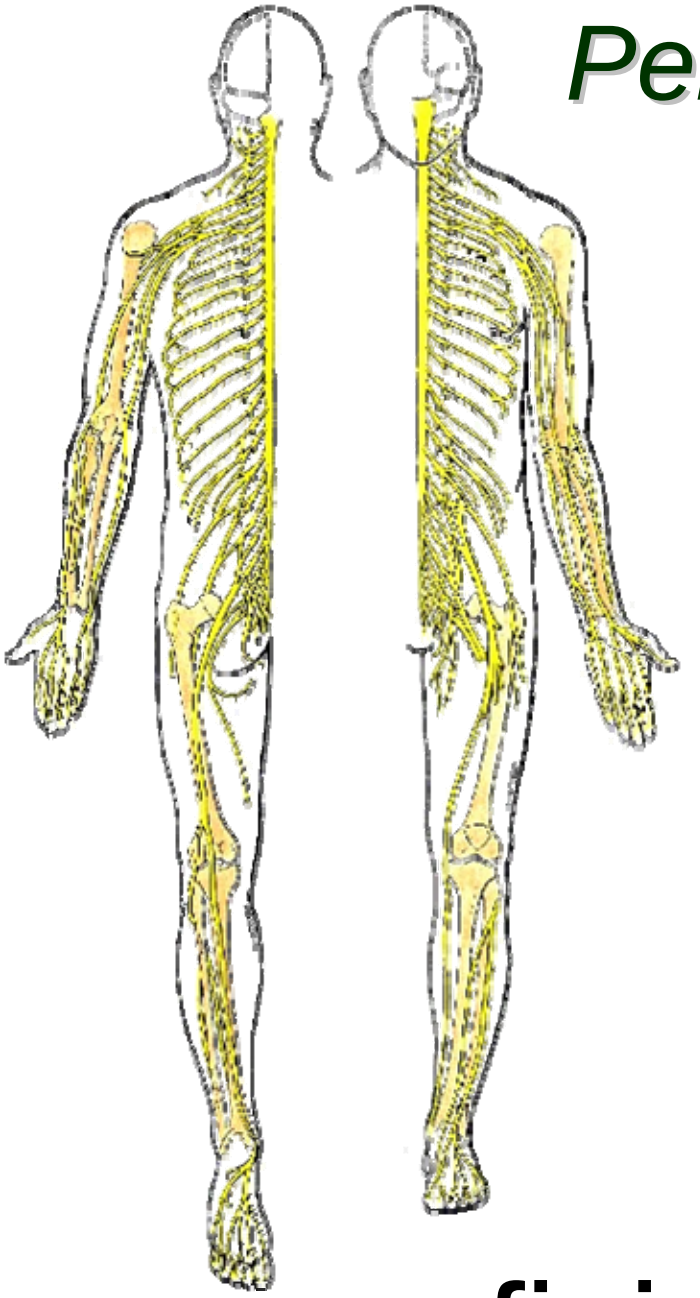

# *Peripheral Nervous System*
# *The Somatic System*

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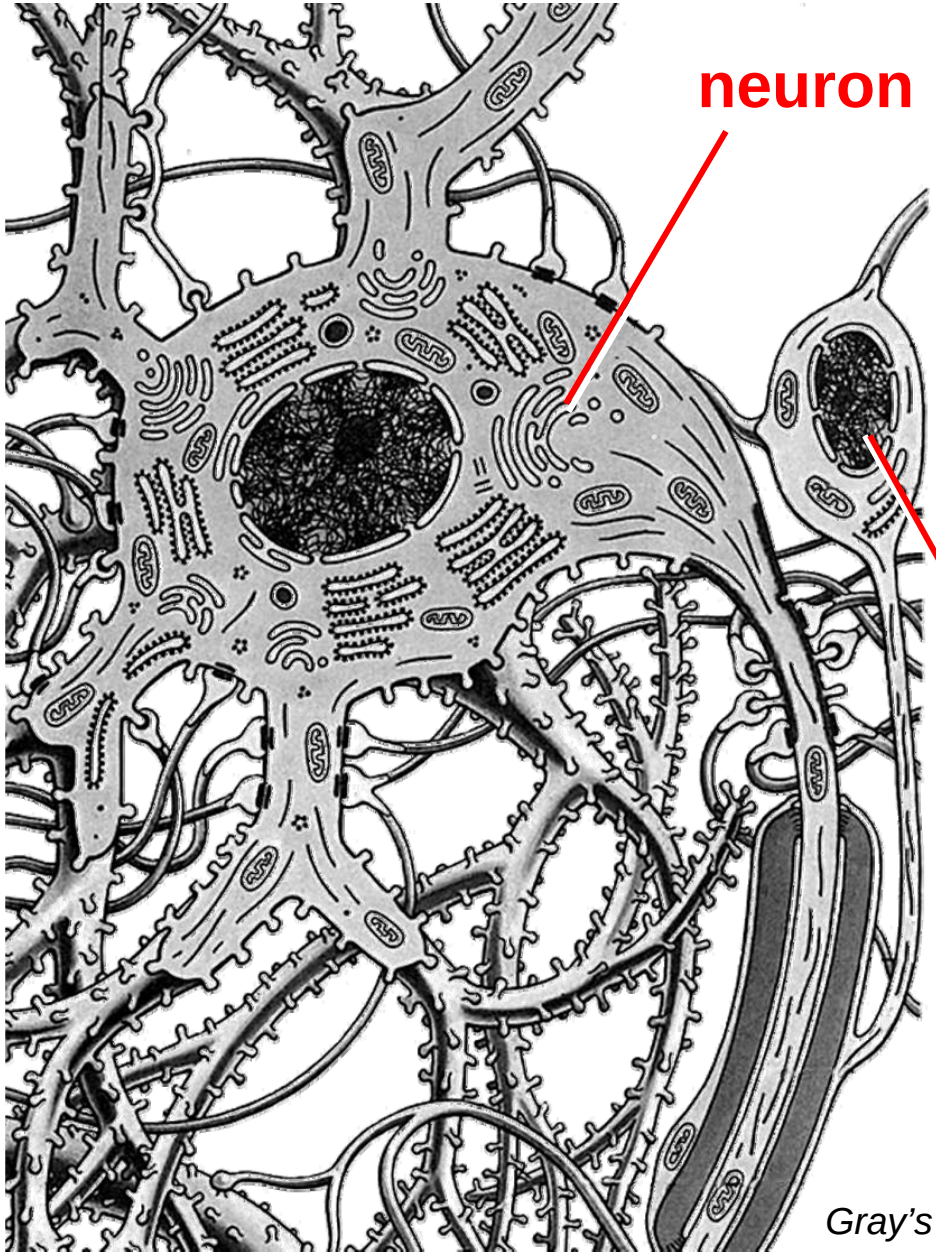
# Dichotomies

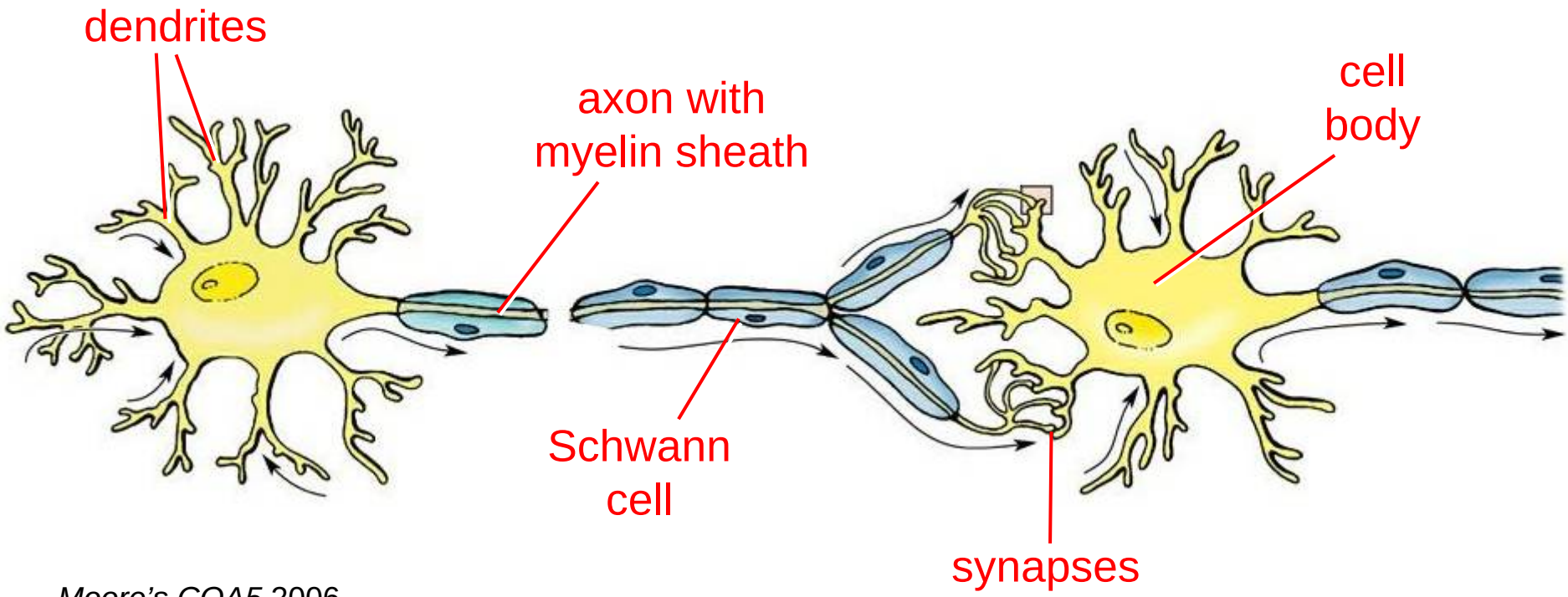



1. Tissues: neurons vs. glia
2. Position: CNS vs. PNS
3. Function 1: sensory vs. motor
4. Function 2: somatic vs. visceral

*Gray's Anatomy 38* 1999

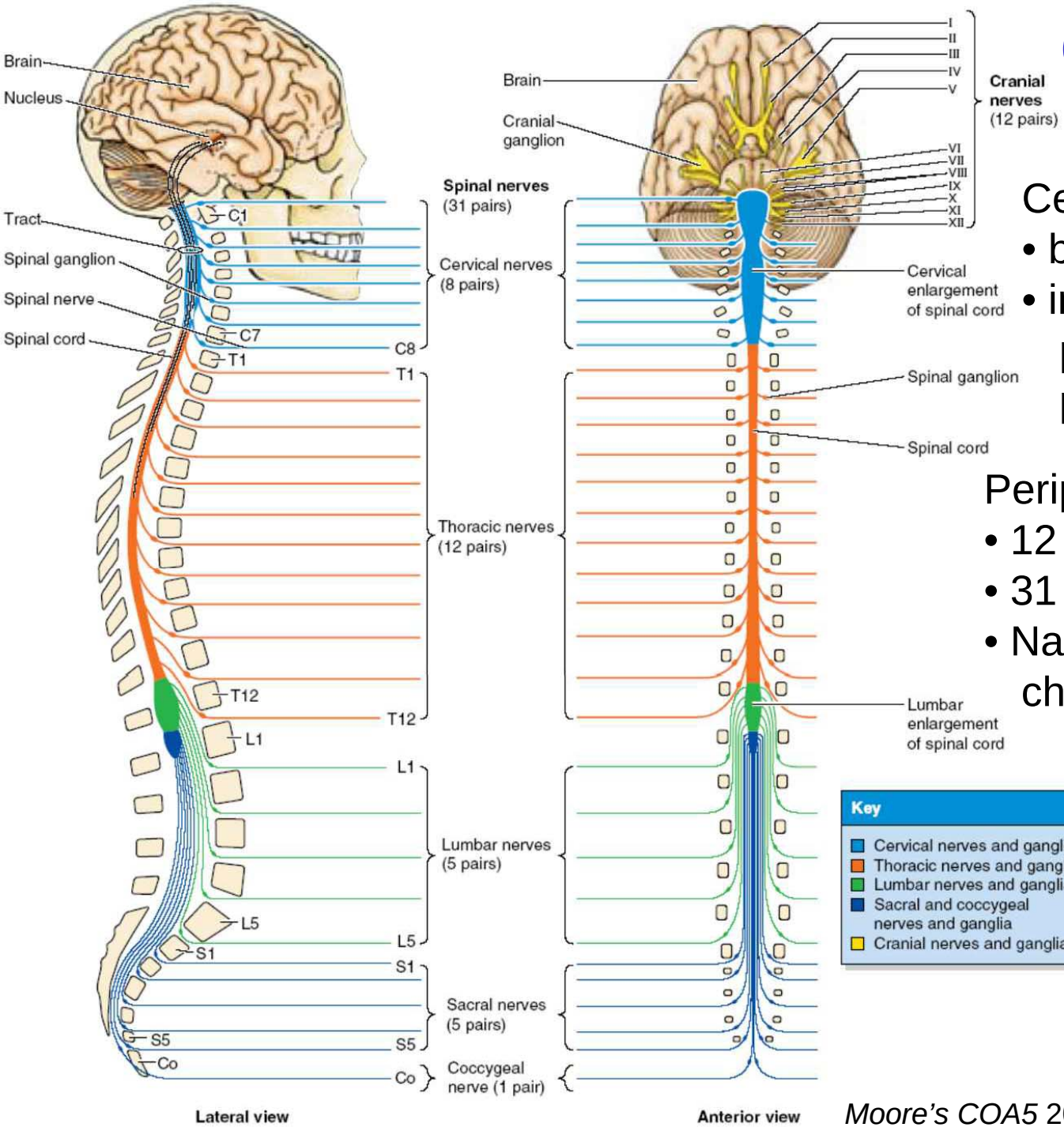
# Neurons

- 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




*Moore's COA5* 2006

# CNS vs. PNS




*Moore's COA5* 2006

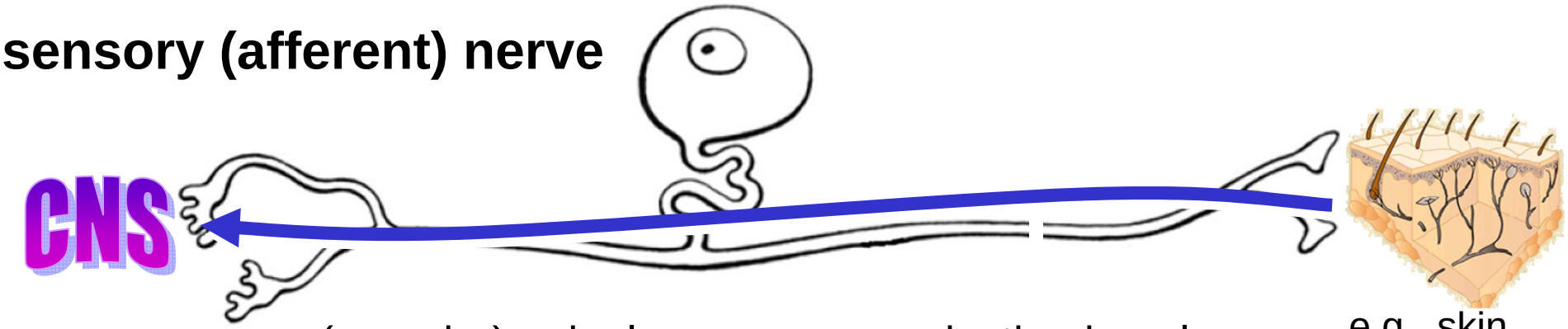
Central Nervous System
- brain & spinal cord
- integration of info passing to & from the periphery

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

# Sensory (Afferent) vs. Motor (Efferent)

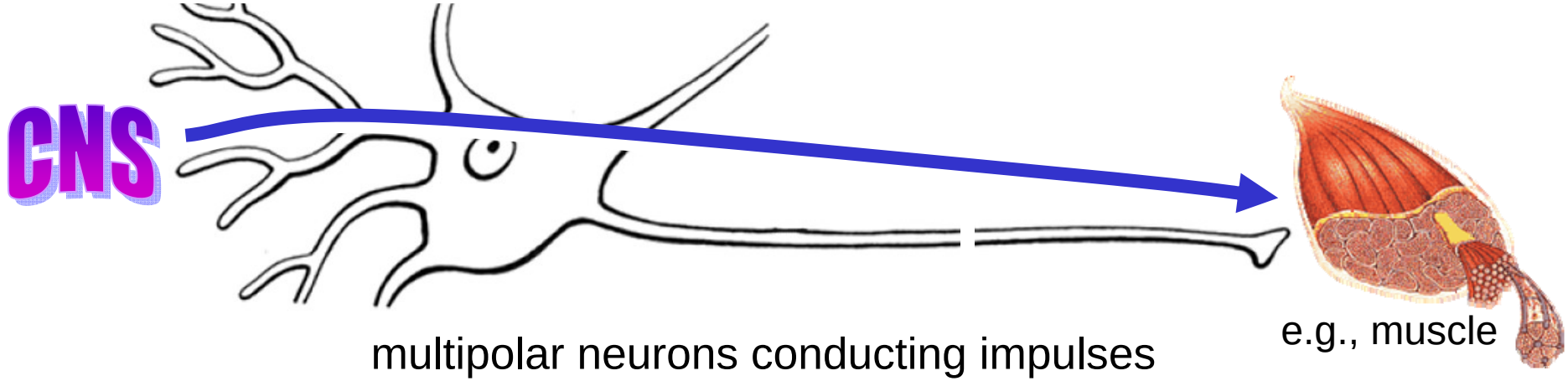
**sensory (afferent) nerve**




e.g., skin

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

**motor (efferent) nerve**



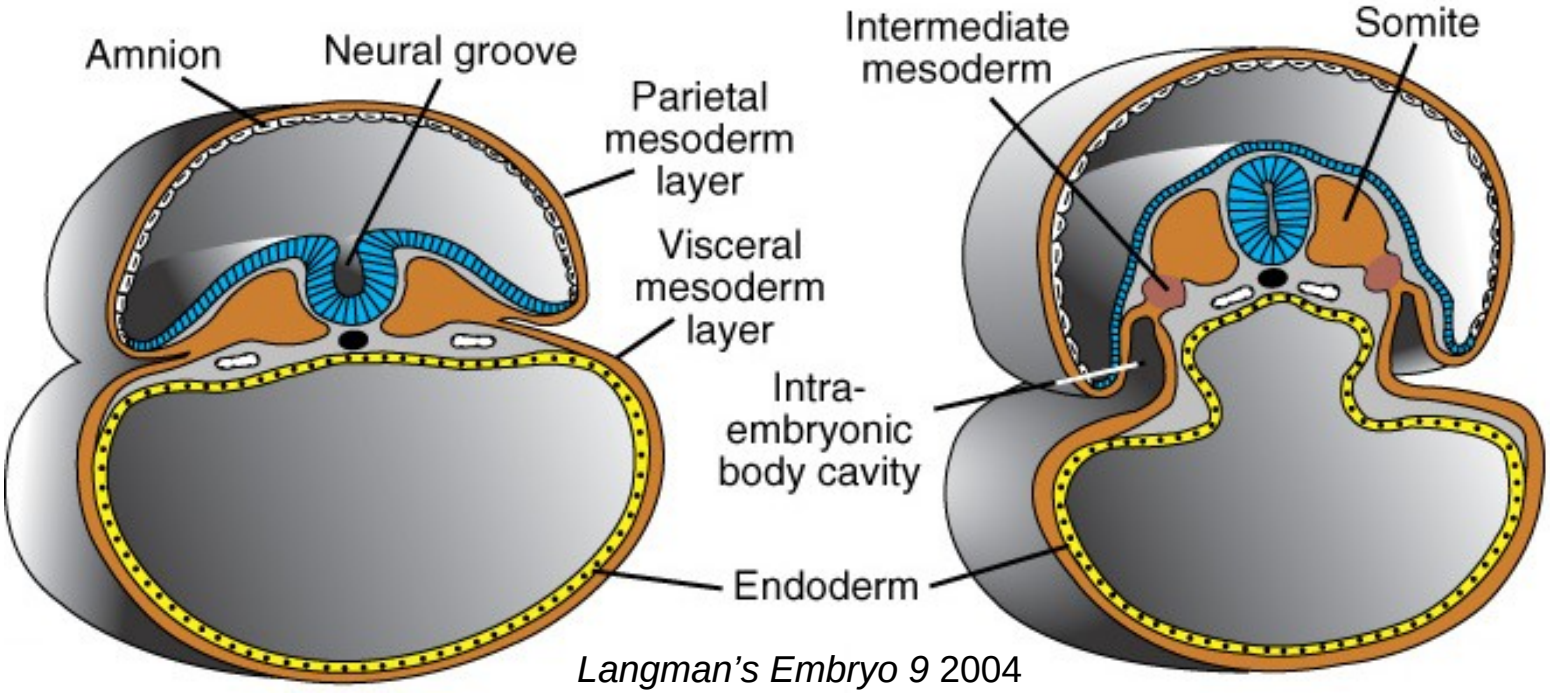

e.g., muscle

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

*Gray's Anatomy 38* 1999

# 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 |




*Langman’s Embryo 9* 2004

# Sensory/Motor + Somatic/Visceral

| | **Somatic** | **Visceral** |
|---|---|---|
| **Sensory (Afferent)** | *somatic sensory* [General Somatic Afferent (GSA)] | *visceral sensory* [General Visceral Afferent (GVA)] |
| **Motor (Efferent)** | *somatic motor* [General Somatic Efferent (GSE)] | *visceral motor* [General Visceral Efferent (GVE)] |

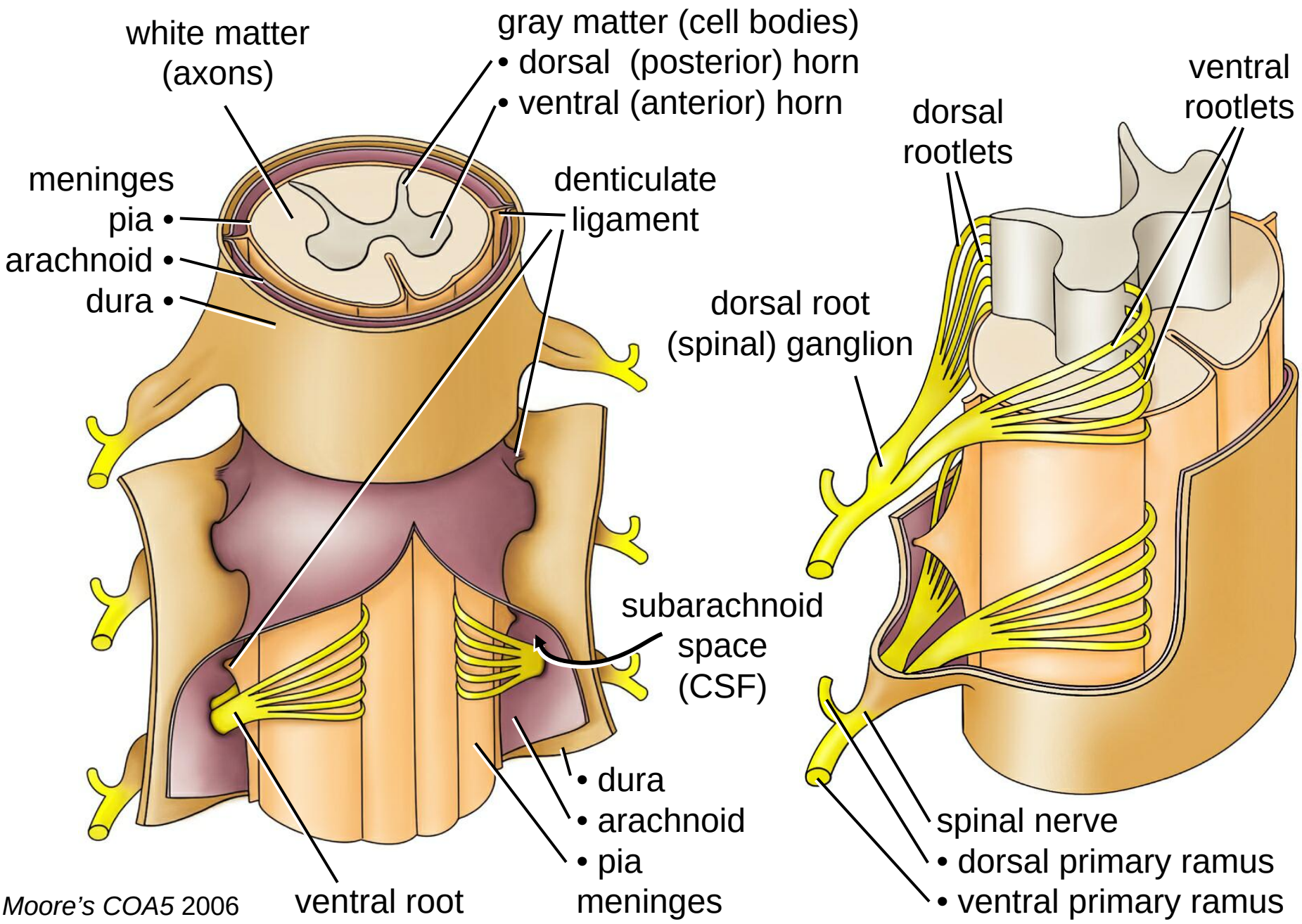
***Somatic Nervous System***

(today)

***Autonomic Nervous System***

(Aug 18)

# Structure of the Spinal Cord




*Moore's COA5* 2006

# Rootlet Damage

## Upper Brachial Plexus Injuries

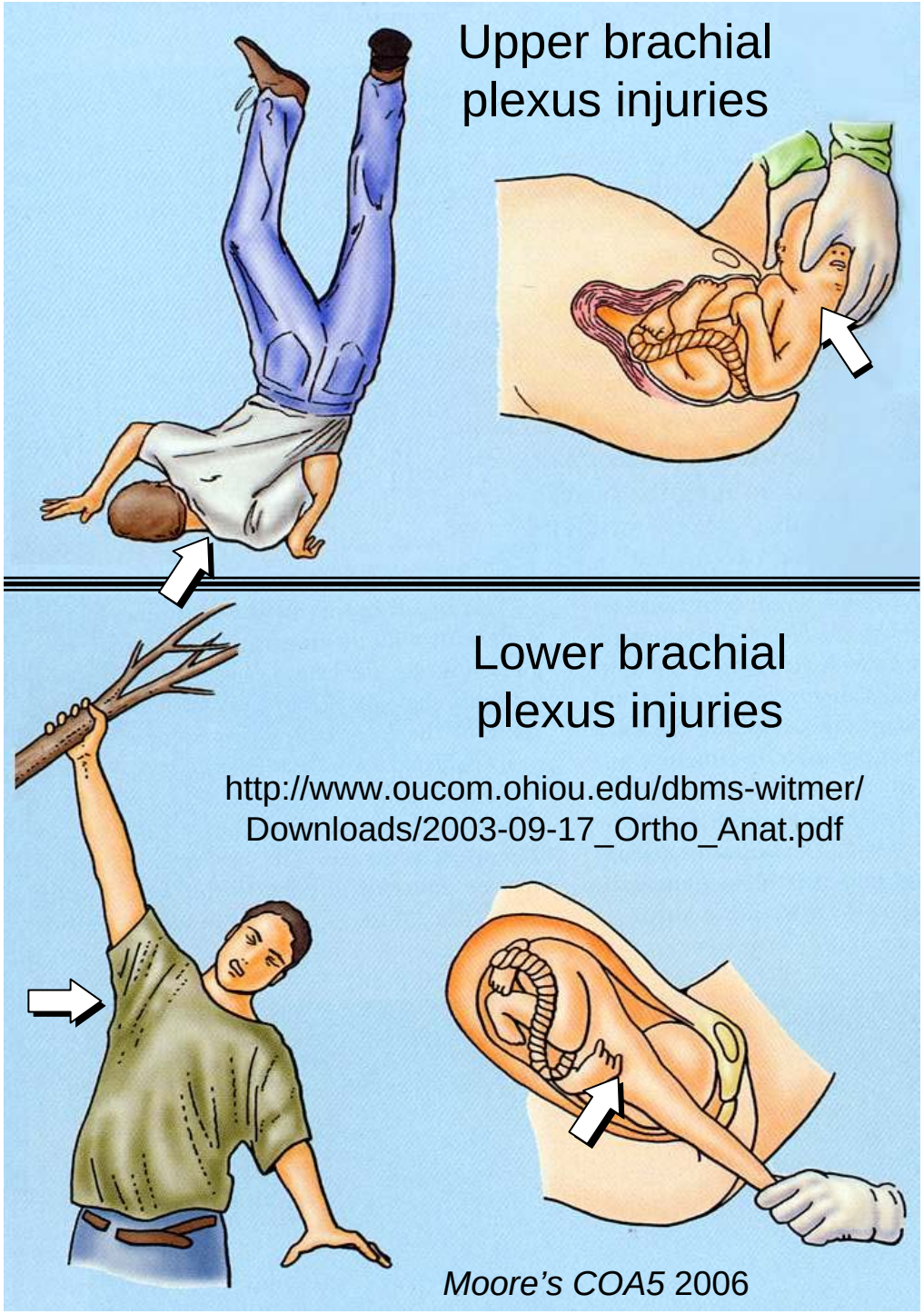
- Increase in angle between neck & shoulder
- Traction (stretching or avulsion) of upper rootlets (e.g., C5,C6)
- Produces Erb's Palsy

## Lower Brachial Plexus Injuries

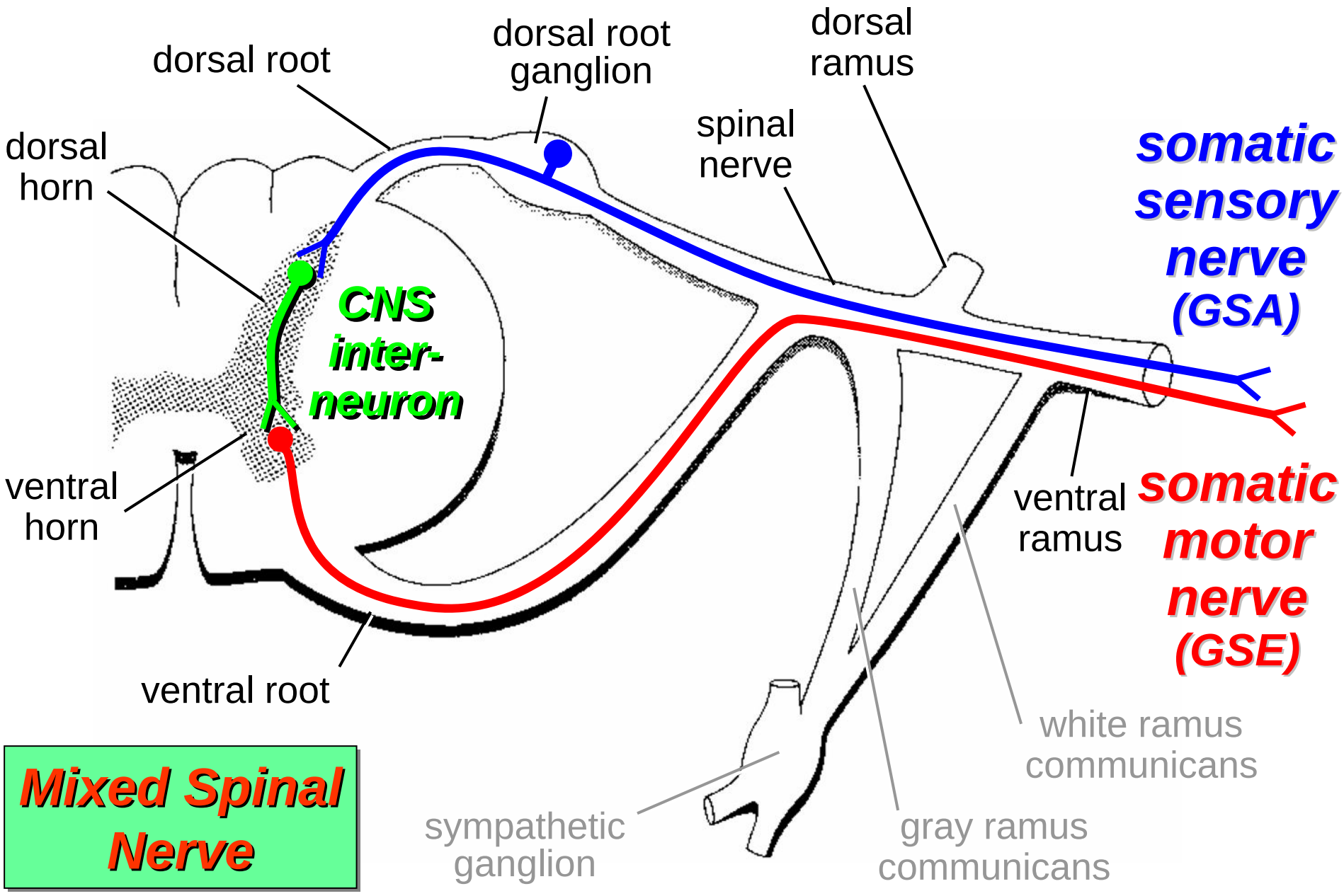
- Excessive upward pull of limb
- Traction (stretching or avulsion) of lower rootlets (e.g., C8, T1)
- Produces Klumpke's Palsy

## "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

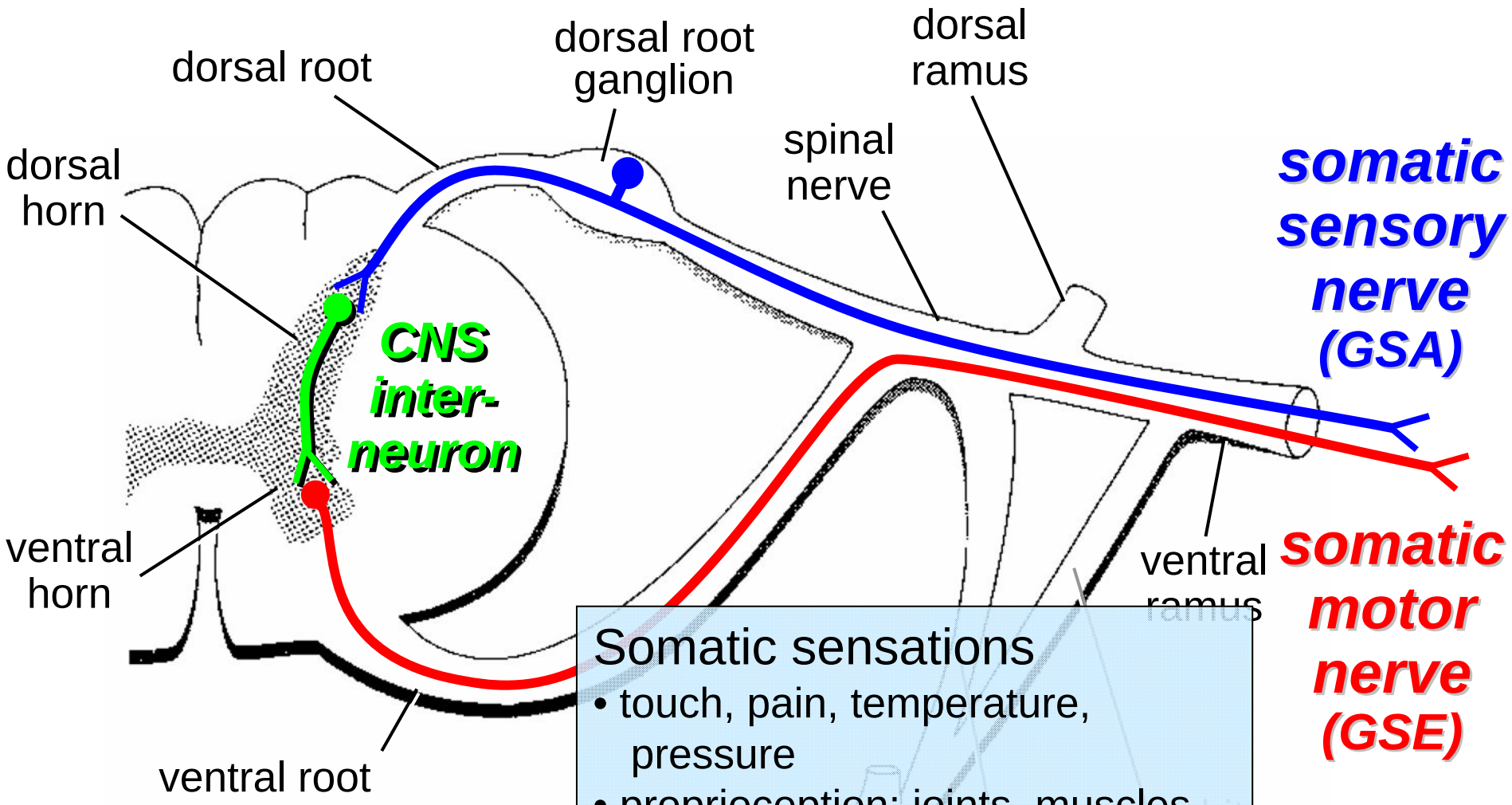


# Structure of Spinal Nerves: Somatic Pathways




**Mixed Spinal Nerve**

# Structure of Spinal Nerves: Somatic Pathways

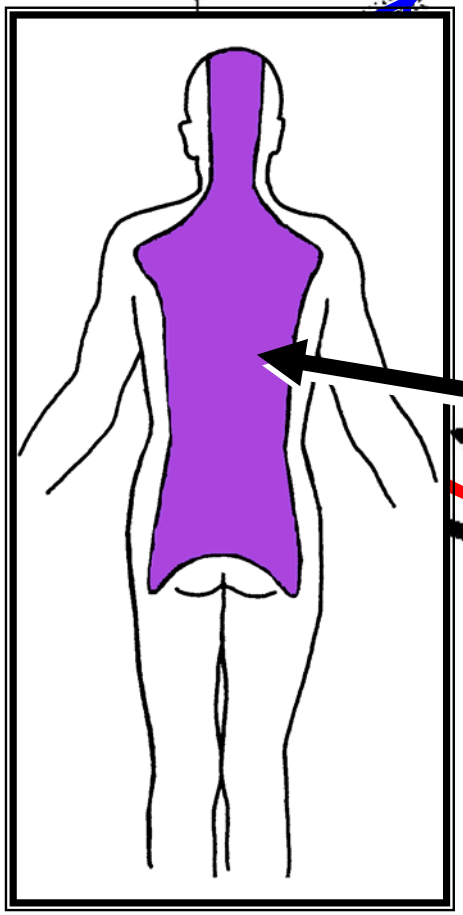



**Mixed Spinal Nerve**

Somatic sensations
- touch, pain, temperature, pressure
- proprioception: joints, muscles

Somatic motor activity:
- innervate skeletal muscles

# Structure of Spinal Nerves: Dorsal & Ventral Rami

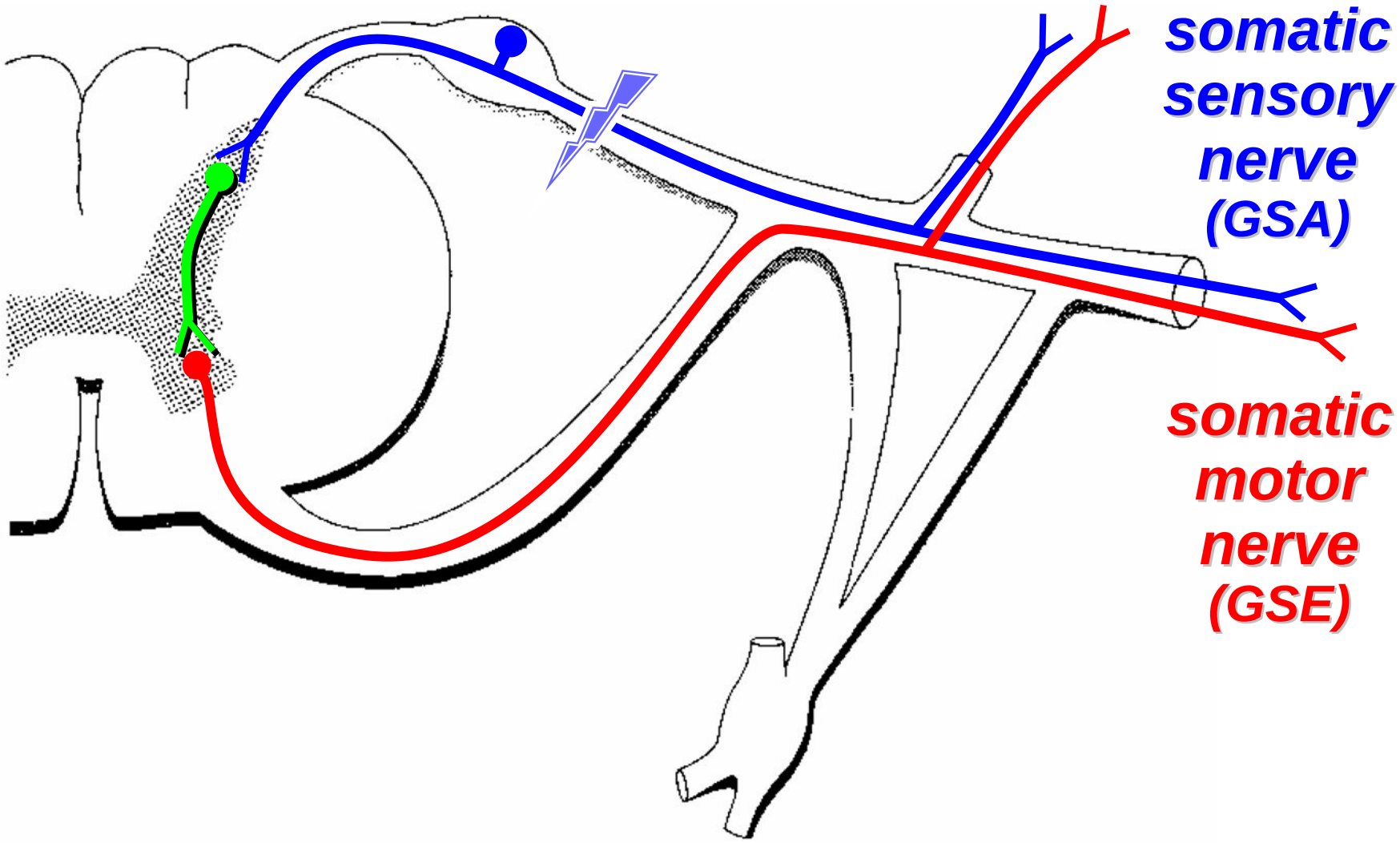




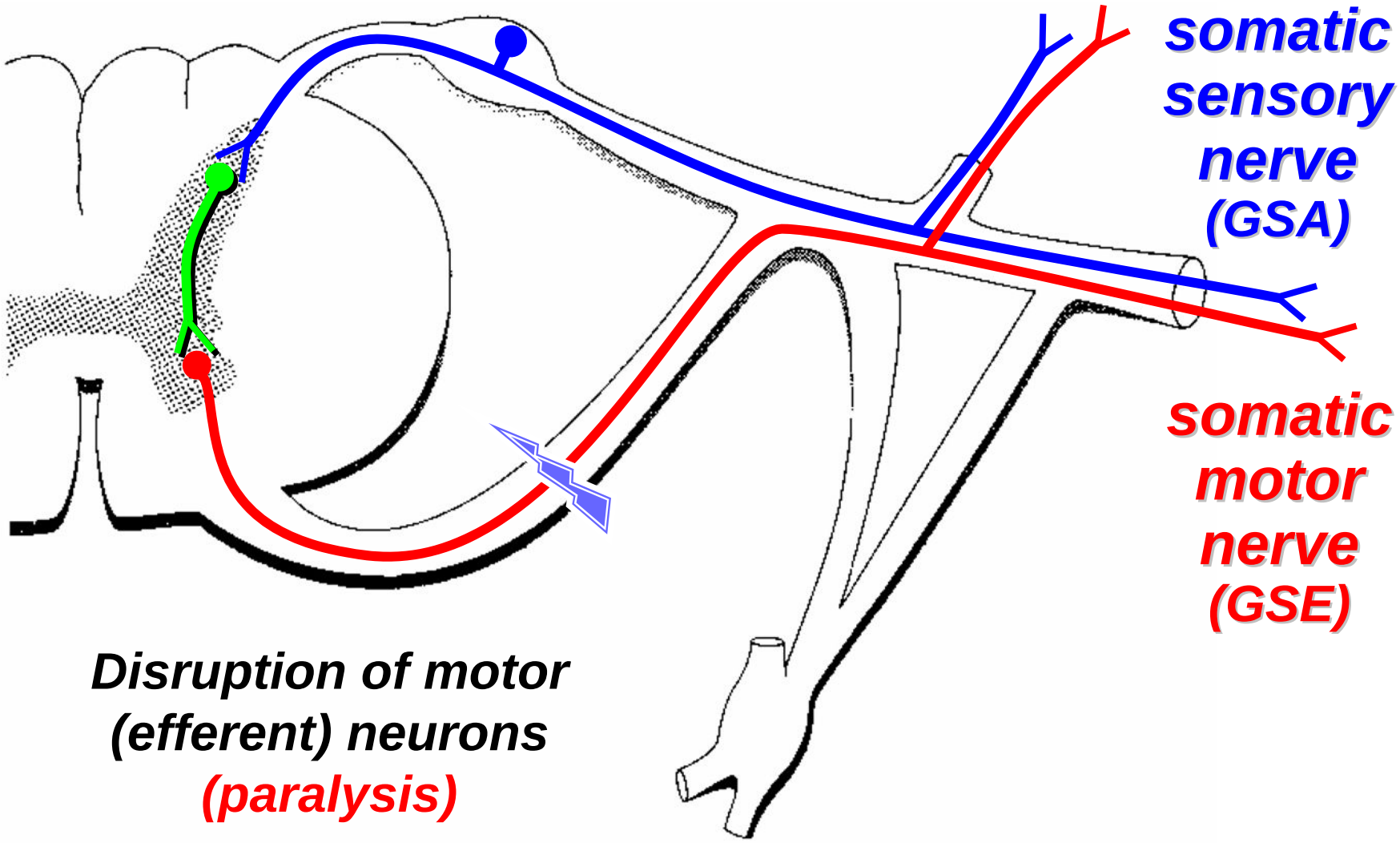

Stern *Essentials of Gross Anatomy*

# Impact of Lesions

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



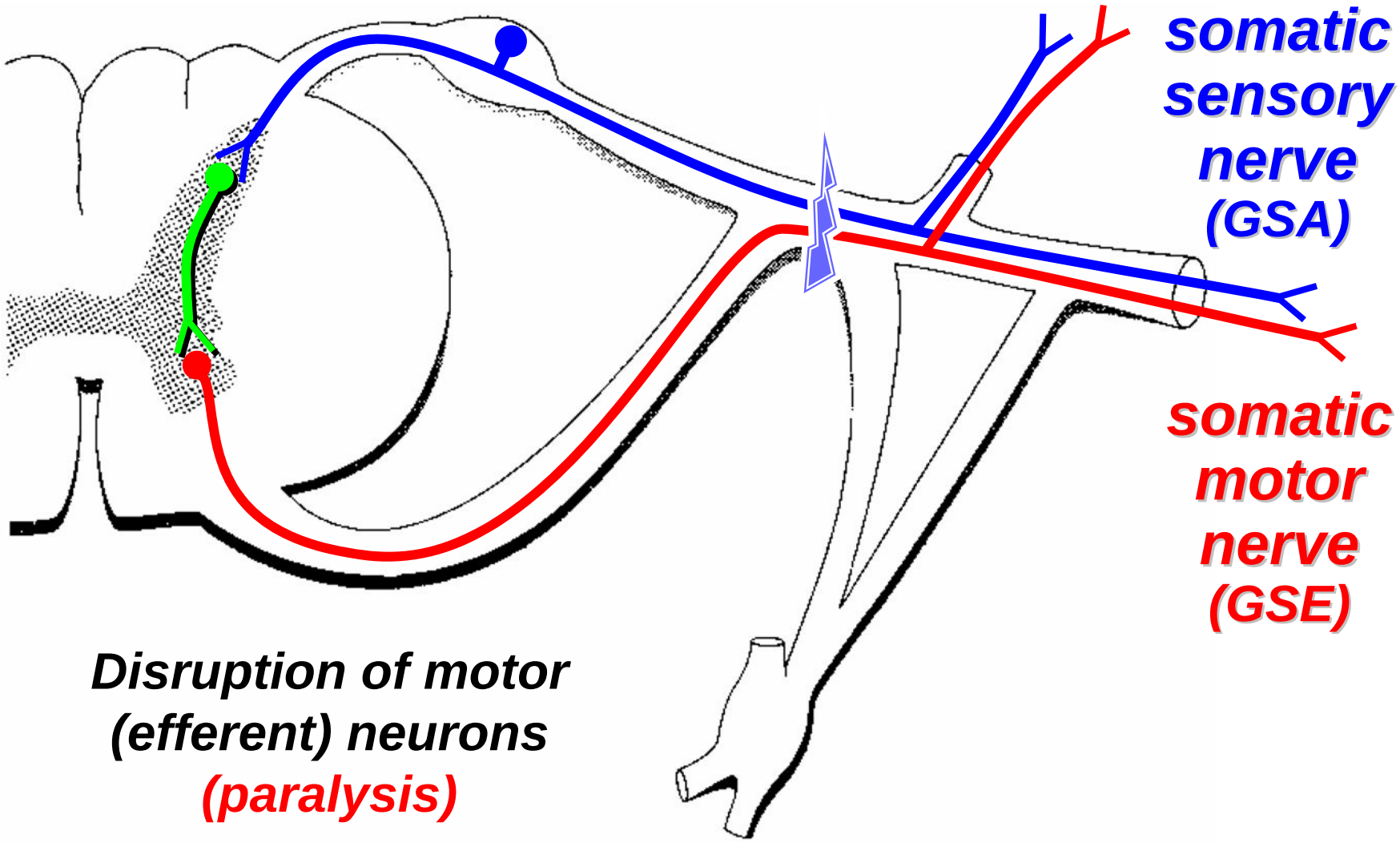
# Impact of Lesions




***Disruption of motor (efferent) neurons (paralysis)***

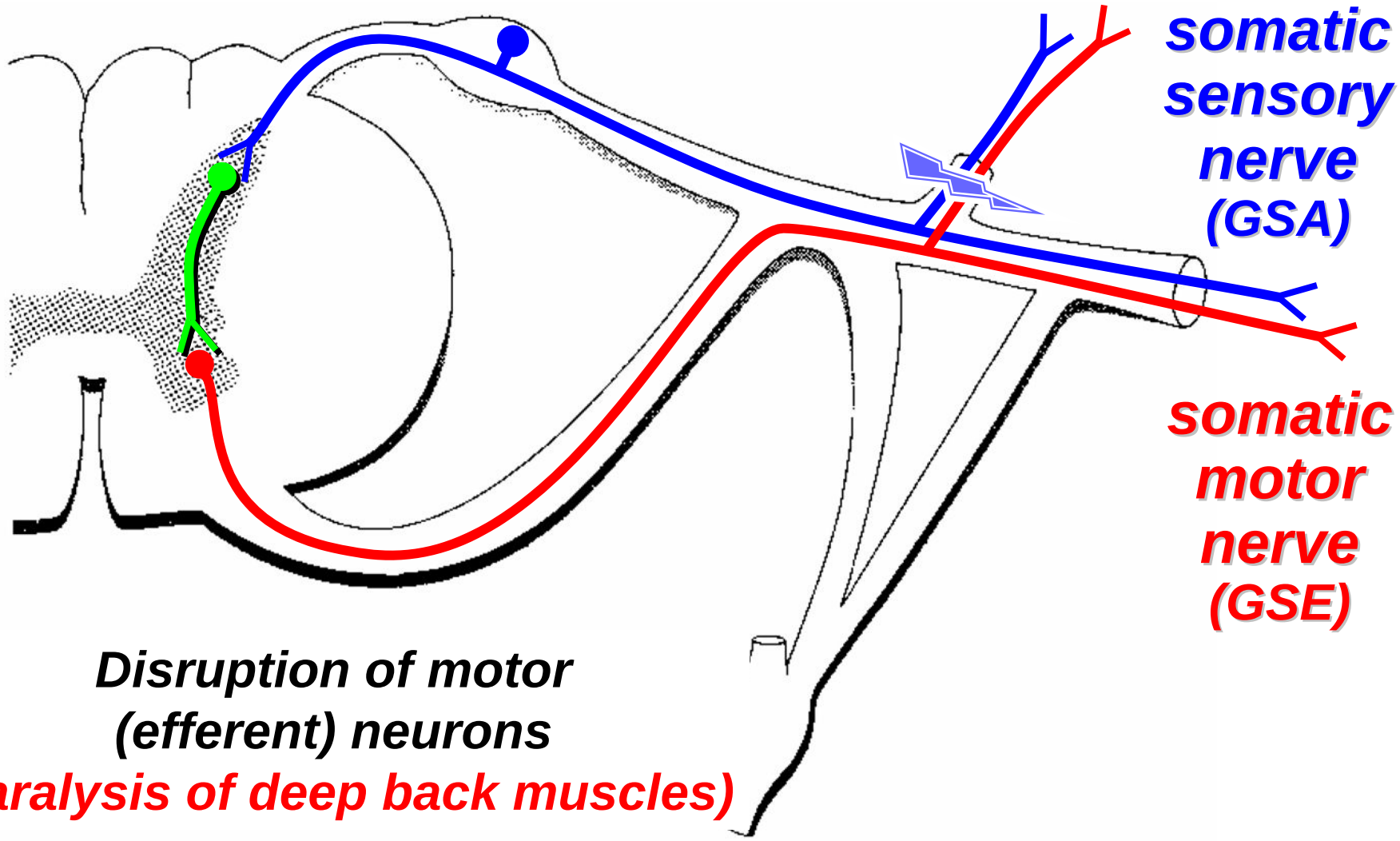
# Impact of Lesions

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



# Impact of Lesions

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

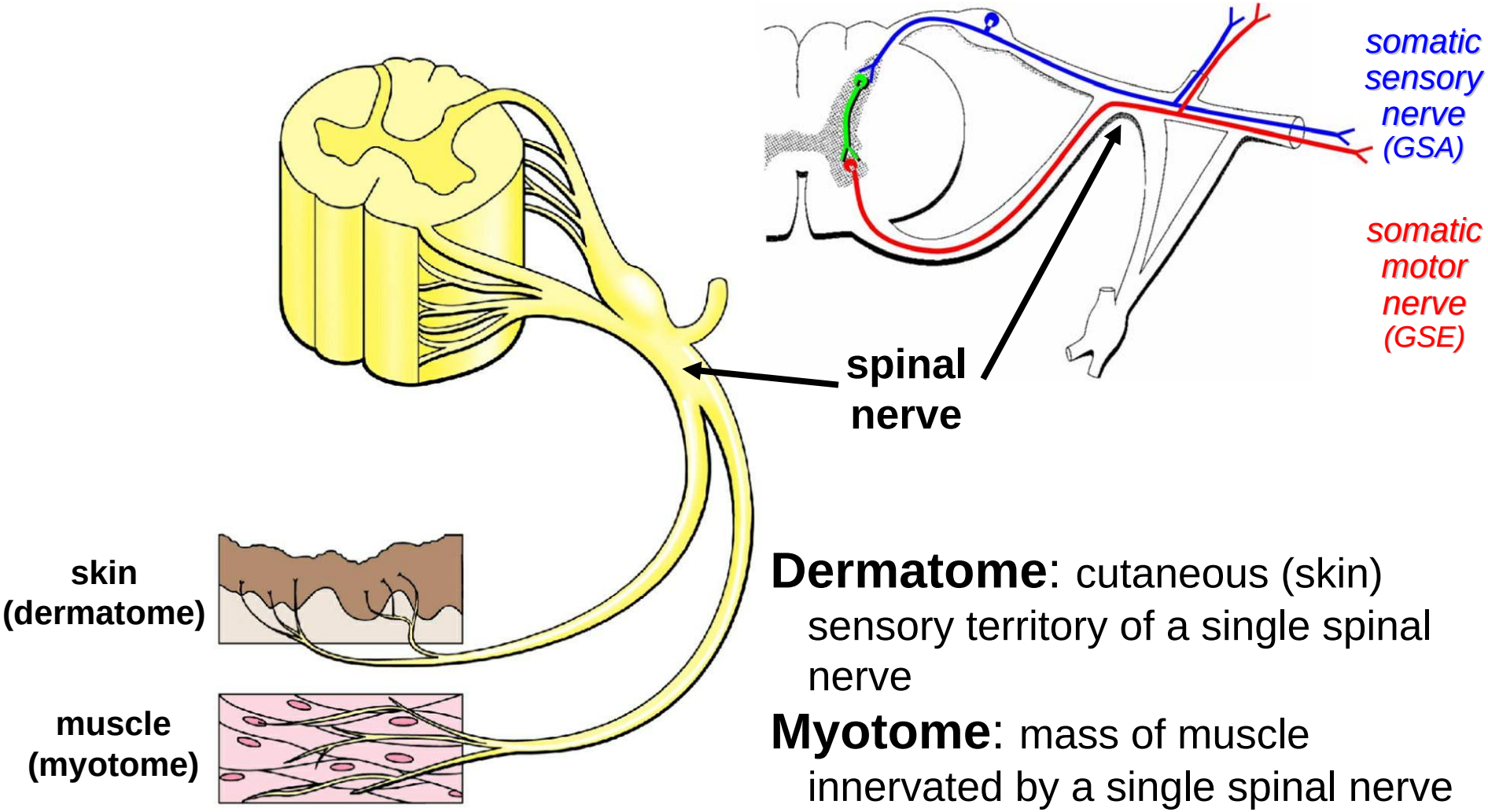


***somatic sensory nerve (GSA)***

***somatic motor nerve (GSE)***

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

# Segmental Innervation: Dermatomes & Myotomes

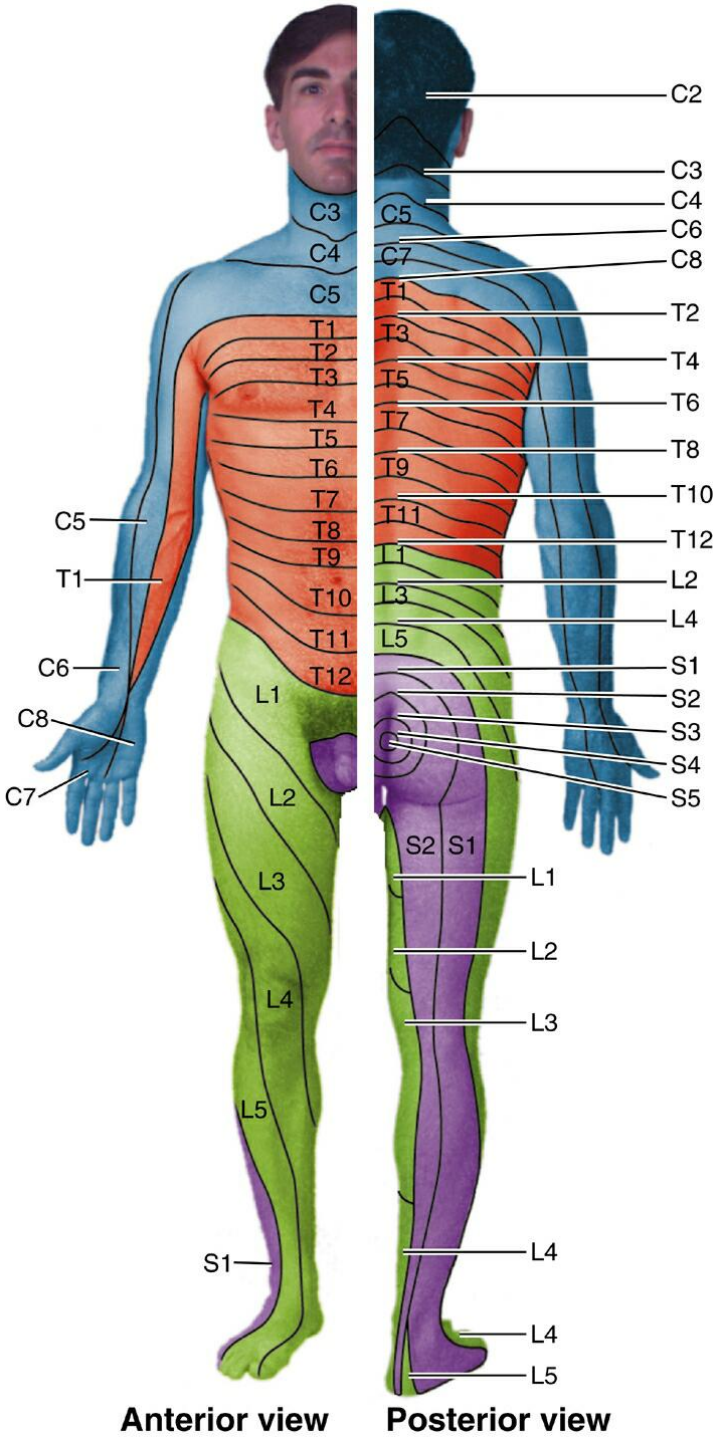



**Dermatome**: cutaneous (skin) sensory territory of a single spinal nerve

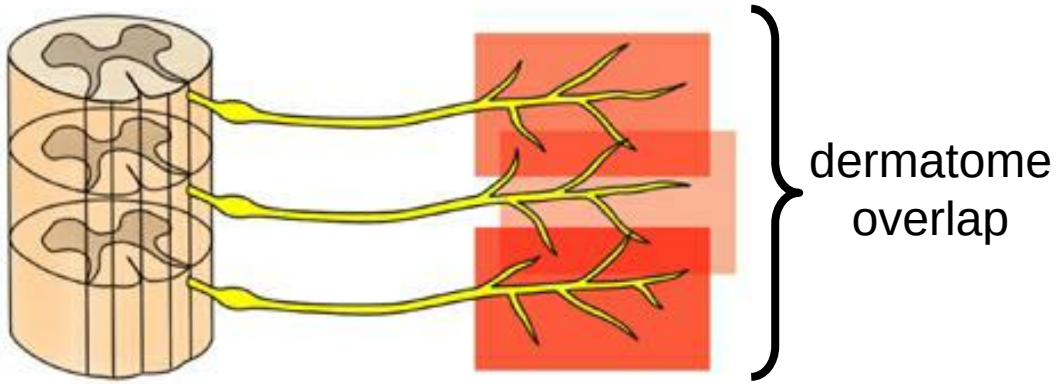
**Myotome**: mass of muscle innervated by a single spinal nerve

*Moore's COA5* 2006

# Segmental Innervation: Dermatome Maps

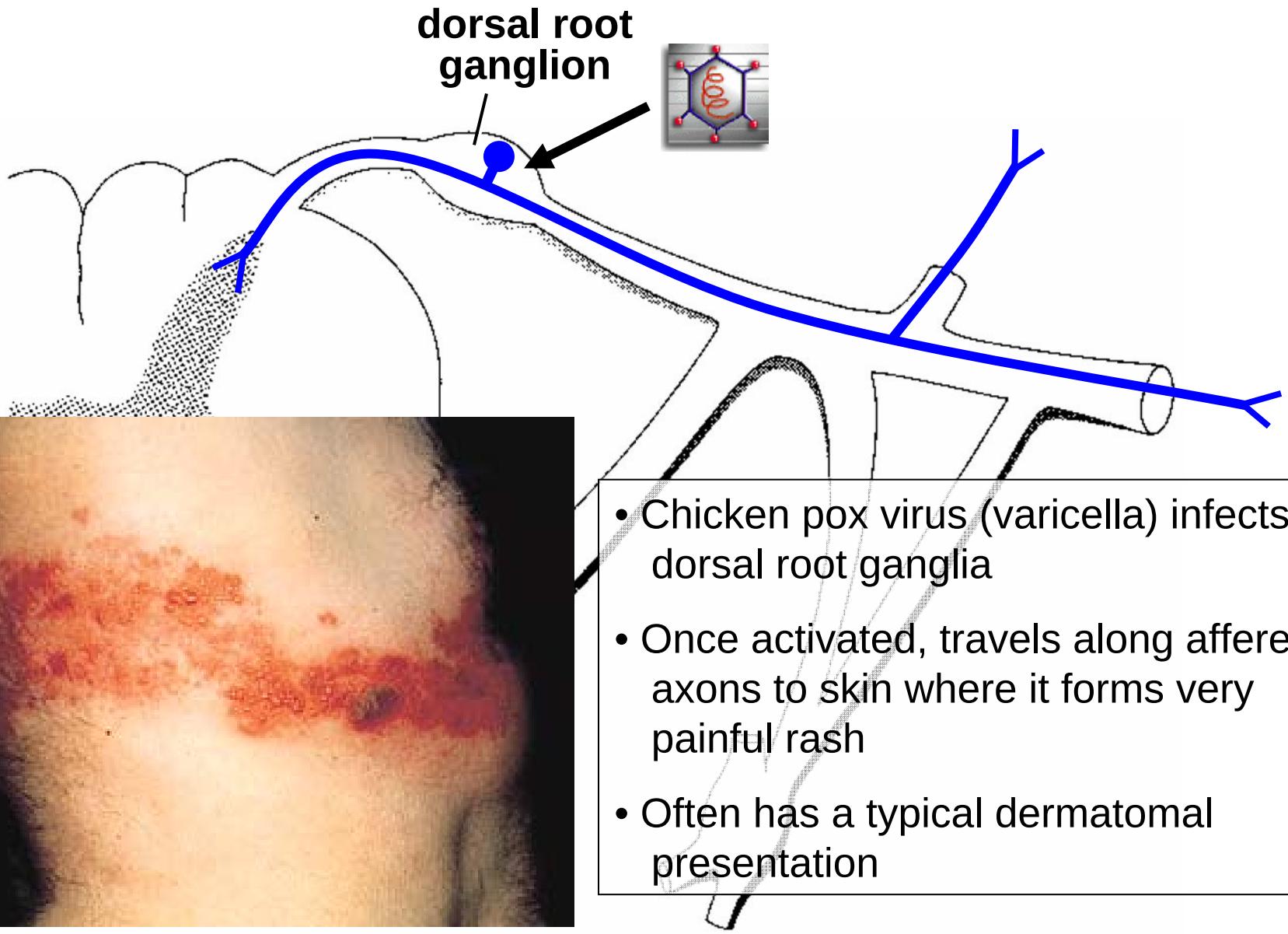



- Based on clinical findings of deficits in cutaneous sensation
- Diagnostic aids: localization of lesions to cord levels
- Limits to specificity due to overlap of dermatomes




*Moore's COA5* 2006

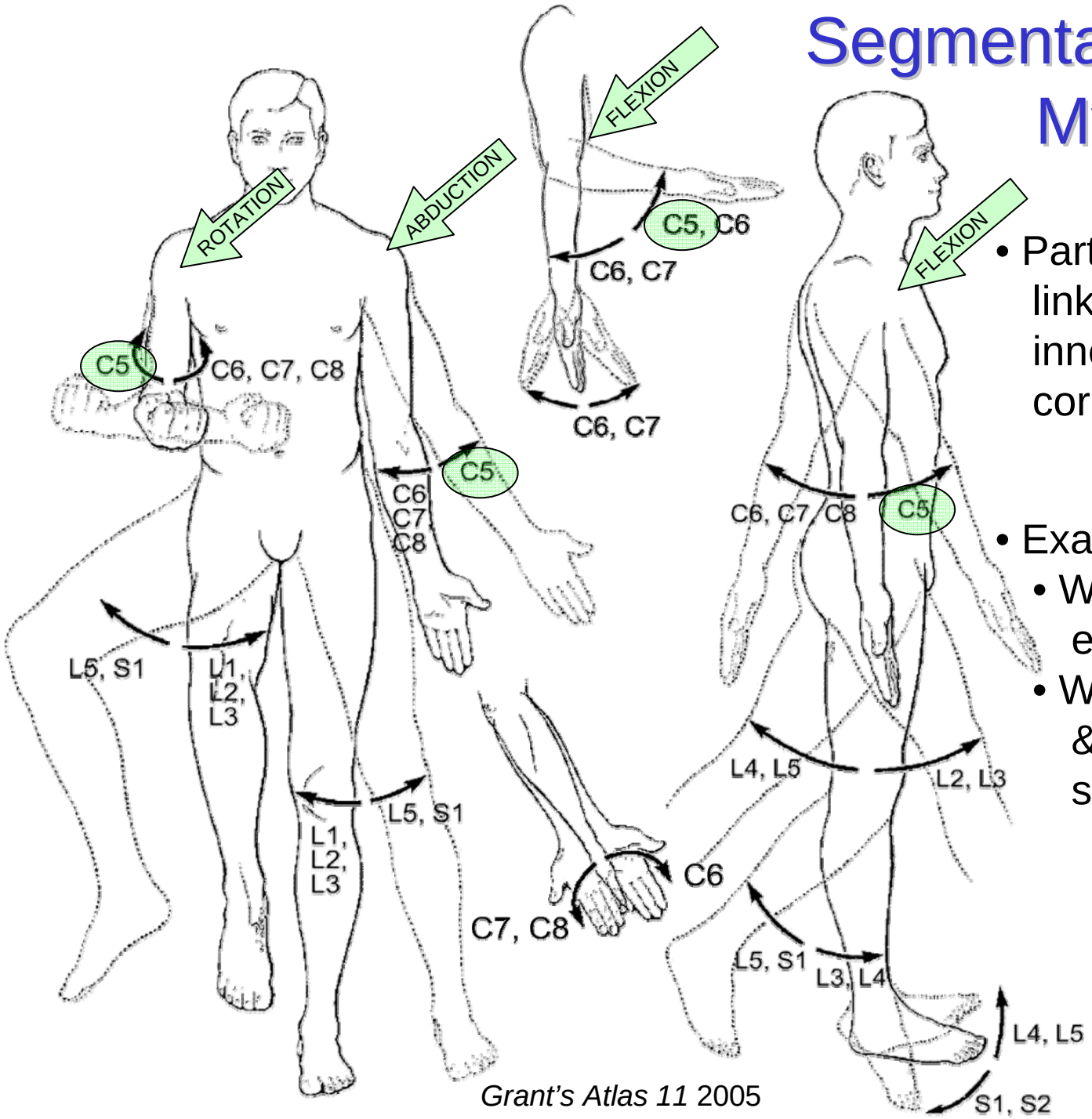
# Dermatomes & Herpes Zoster ("Shingles)"






- 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



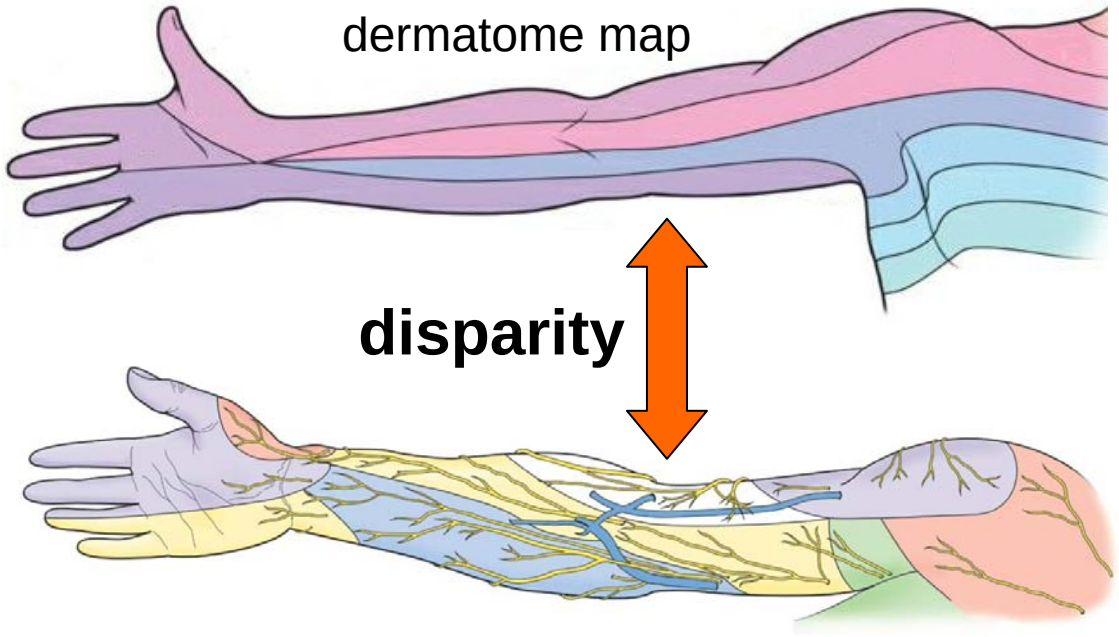

*Grant's Atlas 11* 2005

- Particular functions are linked to muscles innervated by particular cord levels

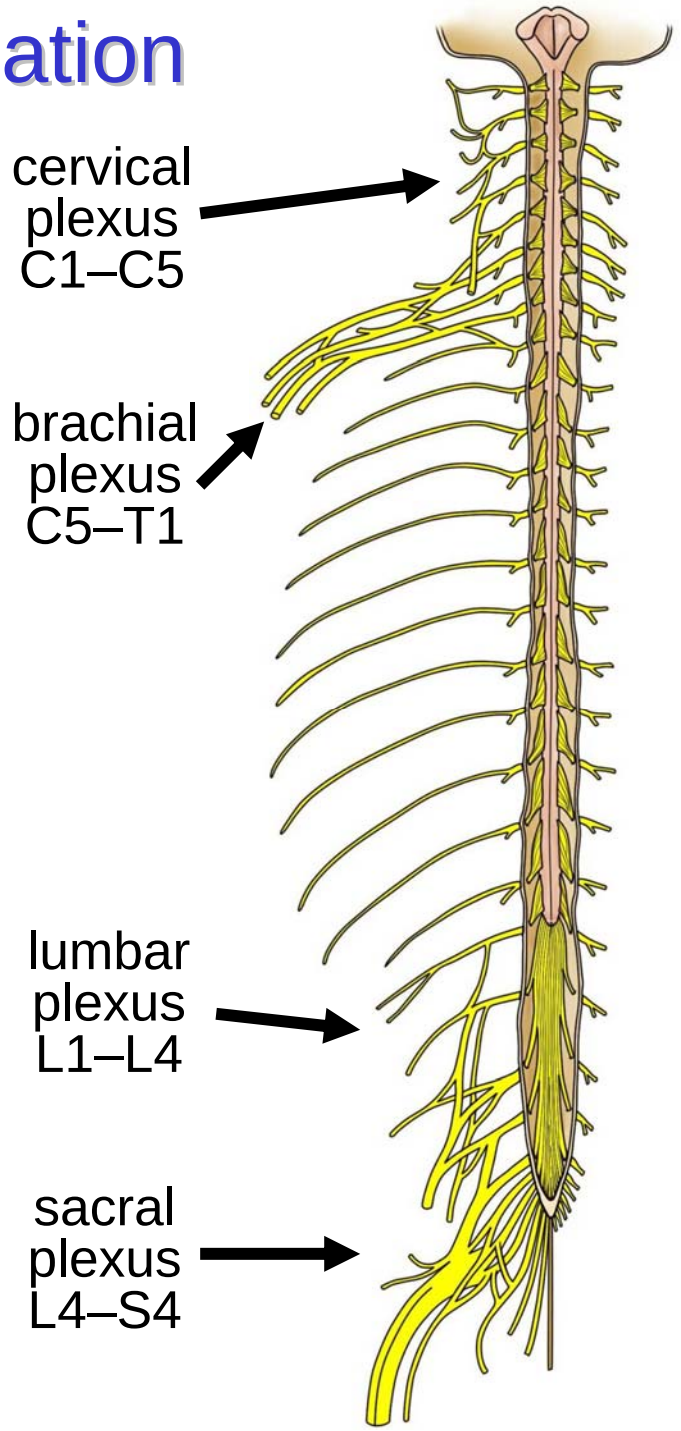
- Example: C5 lesion
  - Weakness in flexion of elbow & shoulder
  - Weakness in abduction & lateral rotation of shoulder

# 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




map of named peripheral nerves

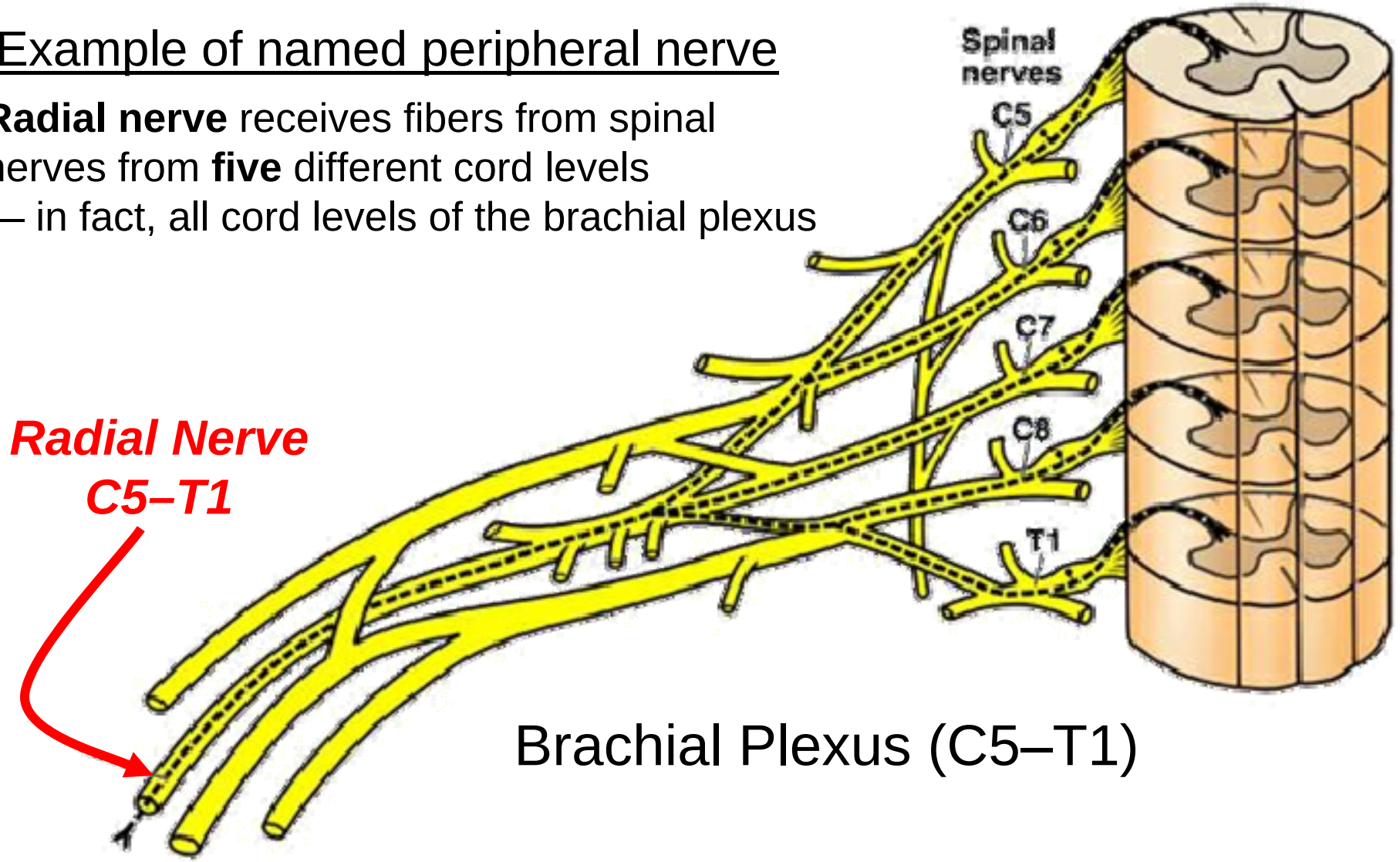



*Moore's COA5* 2006

# PNS Plexus Formation

## Example of named peripheral nerve

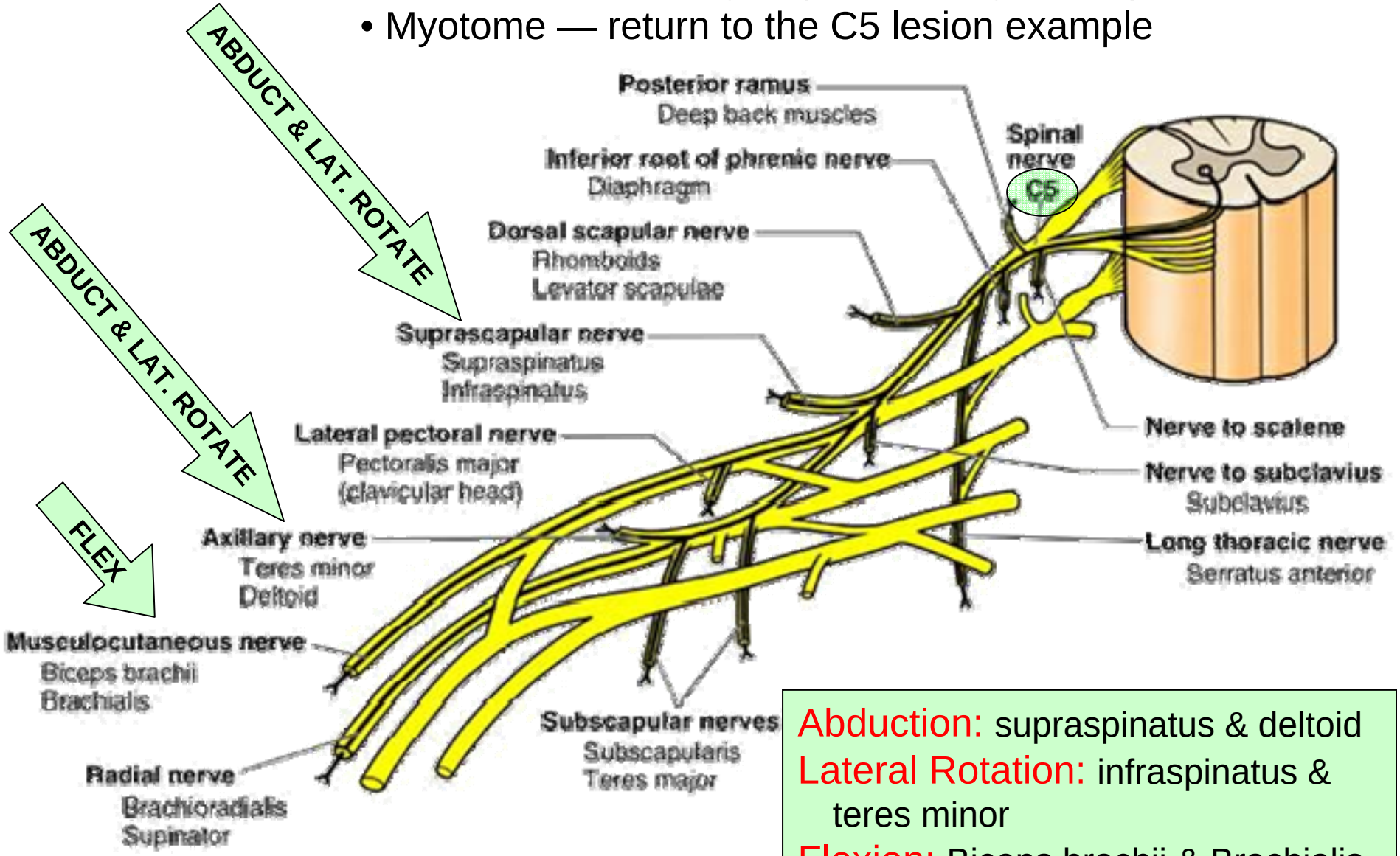
**Radial nerve** receives fibers from spinal nerves from **five** different cord levels
— in fact, all cord levels of the brachial plexus




*Moore's COA5* 2006

# PNS Plexus Formation

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




*Moore's COA5* 2006

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

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