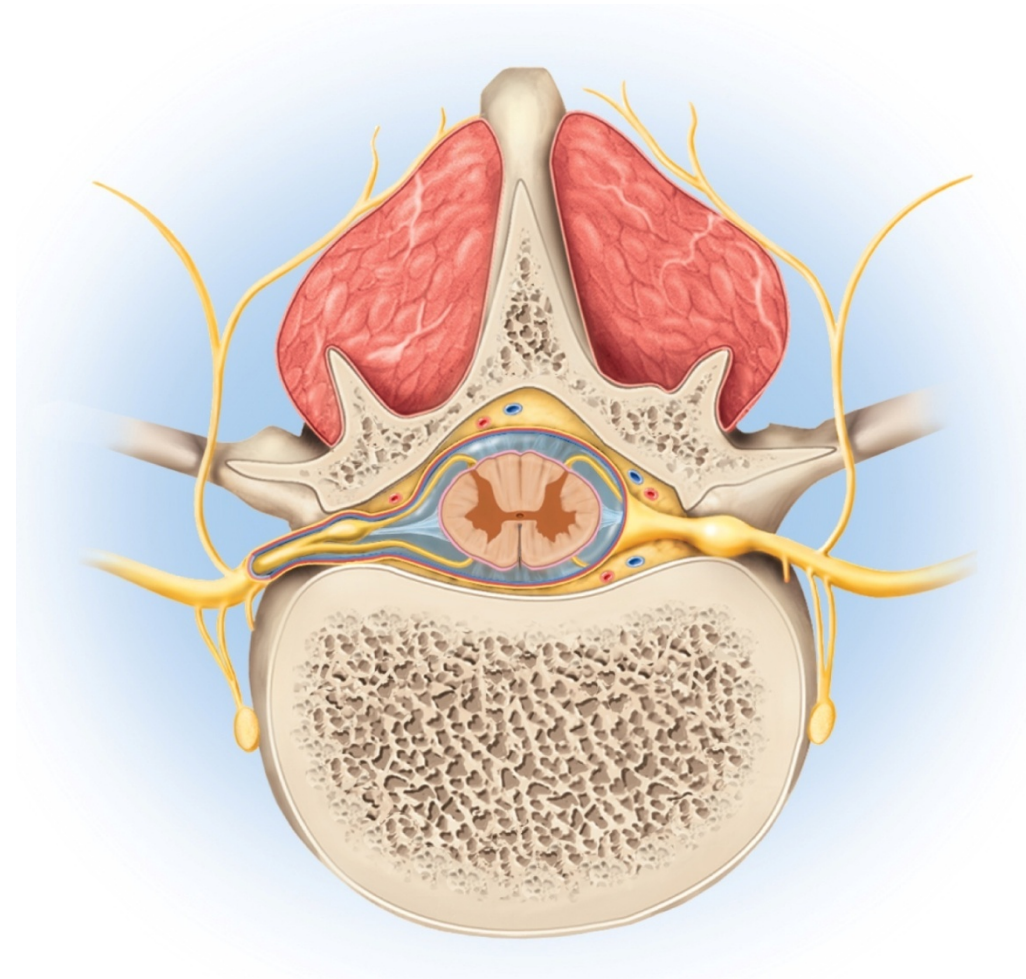
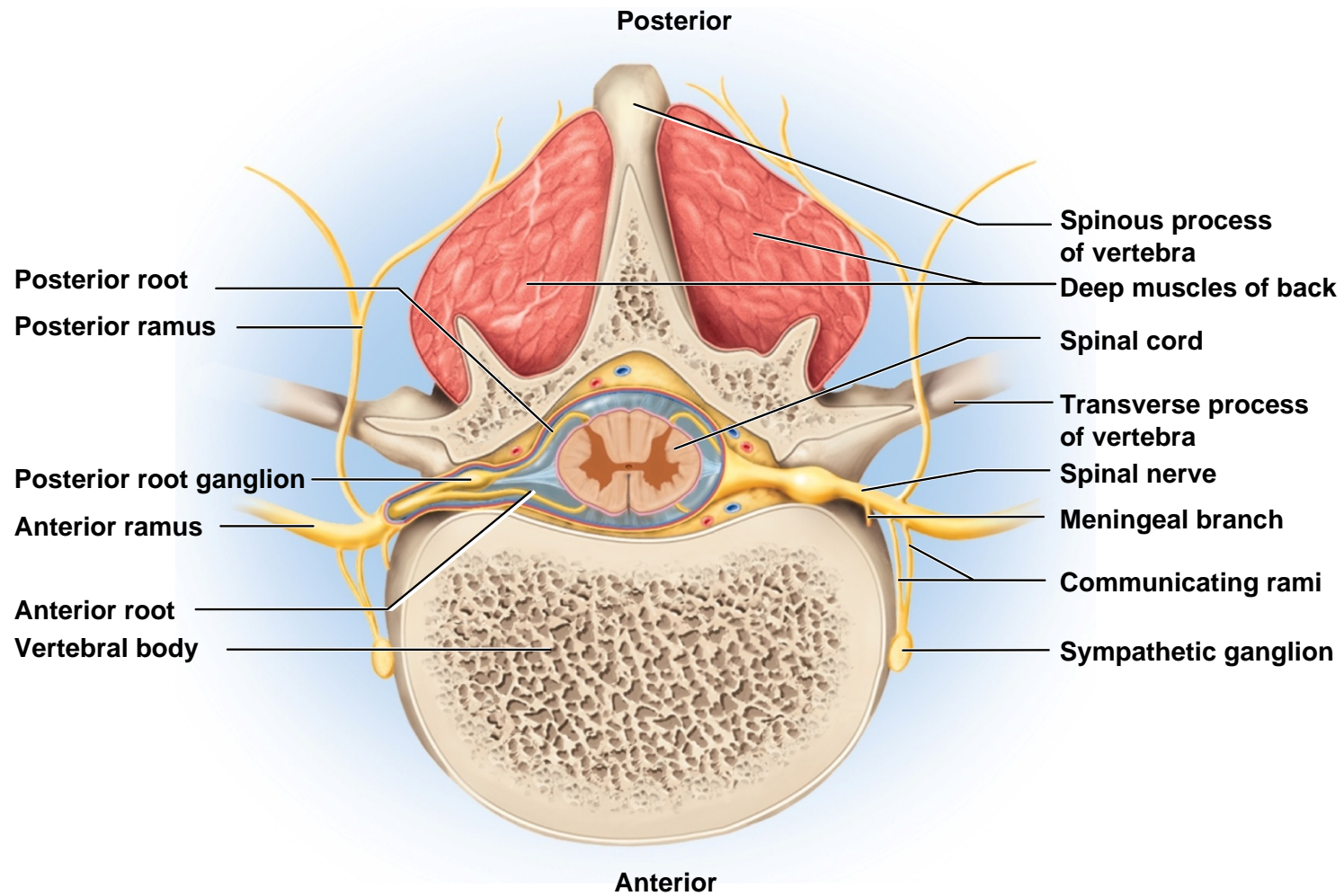


## Chapter 13

# Spinal Nerves, Ganglia, and Nerve Plexus



# Spinal Nerves



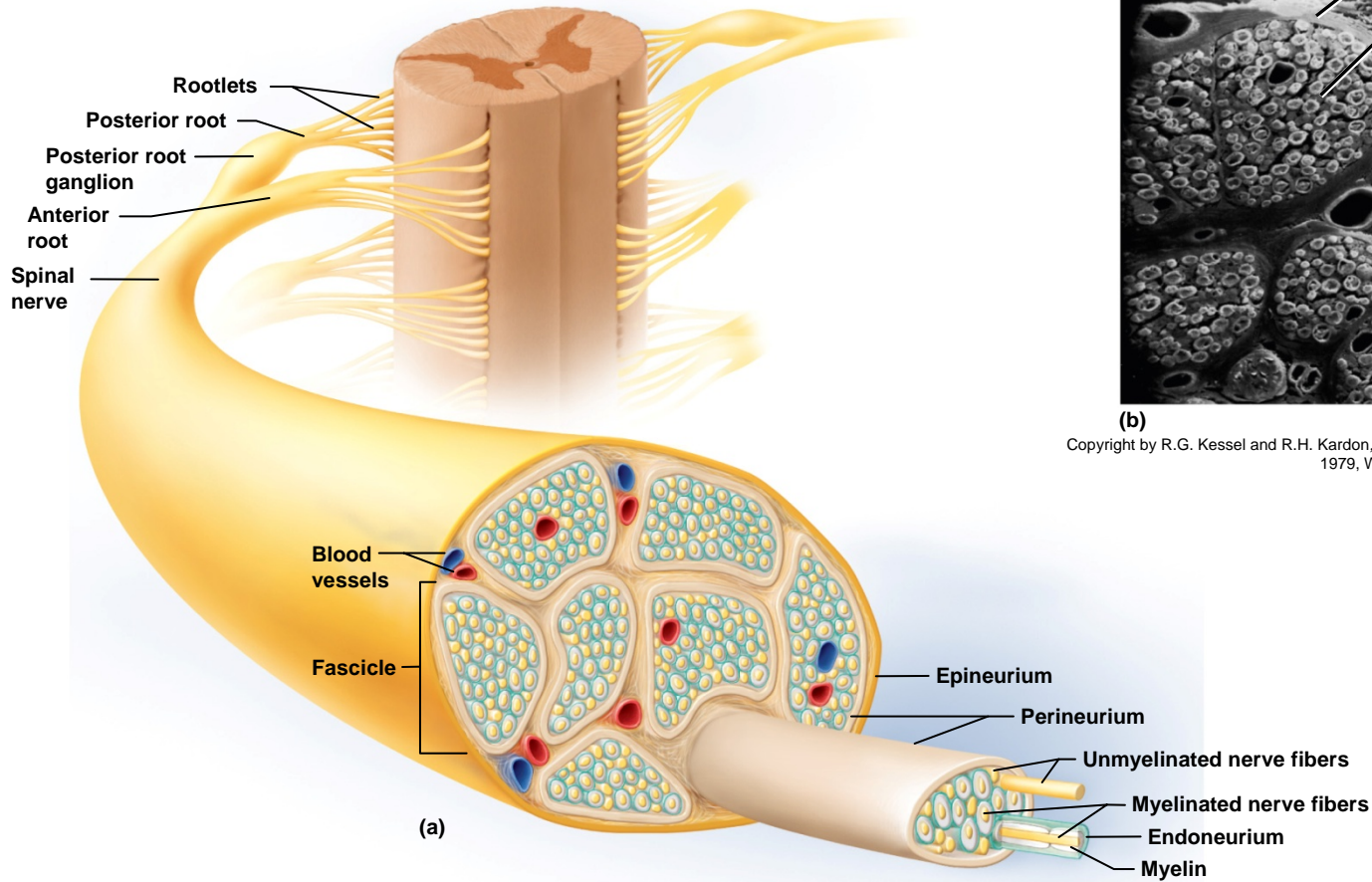
# General Anatomy of Nerves and Ganglia

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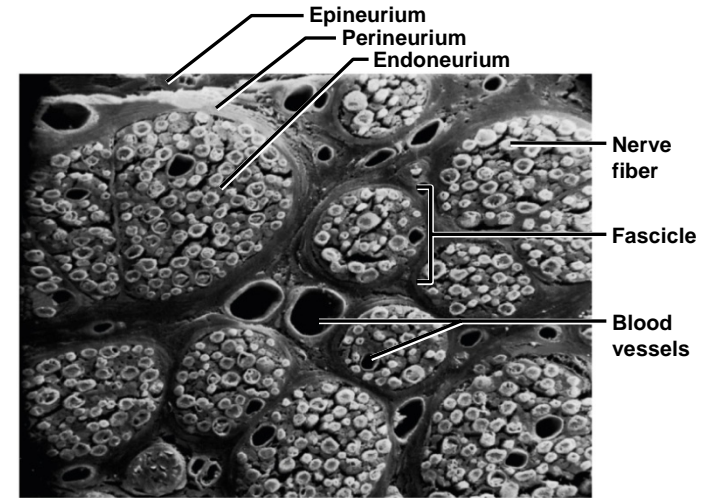
- Spinal cord communicates with the rest of the body by way of spinal nerves
- nerve = a cordlike organ composed of numerous nerve fibers (axons) bound together by connective tissue
  - **mixed nerves** contain both afferent (sensory) and efferent (motor) fibers
  - composed of thousands of fibers carrying currents in opposite directions

# Anatomy of a Nerve

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(b)

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# General Anatomy of Nerves and Ganglia

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- nerves of peripheral nervous system are ensheathed in Schwann cells
  - forms **neurilemma** and often a myelin sheath around the axon
  - external to neurilemma, each fiber is surrounded by basal lamina and then a thin sleeve of loose connective tissue – **endoneurium**
  - **fascicles** – nerve fibers gathered in bundles
  - **perineurium** – wraps fascicles // composed of up to 20 layers of overlapping, squamous, epithelium-like cells
  - **epineurium** – bundles numerous fascicles that constitutes whole nerve // composed of dense irregular connective tissue // protects nerve from stretching and injury
- blood vessels penetrate connective tissue coverings // nerves have high metabolic rate and need plentiful blood supply



# Classification of Nerve Fibers

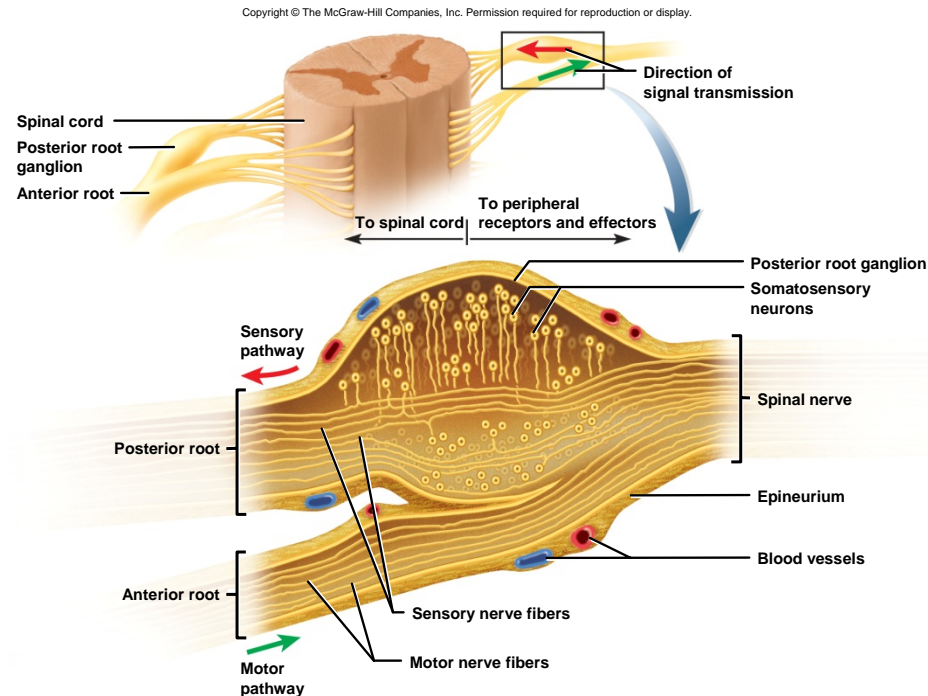
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- **sensory (afferent) nerves**
  - carry signals from sensory receptors to the CNS
- **motor (efferent) nerves**
  - carry signals from CNS to muscles and glands
- **mixed nerves**
  - consists of both afferent and efferent fibers
  - conduct signals in two directions
- both sensory and motor fibers can also be described as:
  - **somatic** or **visceral**
  - **general** or **special**

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TABLE 13.2		The Classification of Nerve Fibers
Class	Description	
Afferent fibers	Carry sensory signals from receptors to the CNS	
Efferent fibers	Carry motor signals from the CNS to effectors	
Somatic fibers	Innervate skin, skeletal muscles, bones, and joints	
Visceral fibers	Innervate blood vessels, glands, and viscera	
General fibers	Innervate widespread organs such as muscles, skin, glands, viscera, and blood vessels	
Special fibers	Innervate more localized organs in the head, including the eyes, ears, olfactory and taste receptors, and muscles of chewing, swallowing, and facial expression	

# Anatomy of Ganglia in the PNS



- **ganglion** - cluster of neurosomas outside the CNS // enveloped in an endoneurium continuous with that of the nerve
- among neurosomas are bundles of nerve fibers leading into and out of the ganglion // posterior root ganglion associated with spinal nerves

# Spinal Nerves

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- 31 pairs of spinal nerves (**mixed nerves**)
  - 8 cervical nerves (C1 – C8) C1 between skull and atlas // others exiting at intervertebral foramen
  - 12 thoracic nerves (T1 – T12)
  - 5 lumbar nerves (L1 – L5)
  - 5 sacral nerves (S1 – S5)
  - 1 coccygeal nerve (Co)



# Spinal Nerves

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- proximal branches forming spinal nerves /// each spinal nerve has two points of attachment to the spinal cord
  - posterior (dorsal) root
    - sensory input to spinal cord
    - posterior (dorsal) root ganglion – contains the somas of sensory neurons carrying signals to the spinal cord
    - six to eight rootlets that emerge from the posterior horn of cord

# Spinal Nerves

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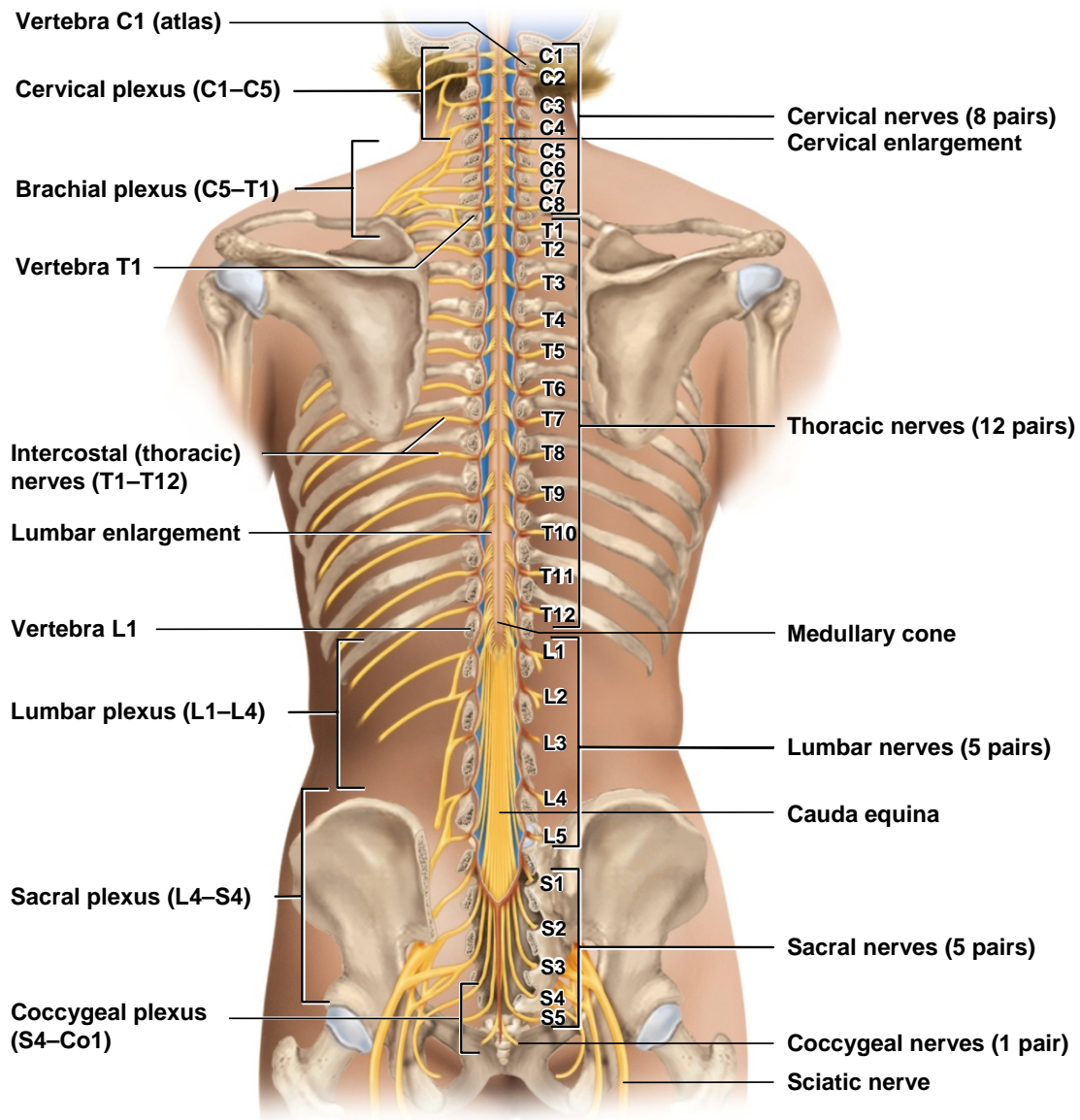
- anterior (ventral) root
  - motor output /// exit out of spinal cord
  - six to eight rootlets leave spinal cord and converge to form anterior root
- posterior & anterior roots merge to form spinal nerve proper that enters intervertebral foramen
- cauda equina
  - formed from roots that arise from L2 to Co
  - occupy lumbar cisterna

# Spinal Nerves

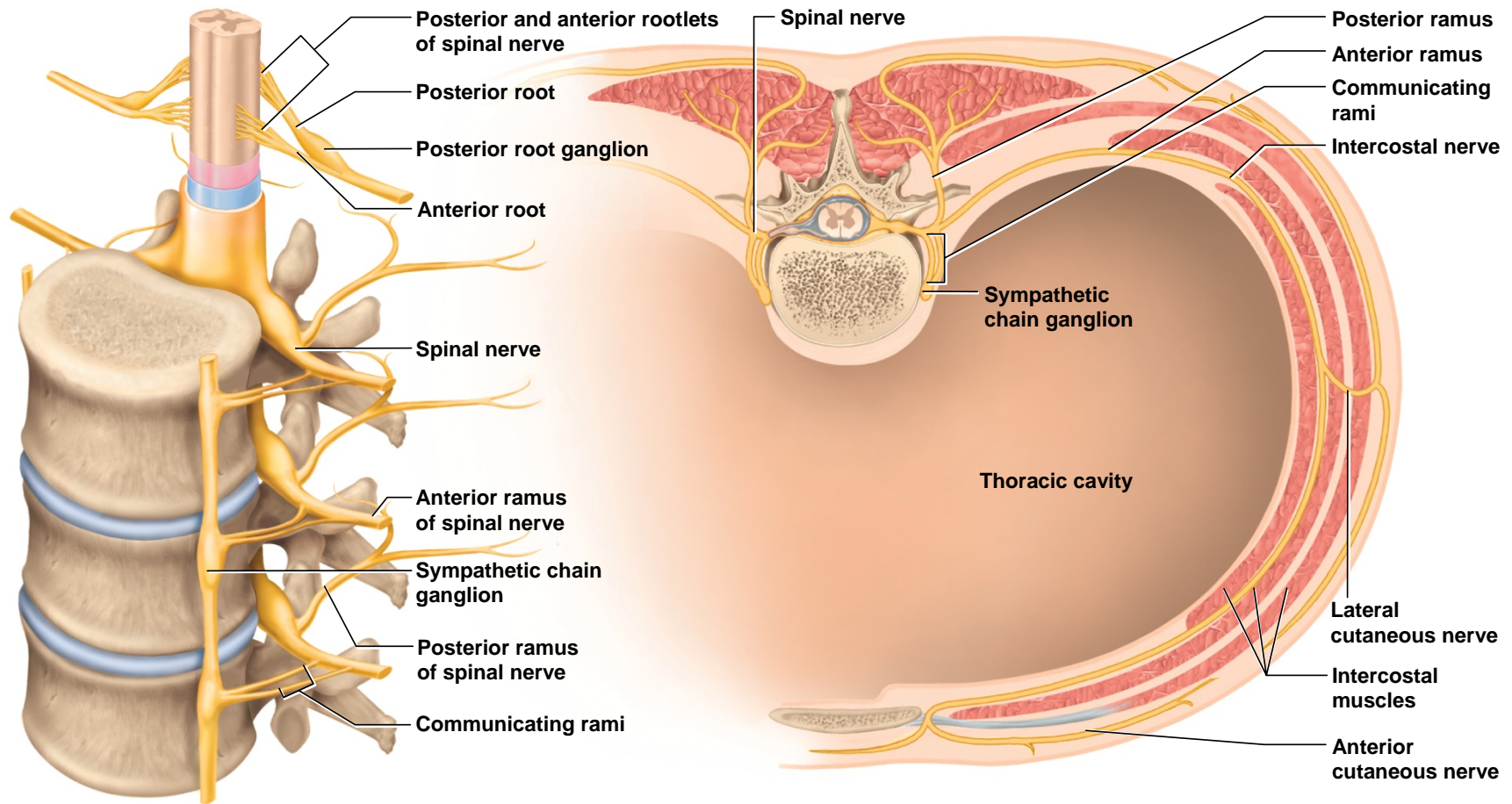
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- distal branches of spinal nerves /// distal to vertebral foramen
- the nerve divides into three branches:
  - **anterior ramus** – innervates the anterior and lateral skin and muscles of the trunk // gives rise to nerves of the limbs
  - **posterior ramus** – innervates the muscles and joints in that region of the spine and the skin of the back
  - **meningeal branch** – re-enters the vertebral canal and innervates the meninges, vertebrae and spinal ligaments

# Spinal Nerves and Plexuses

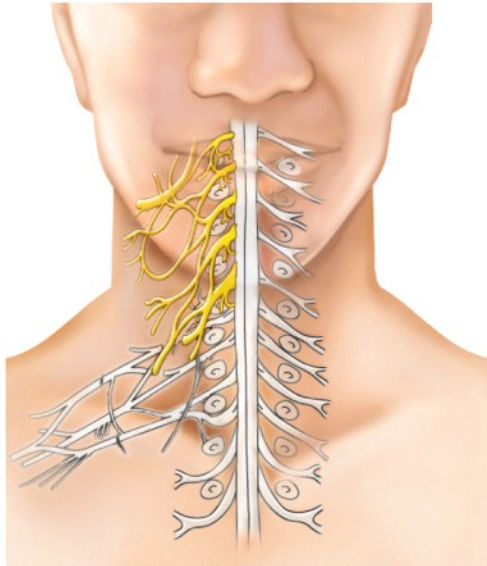


# Anterior Rami Form Nerve Plexuses

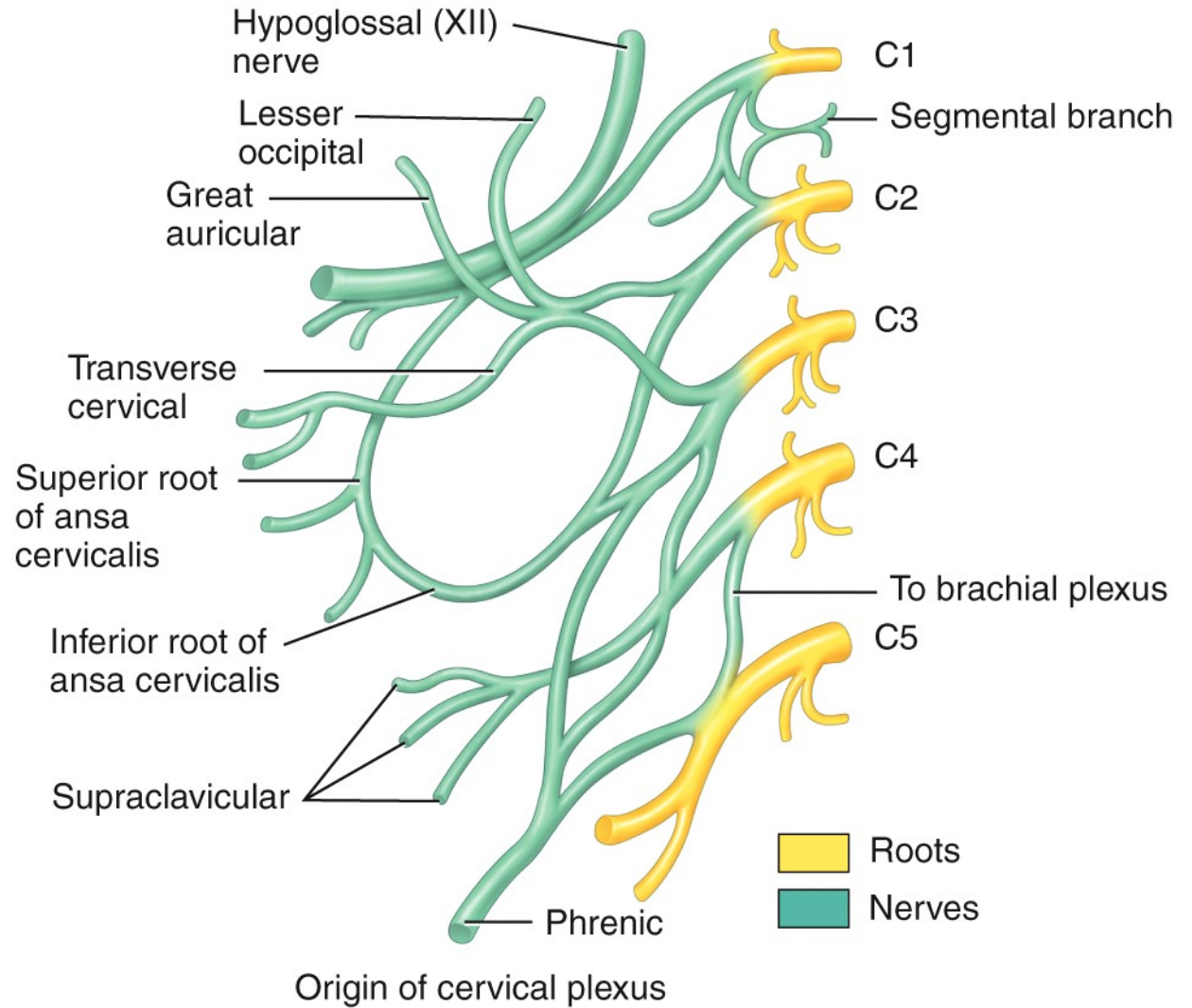


(a) Anterolateral view

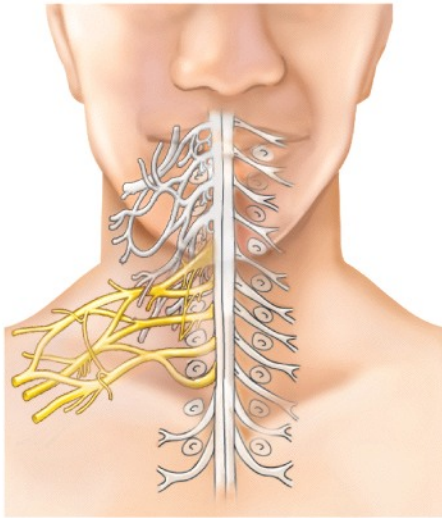
(b) Cross section



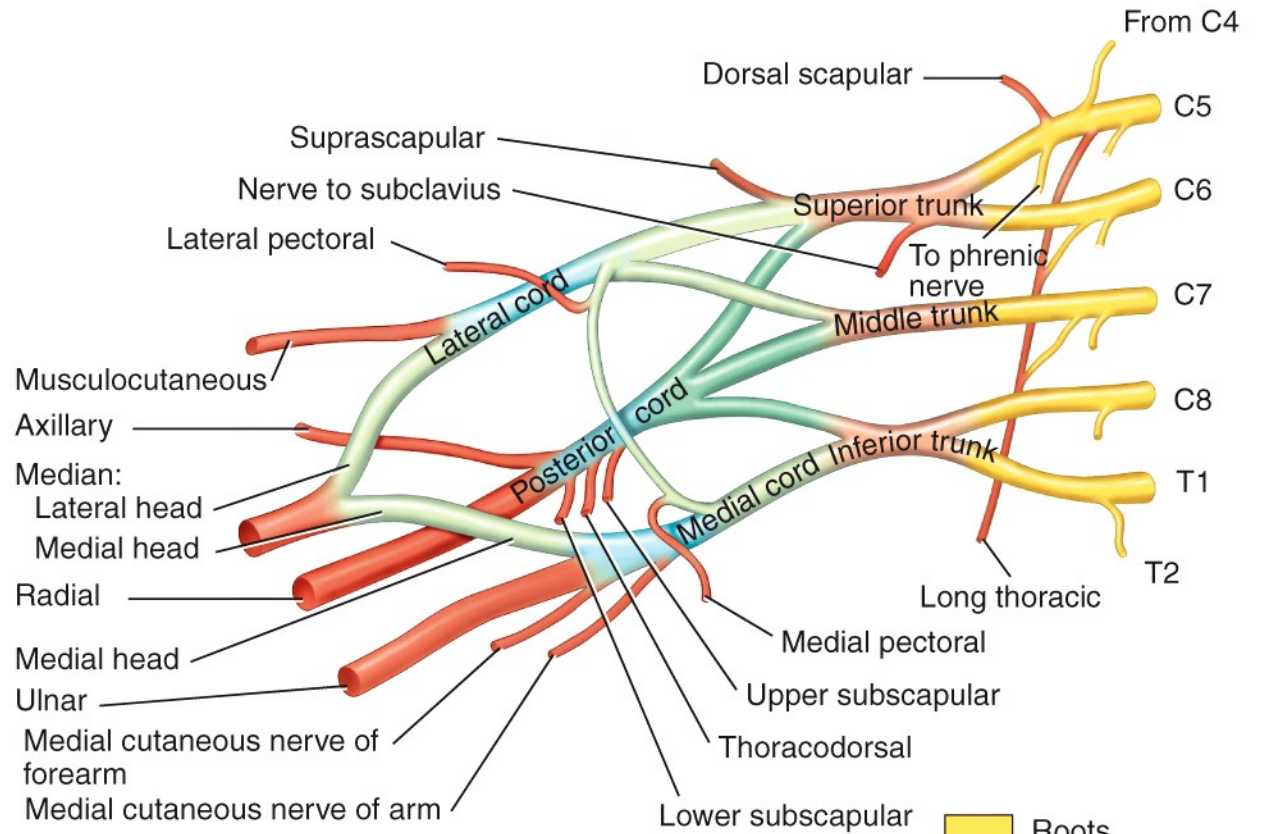
Cervical plexus projected to surface





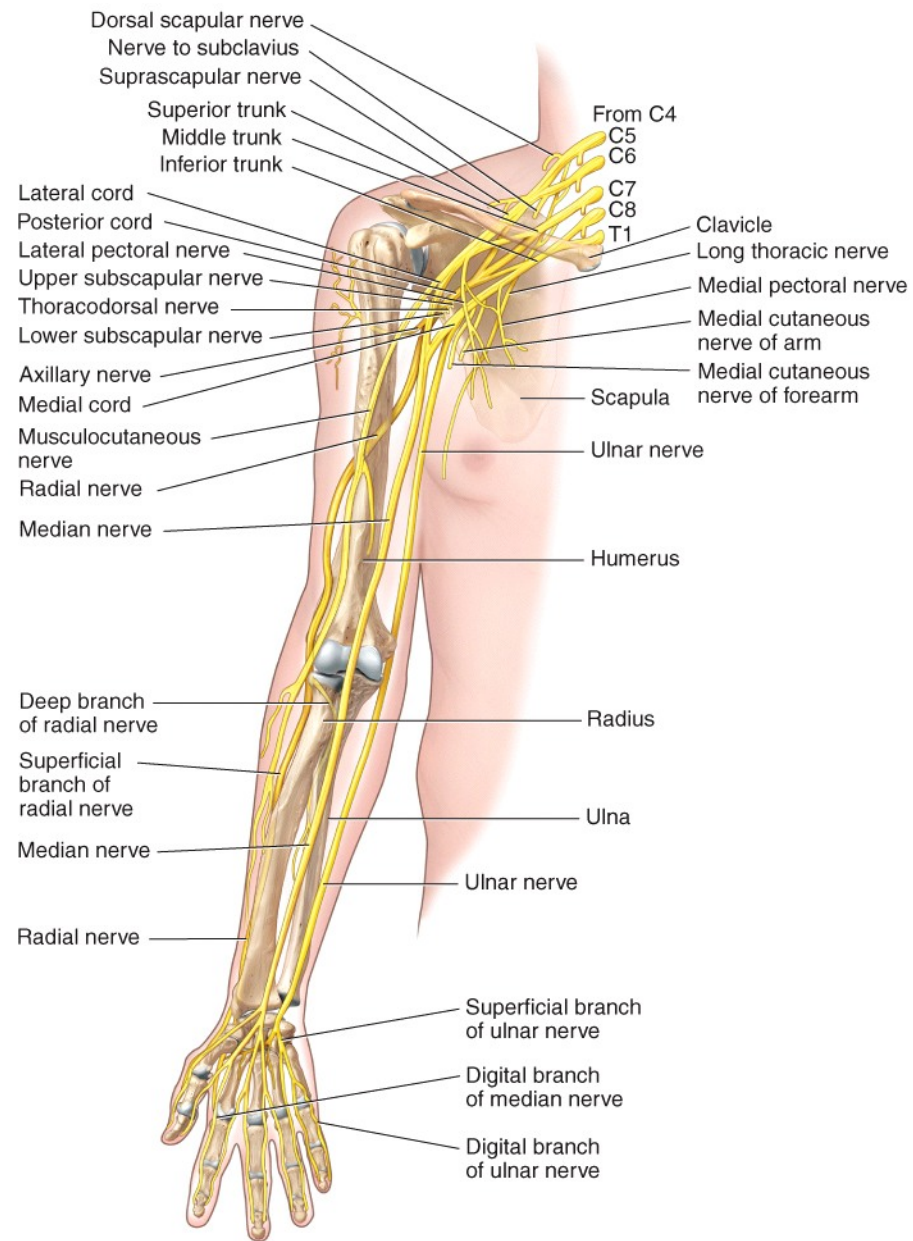


Brachial plexus projected to surface

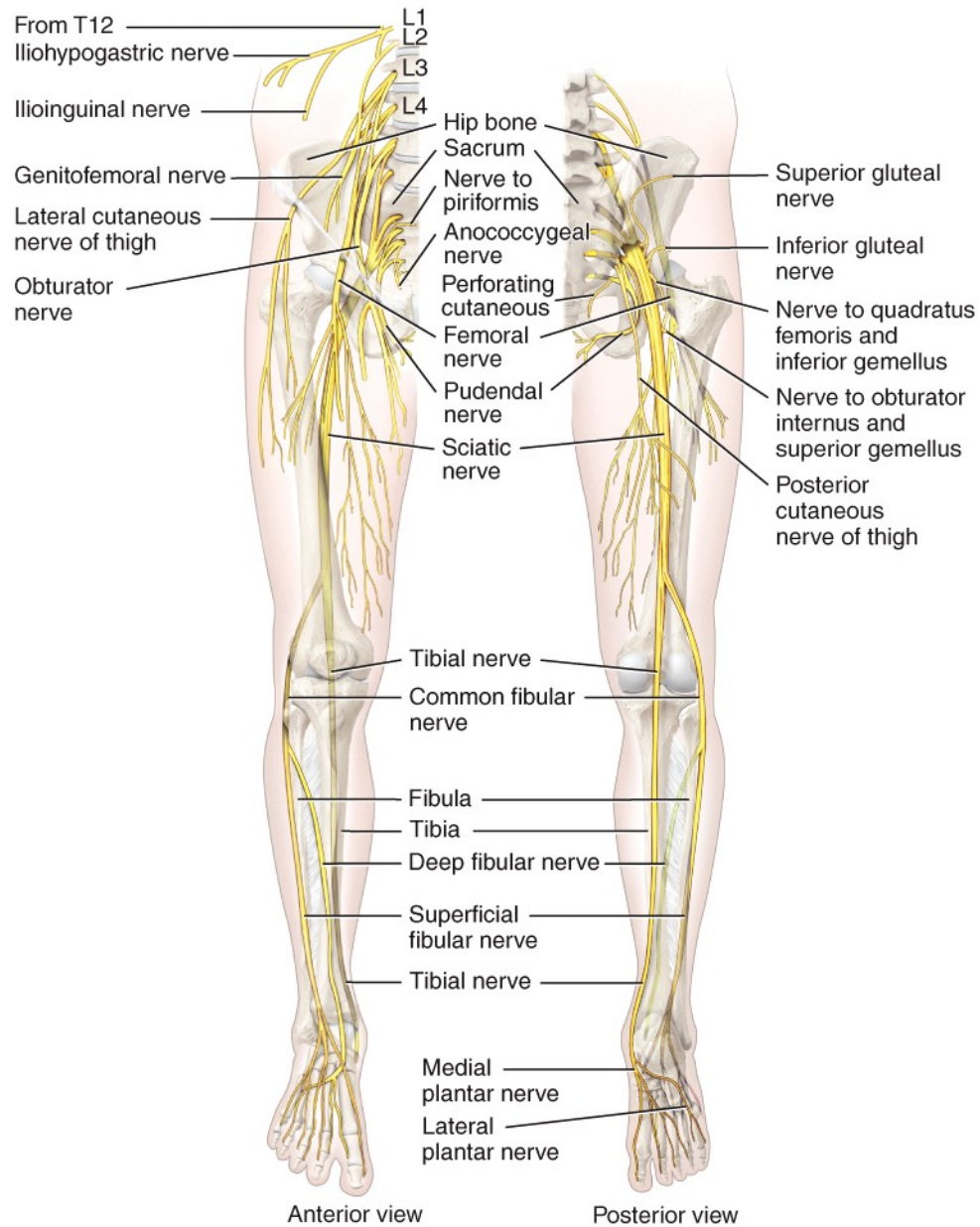


(a) Origin of brachial plexus

MNEMONIC for subunits of the brachial plexus:  
**R**isk **T**akers **D**on't **C**autiously **B**ehave.  
**R**oots, **T**runks, **D**ivisions, **C**ords, **B**ranches

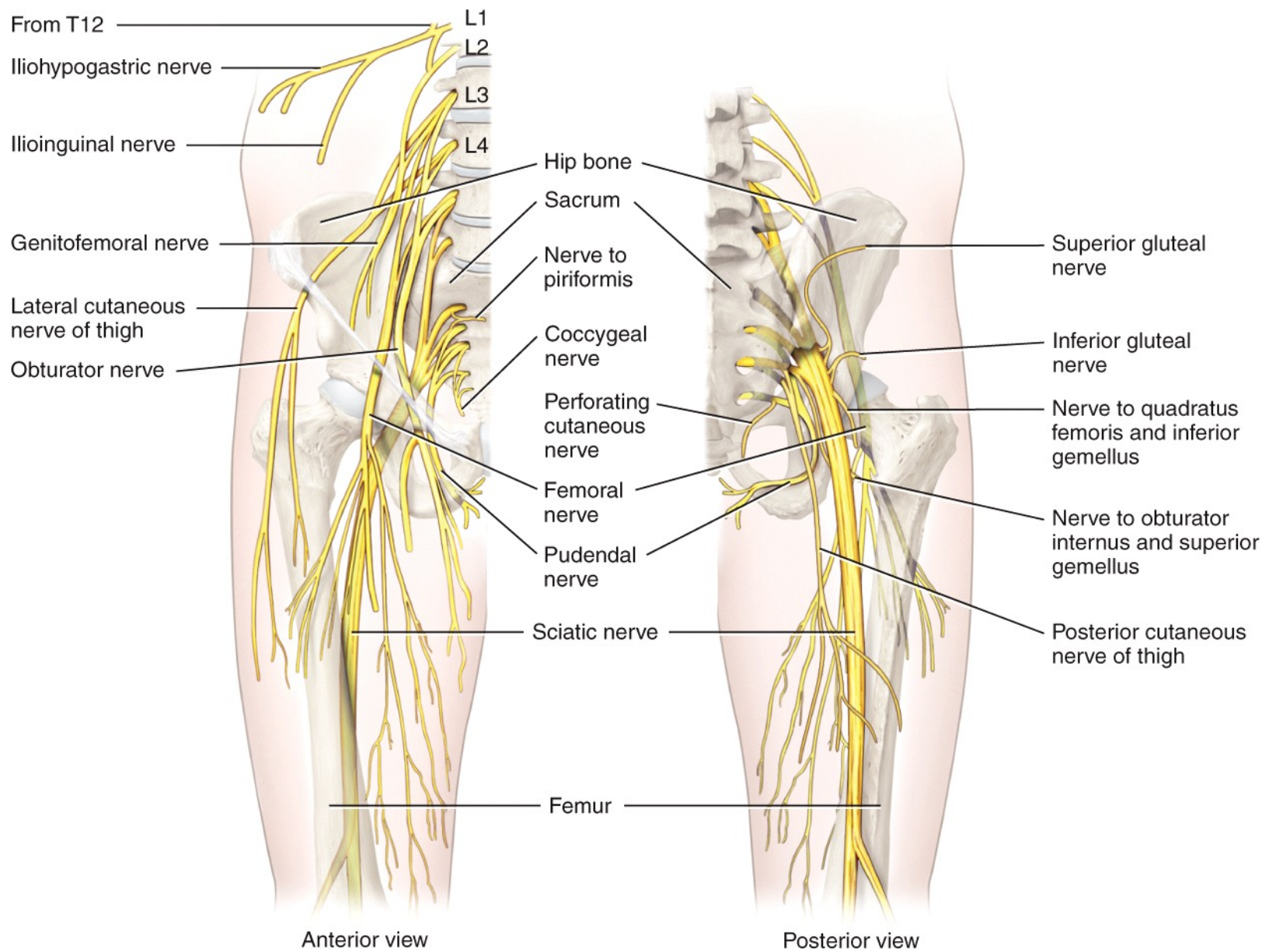


(b) Distribution of nerves from brachial plexus

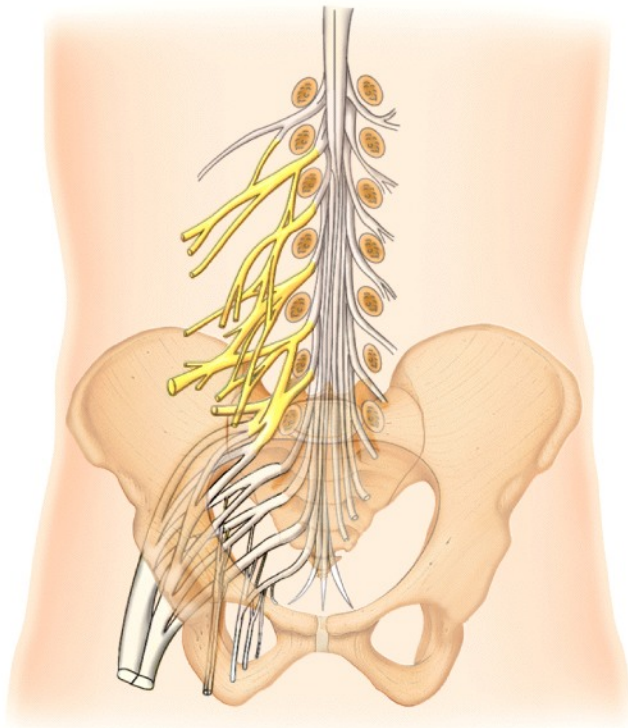


(b) Distribution of nerves from the sacral and coccygeal plexuses

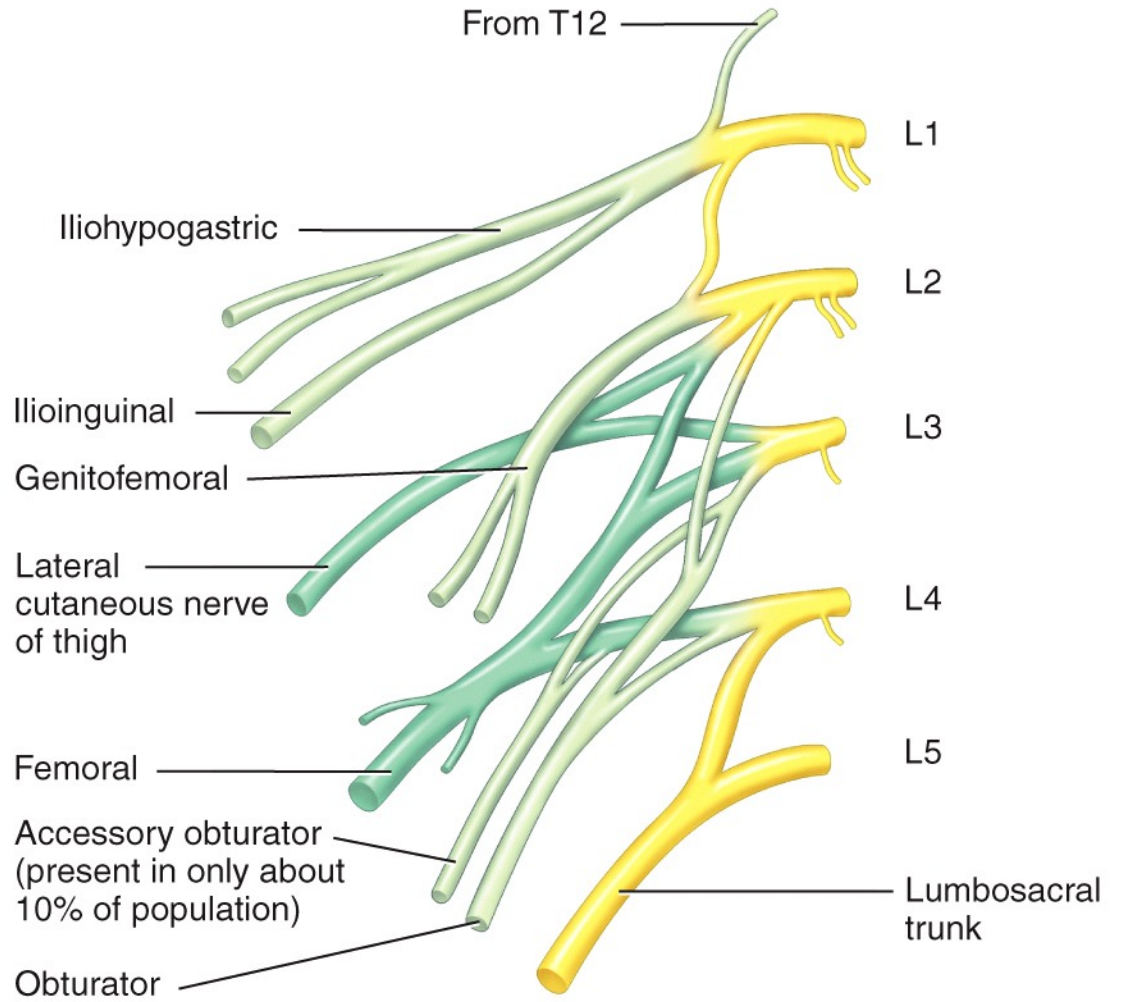




(b) Distribution of nerves from lumbar plexus

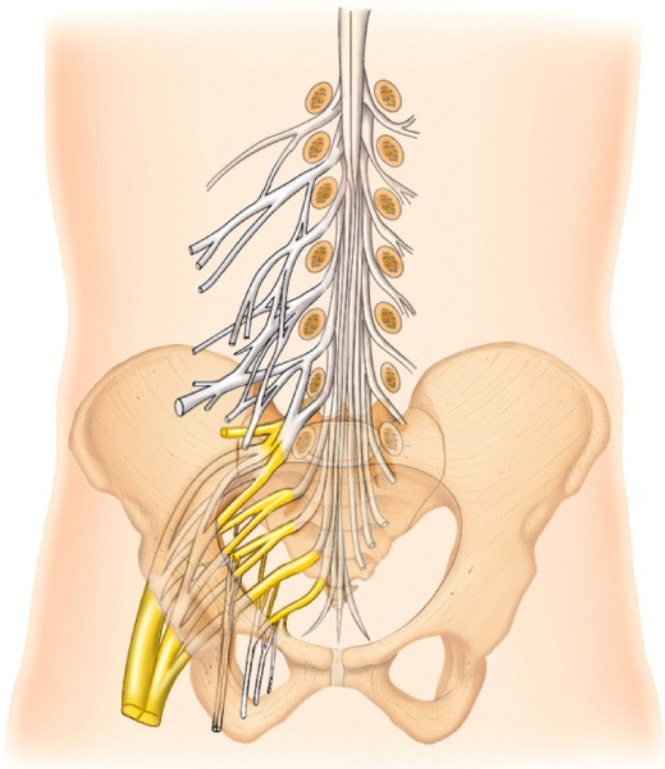


Lumbar plexus projected to surface

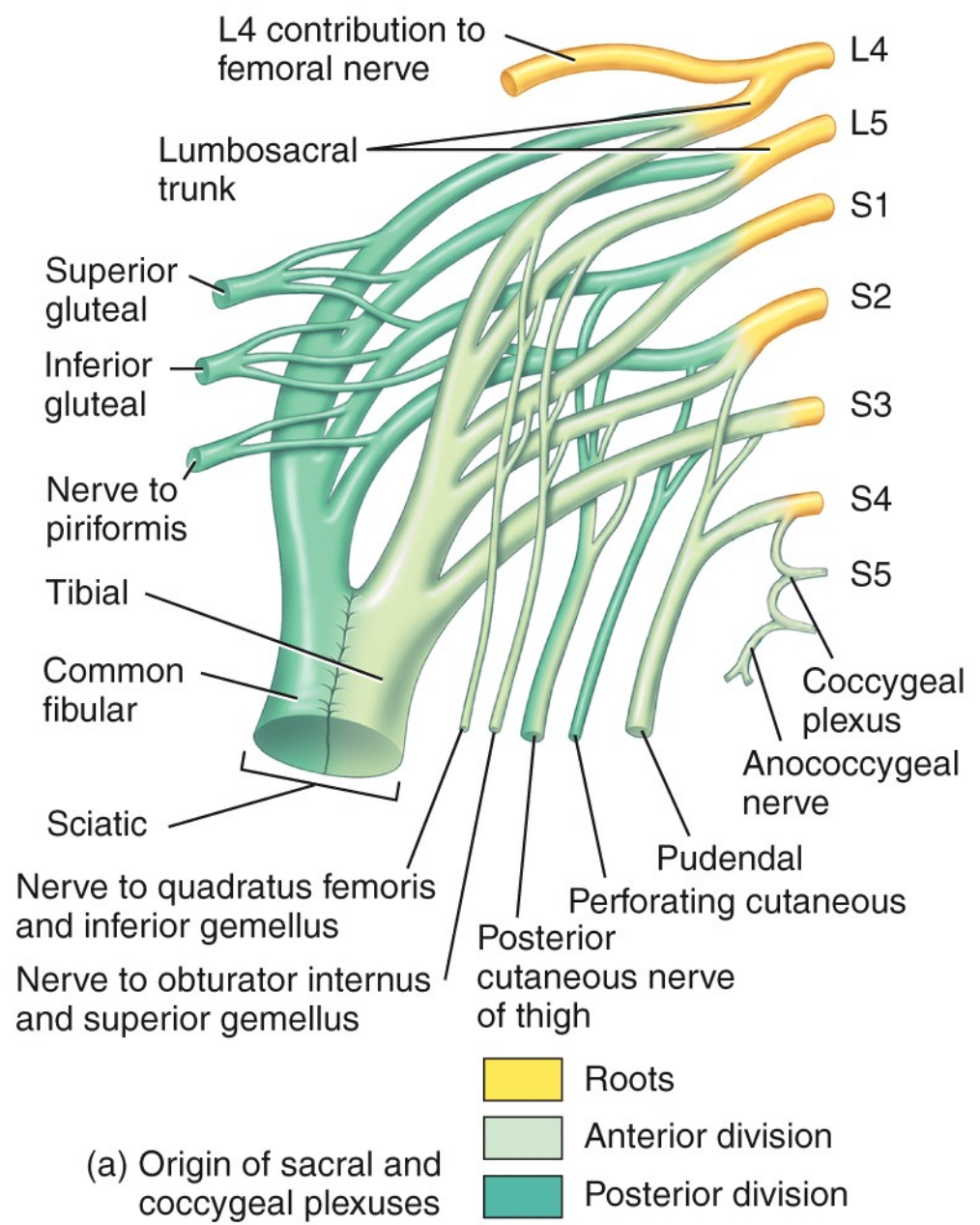


(a) Origin of lumbar plexus

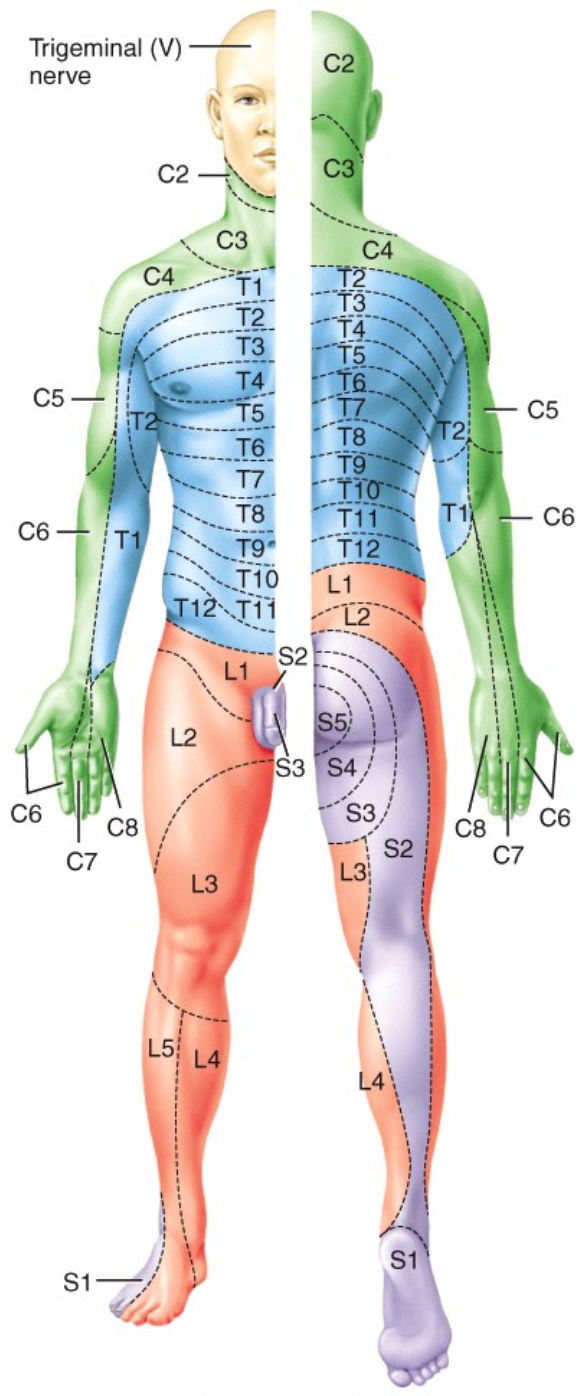
- Roots
- Anterior division
- Posterior division



Sacral and coccygeal plexuses projected to surface







Anterior view

Posterior view



Erb-Duchenne palsy  
(waiter's tip)



Wrist drop



Median nerve palsy



Ulnar nerve palsy



Winging of right scapula

(c) Injuries to the brachial plexus

# Spinal Nerve Injuries

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- radial nerve injury // passes through axilla
  - *crutch paralysis*
  - *wrist drop*
- sciatic nerve injury
  - **sciatica** – sharp pain that travels from gluteal region along the posterior side of the thigh and leg to ankle
  - ninety percent of cases result from herniated intervertebral disc or osteoporosis of lower spine
  - Sometimes caused by men “sitting” on their wallets

# Dissection of Spinal Nerve

