

Peripheral Nervous System 1: The Somatic System

24 July 2017

Reading: Moore's ECA5 27–33
ECA4 31–36

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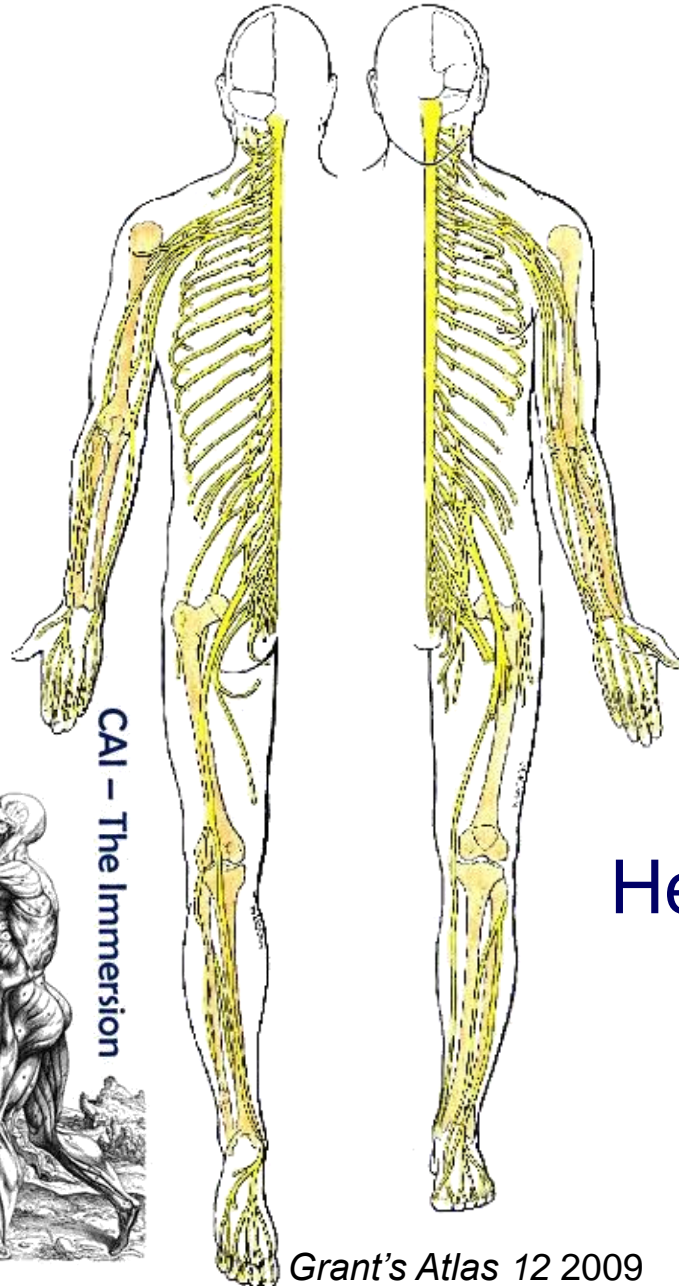
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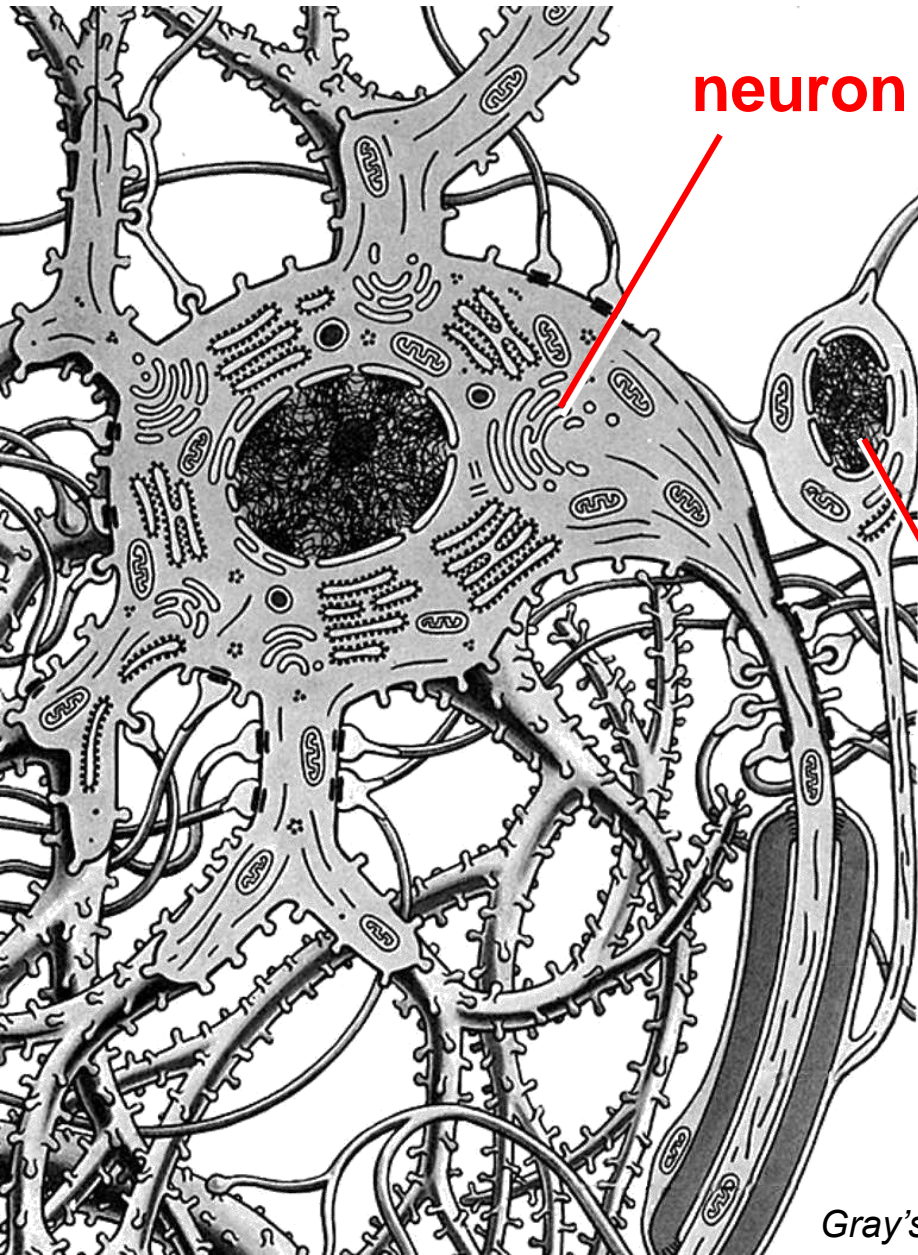
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Dichotomies



neuron

1. Tissues: neurons vs. glia
2. Position: CNS vs. PNS
3. Function 1: sensory vs. motor
4. Function 2: somatic vs. visceral

glial cell

Neurons

- Dendrites: carry nerve impulses toward cell body
- Axon: carries impulses away from cell body
- Synapses: site of communication between neurons using chemical neurotransmitters
- Myelin & myelin sheath: lipoprotein covering produced by glial cells (e.g., Schwann cells in PNS) that increases axonal conduction velocity
- Demyelinating diseases: e.g., Multiple Sclerosis (MS) in CNS or Guillain-Barré Syndrome in PNS

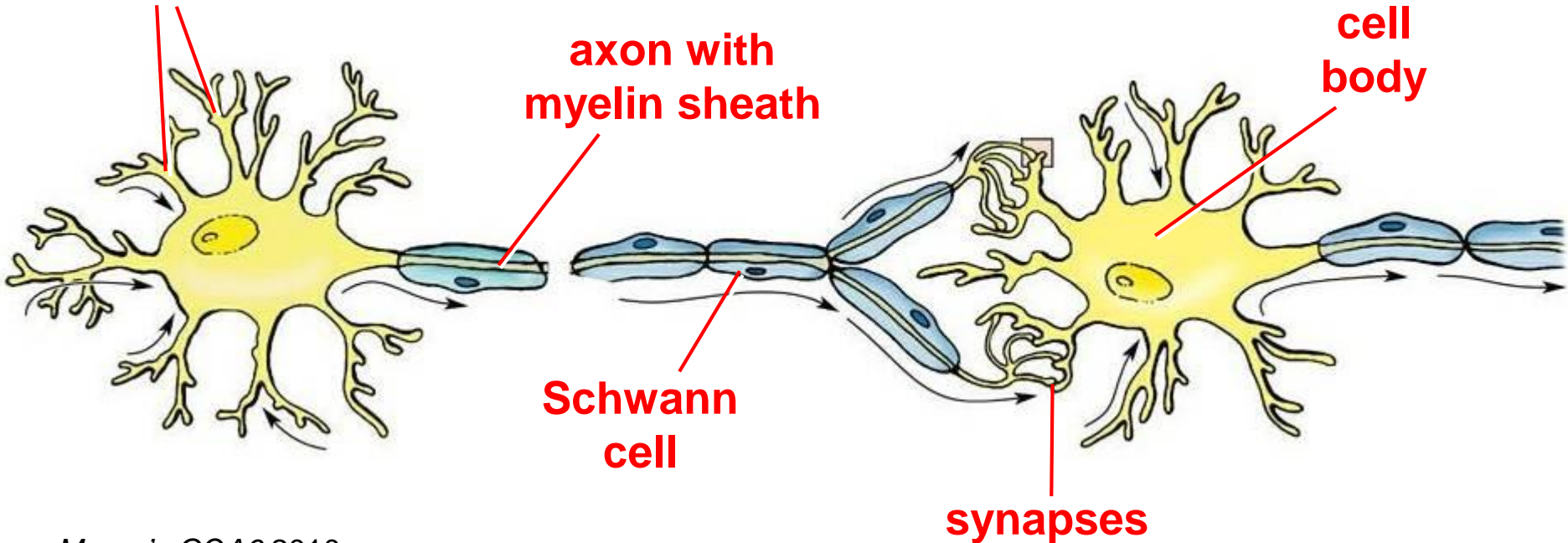
dendrites

**axon with
myelin sheath**

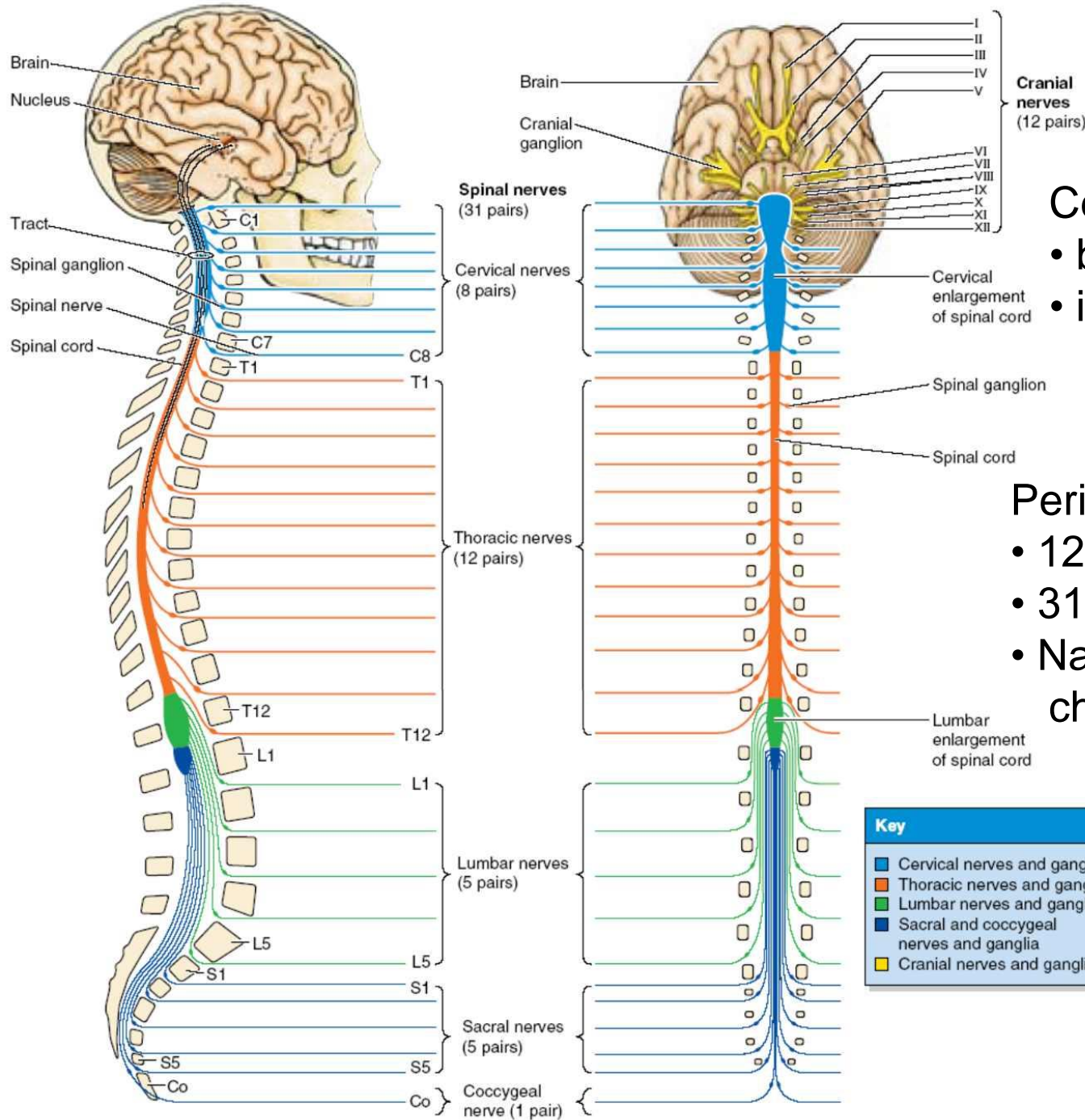
**cell
body**

**Schwann
cell**

synapses



CNS vs. PNS



Central Nervous System

- brain & spinal cord
- integration of info passing to & from the periphery

Peripheral Nervous System

- 12 cranial nerves
- 31 pairs of spinal nerves
- Naming convention changes at C7/T1

Collection of nerve cell bodies:

- CNS: nucleus
- PNS: ganglion

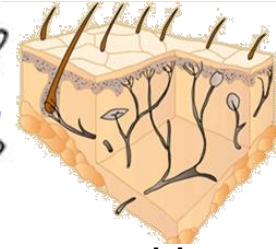
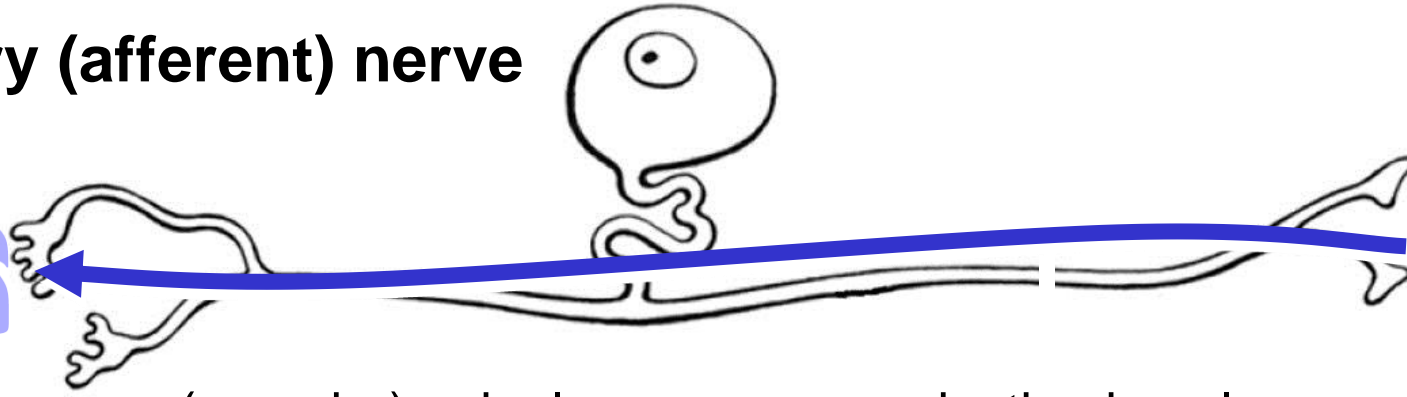
Lateral view

Anterior view

Sensory (Afferent) vs. Motor (Efferent)

sensory (afferent) nerve

CNS

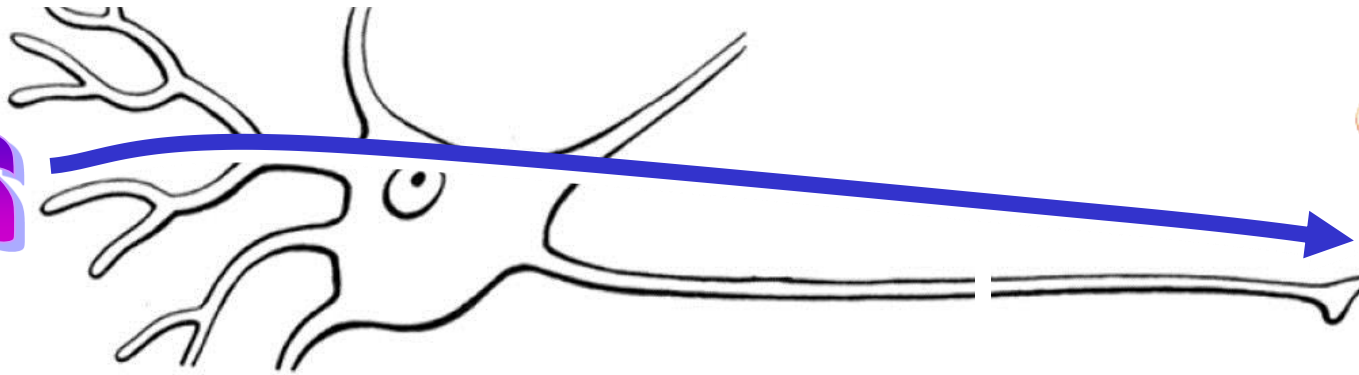


e.g., skin

(pseudo-) unipolar neurons conducting impulses from sensory organs to the CNS

motor (efferent) nerve

CNS

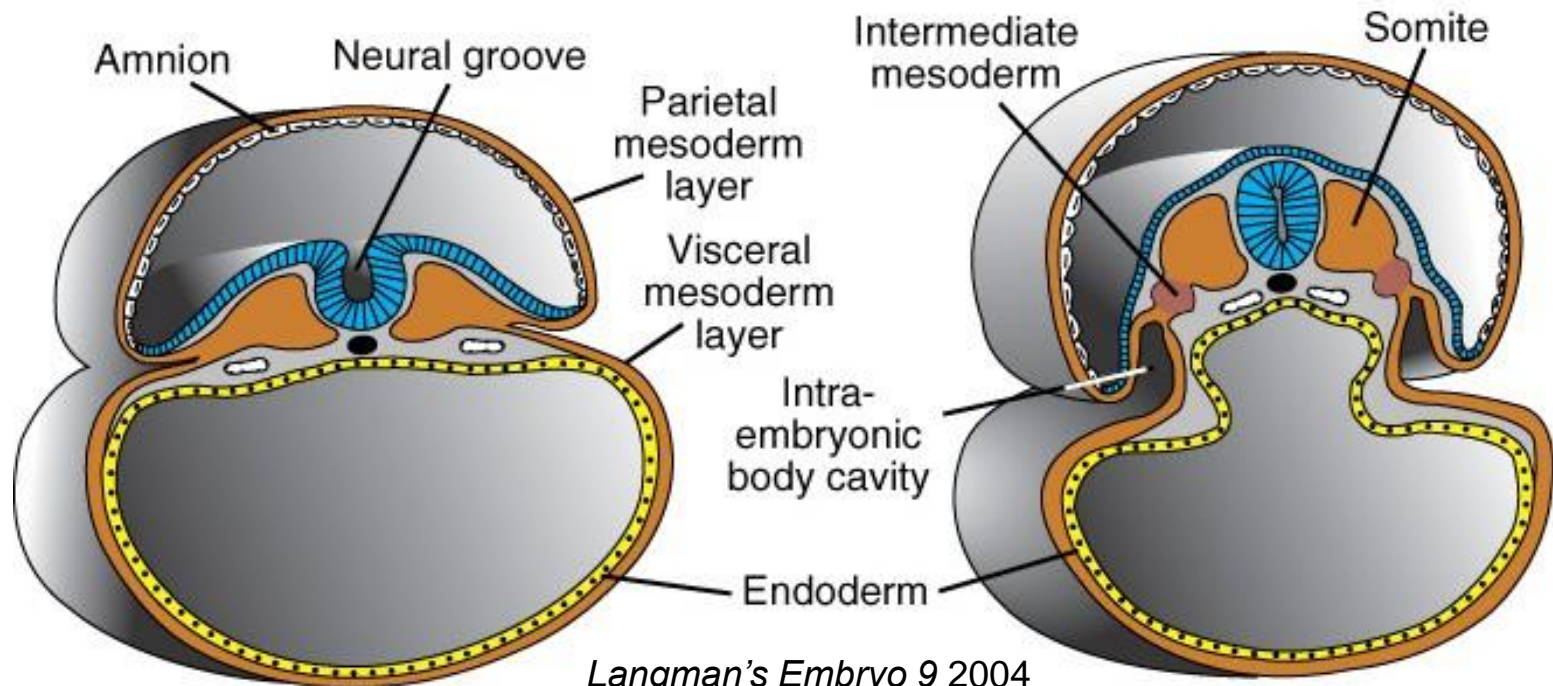


e.g., muscle

multipolar neurons conducting impulses from the CNS to effector organs (muscles & glands)

Somatic vs. Visceral

attribute	Somatic System	Visceral System
embryological origin of tissue	“body wall:” somatic (parietal) mesoderm (dermatome, myotome)	“organs:” splanchnic (visceral) mesoderm, endoderm
examples of adult tissues	dermis of skin, skeletal muscles, connective tissues	glands, cardiac muscle, smooth muscle
perception	conscious, voluntary	unconscious, involuntary



Sensory/Motor + Somatic/Visceral

	Somatic	Visceral
Sensory (Afferent)	<i>somatic sensory</i> [General Somatic Afferent (GSA)]	<i>visceral sensory</i> [General Visceral Afferent (GVA)]
Motor (Efferent)	<i>somatic motor</i> [General Somatic Efferent (GSE)]	<i>visceral motor</i> [General Visceral Efferent (GVE)]



***Somatic
Nervous
System***

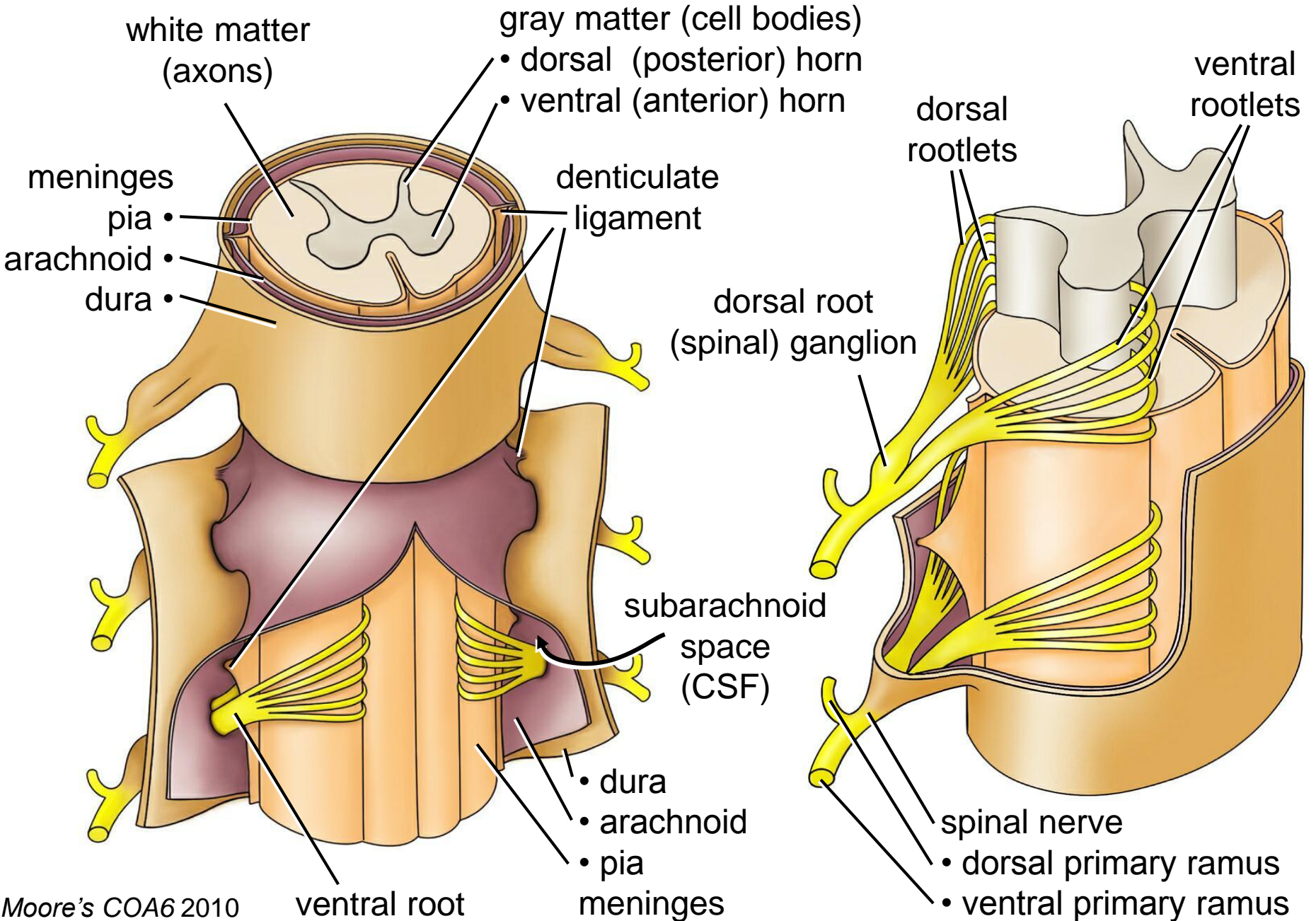
(today)



***Autonomic
Nervous
System***

(August 7)

Structure of the Spinal Cord



Rootlet Damage

Upper Brachial Plexus Injuries

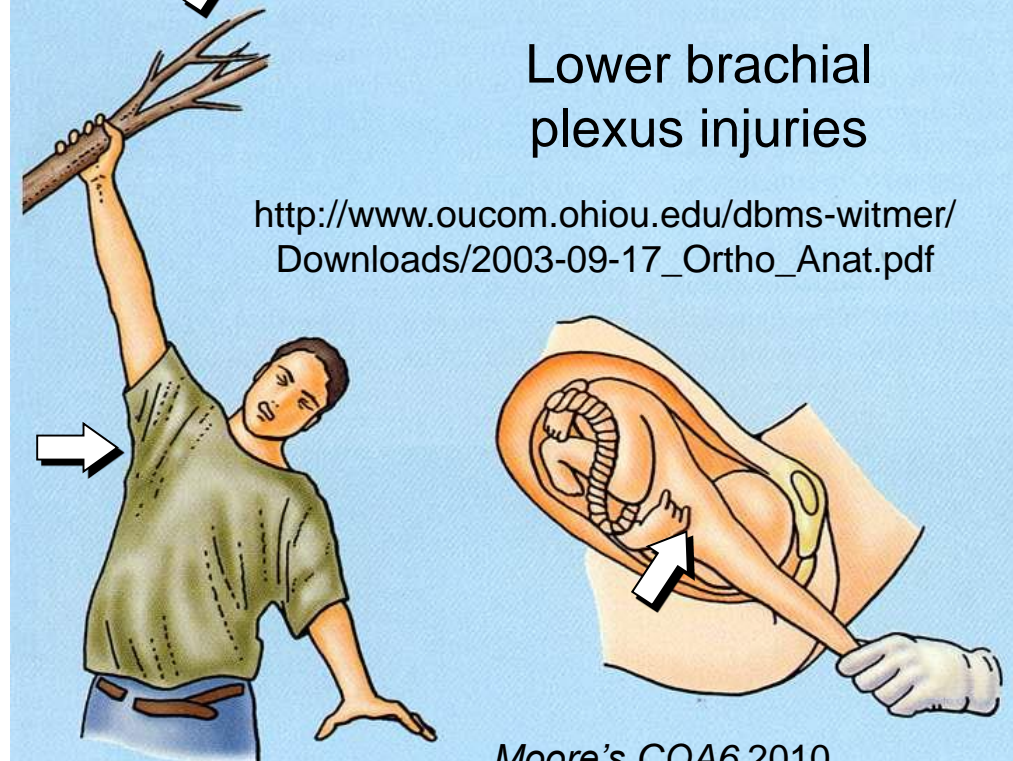
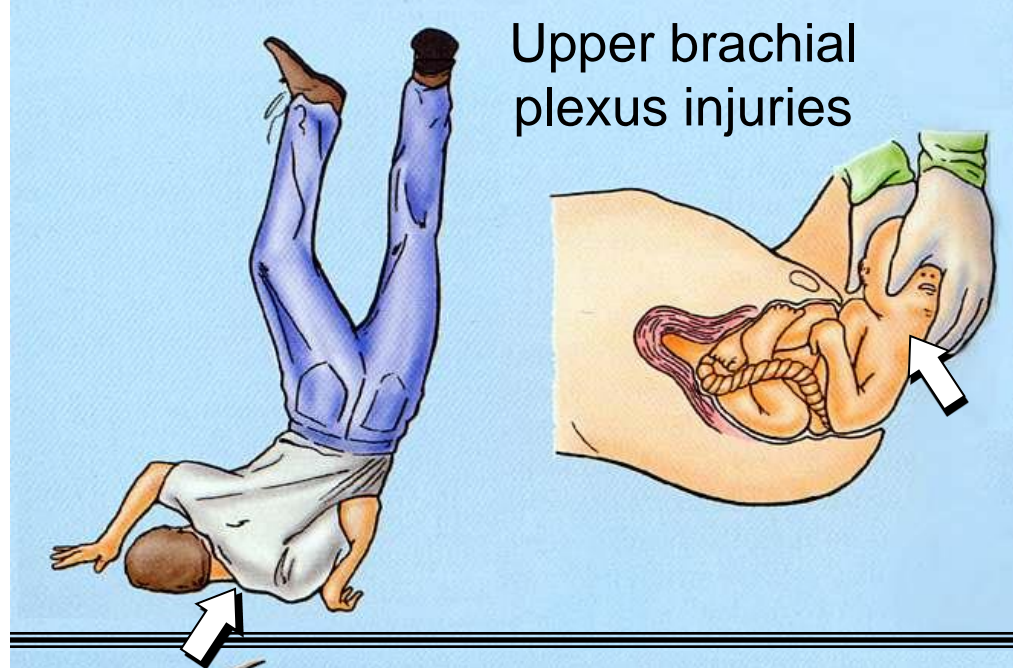
- Increase in angle between neck & shoulder
- Traction (stretching or avulsion) of upper rootlets (e.g., C5,C6)
- Produces Erb's Palsy

Lower Brachial Plexus Injuries

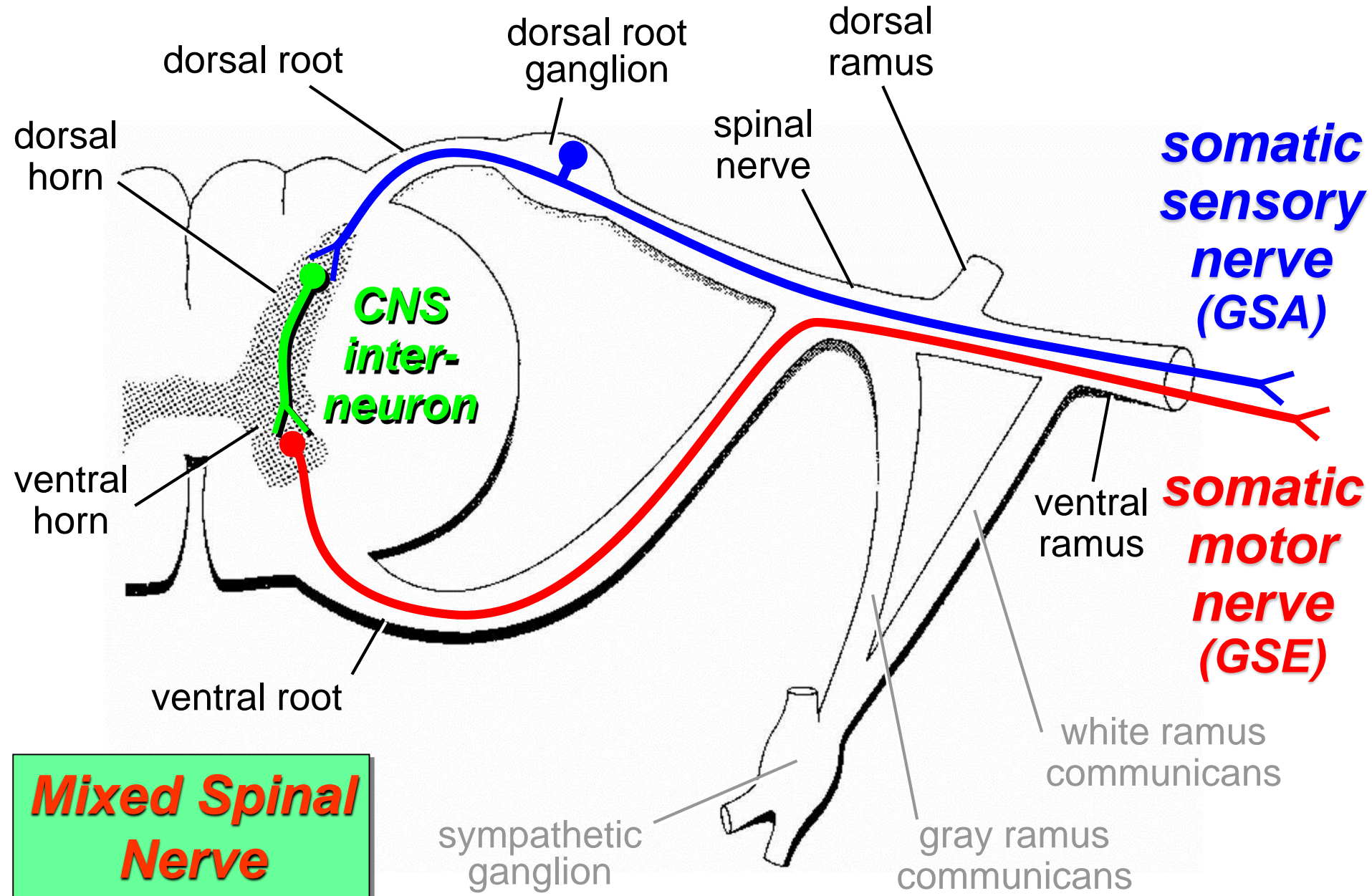
- Excessive upward pull of limb
- Traction (stretching or avulsion) of lower rootlets (e.g., C8, T1)
- Produces Klumpke's Palsy

"Obstetrical" or "Birth palsy"

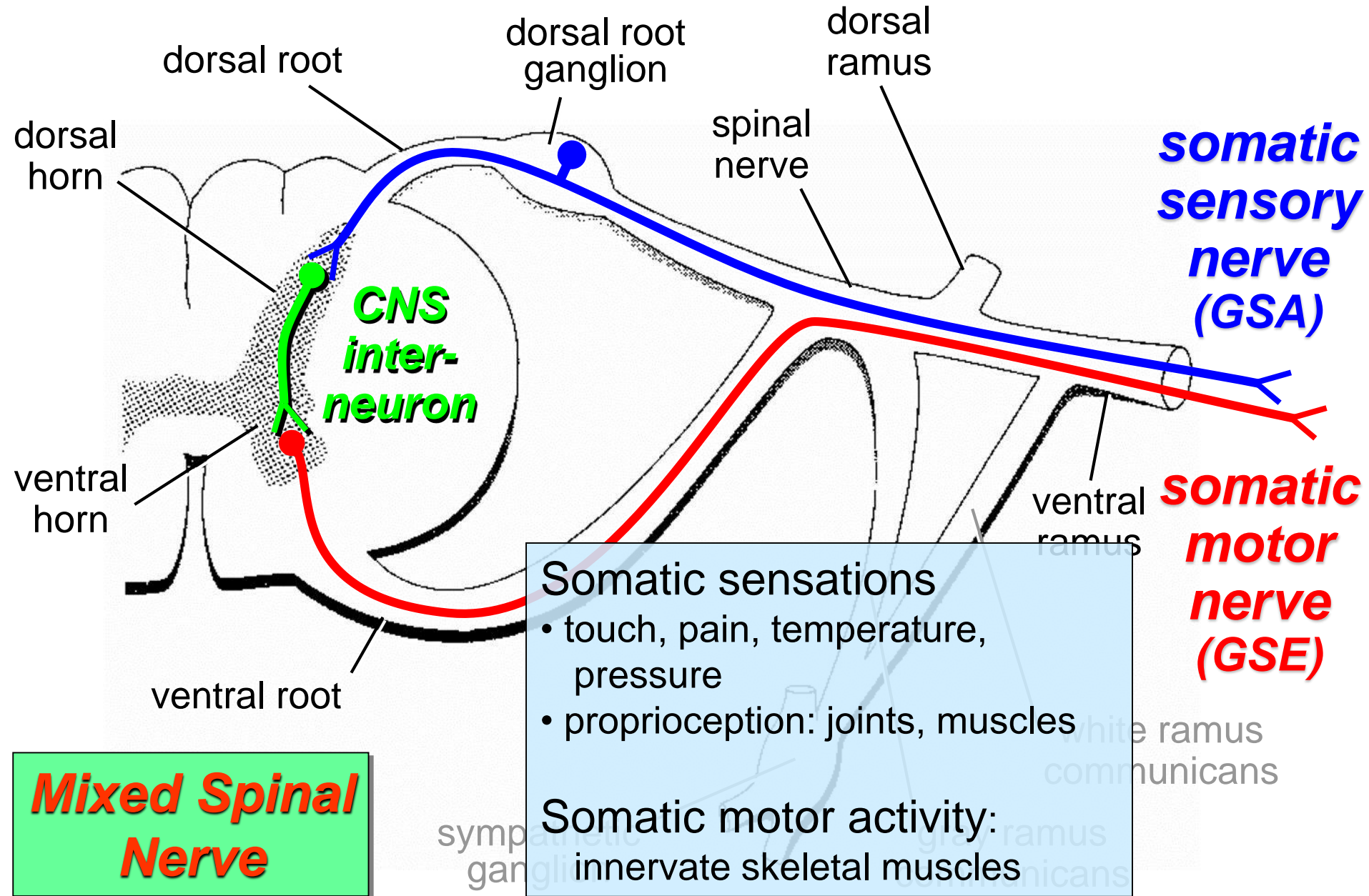
- Becoming increasingly rare
- Categorized on basis of damage
 - Type I: Upper (C5,6), Erb's
 - Type II: All (C5-T1), both palsies
 - Type III: Lower (C8, T1), Klumpke's Palsy



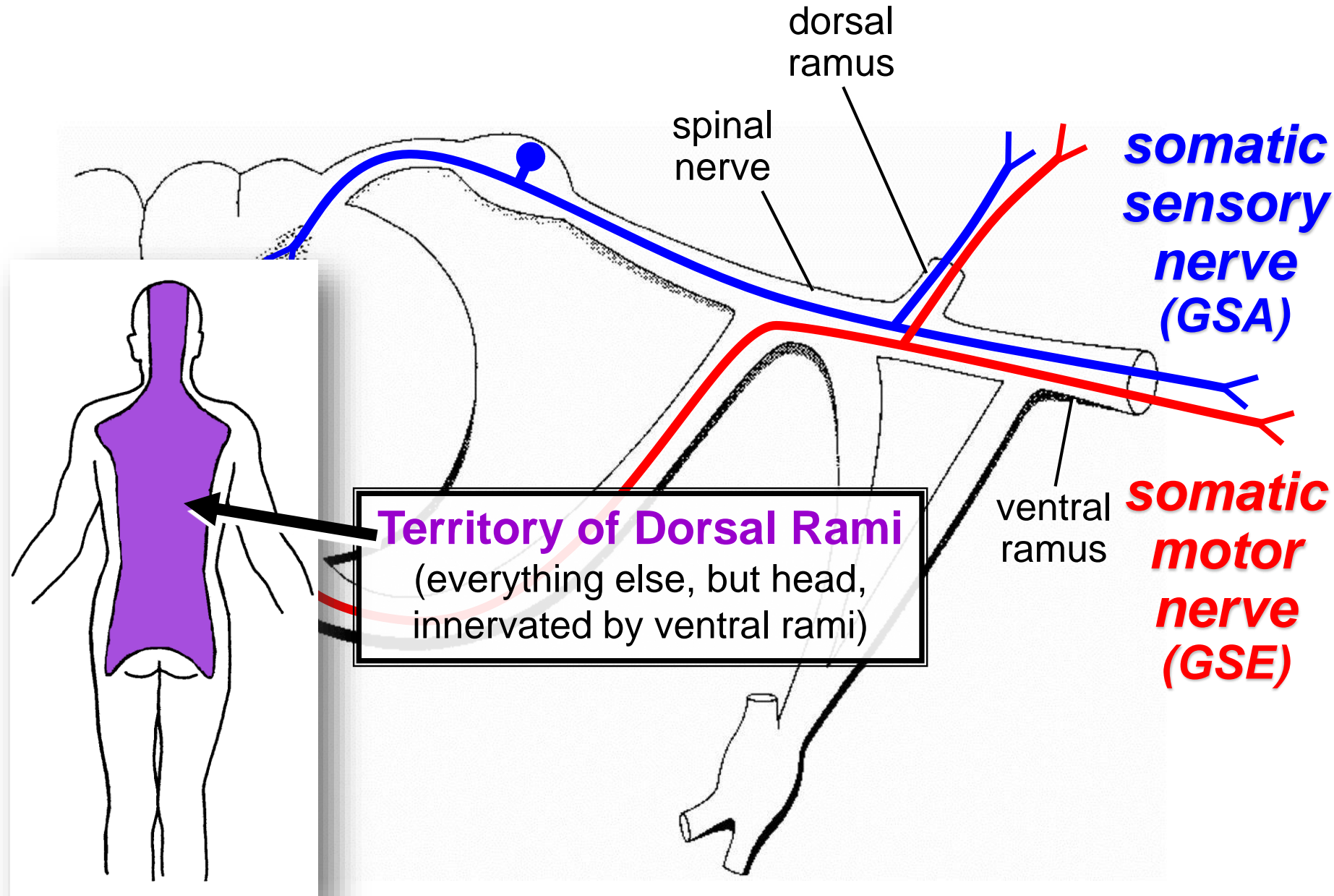
Structure of Spinal Nerves: Somatic Pathways



Structure of Spinal Nerves: Somatic Pathways

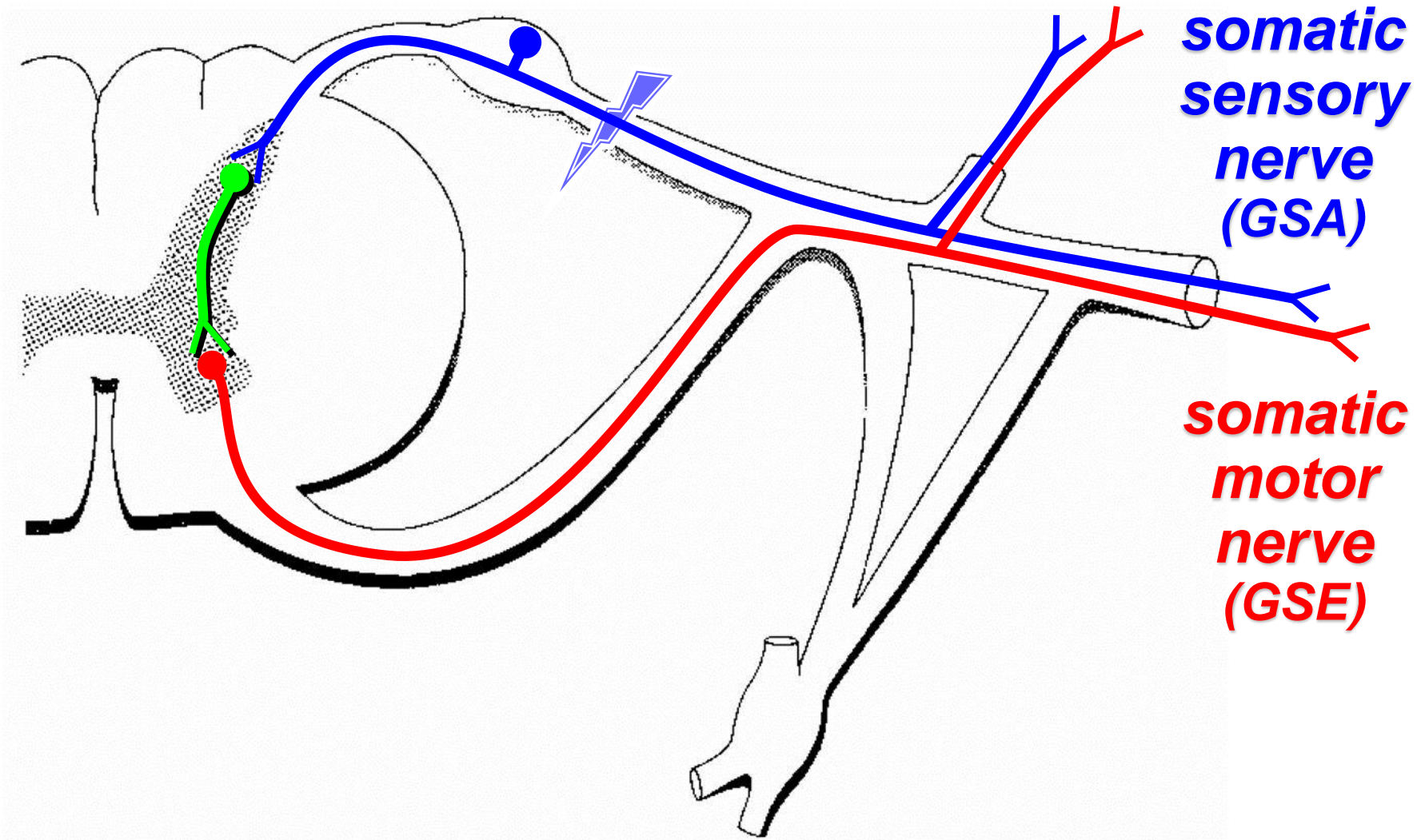


Structure of Spinal Nerves: Dorsal & Ventral Rami

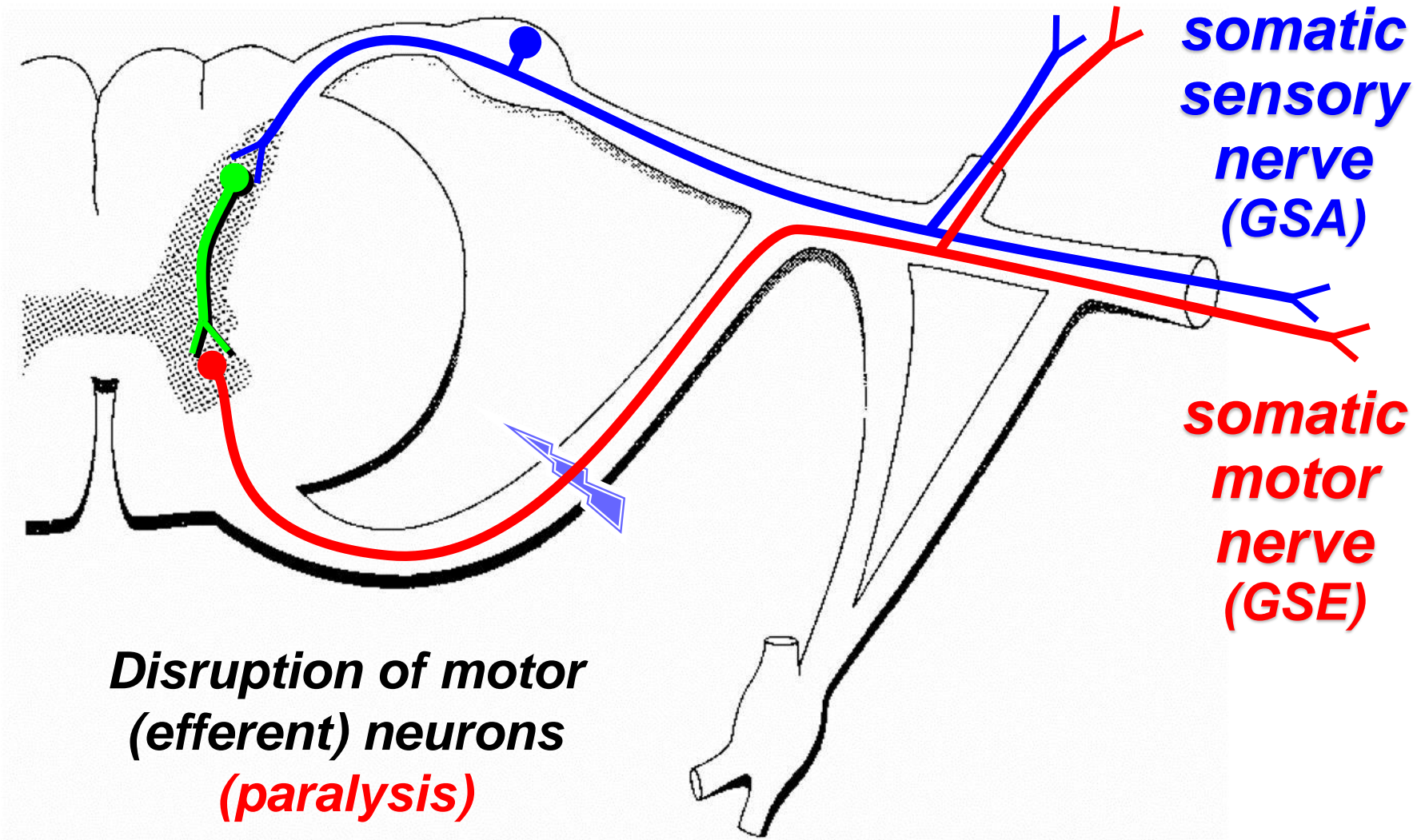


Impact of Lesions

Disruption of sensory (afferent) neurons (*paresthesia*)

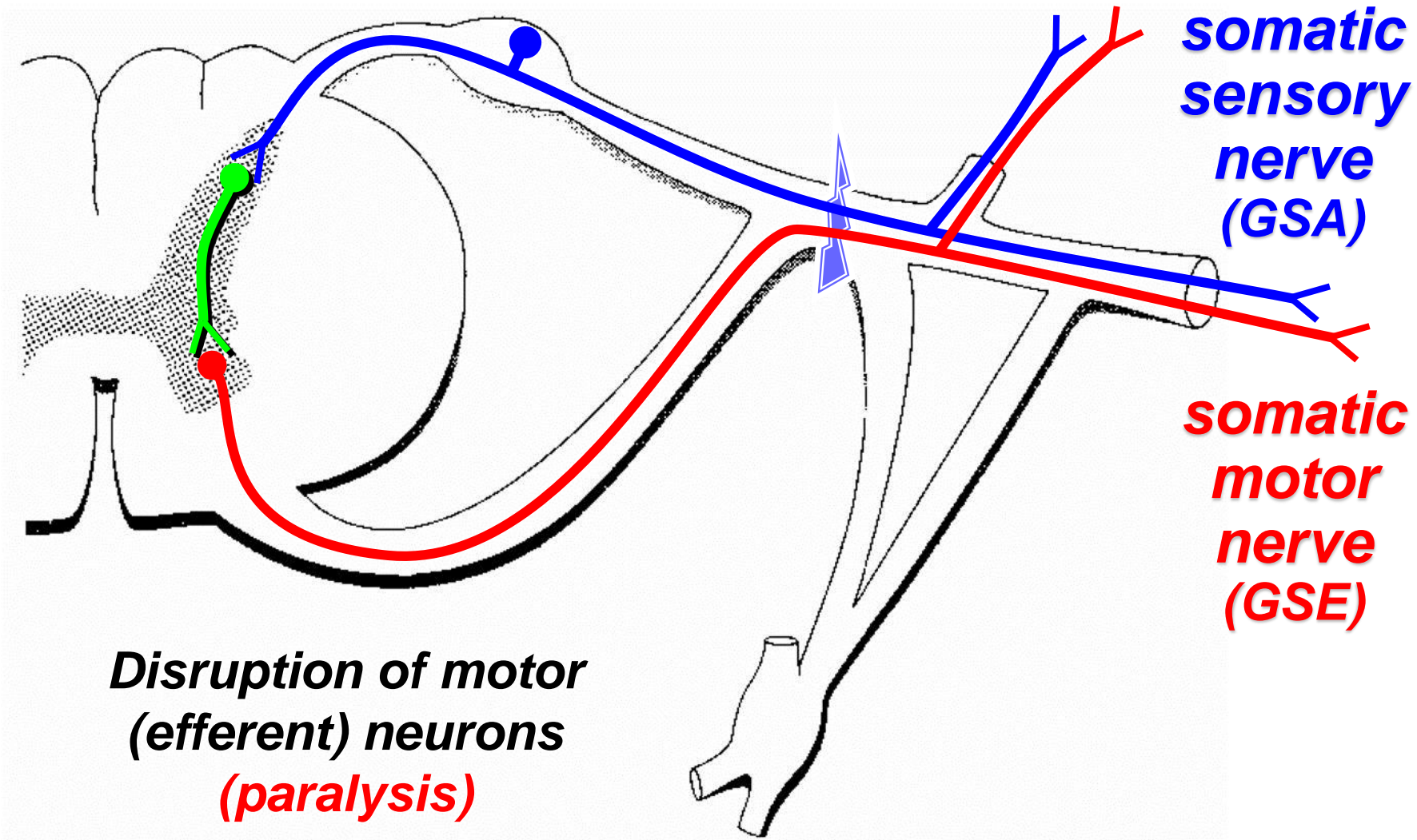


Impact of Lesions



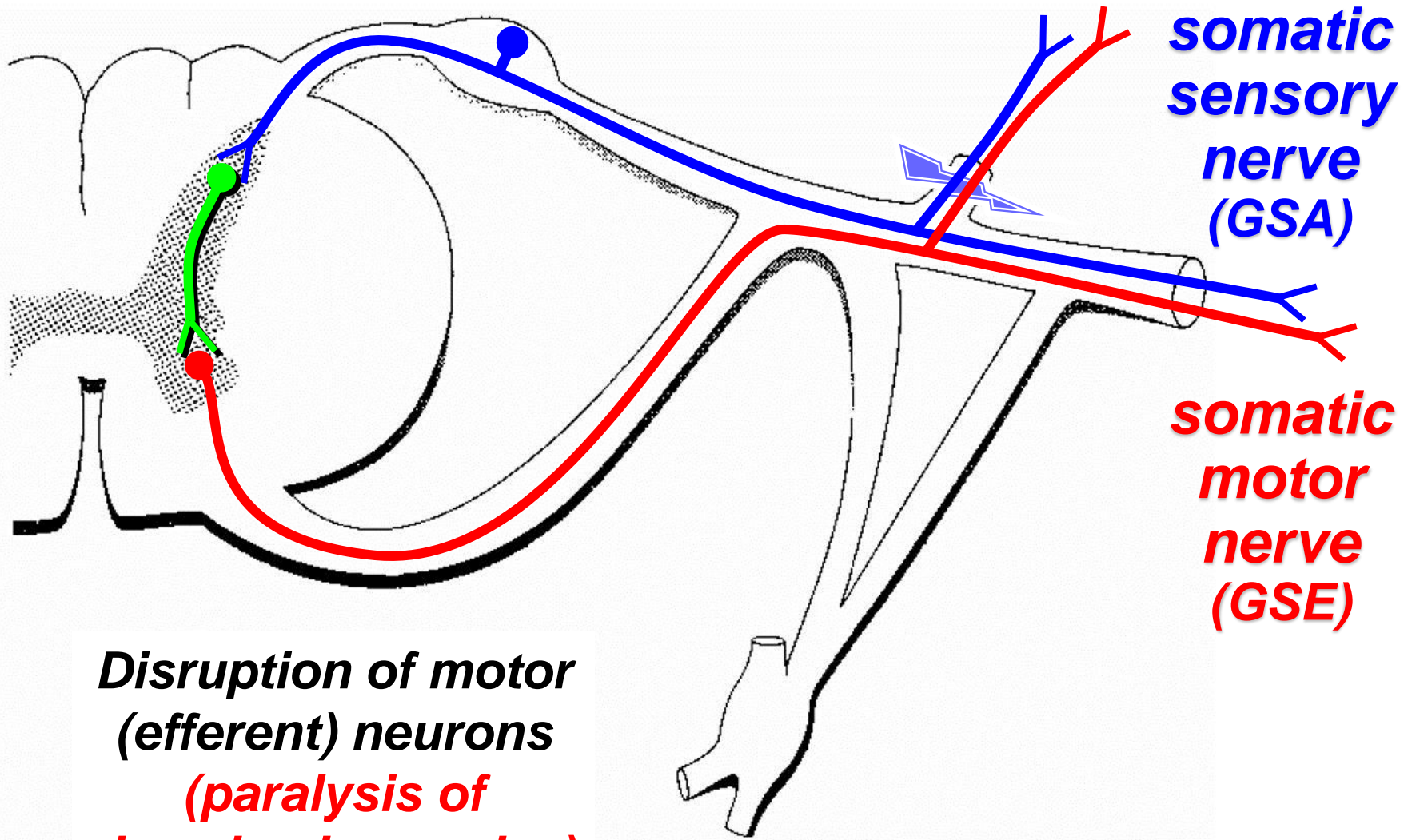
Impact of Lesions

Disruption of sensory (afferent) neurons (*paresthesia*)



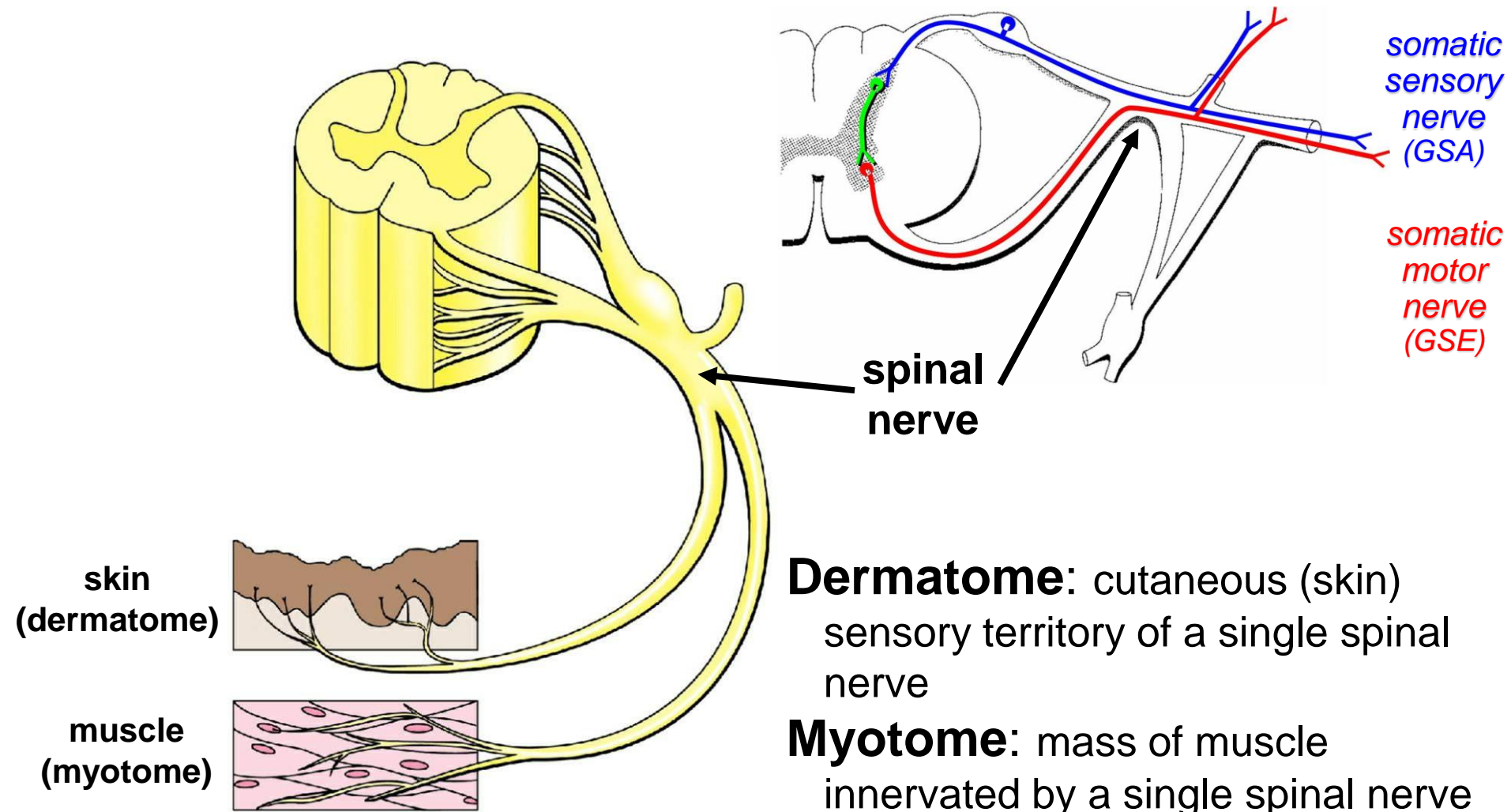
Impact of Lesions

Disruption of sensory (afferent) neurons (*back paresthesia*)

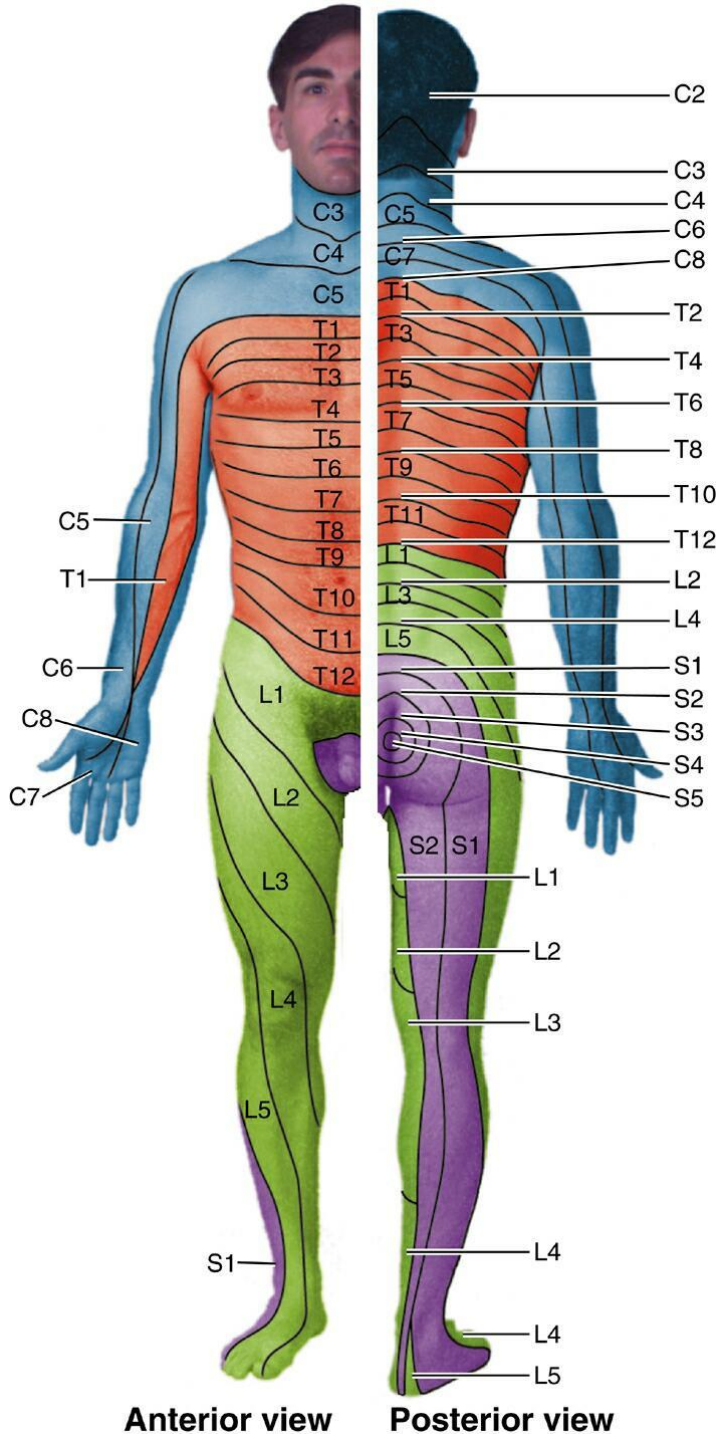


Disruption of motor (efferent) neurons
(*paralysis of deep back muscles*)

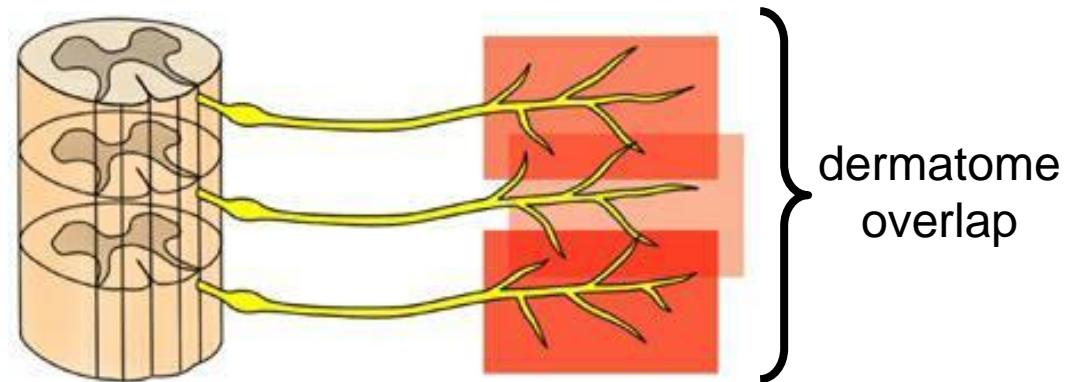
Segmental Innervation: Dermatomes & Myotomes



Segmental Innervation: Dermatome Maps

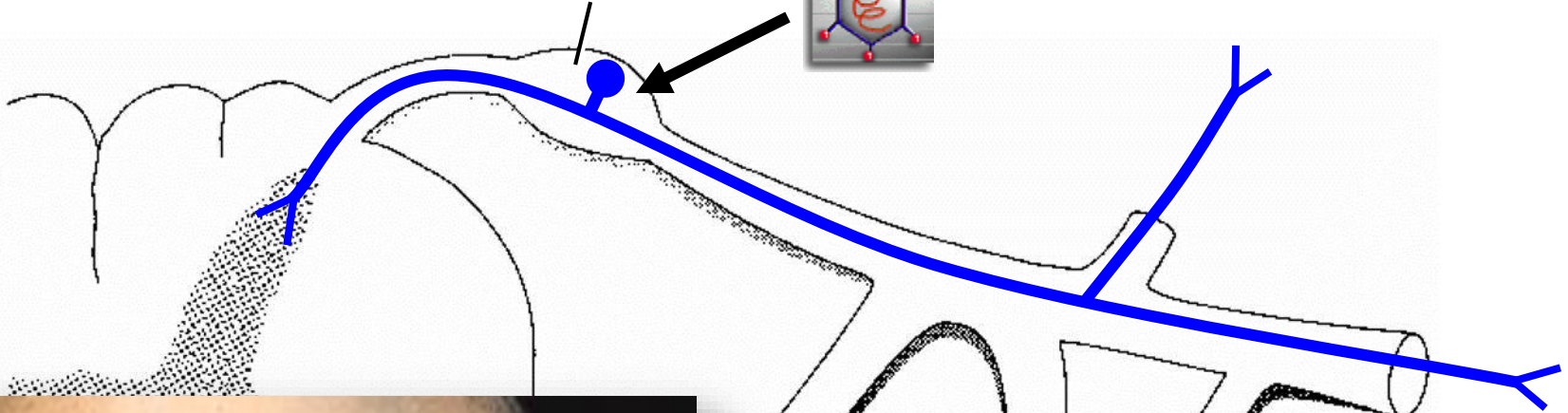
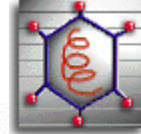


- Based on clinical findings of deficits in cutaneous sensation
- Diagnostic aids: localization of lesions to cord levels
- Limits to specificity due to overlap of dermatomes



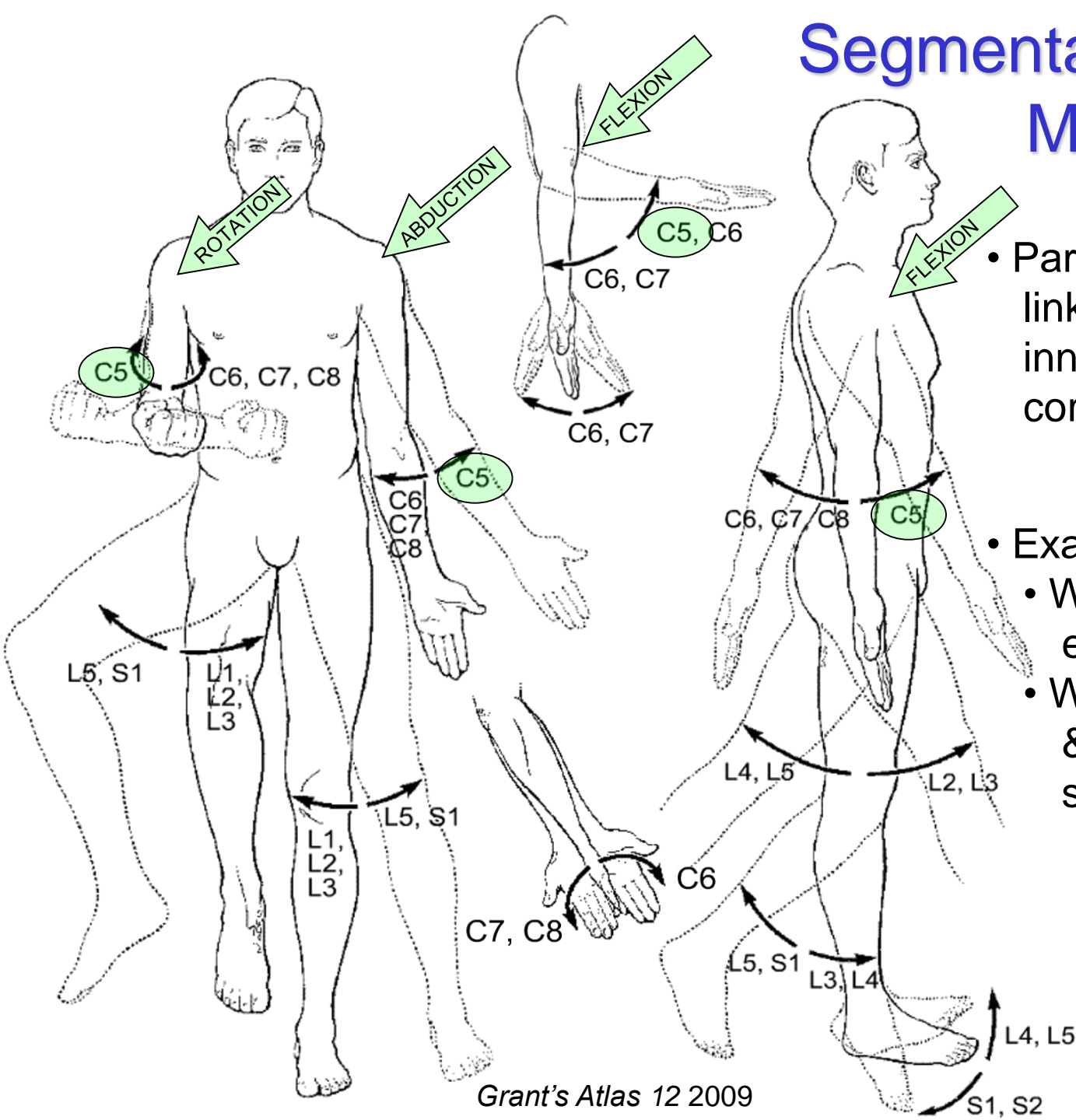
Dermatomes & Herpes Zoster (“Shingles”)

dorsal root ganglion



- Chicken pox virus (varicella) infects dorsal root ganglia
- Once activated, travels along afferent axons to skin where it forms very painful rash
- Often has a typical dermatomal presentation

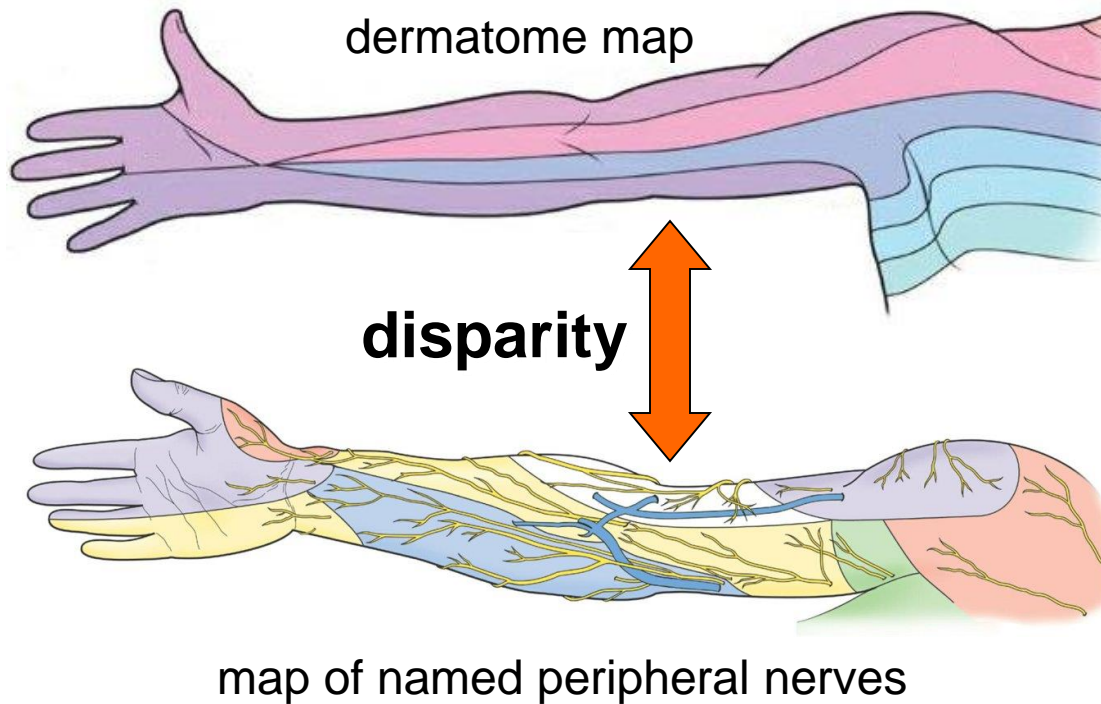
Segmental Innervation: Myotome Maps



- Particular functions are linked to muscles innervated by particular cord levels
- Example: C5 lesion
 - Weakness in flexion of elbow & shoulder
 - Weakness in abduction & lateral rotation of shoulder

PNS Plexus Formation

- Dermatomes: single spinal nerve
- Peripheral nerves: multiple spinal nerves from different cord levels
- Plexus formation: mixing of nerves from different cord levels by union and division of bundles



cervical
plexus
C1–C5

brachial
plexus
C5–T1

lumbar
plexus
L1–L4

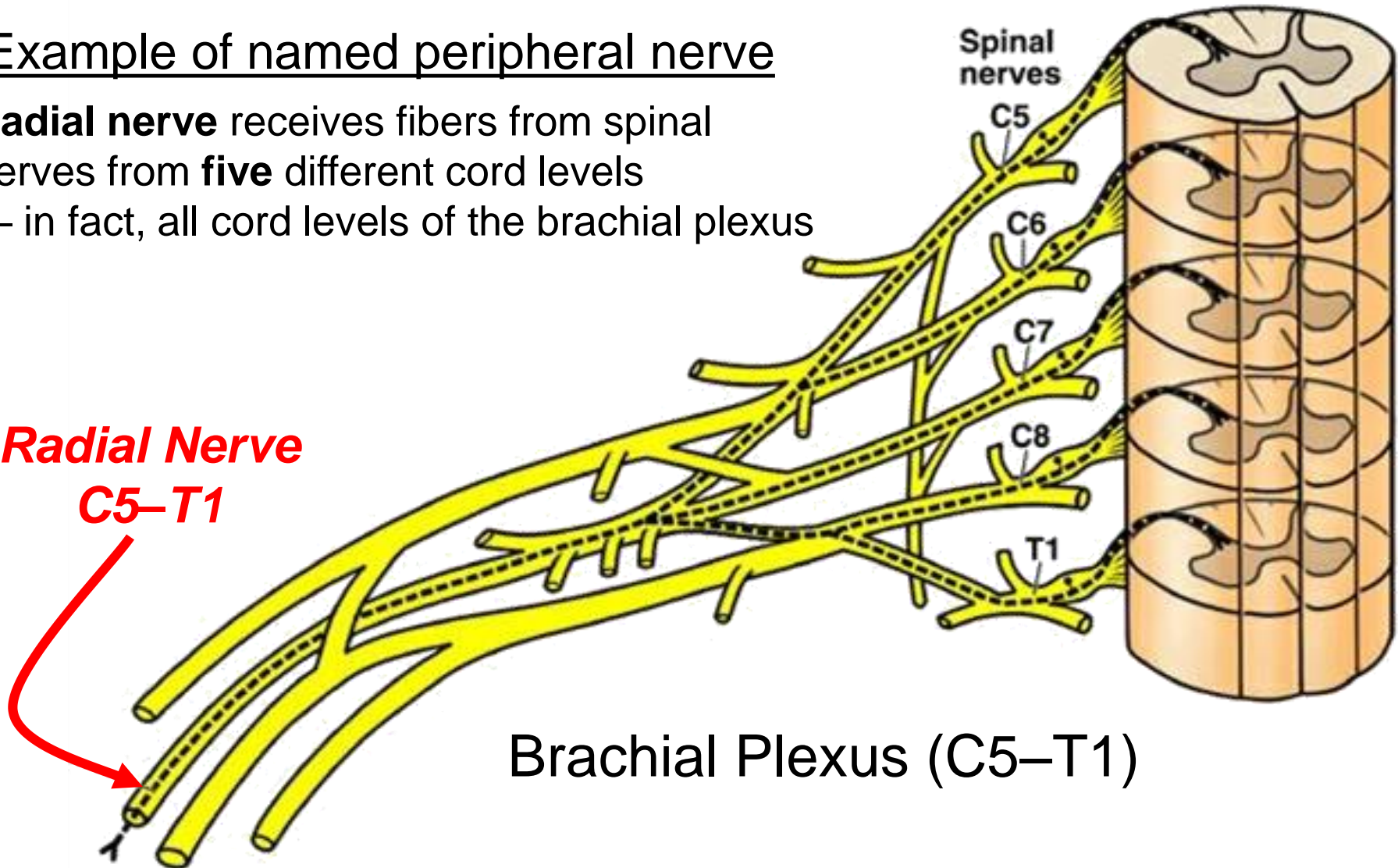
sacral
plexus
L4–S4

PNS Plexus Formation

Example of named peripheral nerve

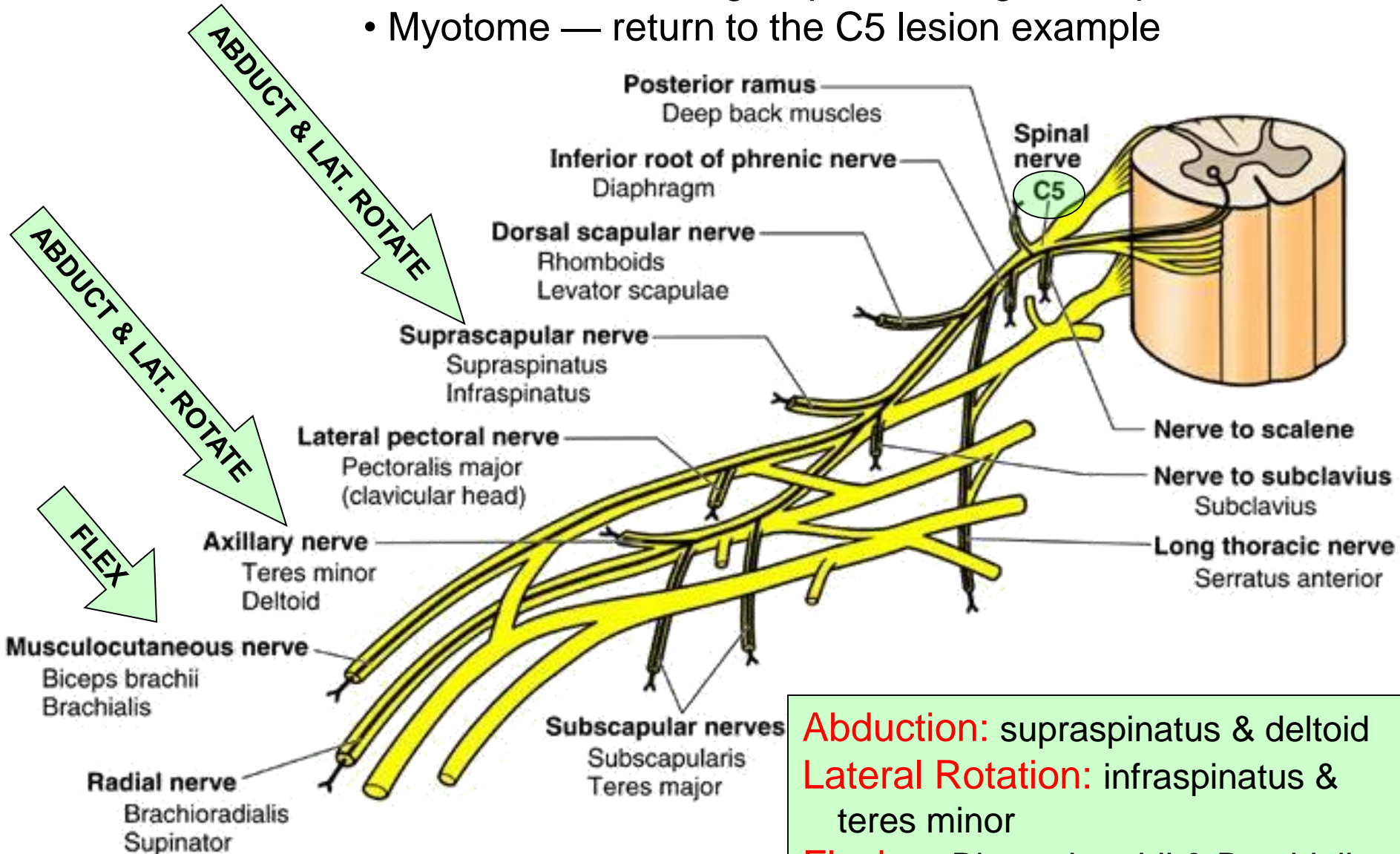
Radial nerve receives fibers from spinal nerves from **five** different cord levels — in fact, all cord levels of the brachial plexus

Radial Nerve
C5–T1



PNS Plexus Formation

- Distribution of a single spinal throughout a plexus
- Myotome — return to the C5 lesion example



Moore's COA6 2010

Abduction: supraspinatus & deltoid
Lateral Rotation: infraspinatus & teres minor
Flexion: Biceps brachii & Brachialis

References

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