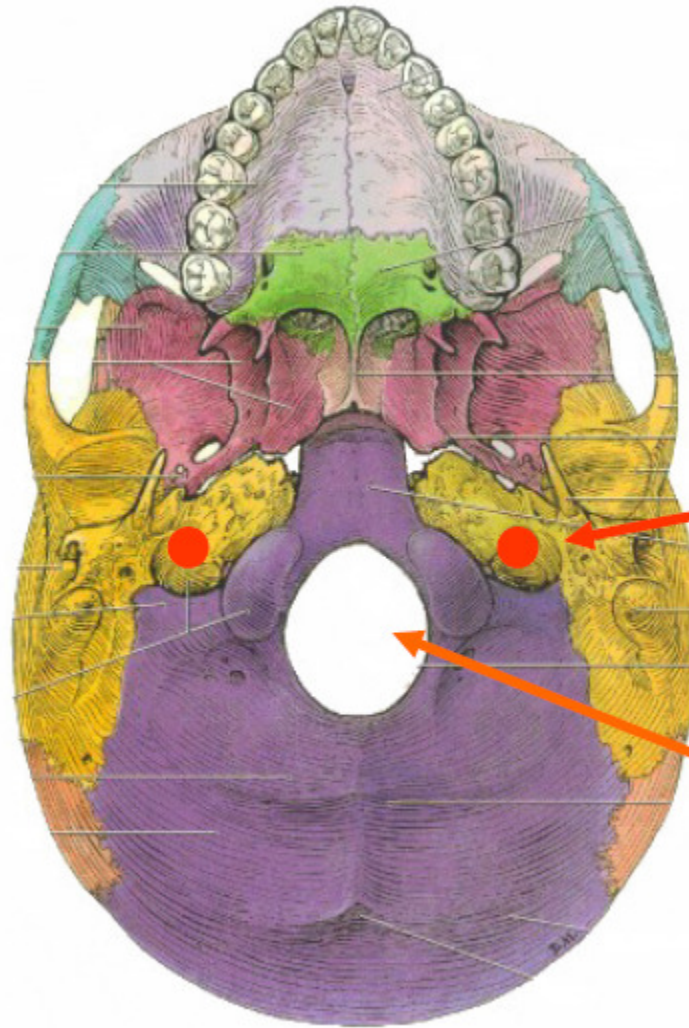


Arterial Blood Supply

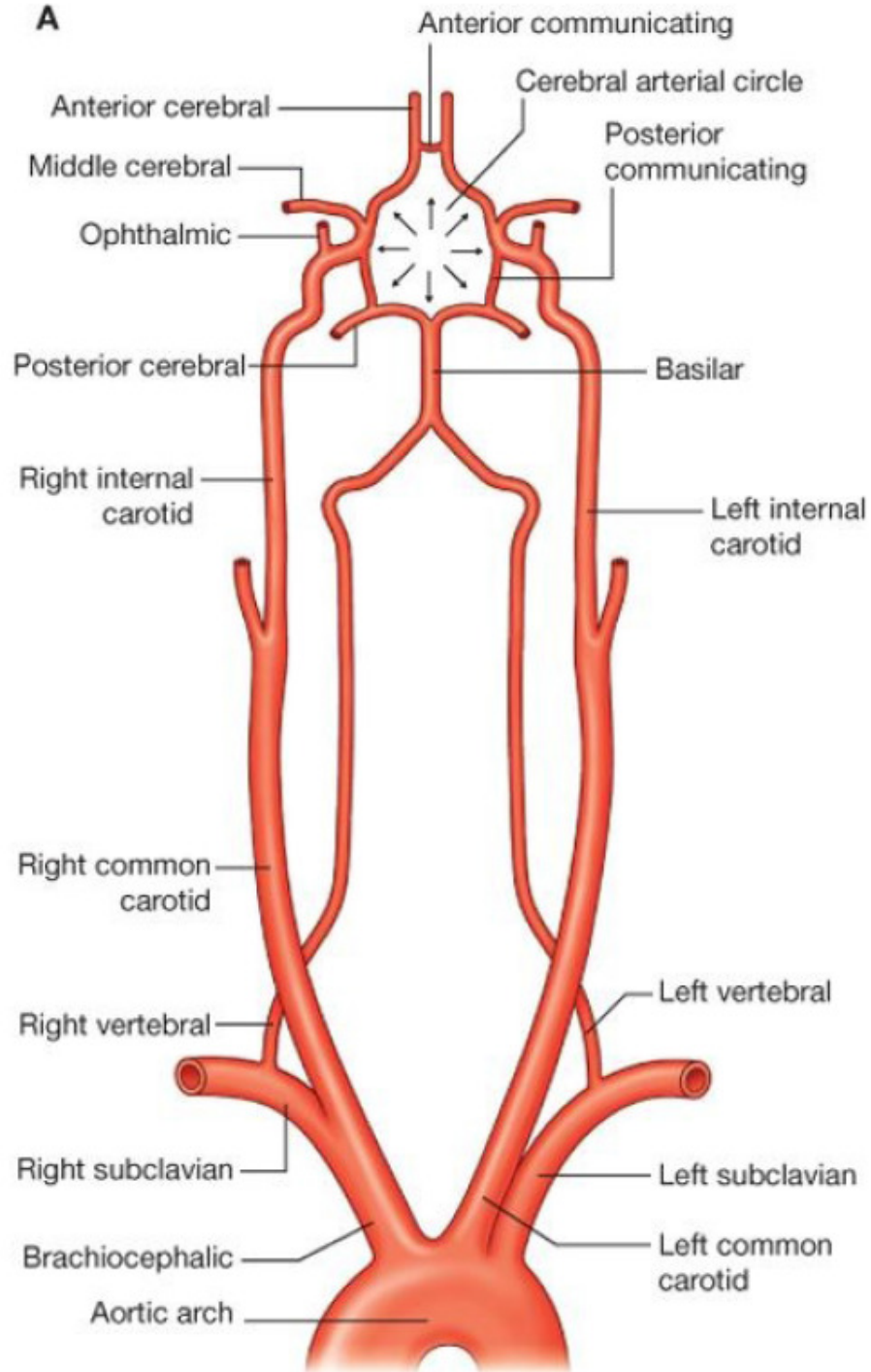
- Brain is supplied by pairs of internal carotid artery and vertebral artery.
- The four arteries lie within the subarachnoid space
- Their branches anastomose on the inferior surface of the brain to form the **circle of Willis**



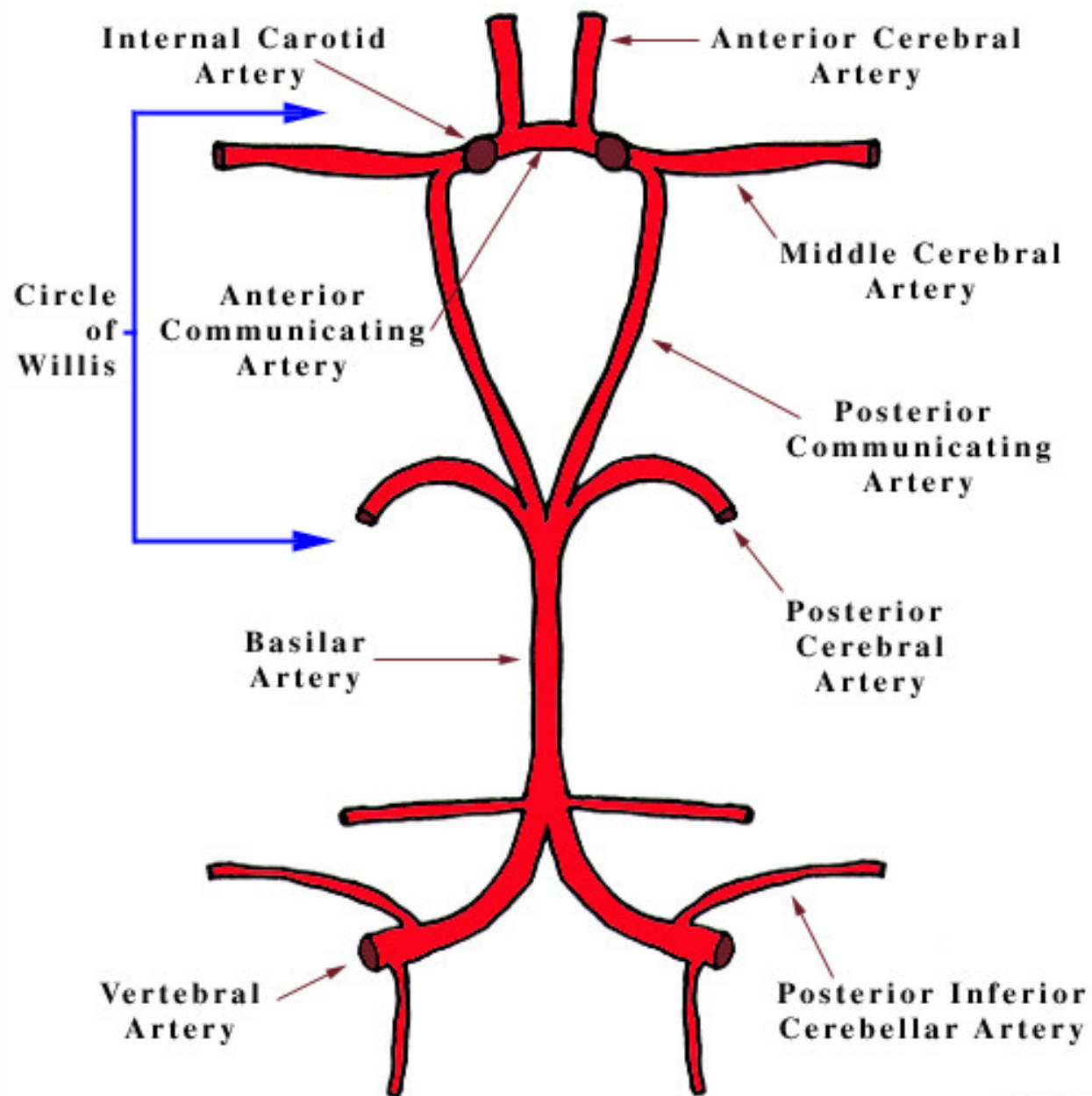
A. Internal Carotid Artery- enters skull via Carotid Canal And Foramen Lacerum

B. Vertebral artery- enters skull via Foramen Magnum

A



CIRCLE OF WILLIS

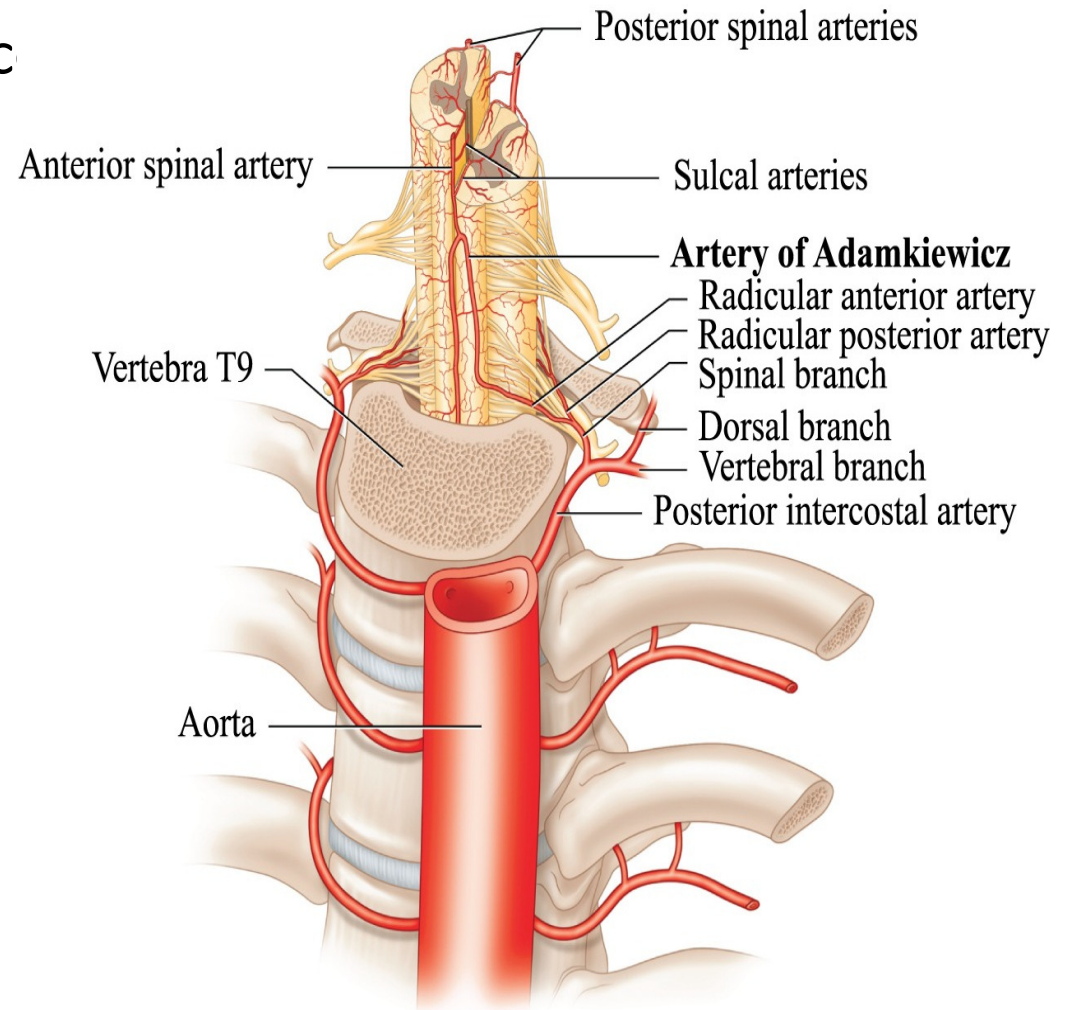
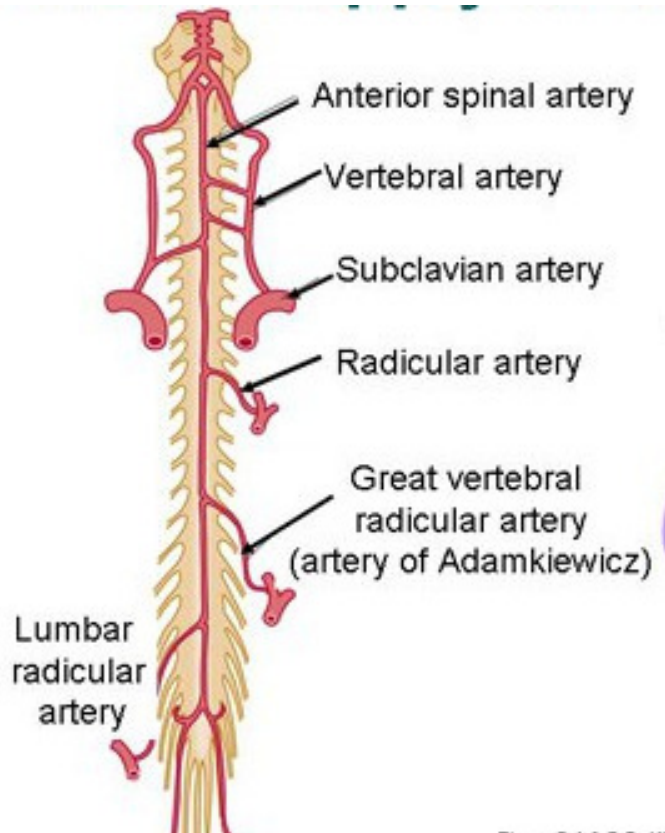


WALTER CRANE

Blood supply of spinal c

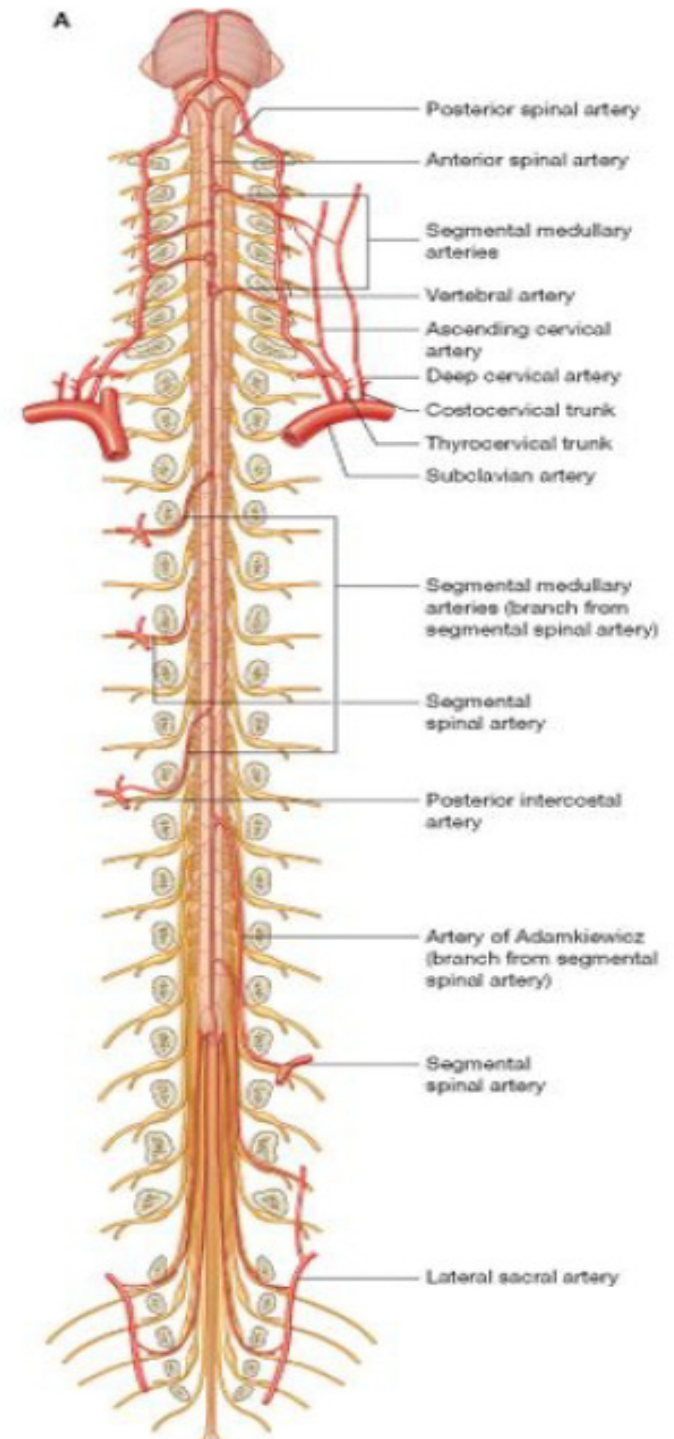
- **Longitudinal arteries:**

- **One anterior spinal artery:** arise from the vertebral arteries (in anterior median fissure)
- **Two posterior spinal arteries:** arise from the posterior inferior cerebellar artery (in the posterolateral sulcus)



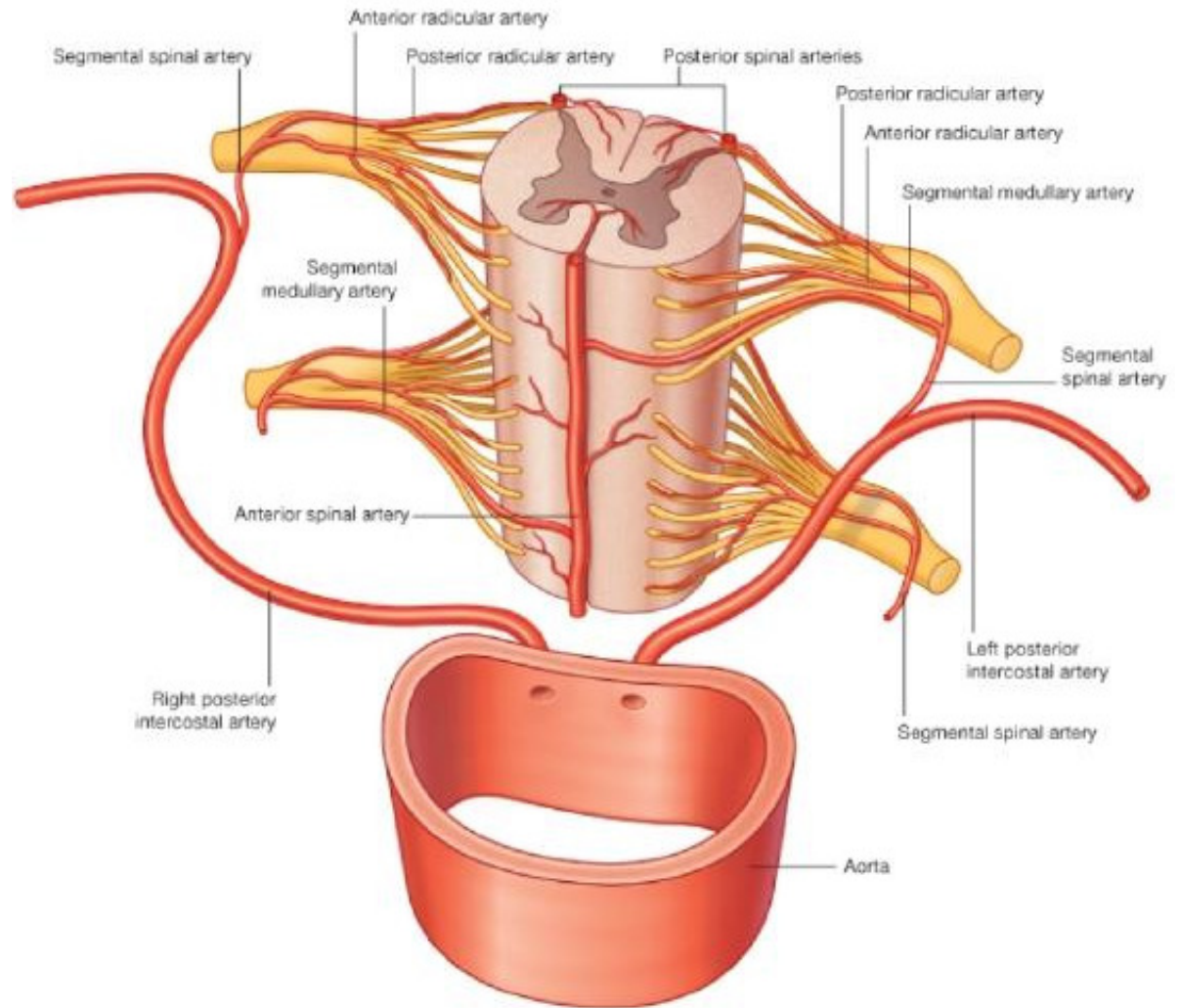
Blood supply of spinal cord

- **segmental spinal arteries**, arise from:
 - Vertebral arteries
 - Deep cervical arteries in the neck
 - Posterior intercostal arteries in the thorax
 - lumbar arteries in the abdomen
- **Branches :**
 - **Anterior radicular arteries**
 - **Posterior radicular arteries**
 - **Segmental medullary arteries**
- **Artery of Adamkiewicz**
 - usually on the left side,
 - reinforces the arterial supply to the lower portion of the spinal cord
 - From Left posterior intercostal artery at the level of the 9th to 12th intercostal artery, which branches from the aorta, and supplies the lower two thirds of the spinal cord
 - Anastomose with anterior spinal artery



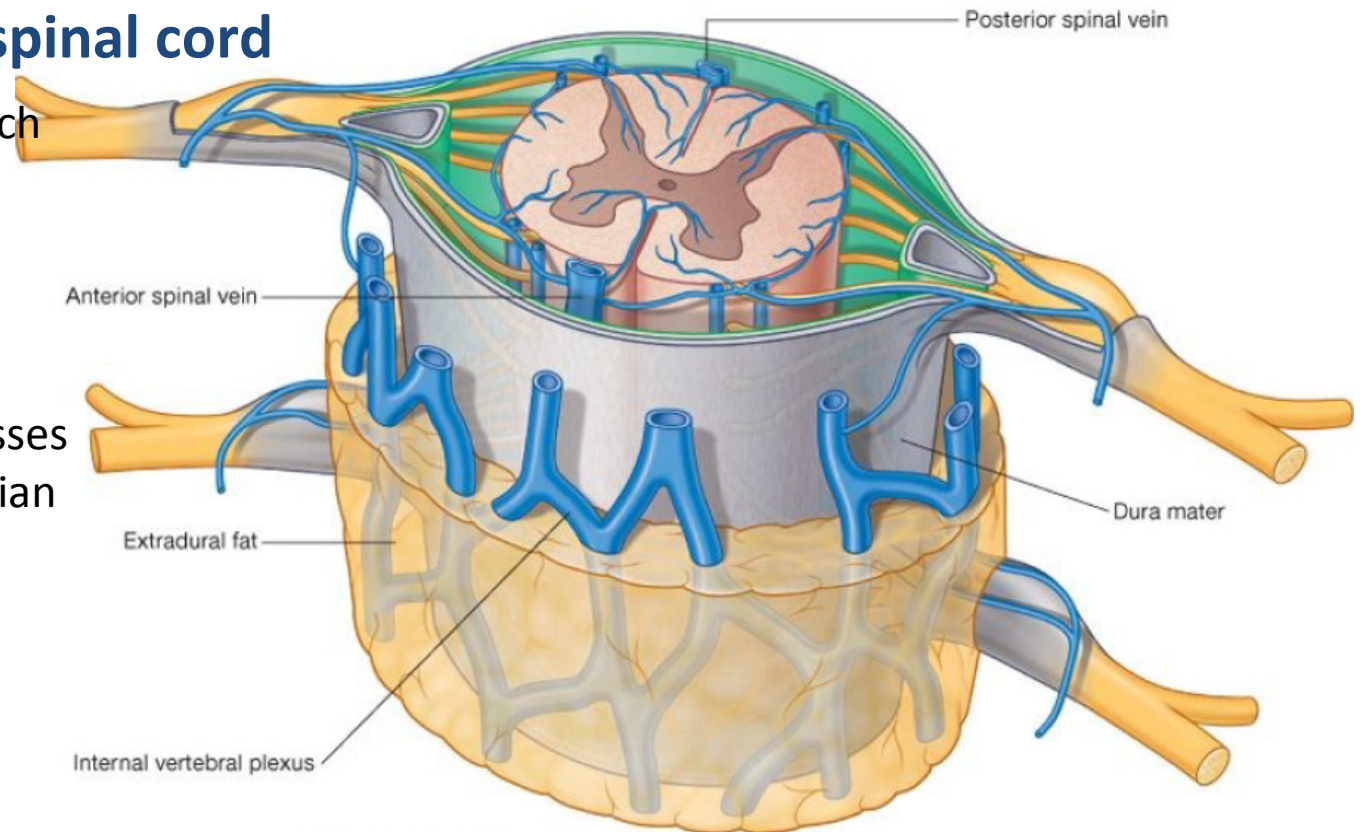
Blood supply of spinal cord

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 - **Segmental medullary arteries**
- **Artery of Adamkiewicz**



Venous drainage of spinal cord

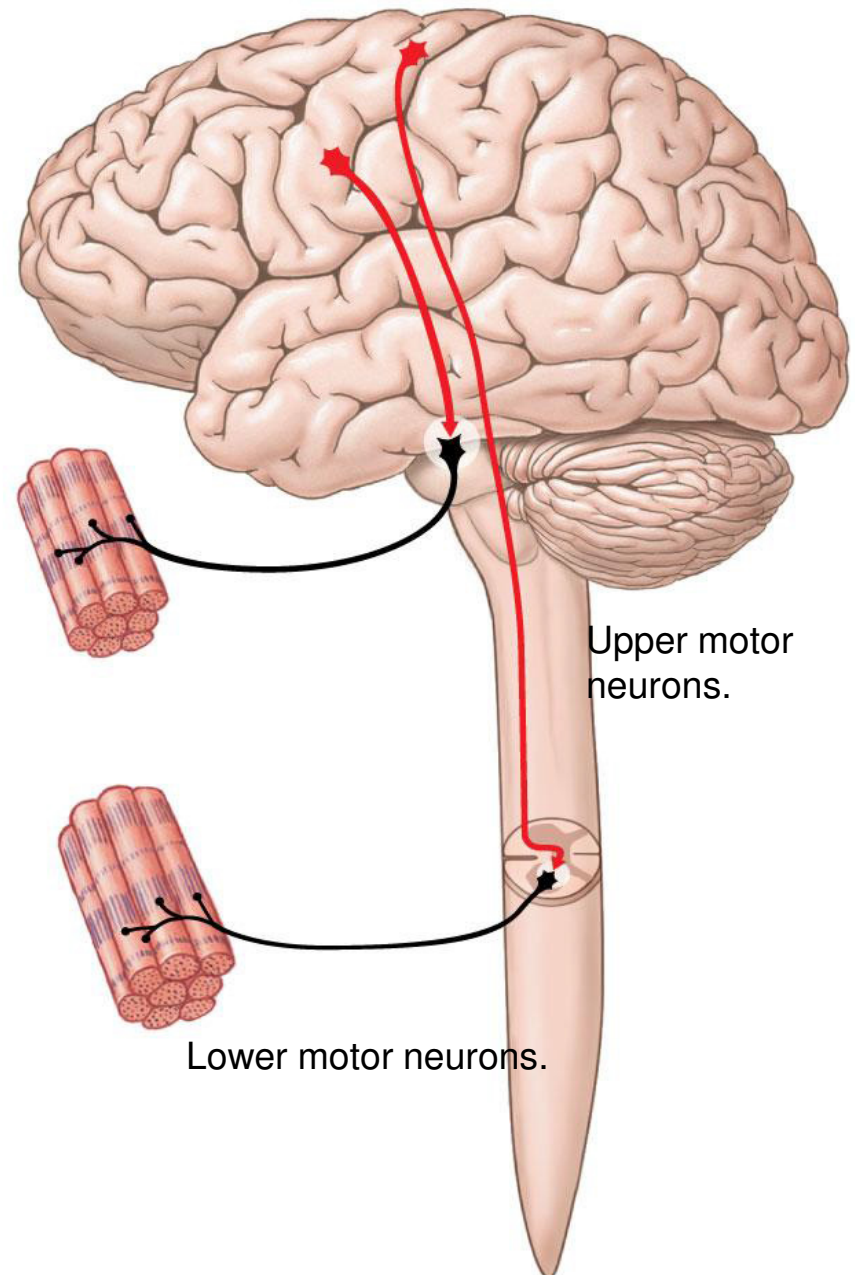
- Two pairs of veins on each side
- One midline channel parallels the anterior median fissure
- One midline channel passes along the posterior median sulcus



- Drain into an extensive internal vertebral plexus in the extradural (epidural) space of the vertebral canal
- Then drains into segmentally arranged vessels that connect with major systemic veins
 - Azygos system in the thorax.
 - The internal vertebral plexus
 - Intracranial veins

Motor tracts

- ❑ There are two major descending tracts
 - **Pyramidal tracts**
(Corticospinal) :
Conscious control of skeletal muscles
 - **Extrapyramidal:**
Subconscious regulation of balance, muscle tone, eye, hand, and upper limb position:
- ❖ **Vestibulospinal tracts**
- ❖ **Reticulospinal tracts**
- ❖ **Rubrospinal tracts**
- ❖ **Tectospinal tracts**



a

Extrapyramidal tracts arise in the brainstem, but are under the influence of the cerebral cortex

Rexed laminae

- **Lamina 8:** motor interneurons, Commissural nucleus
- **Lamina 9:** ventral horn, LMN, divided into nuclei:
 - **Ventromedial:** all segments (extensors of vertebral column)
 - **Dorsomedial:** (T1-L2) intercostals and abdominal muscles
 - **Ventrolateral:** C5-C8 (arm) L2-S2 (thigh)
 - **Dorsolateral:** C5-C8 (Forearm), L3-S3 (Leg)
 - **Reterodorsolateral:** C8-T1 (Hand), S1-S2 (foot)
 - **Central:** Phrenic nerve (C3-C5)
- **Lamina X:** Surrounds the central canal – the grey commissure

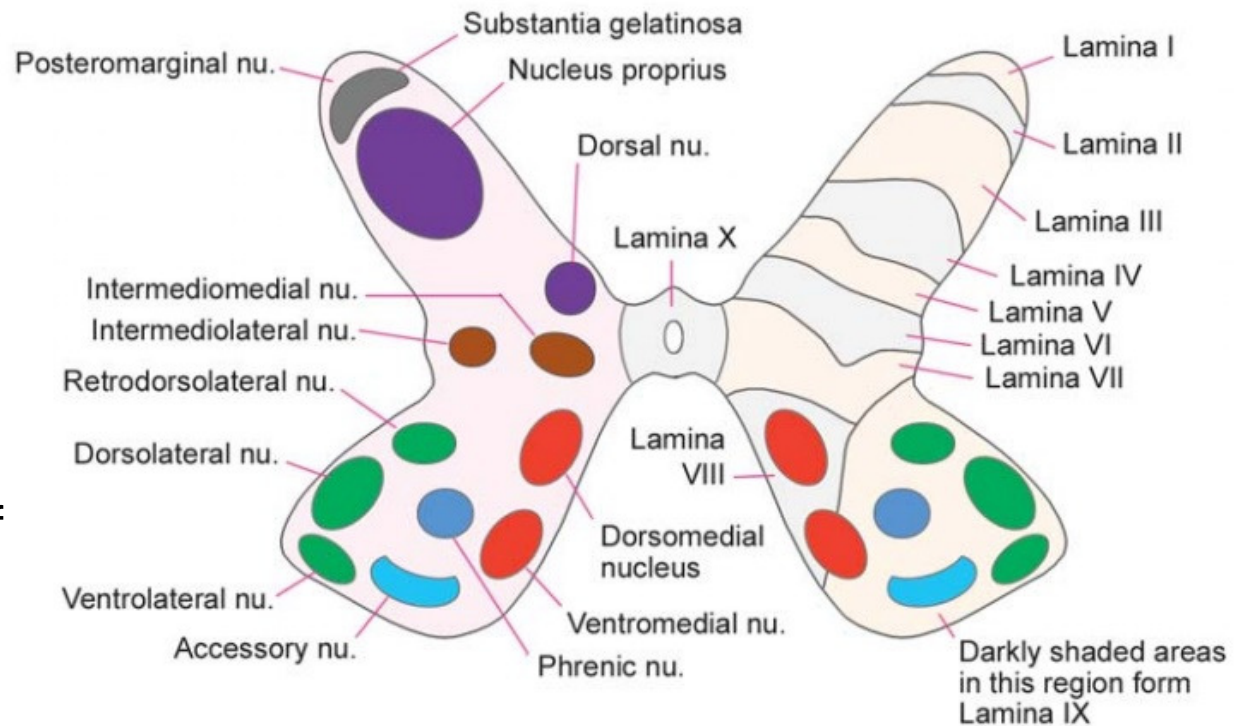
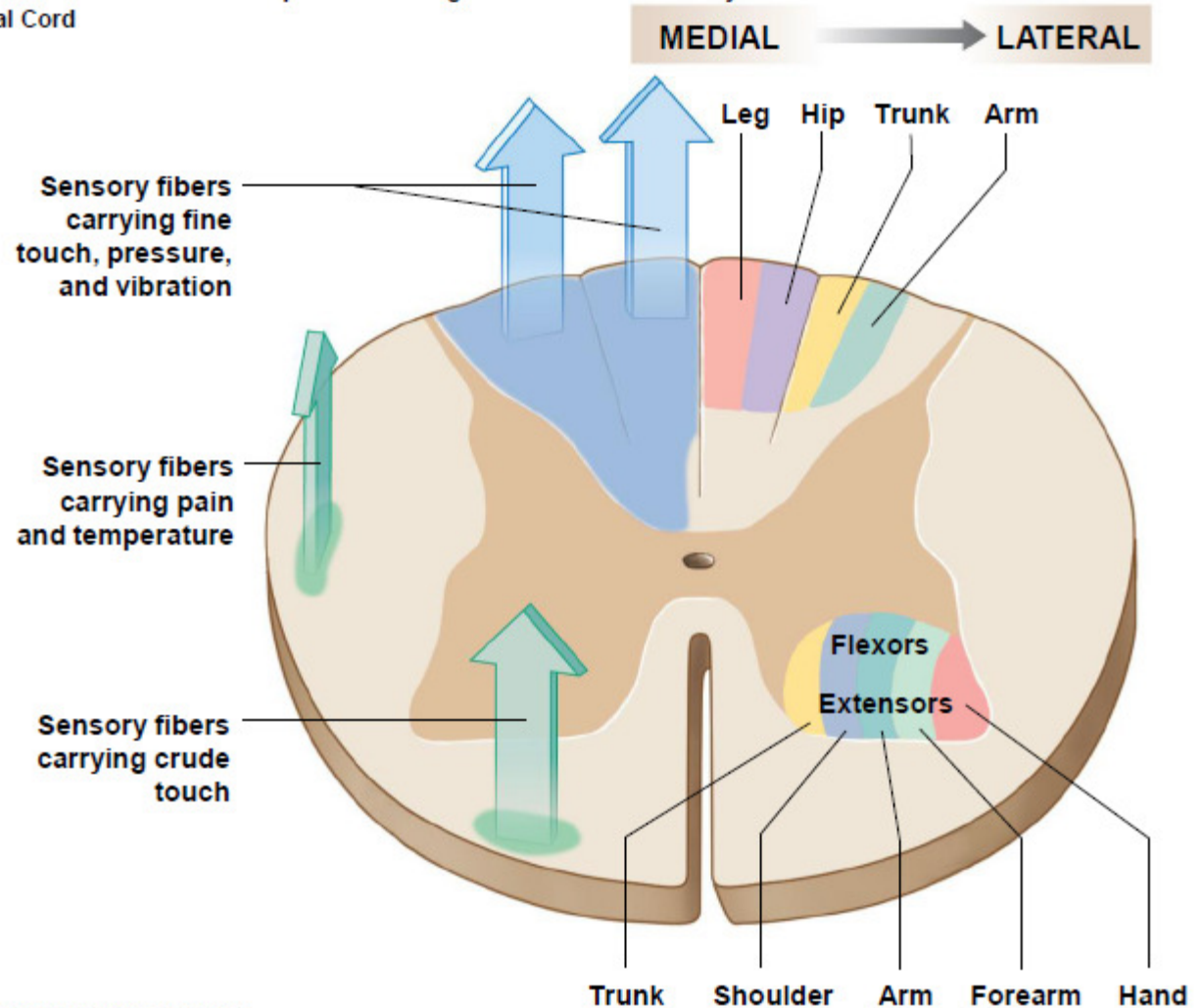


Fig. 5.2. Subdivisions of the grey matter of the spinal cord. The left half of the figure shows the cell groups usually described. The right half shows the newer concept of laminae.

Figure 15.1 Anatomical Principles for the Organization of the Sensory Tracts and Lower-Motor Neurons in the Spinal Cord

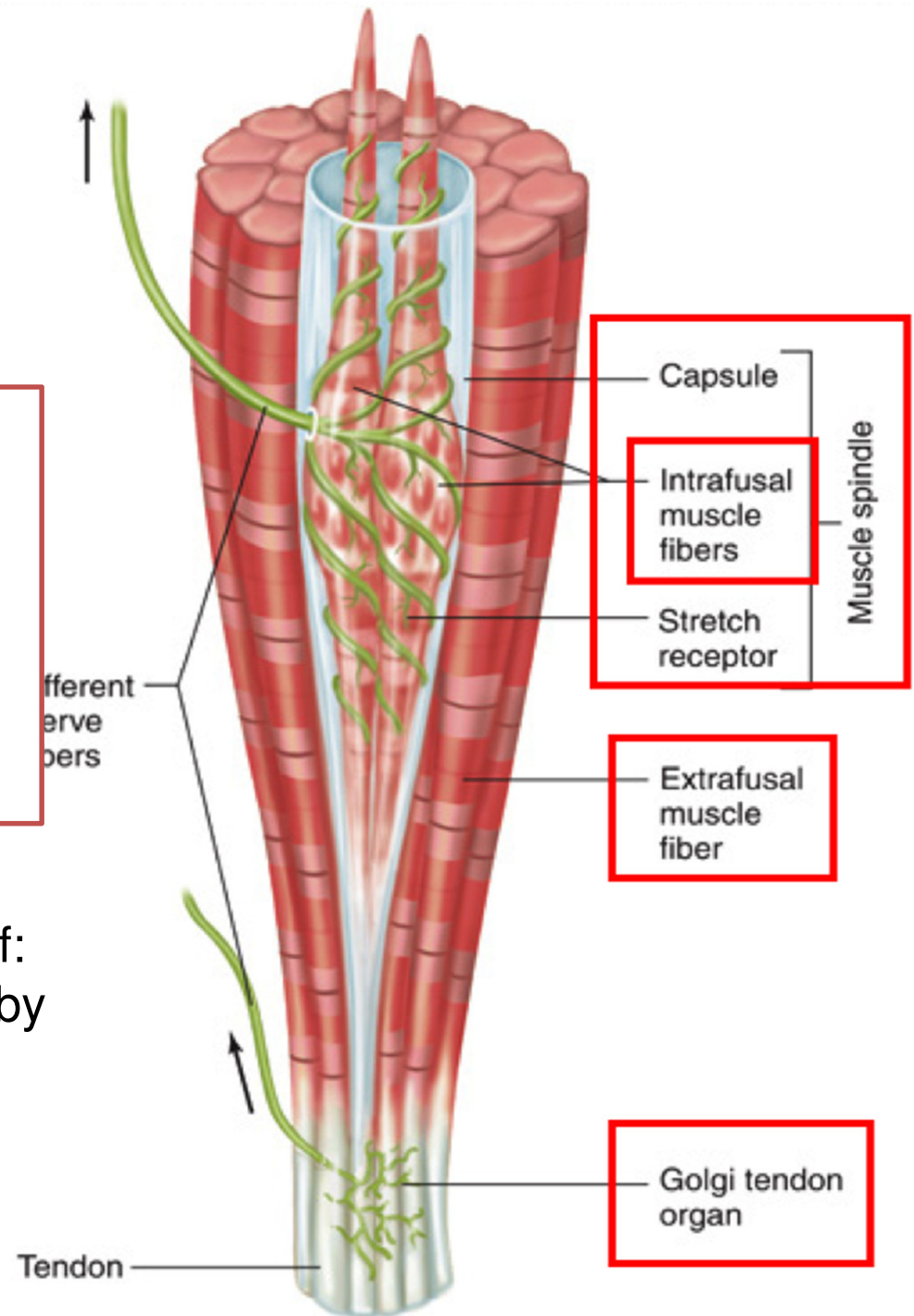
- ❑ Motor neurons of anterior horn
- **Medial group:** (All segments)
- **Lateral group:** only enlargements

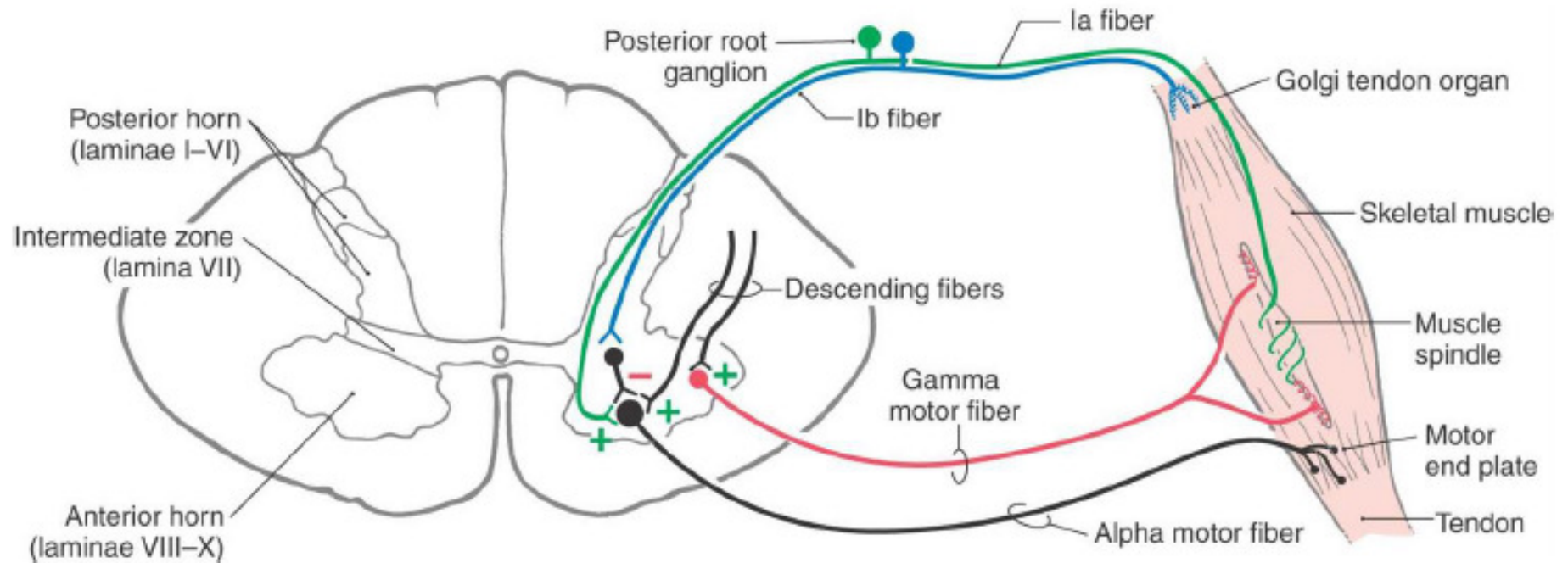


Muscle spindles are sensory receptors within the belly of a muscle that primarily detect changes in the length of this muscle.

Each muscle spindle consists of an encapsulated cluster of small striated muscle fibers ("**intrafusal muscle fibers**") with somewhat unusual structure (e.g., nuclei may be concentrated in a cluster near the middle of the fiber's length).

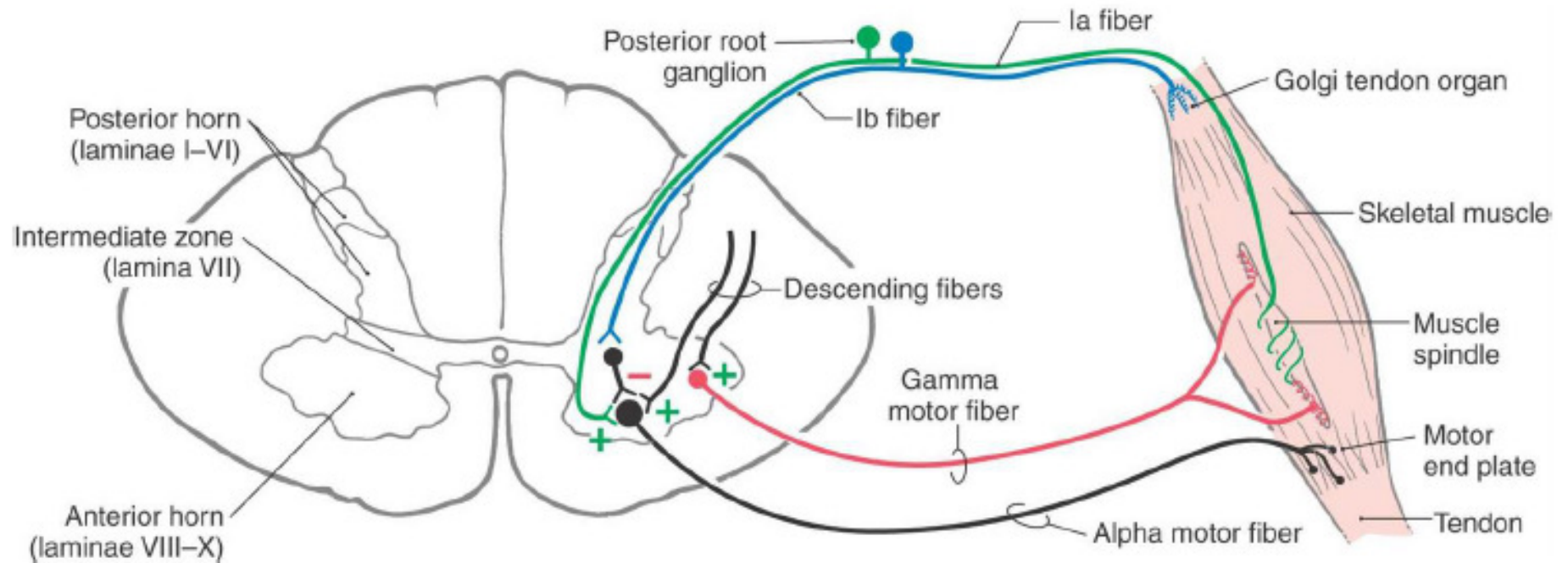
- ❑ The skeletal muscle is composed of:
 - Extrafusal fibers (99%): innervated by **alpha motor neurons**.
 - Intrafusal fibers (1%): innervated by **gamma motor neurons**. depend on the muscle spindle receptors





❑ Activating alpha motor neurons

- Directly through supraspinal centers: Descending motor pathways (UMN)
- Indirectly through Muscle spindles
 - Stretch reflex: skeletal muscles are shorter than the distance between its origin and insertion
 - Gamma loop



- ❑ Gamma fibers activate the muscle fibers indirectly, while alpha fibers do it directly.
- ❑ Alpha fibers give faster but short contraction
- ❑ Gamma fibers give slow but long contraction.
- ❖ For fast contraction: stimulate alpha.
- ❖ For muscle tone: stimulate gamma.
- ❖ For continuous contraction and a certain movement: stimulate both.

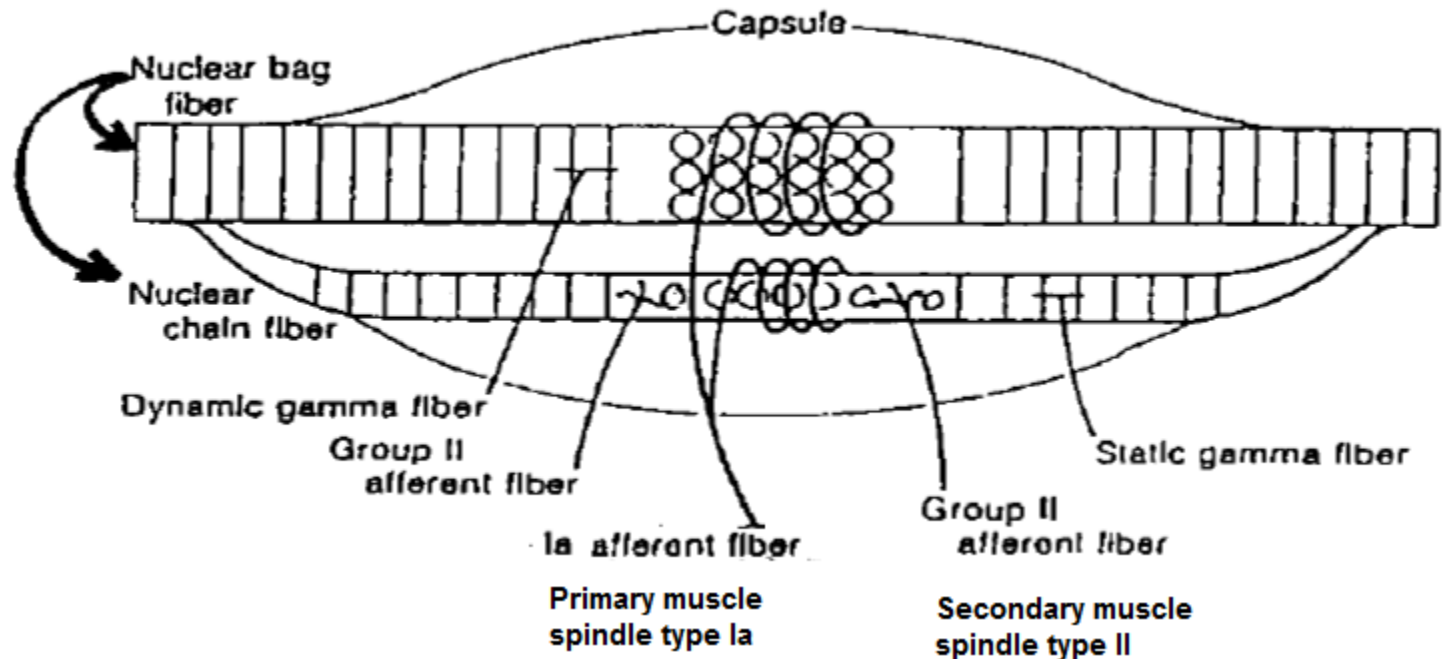
❑ Intrafusal fibers

➤ **Nuclear Bag**

Fibers: supplied by dynamic Gamma

➤ **Nuclear chain**

fibers: supplied by static Gamma



❖ *Both Nuclear bag and chain Don't contain sarcomeres*

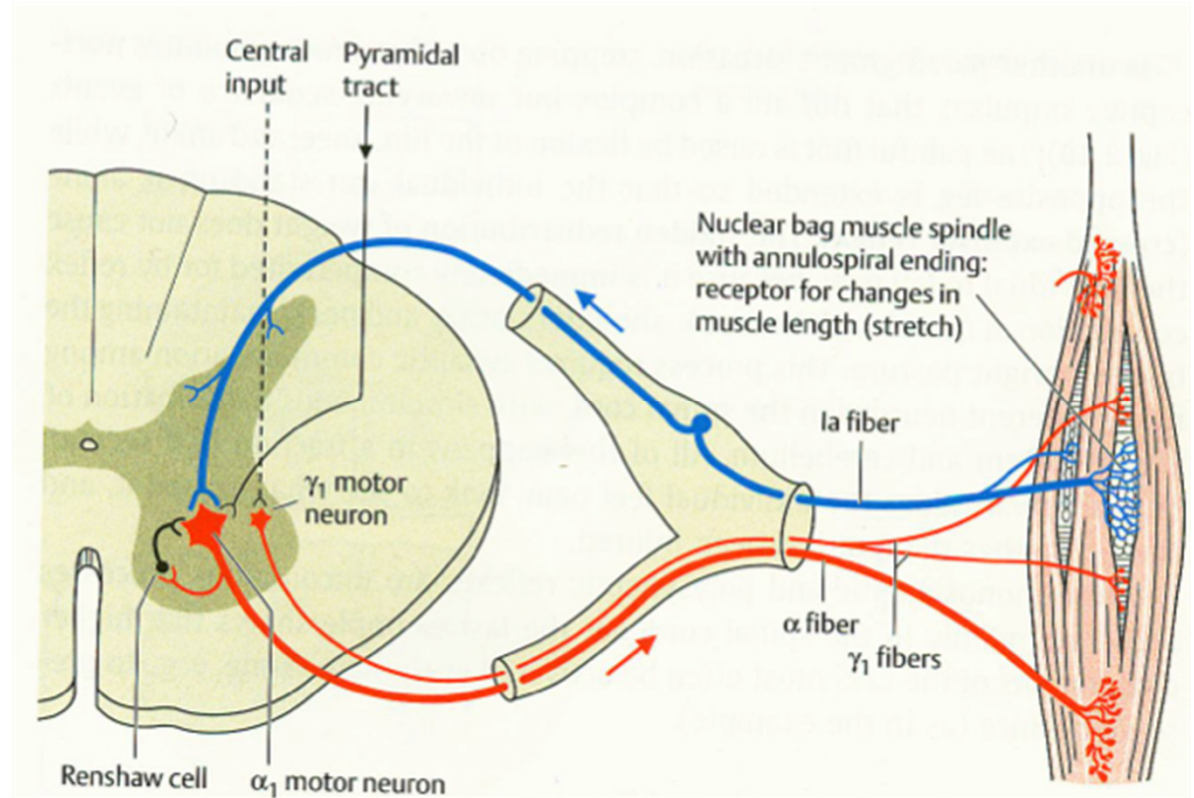
❑ **Primary afferent: type Ia,**

- Around both nuclear bag and chain fibers
- Rapidly adapting
- Dynamic stretch reflex: e.g jerk (Knee, ankle quadriceps)

❑ **Secondary afferent: type II**

- Found only in nuclear chain fibers.
- Slowly adapting
- Static stretch reflex. Important for muscle tone

- Alpha motor neuron activity It is controlled by inhibitory cells in **lamina 7** called reshaw cells
- The reshaw cells secrete glycine and inhibit the alpha motor neuron
- **Strychnine poisoning**
 - inhibits the reshaw cells and prevents them from secreting glycine
 - Alpha motor neuron will cause excessive firing (contractions and convulsions)



ELECTROPHYSIOLOGIC CLASSIFICATION OF PERIPHERAL NERVES	CLASSIFICATION OF AFFERENT FIBERS ONLY (CLASS/GROUP)	FIBER DIAMETER (μm)	CONDUCTION VELOCITY (m/s)	RECEPTOR SUPPLIED
Sensory Fiber Type				
A α	Ia and Ib	13-20	80-120	Primary muscle spindles, Golgi tendon organ
A β	II	6-12	35-75	Secondary muscle spindles, skin mechanoreceptors
A δ	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				
A α	N/A	12-20	72-120	Extrafusal skeletal muscle fibers
A γ	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