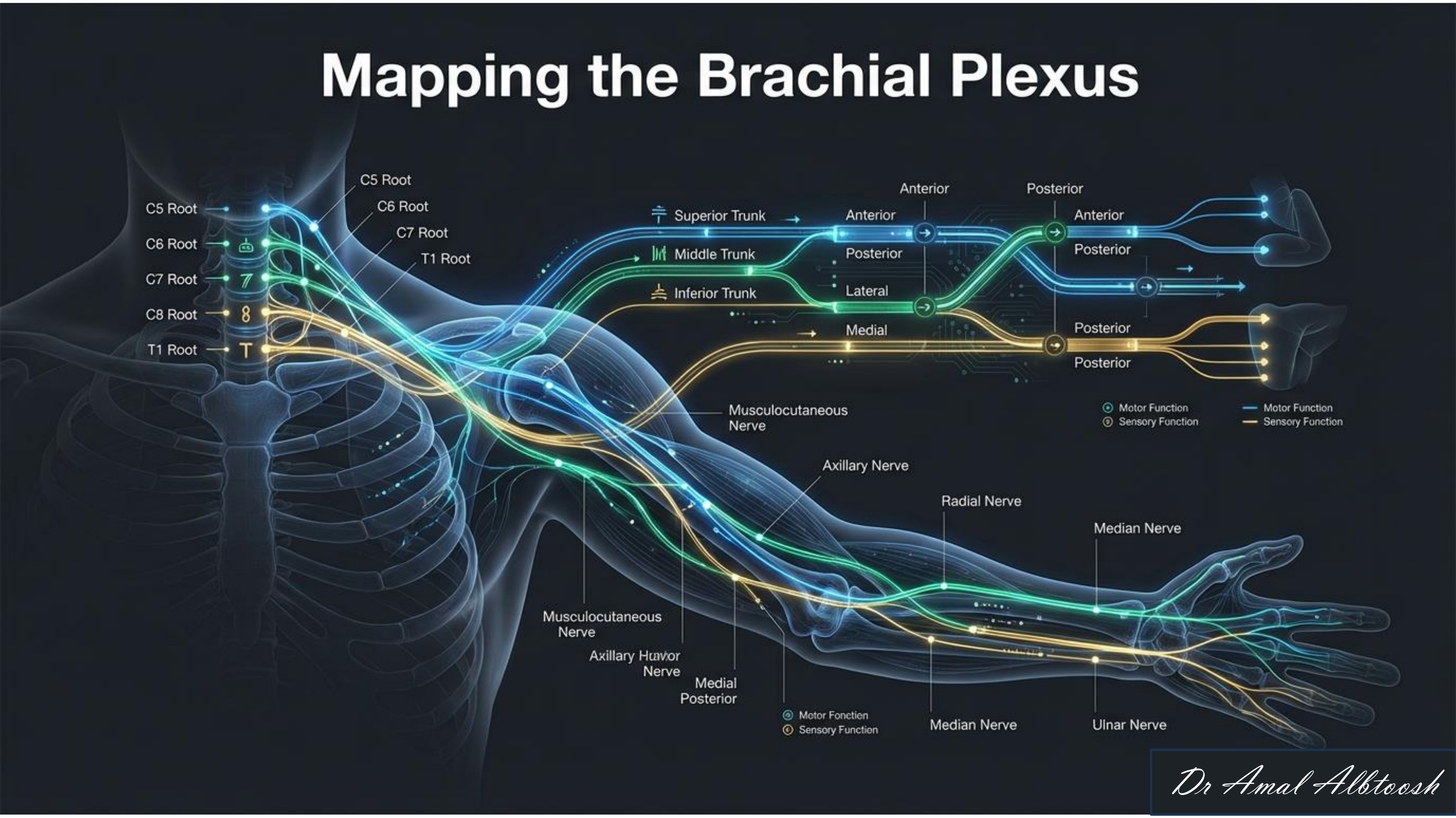
Mapping the Brachial Plexus



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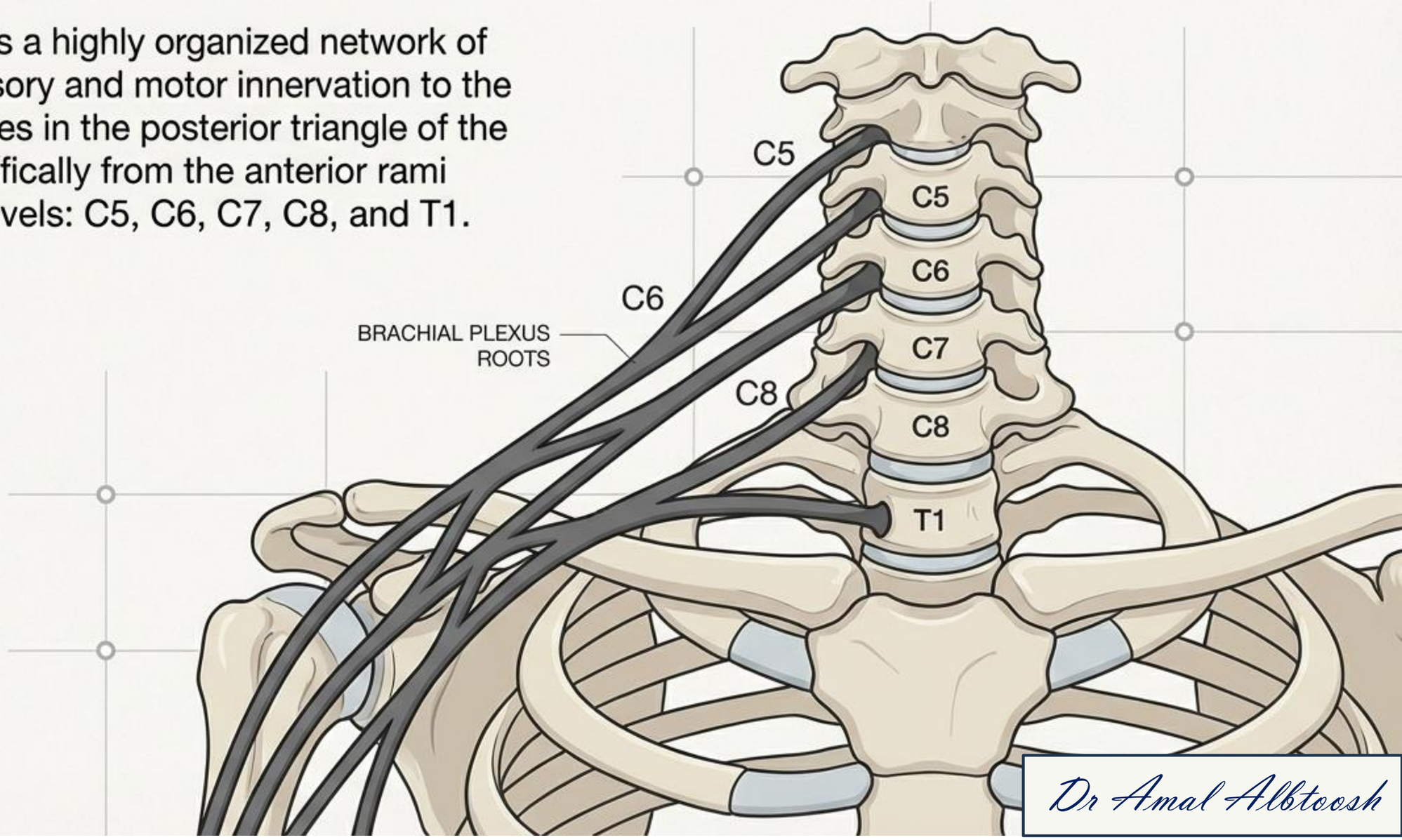
The Command Center for the Upper Limb

The Brachial Plexus is a highly organized network of nerves providing sensory and motor innervation to the upper limb. It originates in the posterior triangle of the neck, emerging specifically from the anterior rami of five spinal nerve levels: C5, C6, C7, C8, and T1.



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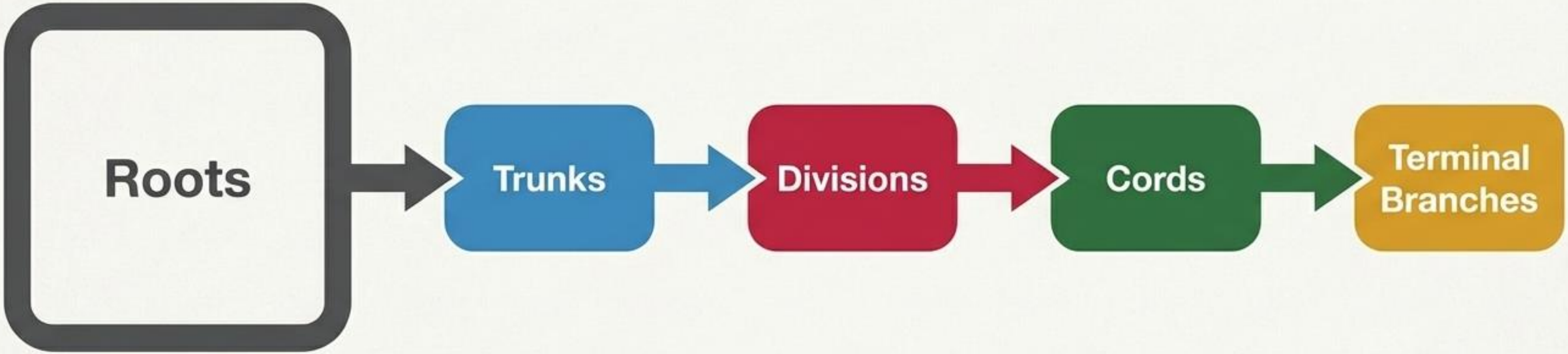
The Architecture of the Plexus

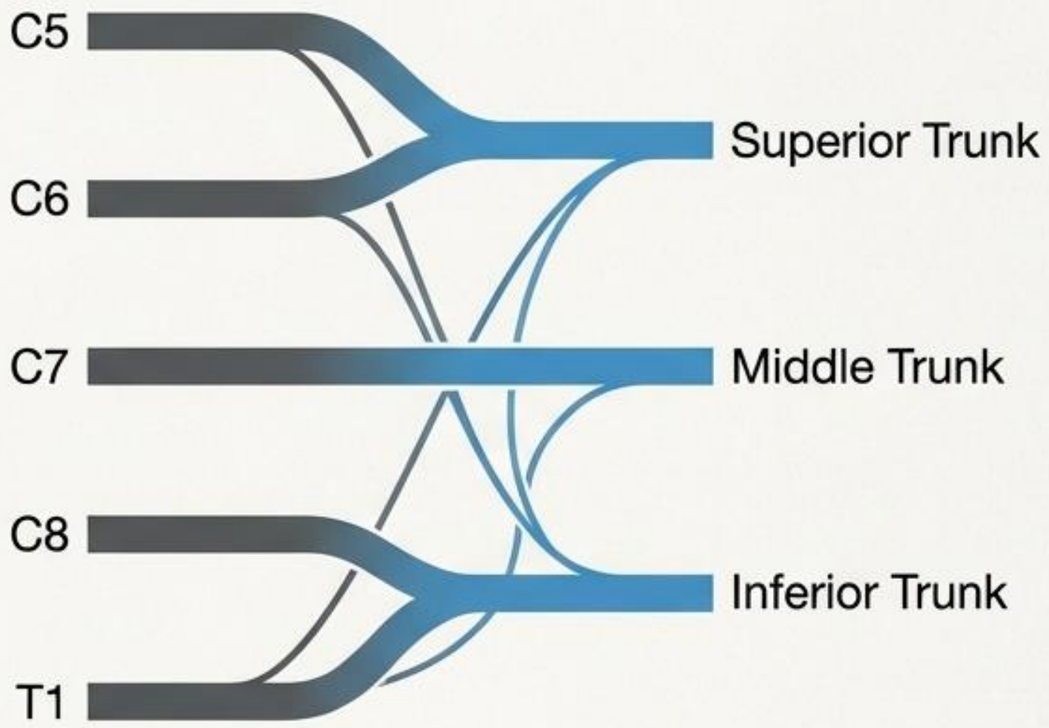
The network is organized through a strict anatomical hierarchy, transforming individual **spinal roots** into **highly specialized peripheral nerves**.



Forging the Main Trunks

As the C5–T1 roots exit between the anterior and middle scalene muscles, they systematically unite to form three distinct trunks:

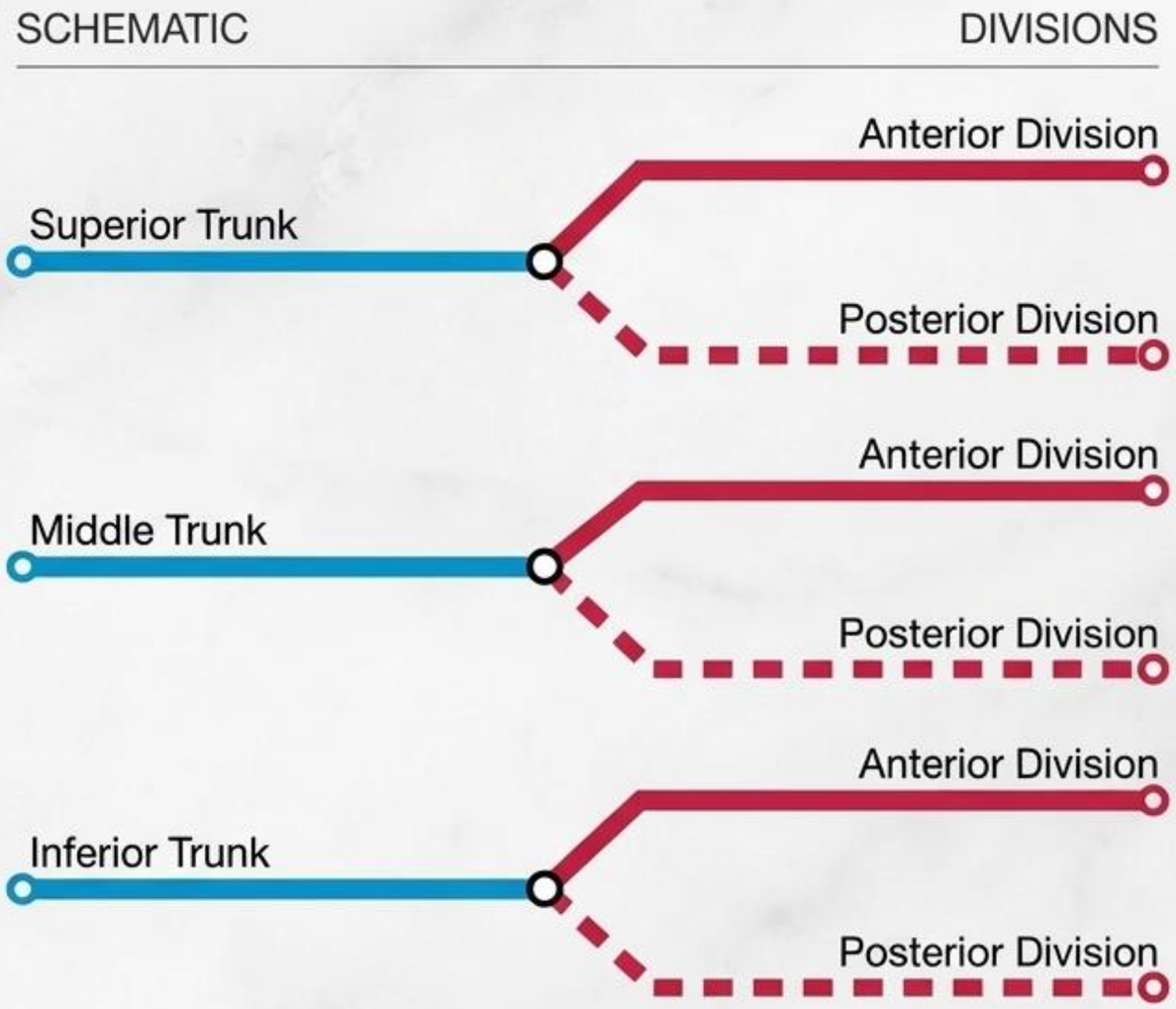
- Superior (Upper) Trunk: Formed by the union of C5 and C6.
- Middle Trunk: A direct continuation of the C7 root.
- Inferior (Lower) Trunk: Formed by the union of C8 and T1.



The Great Divide: Flexors and Extensors

Each of the three trunks quickly splits into an anterior and a posterior division as the network approaches the clavicle. This split represents a major functional sorting mechanism:

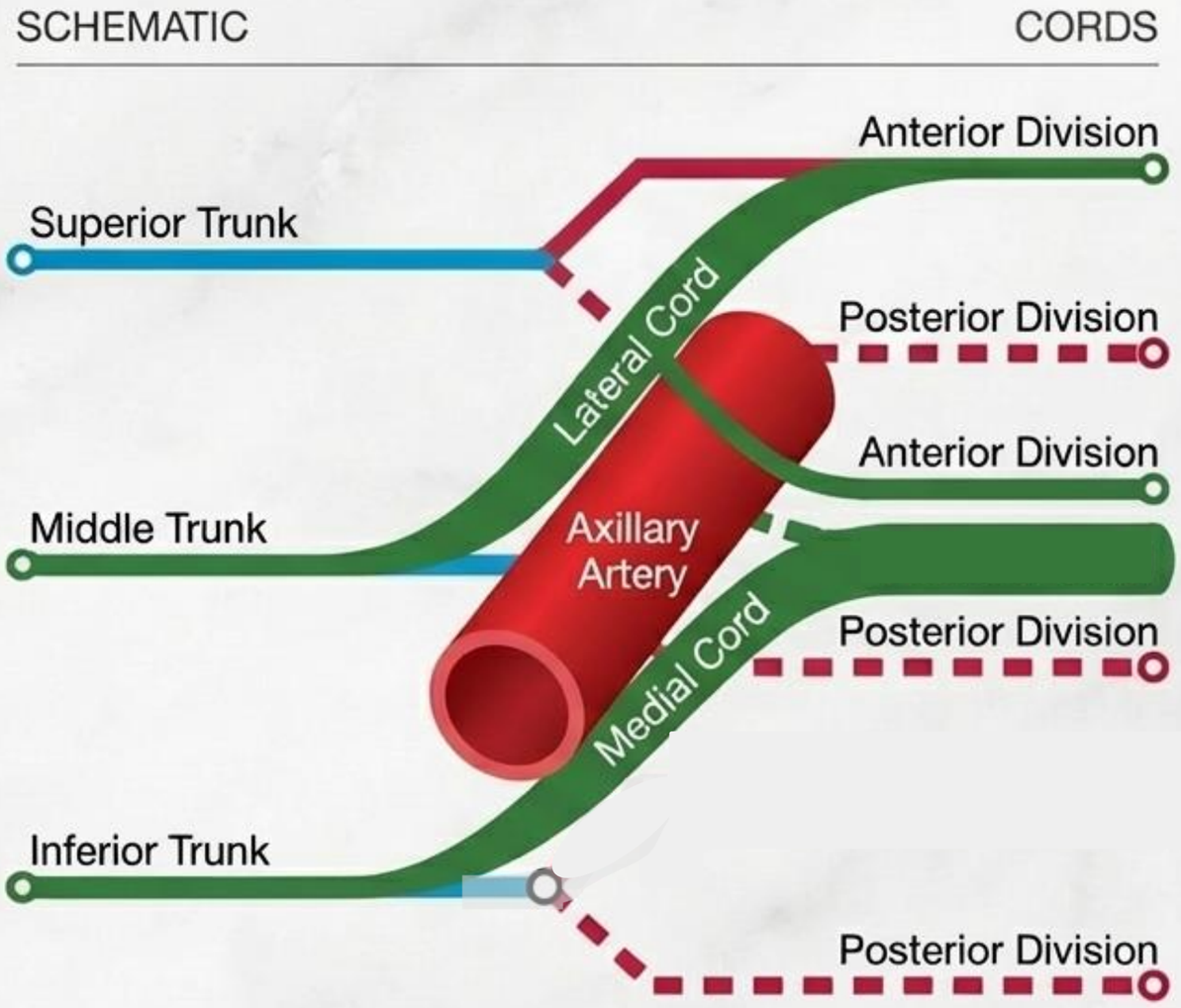
- **Anterior Divisions:** Give rise to nerves that will eventually innervate the anterior compartments (flexors) of the arm and forearm.
- **Posterior Divisions:** Give rise to nerves that will innervate the posterior compartments (extensors).



Recombining into the Three Cords

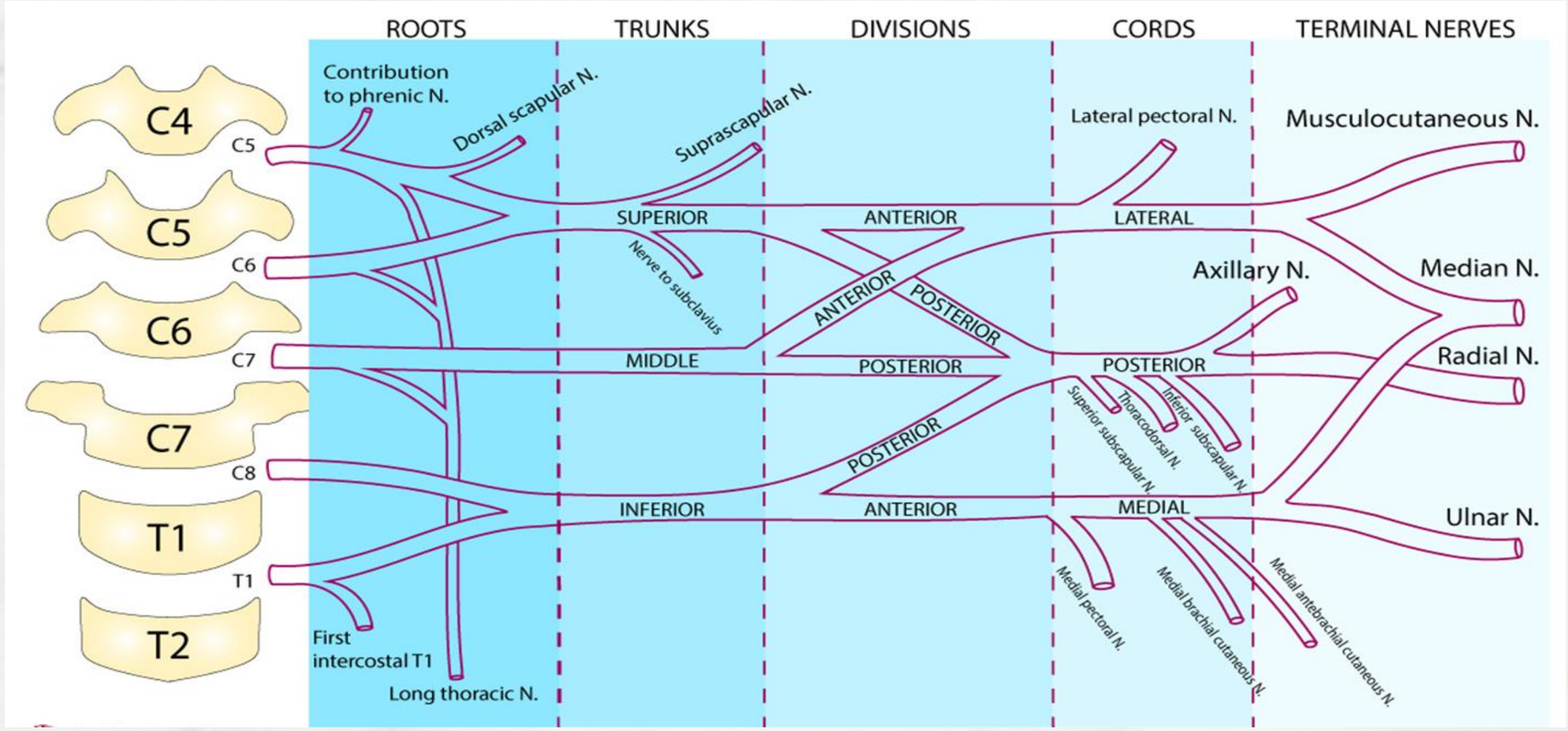
The divisions merge into three distinct cords, named explicitly for their physical relationship to the axillary artery:

- **Lateral Cord:** Formed by the anterior divisions of the superior and middle trunks.
- **Medial Cord:** A continuation of the anterior division of the inferior trunk.
- **Posterior Cord:** Formed by the convergence of all three posterior divisions.



The Five Terminal Branches

From the three cords, the network finally terminates into five major peripheral branches that journey down the arm.

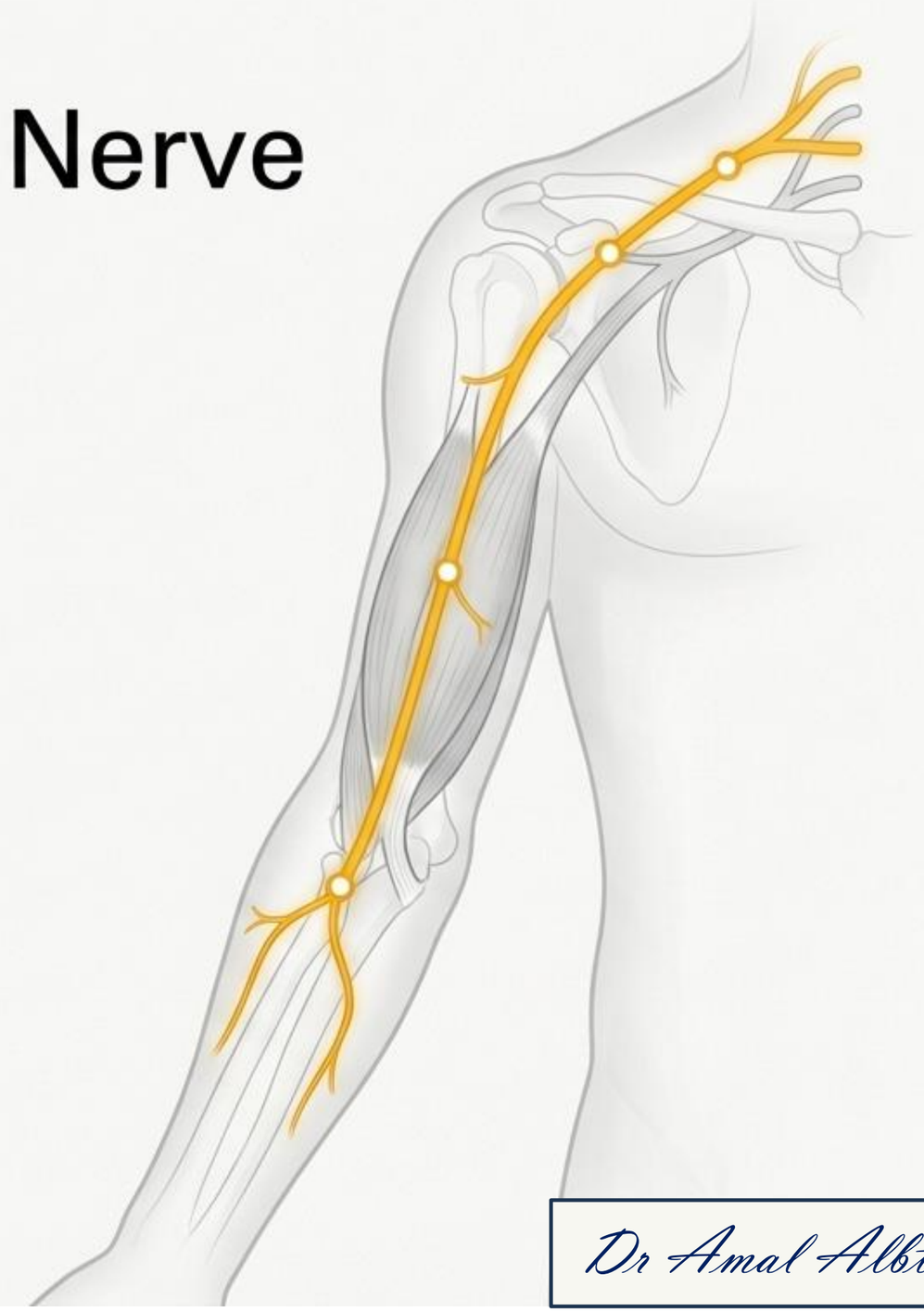


The Musculocutaneous Nerve

Origin: Lateral cord (C5–C7).

Motor Function: Provides innervation to the anterior compartment of the arm (flexors).

Sensory Function: Continues distally to provide cutaneous innervation to the lateral forearm.



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The Median Nerve

Origin: Medial and Lateral cords (C6–T1).

Motor Function: Innervates most of the anterior forearm flexors, continuing into the hand to control the thenar eminence and lumbricals 1 and 2.

Sensory Function: Supplies the medial palmar side of the hand, covering digits 1 through 3, and exactly half of digit 4.

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The Ulnar Nerve

Origin: Medial cord (C7–T1).

Motor Function: Supplies the remaining one and one-half muscles in the anterior forearm, but primarily controls the intrinsic hand musculature (hypothenar eminence, lumbricals 3 and 4).

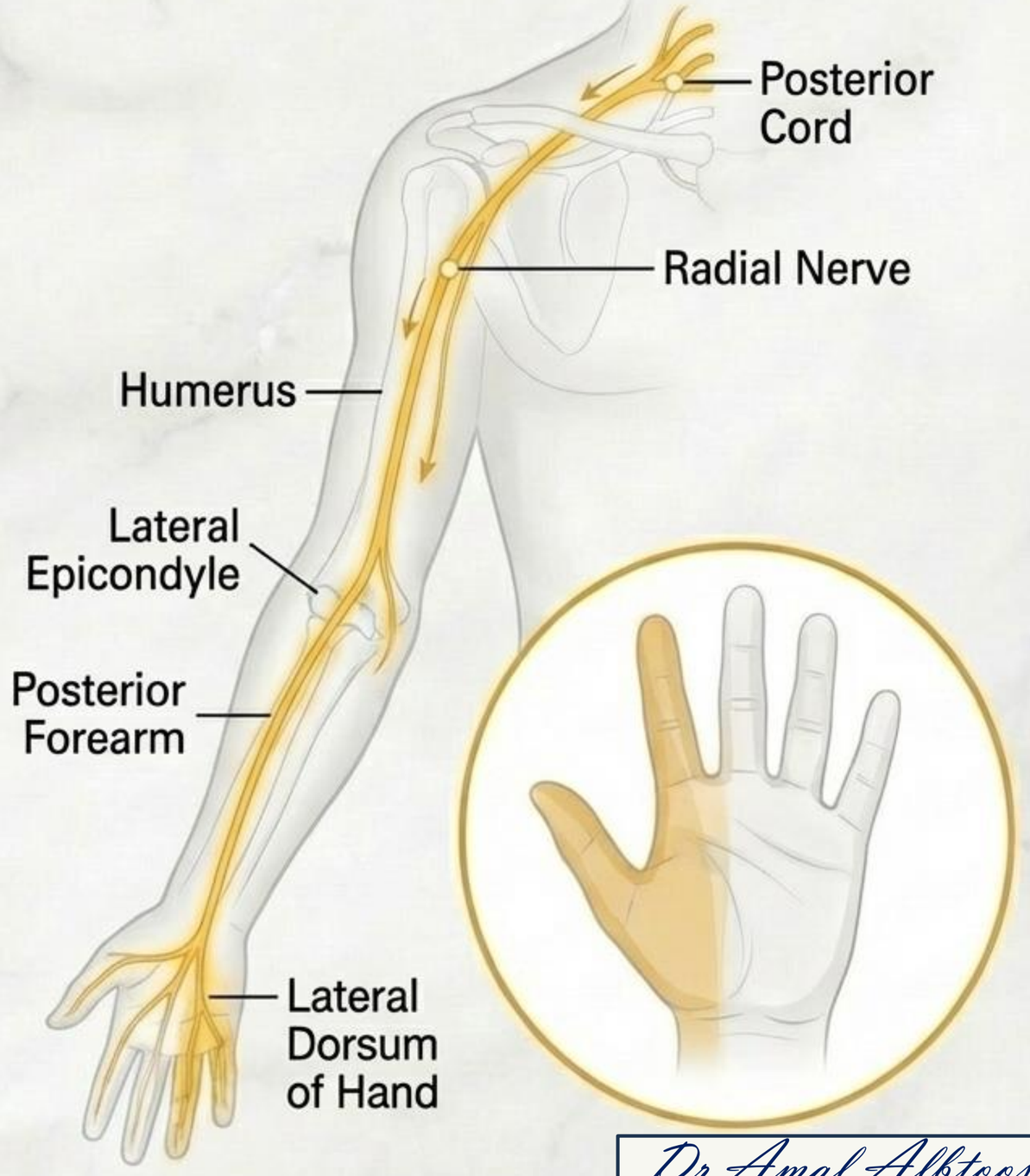
Sensory Function: Supplies the medial half of digit 4 and all of digit 5.

The Radial Nerve

Origin: Posterior cord (C5–T1).

Motor Function: The primary nerve for the entire posterior compartment of both the arm and forearm (the extensors).

Sensory Function: Provides cutaneous innervation to the posterior and inferior lateral arm, posterior forearm, and the lateral dorsum of the hand.

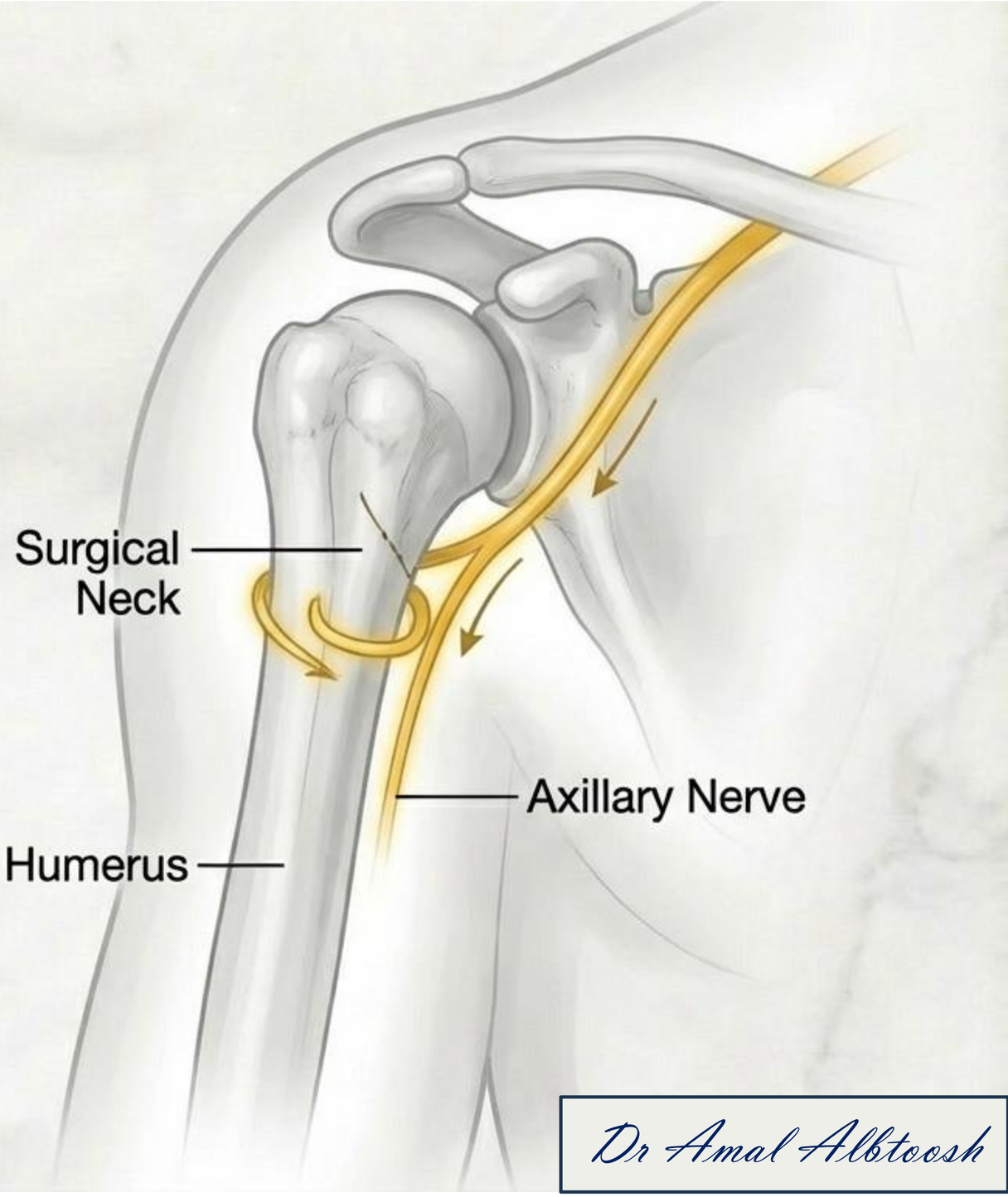


The Axillary Nerve

Origin: Posterior cord (C5–C6).

Motor Function: Loops tightly around the surgical neck of the humerus to innervate the deltoid and teres minor muscles.

Sensory Function: Provides localized cutaneous innervation to the superior portion of the lateral arm.



Cutaneous Fields vs. Dermatomes

Sensory mapping in the upper limb relies on distinguishing between two distinct distribution patterns:

Dermatomal Distribution

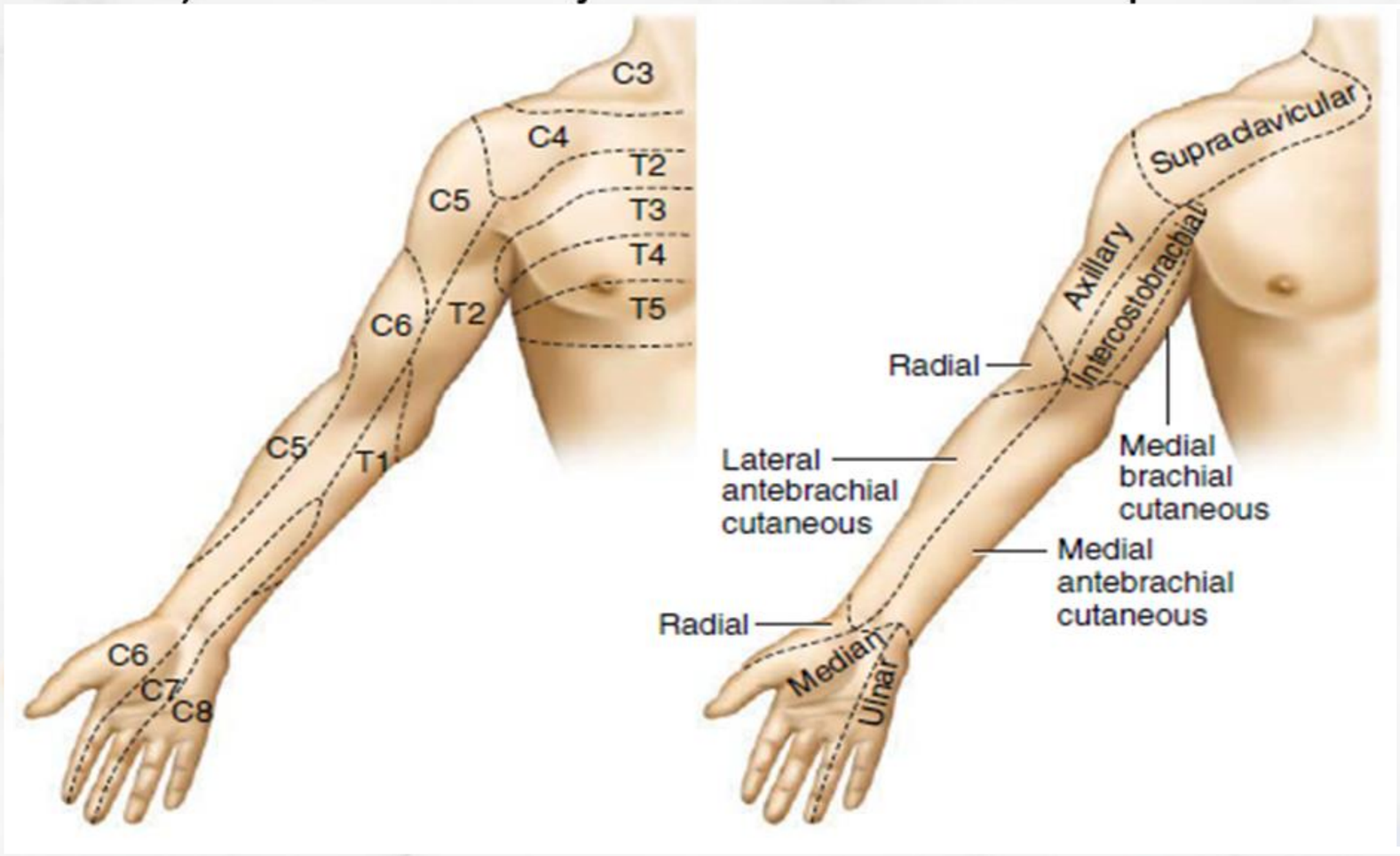
An area of skin supplied by sensory neurons originating from a single spinal nerve root (e.g., just C6), carried via multiple peripheral nerves.

Cutaneous Distribution

An area of skin supplied by a single peripheral nerve branch, which may contain fibers from multiple spinal roots.

Mapping the Sensory Disconnect

These overlapping maps dictate clinical diagnosis. A lesion to a specific peripheral cutaneous nerve results in a localized loss of sensation. However, a severed spinal root (like C6) affects all sensory innervation across multiple nerves within that dermatome.



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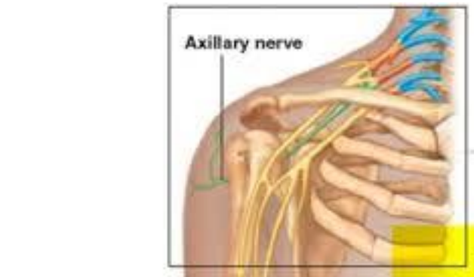
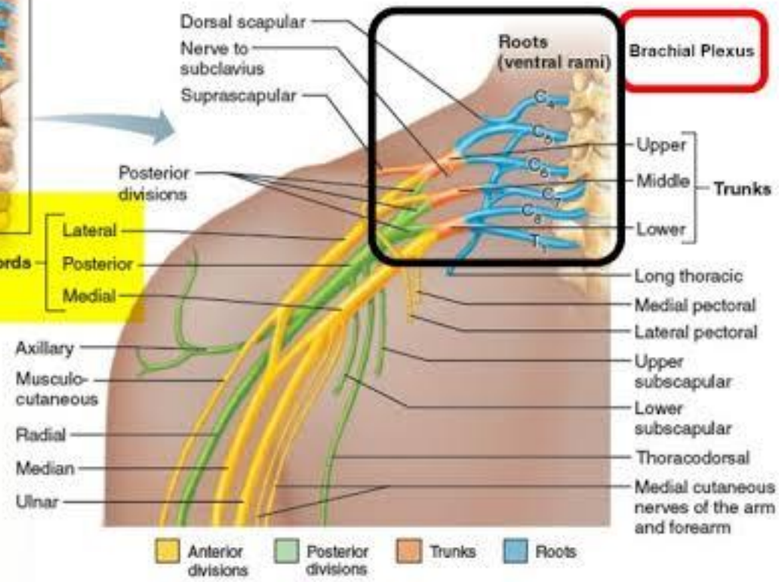
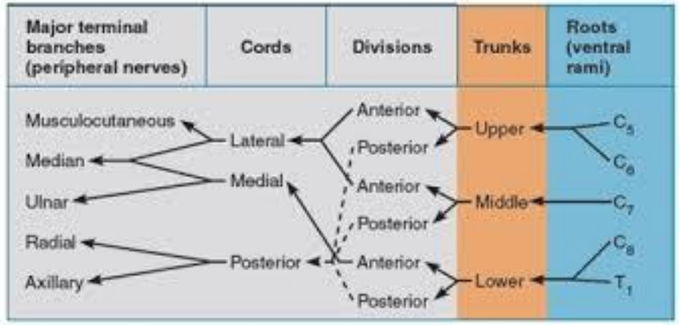


(a) The major nerves of the upper limb



(b) Roots (rami C_5–T_1), trunks, divisions, and cords



(c) Flowchart summarizing relationships within the brachial plexus

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