERVE
MEDIAN NERVE
ULNAR NERVE
Medial cutaneous nerve of forearm
Medial cutaneous nerve of arm
Thoracodorsal nerve
to latissimus dorsi
C5
C6
C7
C8
T1
T2
Scalenus anterior
Medial pectoral nerve
Lateral pectoral nerve
MEDIAL CORD
Subscapular nerves
to subscapularis
and teres major







Mode Of Function



Visceral Component (ANS)

- Deals any change in internal environment (Interoceptive Or Viceroceptive)
- Called visceral or Splanchnic nerves
- Connected to CNS through somatic nerves
- Innervate –

  Viscera, Glands, Blood vessels,

  Nonstriated muscles

ANS

Activity expressed

- Regulation of Blood Pressure
- Regulation of Body Temperature
- Cardio-respiratory rate
- Gastro-intestinal motility
- Glandular Secretion

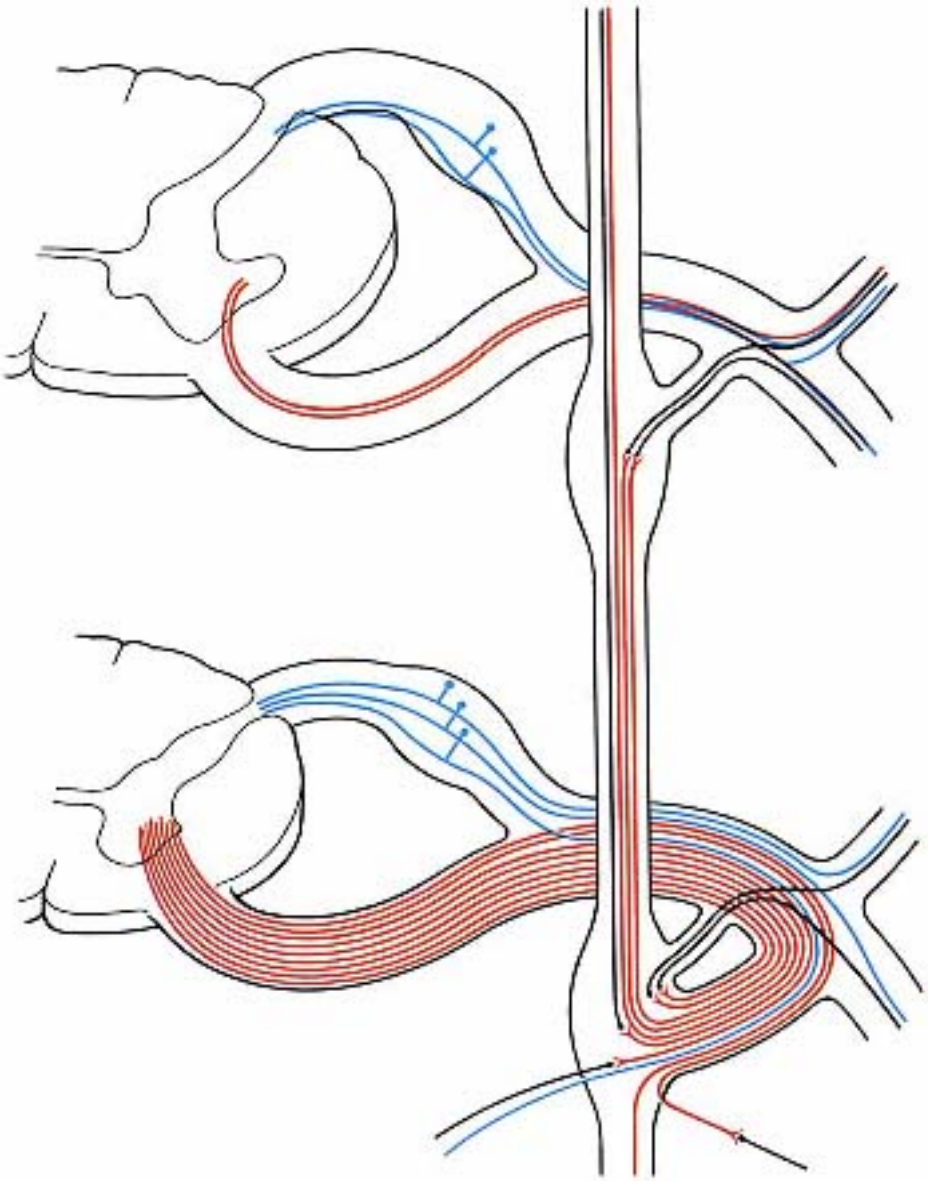
Sensations

- General – Hunger , Thirst , Nausea
- Special -- Smell, taste

and visceral pain

- Location of ANS in CNS:
  1. cerebral hemispheres (limbic system)
  2. Brain stem (general visceral nuclei of cranial nerves)
  3. Spinal cord (intermediate grey column)

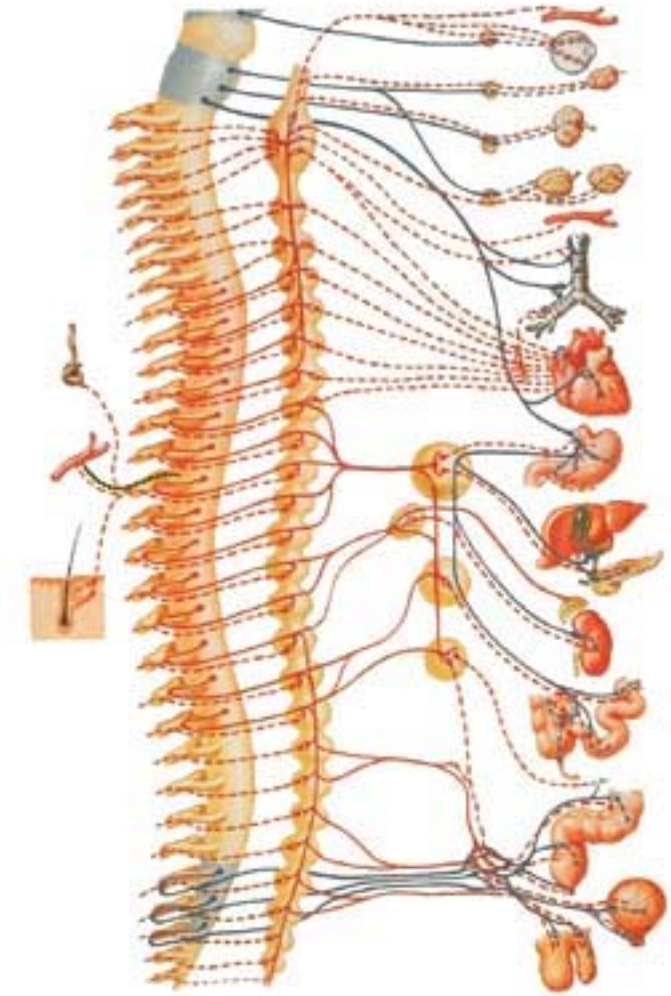
Sympathetic System

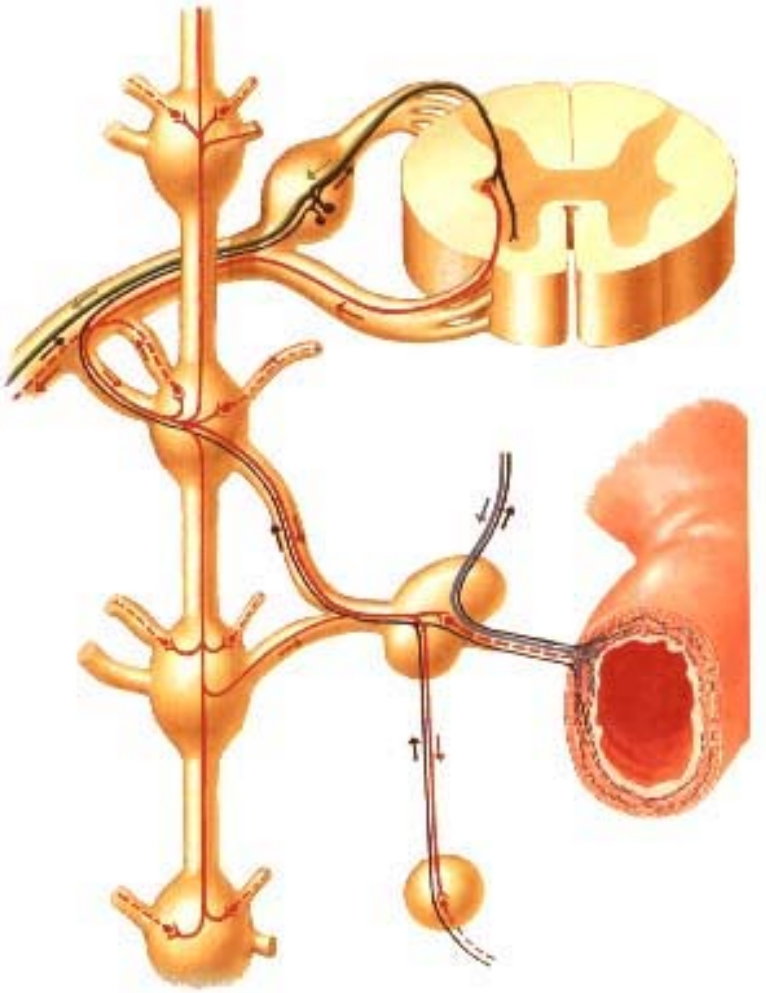


Called Thoracolumbar outflow
Arises from T1 – L2-3 Segment

Motor Preganglionic Fibres
(**White rami communicantes**)
Arise from lateral grey column
emerges through ventral rami and
connected to ganglia (lateral ganglia)
Of sympathetic chain or relay in
Collateral ganglia

Postganglionic fibres (**Grey rami Commucantis**) reach the organ of supply
ie. – involuntary muscles of hairs,
blood vessels, sweat glands
Sebaceous glands



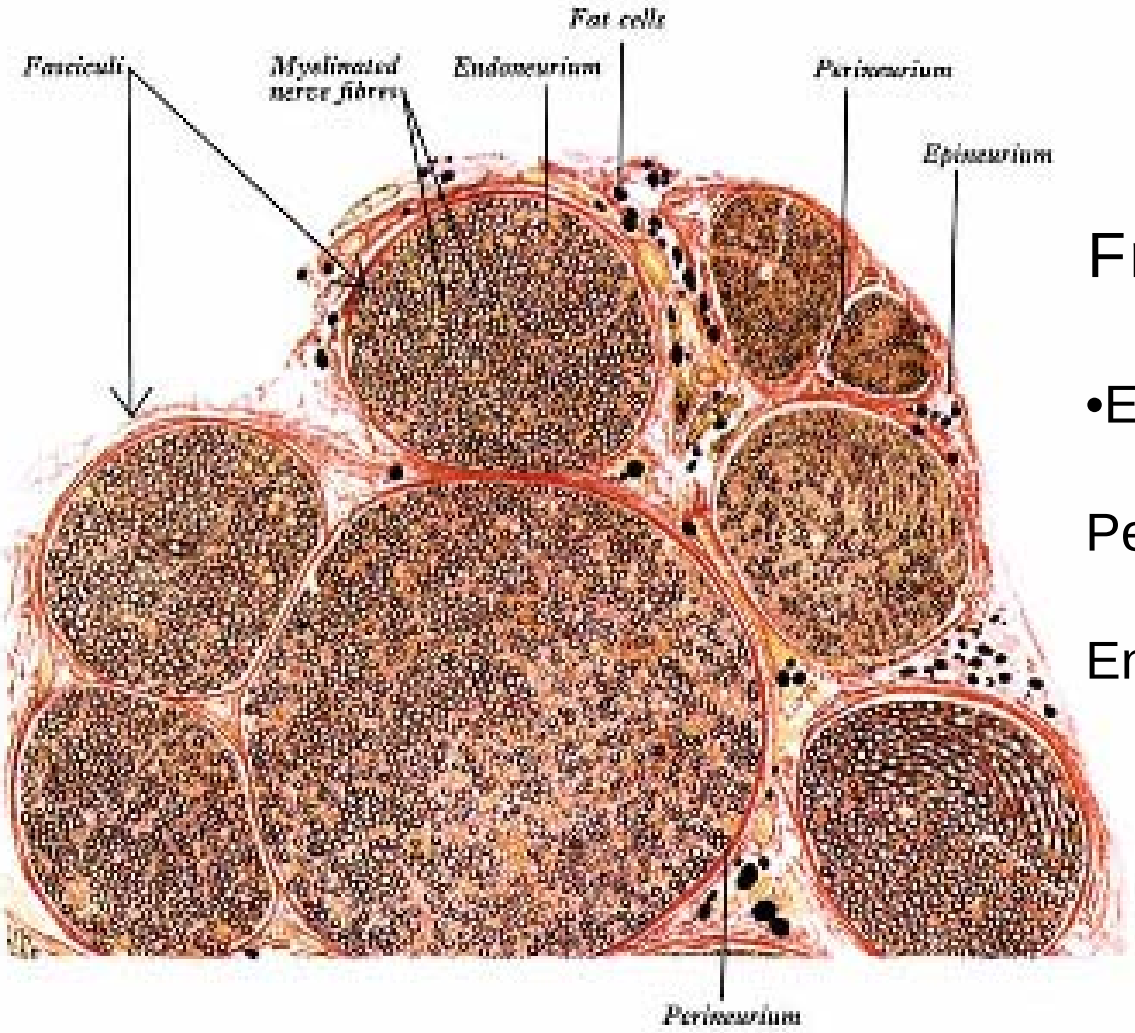


Sympathetic nerves are adrenergic in nature

Functionally – Vasomotor (vasoconstrictor), Sudomotor (Secretomotor to sweat glands) and Pilomotor (Contract arrector pili muscle)

Parasympathetic System

- Craniosacral outflow
- 3,7,9,10 cranial nerves and S2,3,4 segment
- Activity cholinergic in nature
- Preganglionic fibres are long
- Ganglia mostly on the viscera
- Postganglionic fibres short



From outside – inward

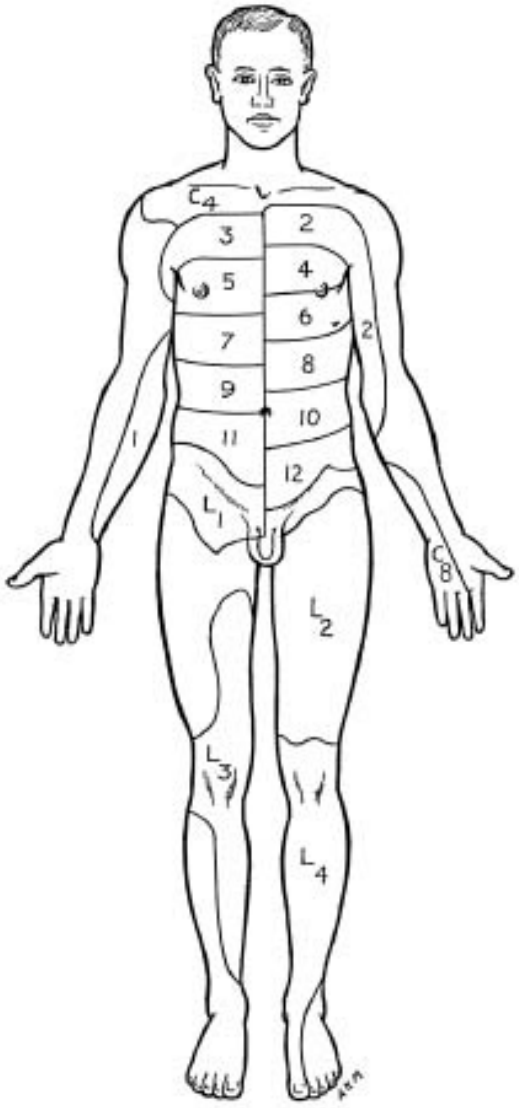
- Epineurium – whole nerve trunk

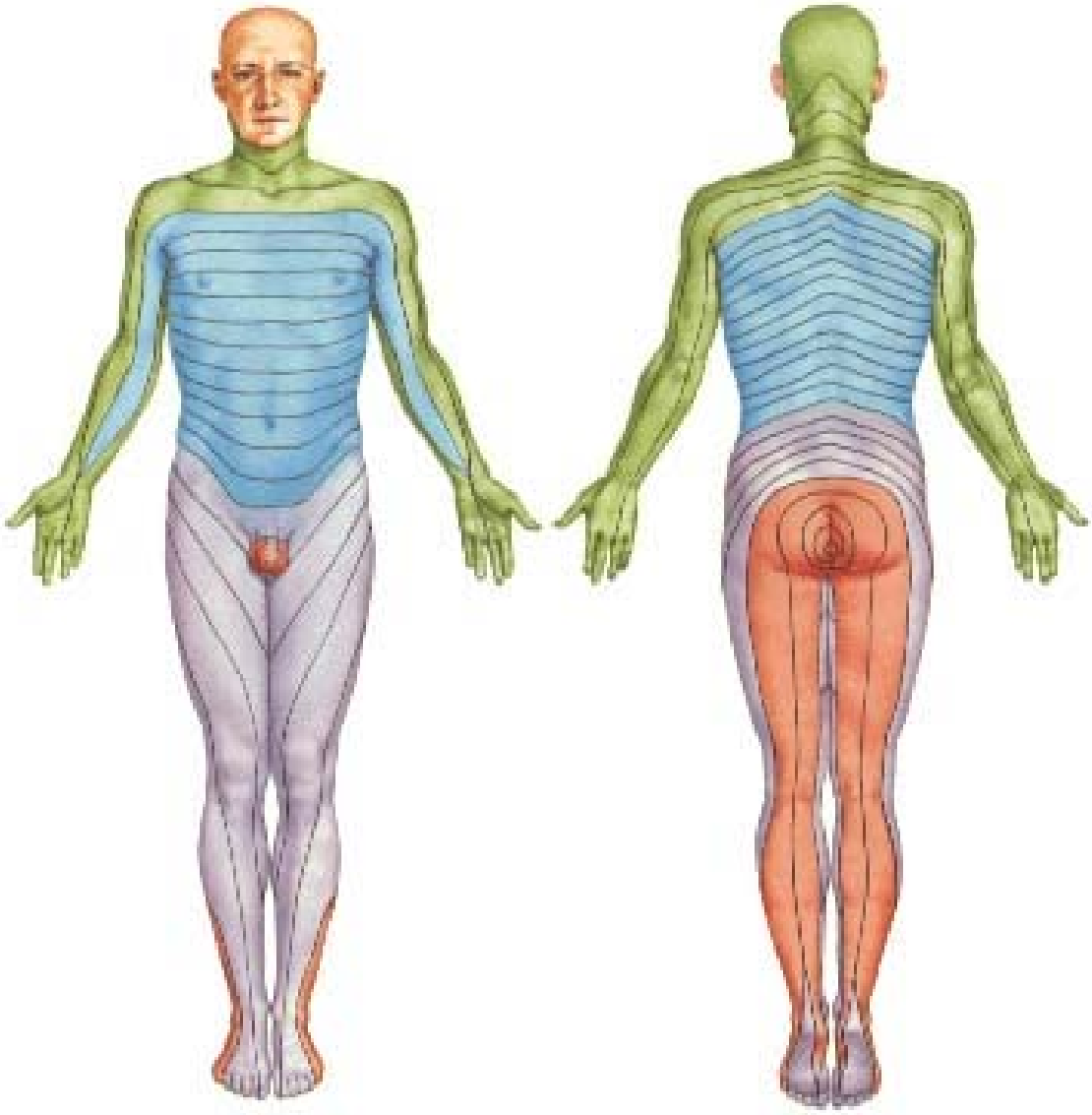
Perineurium –each fasciculus

Endoneurium – Each nerve fiber

Nerve – composed of bundle (Fasciculi) of nerve fiberes bounded by connective tissue sheath

Dermatome – Area of the skin supplied by a single segment of spinal cord



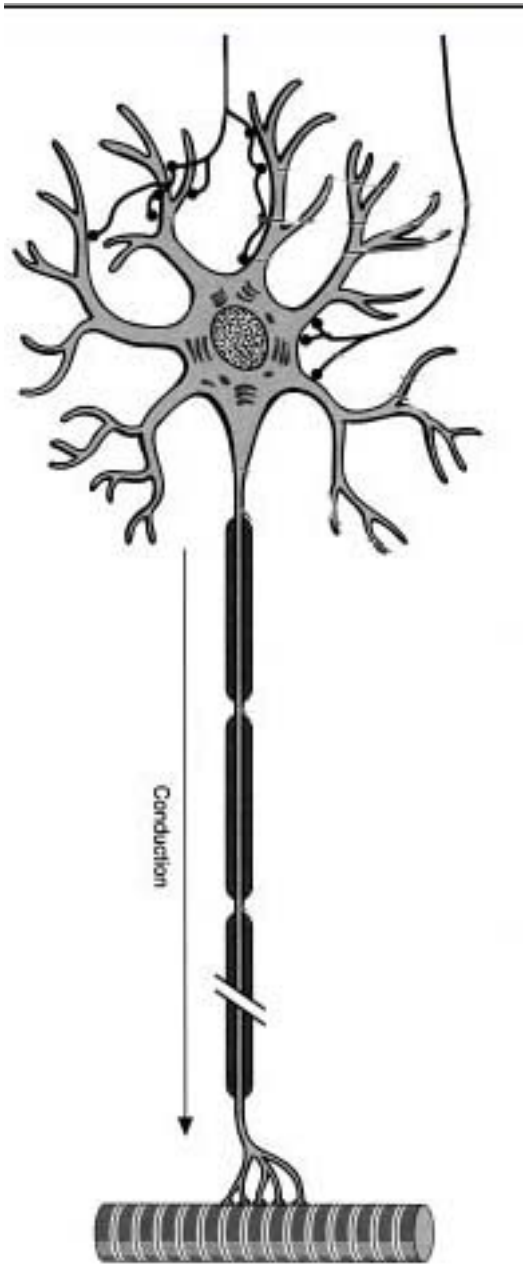


Cell Types in Nervous System

Functionally

- Excitable - Neuron (Nerve Cell)
  Vary in their Shape , Size, Function

- Non Excitable – Neuroglia
  -- Macroglia ,
  -- Microglia
- Ependymal Cells
- Schwann Cells - In PNS

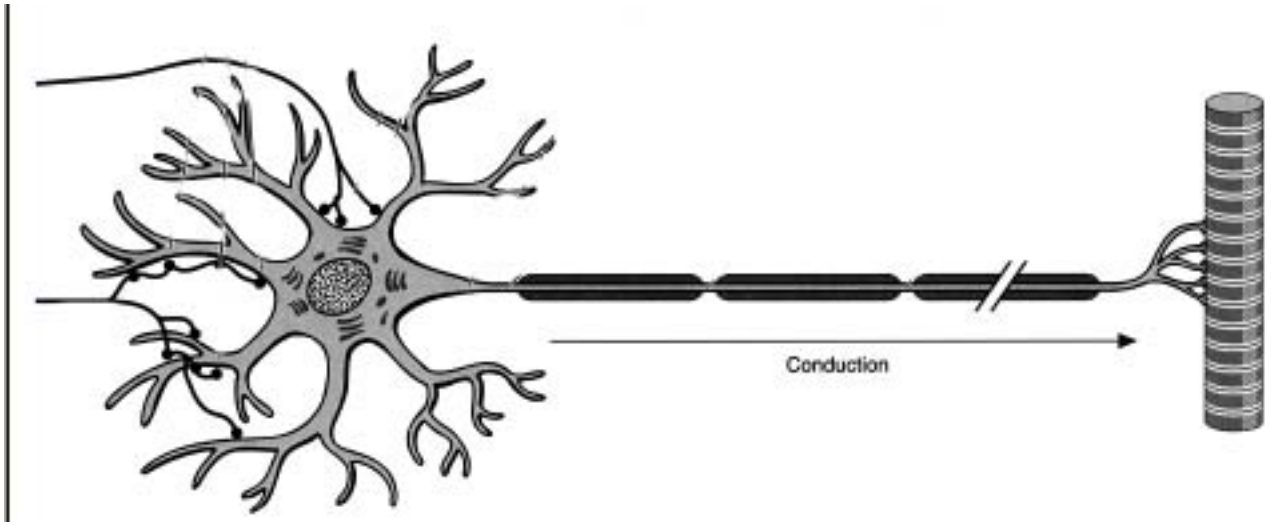


Neuron (Nerve Cell)

Components

1.Cell Body

2.Cell Processes



Cell Body - Dia vary from 5 µm – to up to 120 µm

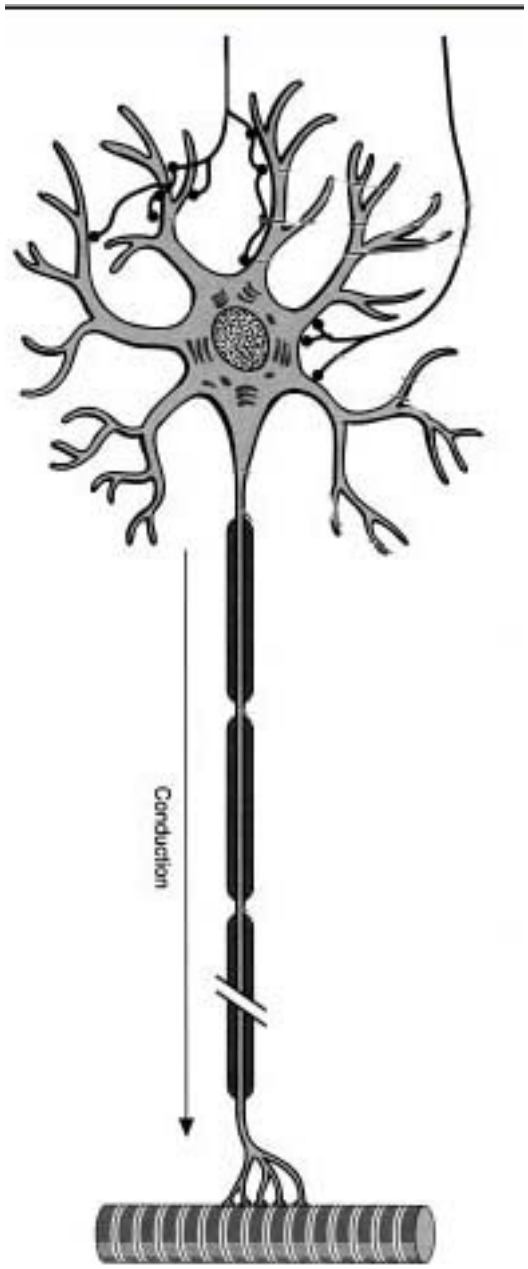
(Perikaryon) – Plasma memb

Nucleus

Cytoplasm

Axon Hillock

Neuronal Skeleton



Cell Processes

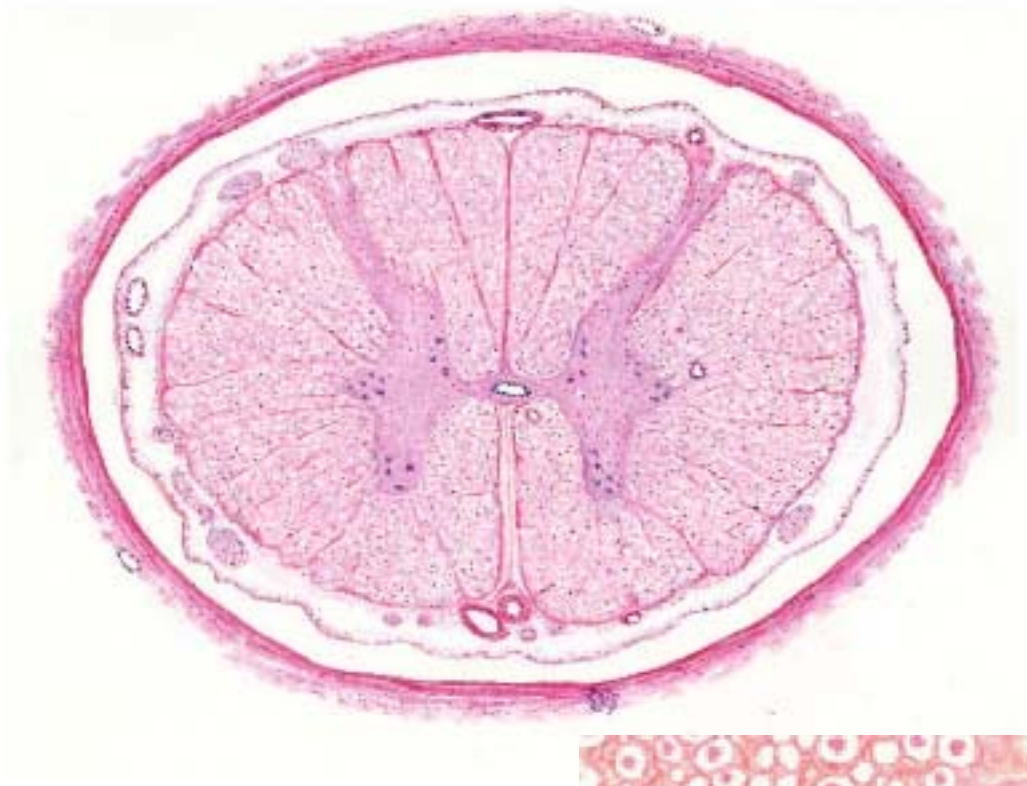
1.Dendrites : Short , irregular thickness. Freely Branching, Afferent processes , Contain Nissl Granules

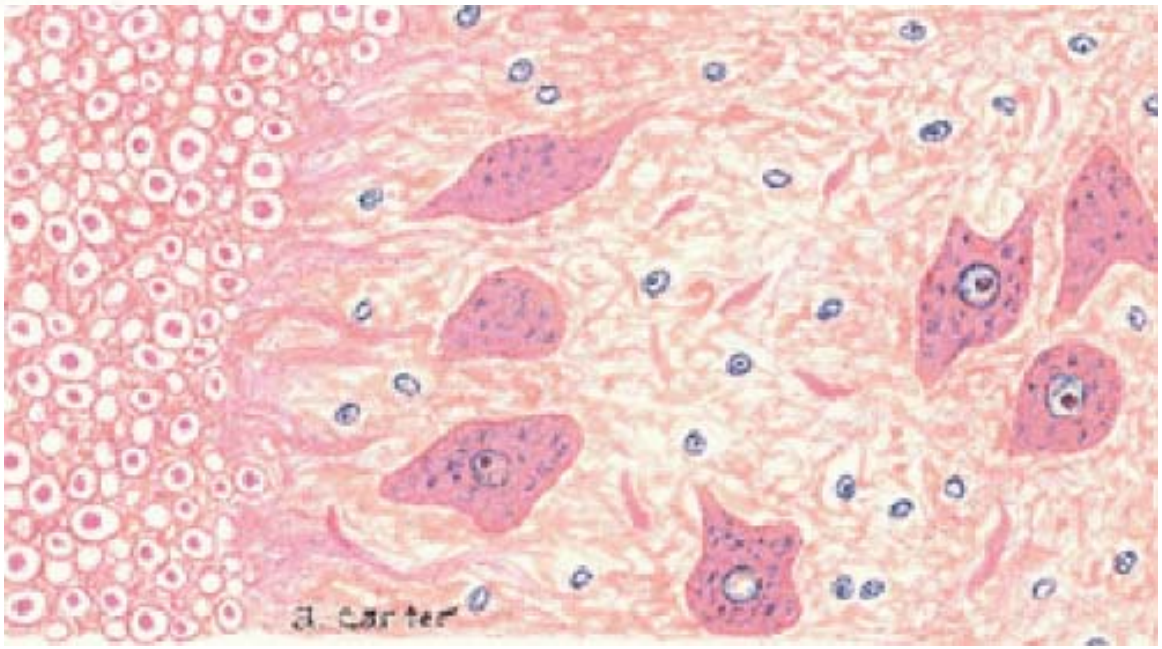
2. Axon –

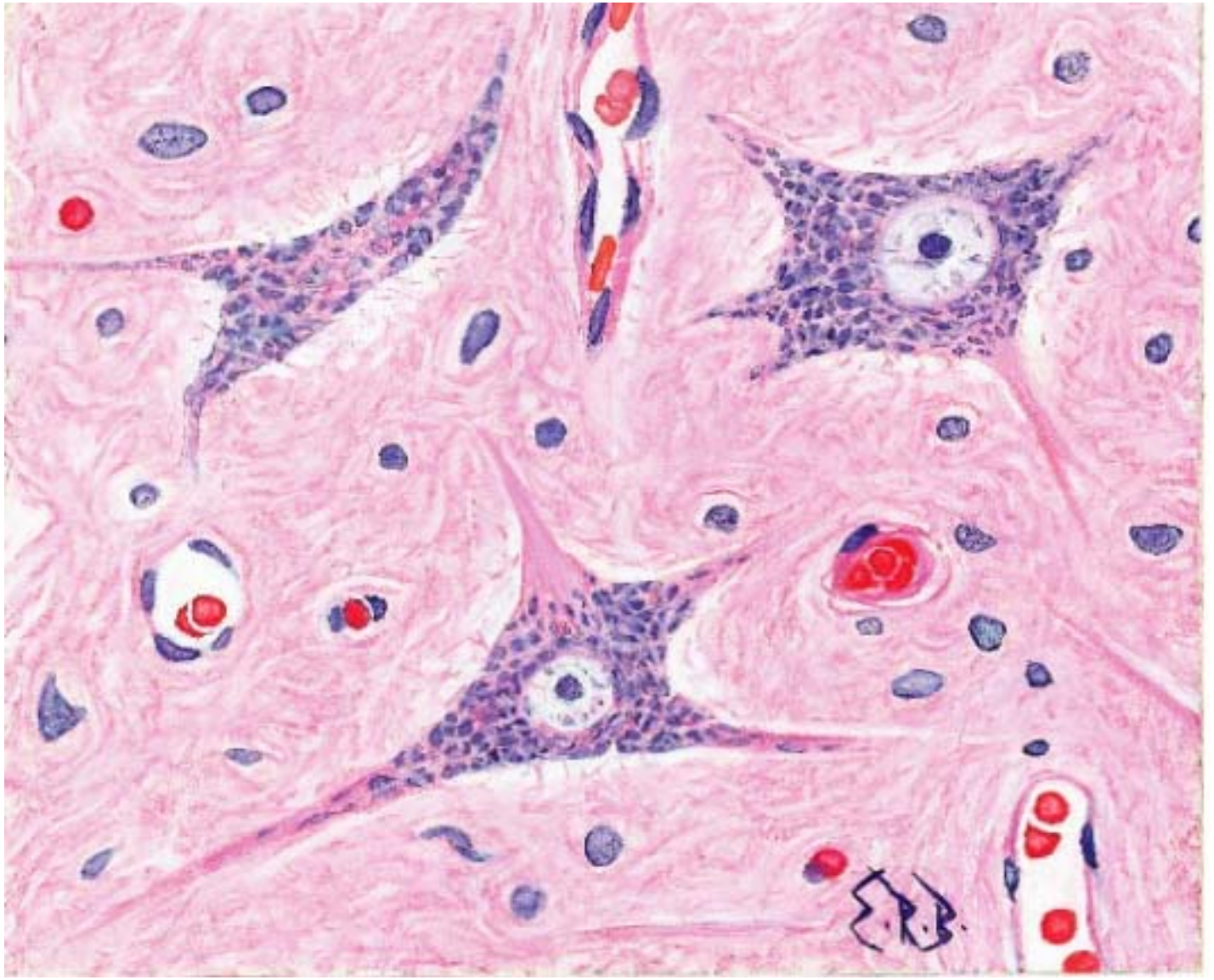
Long , Single, Efferent process of Uniform Diameter, Devoid of Nissl Granules, Ensheathed by Schwann cells, Gives collateral branches Terminal branches called telodendria (axon terminals)

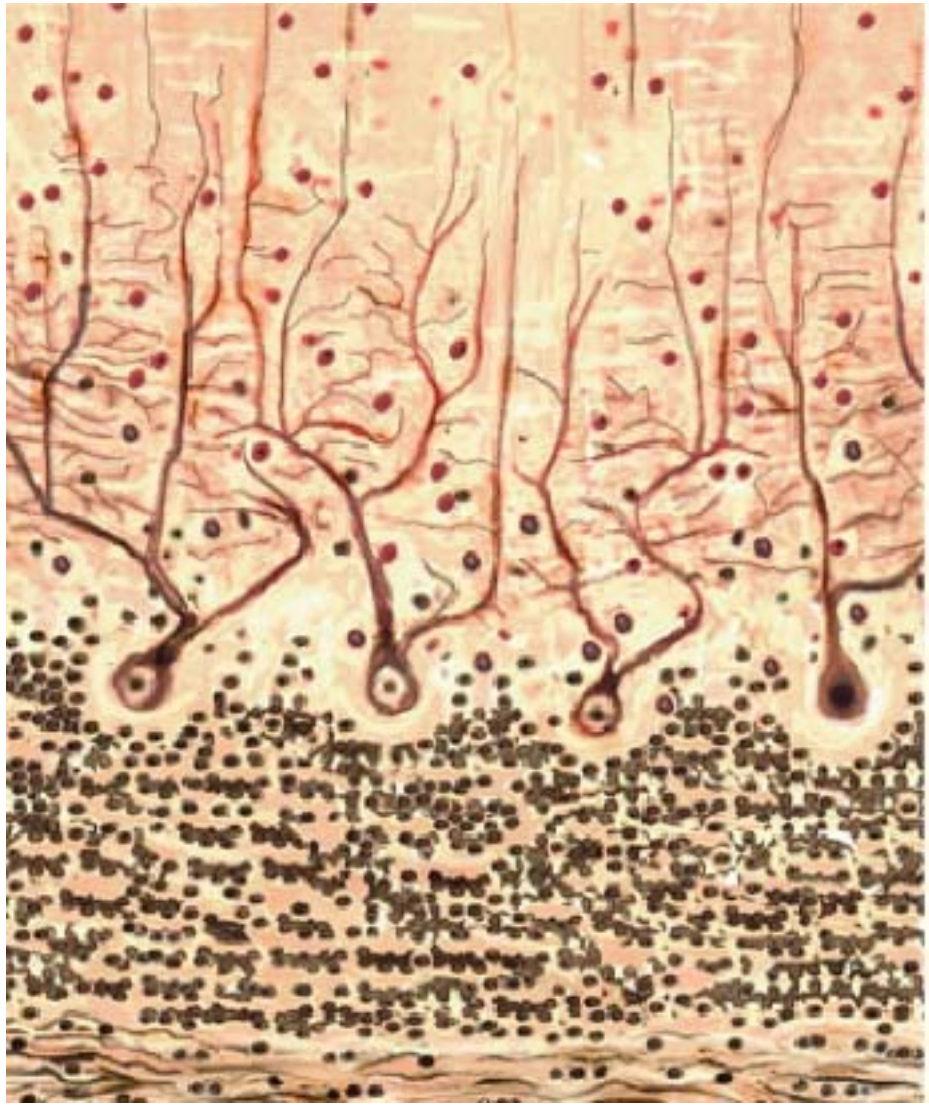
Terminate – within CNS - Always with another neuron

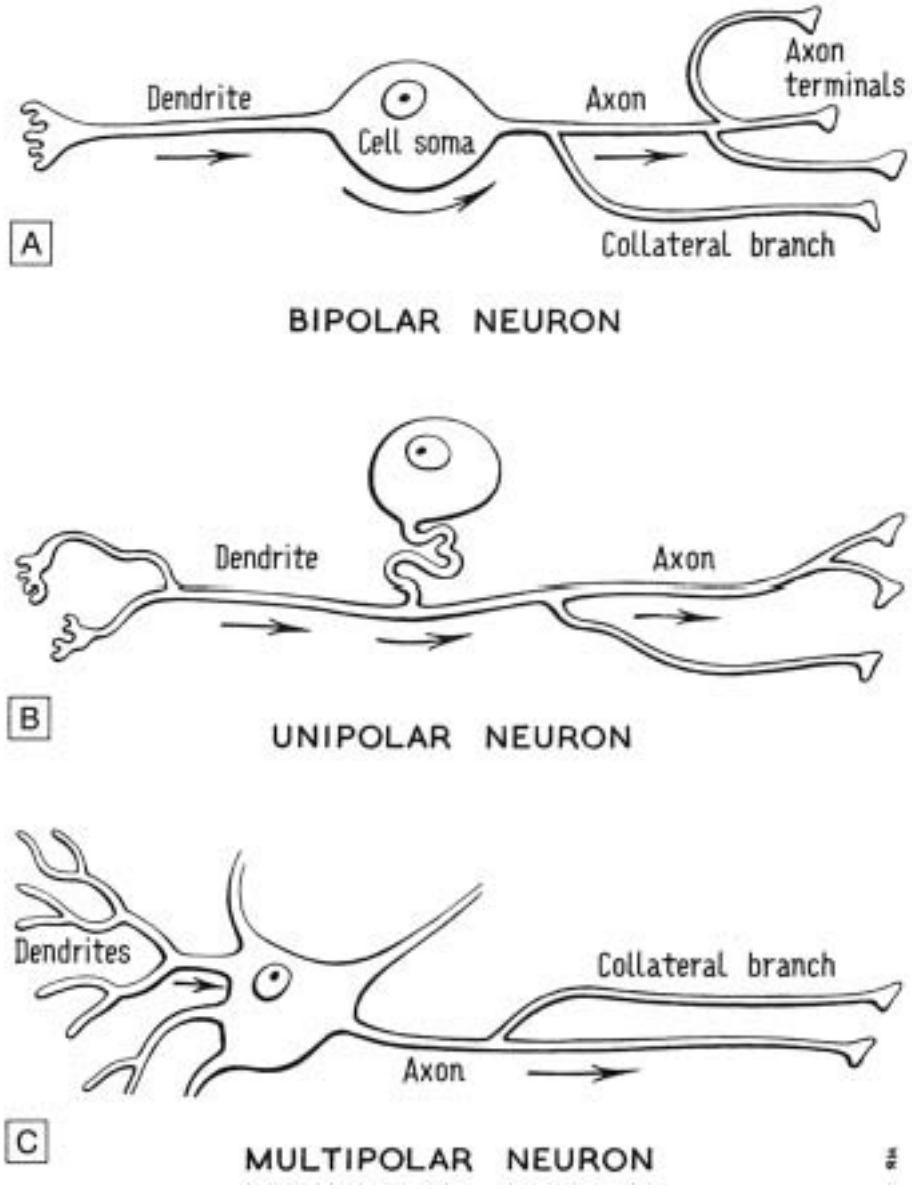
Outside CNS – Either may end in relation to the effector organ or Synapse with neurons of Peripheral ganglia




A. Carter

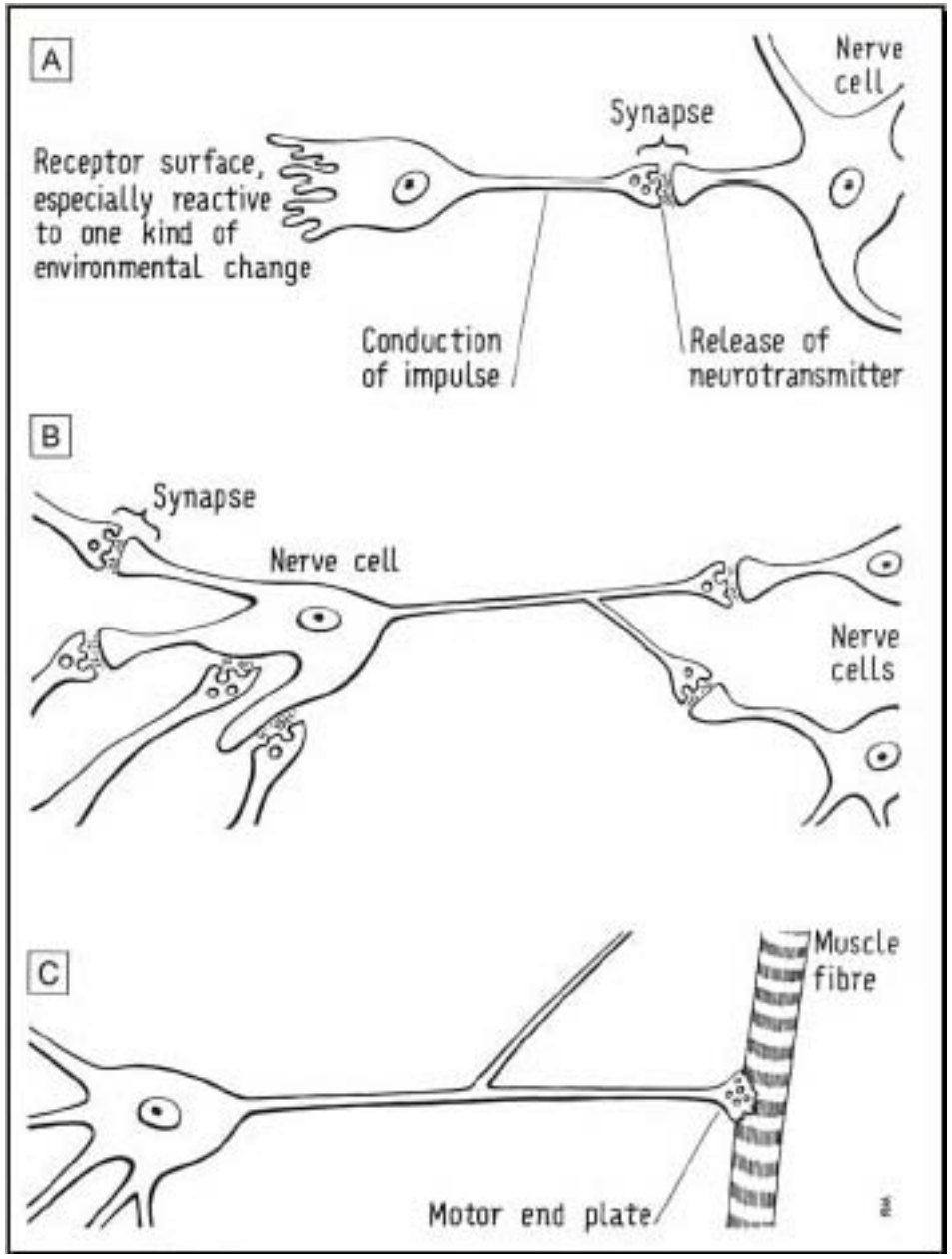






Types Of Neuron

1. Acc. To no of Processes
   - Unipolar
   - Bipolar
   - Multipolar
   - Pseudounipolar
2. Acc. To Function
   - Sensory
   - Motor
3. Acc. To Axon Length
   - Golgi type-1
   - Golgi type-II



Synapse

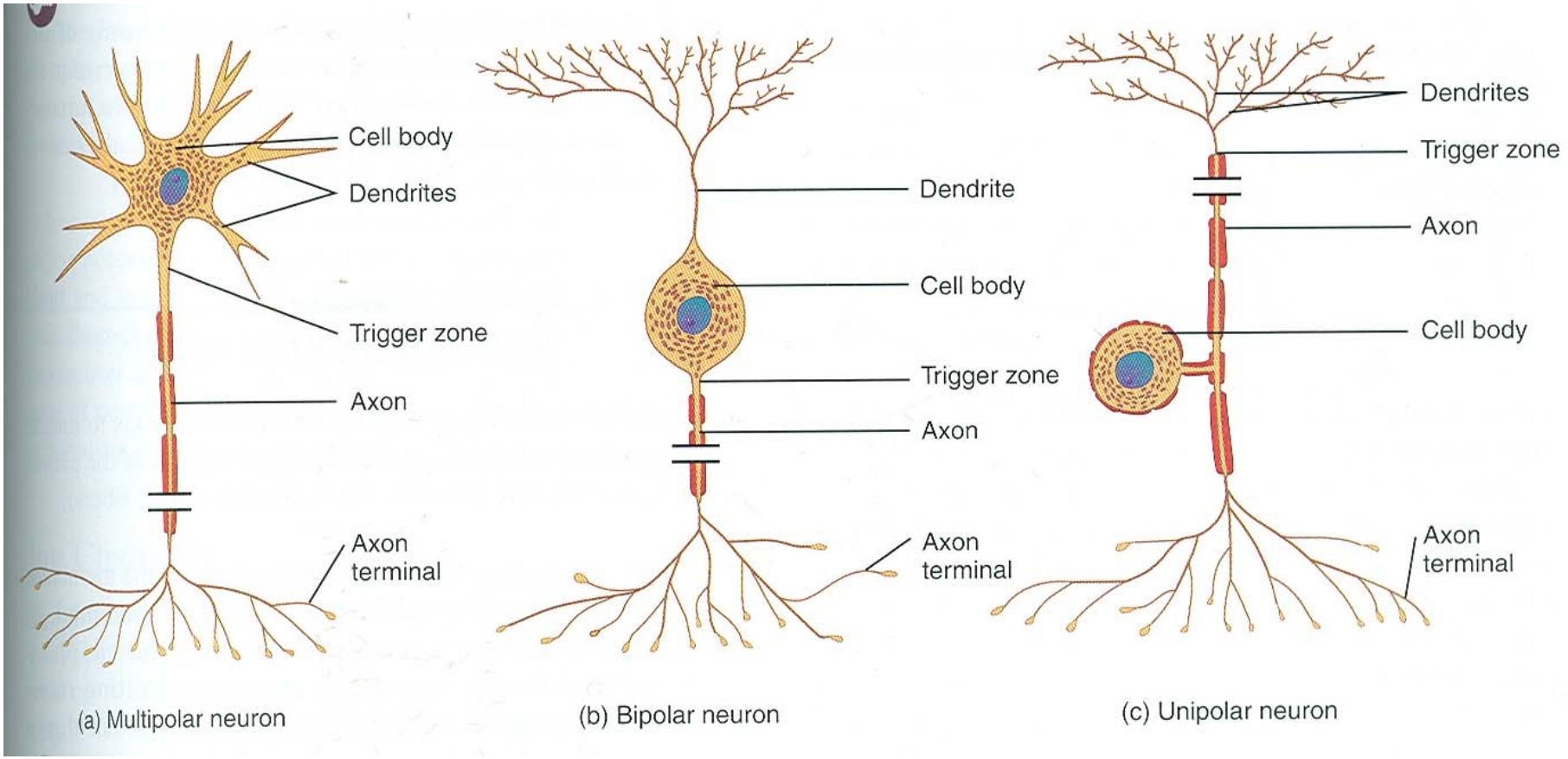
site of junction of neuron

Types

Axo- Dendritic

Axo – Somatic

Axo- Axonal


Cell body
Dendrites
Trigger zone
Axon
Axon terminal
(a) Multipolar neuron
Dendrite
Cell body
Trigger zone
Axon
Axon terminal
(b) Bipolar neuron
Dendrites
Trigger zone
Axon
Cell body
Axon terminal
(c) Unipolar neuron

Neuroglia

- **Astrocytes** : Fibrous
  Protoplasmic

Metabolism of neurotransmitters

K+ Balance

Contribute in brain development

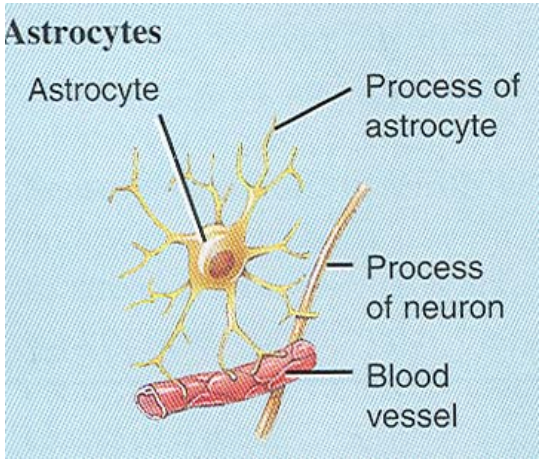
Blood brain barrier

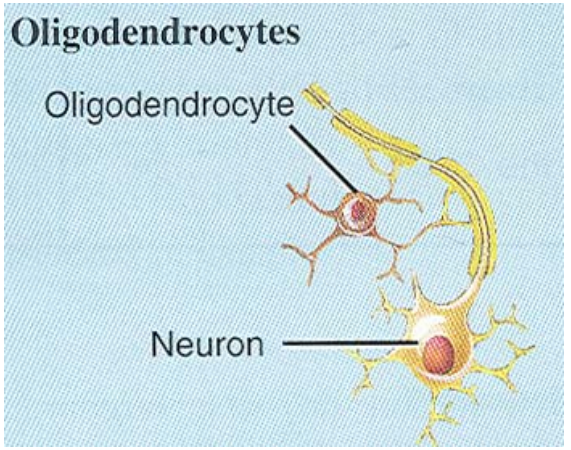
Link between neurons and blood vessels

- **Oligodendrocytes:**

  Form a supporting network around neurons

  Produce myelin sheath around several neurons





Neuroglia- contd.

- Microglia: Phagocytic cells

  Migrate to area of injured nervous tissue.
- Ependymal cells: Line the ventricles of brain and central canal of SC.

  Form CSF and assist in its circulation.
- Schwann cells: Produce a part of myelin sheath around a single axon of a PNS neuron.
- Satellite cells: Flattened cells around neurons in ganglia; support neurons