

ANAT LEC 1 (FINAL)

* NS Cell types:

① Neurons

functional, conducting, don't divide, long lived, high metabolic activity, electrically excitable

② Neuroglia

Support, nourish, protection, divide, smaller

• in CNS:

a) **oligodendrocytes** → form myelin

b) **astrocytes** → form BBB & new synapses, get rid of extra NTs

c) **ependymal cells** → line ventricles & central canal of spinal cord

d) **microglial cells** → macrophages of CNS

• in PNS

a) **Schwann's cells** → form myelin

b) **Stellate cells** → support neurons

* Functional Classification of Neurons:

① afferent (sensory)

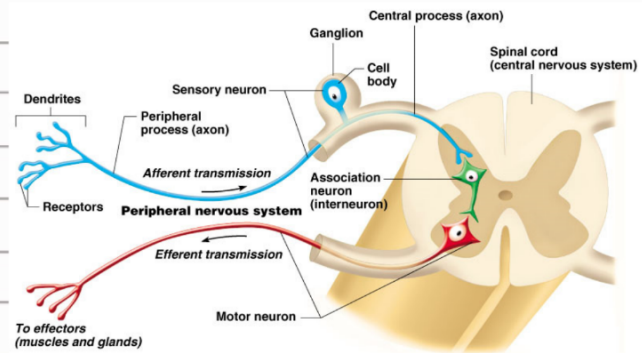
• Cell bodies gather in dorsal root ganglion

• pseudounipolar

② interneuron (association)

③ efferent (motor)

• Cell bodies gather in grey matter



* Spinal N → Union of sensory & motor neurons (each nerve has 2 roots: one pure motor & one pure sensory)

* ant. & post. rami could be mixed

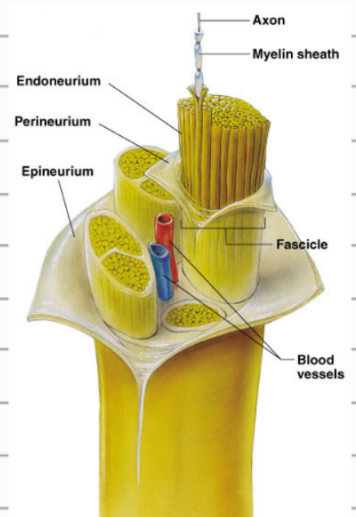
* brain has grey matter outside while spinal cord has it inside

* CT of NS:

① **endoneurium** → around each axon

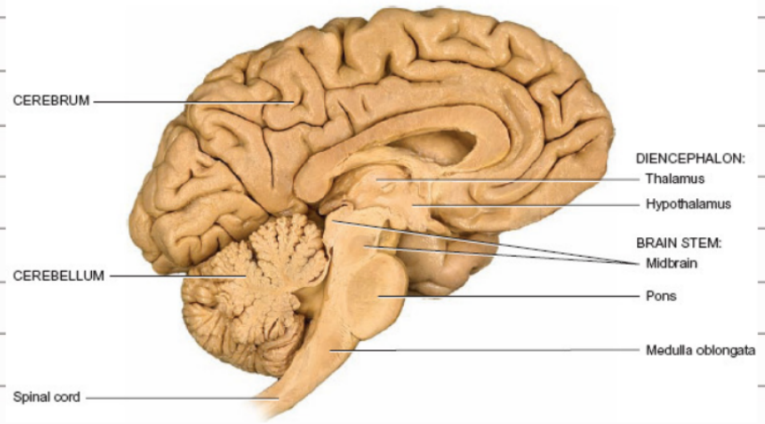
② **perineurium** → around a group of fibers (bundles or fascicles)

③ **epineurium** → around a group of fascicles



Embryonic (developmental) divisions of the Brain

Primary vesicle	Secondary vesicle	Derivatives
Prosencephalon (fore brain)	telencephalon	Cerebral cortex Cerebral white matter Basal ganglia
	diencephalon	Thalamus Hypothalamus Subthalamus Epithalamus
Mesencephalon (midbrain)	mesencephalon	Midbrain
Rhombencephalon (hind brain)	metencephalon	Cerebellum Pons
	myelencephalon	Medulla oblongata



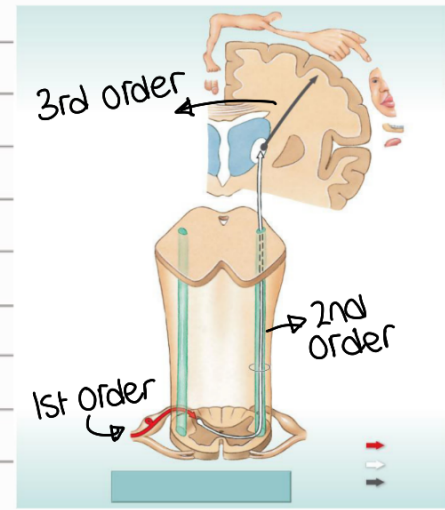
* PNS

① **Somatic** (Skin, skeletal M, joints, Special Senses)

↳ sensory / motor (voluntary)

② **viseral** (internal Organs, by baroreceptors)

↳ sensory / motor (involuntary)



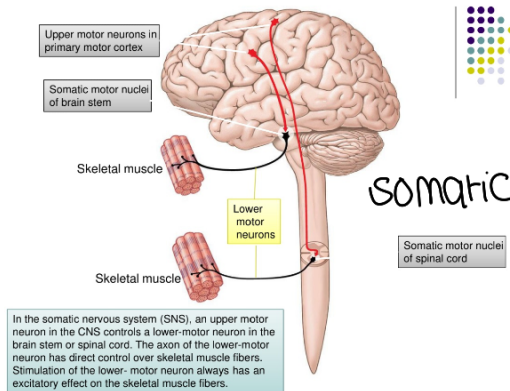
* Sensory neurons:

- 1st Order neuron (body → grey matter)
- 2nd Order neuron → Crosses midline of spinal cord (so sense is contralateral) → tract (ascends in white matter to reach thalamus)
- 3rd Order neuron (thalamus → Cortex)

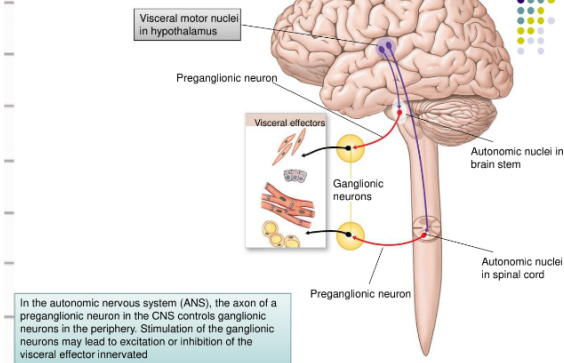
* Motor neurons

① **Somatic (cord)**

Cortex → descends down from ventral root to ant. horn of grey matter of spinal cord (upper motor neuron) →



Autonomic



inter neuron (important to activate next step → from cord to muscle (lower motor neuron))

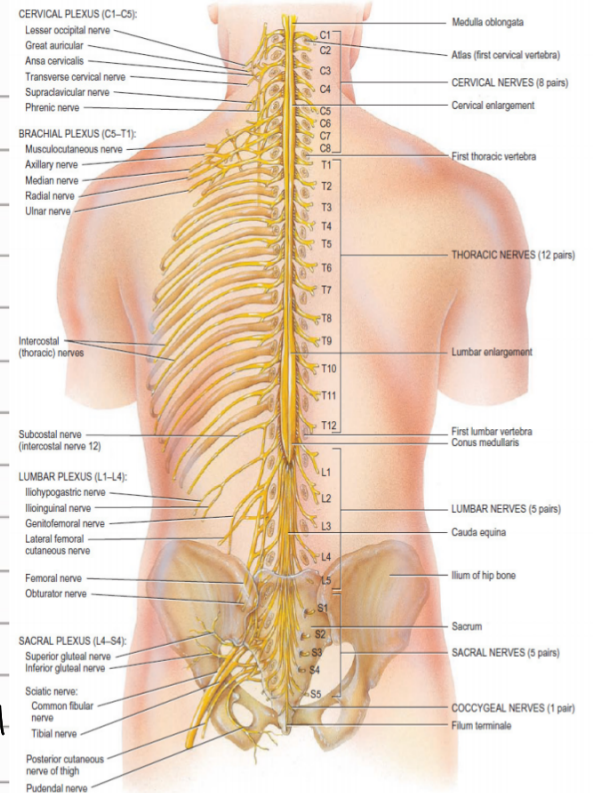
② **Somatic (From brain stem)**: Cortex → brain stem nucleus (upper motor neuron) → from nucleus to muscle (lower motor neuron)

③ **Autonomic**: Visceral motor nuclei in hypothalamus → lat horn of cord or parasymp. nuclei of brain stem (preganglionic neuron) → ganglion (synapse) → to effectors (post ganglionic neuron)

* note: sensory cells in dorsal root ganglia don't receive synapses

* external anat of Spinal Cord:

- runs from foramen magnum through the vertebral canal & ends at L2
- 31 regions (8 cervical, 12 thoracic, 5 lumbar, 5 sacral, 1 coccygeal) & give 31 pairs of (mixed) Spinal Nerves
- Not uniform in diameter, there are 2 enlargements:
- **Cervical** → Supplies upper limbs
- **lumbar** → Supplies lower limbs
- Slightly flattened anteriorly & posteriorly
- length for adult: 42-45 cm.
- **Conus medullaris**: tapered inf. end (conical structure bet. L1-L2)
- **Cauda equina**: Origin of spinal Nerves extending inferiorly from Conus medullaris



* meninges:

① Dura matter

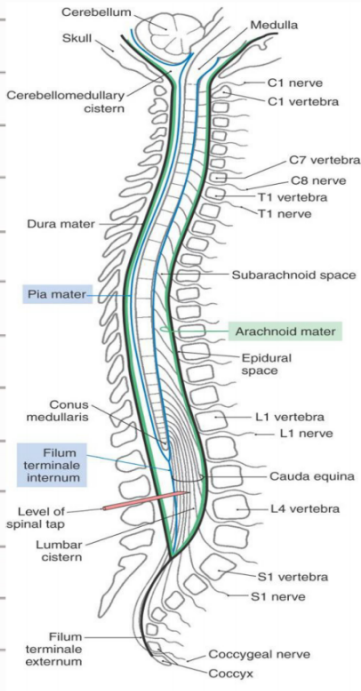
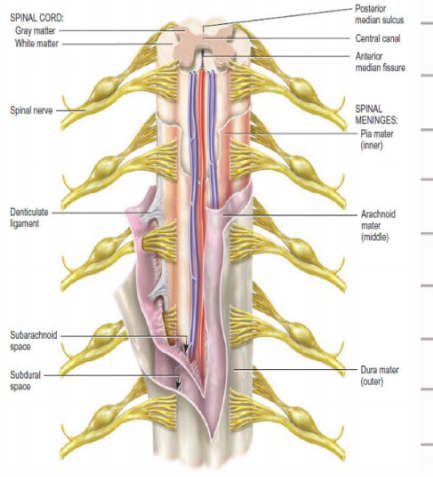
- Outer, cont. with epineurium
- dense irregular CT
- from foramen magnum level to S2 (closed caudal end is anchored to Coccyx by filum terminale)

② Arachnoid matter

- web of collagen & elastic fibers, lines dura matter

③ pia matter

- inner, adheres to spinal cord, thin transparent CT
- forms filum terminale that anchors spinal cord to Coccyx
- forms denticulate ligament that attach spinal cord to Arachnoid & dura matter



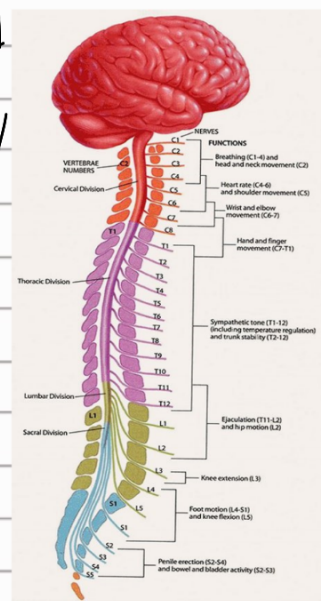
* Spaces: ① Epidural → bet. dura & vertebrae / fat filled / inject anesthetics here

② Subdural → Serous fluid

③ Subarachnoid → bet. Arachnoid & pia / CSF filled (lumbar puncture test bet. L3-L4)

* Spinal cord segments:

each pair of spinal Ns emerge under corresponding except Cervical Ns (above it)



ANAT LEC 2 (FINAL)

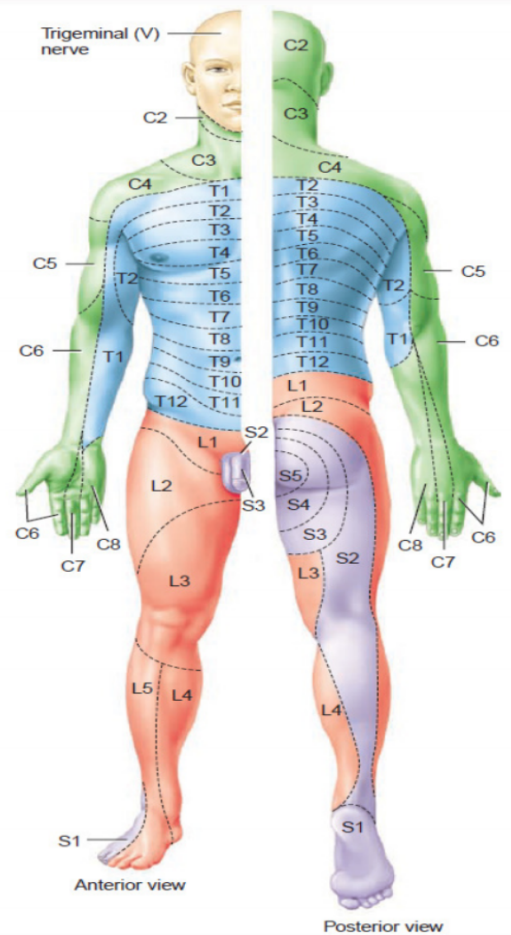
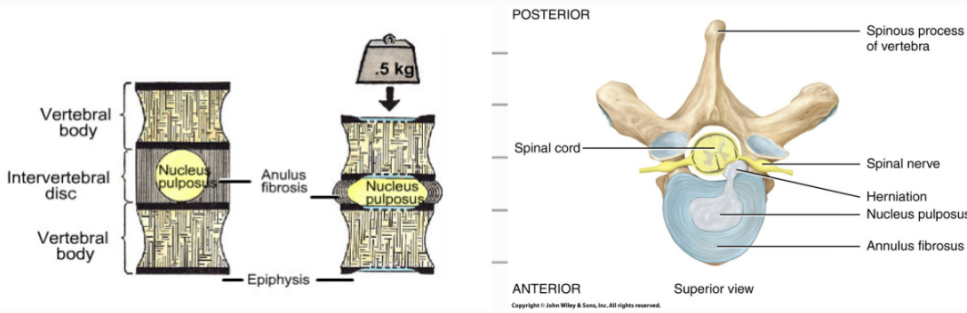
* **herniated disc** : protrusion (leakage) of gelatinous nucleus pulposus through annulus fibrosus of IV disc (posterolaterally, cuz it's the thinnest weakest area) resulting from heavy pressure, hernia pain results from pressuring spinal nerves

• most common discs herniated discs : **bet. L4-L5, L5-S1**

* **dermatome** : Skin Area Supplied by 1 Spinal N

• **myotome** : A group of muscles supplied by 1 spinal N (biceps is supplied by musculocutaneous N - C₆)

• **Compressed N** → Abnormal sensation + muscle weakness



Disc	Root	Percentage	Motor weakness	Sensory changes	Reflex affected
L3-L4	L4	3-10%	Knee extension (Quadriceps femoris)	Anteriomedial leg (saphenous)	Knee jerk
L4-L5	L5	40-45%	Big toe dorsiflexion (EHL) and TA	Big toe, anteriolateral leg (Common P)	Hamstring jerk
L5-S1	S1	45-50%	Foot planter flexion (Gastrocnemius)	Lateral border of foot (sural)	Ankle jerk

- EHL : ext. hallucis longus
- TA : tibialis anterior
- CPN : Common peroneal N

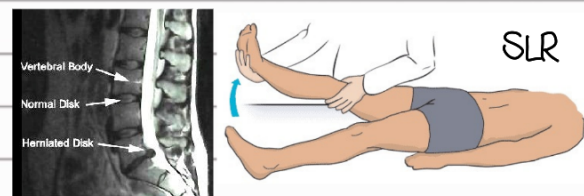
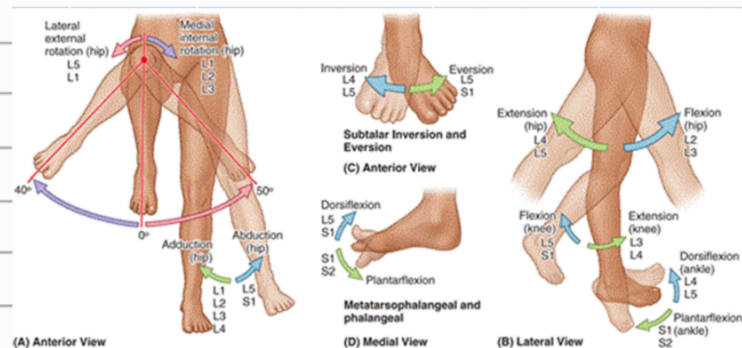
* **root value ≠ nerves innervating muscle**
(for quadriceps femoris : root value = L₄ / innervation = L₂-L₄)

* tests for spinal nerves :

- L₅ → Stand on heels
- S₁ → Stand on toes
- SLR (straight leg raise test) → flex hip joint while extending knee

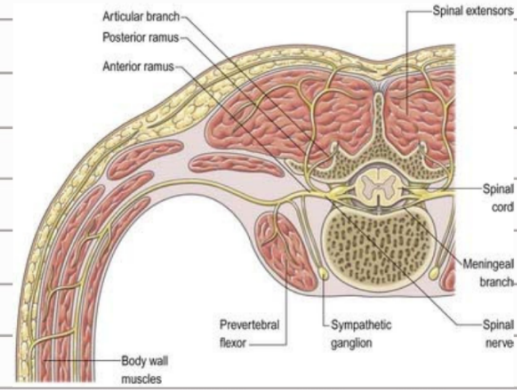
pulling sciatic N (L₄-S₃) & removing pressure of nerve root to check for herniation

• MRI → the best to check for hernia



*** herniated disc Symptoms:**

- ① lower back pain reaches gluteal region, post. aspect of leg & thigh
- ② Spinal nerves give a meningeal branch to bring sensation from dura matter → Compressed meningeal branch leads to diffused pain & numbness to other dermatomes



*** Suggested management**

- Sensory Problem → Physiotherapy
- Motor Problem → Surgery

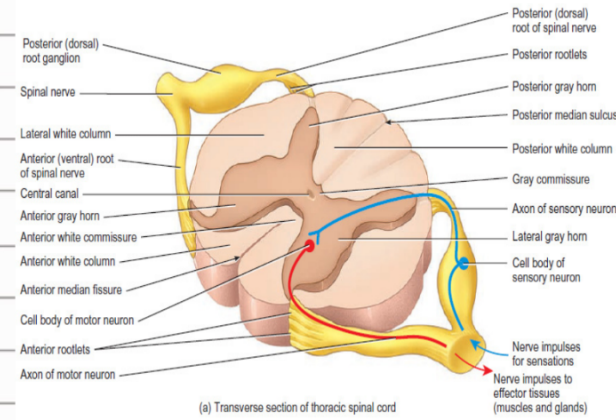
*** Cross section of spinal cord**

- anterior median fissure (wide groove)
- posterior median sulcus (narrow groove)
- grey matter (cell bodies)

↳ posterior (dorsal) horn → Sensory N

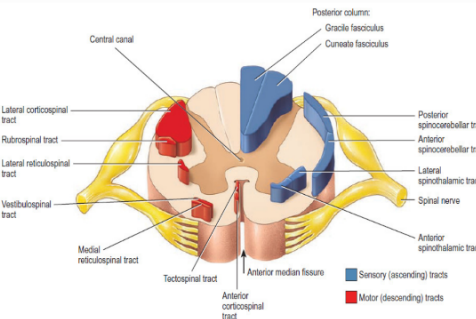
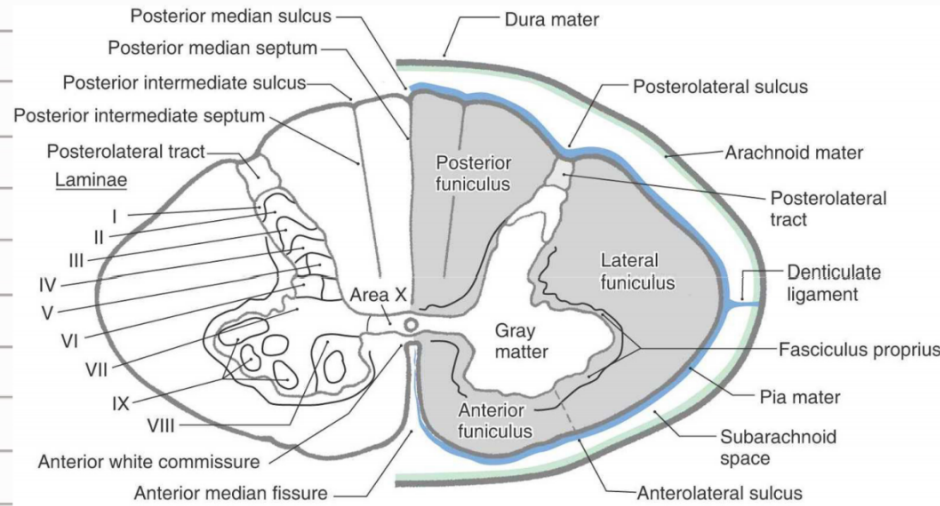
↳ anterior (ventral) horn → motor N (to skeletal M)

↳ lateral horn → motor N (to cardiac or smooth M or glands, Autonomic)



*** Rexed's Classification of Grey matter:**

- Roman Numbers
- can be ascending or descending (Sensory or Motor)
- **posterior column only has sensory ascending tracts**



ELECTROPHYSIOLOGIC CLASSIFICATION OF PERIPHERAL NERVES	CLASSIFICATION OF AFFERENT FIBERS ONLY (CLASS/GROUP)	FIBER DIAMETER (µm)	CONDUCTION VELOCITY (m/s)	RECEPTOR SUPPLIED
Sensory Fiber Type				
Aα	Ia and Ib	13-20	80-120	Primary muscle spindles, Golgi tendon organ
Aβ	II	6-12	35-75	Secondary muscle spindles, skin mechanoreceptors
Aδ	III	1-5	5-30	Skin mechanoreceptors, thermal receptors, and nociceptors
C	IV	0.2-1.5	0.5-2	Skin mechanoreceptors, thermal receptors, and nociceptors
Motor Fiber Type				
Aα	N/A	12-20	72-120	Extrafusal skeletal muscle fibers
Aγ	N/A	2-8	12-48	Intrafusal muscle fibers
B	N/A	1-3	6-18	Preganglionic autonomic fibers
C	N/A	0.2-2	0.5-2	Postganglionic autonomic fibers