

Academic year 2021-2022
2nd year S3

Musculo-Skeletal System

Session: 5 Lecture: 1 Date: 16/11/2021

**Dermatomes and Myotomes &
Segmental Innervation of upper and lower limbs**

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References: Moore, K.L. and Dalley, A.F. Clinically Oriented Anatomy, 8th Edition. Lipincott Williams and Wilkins, 2018.



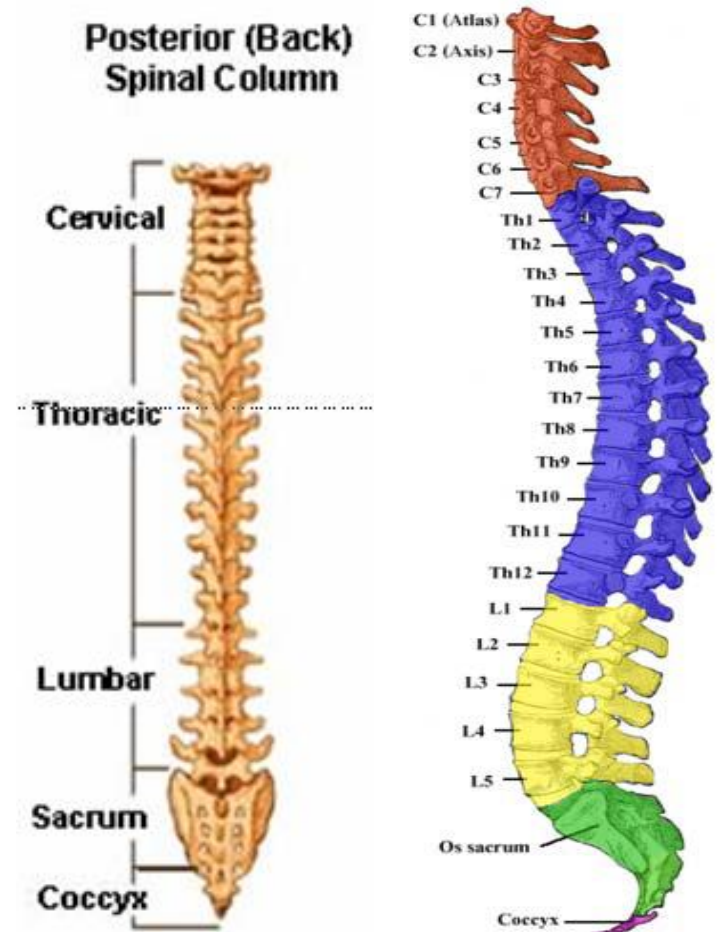


Learning Objectives (Module Objectives: 15, 18, 19 and 25)

- **State the composition and formation of a mixed spinal nerve. L01**
- **Define the term dermatome and briefly describe their development. L02**
- **Identify the segmental sensory innervation of all parts of the upper and lower limb. L03**
- **State the segmental innervation of all movements at the shoulder, elbow, wrist and finger joints. L04**
- **Describe the segmental innervation of the various movements of the lower limb. L05**
- **Define the term myotome and motor unit. L06**
- **Describe the lumbar-sacral plexus. L07**
- **Utilize anatomical knowledge to describe the site of neural lesions (near the spinal cord or peripheral) producing sensory and motor deficits. L08**

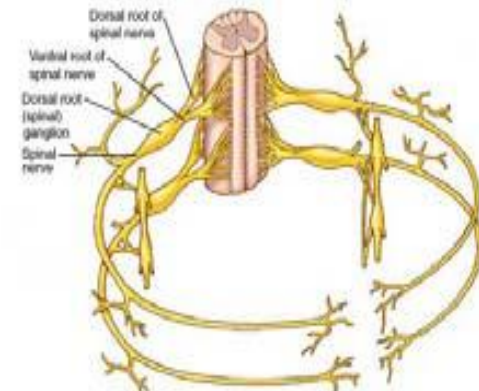
Segmental Nerve Supply to The Limbs

- Nerve Supply to the limbs comes from the Spinal Cord
- The Spinal Cord is protected by the Vertebral Column
- Vertebral Column consists 33 Spinal Vertebrae
- 24 are Discrete (typical) Spinal Vertebrae
- 9 are fused to form the Sacrum & Coccyx
- 5 Distinct Groups of Spinal Vertebrae:
 1. Cervical (7)
 2. Thoracic (12)
 3. Lumbar (5)
 4. Sacrum (fused 5)
 5. Coccyx (fused 4)

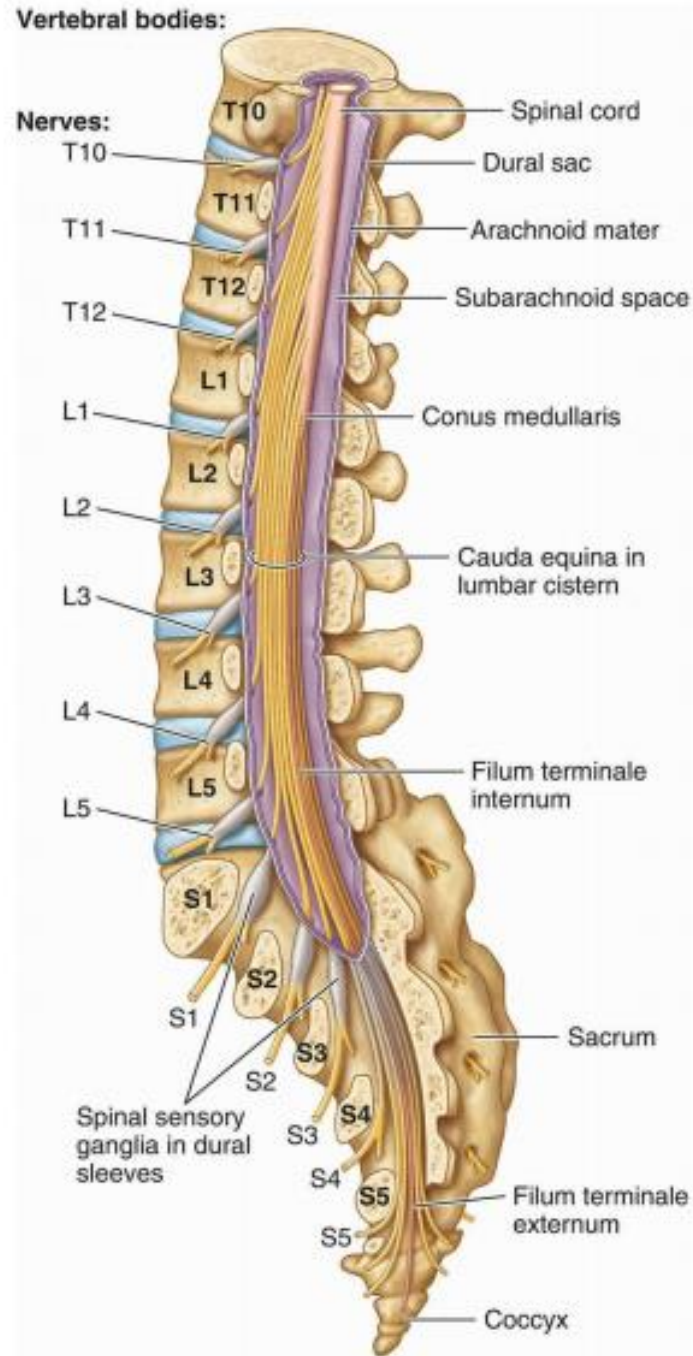


What is a Segmental Nerve?

- At each vertebral level the spinal cord gives out a pair of nerves:
 - ✓ One to the Left
 - ✓ One to the Right
- The nerves exit the vertebral column through intervertebral foramina
- Each of these nerves is known as a *Spinal Segmental Nerve*

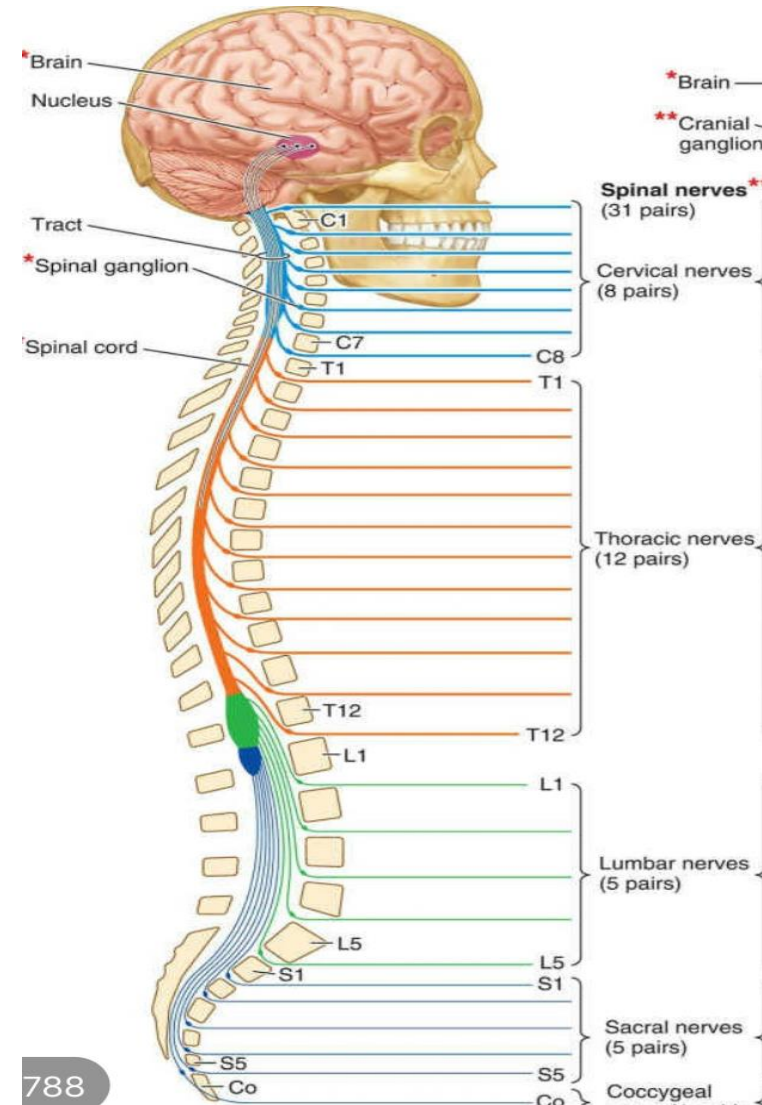


There is an established relationship between a vertebral level and a neuronal spinal level.



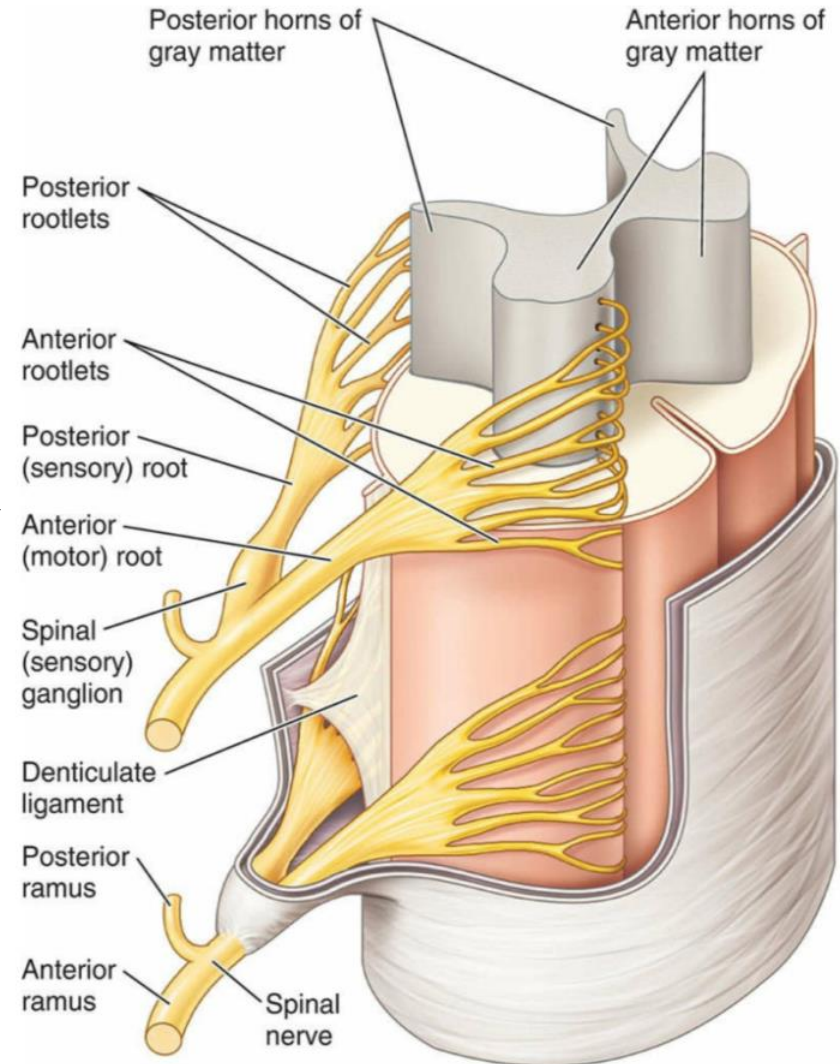
LO1

- There are 31 pairs of spinal nerves
- C(8)
- T(12)
- L(5)
- S(5)
- Co(1)



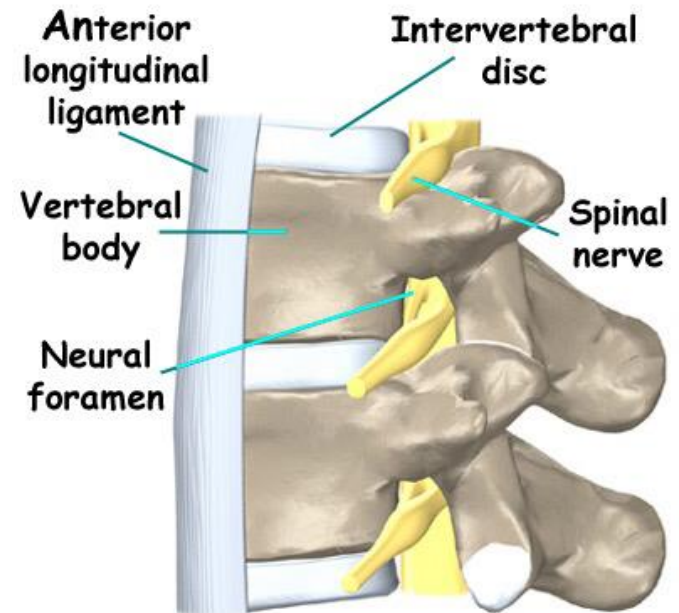
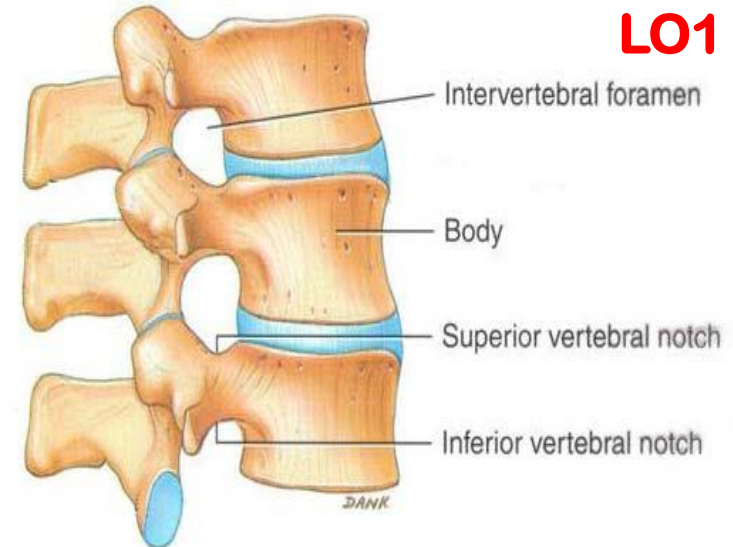
Composition of a Segmental Nerve

- Segmental Nerves are known as Mixed Spinal Nerve
- Each Spinal Segmental Nerve contains:
 - *Dorsal Roots (Sensory), which contains the posterior(dorsal) root ganglia
 - *Ventral Roots (Motor)+(Autonomic)

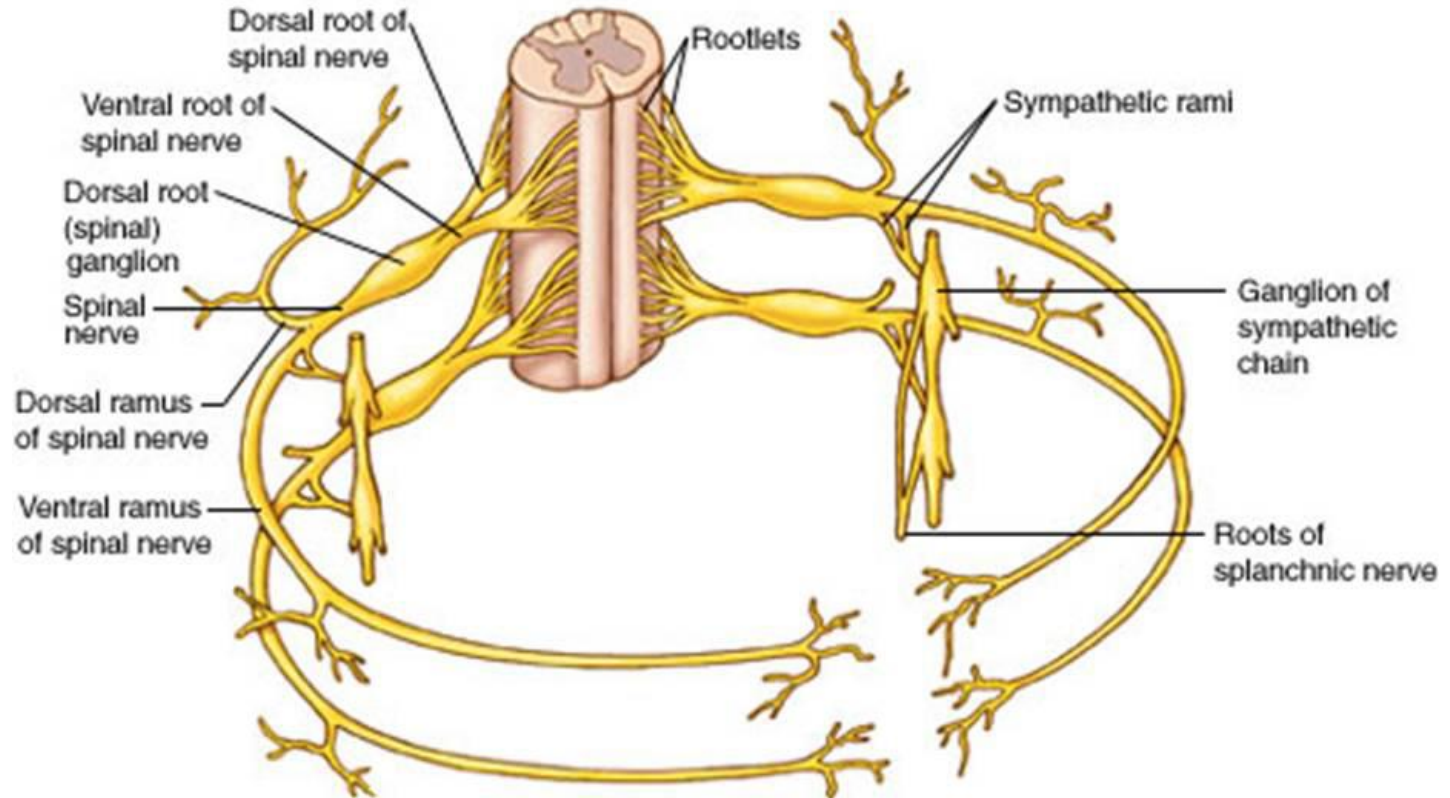


- The Spinal nerve passes through the Vertebral Foramina.
- Each vertebra has an inferior & a superior vertebral notch on each side.
- The corresponding inferior and superior vertebral notches form an intervertebral foramen.
- As the mixed spinal nerve emerges through the intervertebral foramen it divides into 2 branches: anterior ramus and posterior ramus.

LO1

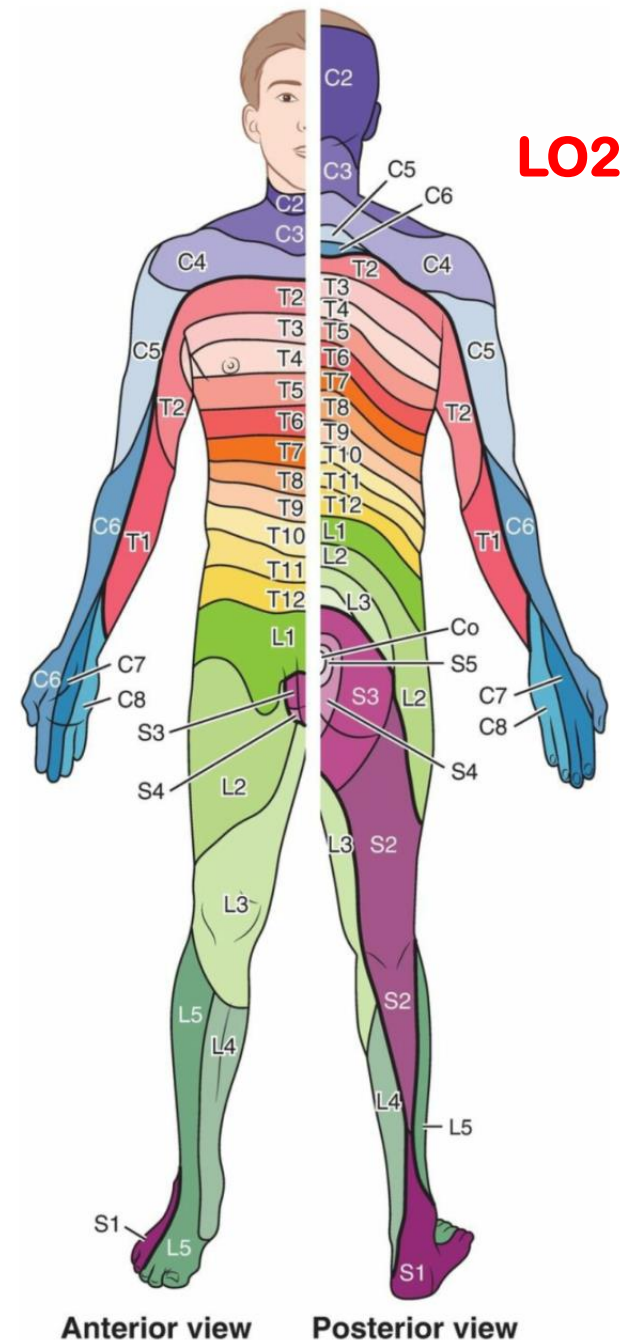


Anterior and posterior rami of spinal nerves LO1



Dermatomes

- Dermatome (Derma= skin ; tome = segment)
- It is an area of skin supplied by sensory fibers from a single spinal nerve.
- Each dermatome is named according to the spinal nerve which provides most of its sensory innervation.
- There is considerable overlap between adjacent dermatomes and thus section of a single dorsal spinal root does NOT USUALLY lead to anaesthesia of the entire dermatome area.
- The exception to this rule concerns skin areas abutting onto an axial line.



Anterior view

Posterior view

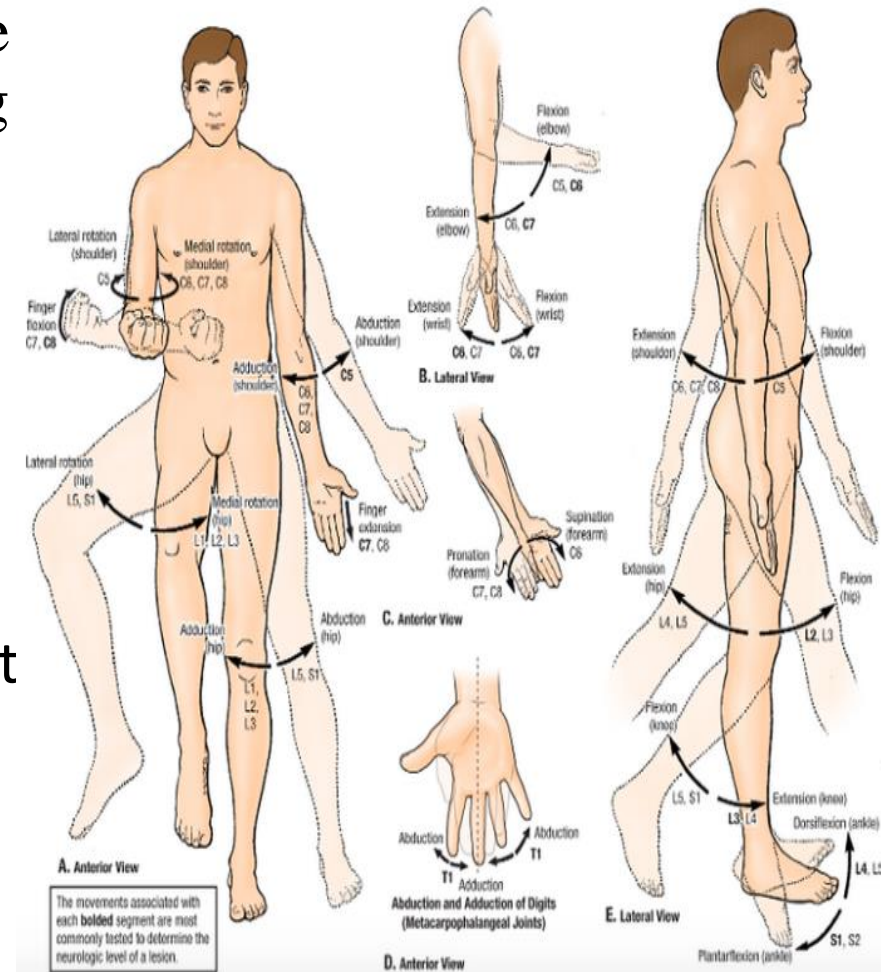


Why Study Dermatomes?

- To enable examination of integrity of sensory function of the skin of the body (as a major organ of the body)
- To accurately pinpoint areas of skin with disturbed function (e.g. anaesthesia)
- To predict what nerves & spinal segments may be affected.
- To anaesthetize segments or nerves and associated skin with accuracy

Myotome

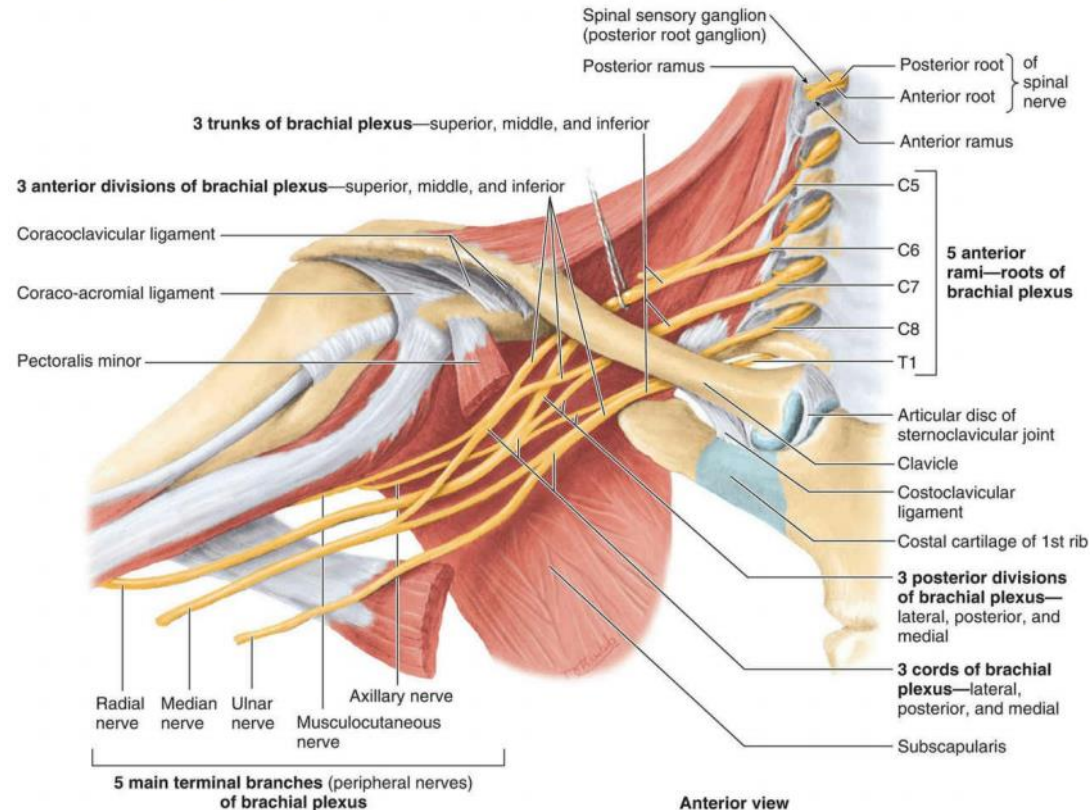
- The unilateral embryological muscle mass (and derived muscle) receiving innervation from single spinal cord segment or spinal nerve.
- Muscle fibers innervated by a motor nerve fiber is called a **motor unit**.
- **Clinical Significance:**
 - ✓ Information about the level in the spine where a lesion may be present
 - ✓ Muscle weakness.
 - ✓ Intervertebral disc herniation?



Nerve Supply to The Upper Limb

LO3

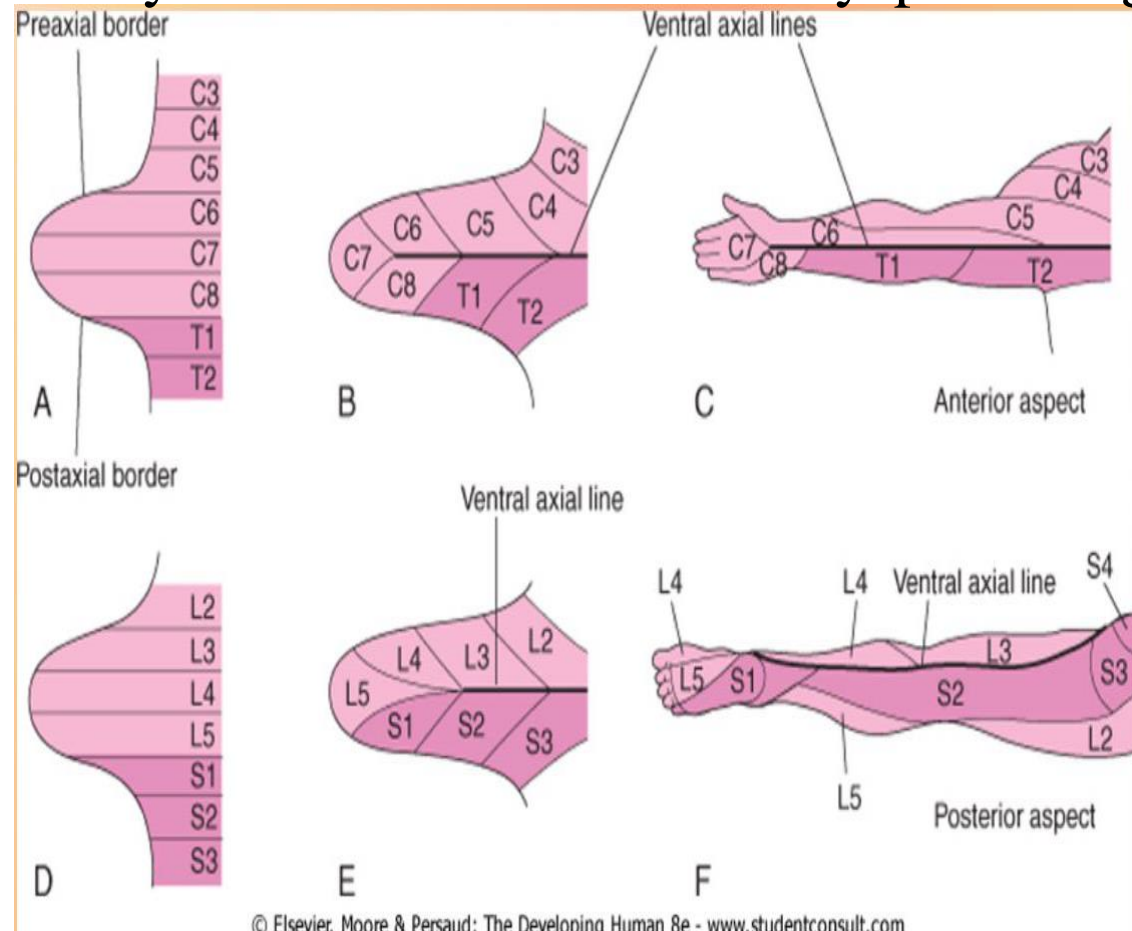
The upper limb is innervated by the anterior primary rami of spinal nerves originating from C5 to T1 complete. These rami form the roots of **Brachial plexus** and it is from the various parts of this plexus that the entire innervation of the limb is derived.



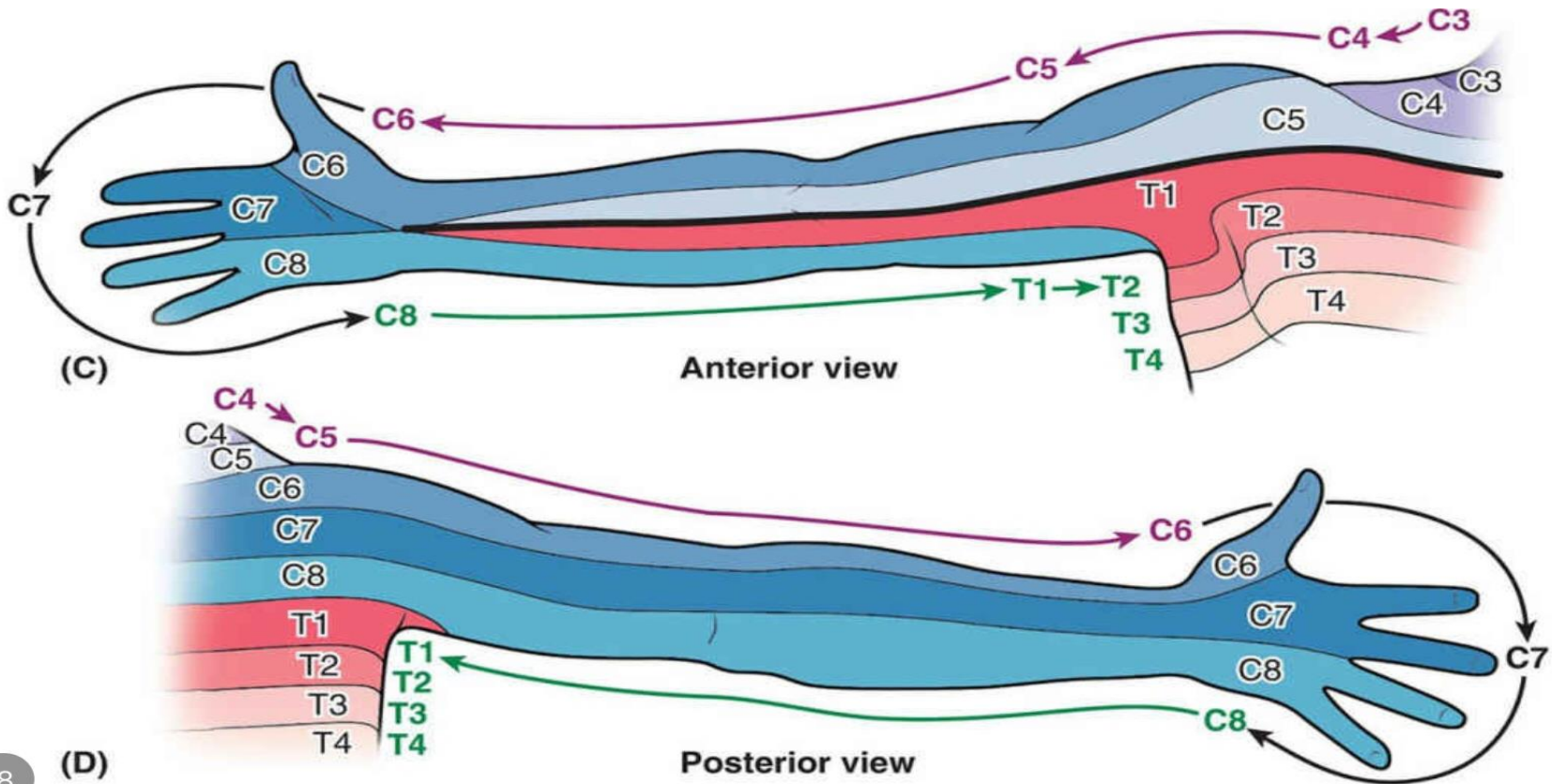
Nerve Supply to The Upper Limb

LO3

- During development, nerves grow into the developing limb buds.
- As the limb bud increases in size, the nerves are „dragged“ along with the structures they innervate thus eventually producing the adult pattern.



Dermatomes of upper limbs



Sensory Supply of Upper Limb

LO3

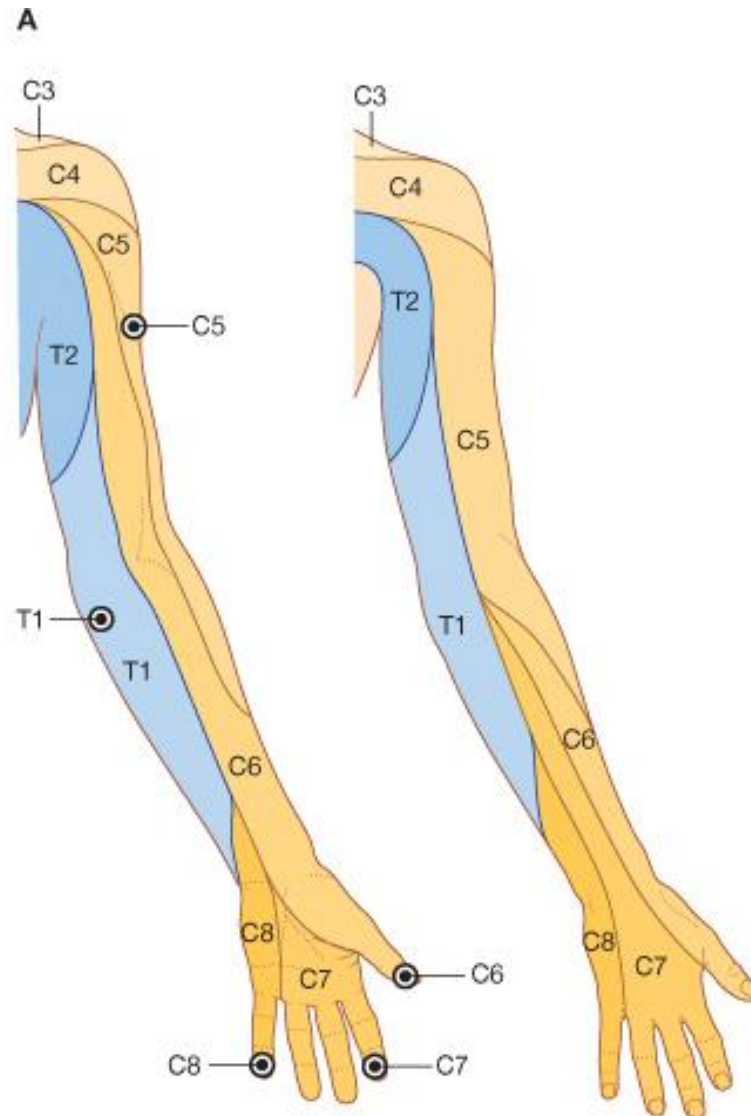
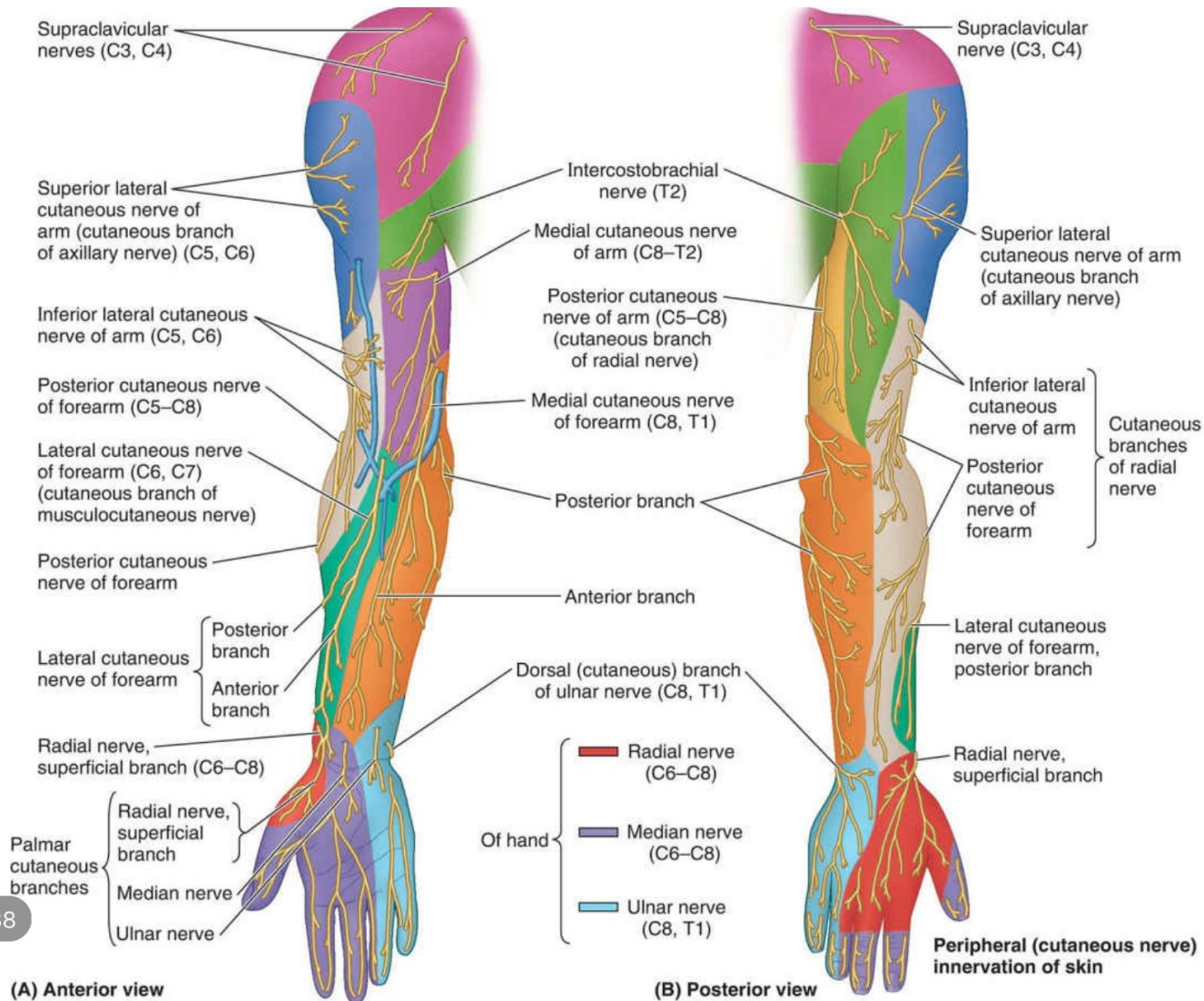


TABLE 3.1. **Dermatomes** of Upper Limb

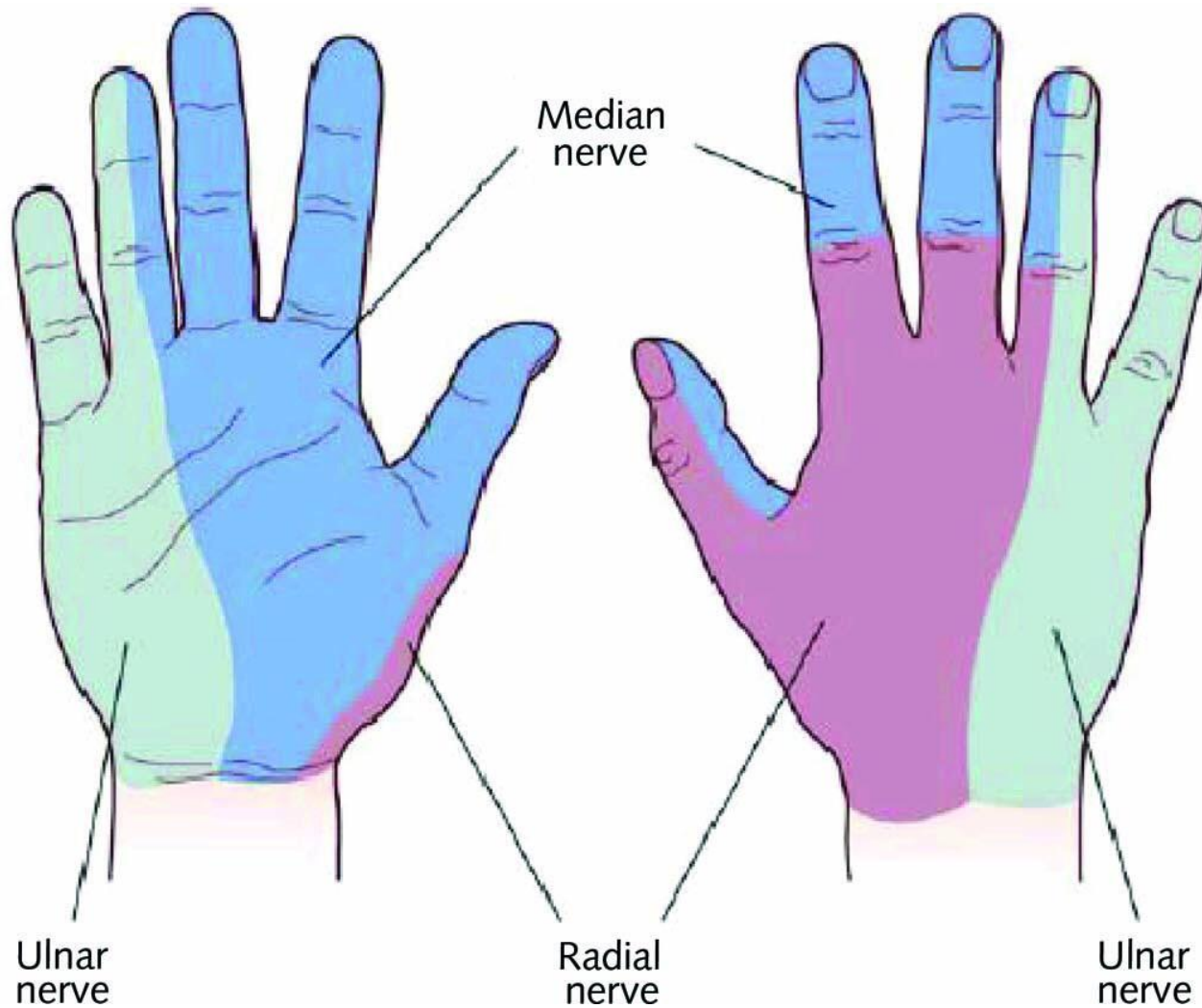
Spinal Segment/Nerve(s)	Description of Dermatome(s)
C3, C4	Region at base of neck, extending laterally over shoulder
C5	Lateral aspect of arm (i.e., superior aspect of abducted arm)
C6	Lateral forearm and thumb
C7	Middle and ring fingers (or middle three fingers) and center of posterior aspect of forearm
C8	Little finger, medial side of hand and forearm (i.e., inferior aspect of abducted arm)
T1	Medial aspect of forearm and inferior arm
T2	Medial aspect of superior arm and skin of axilla ^a

Distribution of the cutaneous nerves



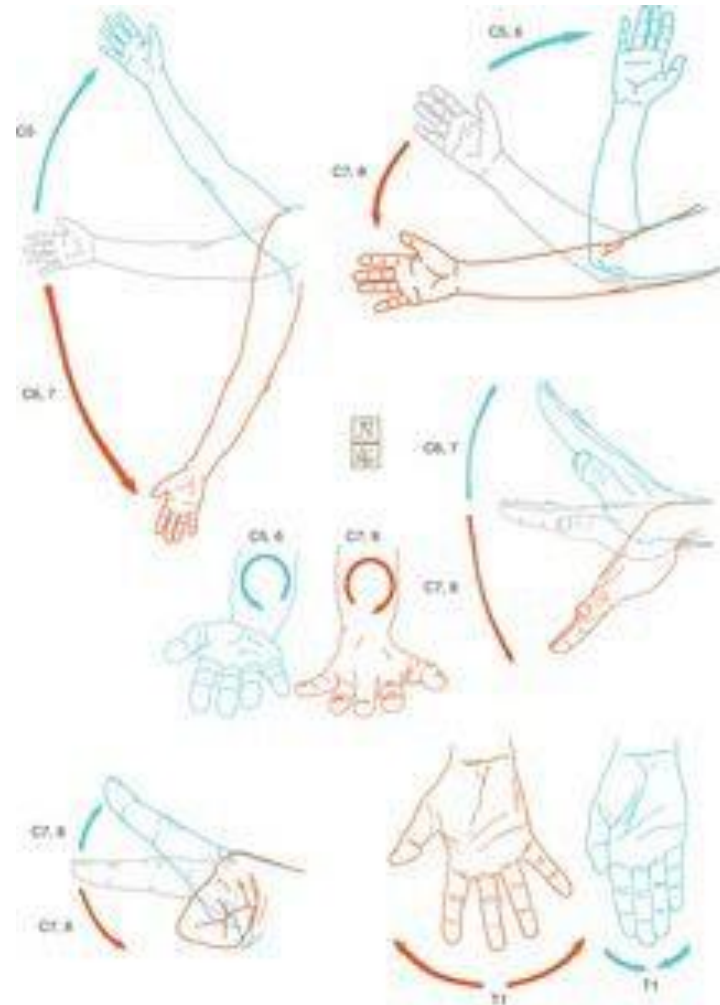
Hand: cutaneous nerves

LO3



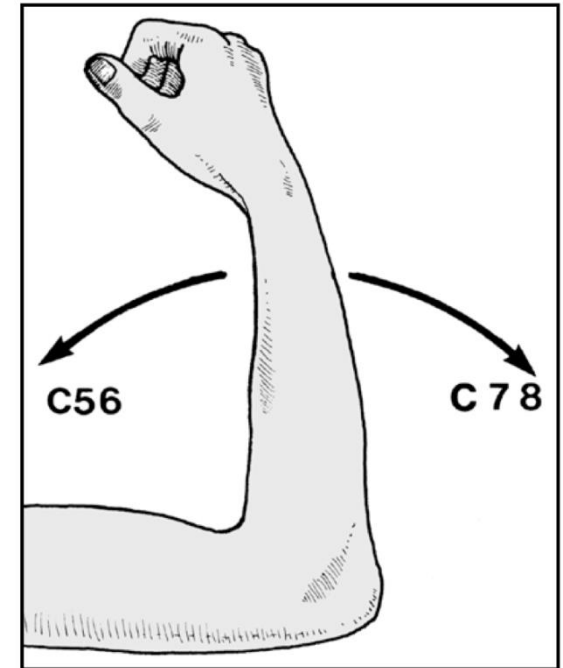
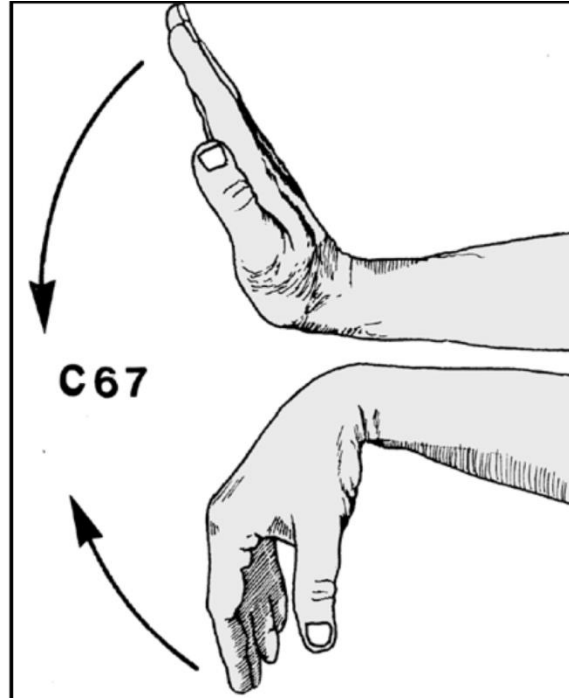
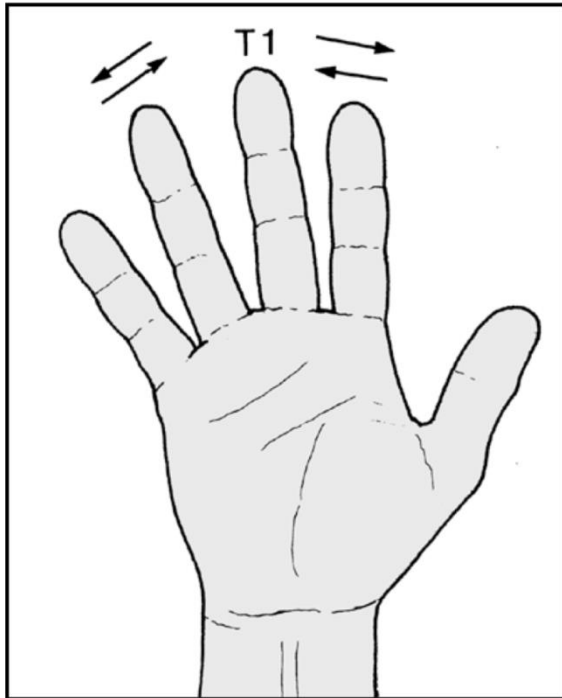
Motor Innervation (Myotomes) of Upper Limb

- Most of upper limbs muscles receive nerve supply from more than one spinal nerve (so they contain more than one myotome)
- Except the intrinsic muscle of the hand receive from (T1) only



Motor Innervation (Myotomes) of Upper Limb

Moore page 446 [picture]

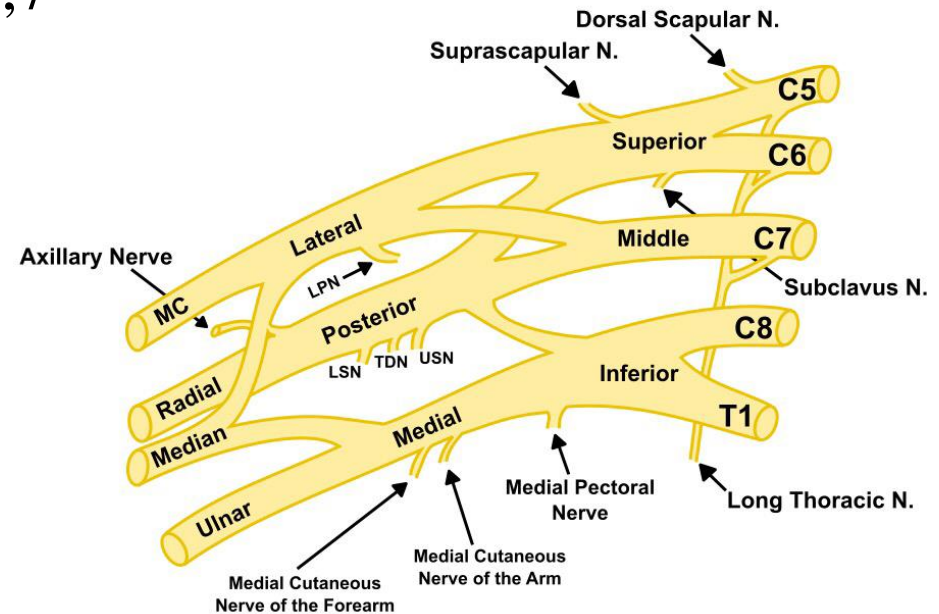


Upper limbs peripheral nerves

LO4

- Axillary Nerve: C5,6
- Musculocutaneous Nerve: C5,6,7
- Radial Nerve: C5,6,7,8,T1
- Ulnar Nerve: C7,8,T1
- Median Nerve: C6,7,8,T1

Brachial Plexus

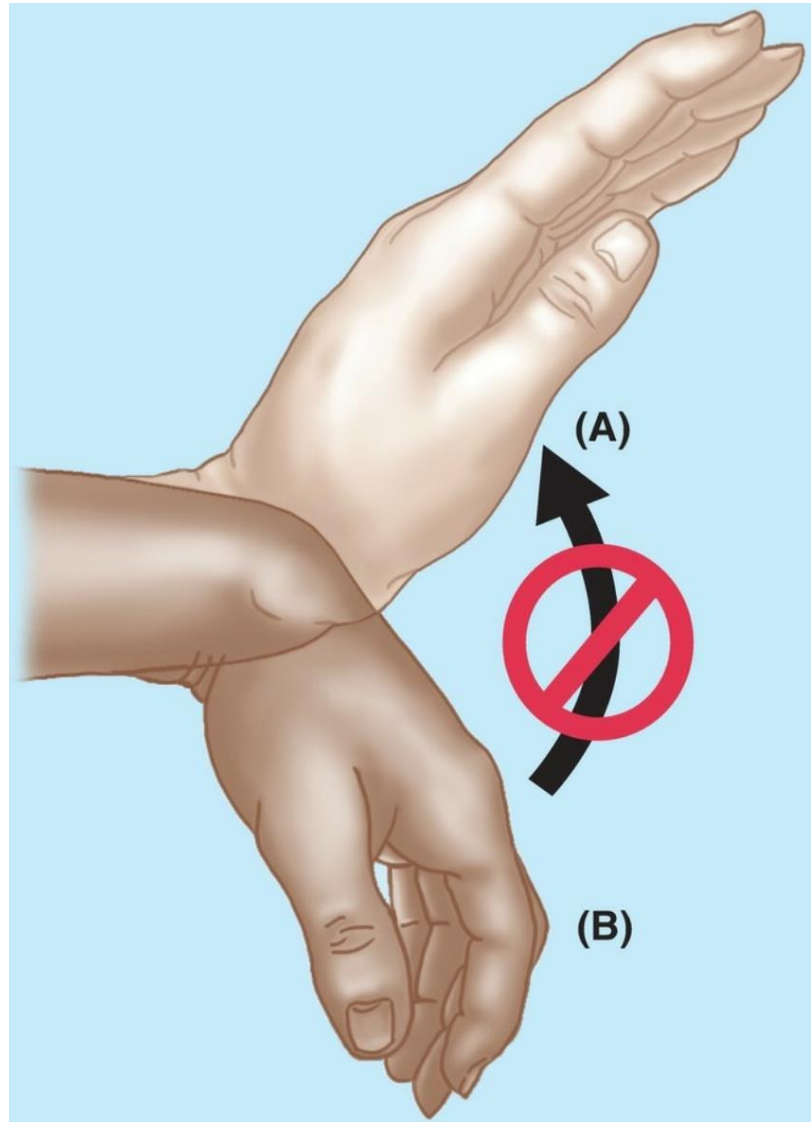


Key

- MC = Musculocutaneous nerve
- LPN = Lateral pectoral nerve
- USN = Upper subscapular nerve
- TDN = Thoracodorsal nerve
- LSN = Lower subscapular nerve

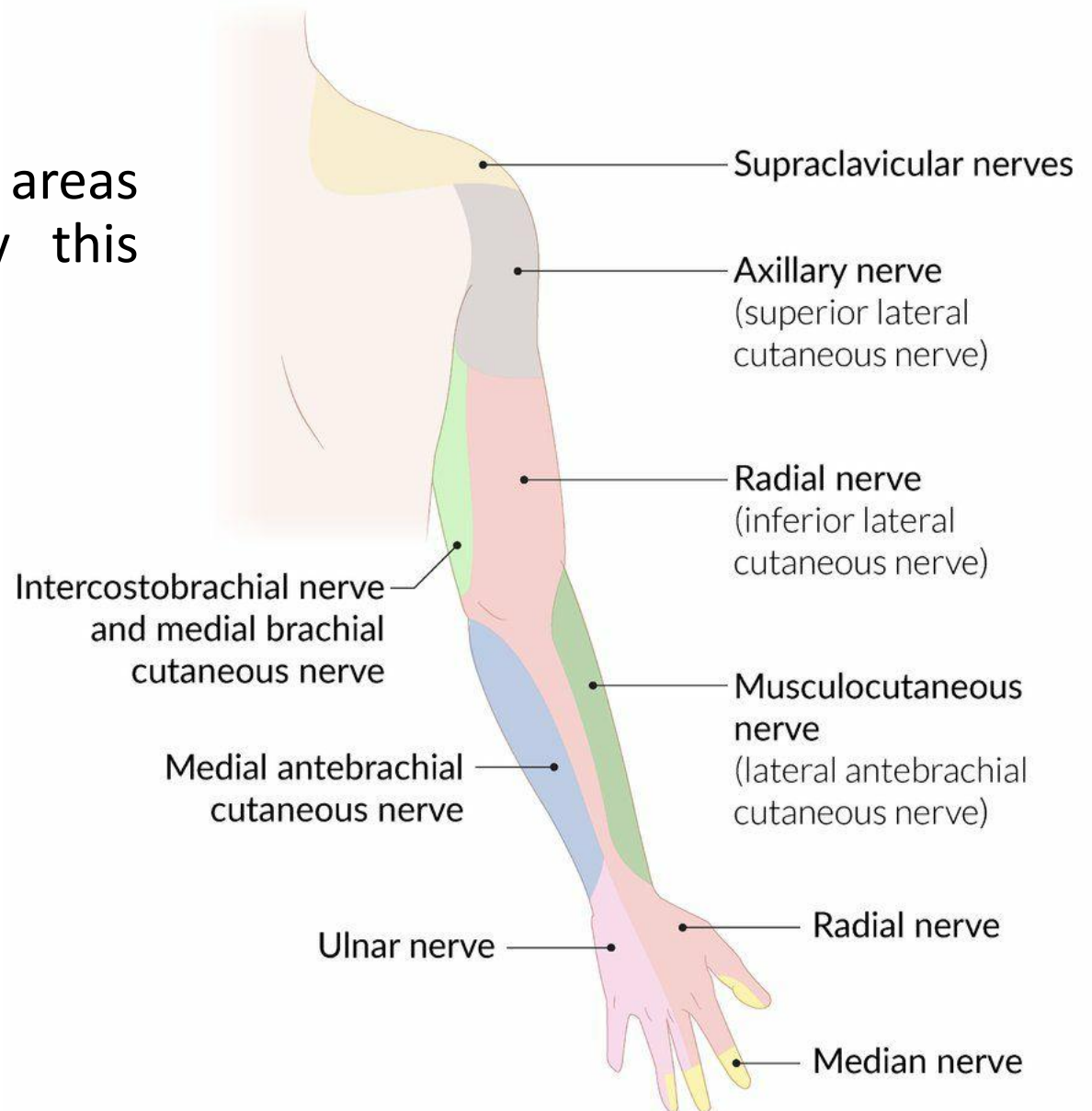
Radial nerve injury

- Motor: Paralysis of triceps, brachioradialis, supinator, and extensor muscles of the wrist and fingers.
- (**Wrist drop**)
- Loss of sensation.



Radial nerve injury

- Loss of sensation in areas of skin supplied by this nerve.

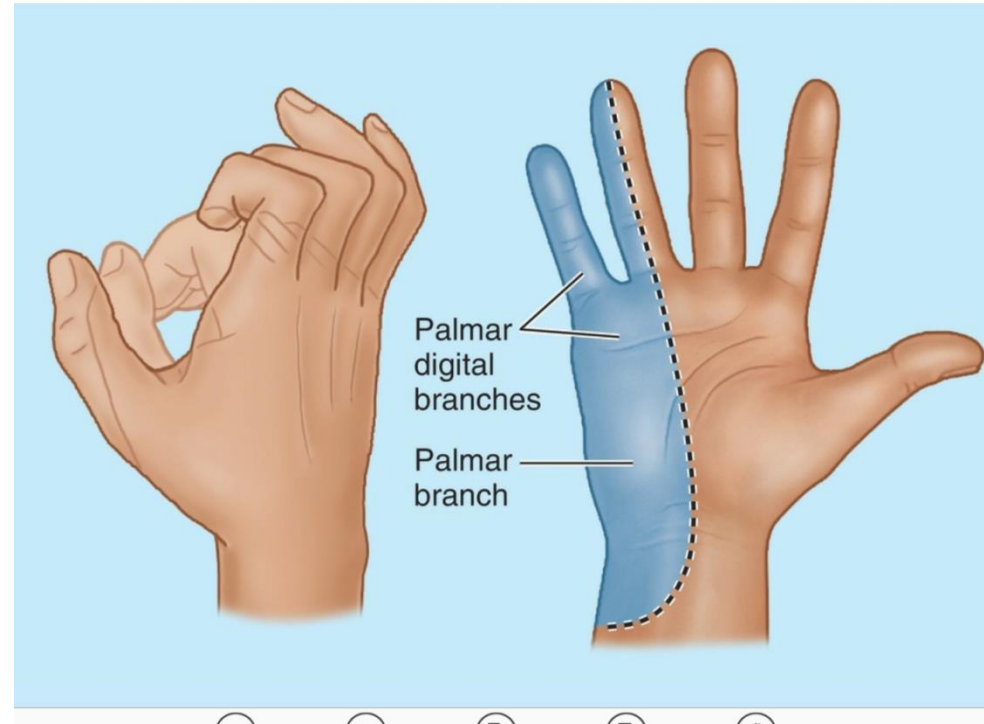


Ulnar nerve injury

LO8

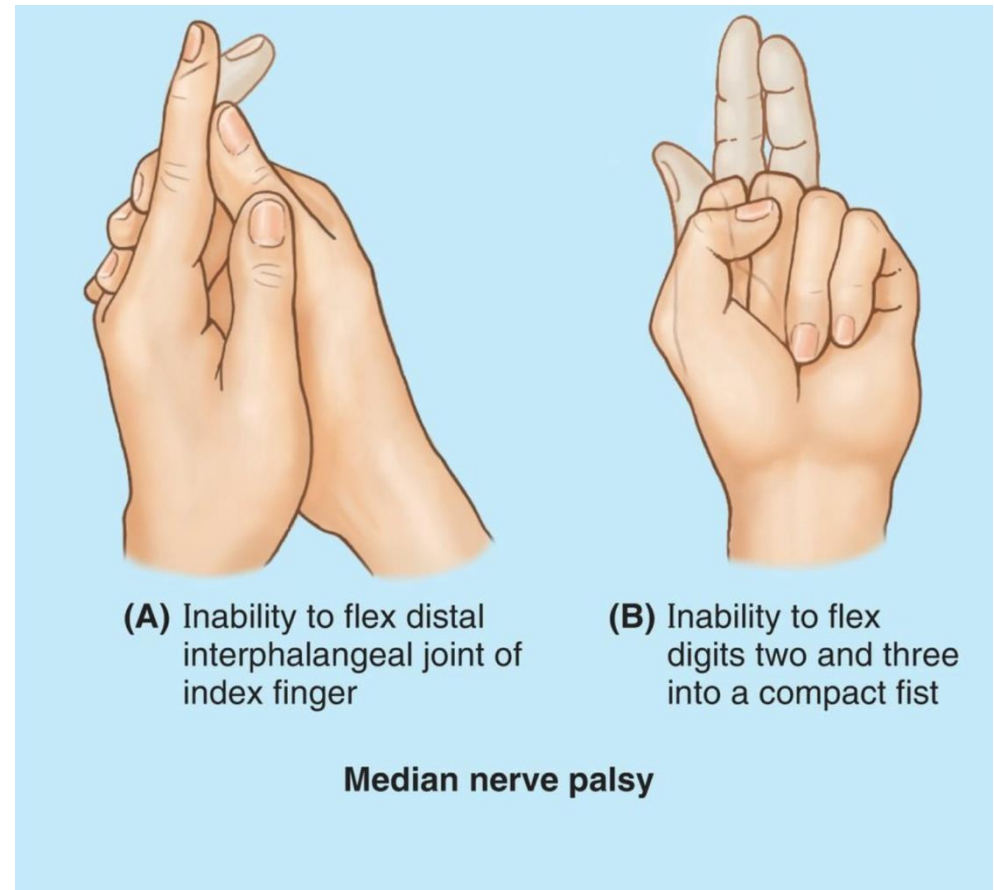
- Ulnar claw hand, loss of fingers adduction and abduction. Sensory loss

Home work:How claw hand deformity occur?



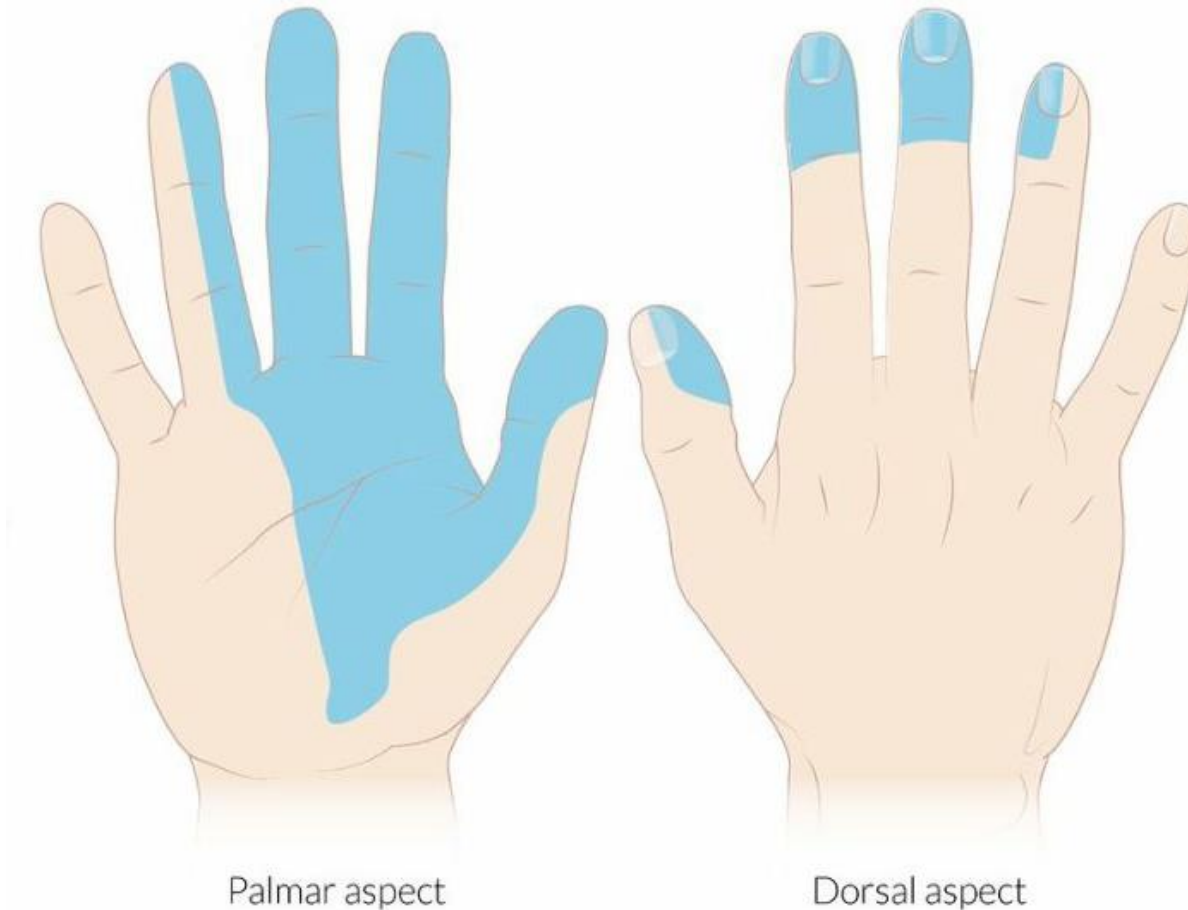
Median nerve injury

- hand of benediction, weak grip, sensory deficit



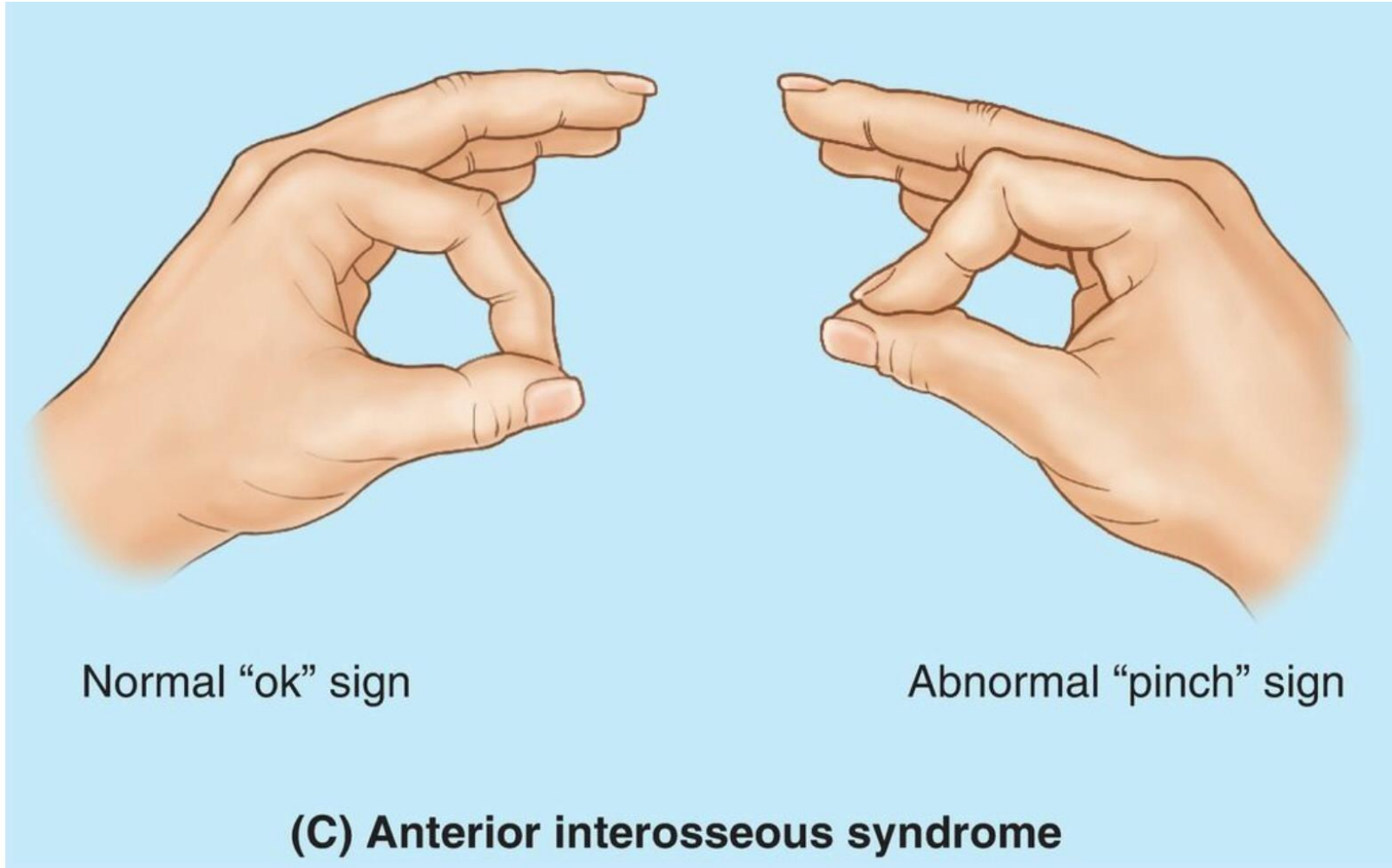
Median nerve injury :sensory deficit

LO8



Palmar aspect
Dorsal aspect
Sensory deficit in the regions innervated by the median nerve

Median nerve injury



Normal "ok" sign

Abnormal "pinch" sign

(C) Anterior interosseous syndrome



"Hand of benediction" Or ape hand
(a) Median nerve injury



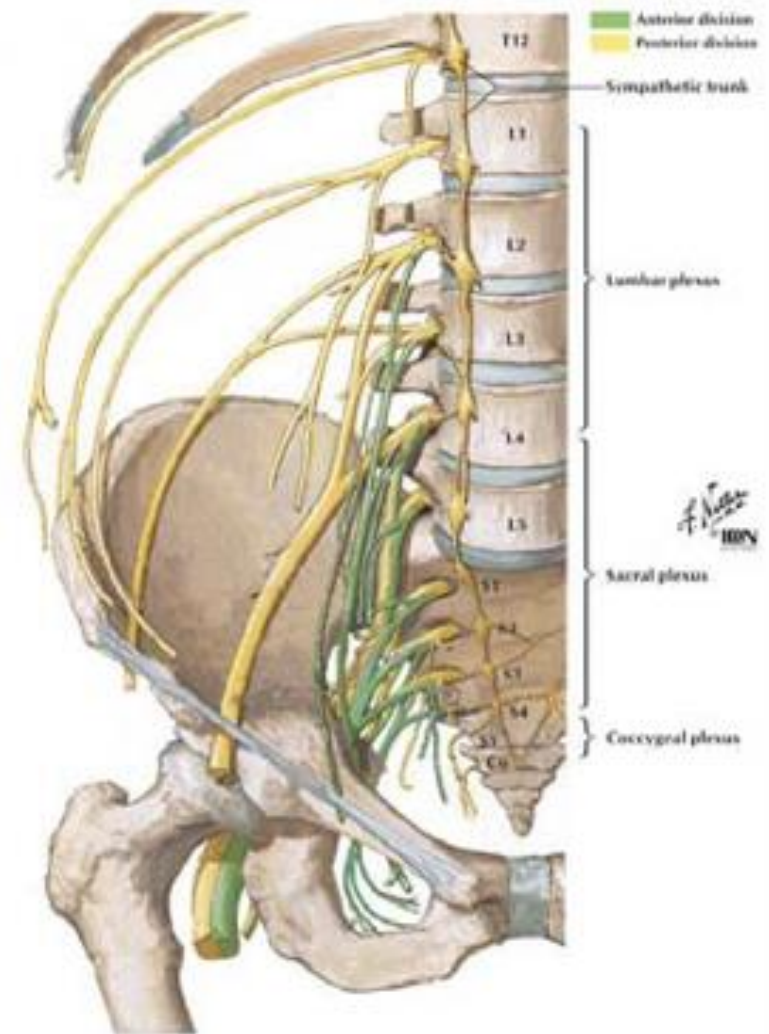
Clawhand
(b) Ulnar nerve injury



Wrist-drop
(c) Radial nerve injury

Nerve Supply to The Lower Limb

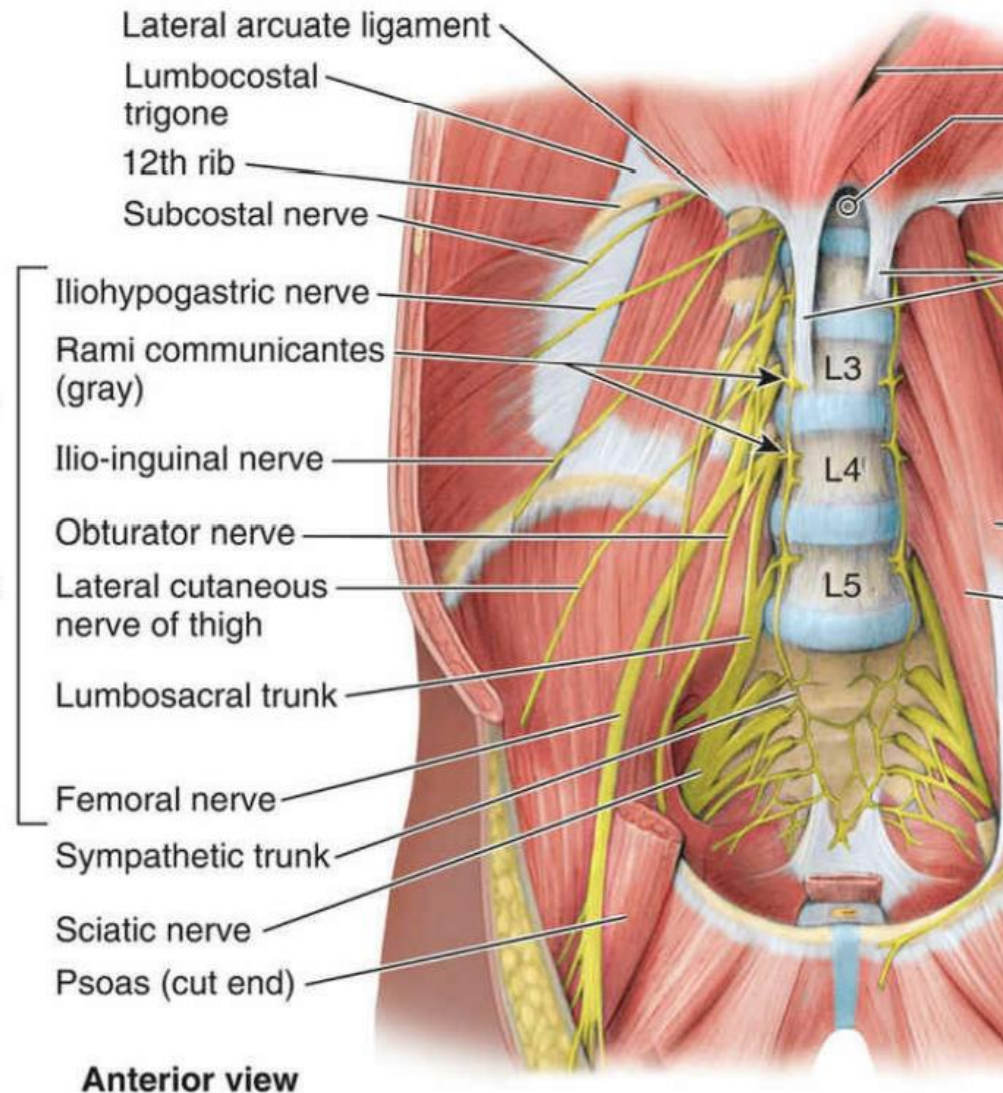
- Also receives all its Nerve Supply from the Spinal Cord: From Lumbar and Sacral Spinal Segments (L1-S4)
- *Two nerve plexuses:*
 1. **Lumbar Plexus:** formed from the anterior rami of (L1-L4).
 2. **Sacral Plexus:** Ant. rami (L4-S4)



Lumbar plexus

Lies in the substance of the psoas major muscle, anterior to lumbar transverse processes.

Lumbar plexus, composed of the anterior rami of lumbar spinal nerves, revealed by the removal of the psoas muscle



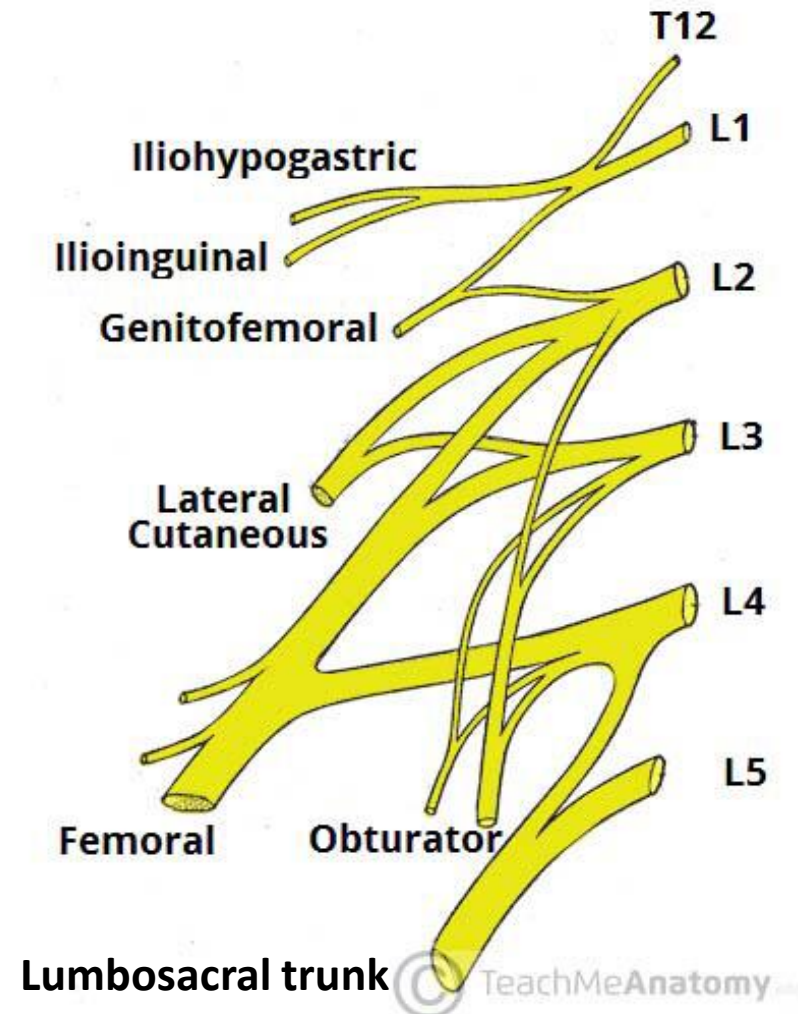
Nerve Supply to The Lower Limb

L07

Lumbar plexus

Main branches:

- 1.Femoral nerve
- 2.Obturator nerve
- 3.Lumbosacral trunk.



Sacral plexus

L07

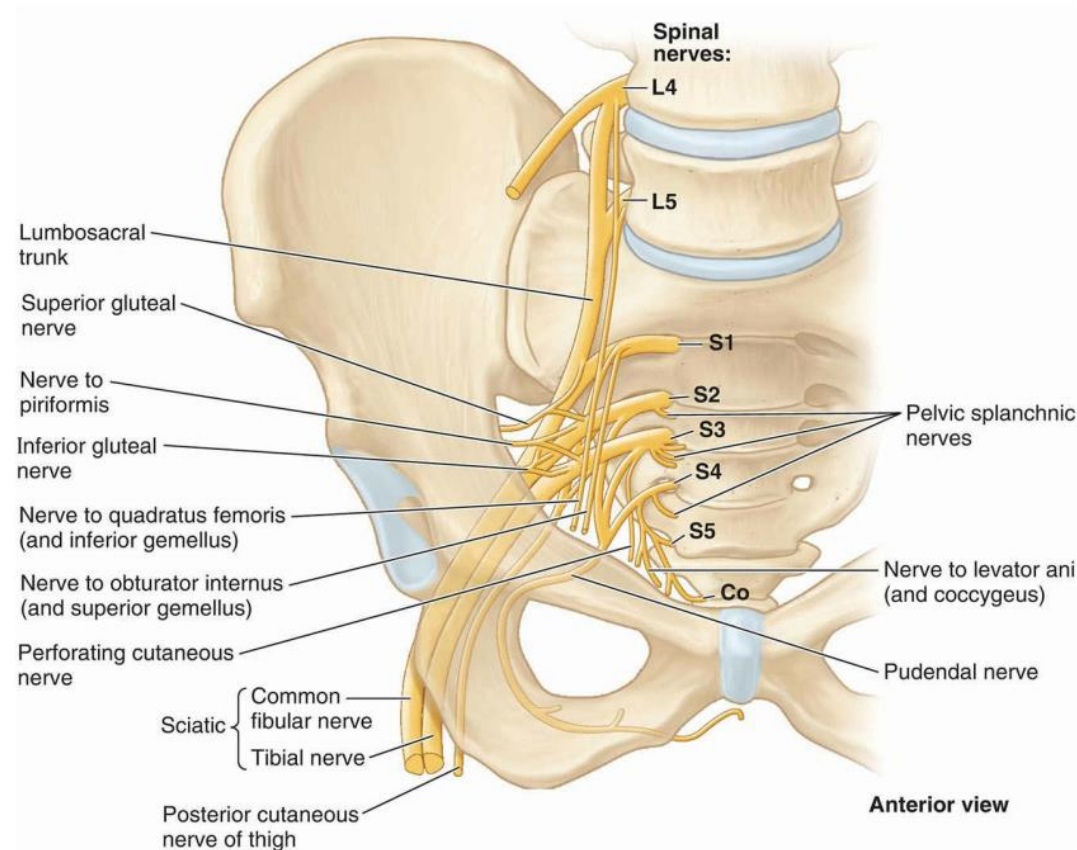
*Arises from Anterior rami of (L4-S4).

*Most of its branches leave the pelvis through the greater sciatic foramen.

*The two main branches:

1.Sciatic nerve(largest nerve in the body).

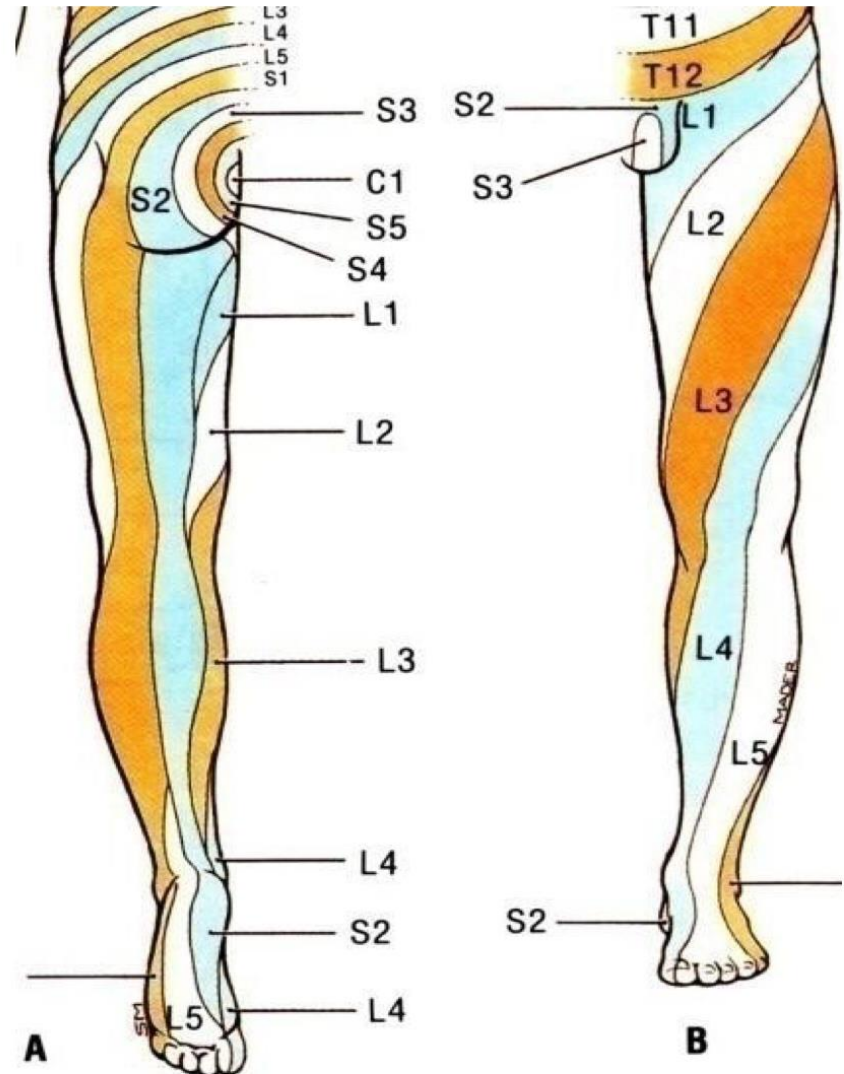
2.Pudendal nerve



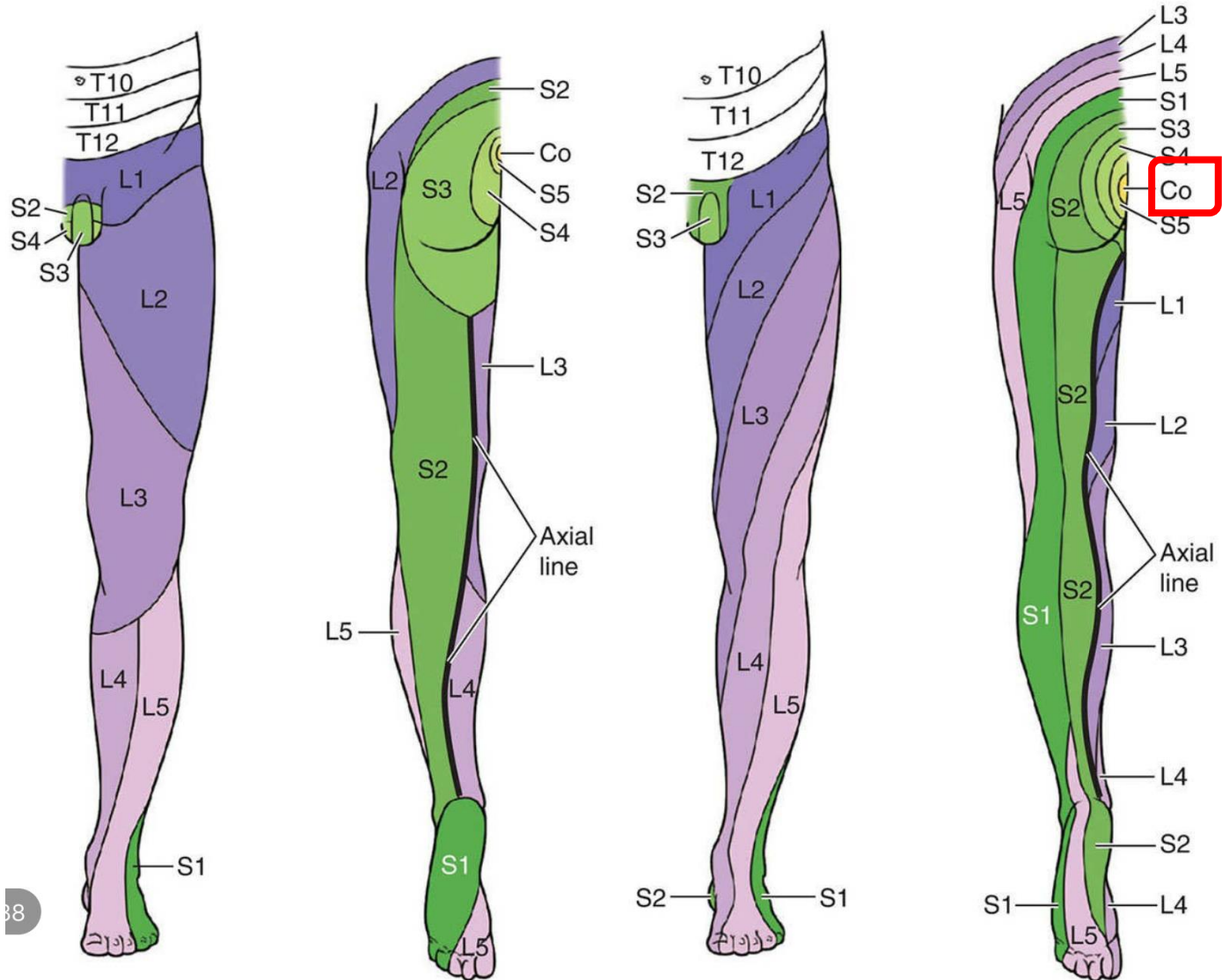
Sensory Supply of Lower Limb

LO5

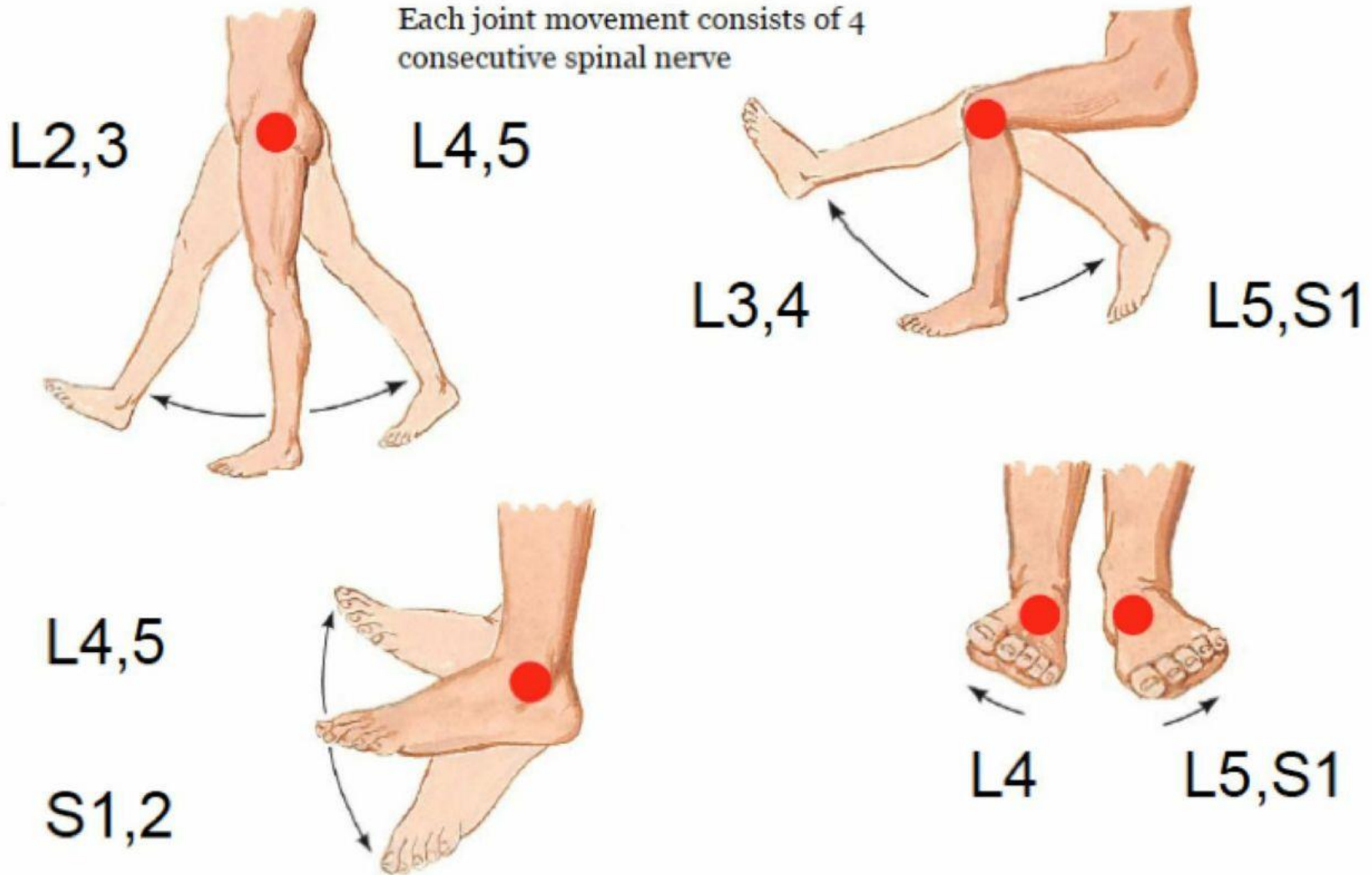
- The front of limb is supplied largely by Lumbar Segments
- The back of limb is supplied largely by Sacral Segments
- The Saddle area: by Sacral Segments
- The Perineal area: by Sacral Segments

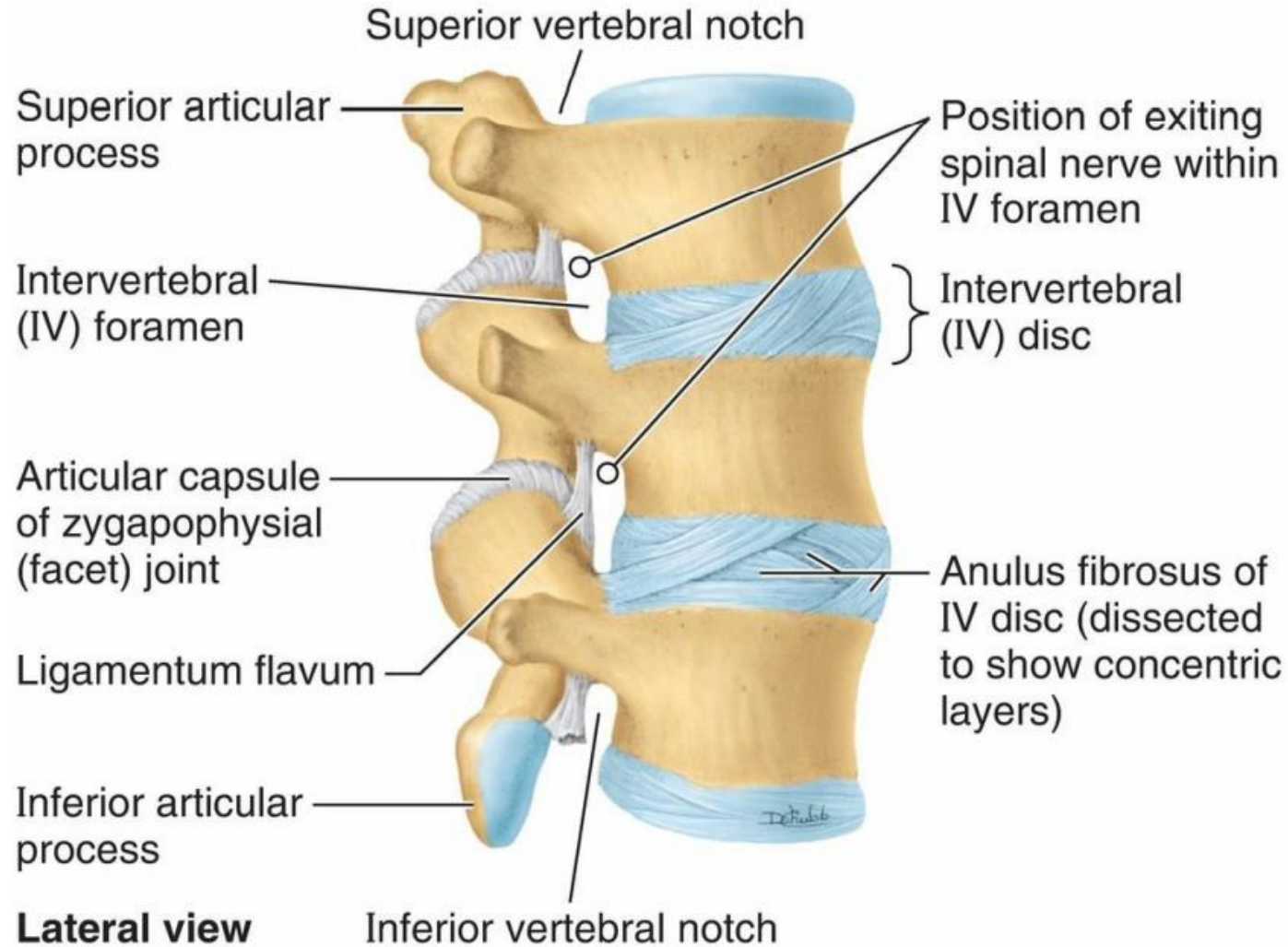


LO5



Myotomes of lower limbs ... Moore page 1599 [picture] ^{LO5}





The general rule: IV disc prolapse, usually compresses the nerve root numbered one inferior to the herniated disc; example:

L5 nerve is compressed by an L4–L5 IV disc herniation.

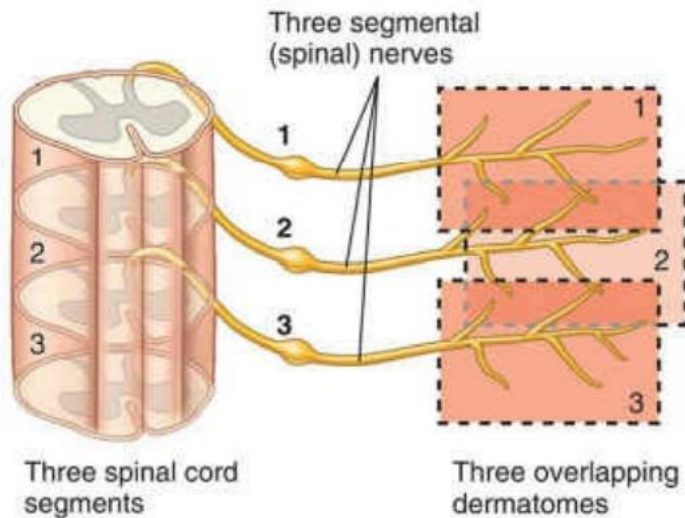
Motor deficit: weak muscles of foot and toe extension

Sensory deficit: dorsum of foot.



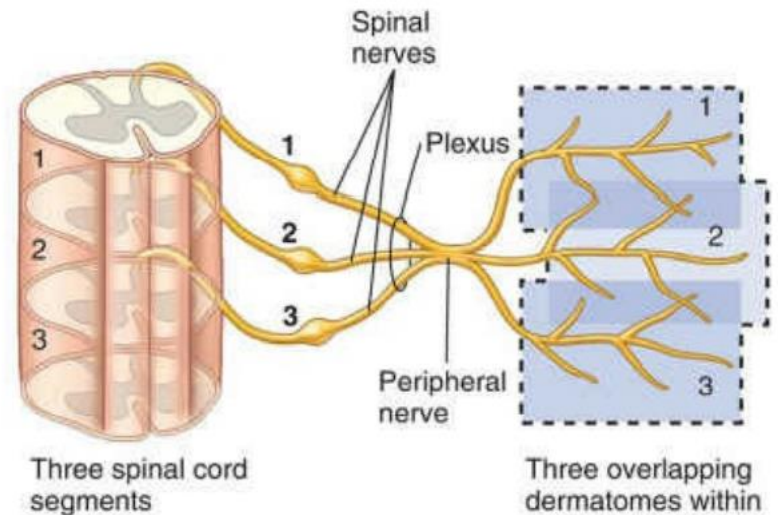
Q: Home work:

What is the difference between the segmental innervation and the peripheral nerve innervation (or distribution)? Moore page 204-205 and page 443-444



(C) Anterolateral views

- Segmental innervation of skin by three separate spinal nerves (as in skin of trunk)



- Innervation of skin by three spinal nerves combined into one peripheral nerve through plexus formation (as in skin of limbs)



Thank You

