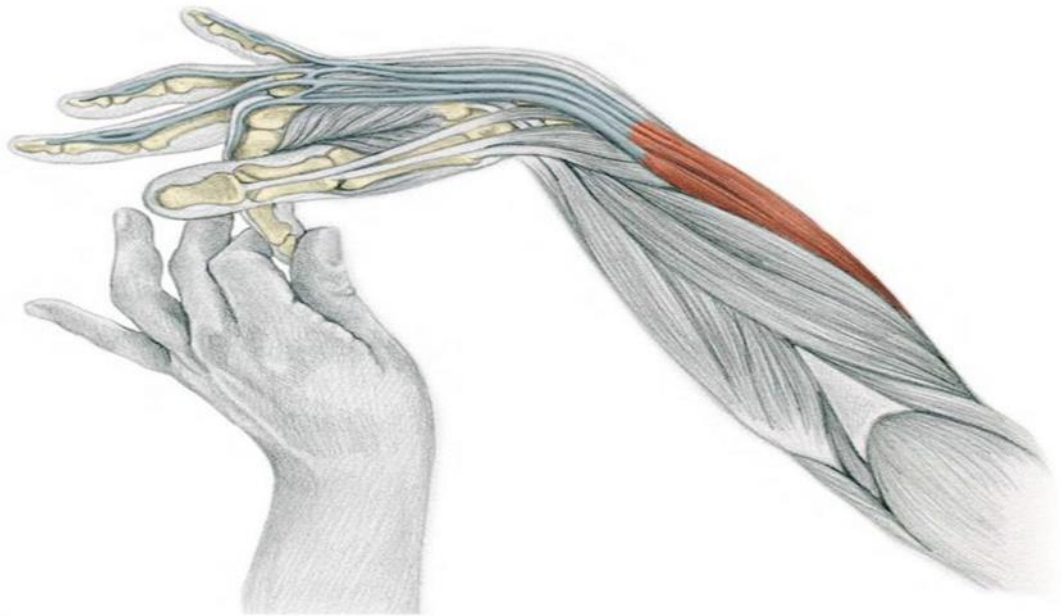


Department of Human Anatomy

College of Medicine



**Human Anatomy Practical Lectures( Upper limb) (Part 1)**

**BY**

**Assisted lecturer Dr.Dhamyaa Abed Najm**

**For**

**First stage students in college of medicine**

## Axilla and Brachial Plexus

The axilla is a pyramid-shaped space located between the upper thorax and the arm. The axilla has a base, an apex, and 4 walls (anterior, medial, lateral, posterior). The base of the pyramid is made up of the axillary skin. The apex is the axillary inlet, located between the 1st rib, superior border of the scapula, and clavicle. The apex includes various vessels and nerves, such as the axillary artery and its branches, the axillary vein and its tributaries, the branches of the brachial plexus, and the axillary lymph nodes.

### Boundaries of the Axilla:

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The axilla is a pyramid-shaped space below the glenohumeral joint that is the passageway for nerves and vessels to pass into the upper arm.

- Base: hair and sweat gland-bearing axillary skin
- Apex (axillary inlet): between the 1st rib, scapula, and clavicle
- 4 converging walls:
  - Anterior wall: pectoralis major and minor
  - Medial wall: serratus anterior, thoracic wall
  - Lateral wall: intertubercular sulcus of the humerus
  - Posterior wall: subscapularis, latissimus dorsi, teres major muscles

## Contents of the Axilla:

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The contents of the axilla are structures enclosed in the axillary sheath.

The axillary artery is a direct continuation of the subclavian artery and is composed of 3 parts:

- 1st part:
  - Superior to the pectoralis minor muscle
  - Branches: superior thoracic artery
- 2nd part:
  - Deep to the pectoralis minor muscle
  - Branches: thoracoacromial and lateral thoracic artery
- 3rd part:
  - Inferior to the pectoralis minor muscle and extending to the lower border of the axilla
  - Branches: subscapular artery, anterior, and posterior circumflex humeral artery
- Axillary vein
- The axillary vein is the primary venous drainage of the upper arm, formed by the cephalic and basilic veins

### Axillary lymph nodes

There are 5 groups of axillary lymph nodes draining to the apical lymph nodes:

1. The **anterior or pectoral group** drains the anterolateral abdominal wall and lateral quadrants of the breast.

2. The **posterior or subscapular group** drains the superficial layers of the back.
3. The **lateral group** drains the upper limb.
4. The **central group** drains the anterior, posterior, and lateral groups, which drain into the **apical or subclavicular group** at the apex of the axilla (apical → subclavian lymph trunk → thoracic duct on the left and right lymphatic trunk on the right).
5. The **infraclavicular or deltoid group** (not found within the axilla) drains the superficial layers of the upper limb.

These lymph nodes filter lymph fluid from the arm and pectoral region, including the breast (important in the diagnosis and management of breast cancer).

### **Brachial plexus:**

The brachial plexus is formed from the anterior rami of spinal cord segments C5–T1, which are the roots of the brachial plexus and the network of nerves that supply the upper arm.

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- **The Brachial Plexus**

- The brachial plexus is a nerve plexus formed by intercommunication of the ventral rami of C5–T1 nerves. The brachial plexus serves as the origin of all the peripheral nerves that innervate the upper limb and shoulder.
- **Axillary Spaces**
- The axillary spaces are anatomic spaces in the axilla where

important nerves and vessels exit the axilla.

### **Arterial Anastomosis around the Shoulder Joint:**

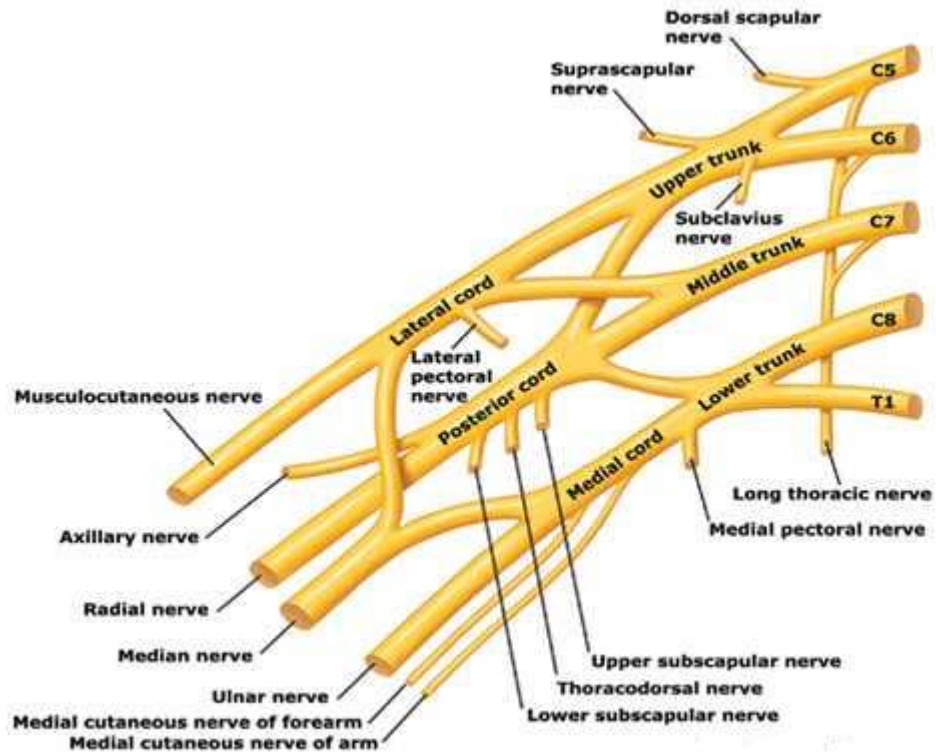
The extreme mobility of the shoulder joint may result in kinking of the axillary artery and a temporary occlusion of its lumen. To compensate for this, an important arterial anastomosis exists between the branches of the subclavian artery and the axillary artery, thus ensuring that an adequate blood flow takes place into the upper limb irrespective of the position of the arm.

Branches from the Subclavian Artery:

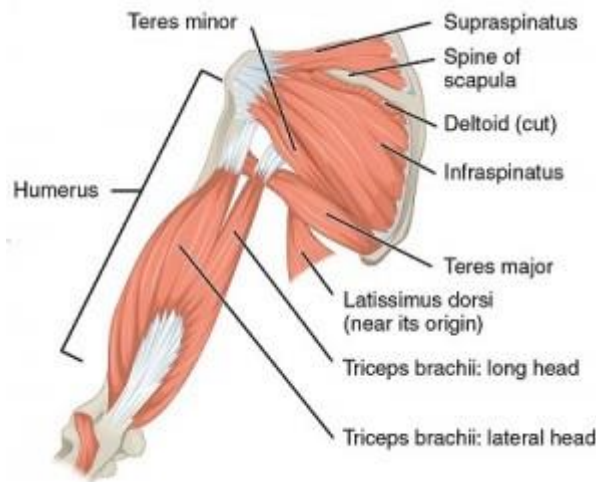
- The suprascapular artery, which is distributed to the supraspinous and infraspinous fossae of the scapula
- The superficial cervical artery, which gives off a deep branch that runs down the medial border of the scapula

Branches from the Axillary Artery:

- The subscapular artery and its circumflex scapular branch supply the subscapular and infraspinous fossae of the scapula, respectively.
- The anterior circumflex humeral artery
- The posterior circumflex humeral artery Both the circumflex arteries form an anastomosing



## Rotator Cuff Muscles:



## The rotator cuff muscles:

It is a group of muscles and tendons, surrounding the shoulder joint, that is essential for the mobility and stability of the shoulder joint by pulling the ball of the humerus into the shallow socket of the scapula.

This group of muscles includes four skeletal muscles.

- **Supraspinatus muscle**
- **Infraspinatus muscle**
- **Teres minor muscle**
- **Subscapularis muscle**

The flat tendons of these muscles are connected to the capsular ligament apparatus, stabilizing the shoulder joint.

## Supraspinatus muscle:

The **supraspinatus muscle** runs from the **supraspinatus fossa** and inserts into the **greater tubercle of the humerus**. It is supplied by the **suprascapular nerve (C5-C6)**, that arises from the **upper trunk of the brachial plexus** and is supplied by the **suprascapular artery**.

### **Functions of the supraspinatus muscle:**

The main functions of the supraspinatus muscle include the **abduction** at the shoulder joint and humeral head depression. It plays an essential role in the scapulohumeral balance of the rotator cuff against gravitational pull. It centers the humeral head in the **glenoid cavity** and, along with the **deltoid muscle**, prevents downward (inferior) subluxation of the humerus.

### **Infraspinatus muscle**

The **infraspinatus muscle** arises from the **infraspinous fossa** of the scapula and attaches to the middle facet of the greater tubercle of the humerus and the capsule of the shoulder joint. It is innervated by the **suprascapular nerve (C5-C6)** that arises from the upper trunk of brachial plexus and supplied blood by suprascapular artery and the circumflex scapular arteries.

### **Function of the Infraspinatus Muscle**

The **infraspinatus muscle** is the main external (lateral) rotator at the shoulder joint. It can perform both **adduction and abduction**. It also reinforces the shoulder by connecting to the dorsal capsule while centering the head of the humerus in the glenoid.



### Teres minor muscle

The **Teres Minor** arises from the middle section of the **scapula** and is inserted into the caudal impression on the greater tubercle of the humerus. It is innervated by **the axillary nerve (C5-C6)**, arises from the posterior cord of the brachial plexus and is supplied blood by the circumflex scapular artery and the posterior circumflex humeral artery.

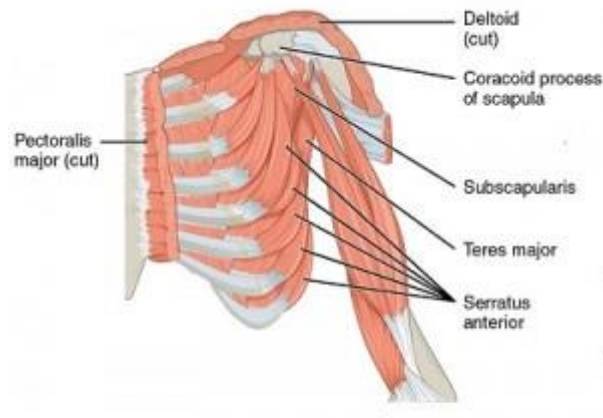
Muscle	Origin	Insertion	Nerve supply	Function
<b>Infraspinatus</b>	Infraspinous fossa	Middle facet of greater tubercle of humerus	Suprascapular nerve (C5)	Laterally rotates shoulder joint. Holds head of humerus in glenoid cavity
<b>Teres minor</b>	Lateral border of scapula, middle portion	Inferior facet of greater tubercle of humerus	Axillary nerve (C6)	

### Function of the teres minor muscle

Besides helping hold the humeral head in the glenoid cavity of the scapula and stabilizing the shoulder joint, it also performs the external

rotation and the adduction of the arm at the shoulder joint.

### Subscapularis muscle:



The **subscapularis** muscle arises from the **subscapular fossa** of the **scapula** and inserts into the **lesser tubercle** of the humerus. Innervation of the **subscapularis** is via the **upper and lower subscapular nerves (C5-C6)**. Blood supply is done by the subscapular artery.

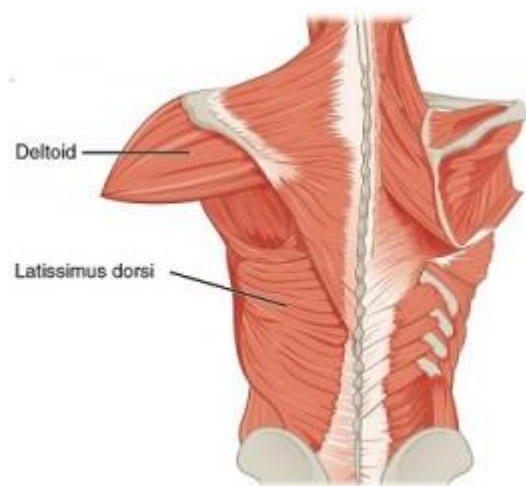
### Function of the Subscapularis Muscle

The subscapularis is the only rotator cuff muscle that performs internal rotation of the humerus. Aside from preventing ventral dislocation of the humeral head and the ventral dislocation, it also fixates the biceps tendon in the intertubercular groove. It also assists with **adduction** of the arm at the shoulder joint.

## Additional Muscles of the Shoulder

The shoulder muscles include skeletal muscles that are attached to the head of the humerus which performs various direct and indirect functions of the shoulder joints. However, their origin is found in the osseous structures and they are not to be included with the rotator cuff muscles.

### Deltoid muscle:



The deltoid originates in three distinct sets of fibers: **acromial**, **clavicular**, and **spinal**. All three sets of fibers converge toward their insertion on the deltoid tuberosity and are innervated by the **axillary nerve (C5-C6)** and receive their blood supply via or from the posterior circumflex humeral artery. They are all involved in arm abduction and prevent the dislocation of the humeral head. However, the origin and the secondary functions, such as synergistic movements, of the three sets of fibers should be distinguished.

**Function of the deltoid muscle:**

Due to their extensive paths and three sets of fibers of the deltoid muscle can perform various secondary functions and synergistic movements. Acromial fibers do not have any secondary functions.

**Coracobrachialis muscle:**

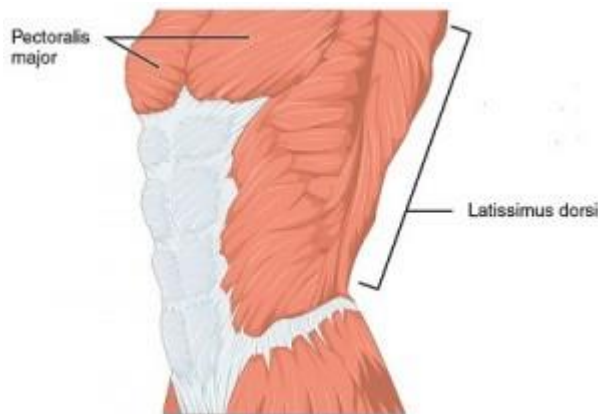
The Coracobrachialis arises from the apex of the **coracoid process** under **the short head of the biceps brachii**. It inserts into an impression in **the middle of the medial surface and border of the body of the humerus** between the origins of **triceps brachii** and **brachialis**. It is innervated by the **musculocutaneous nerve (C6-C7)**.

**Characteristics of the coracobrachialis muscle:**

The muscle creates an outlet opening for the musculocutaneous nerve.

**Function of the coracobrachialis muscle:**

The coracobrachialis muscle is a weak flexor and adductor of the arm. It also assists in preventing the dislocation of the humerus.

**Pectoralis major muscle:**

Similar to the deltoid muscle, the pectoralis major muscle originates in three distinct sets of fibers: **clavicular fibers**, **sternal fibers**, and **abdominal fibers**. The clavicular fibers arise from **the medial end of the clavicle**. The sternal fibers arise from **the anterior surface of the sternum to as low as the cartilage of the sixth rib**; the abdominal fibers arise from **the ventral leaf of the rectus sheath**.

From this extensive origin, the fibers converge toward their insertion into the lateral lip of the bicipital **groove of the humerus**.

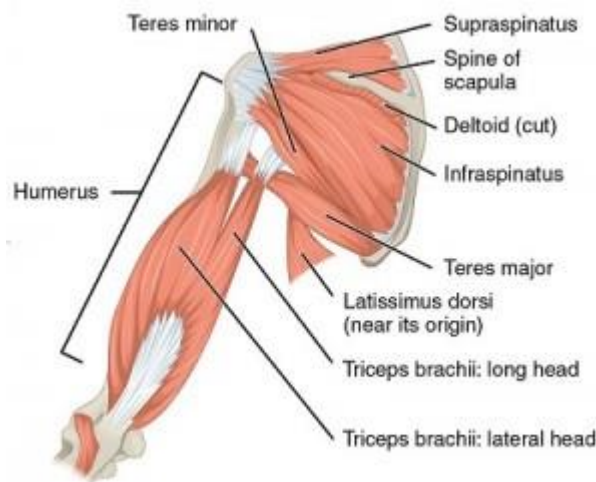
The Pectoralis Major muscle is innervated by the **medial pectoral nerve** and the **lateral pectoral nerve (C5-T1)**. Its functions include flexion, adduction, and internal rotation.

**Function of the Pectoralis Major Muscle:**

The main functions of pectoralis major are flexion, adduction, and internal rotation of the arm. The pectoralis major muscle is the most important muscle for the adduction and anteversion of the shoulder joint which is why it is also known as the ‘breaststroke muscle’. It rotates the upper arm inwards (medial rotation) and makes a powerful stroke

movement (retroversion) when the arms are elevated. If the arms are fixed, the muscle lifts the trunk which can be helpful in climbing or during inspiration. At the fixed end of the humerus, the pectoralis major muscle pulls the shoulder girdle in the ventral direction. Due to its location, it belongs to the **chest (pectoral) muscle group**.

### Teres major muscle:



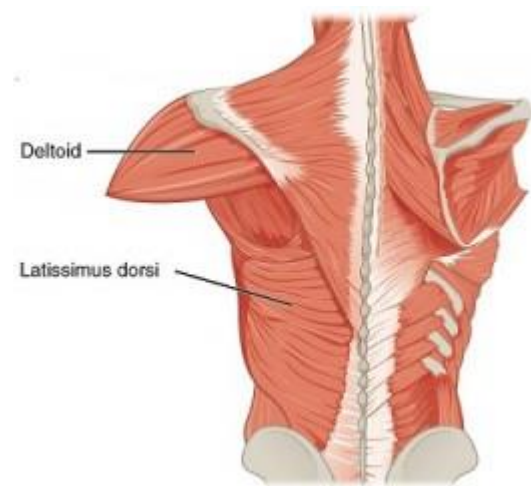
The **teres major muscle** arises from the oval area on the dorsal surface of the **inferior angle of the scapula** and inserts into **the medial lip of the intertubercular sulcus of the humerus** near the insertion area of the **latissimus dorsi muscle**. It is innervated by **the thoracodorsal nerve (C6-C7)**. Blood supply is provided by the circumflex scapular artery. It is responsible for the extension, adduction and internal rotation of the arm.

Muscle	Origin	Insertion	Nerve supply	Function

<b>Teres major</b>	Later border of the scapula, the inferior portion	The medial lip of the intertubercular groove	Lower subscapular nerve (C6)	Adducts and medially rotates the shoulder joint
<b>Subscapularis</b>	Subscapular fossa	Lesser tubercle of the humerus	Upper and lower subscapular nerves (C6)	Medially rotates and adducts shoulder joint. Holds the head of the humerus in the glenoid cavity

**Function of the teres major muscle:**

The main functions of Teres Major are the extension, adduction and internal rotation of the arm. **At the fixed end** of the arm, the teres major pulls the scapula outwards.

**Latissimus dorsi muscle:**

The latissimus dorsi muscle originates in four distinct sets of fibers: **scapular fibers**, **costal fibers**, **vertebral fibers**, and **iliac fibers**. All four fibers converge toward their insertion in **the middle of the medial surface and border of the body of the humerus**. They are innervated by the **thoracodorsal nerve (C6-C8)**. Blood supply is provided by the thoracodorsal artery via the axillary artery. The muscle performs extension, adduction, and internal rotation.

The scapular fibers arise from the inferior angle of the scapula; the costal fibers originate between the tenth and the twelfth ribs, while the vertebral fibers arise from the **thoracolumbar fascia** and **vertebrae T7-**



**T12 and L1-L5.**

**Function of the latissimus dorsi muscle:**

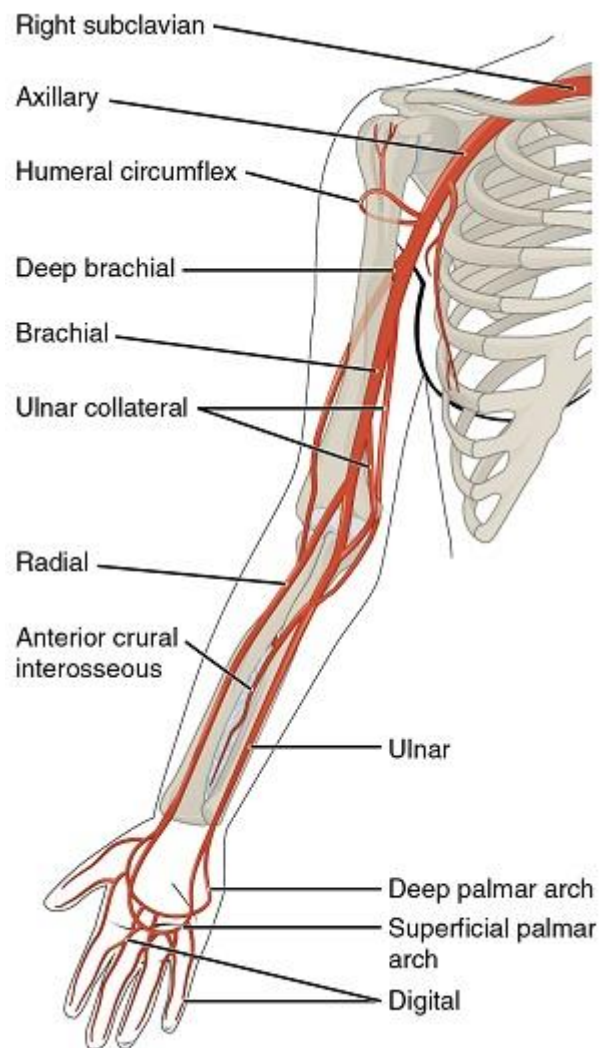
The Latissimus dorsi muscle performs extension, adduction and internal rotation of the arm.

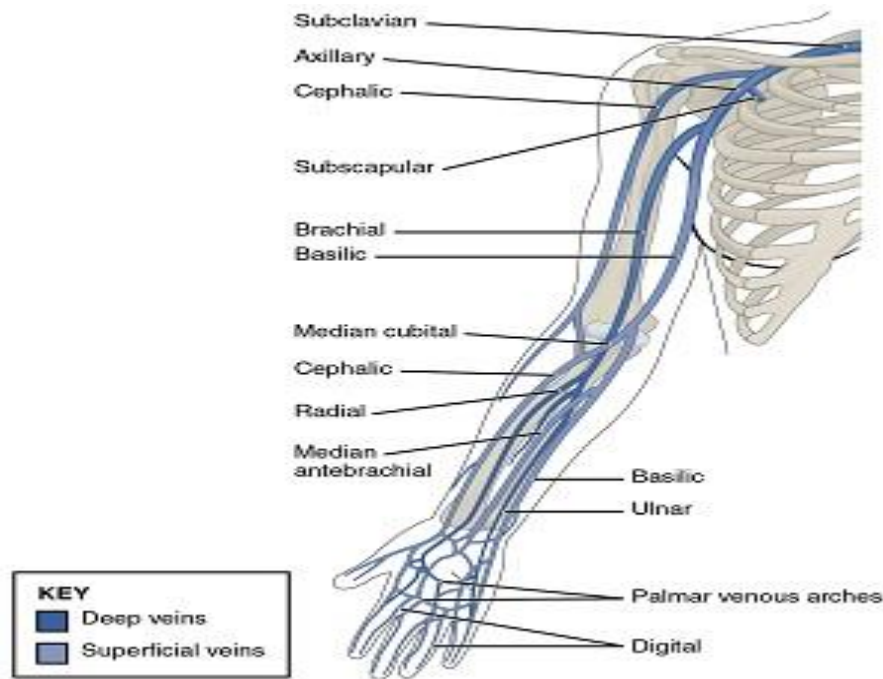
**Muscles of the Upper Arm:**

The upper arm muscles consist of ventral and dorsal muscle groups, each represented by only one muscle – **the biceps brachii muscle as a flexor and the triceps brachii muscle as an extensor.** Fascial Compartments of the Upper Arm .The upper arm is enclosed in a sheath of deep fascia. Two fascial septa, one on the medial side and one on the lateral side, extend from this sheath and are attached to the medial and lateral supracondylar ridges of the humerus, respectively. By this means, the upper arm is divided into an anterior and a posterior fascial compartment, each having its muscles, nerves, and arteries.

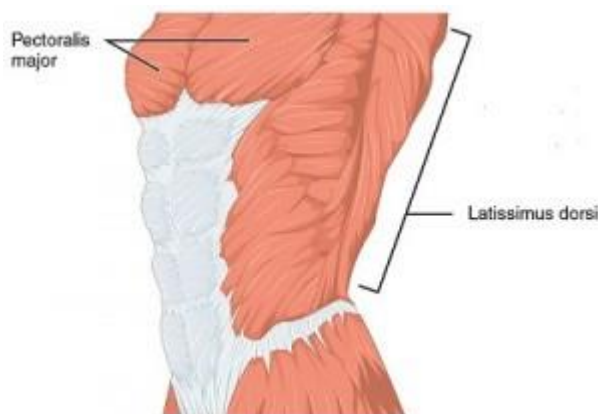
**Contents of the Anterior Fascial Compartment of the Upper Arm:**

- **Muscles:** Biceps brachii, coracobrachialis, and brachialis
- **Blood supply:** Brachial artery
- **Nerve supply to the muscles:** Musculocutaneous nerve
- **Structures passing through the compartment:** Musculocutaneous, median, and ulnar nerves; brachial artery and basilic vein. The radial nerve is present in the lower part of the compartment





#### - Biceps brachii muscle:



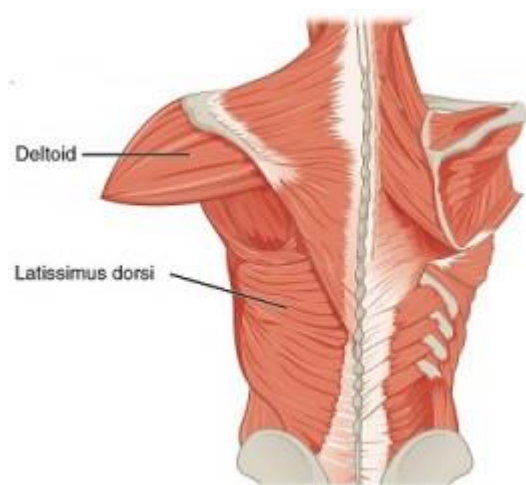
The **biceps brachii** is a bifurcated skeletal muscle with fibers of two different origins. Although the majority of the muscle mass is located anteriorly to the humerus, it has no attachment to the bone itself. The longer head arises from the **supraglenoid tubercle of the scapula**, while the shorter head arises from the **coracoid process of the scapula**. Both

heads join to form one large muscle the tendon of which inserts into the **radial tuberosity**. The muscle also inserts into the **antebrachial fascia** via the **bicipital aponeurosis**. It is innervated by the **musculocutaneous nerve (C5,6)**. Blood is supplied via the brachial artery. Both heads perform flexion and supination of the forearm at the elbow and flexion at the shoulder.

### Characteristics of the Biceps Brachii Muscle:

Both bifurcated heads of the Biceps converge near the insertion of the **deltoid muscle** at the **deltoid tuberosity**.

#### - Triceps brachii muscle:



The **triceps brachii** is a three-headed skeletal muscle with fibers of three different origins. The **long head** arises from the **infraglenoid tubercle of the scapula**. The **lateral head** arises from the **dorsal surface of the surgical neck of the humerus** up to the **deltoid tuberosity**, from the **lateral radial sulcus** and from the **lateral intermuscular septum**. The **medial head** arises from the **dorsal surface of the humerus**, from the **medial and distal radial sulcus** to the **olecranon fossa** and from the

**medial and lateral intermuscular septum.** All three heads converge toward their insertion onto **the olecranon process of the ulna** and are innervated by the **radial nerve (C6-C8)** Blood supply is done by branches of the deep brachial artery. Their primary function is the **extension** of the elbow.

### **Function of the triceps brachii muscle:**

The primary function of the triceps brachii muscle is the **extension** of the elbow. Along with its primary function, the long head of the triceps brachii is synergistic with the latissimus dorsi and teres major, which act as adductors and extensors of the arm at the shoulder joint. It is, however, also capable of the external rotation of the shoulder joint.

### **Arterial Anastomosis around the Shoulder Joint:**

The extreme mobility of the shoulder joint may result in kinking of the axillary artery and a temporary occlusion of its lumen. To compensate for this, an important arterial anastomosis exists between the branches of the subclavian artery and the axillary artery, thus ensuring that an adequate blood flow takes place into the upper limb irrespective of the position of the arm

Branches from the Subclavian Artery

- The suprascapular artery, which is distributed to the supraspinous and infraspinous fossae of the scapula
- The superficial cervical artery, which gives off a deep branch that runs down the medial border of the scapula

Branches from the Axillary Artery

- The subscapular artery and its circumflex scapular branch supply the subscapular and infraspinous fossae

of the scapula, respectively.

- The anterior circumflex humeral artery
- The posterior circumflex humeral artery

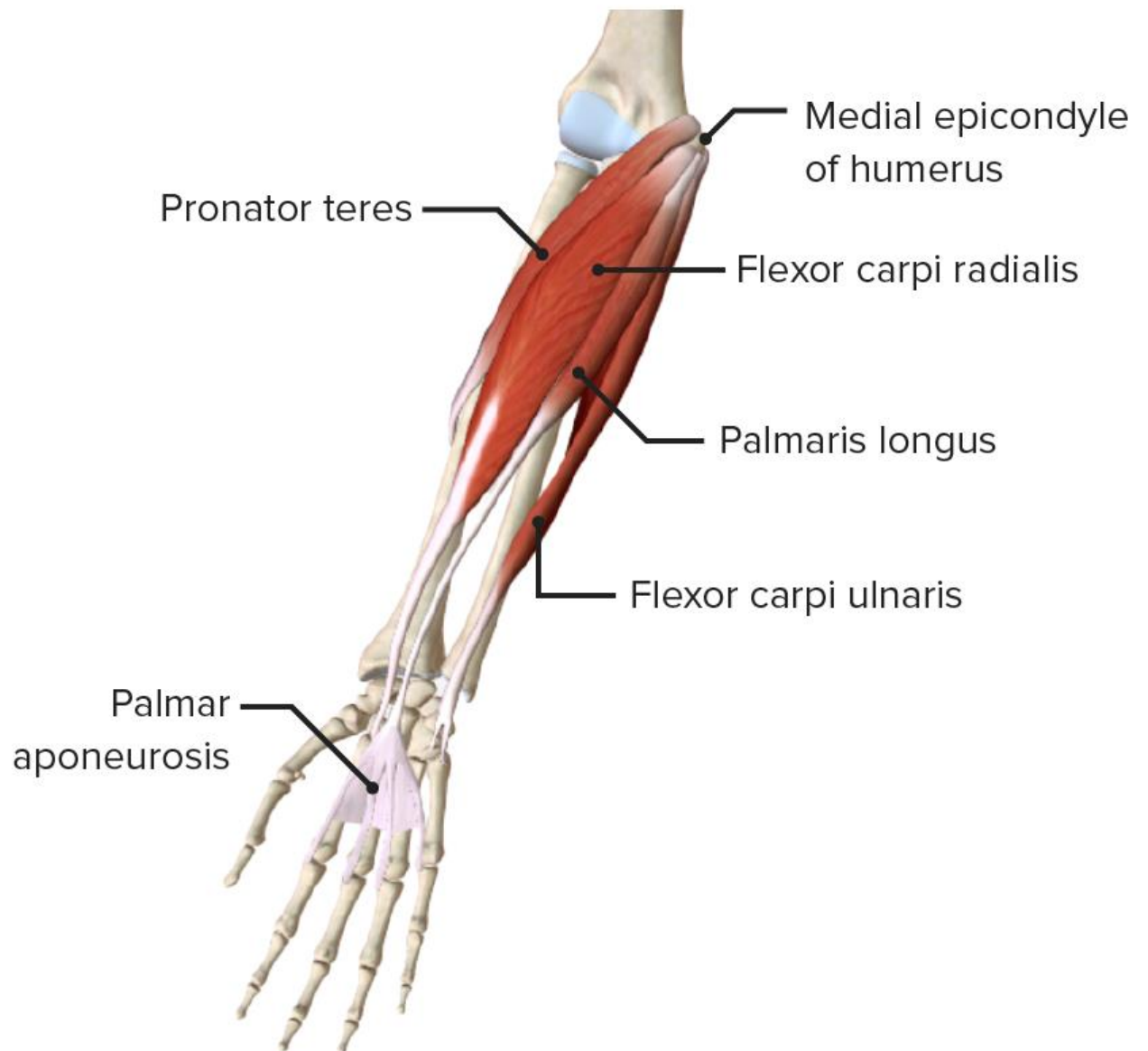
### **Forearm:**

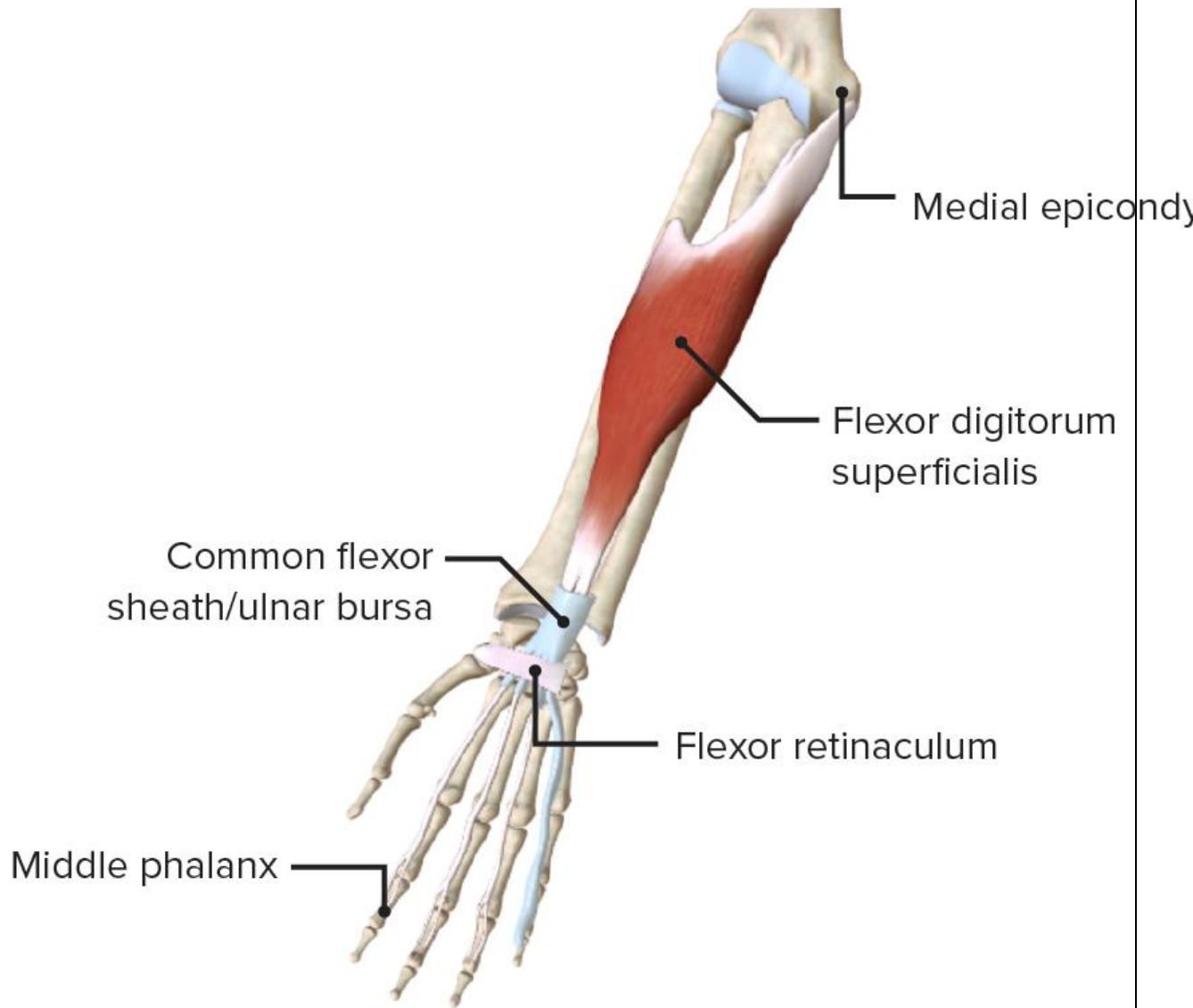
The forearm is the region of the upper limb between the elbow and the wrist. The term “forearm” is used in anatomy to distinguish this area from the arm, a term that is commonly used to describe the entire upper limb. The forearm consists of 2 long bones (the radius and the ulna), the interosseous membrane, and multiple arteries, nerves, and muscles. The muscles are grouped into 2 compartments: anterior and posterior. The function of these muscles is flexion and extension of the wrist and fingers, while also contributing to flexion of the elbow.

### **Muscles of the Anterior Compartment of the Forearm:**

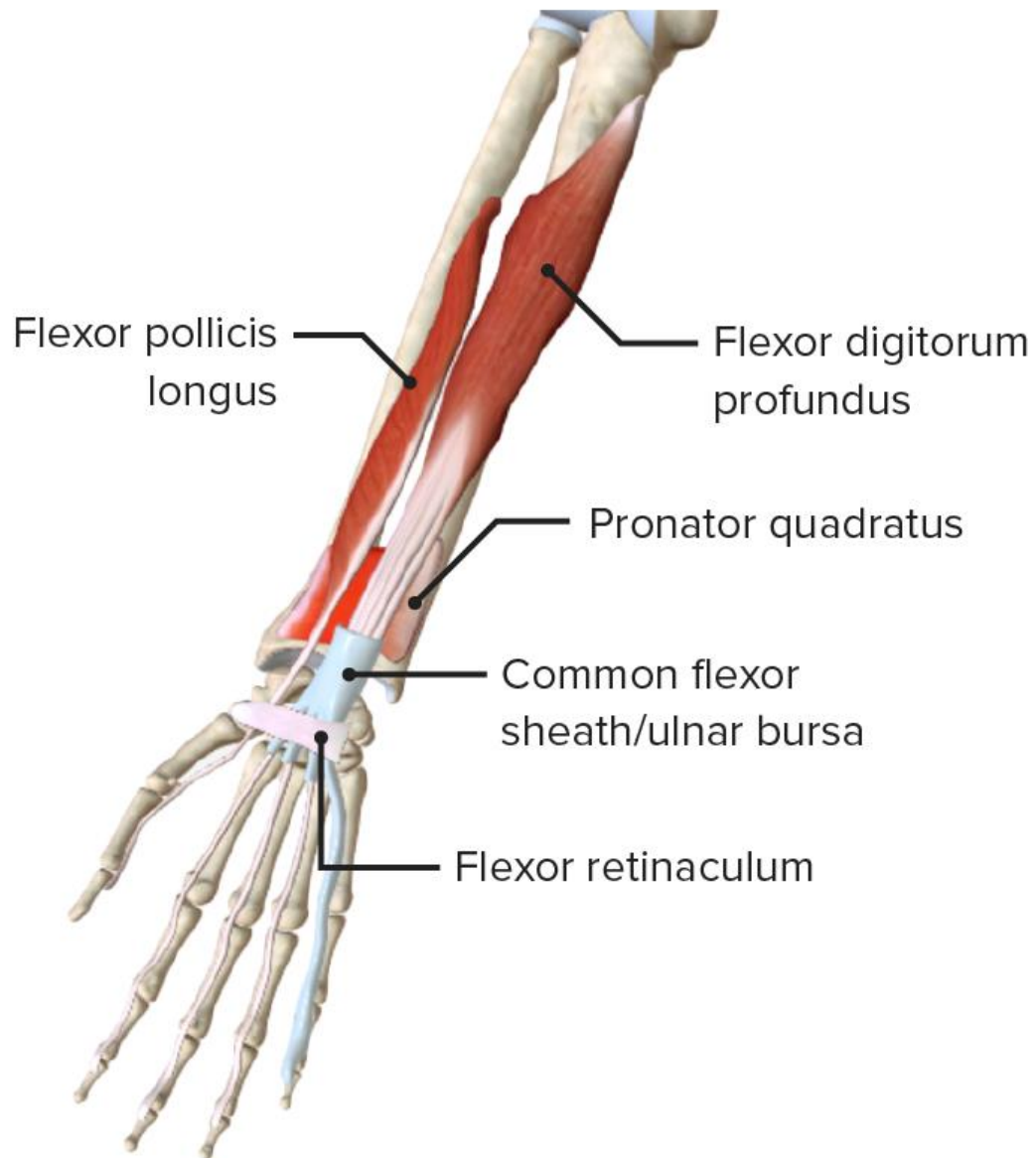
The muscles of the anterior compartment of the forearm are often separated into superficial, intermediate, and deep layers.

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## Muscles of the Posterior Compartment of the Forearm:

The muscles of the posterior compartment of the forearm are separated into superficial and deep layers

Deep layer

Muscle	Origin	Insertion	Innervation	Function
<b>Abductor pollicis longus</b>	Posterior surface of radius and ulna and interosseous membrane	Metacarpal of 1st digit	Posterior interosseous nerve (C8) from deep radial nerve	<ul style="list-style-type: none"> <li>• Extends wrist</li> <li>• Abducts thumb and extends it at carpometacarpal joint</li> </ul>
<b>Extensor pollicis longus</b>	Posterior surface of ulna and interosseous membrane	Dorsal surface of distal phalanx of 1st digit		<ul style="list-style-type: none"> <li>• Extends wrist</li> <li>• Extends distal (extensor pollicis longus)</li> </ul>

Muscle	Origin	Insertion	Innervation	Function
<b>Extensor pollicis brevis</b>	Posterior surface of radius and interosseous membrane	Dorsal surface of proximal phalanx of 1st digit		(EPL)/proximal (extensor pollicis brevis (EPB)) phalanx of thumb at interphalangeal joint <ul style="list-style-type: none"> <li>Extends metacarpophalangeal and carpometacarpal joints</li> </ul>
<b>Supinator</b>	Lateral epicondyle of humerus, supinator fossa, and proximal ulna	Posterior/lateral/anterior surfaces of proximal radius	Deep branch of radial nerve (C8)	Supination of forearm

Muscle	Origin	Insertion	Innervation	Function
<b>Extensor indicis</b>	Posterior surface of ulna and interosseous membrane	Extensor expansion of 2nd digit	Posterior interosseous nerve (C8) from deep radial nerve	<ul style="list-style-type: none"> <li>• Extends wrist</li> <li>• Extends 2nd digit (independent)</li> </ul>

## Vessels of the Forearm

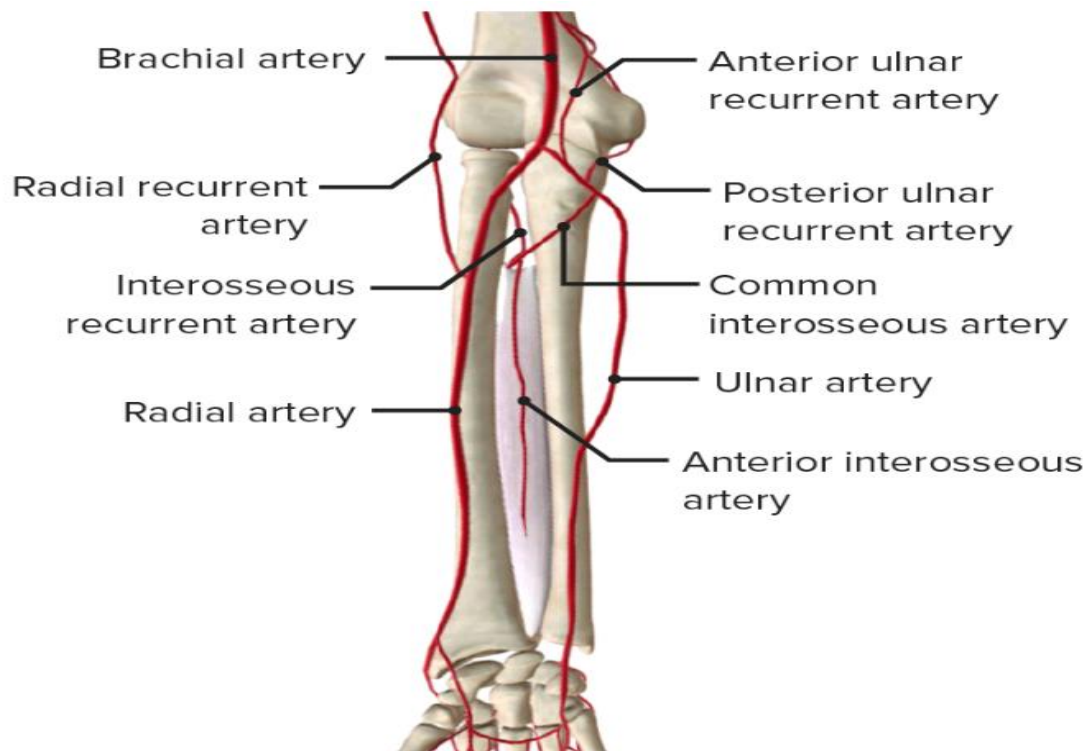
### Arteries

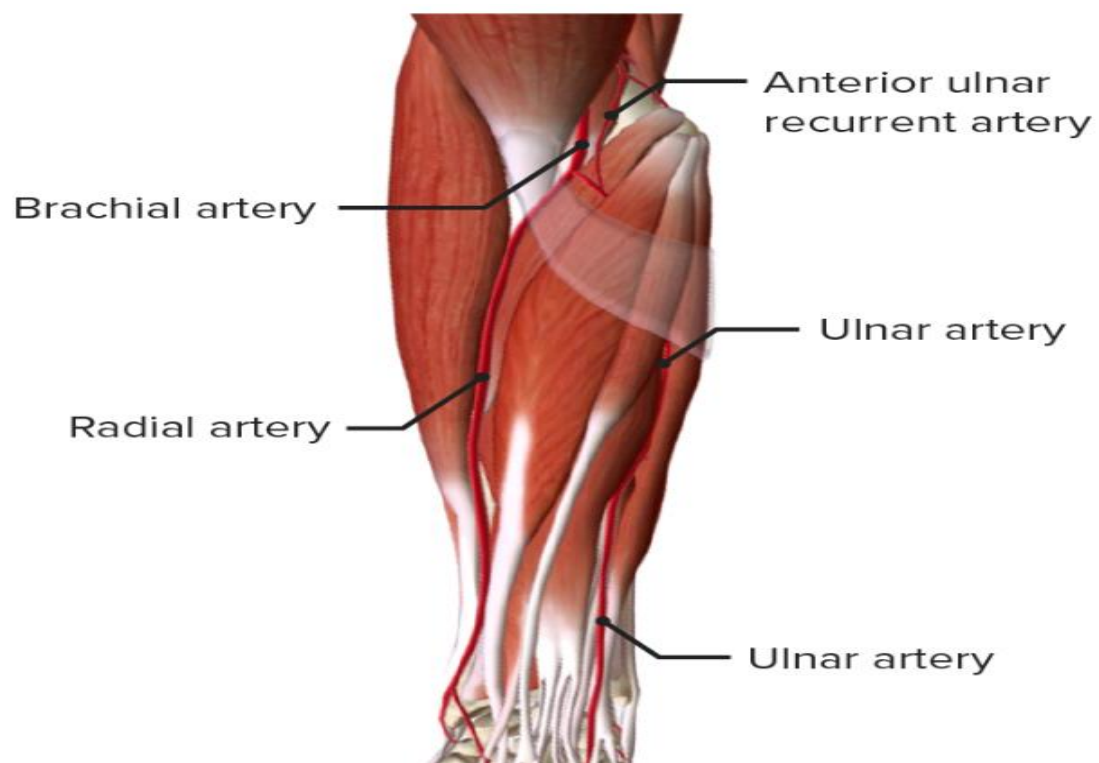
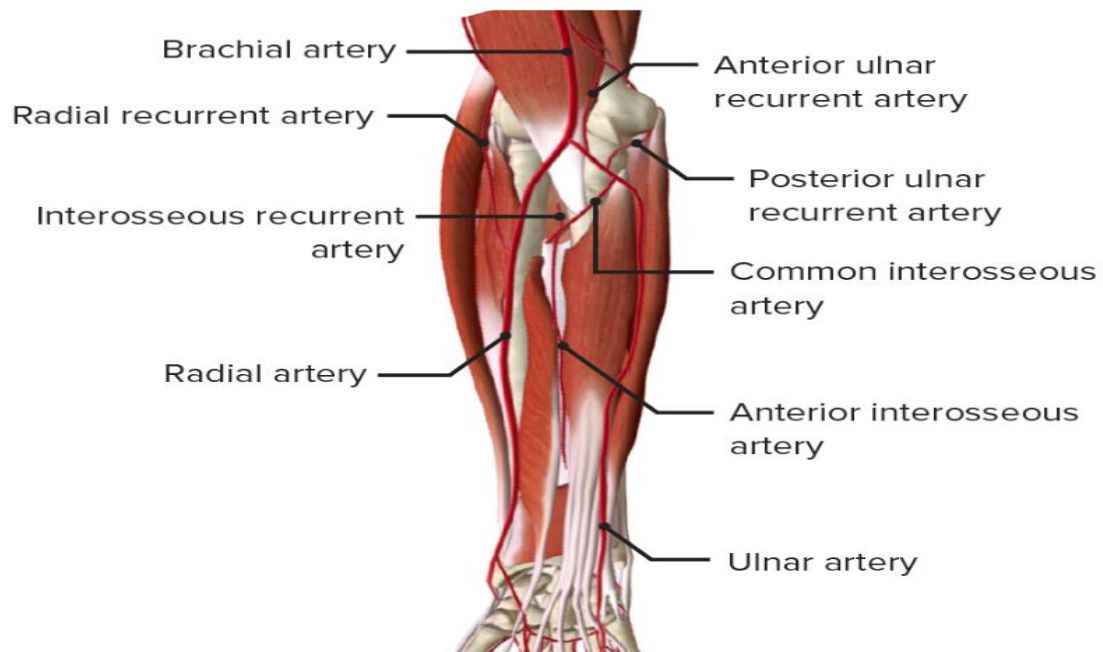
The 2 main arteries of the forearm, the radial and ulnar arteries, are branches of the brachial artery. These 2 arteries join in the hand, forming an anastomosis, the superficial and deep palmar arteries.

- **Radial artery**
  - Supplies the posterior lateral forearm
  - Gives off important branches and contributions:
    - Radial recurrent artery: anastomoses around the elbow
    - Palmar carpal branch: supplies the carpal bones
    - Contributes to the superficial and deep palmar arches of the hand

- **Ulnar artery**

- Supplies the anterior medial forearm and interosseous membrane
- Gives off important branches and contributions:
  - Ulnar recurrent artery: anastomoses around the elbow
  - Common interosseous artery: gives off anterior and posterior interosseous arteries
  - Dorsal and palmar carpal branches: supply the carpal bones
  - Contributes to the superficial and deep palmar arches of the hand





## Veins

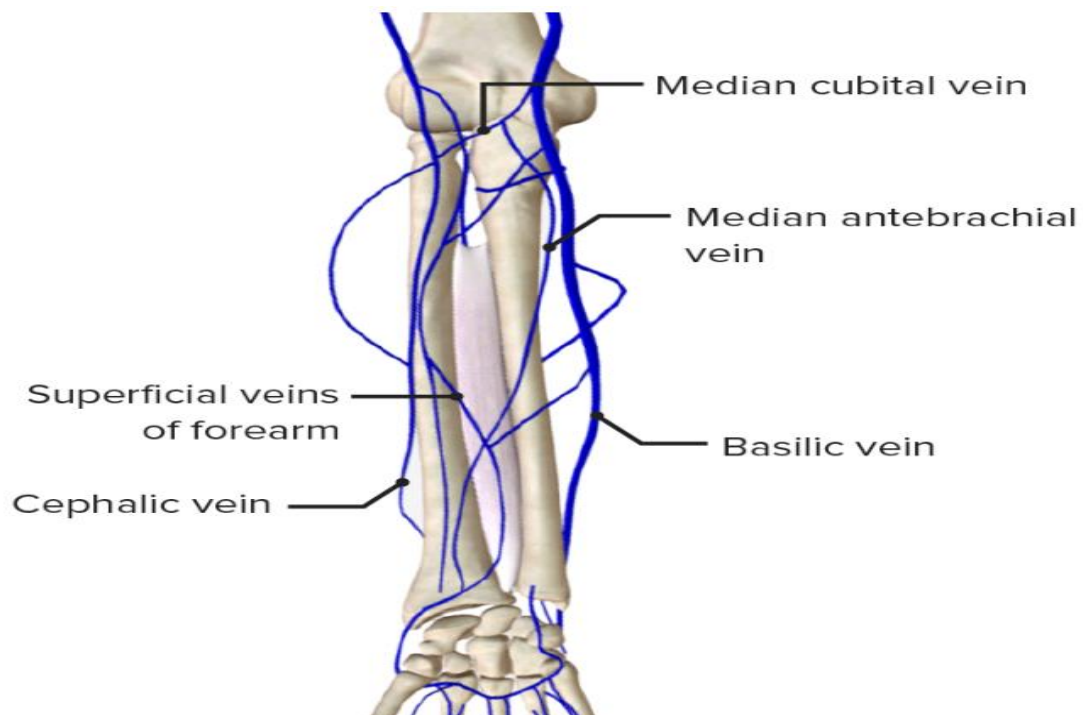
The veins of the forearm are divided into superficial and deep:

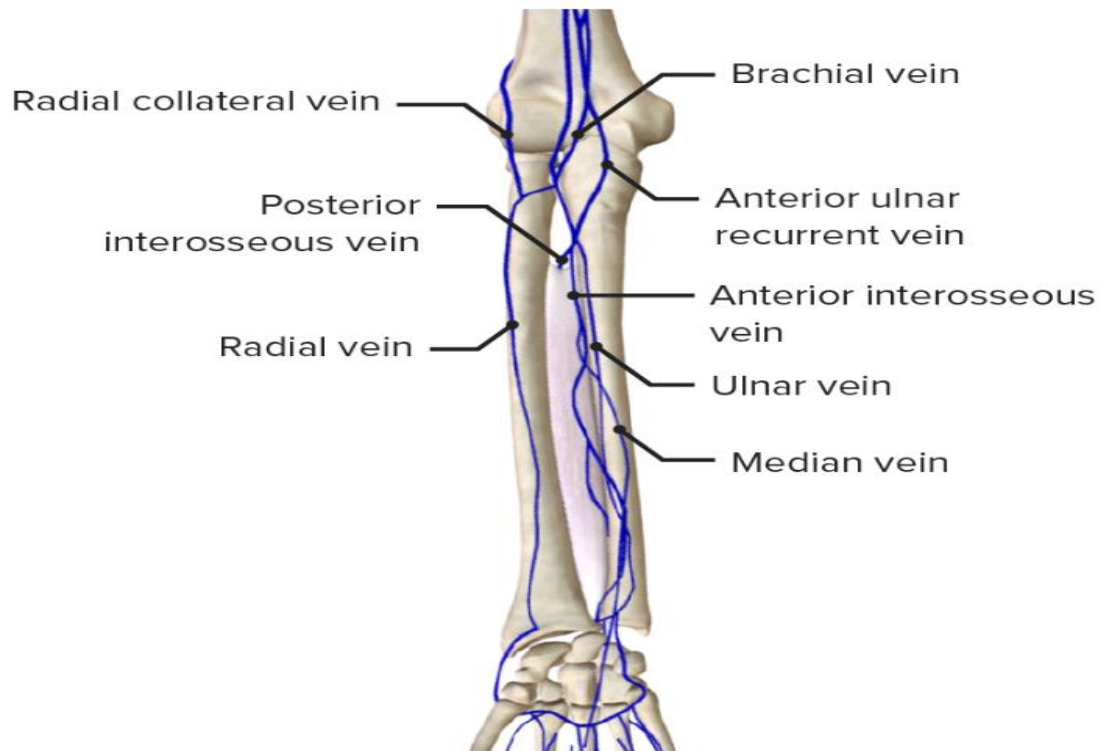
- **Superficial veins**

- Cephalic: lateral forearm, connected to basilic via the median cubital vein
- Basilic: medial forearm, connects with the median cubital vein and median antebrachial vein
- Median antebrachial vein: within subcutaneous tissue, most commonly terminates in the median cubital vein

- **Deep veins**

- Radial and ulnar: communicate with superficial veins via perforator veins, joined by transverse branches





### Innervation of the Forearm

The median, ulnar, and radial nerves pass through the forearm and innervate the muscles of both the anterior and posterior compartments.

The 3 main motor nerves of the forearm innervate the following muscles:

- **Median:** all muscles of the anterior or flexor compartment of the forearm (except for the 2 muscles supplied by the ulnar nerve)
- **Ulnar:** flexor carpi ulnaris and medial half of the flexor digitorum profundus in the anterior or flexor compartment
- **Radial:** all muscles of the posterior or extensor compartment of the forearm



There are 3 main sensory nerves of the forearm:

- **Lateral antebrachial cutaneous nerve** (from the musculocutaneous nerve): innervates the skin over the lateral arm
- **Medial antebrachial cutaneous nerve** (from the medial cord of the brachial plexus): innervates the skin over the medial forearm
- **Inferior or posterior lateral cutaneous nerve** (from the radial nerve): innervates the skin over the posterior arm

