

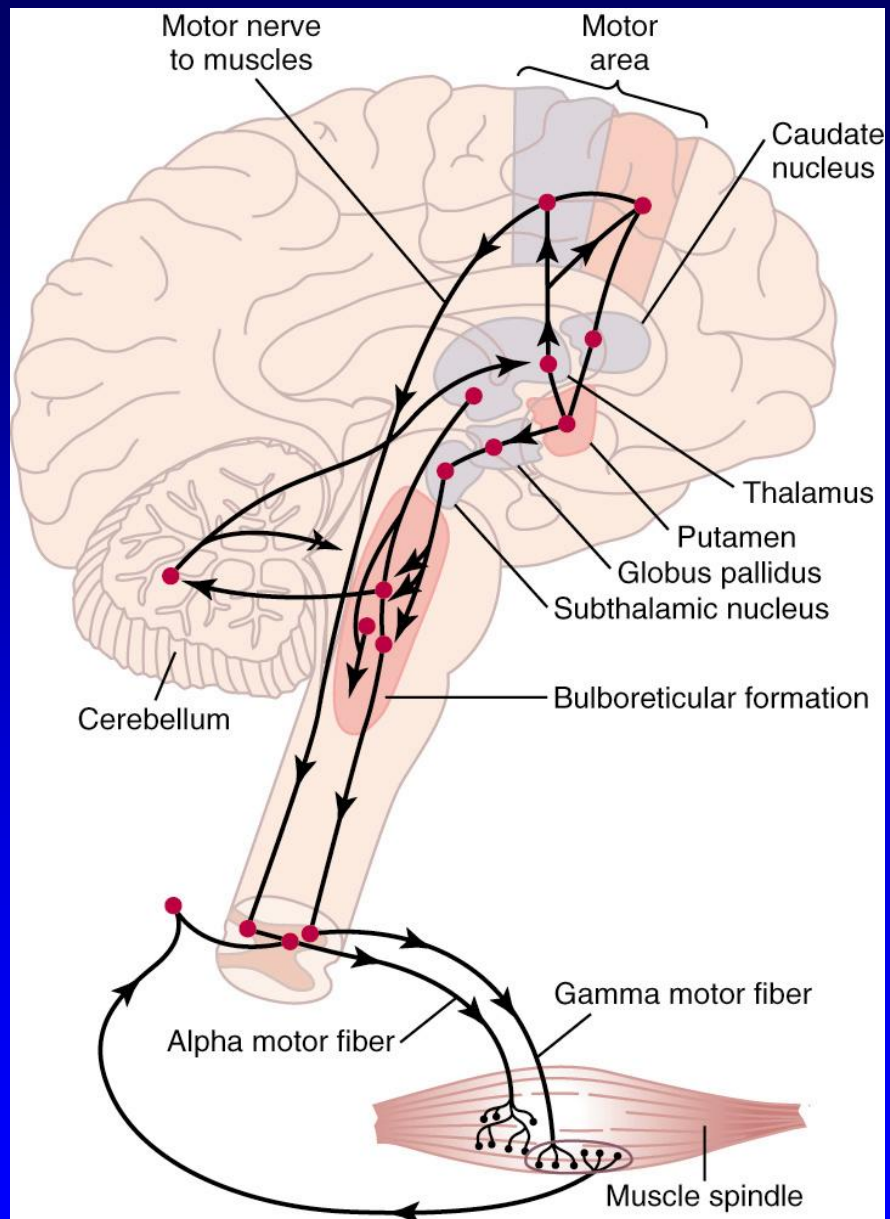
# The Special Senses

## 1) Vision

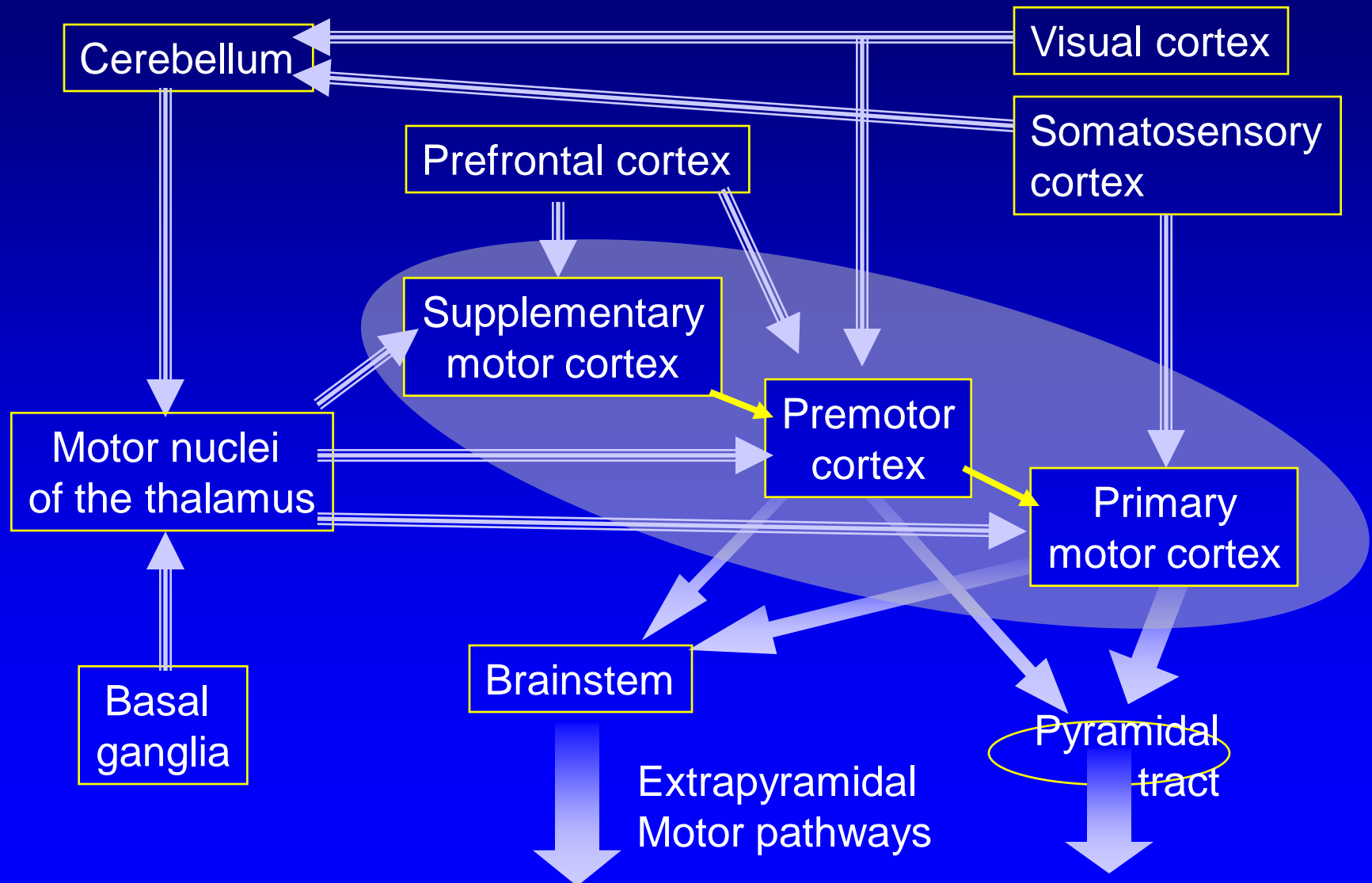
# motor system

## **Chapter 24**

Fundamental neuroscience for basic and clinical  
applications  
fourth edition



# Organisation of the motor system



# Motor system includes

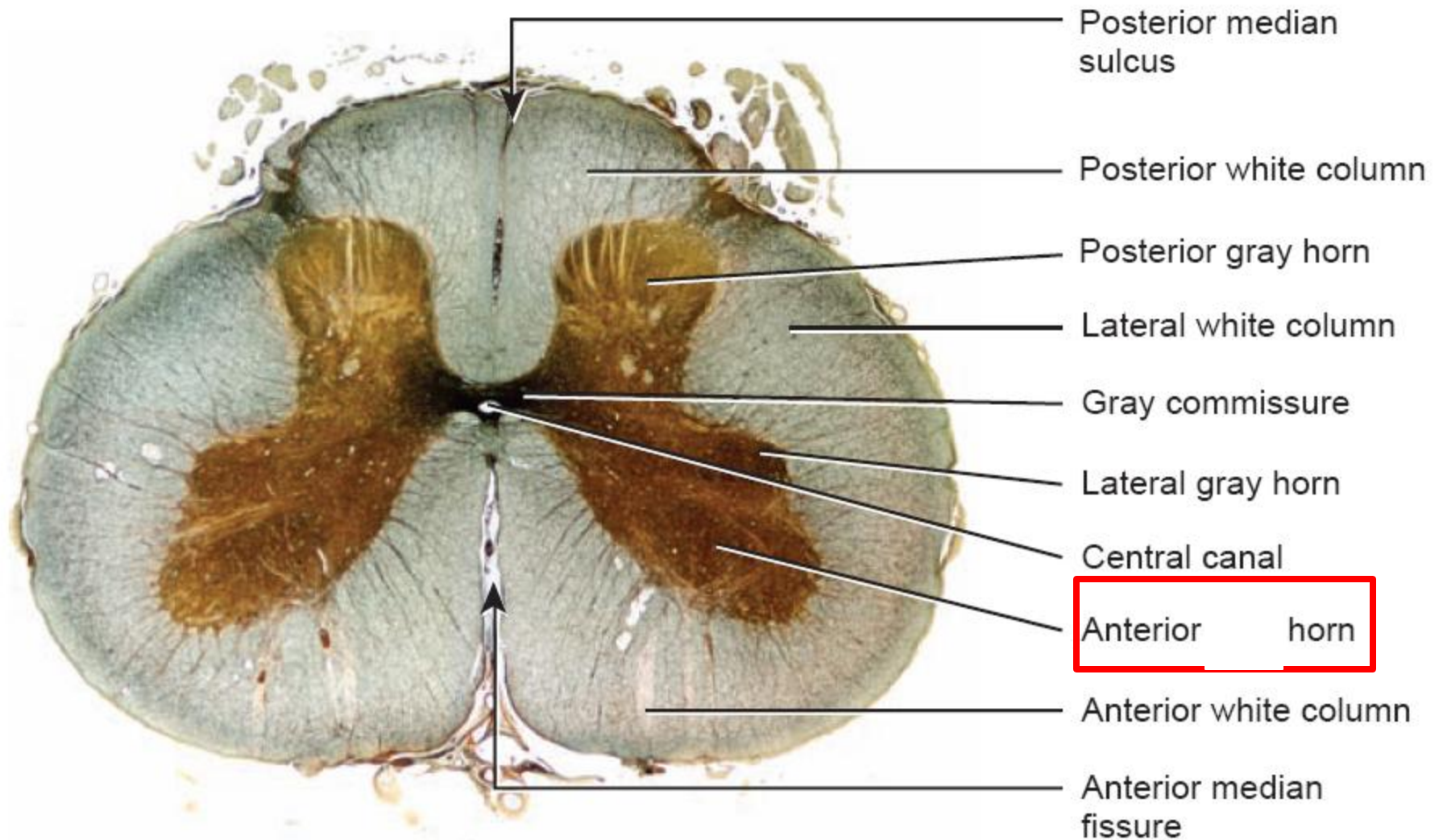
- Tracts

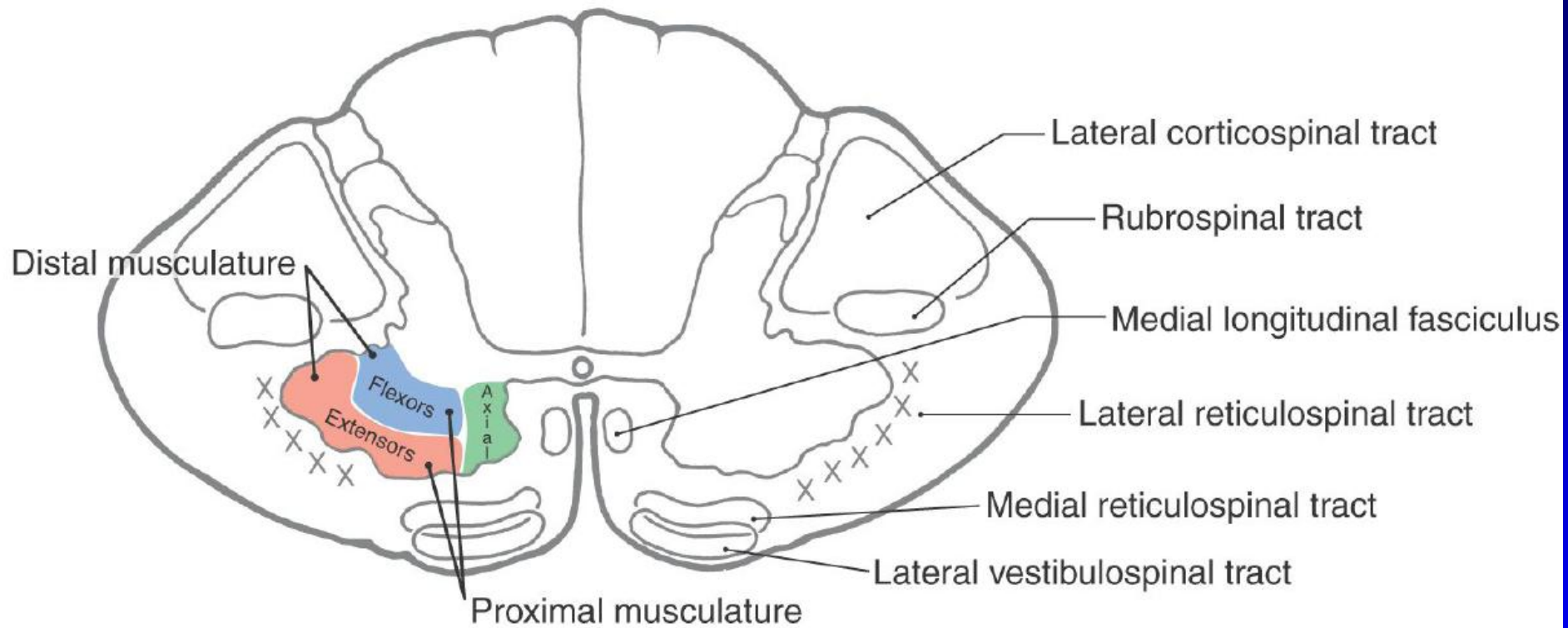
Corticospinal tract (Pyramidal tract )

Extra-pyramidal system

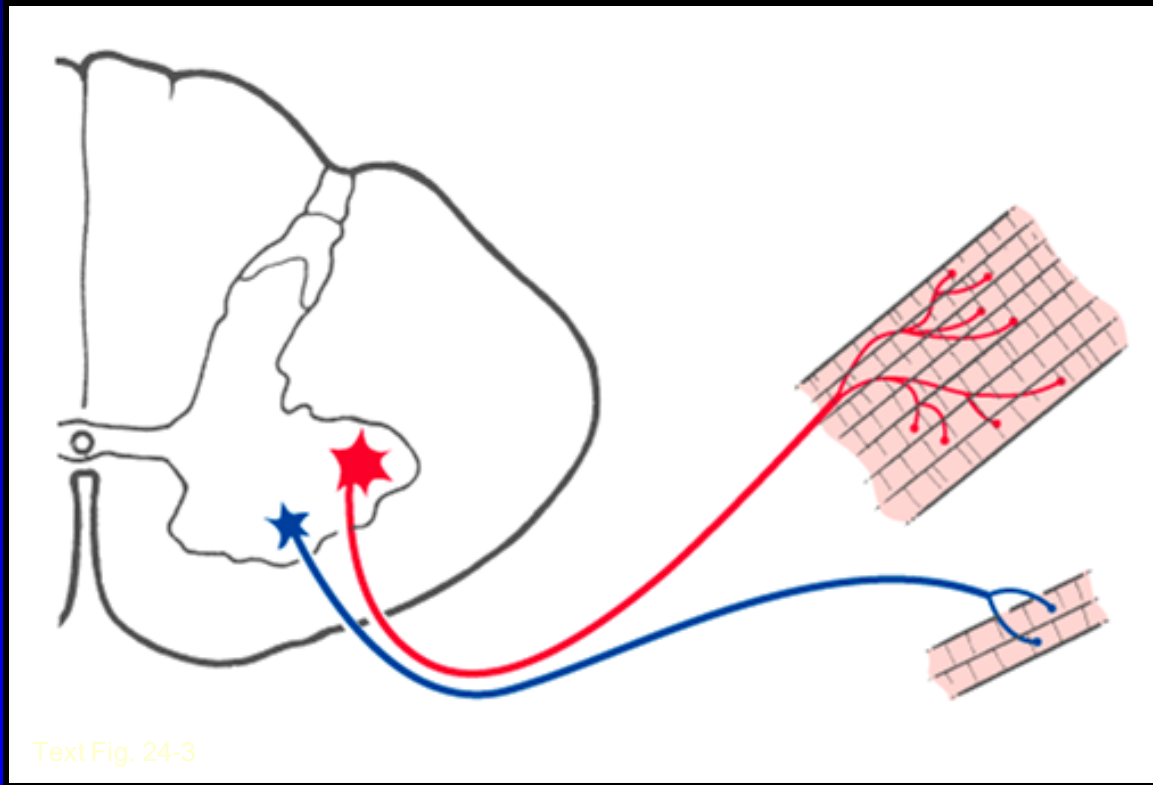
- Basal Ganglia (regulator)

- Cerebellum (regulator)



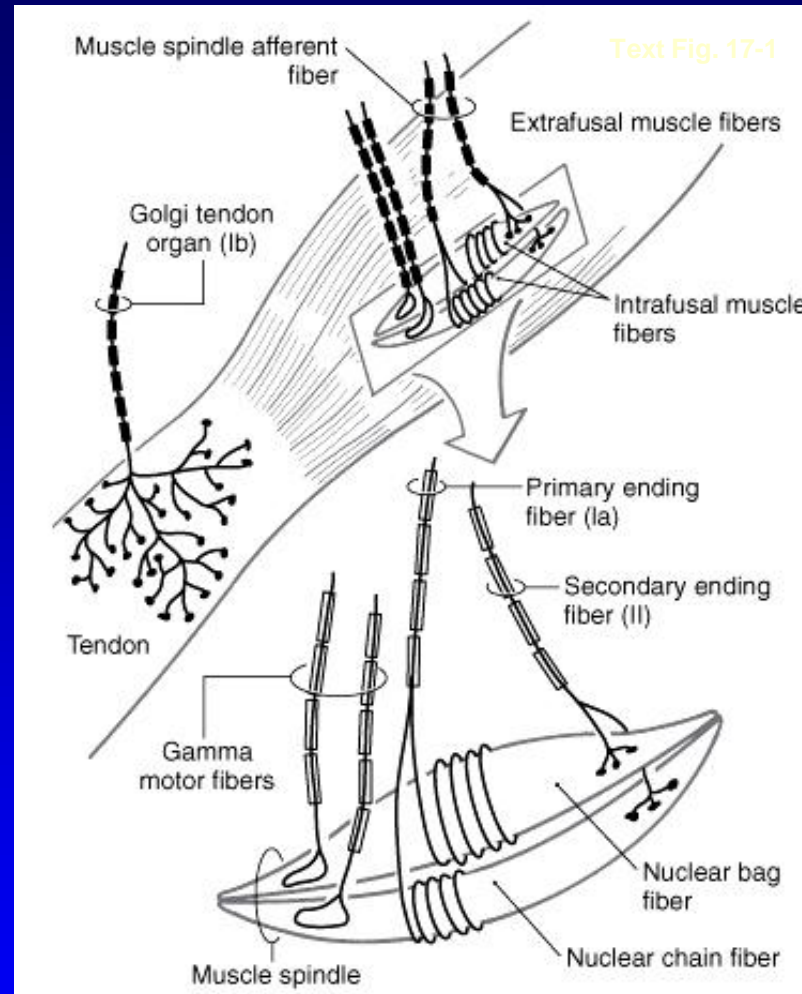


## Motor Units – Large Versus Small





# Major receptors involved in spinal cord reflexes: muscle spindle and golgi tendon organ



**Muscle spindle sense change and rate of change in muscle length**

**Golgi tendon organ sense the force of muscle contraction (tension)**

# The Muscle Spindle

## Nuclear bag fiber (Annulosprial ending)

Nuclei arranged in cluster

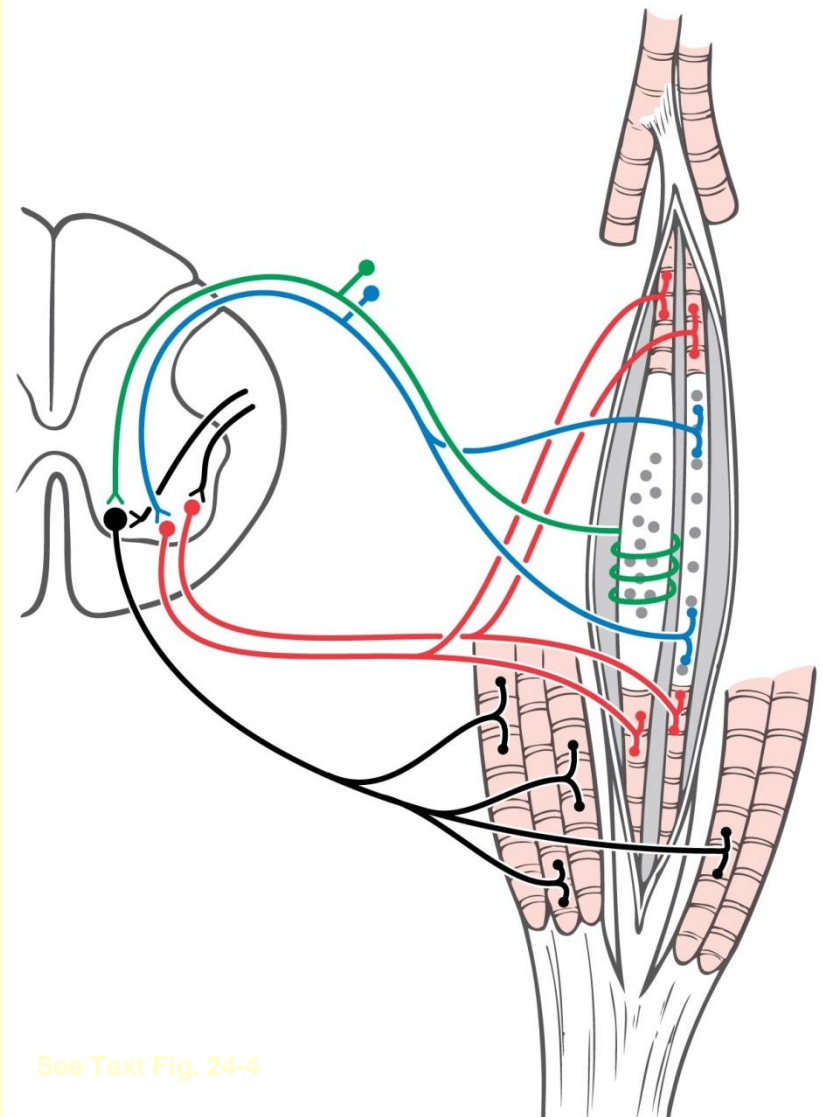
Dynamic/Static

- Primary, Ia, 80-120 msec (12-20)
- Rate** of change in length (**dynamic**) versus only **Change** in length not rate (**static**)
- Dynamic** bag fibers to **Dynamic** gamma motor neurons (sensitivity)
- Static** bag fibers to **Static** gamma motor neurons (length)

## Nuclear chain fiber (Flower-spray ending)

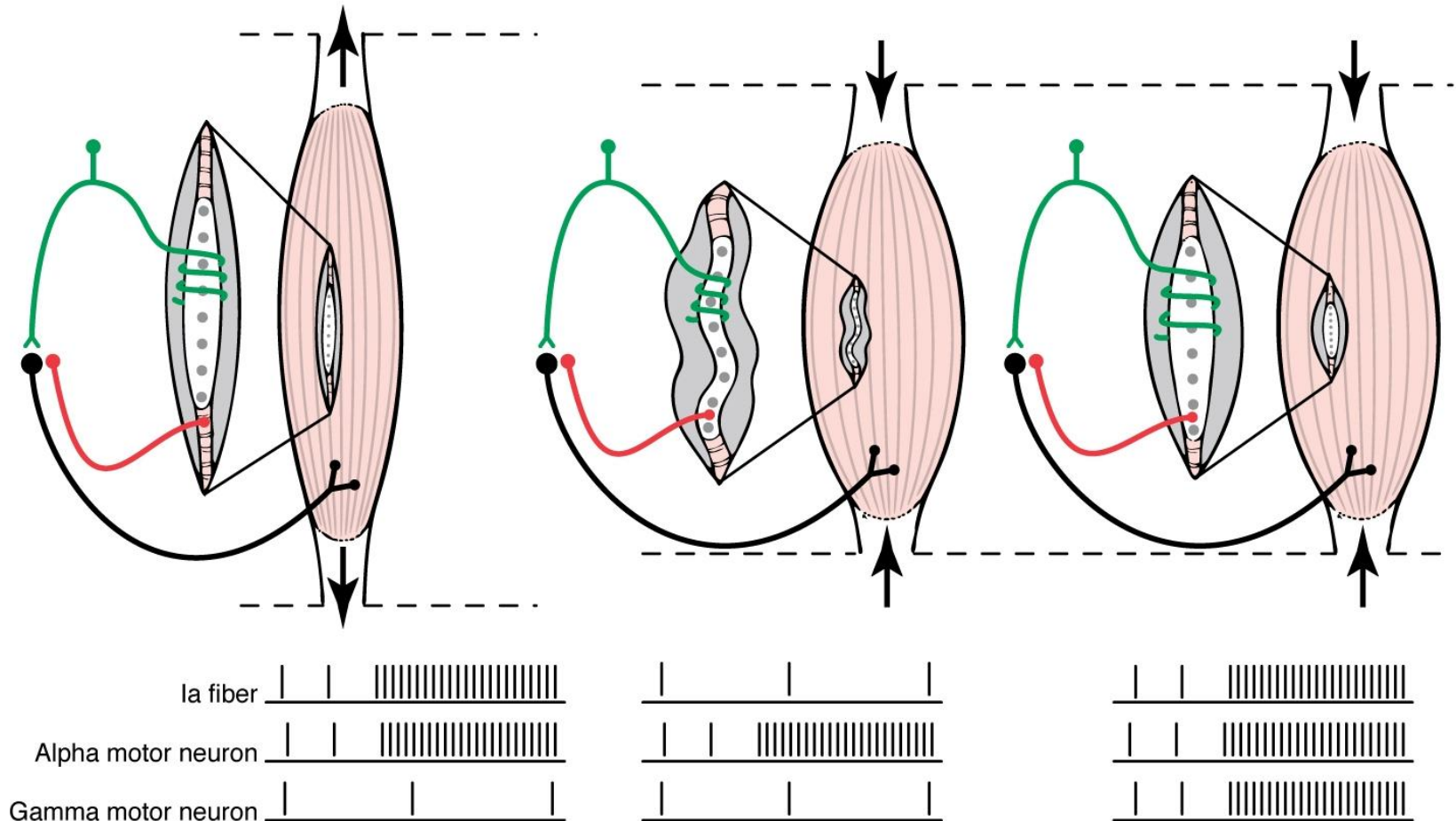
Nuclei arranged in single row

- Secondary, II, 35-70 msec (6-10)
- **Change** in length only, not rate of change



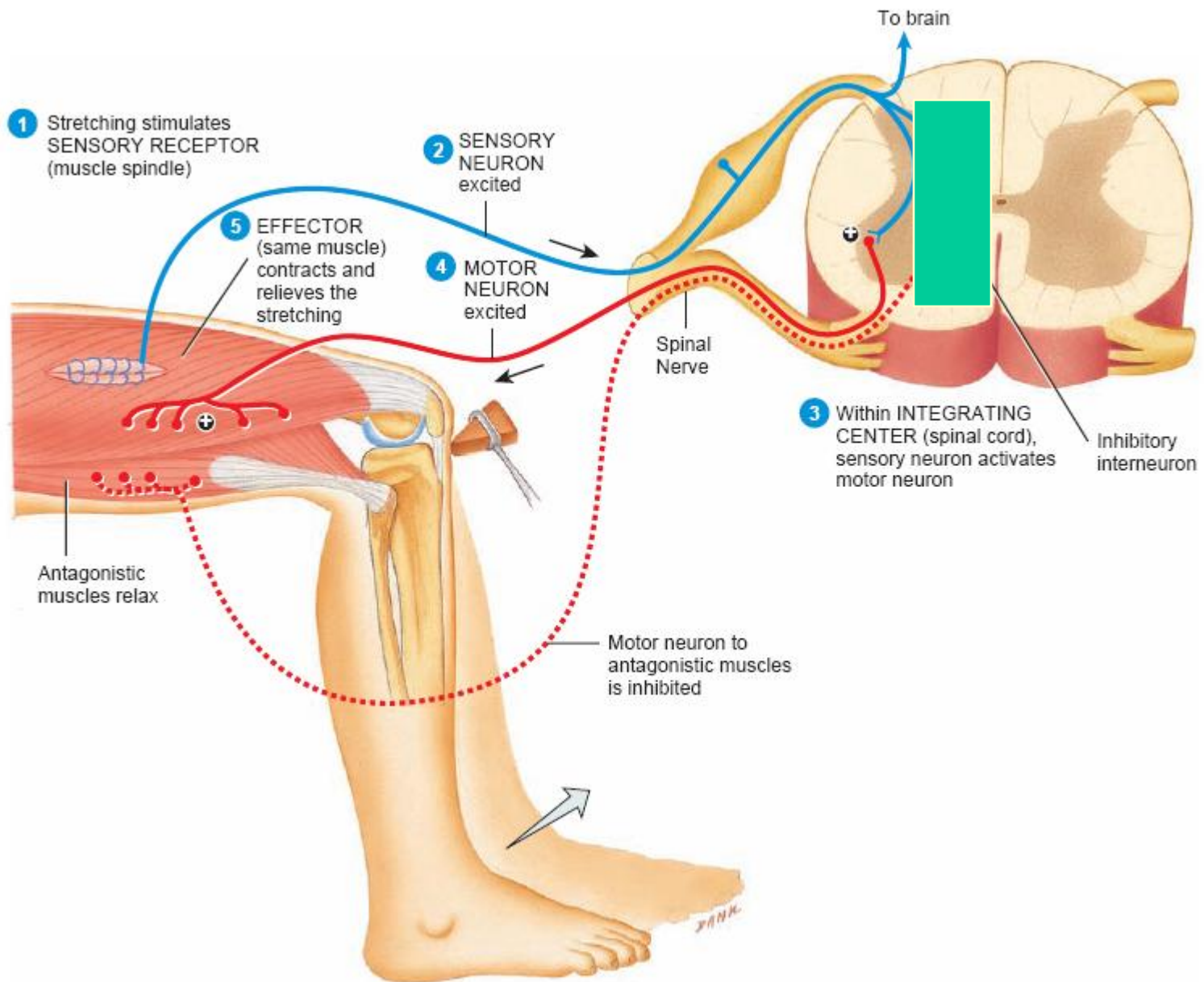
See Text Fig. 24-4

# The Muscle Spindle When Activated



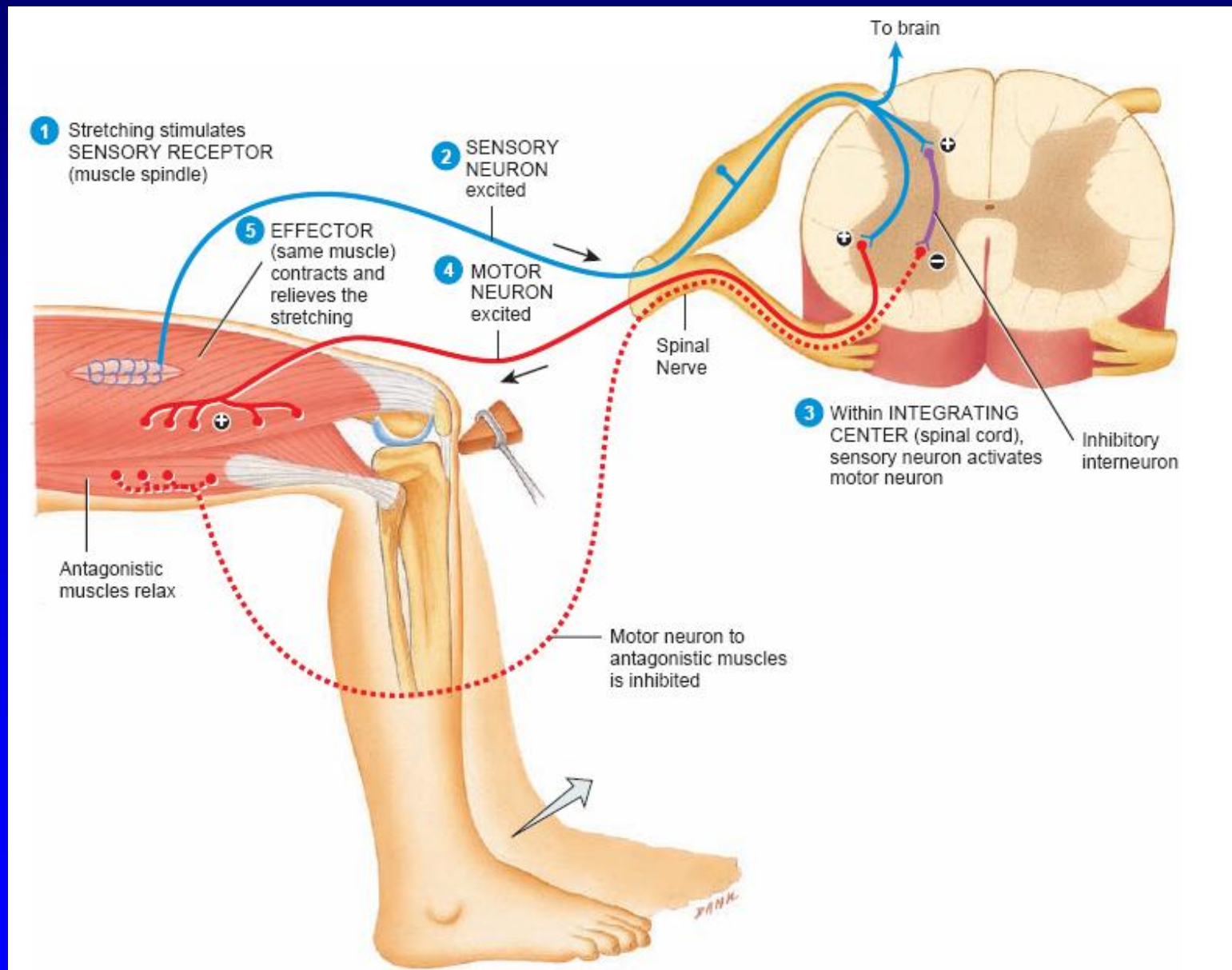
# **Spinal cord Reflexes**

# Muscle stretch reflex

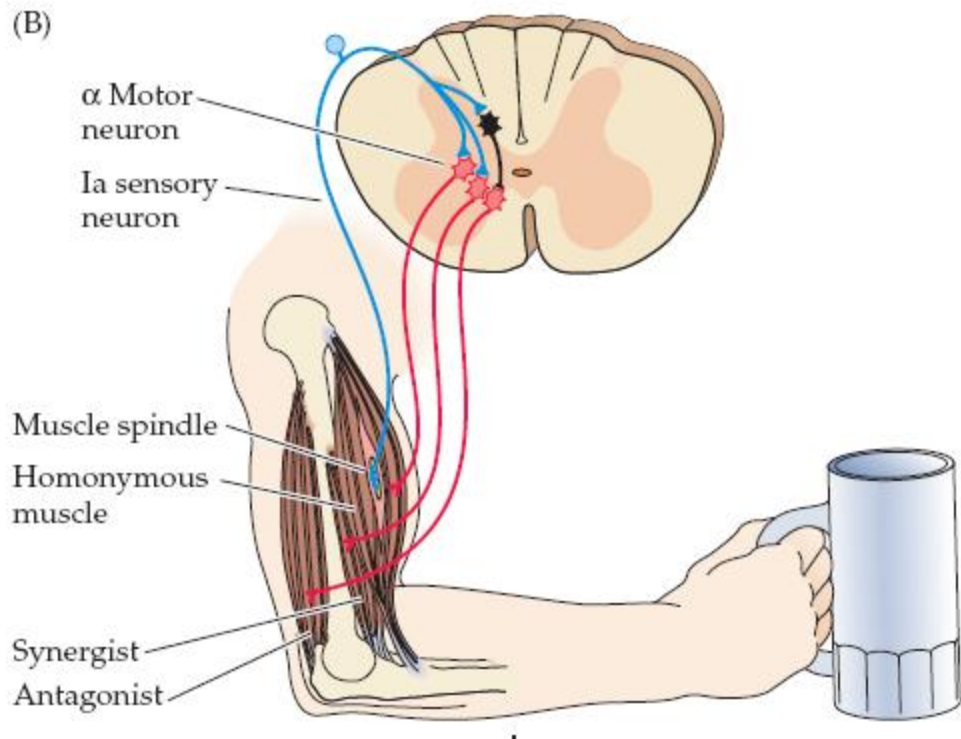




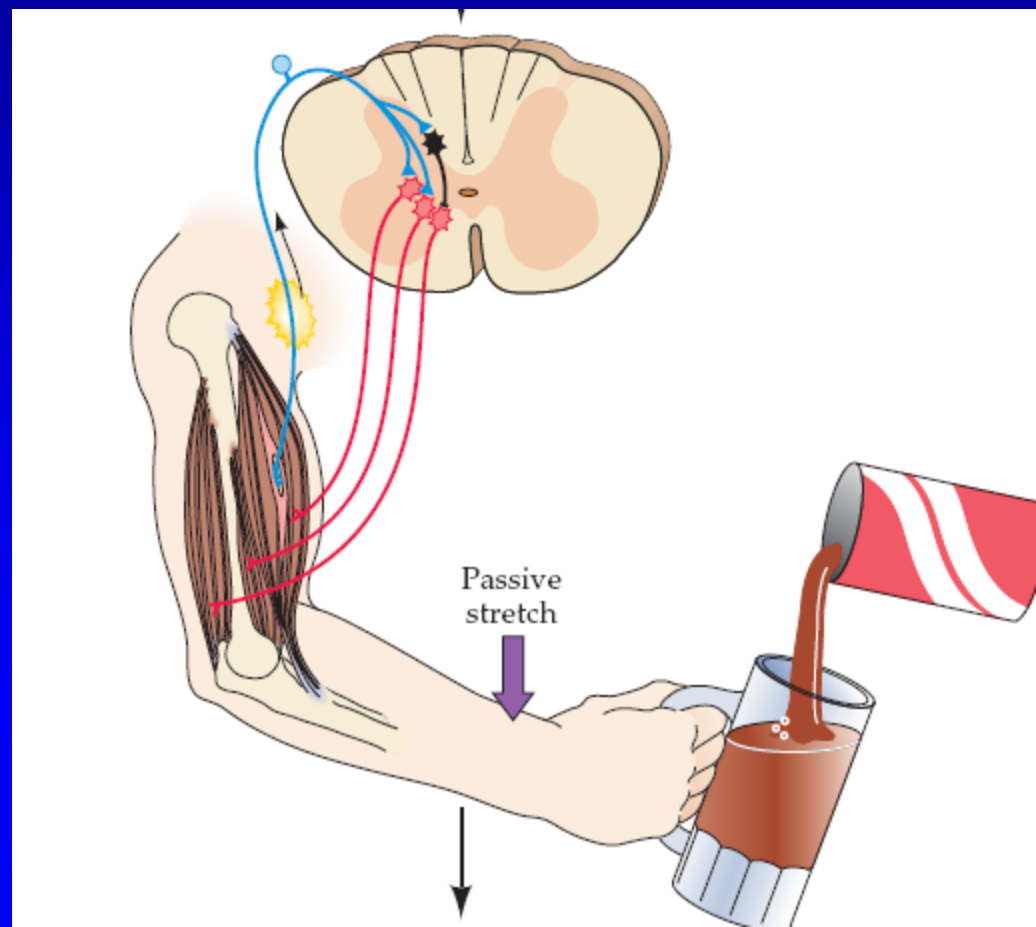
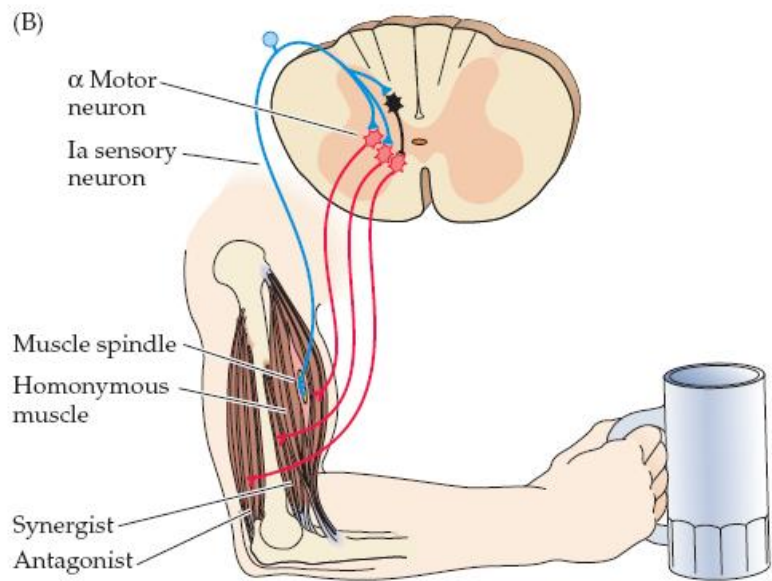
# Muscle stretch reflex / Reciprocal inhibition



(B)

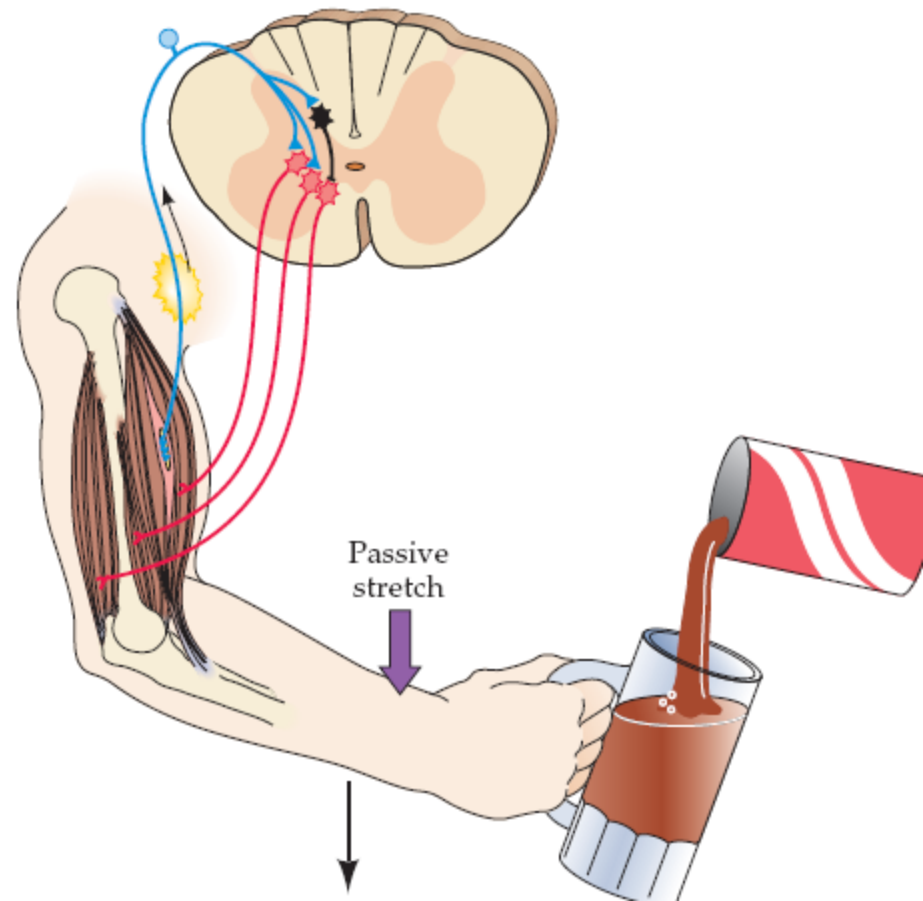
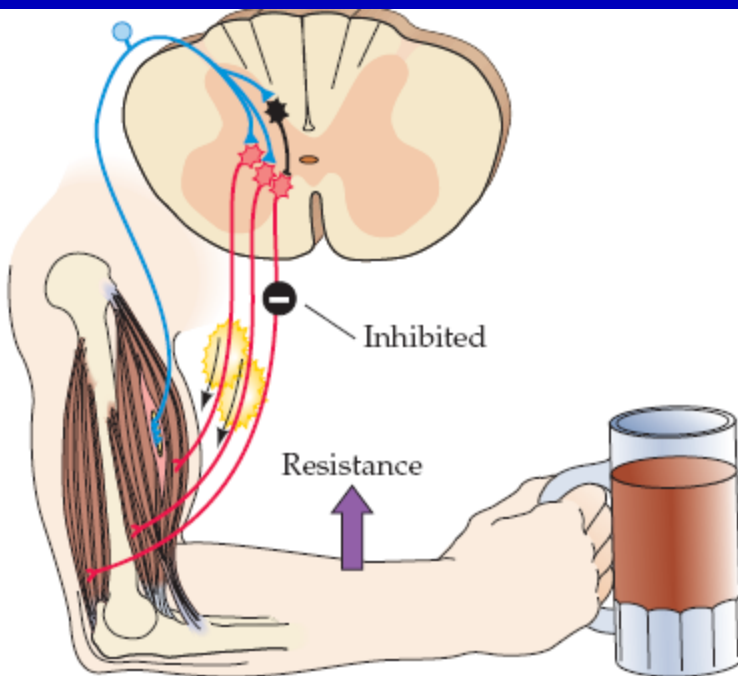
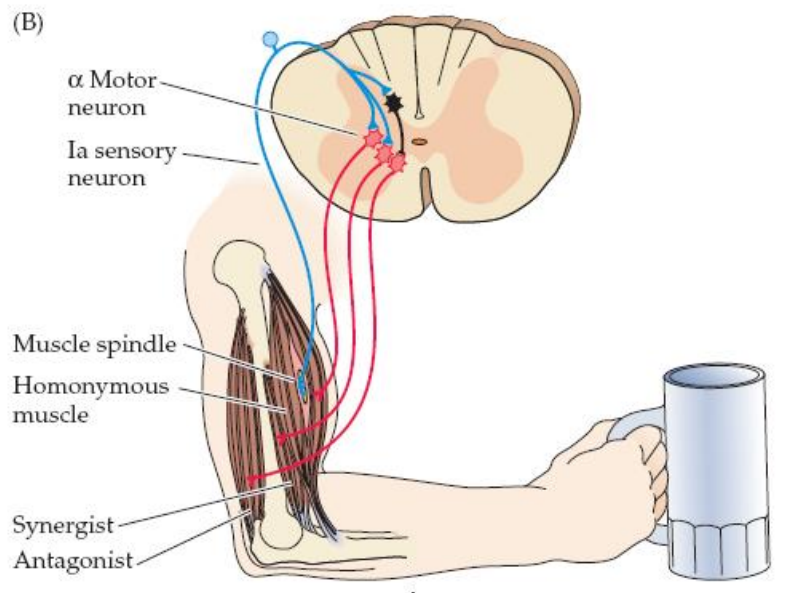


(B)

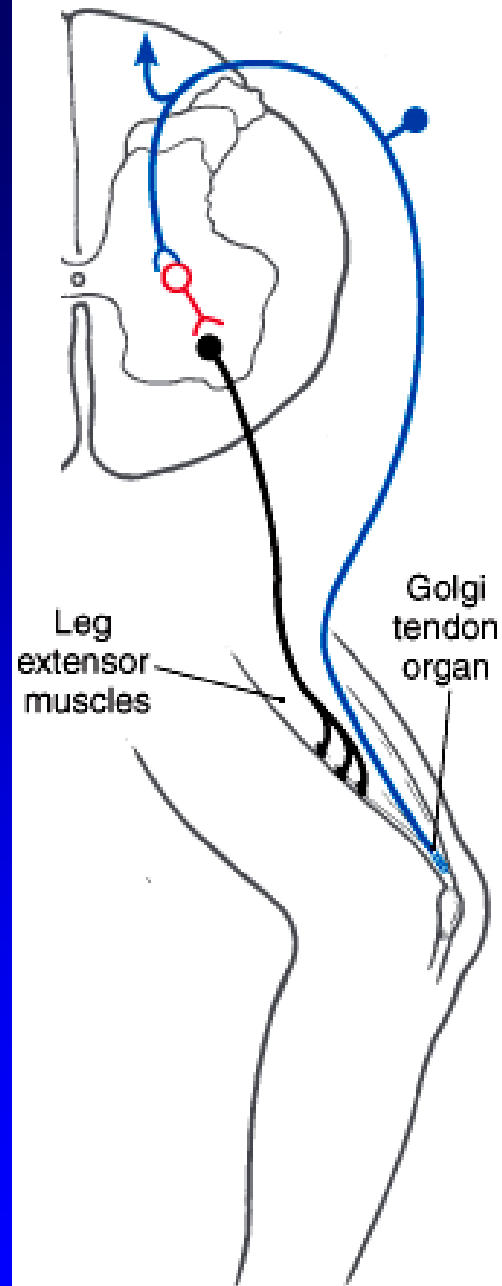




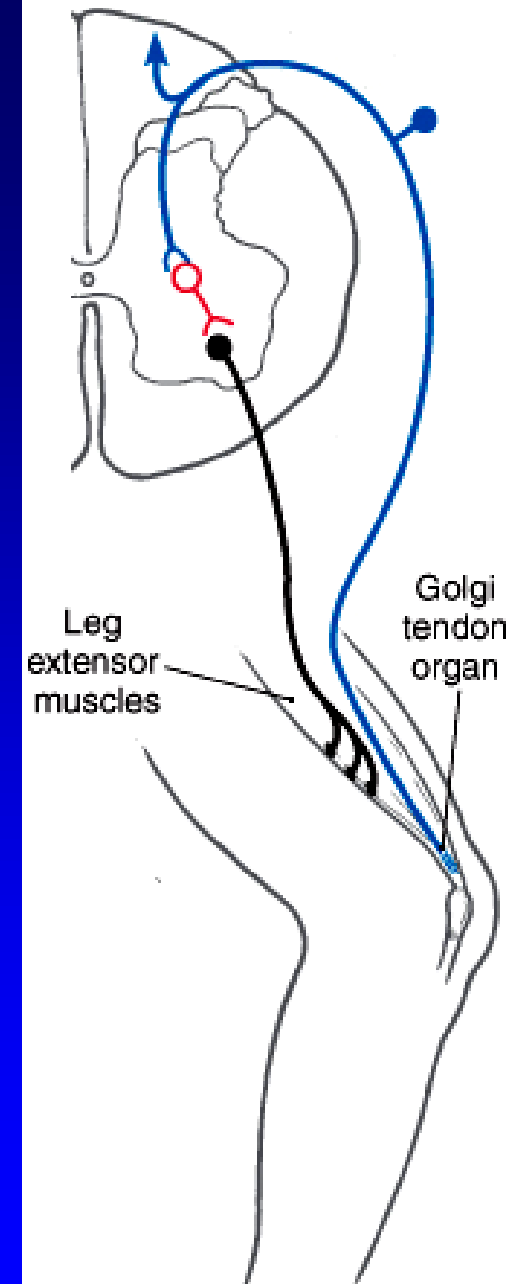
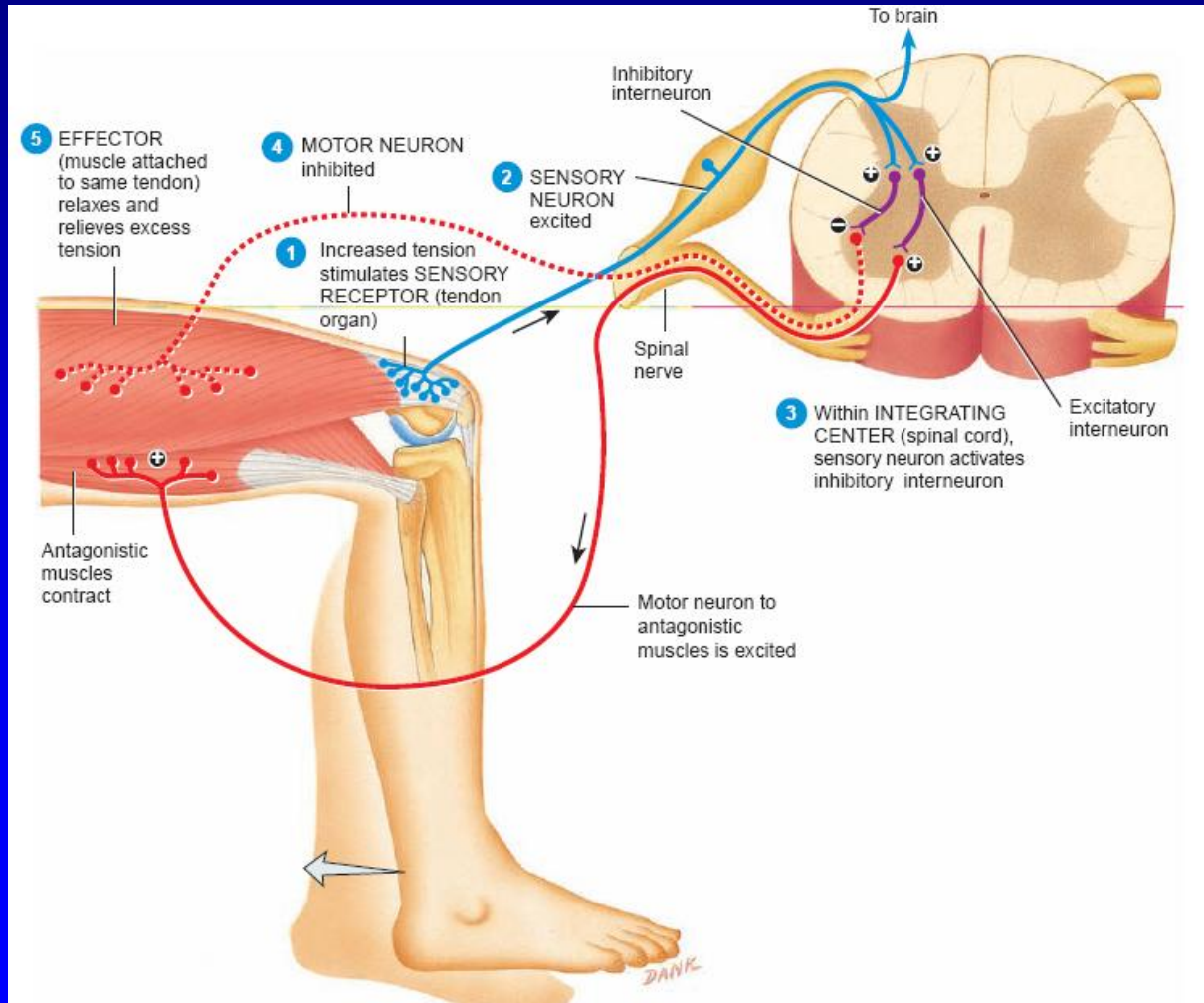
(B)



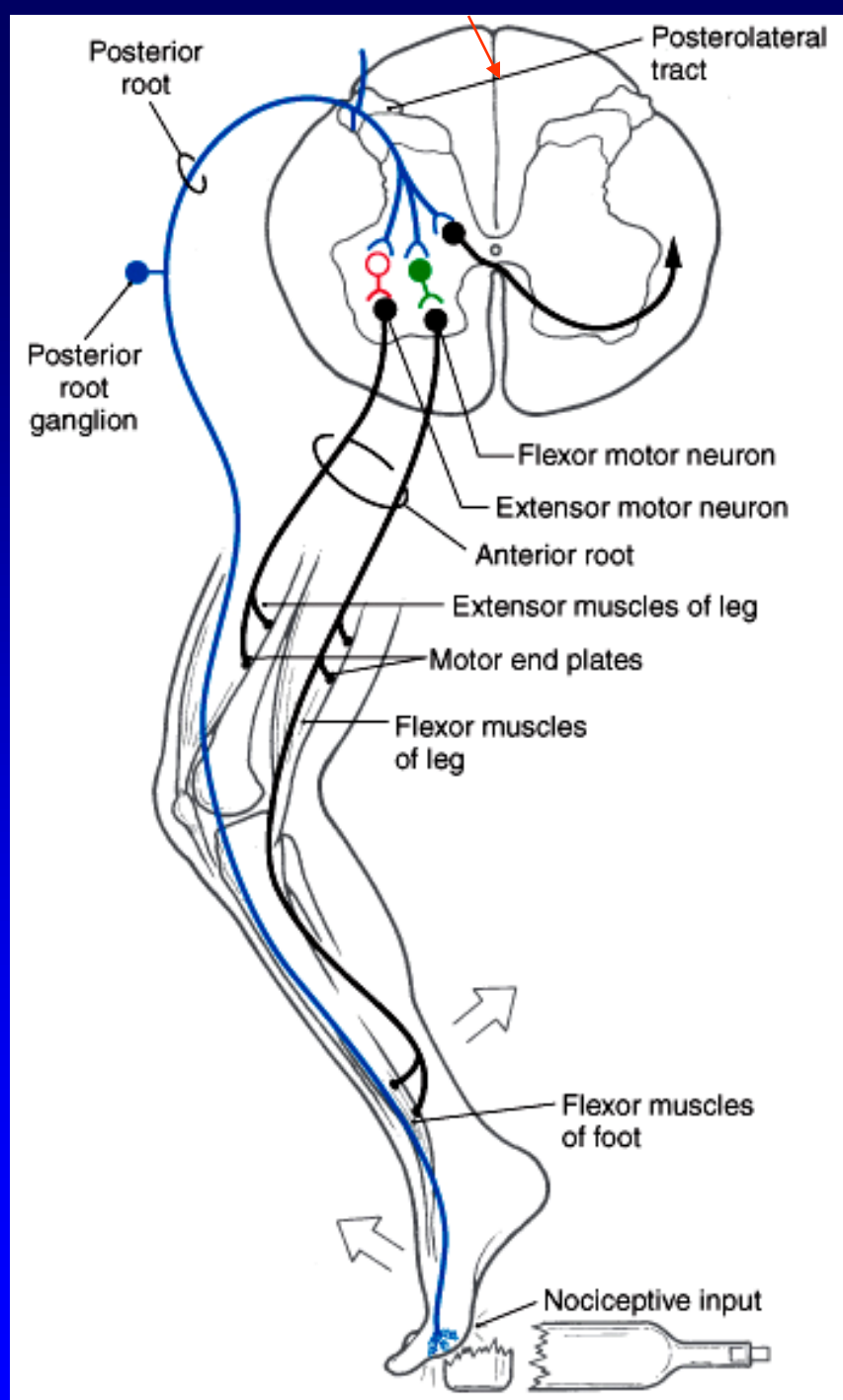
# Tendon reflex (autogenic inhibition)



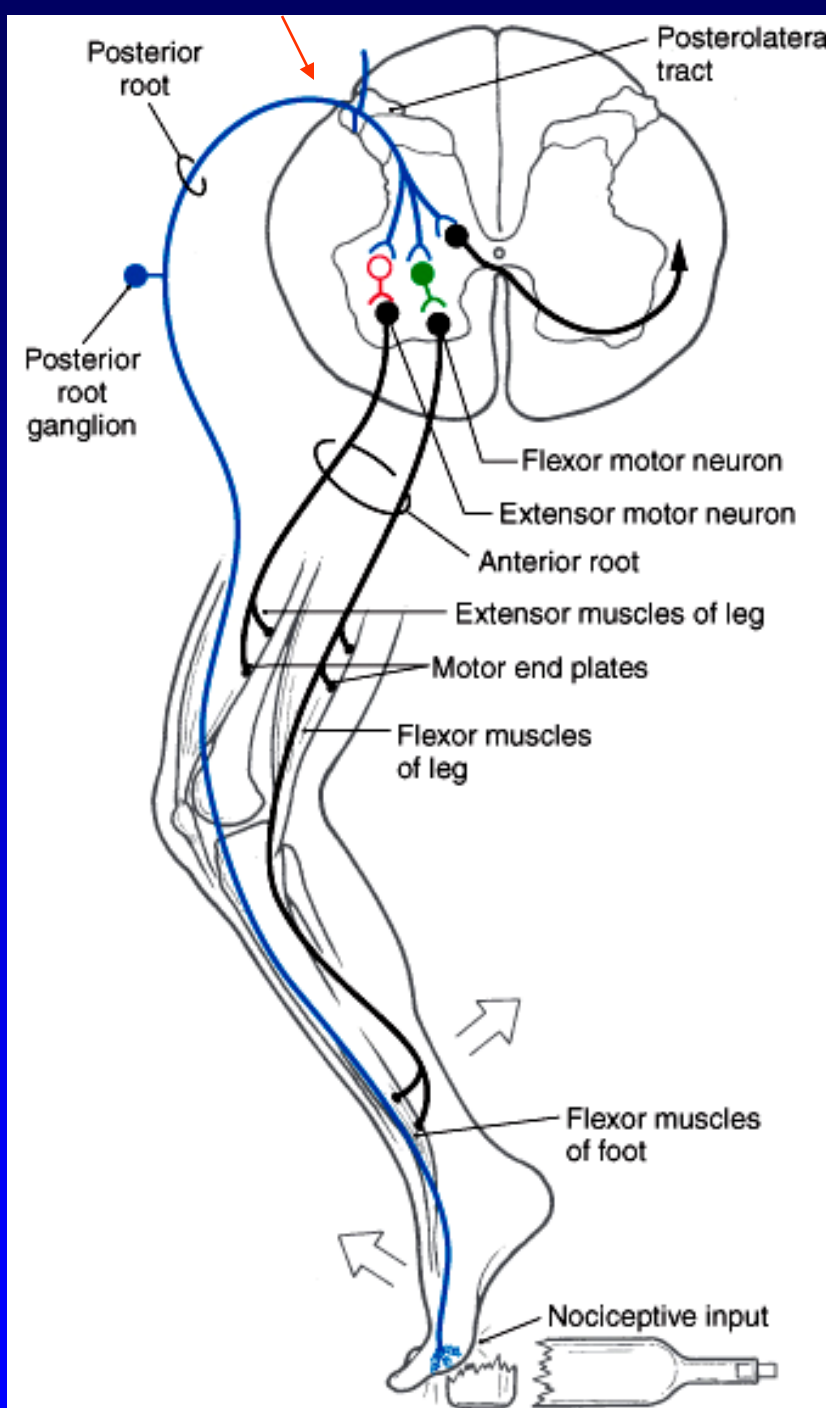
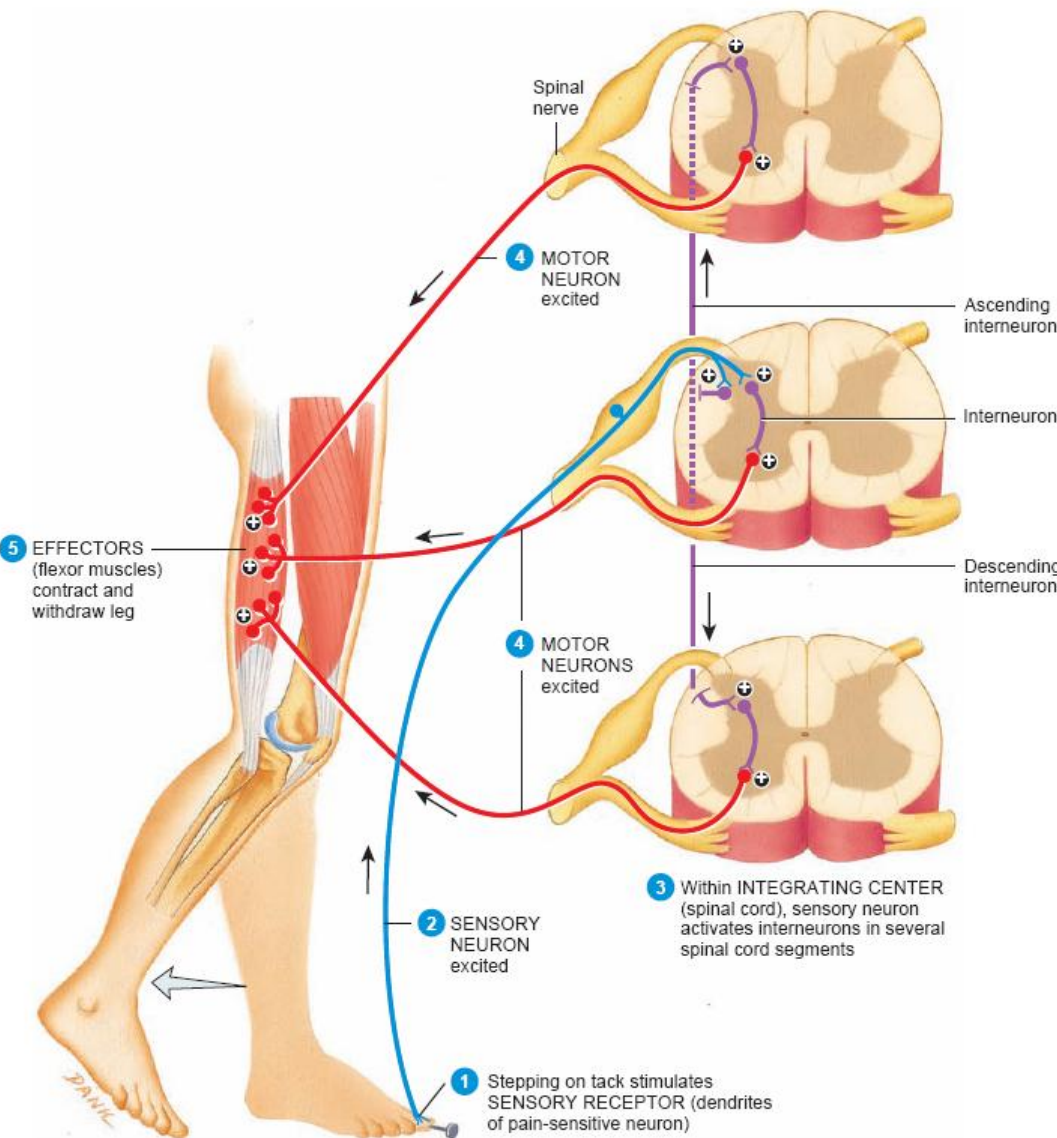
# Tendon reflex (autogenic inhibition)



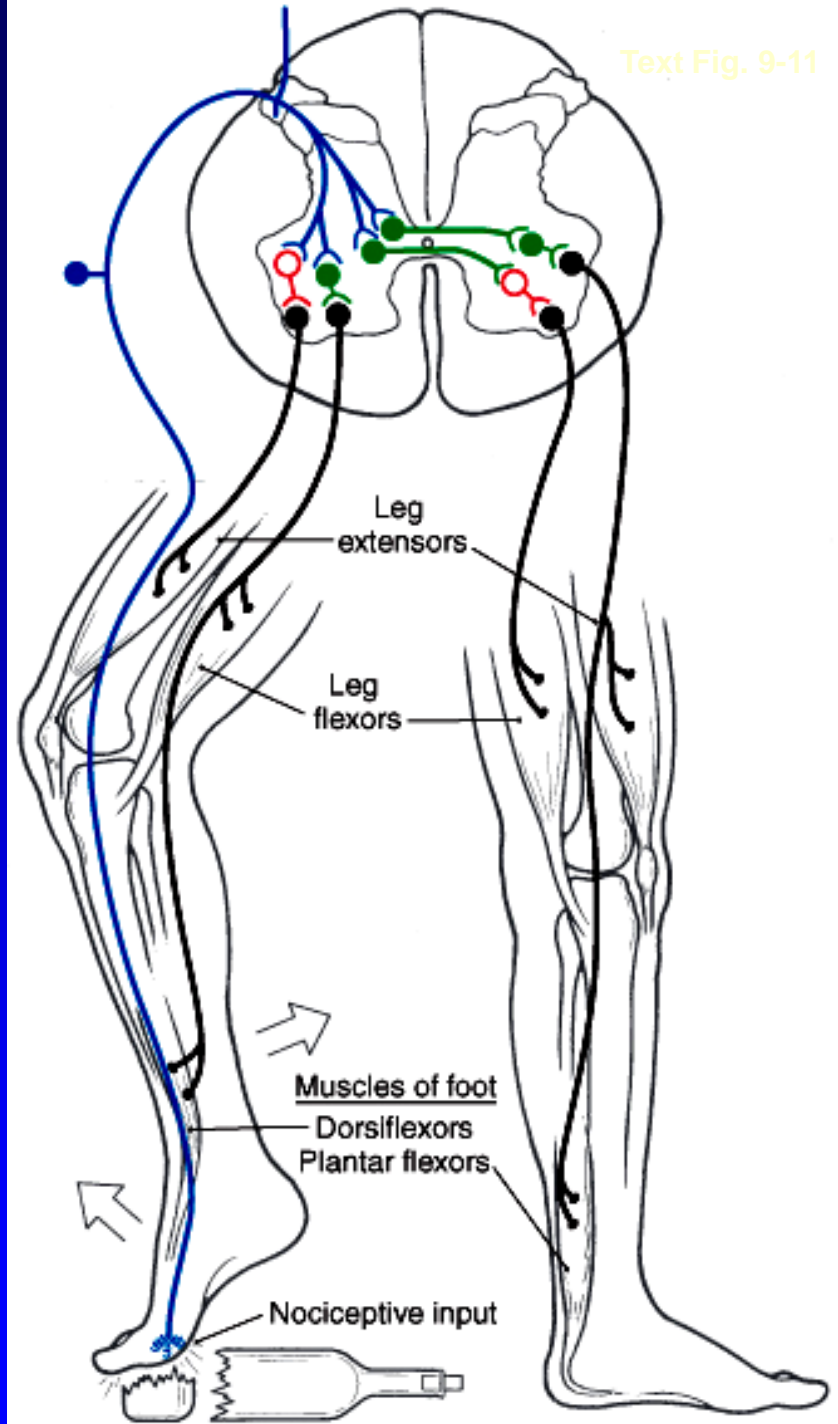
# Flexor (withdrawal ) reflex (nociceptive reflex)



## Flexor (withdrawal ) reflex (nociceptive reflex)



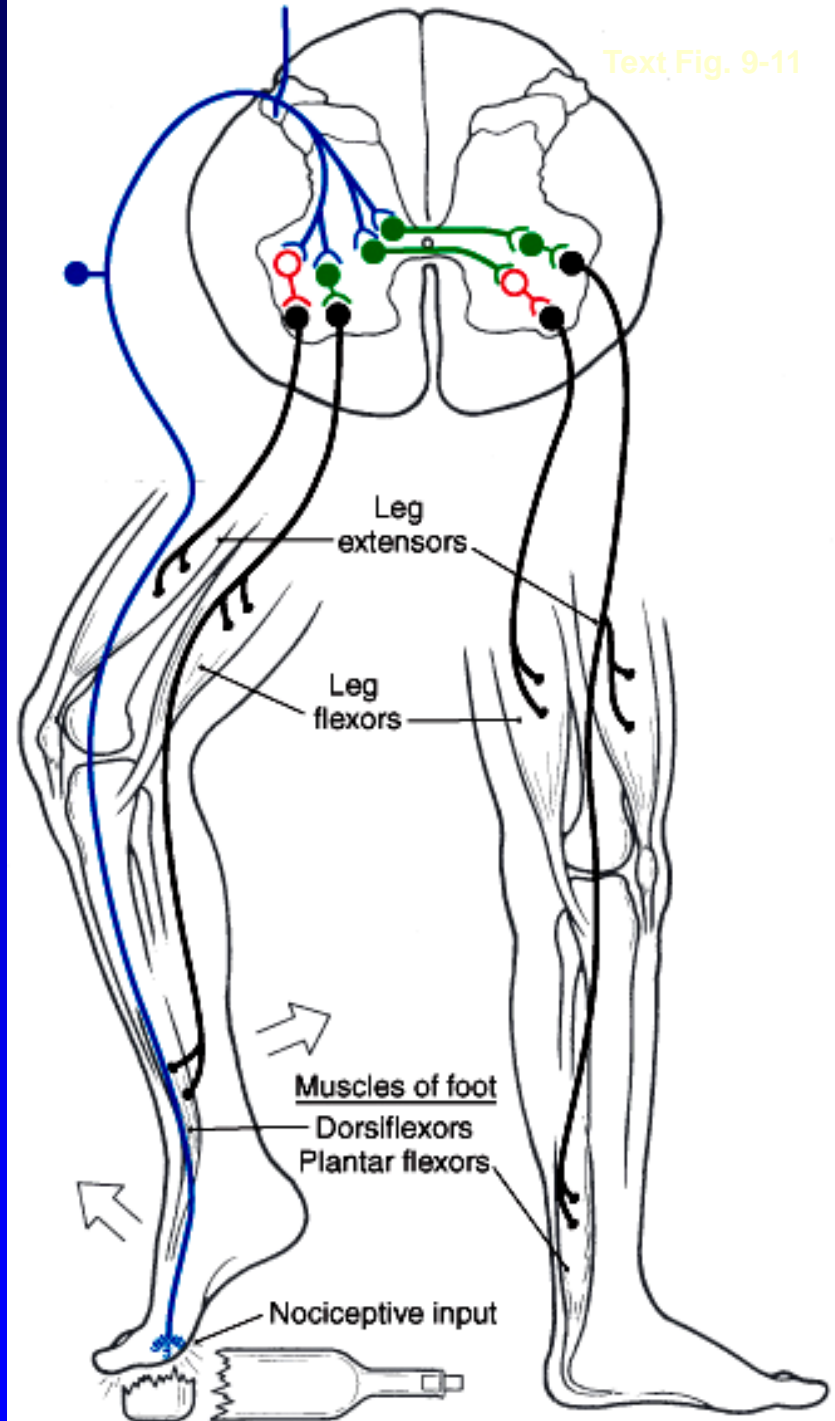
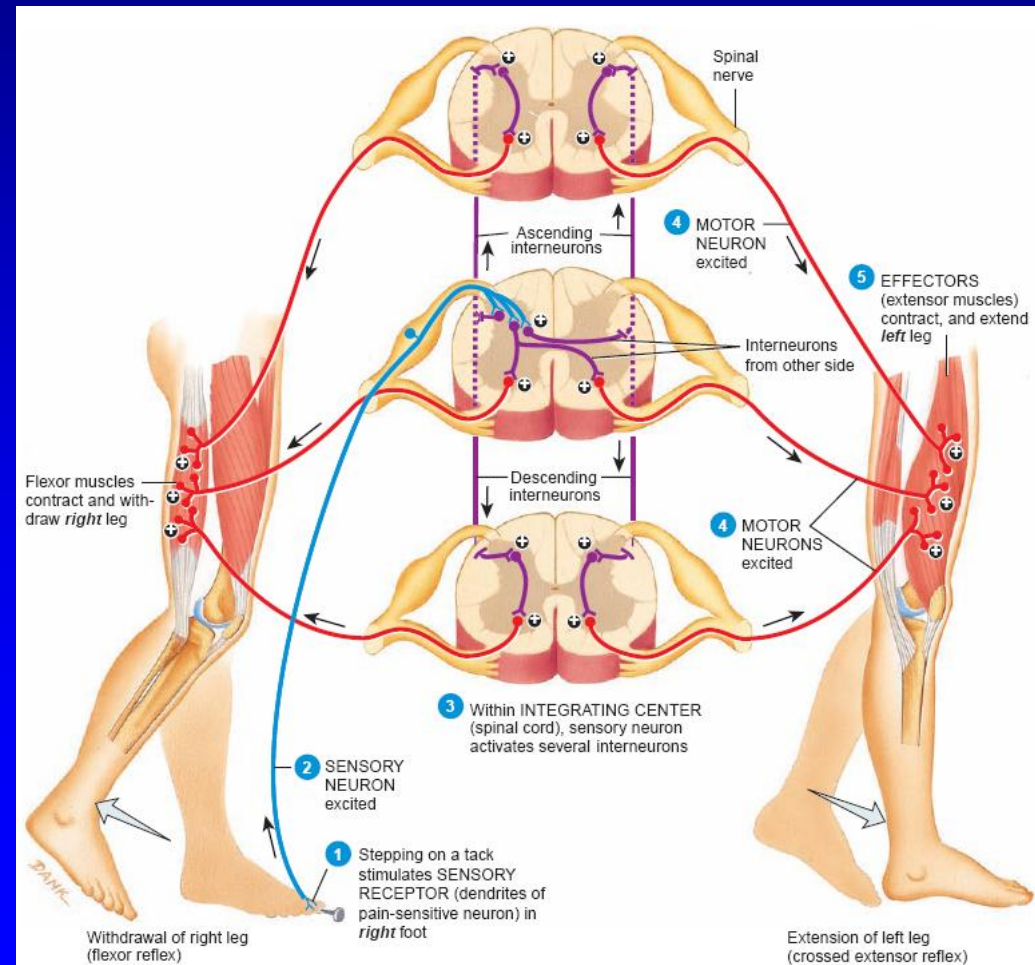
# Crossed Extension Reflex





# Crossed Extension Reflex

Text Fig. 9-11

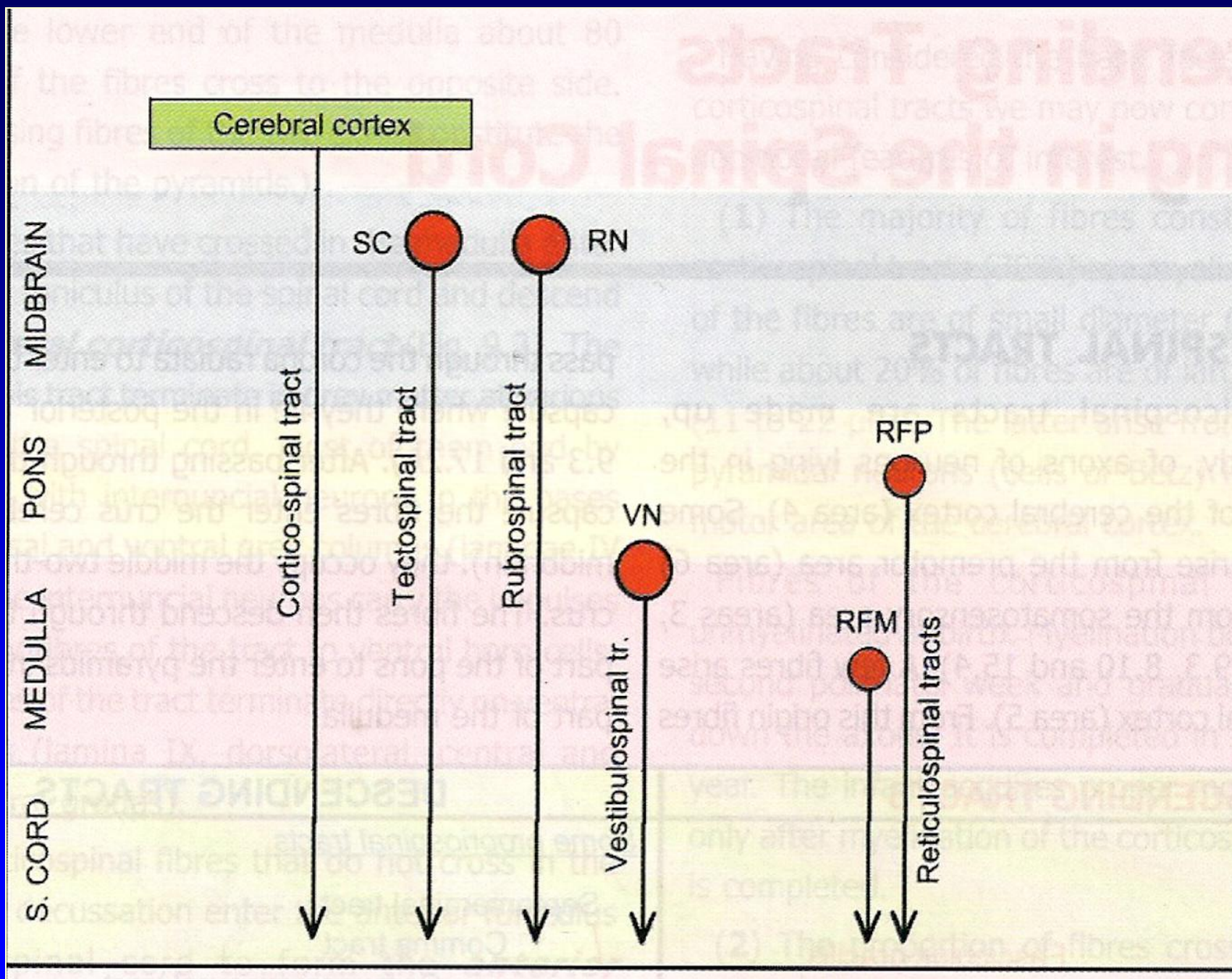


# Extra-pyramidal System, Basal Ganglia and Cerebellum

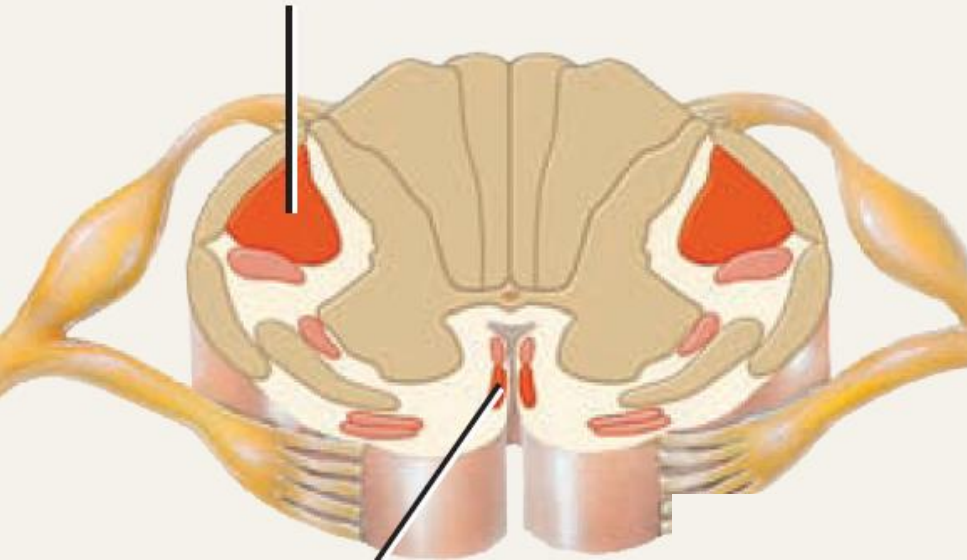


# Extra-pyramidal System

**Definition:** Tracts other than corticospinal tract are known as Extra-pyramidal tract.



Lateral corticospinal tract



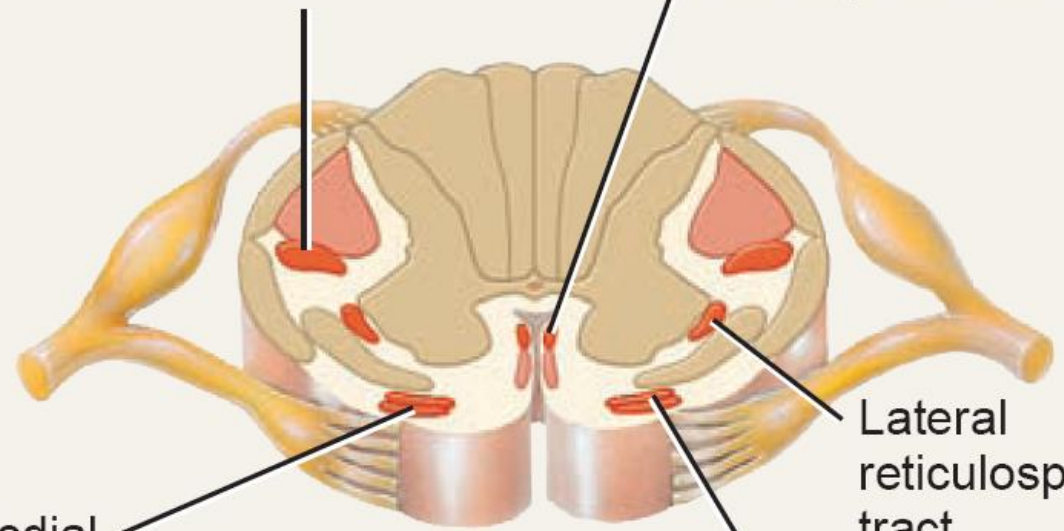
Rubrospinal tract

Tectospinal tract

Medial reticulospinal tract

Lateral reticulospinal tract

Vestibulospinal tract



# Reticulospinal Tract

The reticular formation in the brainstem. It contains many different nuclear groups.

Pontine and medullary nuclei projects to the anterior horn of the spinal cord.

**Functions:** is responsible for regulating muscle tone and maintain posture.



## Rubrospinal Fibers:

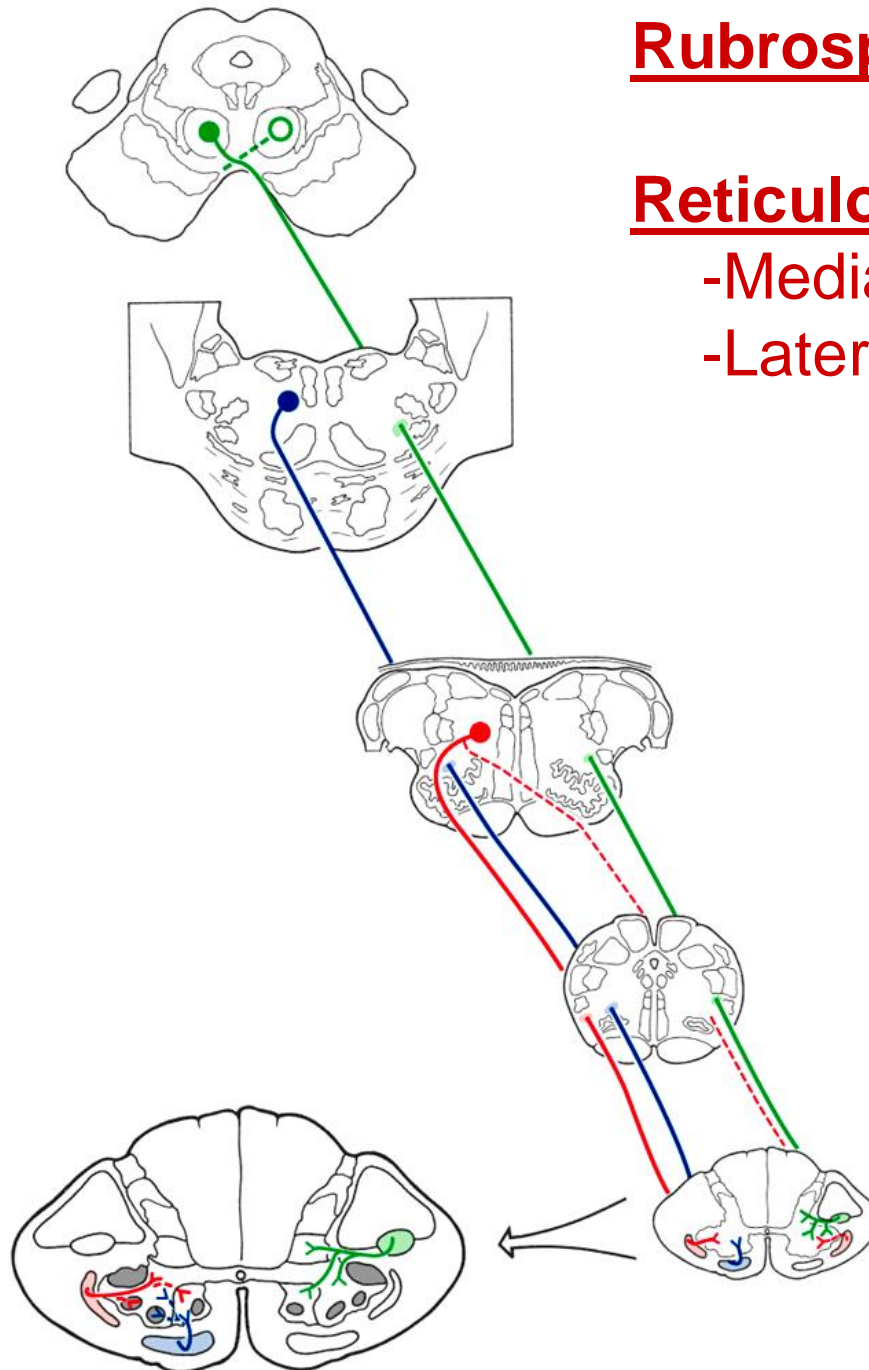


## Reticulospinal Fibers:

-Medial



-Lateral



# Vestibulospinal tract

vestibular apparatus & vestibular nuclei

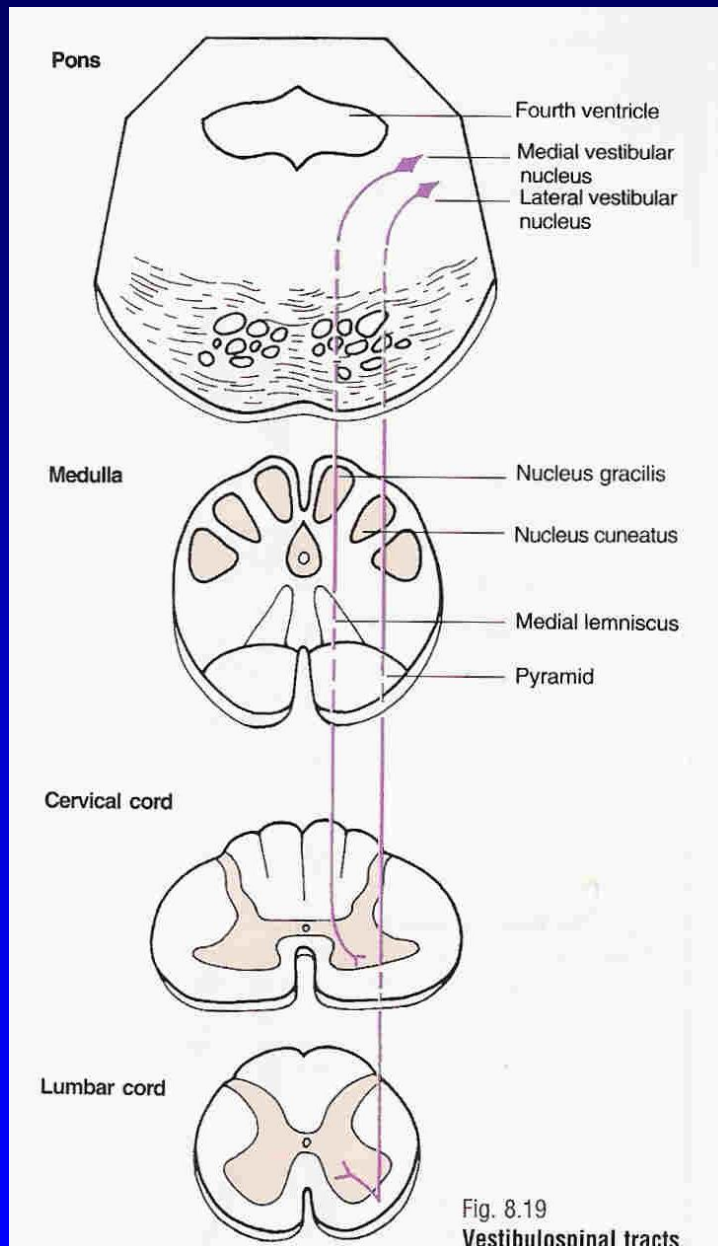


Spinal motor neuron



Innervating axial &  
postural muscles  
(trunk muscles)

Function : maintain Posture & balance  
“head & eye” and balance reflexes



## Rubrospinal Fibers:

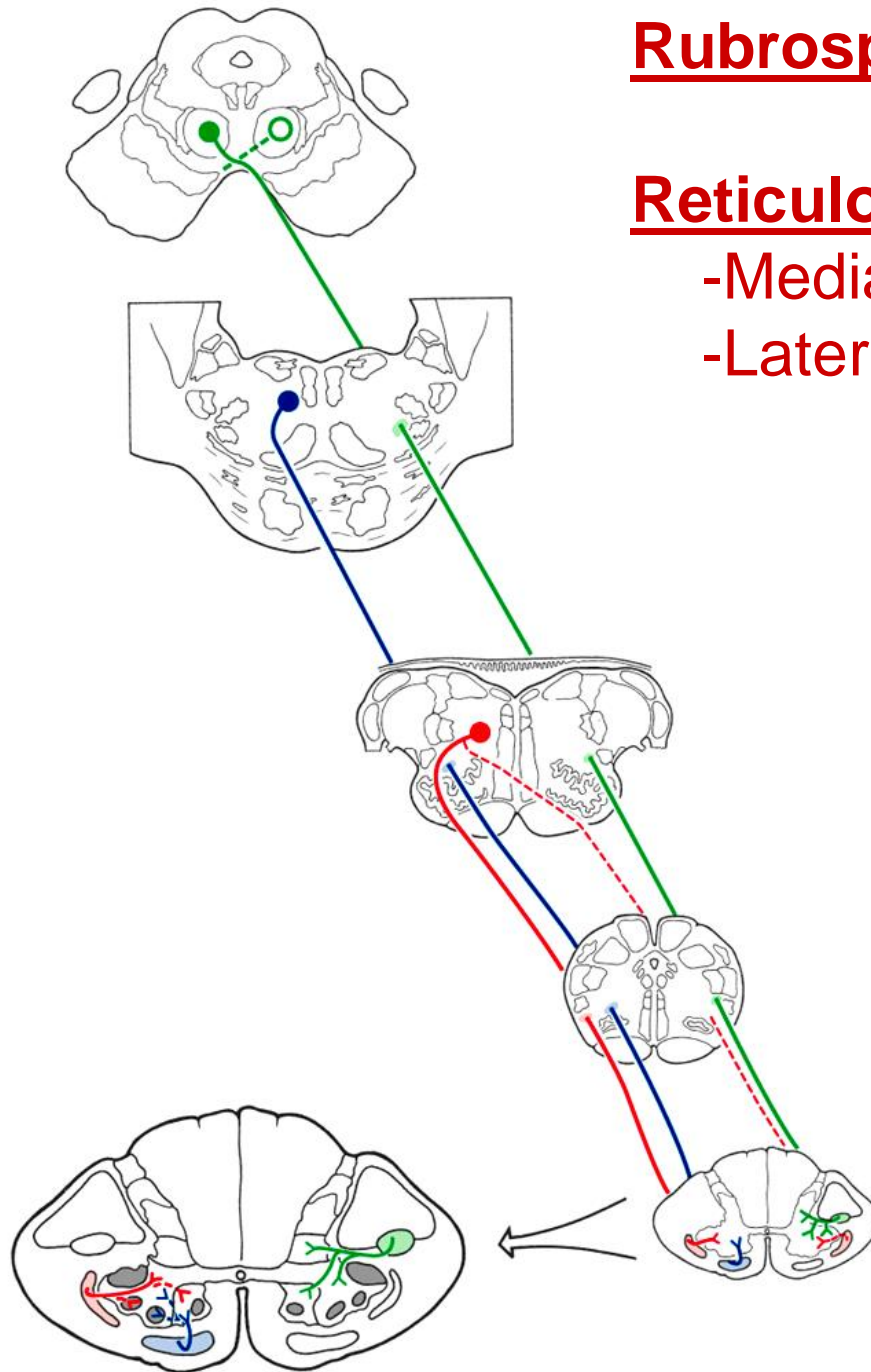


## Reticulospinal Fibers:

-Medial



-Lateral



# Rubrospinal tract

Red Nucleus in Midbrain

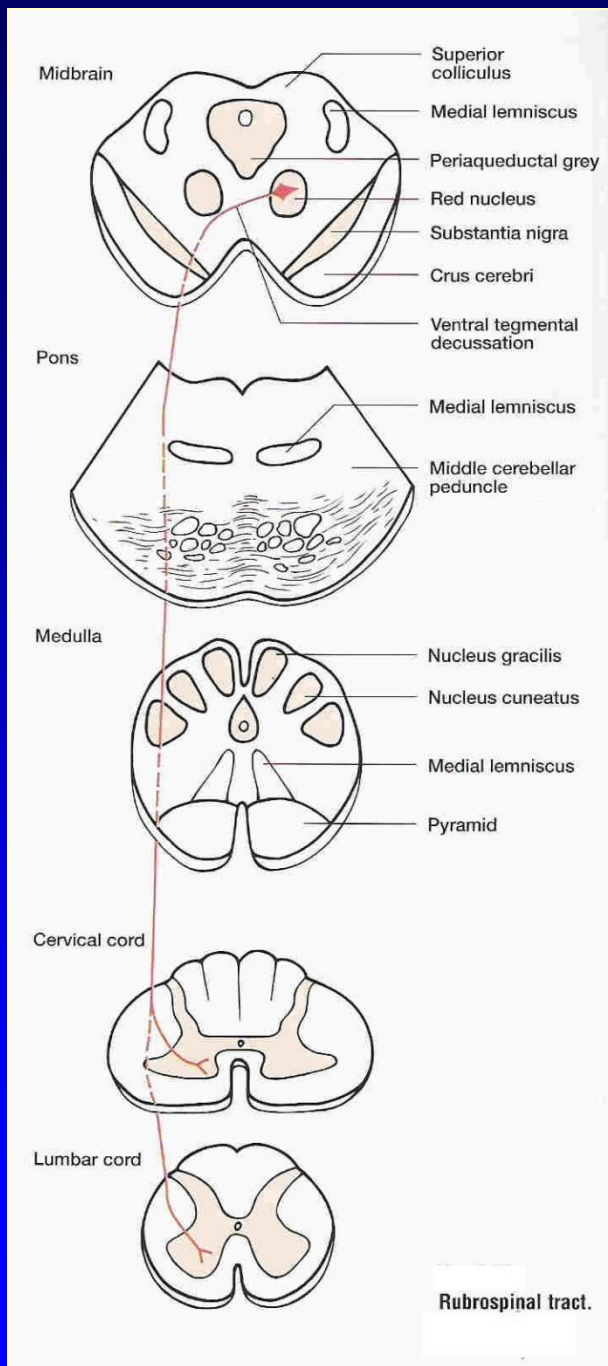


Pass down through Pons & Medulla

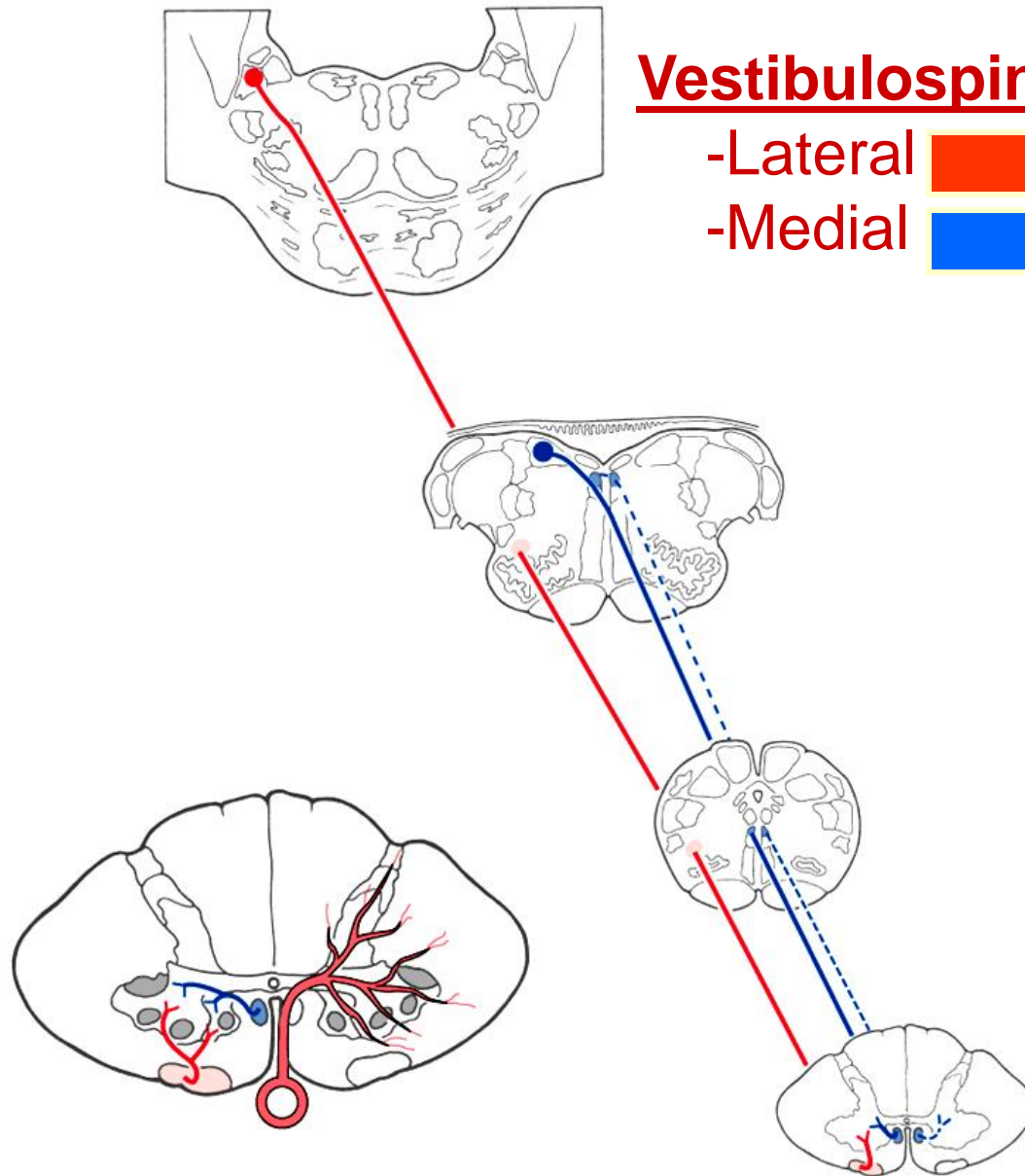


Ends in ant. Horn of spinal cord  
Control motor neurons

Functions. Control Distal muscle of limbs  
“especially upper limb”







## Vestibulospinal Fibers:

-Lateral



-Medial



Text Fig. 24-7, see also Atlas Figs. 8-18, 19A and 19B

# Tectospinal tract

Superior & Inferior colliculi in midbrain



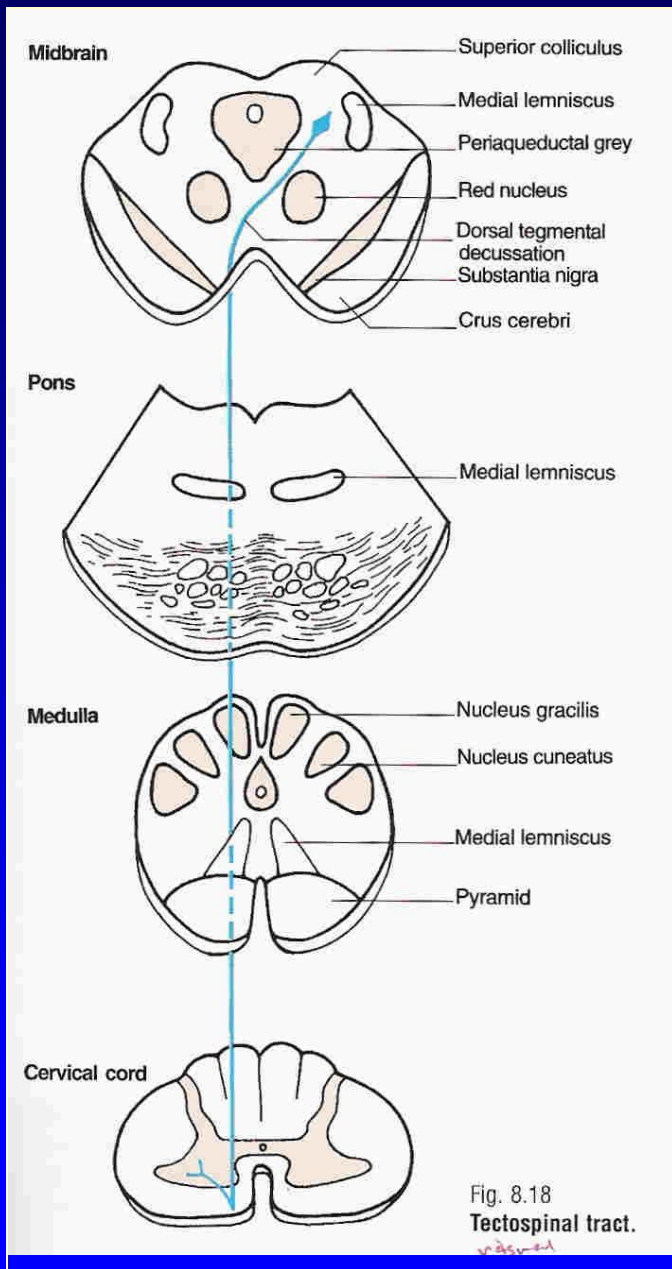
Cervical spinal motor neuron of anterior horn

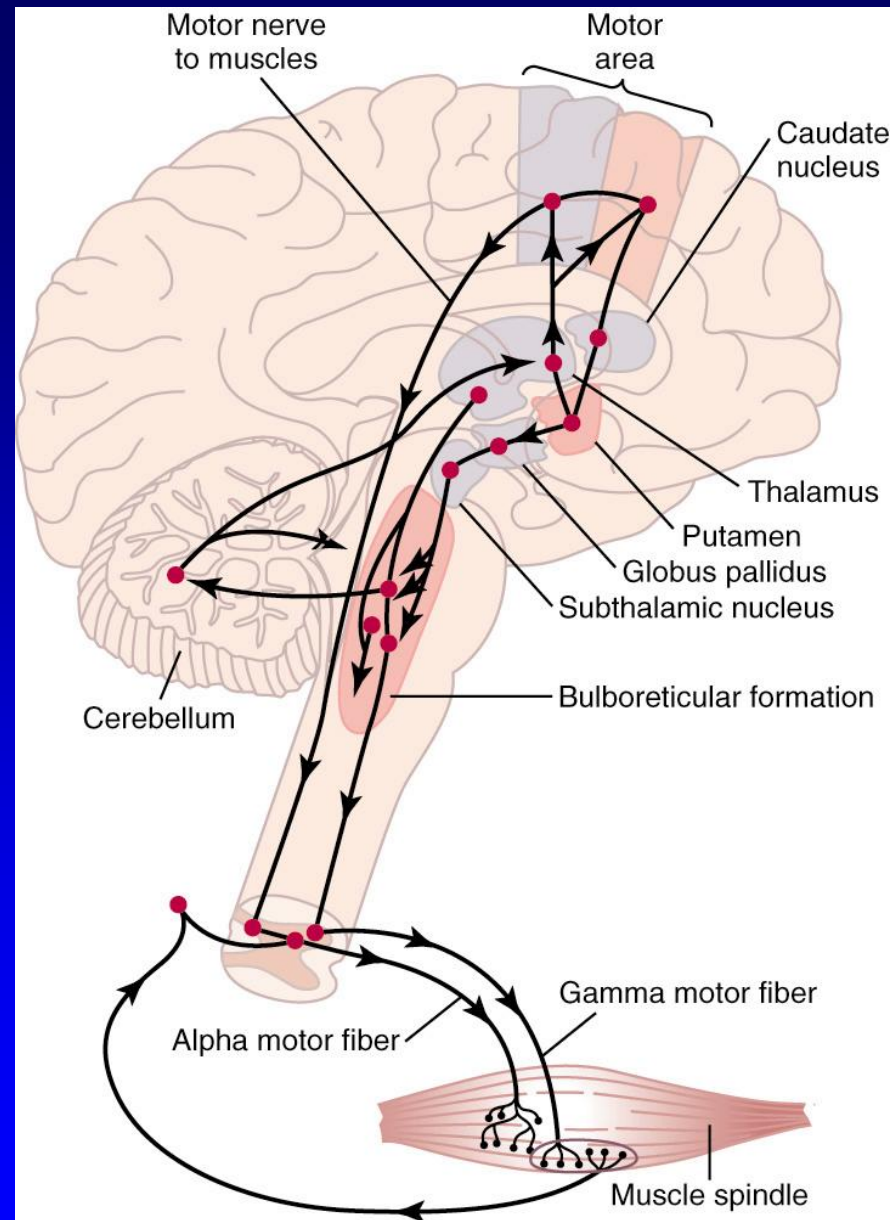
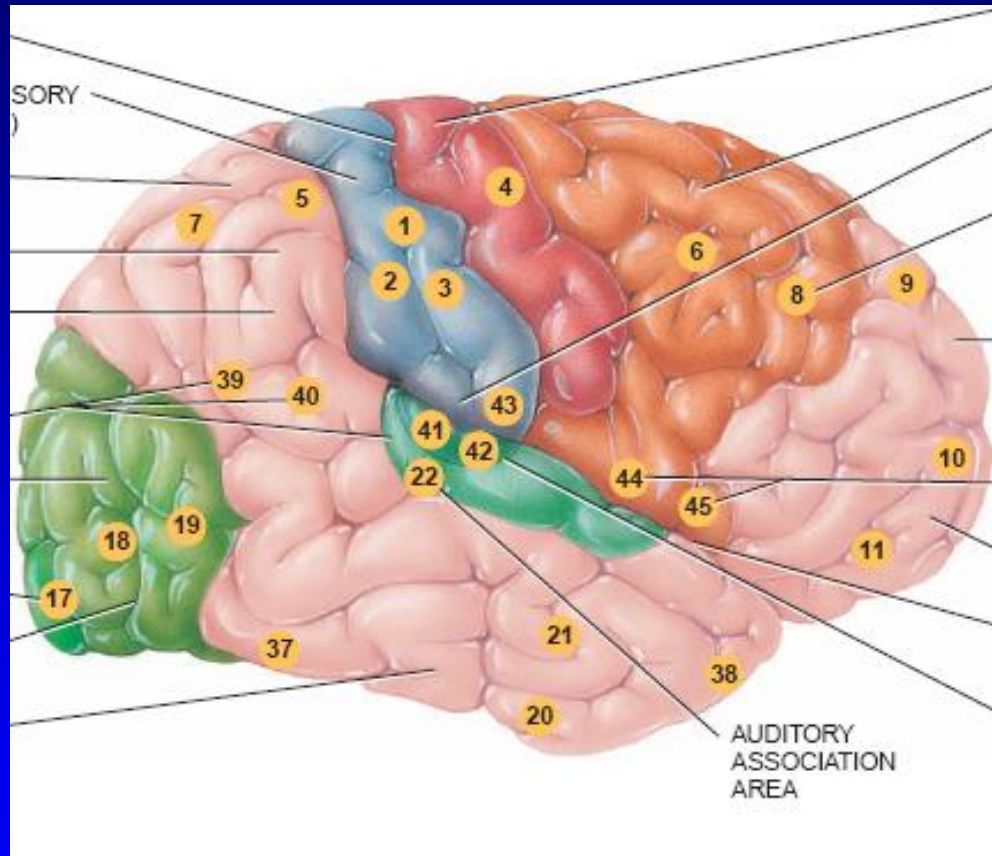


Trunk and head moving muscles

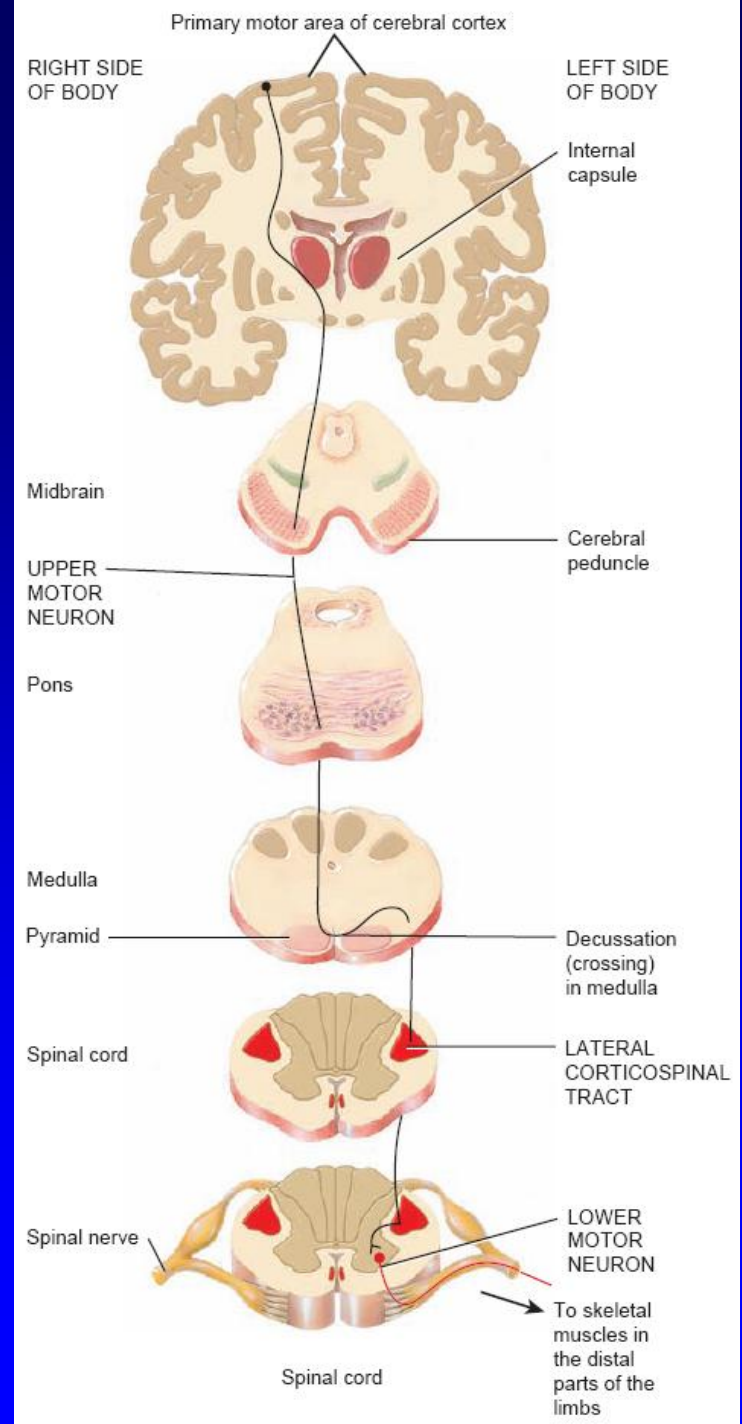
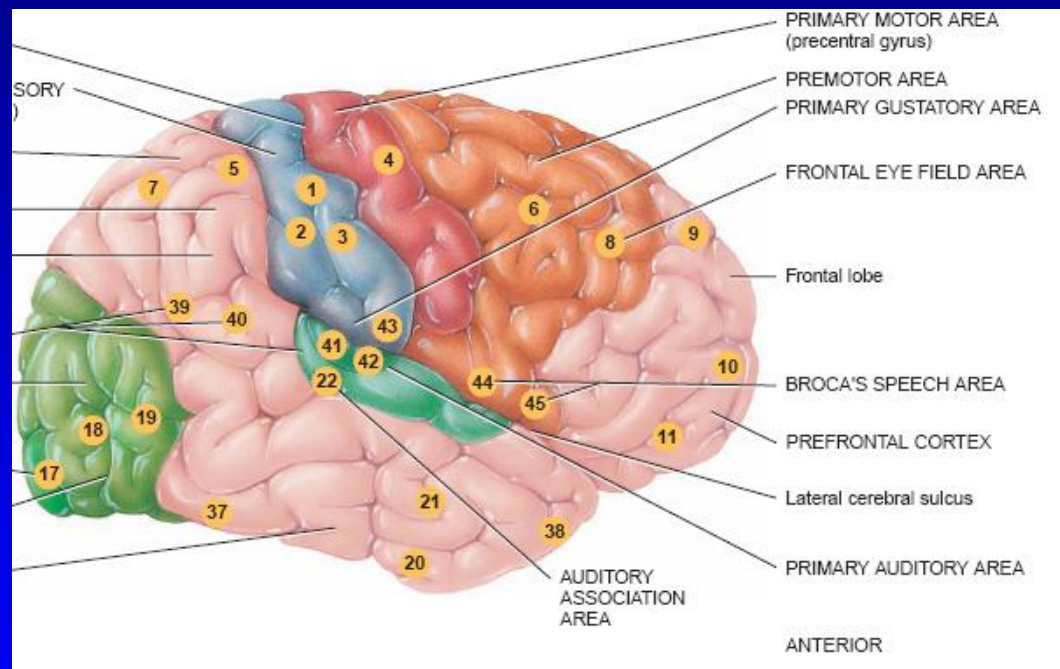
Function:

Allow turning of the head in response to visual or Auditory stimuli.





# Corticospinal pathway

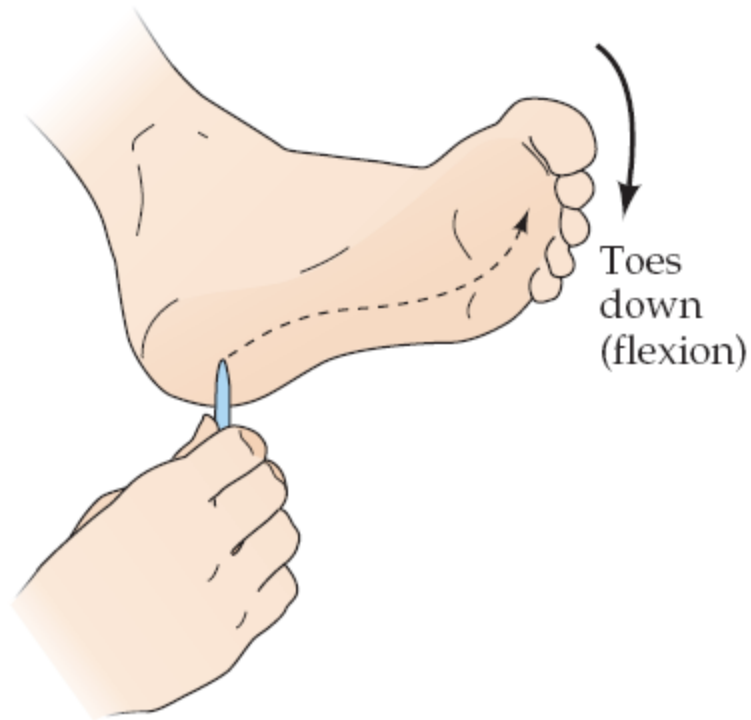




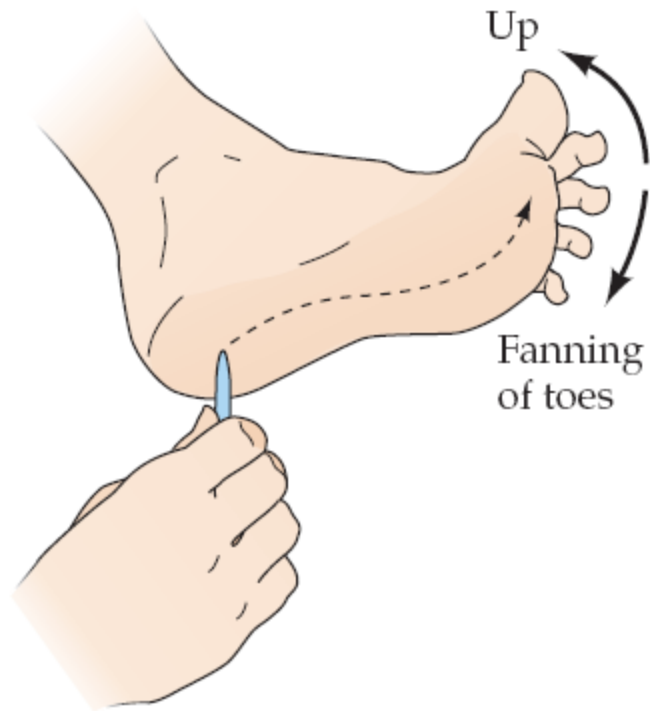
**TABLE 16.1****Signs and Symptoms of Upper and Lower Motor Neuron Lesions**

<i>Upper Motor Neuron Syndrome</i>	<i>Lower Motor Neuron Syndrome</i>
Weakness	Weakness or paralysis
Spasticity	Decreased superficial reflexes
Increased tone	Hypoactive deep reflexes
Hyperactive deep reflexes	Decreased tone
Clonus	Fasciculations and fibrillations
Babinski's sign	Severe muscle atrophy
Loss of fine voluntary movements	

(A) Normal plantar response



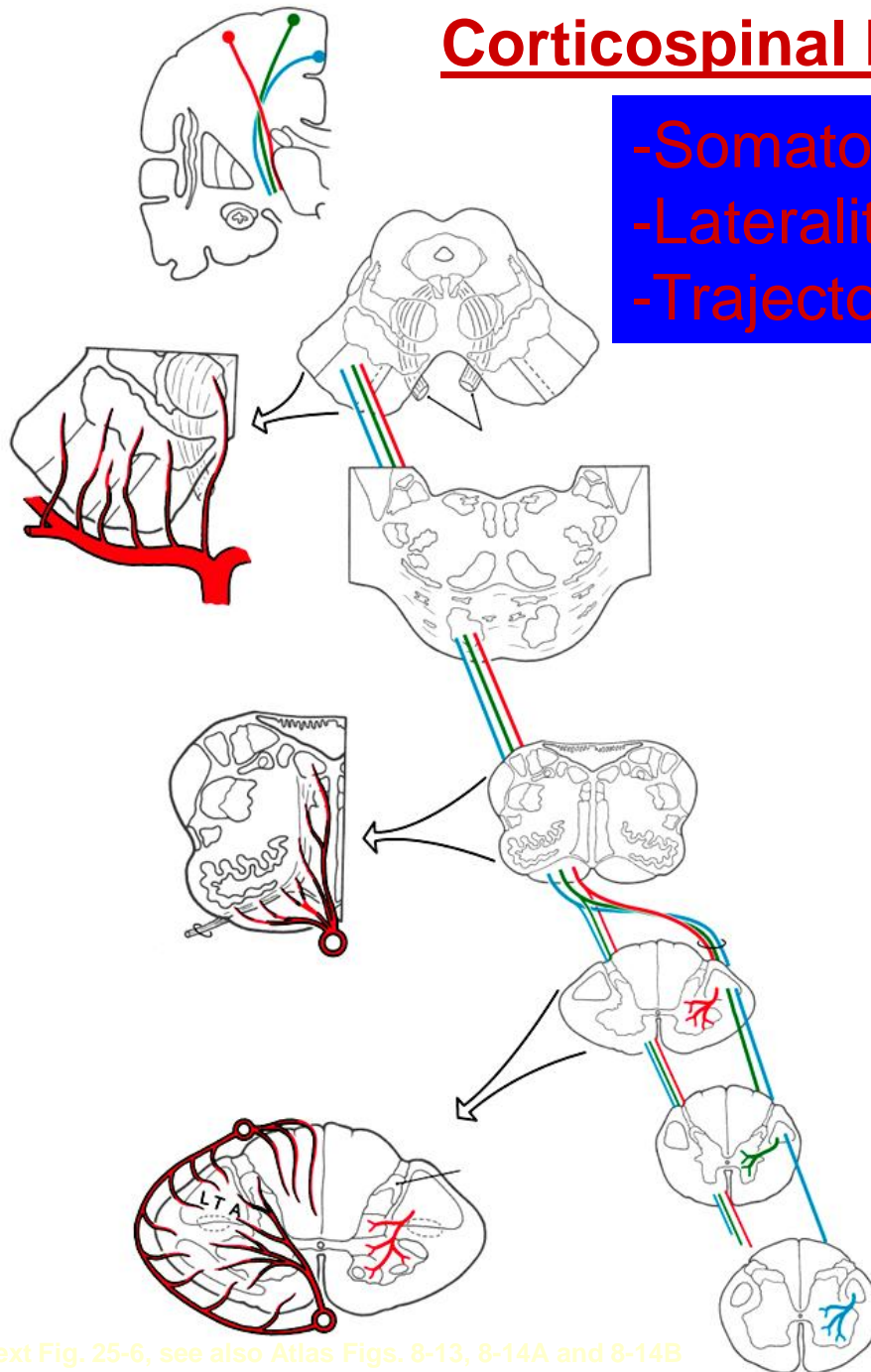
(B) Extensor plantar response (Babinski sign)



- **Babinski sign.** This reflex results from gentle stroking of the lateral outer margin of the sole. The great toe dorsiflexes, with or without a lateral fanning of the other toes. This phenomenon normally occurs in children under  $1\frac{1}{2}$  years of age and is due to incomplete myelination of fibers in the corticospinal tract. A positive Babinski sign after age  $1\frac{1}{2}$  is abnormal and indicates an interruption of the corticospinal tract as the result of a lesion of the tract, usually in the upper portion. The normal response after age  $1\frac{1}{2}$  is the **plantar flexion reflex**, or **negative Babinski**—a curling under of all the toes.

## Corticospinal Fibers:

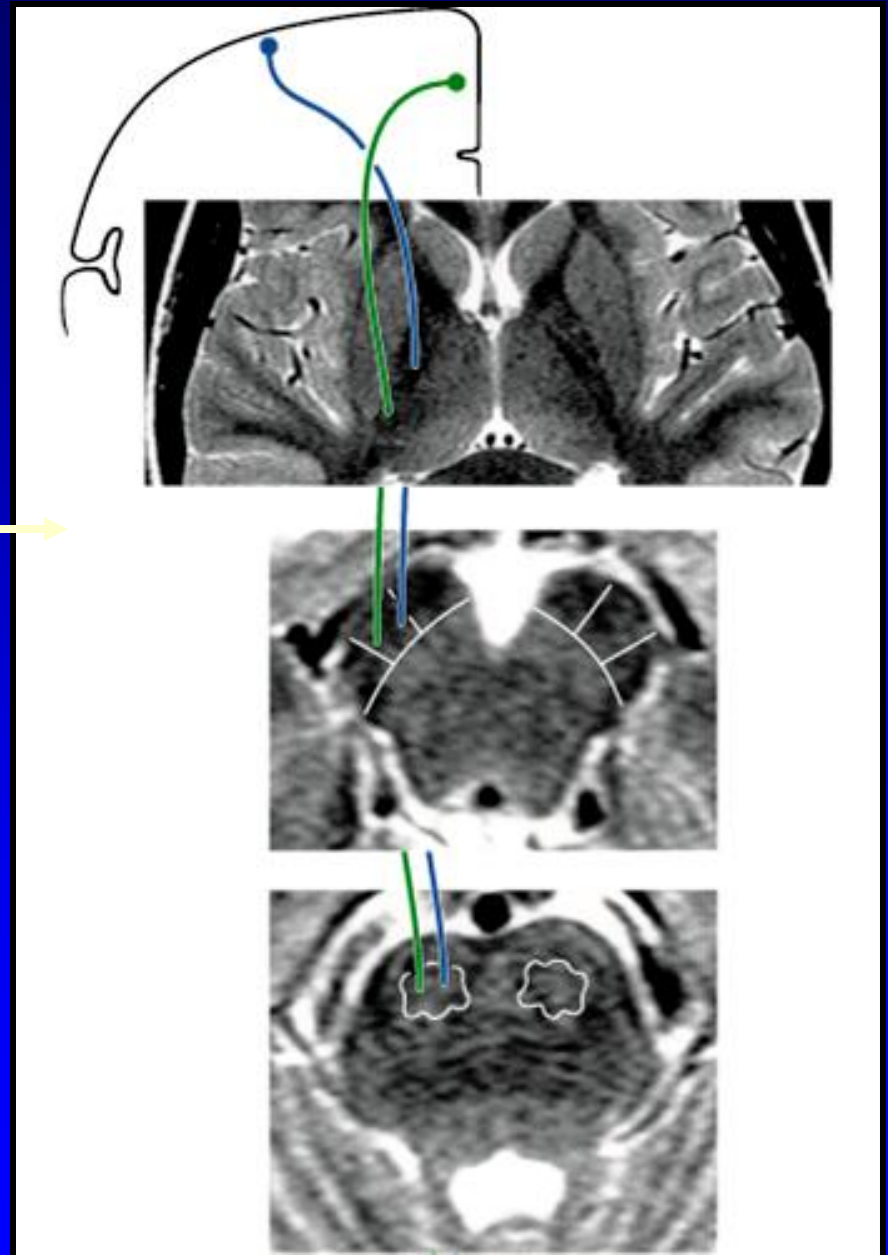
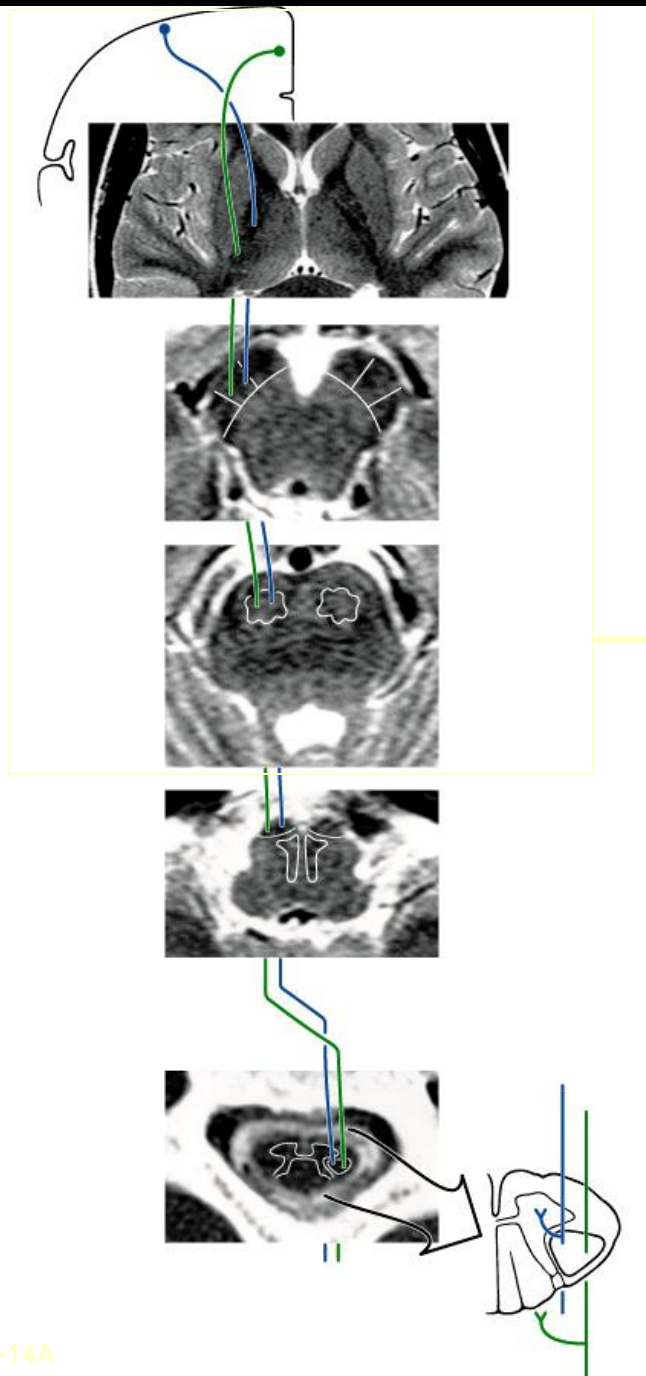
- Somatotopy,
- Laterality,
- Trajectory



Text Fig. 25-6, see also Atlas Figs. 8-13, 8-14A and 8-14B



## Corticospinal Fibers In MRI:



# Corticospinal Fibers In MRI:

