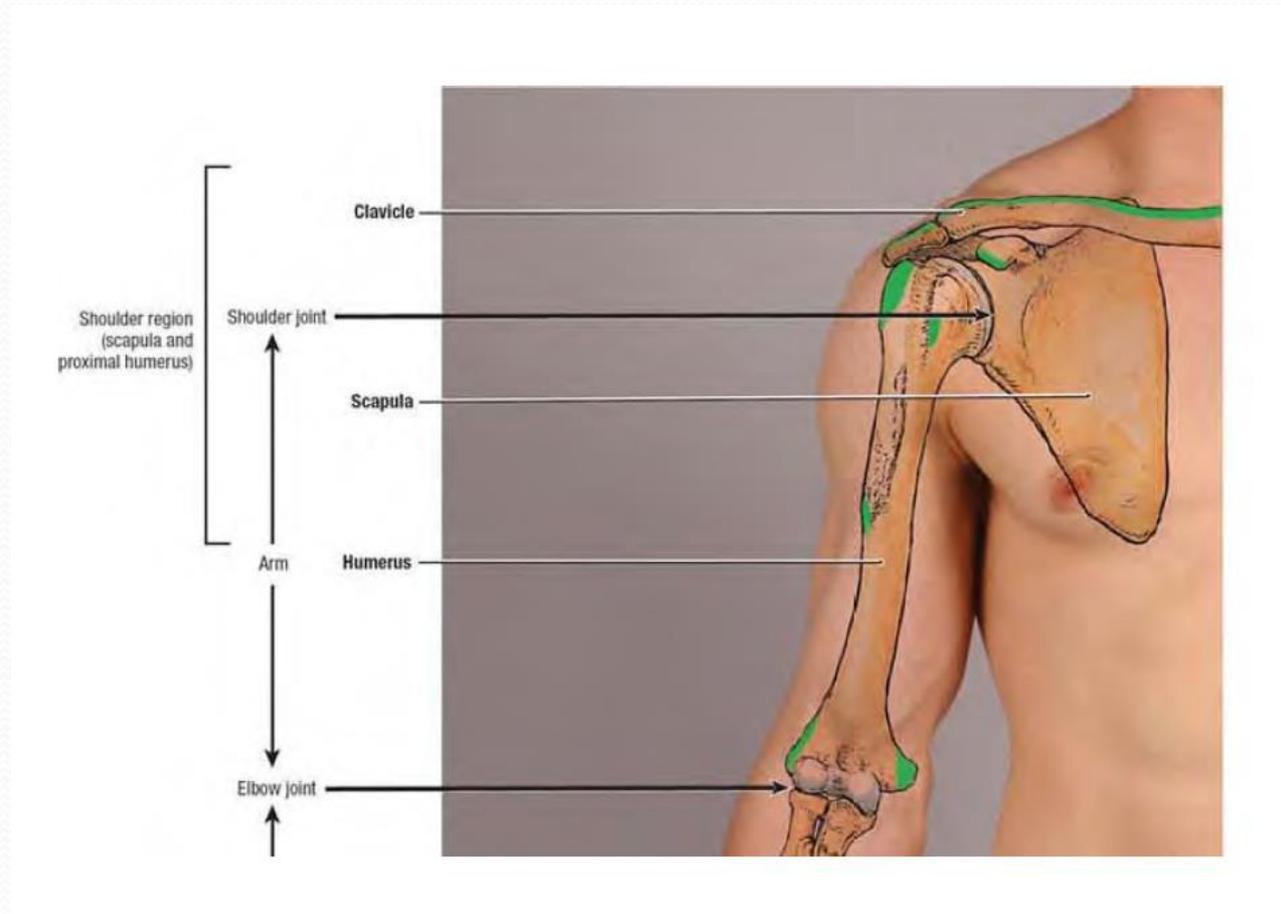


Bones of the Shoulder Girdle and Arm

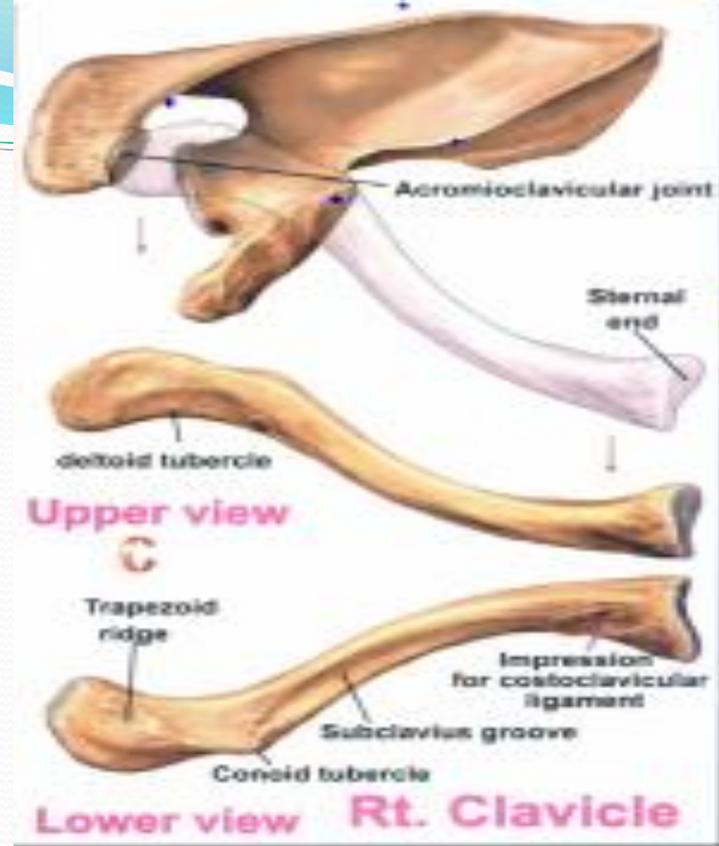


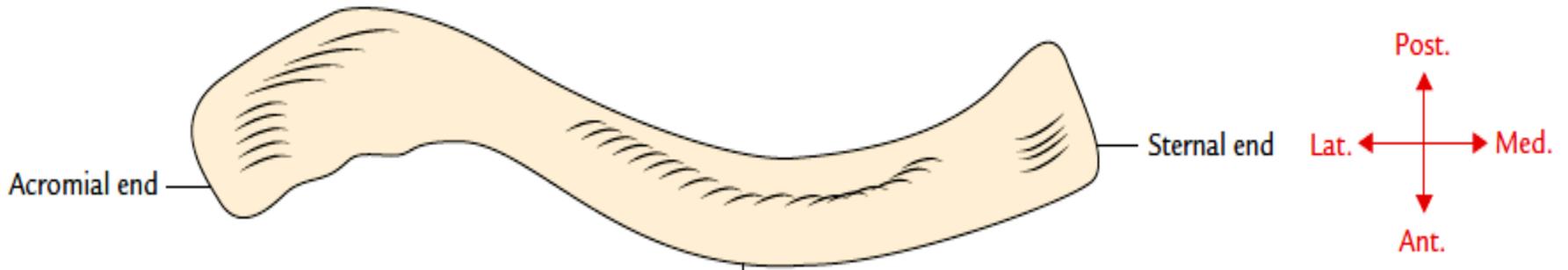
CLAVICLE

- The clavicle is a long, slender bone that lies horizontally across the root of the neck just beneath the skin.
- It articulates with the sternum and first costal cartilage medially and with the acromion process of the scapula laterally .
- The medial two thirds of the clavicle is convex forward and its lateral third is concave forward.

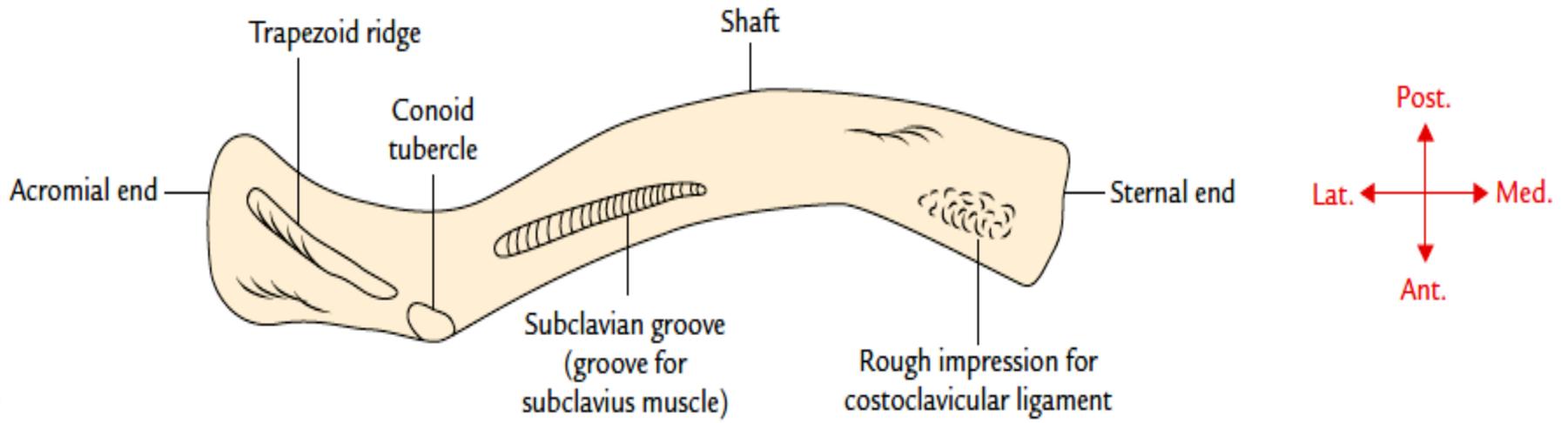
- The Clavicle (the collar bone)
- Site: It lies transversely at the root of the neck forming the anterior bone of the shoulder girdle .
- Is atypical long bone, as it is the only long bone which:
 - 1- Lies transversely in the body. Can be felt all through subcutaneously.
 - 2- Has no medullary cavity (the best design for force transmission).
 - 3- First bone to ossify by membranous ossification .
 - 4- The commonest bone to be fractured.

- **General features:** It has two ends and a shaft.
- A- Medial (sternal) end:
 - - Is large and prism-shaped.
 - - It articulates with manubrium sterni & 1st costal cartilage at the sternoclavicular joint.
- B- Lateral (acromial) end: It is flat, and articulates with the medial margin of acromion at acromioclavicular joint.
- c- The shaft: is divided into 2 parts:
 - a) The medial 2/3: It is cylindrical and convex forwards forming a room for passage of large vessels & nerves.
 - It has:
 - Anterior surface: Convex forwards.
 - Posterior surface: Concave backwards.
 - Superior surface: Is smooth.
 - Inferior surface: Has subclavius groove, costoclavicular tubercle & nutrient foramen.
 - b) The lateral 1/3: It is flat and concave forwards.
 - It has:
 - Anterior border: Concave forwards, it has deltoid tubercle.
 - Posterior border: convex backwards.
 - Superior surface: Smooth.
 - Inferior surface: Has conoid tubercle and trapezoid ridge (line)





A



B

Functions of the clavicle

- 1- It transmits weight of the limb to axial skeleton.
- 2- It protects vessels and nerves.
- 3- It carries UL away from the trunk to swing freely.
- How to determine the side:

We put the clavicle in anatomical position:

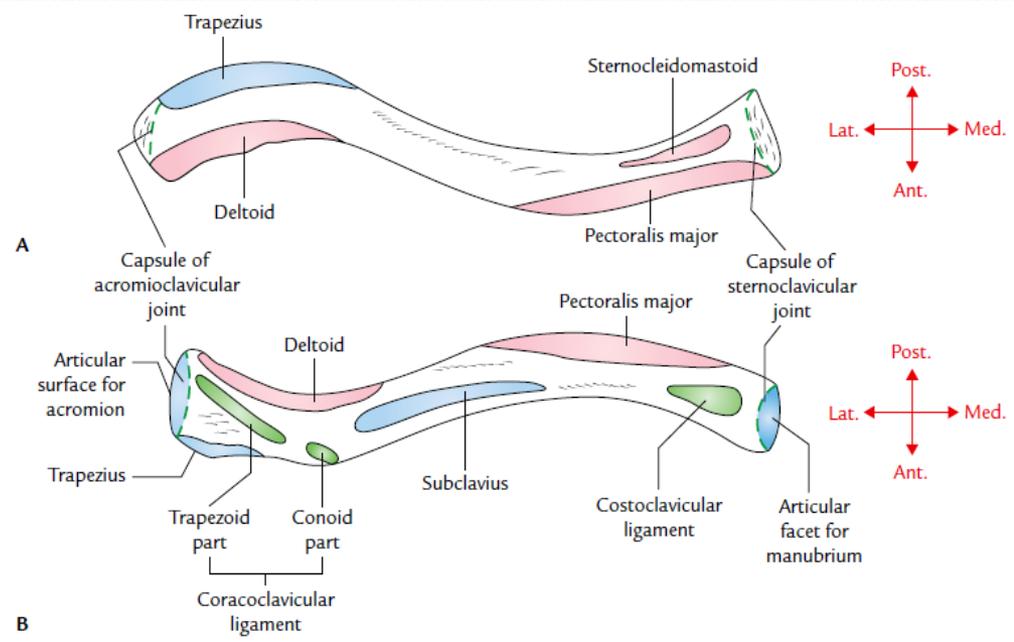
- Medial end is thick. - Lateral end is flat.
- Upper surface is smooth.
- Lower surface is rough.
- Medial 2/3 is convex anteriorly.
- Conoid tubercle is posterior

Applied anatomy :

- - The clavicle is the commonest bone to be fractured in the body.
- - The most common cause of fracture is indirect force as falling on outstretched hand.
- - The site of fracture is the junction of medial 2/3 & lateral 1/3: of the shaft. It is the weakest point as:
 - * It is a junction between 2 curvatures.
 - * It is a junction between 2 different cross sections.
 - * It is weakened by subclavius groove & nutrient foramen.
- - If fracture is medial to the coracoclavicular ligament, it is accompanied by drawing of the lateral fractured fragment downwards, the upper limb falls down.

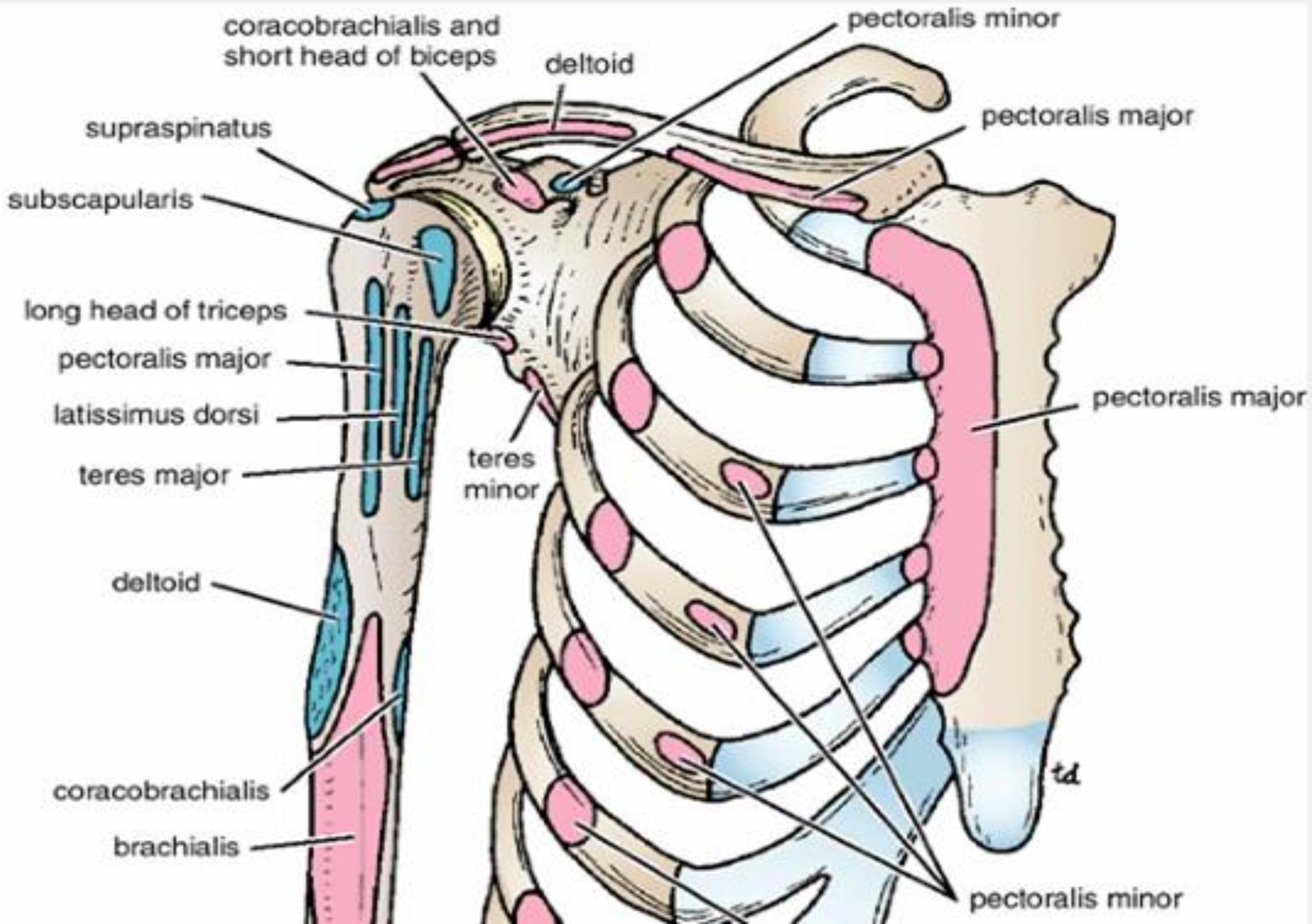
Muscular and ligamentous attachments

- **Three muscles take origin from the clavicle :**
 1. **Sternocleidomastoid;** from the superior surface medially.
 2. **Pectoralis major;** from the medial ½ of the shaft.
 3. **Deltoid;** from the lateral part of the shaft.



- **Two muscles are inserted:**
 1. **Trapezius;** to the posterior border laterally.
 2. **Subclavius;** to the inferior surface medially.

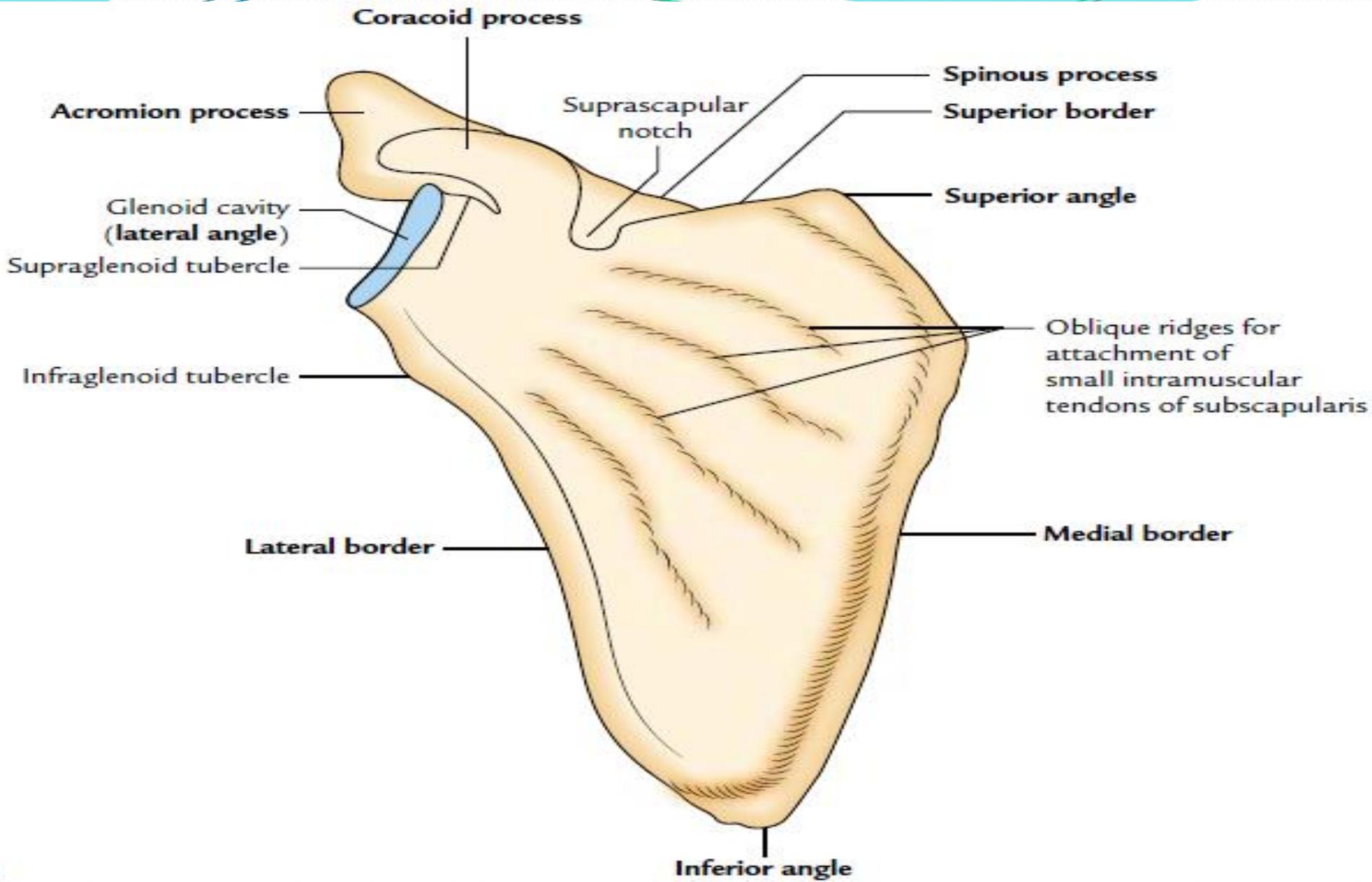
- **Two ligaments attach to the clavicle :**
 1. The **costoclavicular ligament** from the first costal cartilage.
 2. The **coracoclavicular ligament** consists of 2 parts;
 - The **trapezoid part** attaches to the inferior surface laterally .
 - The **conoid part** attaches to the **conoid tubercle**.

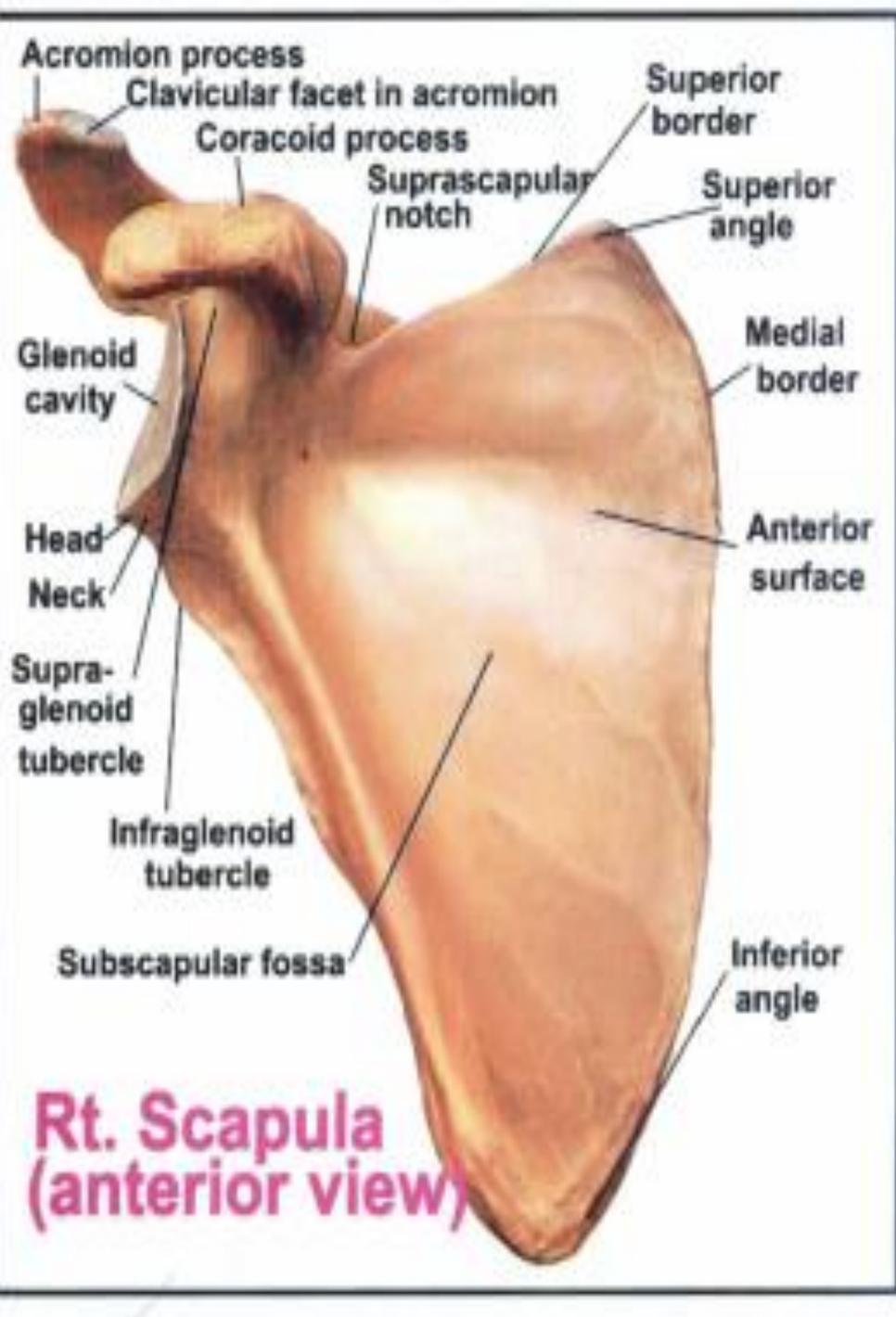
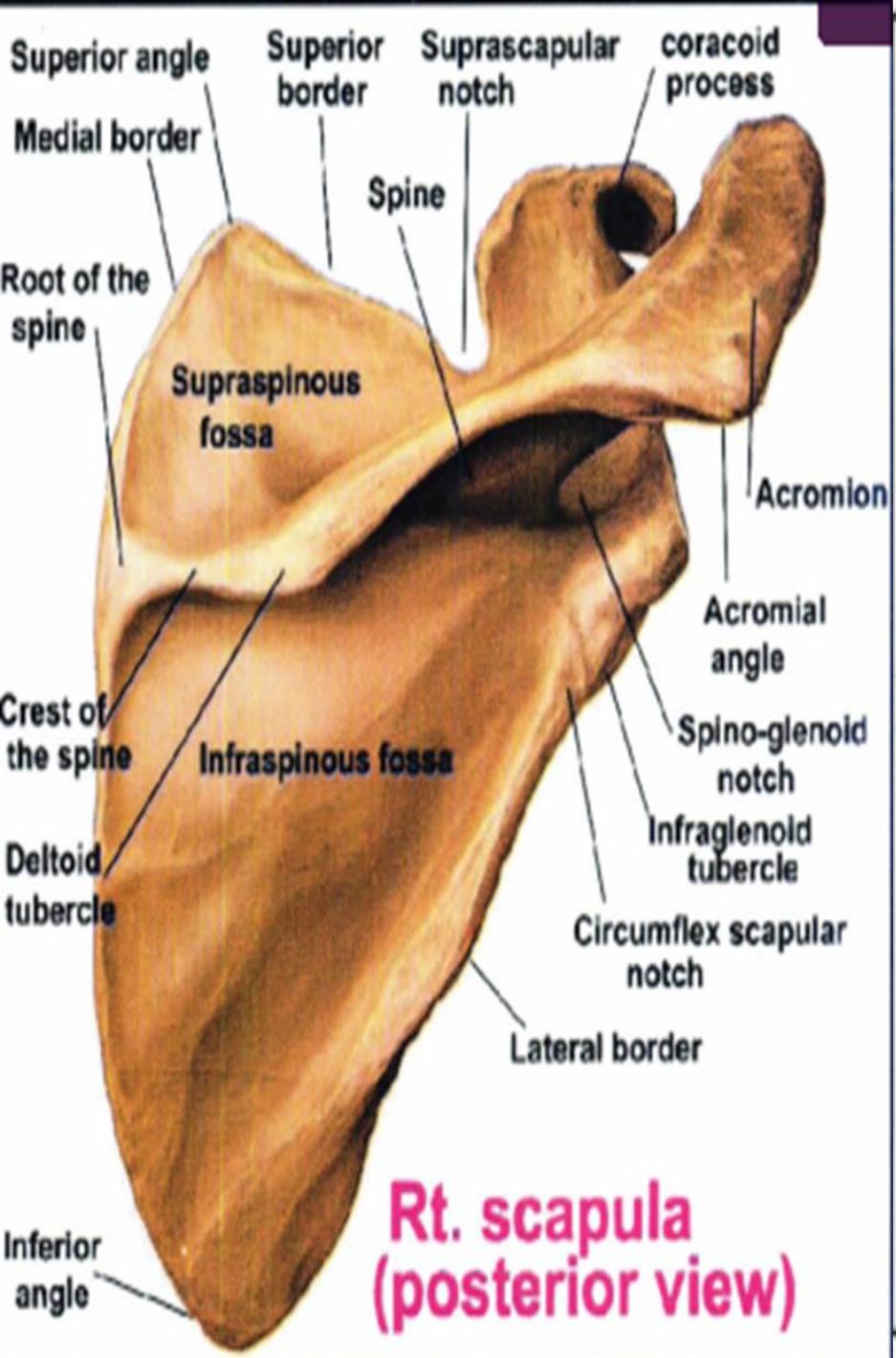


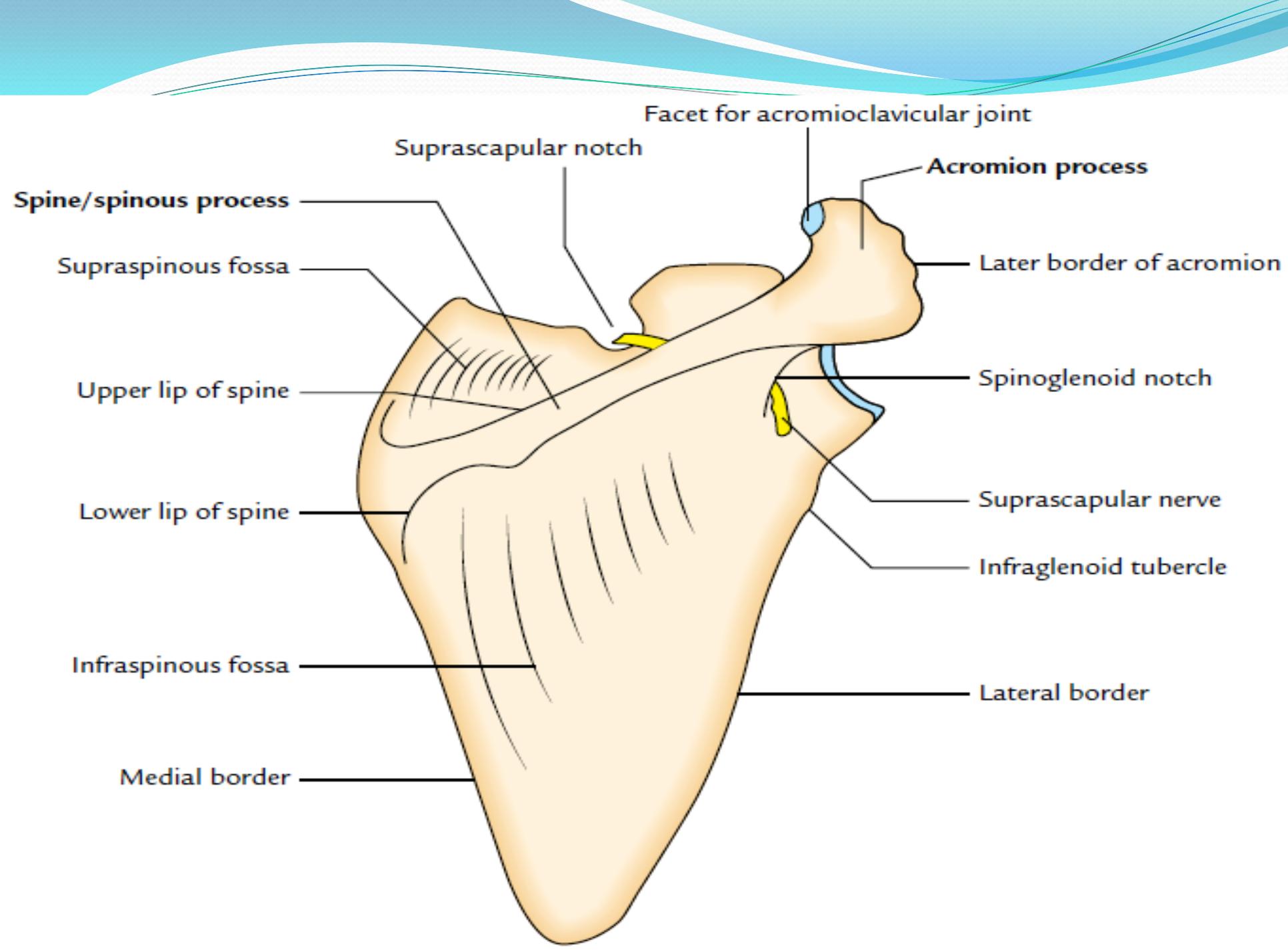
Scapula

- The scapula is a **flat triangular** bone that lies on the **posterior** chest wall between the **2nd** and **7th** ribs. Scapula consist of :
 - 2 surface(anterior or costal surface) directed forward medially and (posterior or dorsal surface) directed backward laterally
 - 3 border(sharp and short upper border), thin medial or vertebral border) and (thick lateral border)
 - 3 angle[Superior angle opposite(2nd rib or 2nd thoracic spine), (inferior angle opposite(7th rib or 7th intercostal space) and lateral angle
 - 3 fossae(supscapular, supraspinatus and infraspinatus)fossae
 - 3 bony process (spine ,coracoid and acromion)process
 - 3 notches(suprascapular, spinoglenoid and circumflex scapular notch
 - 3 tubercle(supraglenoid tubercle, infraglenoid tubercle and deltoid tubercle

- On its posterior surface, the **spine** of the scapula projects backward. The lateral end of the spine is free and forms the **acromion process**, which articulates with the clavicle at the **acromioclavicular** joint.
- The superolateral angle of the scapula forms **glenoid cavity**, which articulates with the head of the humerus at the **shoulder** joint.
- The **coracoid** process projects upward and forward above the glenoid cavity and provides attachment for muscles and ligaments.
- Medial to the base of coracoid process is the **suprascapular** notch.
- The **anterior** surface of the scapula is **concave** and forms the shallow **subscapular** fossa.
- The **posterior** surface of the scapula is divided by the spine into the **supraspinous** fossa above and an **infraspinous** fossa below







Muscular and ligamentous attachments

- **Muscles inserted into scapula (from trunk to medial border)**

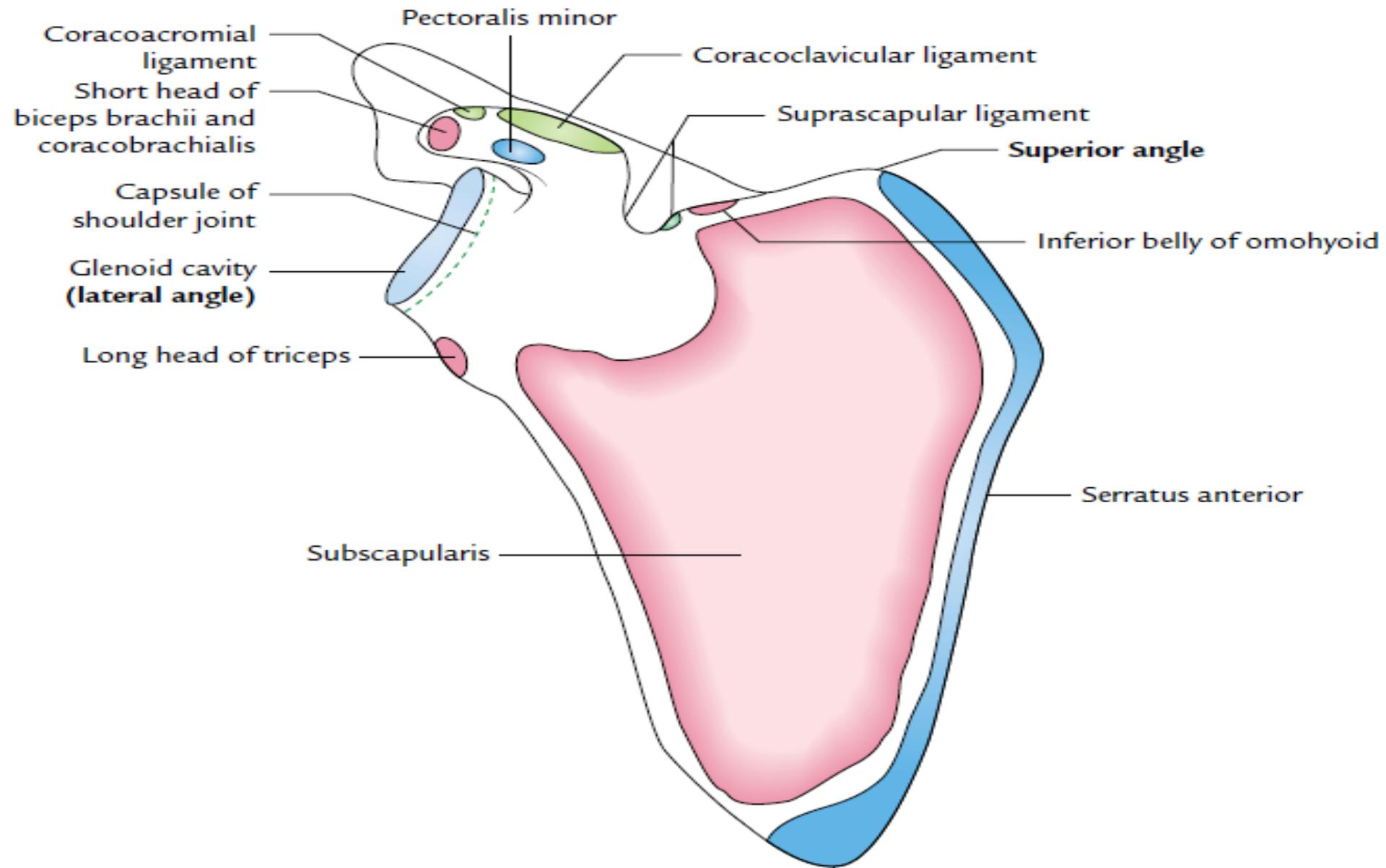
- Serratus anterior.**
- Levator scapulae.**
- Rhomboid minor.**
- Rhomboid major.**
- Trapezius.**
- Pectoralis minor.**
- Latissimus dorsi.**

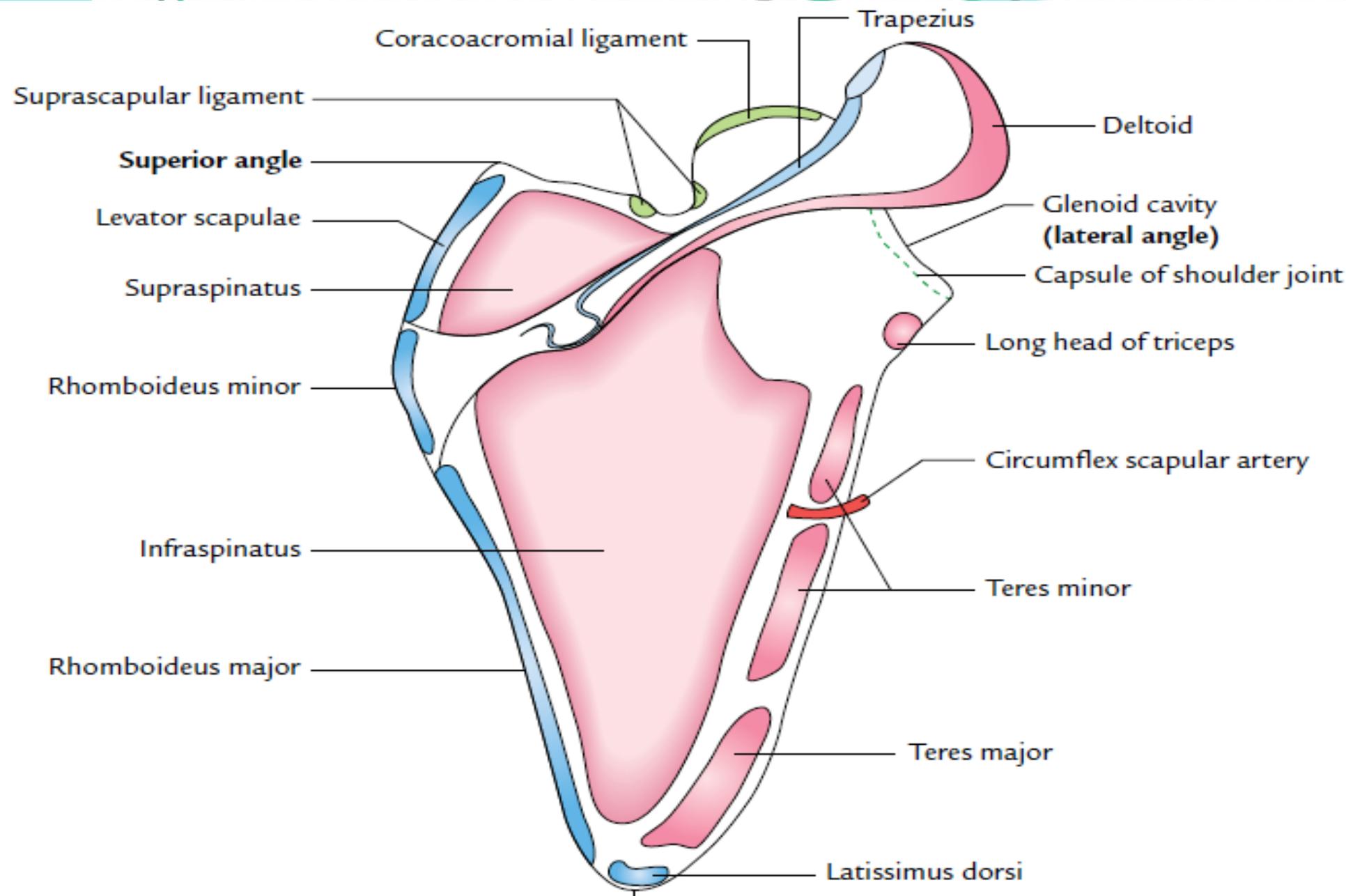
- **Muscles origin from scapula (surfaces and lateral border)**

- Subscapularis.**
- Supraspinatus.**
- Infraspinatus.**
- Teres minor.** **Teres major.**
- Long & Short head of biceps.**
- Long head of triceps.** **Deltoid.**
- Coracobrachialis.** **Omohyoid.**

- **Ligaments attached to the scapula include;**

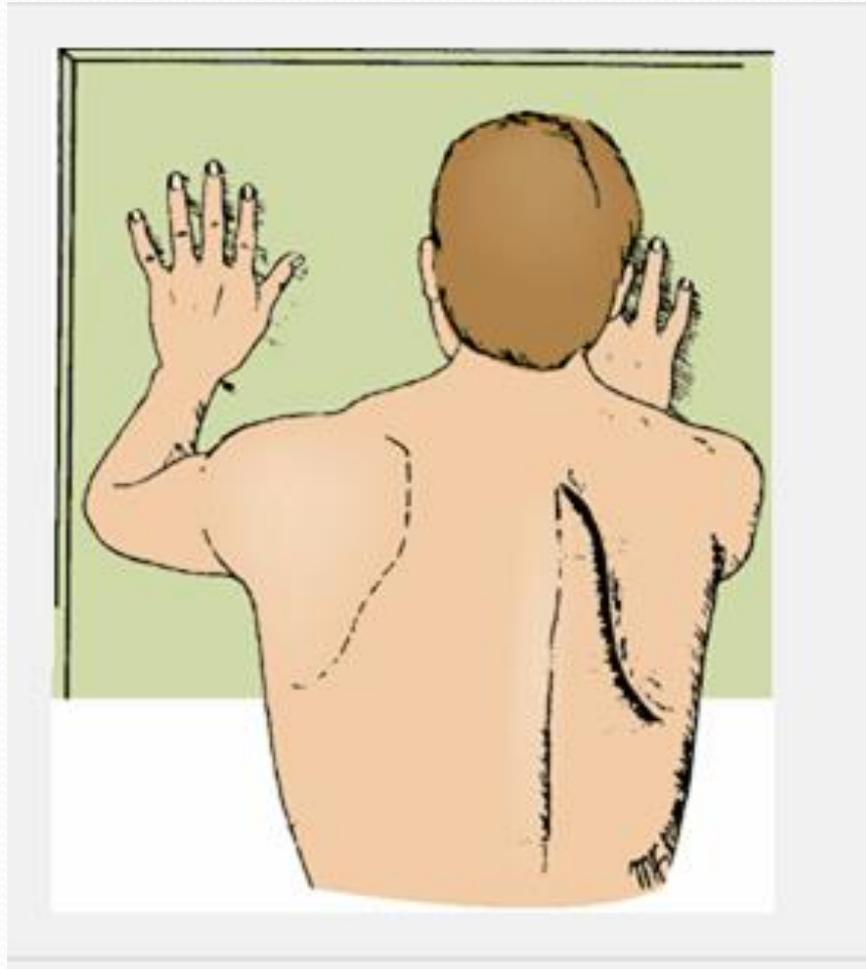
- Coracoclavicular ligament; from coracoid process to the clavicle.**
- Glenohumeral ligaments.**
- Coracohumeral ligament.**
- Coracoacromial ligament; between coracoid process and acromion.**





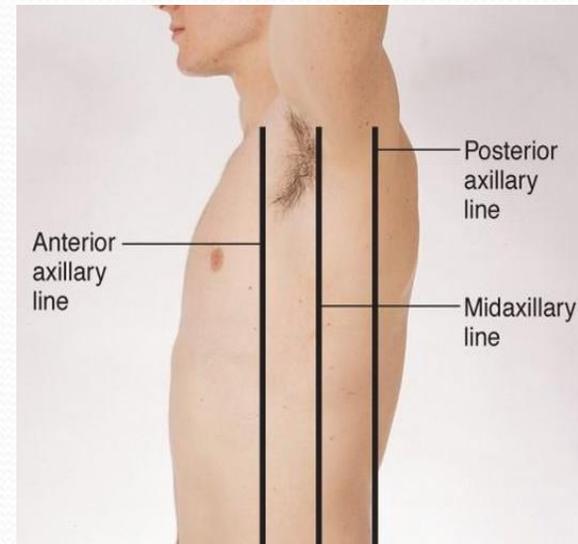
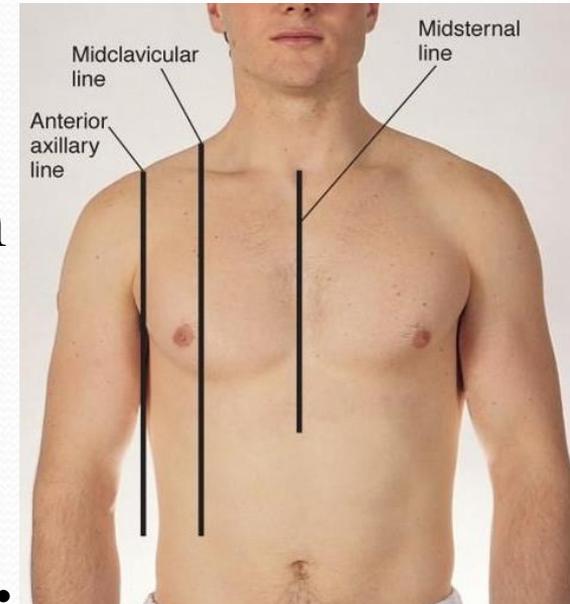
Clinical Notes

- **Fractures of the Scapula**
- Fractures of the scapula are usually the result of severe trauma, such as occurs in run-over accident victims or in occupants of automobiles involved in crashes. Injuries are usually associated with fractured ribs. Most fractures of the scapula require **little treatment** because the muscles on the anterior and posterior surfaces adequately splint the fragments.
- **Dropped Shoulder and Winged Scapula**
- The position of the scapula on the posterior wall of the thorax is maintained by the tone and balance of the muscles attached to it. If one of these muscles is paralyzed, the balance is upset, as in dropped shoulder, which occurs with paralysis of the **trapezius**, or winged scapula, caused by paralysis of the **serratus anterior**. Such imbalance can be detected by careful physical examination.



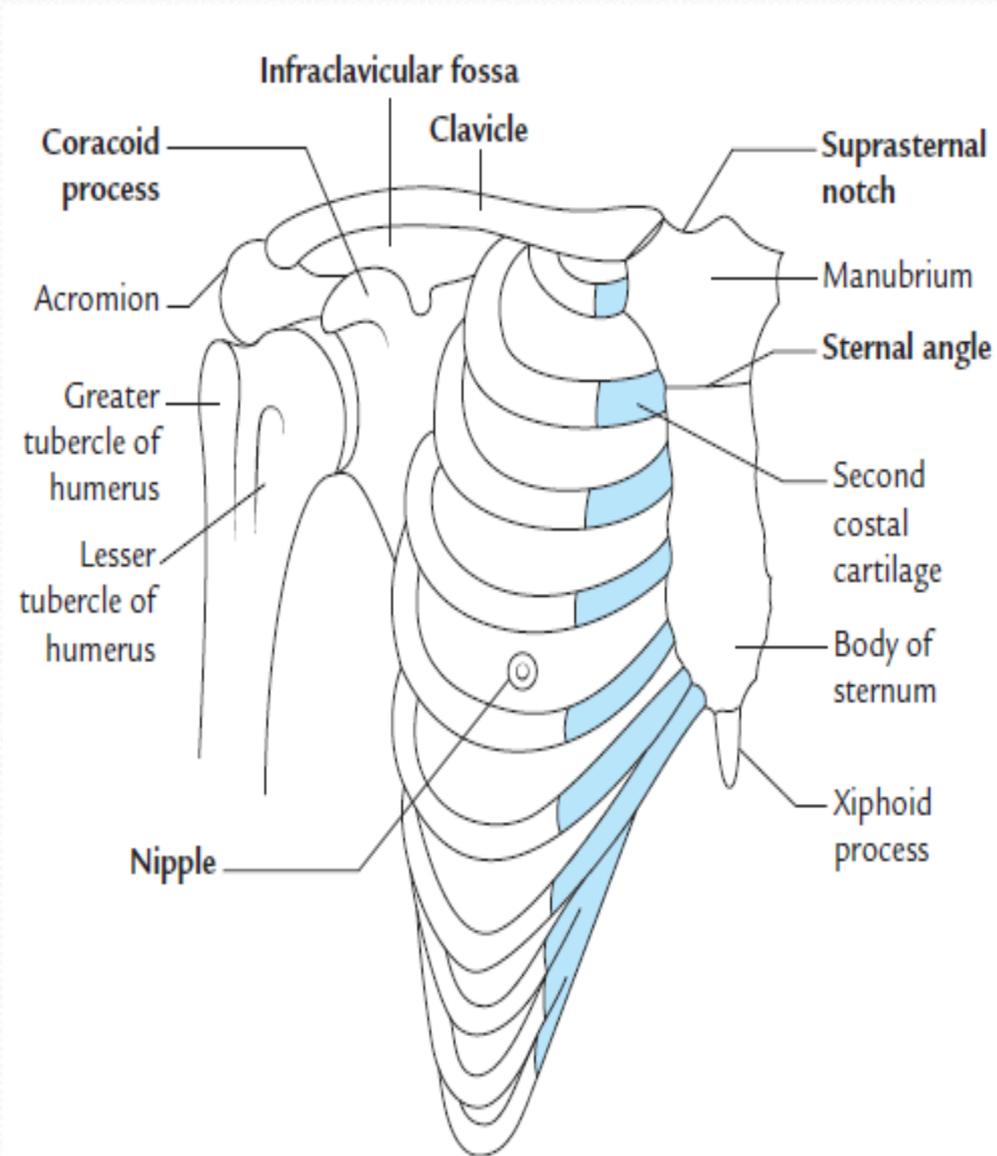
The following (imaginary) lines are used to describe surface anatomy of the pectoral region & axilla

- 1. Midsternal line** runs vertically in the median plane on the front of the sternum.
- 2. Midclavicular line** runs vertically from the midpoint of the clavicle to the midinguinal point.
- 3. Anterior axillary line** runs vertically downwards from the anterior axillary fold.
- 4. Posterior axillary line** runs vertically downwards from the posterior axillary fold.
- 5. Midaxillary line** runs vertically downwards midway between the anterior and posterior axillary folds.



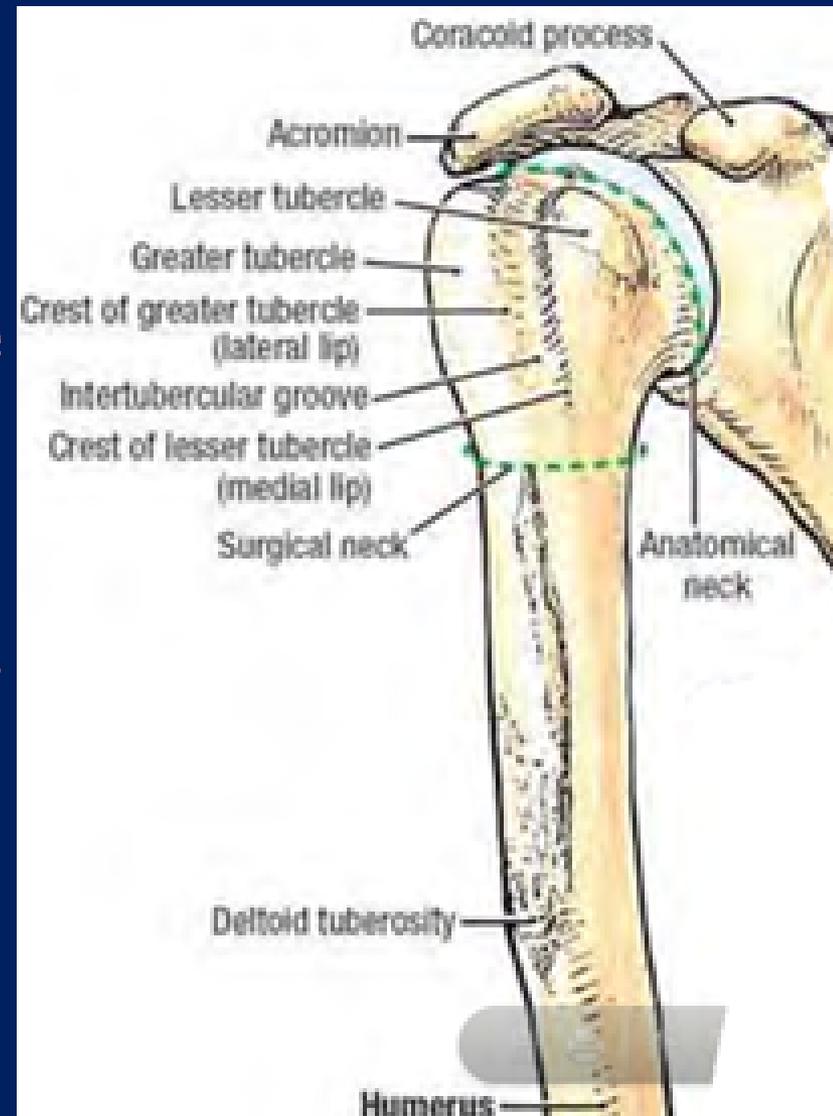
The following landmarks can be felt on the surface of the body in the pectoral region

1. **Clavicle** is palpable.
2. **Suprasternal notch** (jugular notch).
3. **Infraclavicular fossa** is a triangular depression below the junction of middle and lateral third of the clavicle.
4. **Coracoid process:** The tip of coracoid process is felt in the infraclavicular fossa, 2.5 cm below clavicle.
5. **The acromion.**
6. **Nipple.**

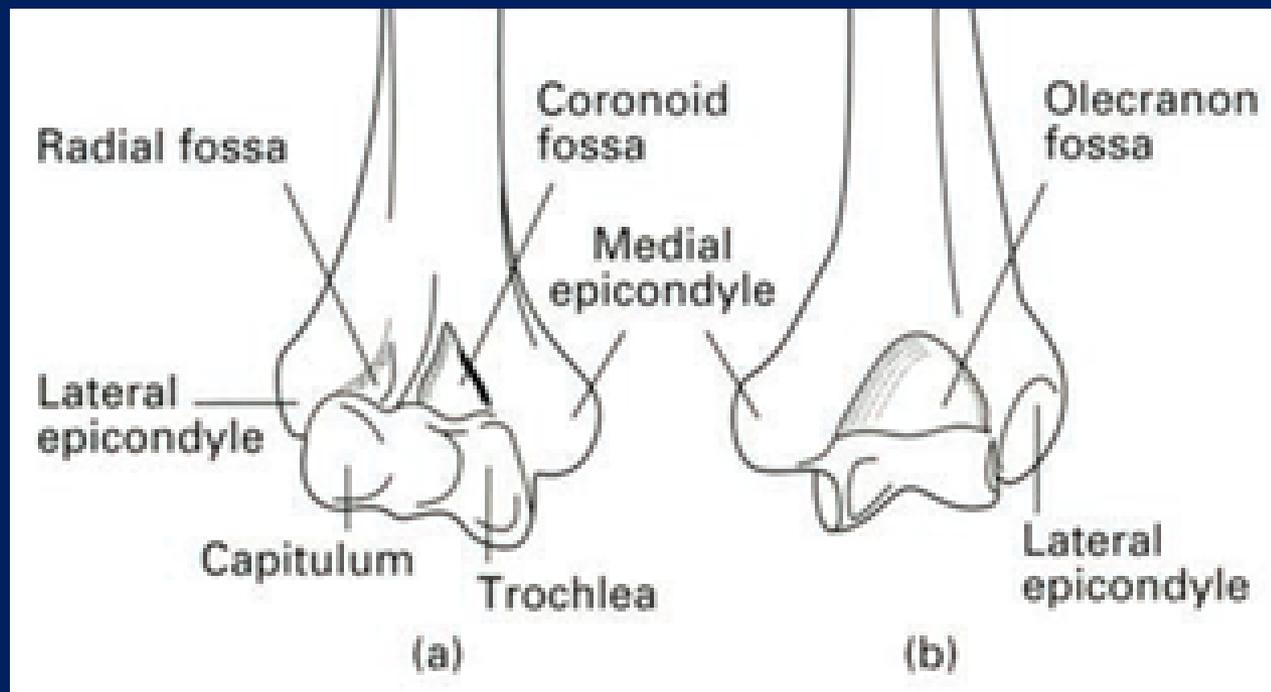


Humerus

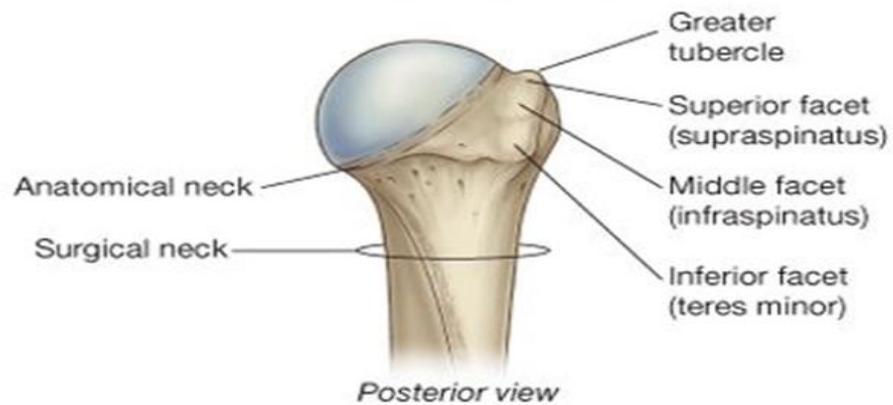
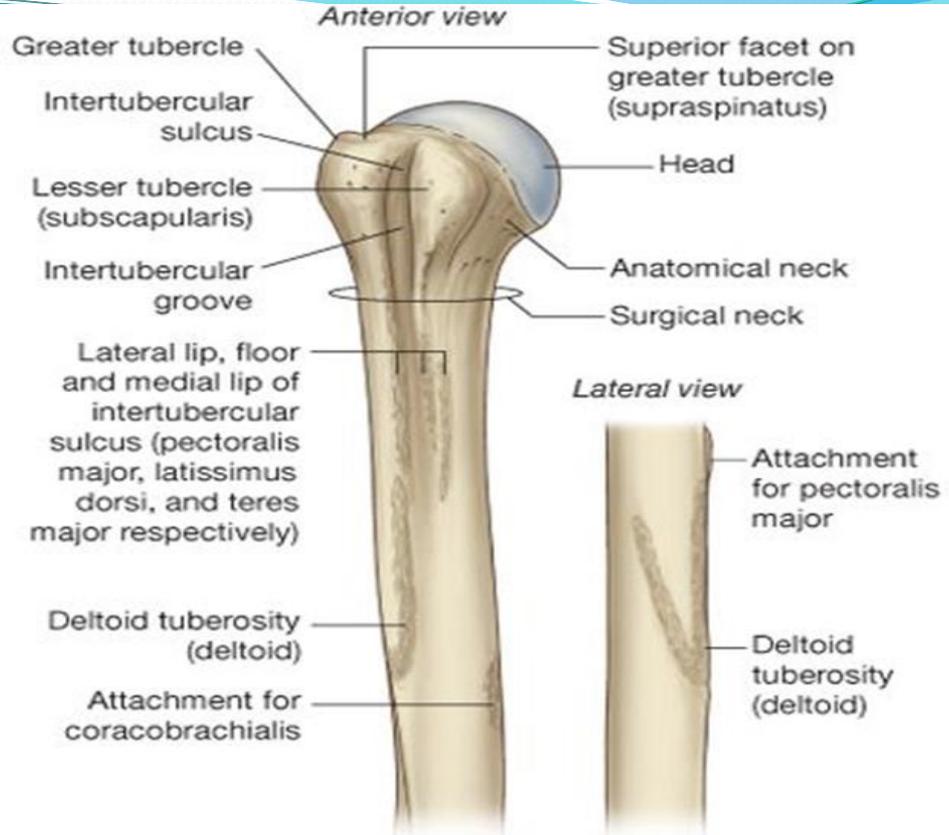
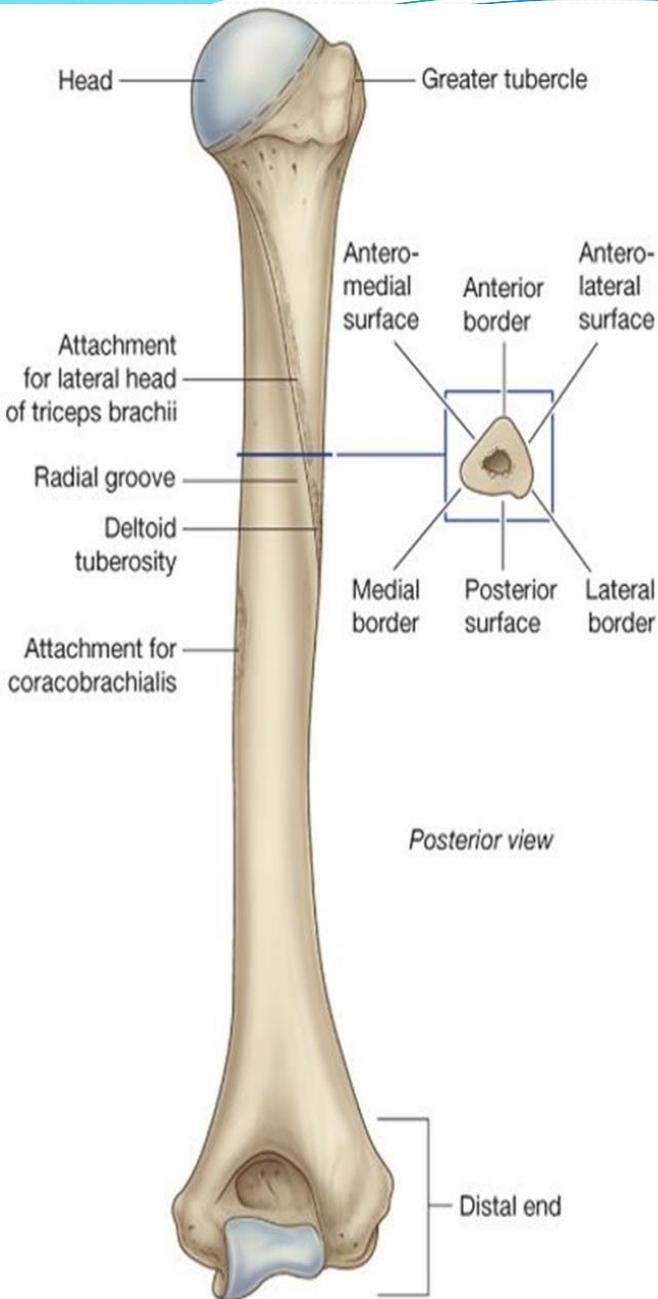
- ❑ The **humerus** articulates with the **scapula** at the **shoulder joint** and with the **radius** and **ulna** at the **elbow joint**.
- ❑ The upper end (**proximal end**) of the humerus has a head articulates with the glenoid cavity of the scapula.
- ❑ Immediately below the head is the **anatomic neck**.
- ❑ Below the neck are the **greater** and **lesser** tuberosities, separated from each other by the **bicipital groove**.
- ❑ (**shaft**) About halfway down the lateral aspect of the shaft is a roughened elevation called the **deltoid tuberosity**. Behind and below the tuberosity is a **spiral groove**, which accommodates the radial nerve .

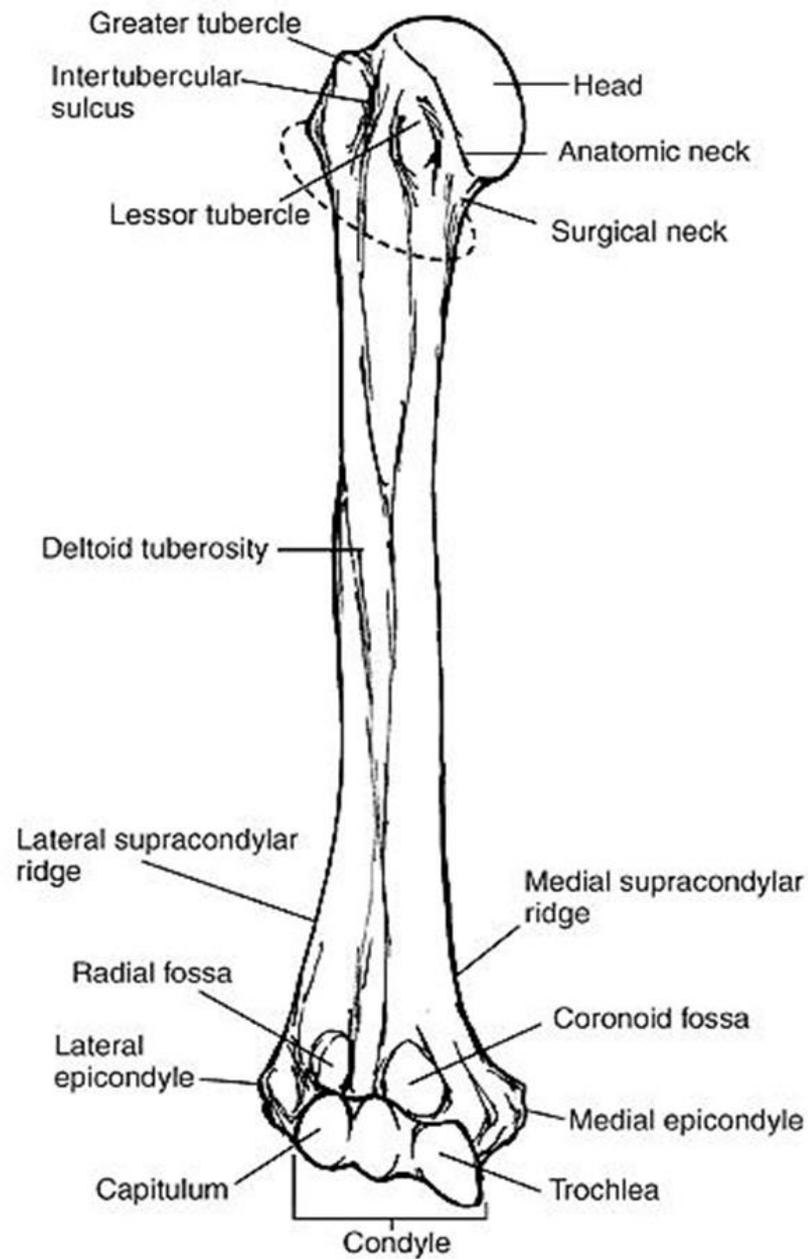


□ The lower end (distal end) of the humerus the **medial** and **lateral** epicondyles for the attachment of muscles and ligaments, the rounded **capitulum** for articulation with the head of **radius**,

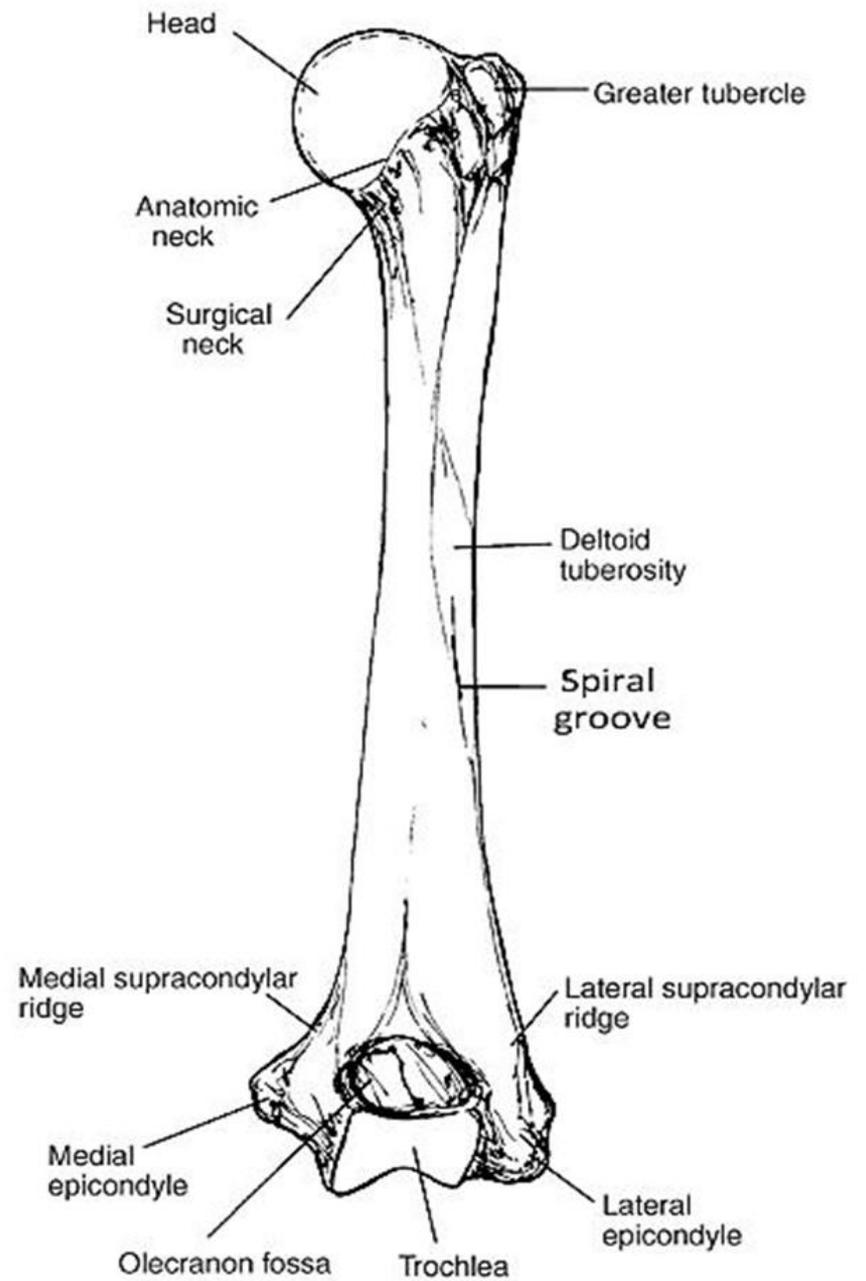


and the pulley-shaped **trochlea** for articulation with the **trochlear notch** of the **ulna**. Above the capitulum is the **radial fossa**, which receives the head of the **radius** when the elbow is flexed. Above the trochlea anteriorly is the **coronoid fossa**, which during the same movement receives the **coronoid** process of the **ulna**. Above the trochlea posteriorly is the **olecranon fossa**, which receives the **olecranon** process of the **ulna** when the elbow joint is extended.





Anterior



Posterior

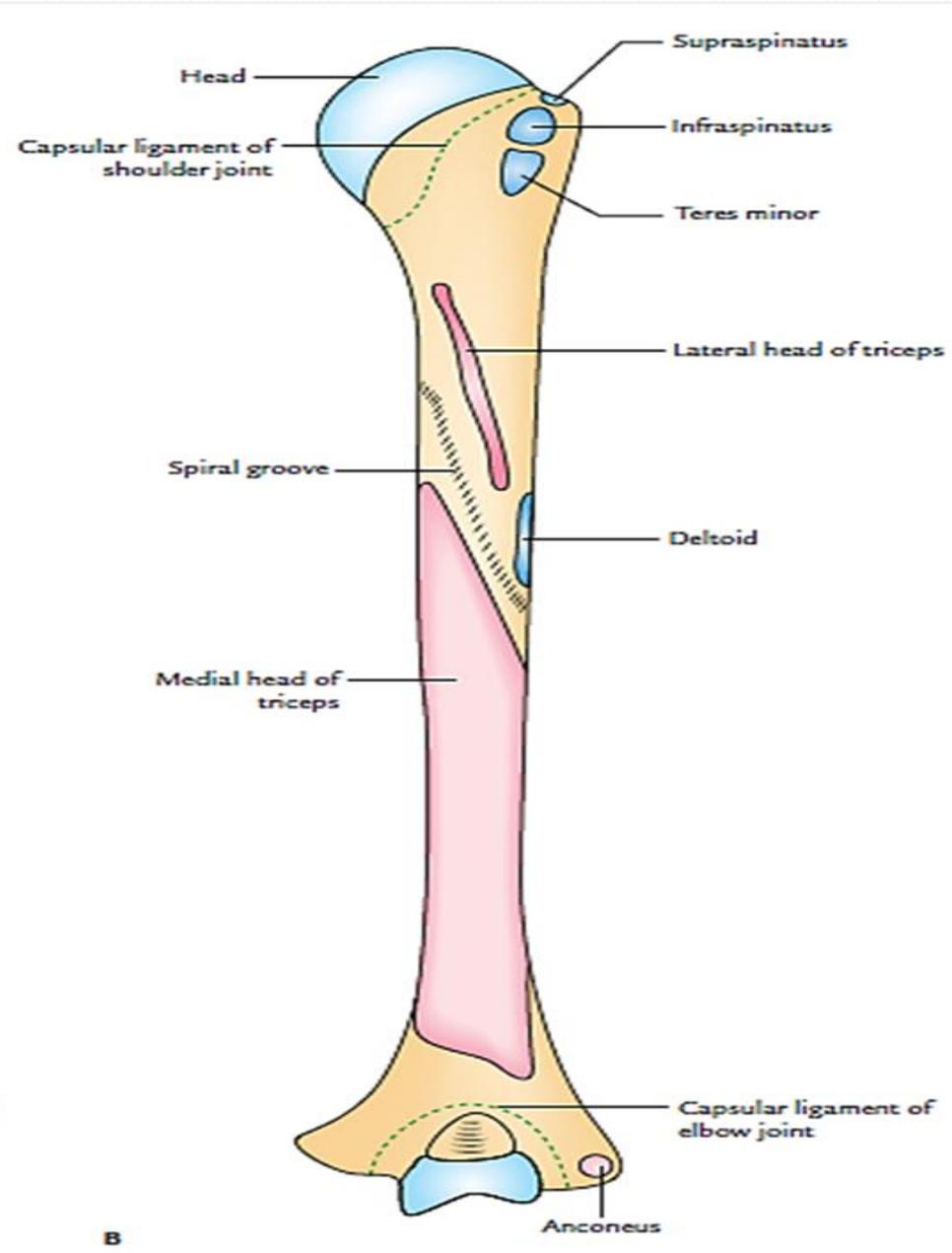
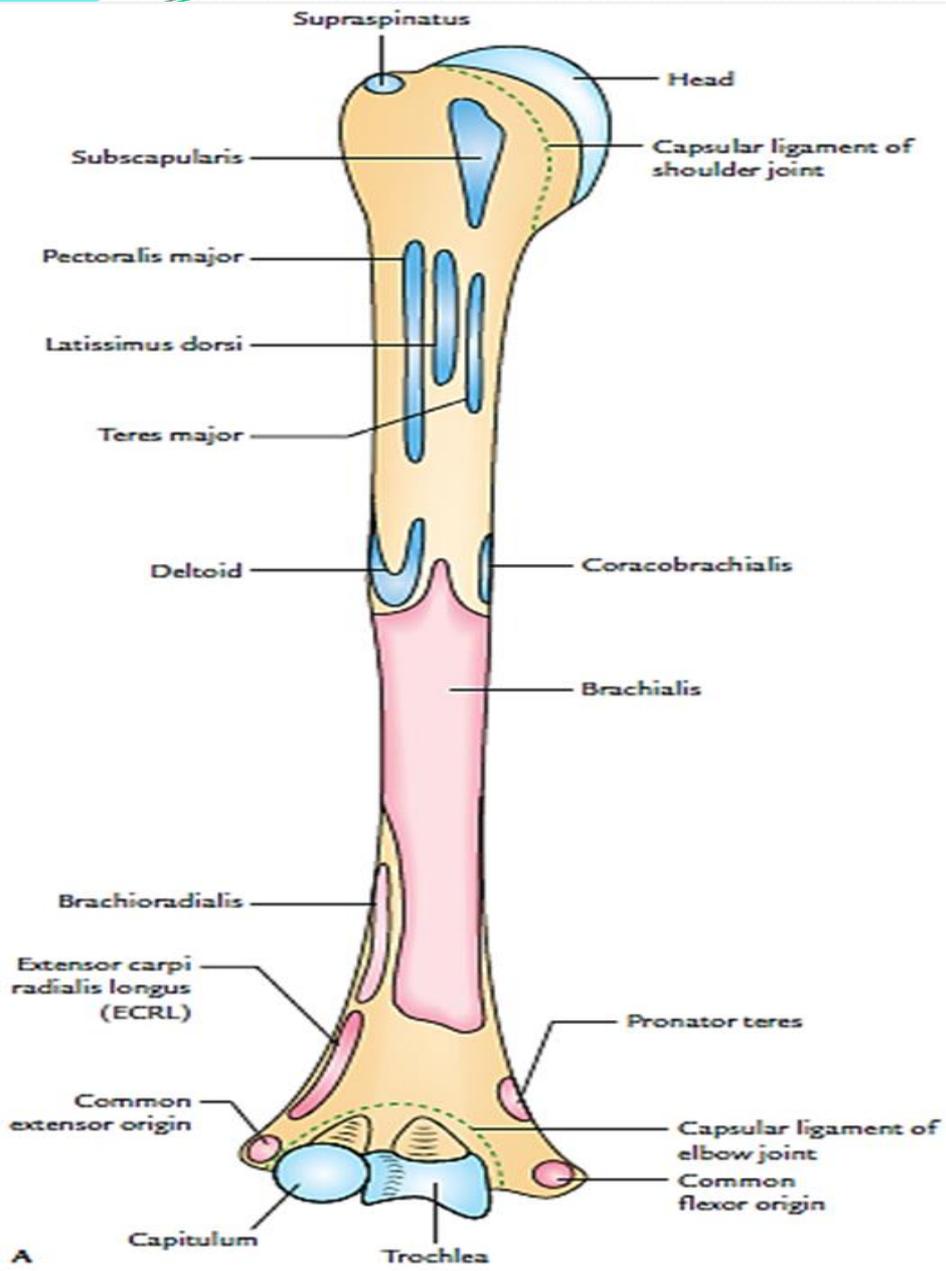
Muscular attachments

➤ Muscles inserted into the humerus are attached to its proximal half and include;

- ↪ Supraspinatus.
- ↪ Infraspinatus.
- ↪ Teres minor.
- ↪ Subscapularis.
- ↪ Pectoralis major.
- ↪ Teres major.
- ↪ Latissimus dorsi.
- ↪ Coracobrachialis.
- ↪ Deltoid.

➤ Muscles which take origin from the humerus do so from its distal half;

- ↪ Brachialis.
- ↪ Lateral head of triceps.
- ↪ Medial head of triceps.
- ↪ Pronator teres.
- ↪ Brachioradialis.
- ↪ Extensor carpi radialis longus.
- ↪ Anconeus.
- ↪ The common flexor tendon
- ↪ The common extensor ten.



Muscles Connecting the Upper Limb to the Thoracic Wall

Muscle	Origin	Insertion	Nerve Supply	Nerve	
				Roots ^a	Action
Pectoralis major	Clavicle, sternum, and upper six costal cartilages	Lateral lip of bicipital groove of humerus	Medial and lateral pectoral nerves from brachial plexus	C5, 6, 7, 8 ; T1	Adducts arm and rotates it medially; clavicular fibers also flex arm
Pectoralis minor	Third, fourth, and fifth ribs	Coracoid process of scapula	Medial pectoral nerve from brachial plexus	C5, 7, 8	Depresses point of shoulder; if the scapula is fixed, it elevates the ribs of origin
Subclavius	First costal cartilage	Clavicle	Nerve to subclavius from upper trunk of brachial plexus	C5, 6	Depresses the clavicle and steadies this bone during movements of the shoulder girdle
Serratus anterior	Upper eight ribs	Medial border and inferior angle of scapula	Long thoracic nerve	C5, 6, 7	Draws the scapula forward around the thoracic wall; rotates scapula

^a The predominant nerve root supply is indicated by boldface type.

Pectoralis major

■ Origin:

- ◆ Clavicle, sternum and upper six costal cartilages

■ Insertion:

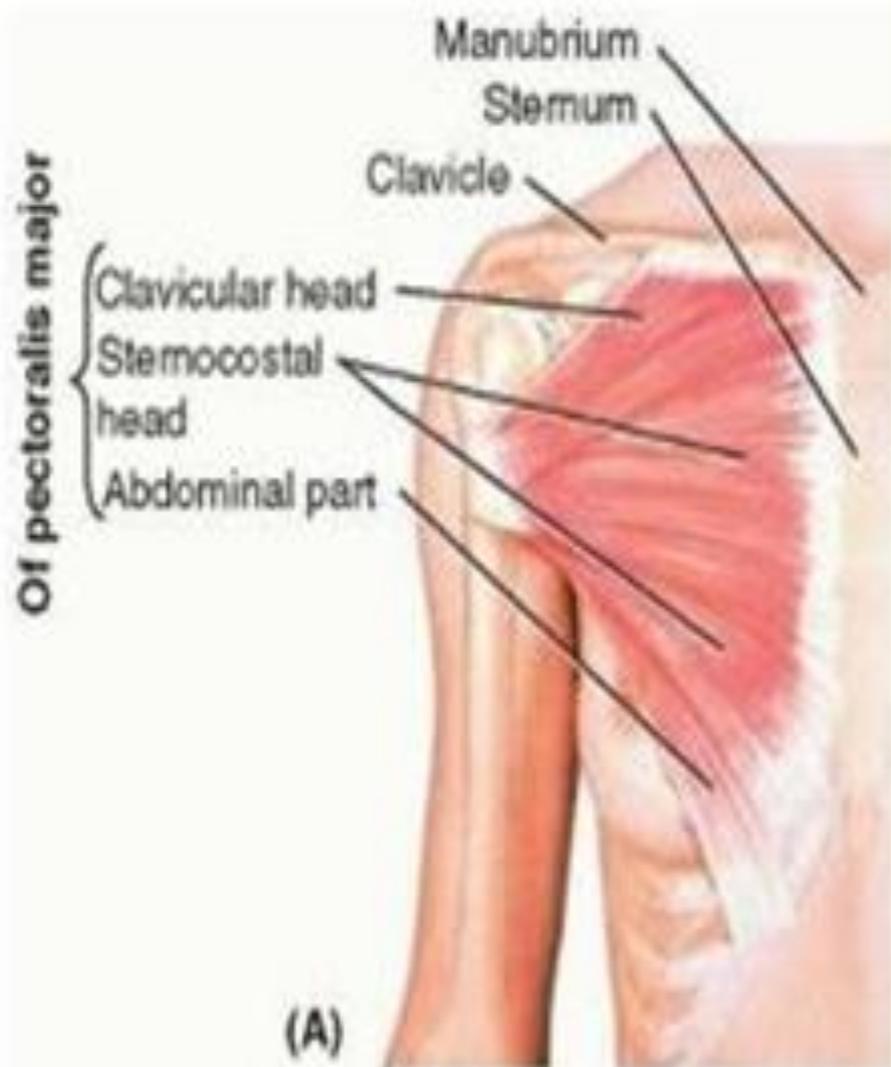
- ◆ Lateral lip of bicipital groove of humerus

■ Nerve supply:

- ◆ Medial and lateral pectoral nerves from brachial plexus
- ◆ C5, 6, 7, 8; T1

■ Actions:

- ◆ Adducts arm and rotates it medially; clavicular fibers also flex arm



■ Absent Pectoralis Major

Occasionally, parts of the pectoralis major muscle may be absent. The sternocostal origin is the most commonly missing part, and this causes weakness in adduction and medial rotation of the shoulder joint.

Pectoralis minor

■ Origin:

- ◆ 3rd, 4th, and 5th ribs

■ Insertion:

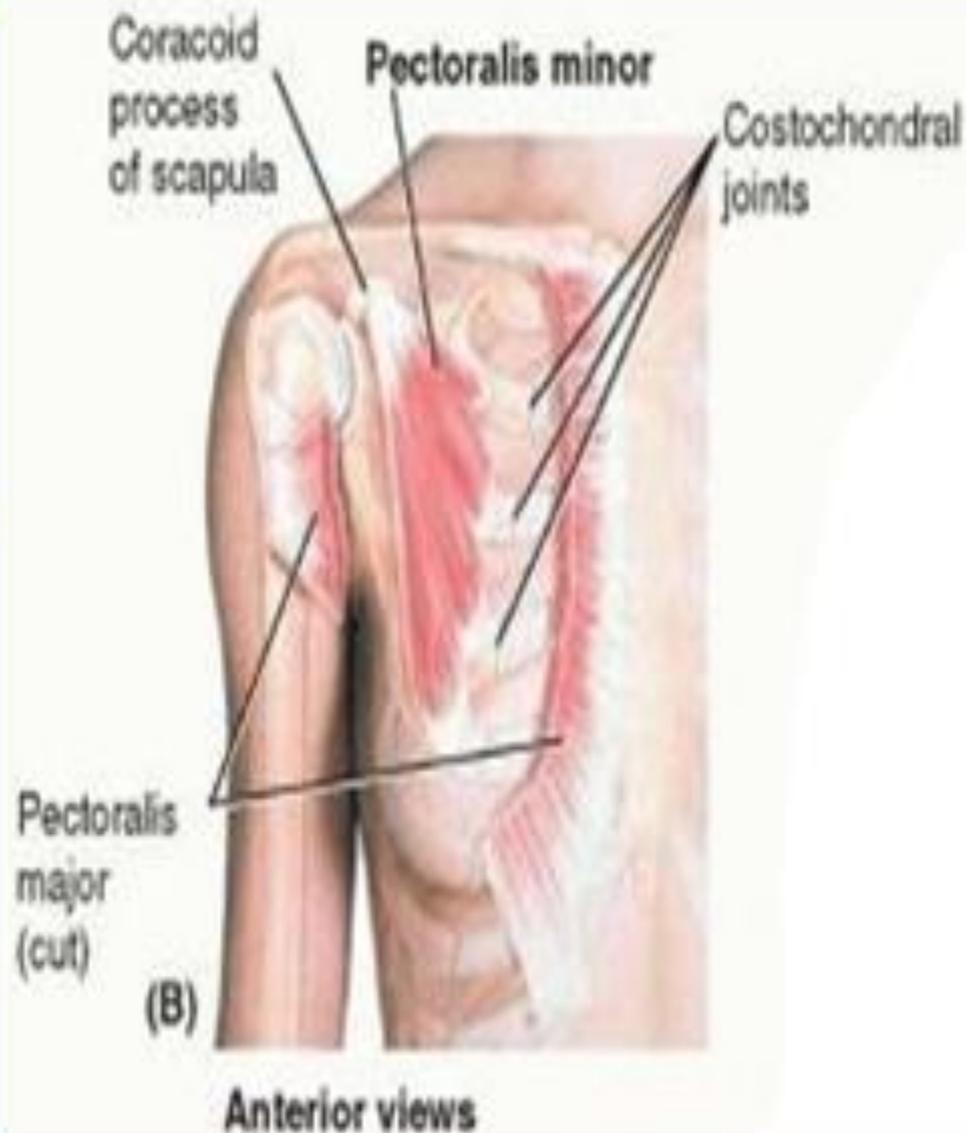
- ◆ Coracoid process of scapula

■ Nerve supply:

- ◆ Medial pectoral nerve from brachial plexus
- ◆ C6, 7, 8

■ Actions:

- ◆ Depresses point of shoulder; if the scapula is fixed, it elevates the ribs of origin



Subclavius

■ Origin:

- ◆ 1st costal cartilage

■ Insertion:

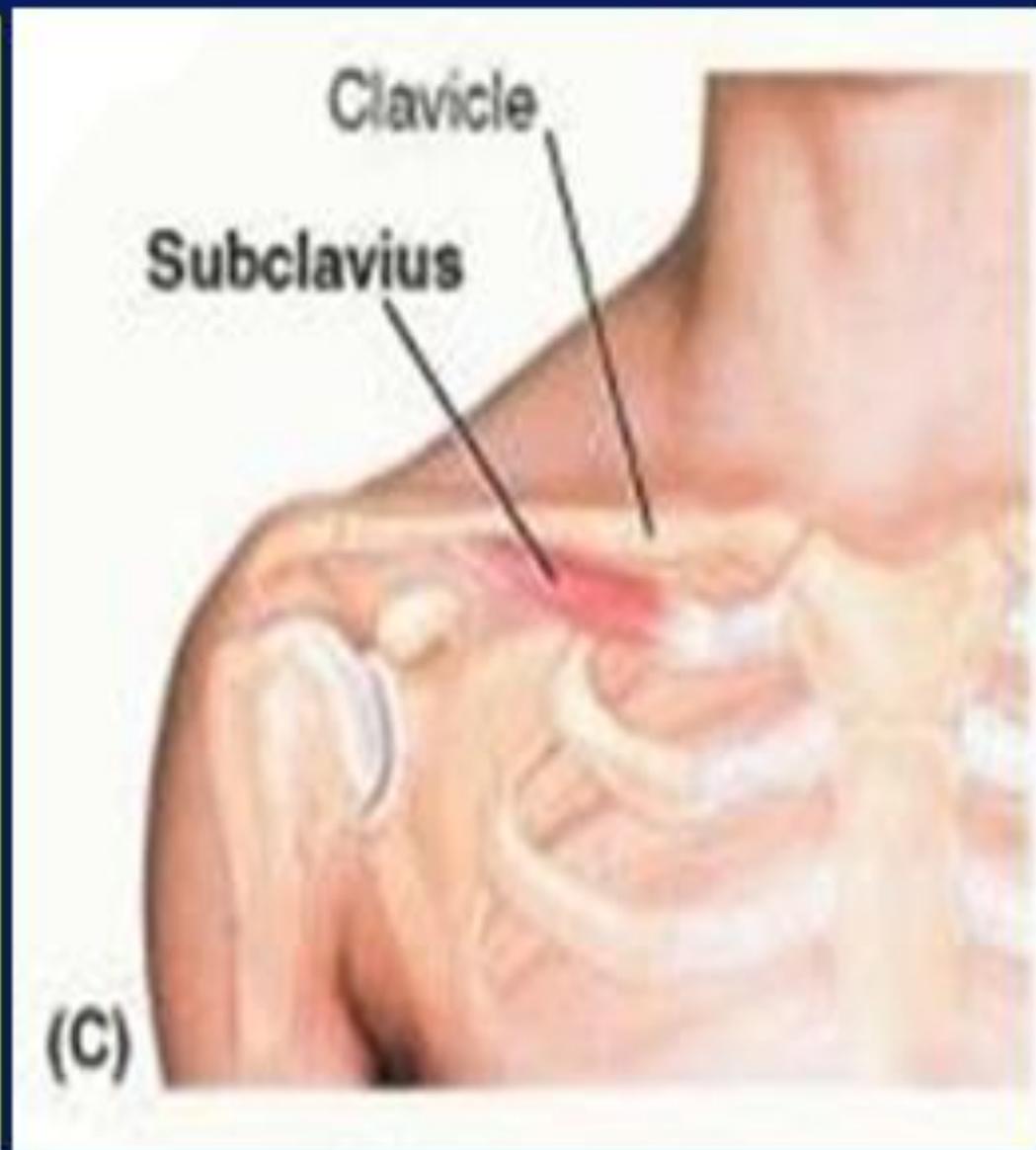
- ◆ Clavicle

■ Nerve supply:

- ◆ Nerve to subclavius from upper trunk of brachial plexus
- ◆ C5, 6

■ Actions:

- ◆ Depresses the clavicle and steadies this bone during movements of the shoulder girdle



Serratus anterior

■ Origin:

- ◆ Upper eight ribs

■ Insertion:

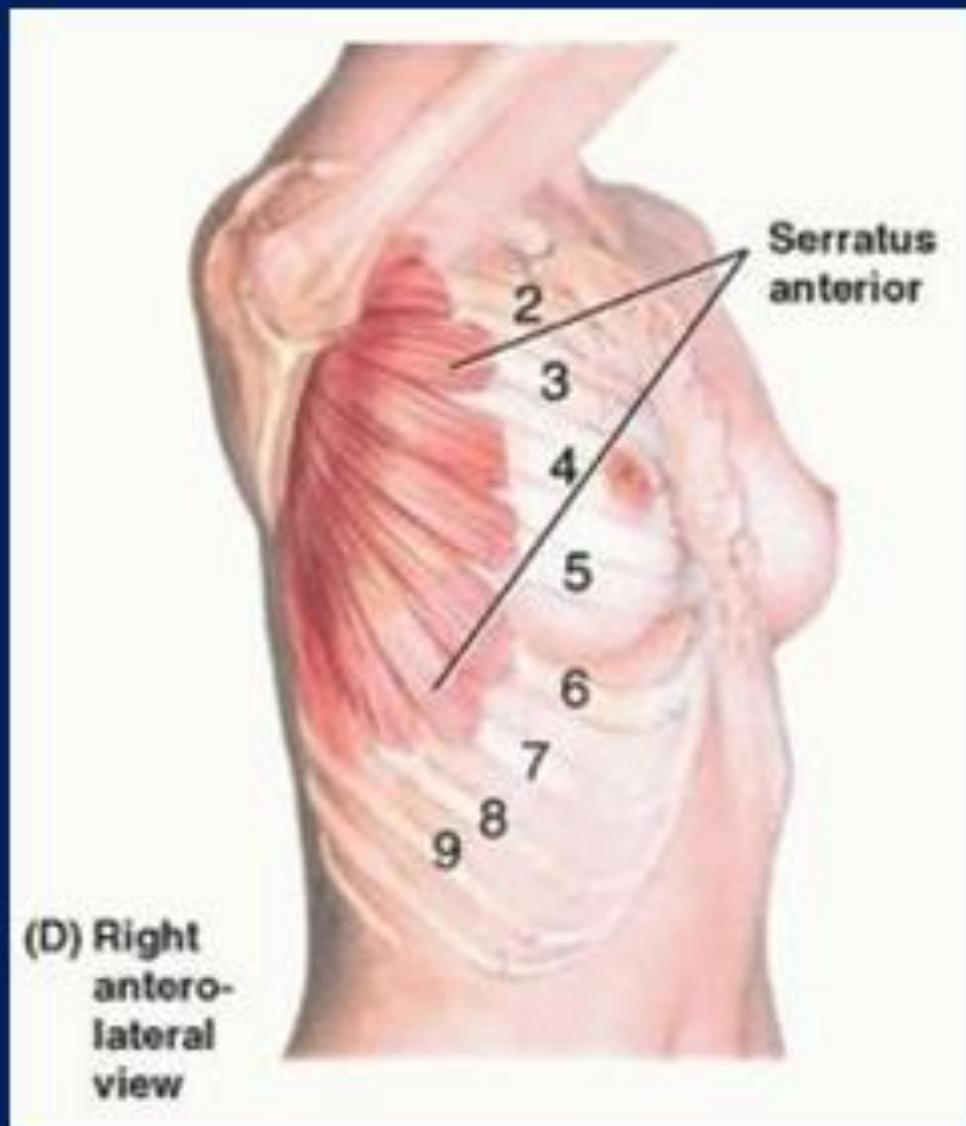
- ◆ Medial border and inferior angle of scapula

■ Nerve supply:

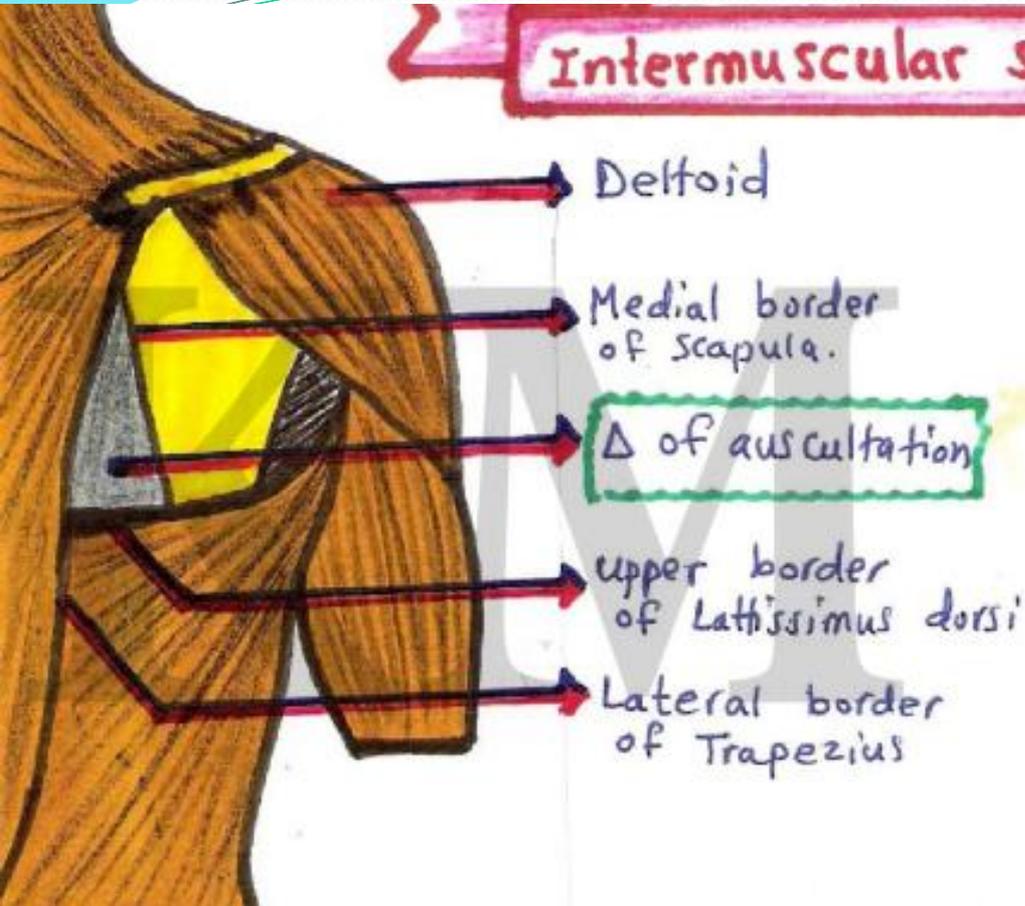
- ◆ Long thoracic nerve
- ◆ C5, 6, 7

■ Actions:

- ◆ Draws the forward anterior around the thoracic wall; rotates scapula



Intermuscular spaces



Triangle of auscultation

- Above & Medial:
 - Lateral border of Trapezius.
- below :-
 - upper border of Latissimus dorsi
- Lateral:-
 - medial border of scapula
- Floor :-
 - Rhomboid major, 6th & 7th ribs with intercostal space.

Significance: Here we can hear air sounds in the principal bronchi during respiration

I- QUADRANGULAR SPACE

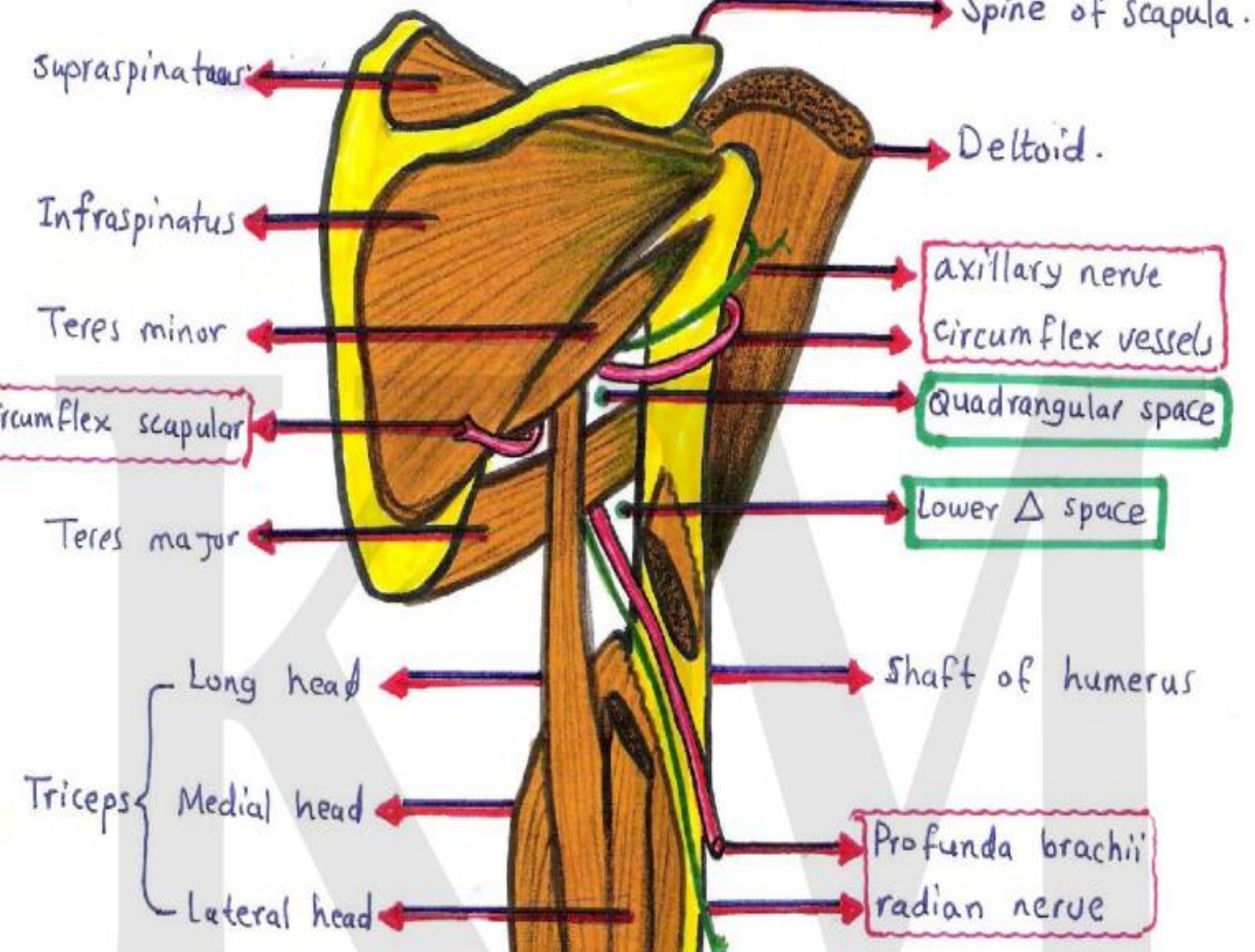
- * **Boundaries** :-
- Above: Teres minor, subscapularis & shoulder joint capsule.
 - below: Teres major.
 - Medial: Long head of triceps.
 - Lateral: Surgical neck of humerus.
- * **Contents** :- axillary nerve & posterior circumflex humeral vessels.

II- TRIANGULAR SPACE "UPPER"

- * **Boundaries** :-
- Above: Teres minor & subscapularis.
 - below: Teres major.
 - Lateral: Long head of triceps.
- * **Contents** :- circumflex scapular vessels.

III- LOWER TRIANGULAR SPACE

- * **Boundaries** :-
- Above: Teres major.
 - lateral: shaft of humerus.
 - Medial: Long head of triceps.
- * **Contents** :- **Radial**: nerve & profunda brachii vessels.



Muscles Connecting the Upper Limb to the Vertebral Column

Muscle	Origin	Insertion	Nerve Supply	Nerve Roots	Action
Trapezius	Occipital bone, ligamentum nuchae, spine of seventh cervical vertebra, spines of all thoracic vertebrae	Upper fibers into lateral third of clavicle; (motor) and middle and lower fibers into acromion and spine of scapula	Spinal part of accessory nerve and C3 and 4 (sensory)	XI cranial nerve (spinal part)	Upper fibers elevate the scapula; middle fibers pull scapula medially; lower fibers pull medial border of scapula downward
Latissimus dorsi	Iliac crest, lumbar fascia, spines of lower six thoracic vertebrae, lower three or four ribs, and inferior angle of scapula	Floor of bicipital groove of humerus	Thoracodorsal nerve	C6, 7, 8,	Extends, adducts, and medially rotates the arm
Levator scapulae	Transverse processes of first four cervical vertebrae	Medial border of scapula	C3 and 4 and dorsal scapular nerve	C3, 4, 5	Raises medial border of scapula
Rhomboid minor	Ligamentum nuchae and spines of seventh cervical and first thoracic vertebrae	Medial border of scapula	Dorsal scapular nerve	C4, 5	Raises medial border of scapula upward and medially
Rhomboid major	Second to fifth thoracic spines	Medial border of scapula	Dorsal scapular nerve	C4, 5	Raises medial border of scapula upward and medially

Muscles Connecting the Scapula to the Humerus

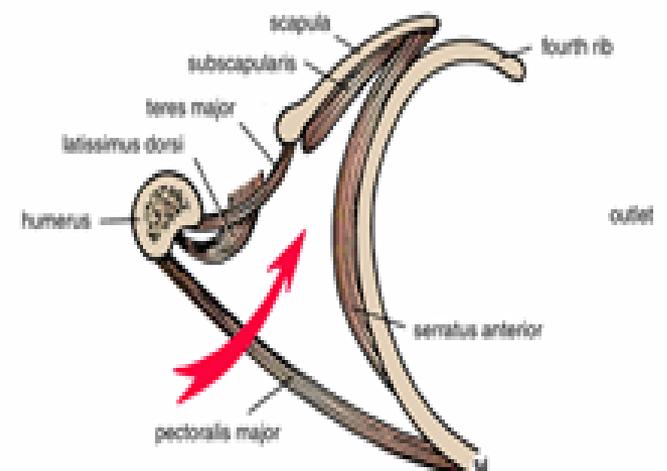
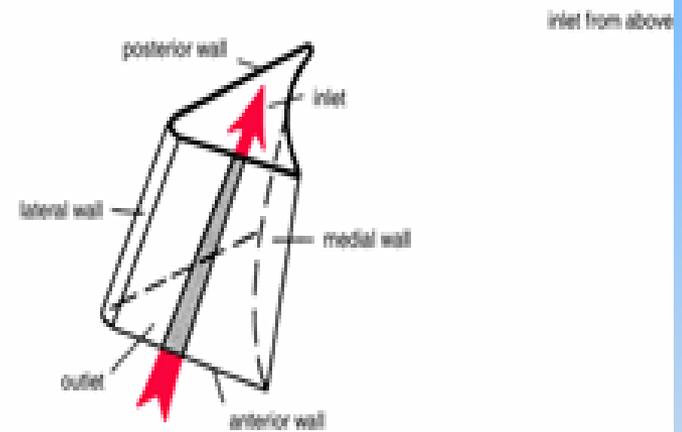
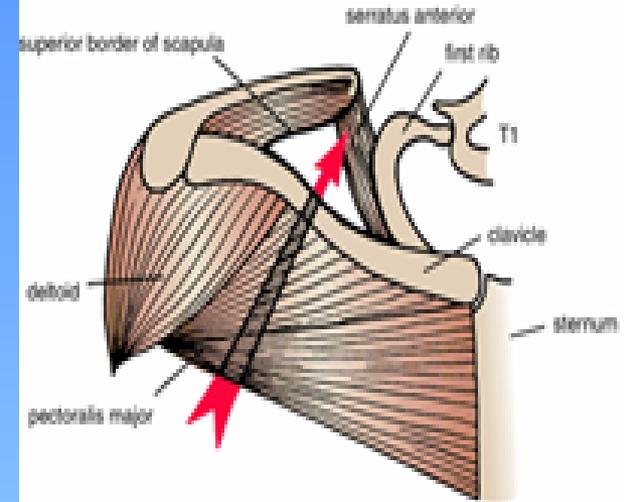
Muscle	Origin	Insertion	Nerve Supply	Nerve Roots	Action
Deltoid	Lateral third of clavicle, acromion, spine of scapula	Middle of lateral surface of shaft of humerus	Axillary nerve	C5, 6	Abducts arm; anterior fibers flex and medially rotate arm; posterior fibers extend and laterally rotate arm
Supraspinatus	Supraspinous fossa of scapula	Greater tuberosity of humerus; capsule of shoulder joint	Suprascapular nerve	C4, 5, 6	Abducts arm and stabilizes shoulder joint
Infraspinatus	Infraspinous fossa of scapula	Greater tuberosity of humerus; capsule of shoulder joint	Suprascapular nerve	(C4), 5, 6	Laterally rotates arm and stabilizes shoulder joint
Teres major	Lower third of lateral border of scapula	Medial lip of bicipital groove of humerus	Lower subscapular nerve	C6, 7	Medially rotates and adducts arm and stabilizes shoulder joint
Teres minor	Upper two thirds of lateral border of scapula	Greater tuberosity of humerus; capsule of shoulder joint	Axillary nerve	(C4), C5, 6	Laterally rotates arm and stabilizes shoulder joint
Subscapularis	Subscapular fossa	Lesser tuberosity of humerus	Upper and lower subscapular nerves	C5, 6, 7	Medially rotates arm and stabilizes shoulder joint

Muscles Connecting the Scapula to the Humerus

Muscle	Origin	Insertion	Nerve Supply	Nerve Roots	Action
Deltoid	Lateral third of clavicle, acromion, spine of scapula	Middle of lateral surface of shaft of humerus	Axillary nerve	C5, 6	Abducts arm; anterior fibers flex and medially rotate arm; posterior fibers extend and laterally rotate arm
Supraspinatus	Supraspinous fossa of scapula	Greater tuberosity of humerus; capsule of shoulder joint	Suprascapular nerve	C4, 5, 6	Abducts arm and stabilizes shoulder joint
Infraspinatus	Infraspinous fossa of scapula	Greater tuberosity of humerus; capsule of shoulder joint	Suprascapular nerve	(C4), 5, 6	Laterally rotates arm and stabilizes shoulder joint
Teres major	Lower third of lateral border of scapula	Medial lip of bicipital groove of humerus	Lower subscapular nerve	C6, 7	Medially rotates and adducts arm and stabilizes shoulder joint
Teres minor	Upper two thirds of lateral border of scapula	Greater tuberosity of humerus; capsule of shoulder joint	Axillary nerve	(C4), C5, 6	Laterally rotates arm and stabilizes shoulder joint
Subscapularis	Subscapular fossa	Lesser tuberosity of humerus	Upper and lower subscapular nerves	C5, 6, 7	Medially rotates arm and stabilizes shoulder joint

The Axilla

- The axilla, or armpit, is a pyramid-shaped space between the upper part of the arm and the side of the chest.
- It forms an important passage for nerves, blood, and lymph vessels as they travel from the root of the neck to the upper limb.
- The **upper end** of the axilla, or **apex**, is directed into the root of the neck and is bounded in front by the clavicle, behind by the upper border of the scapula, and medially by the outer border of the first rib.
- The **lower end**, or **base**, is bounded in front by the anterior axillary fold (formed by the lower border of the pectoralis major muscle), behind by the posterior axillary fold (formed by the tendon of latissimus dorsi and the teres major muscle), and medially by the chest wall.



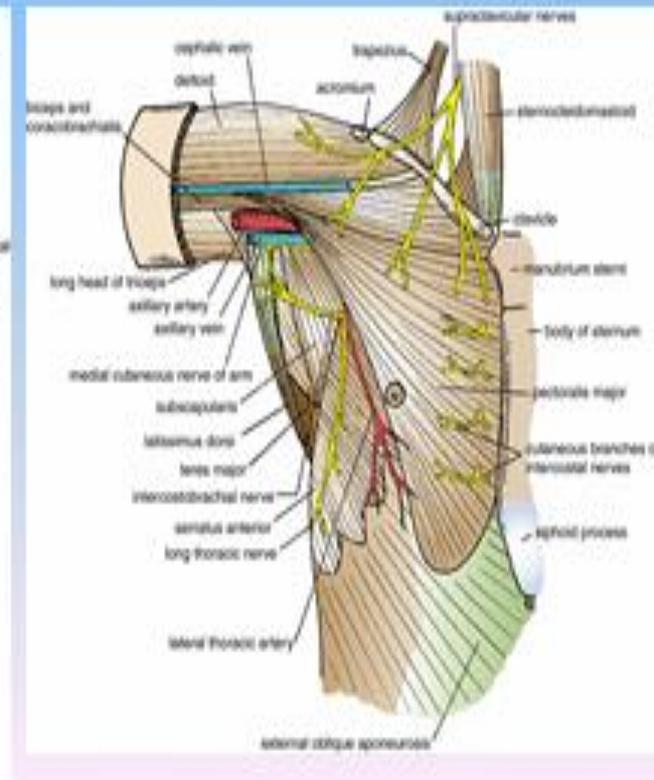
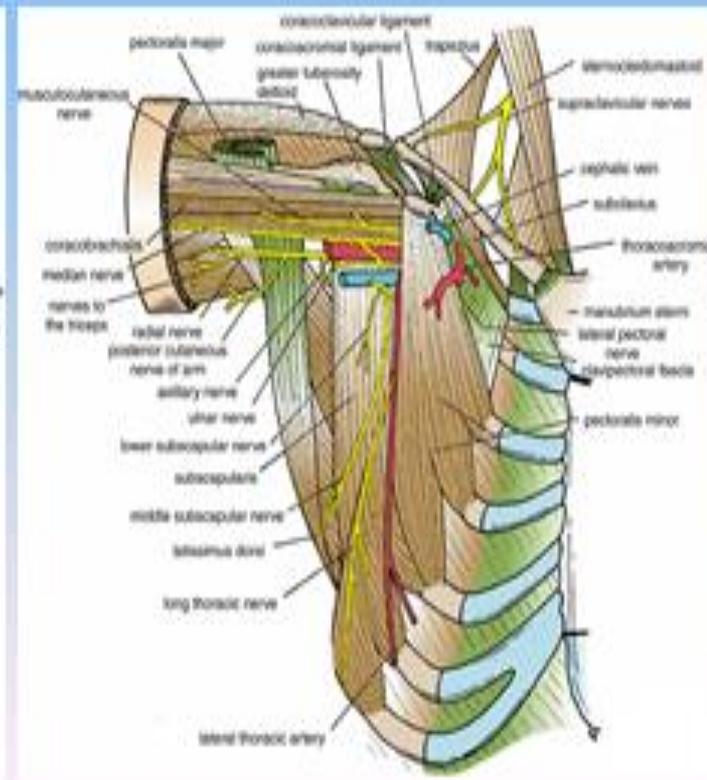
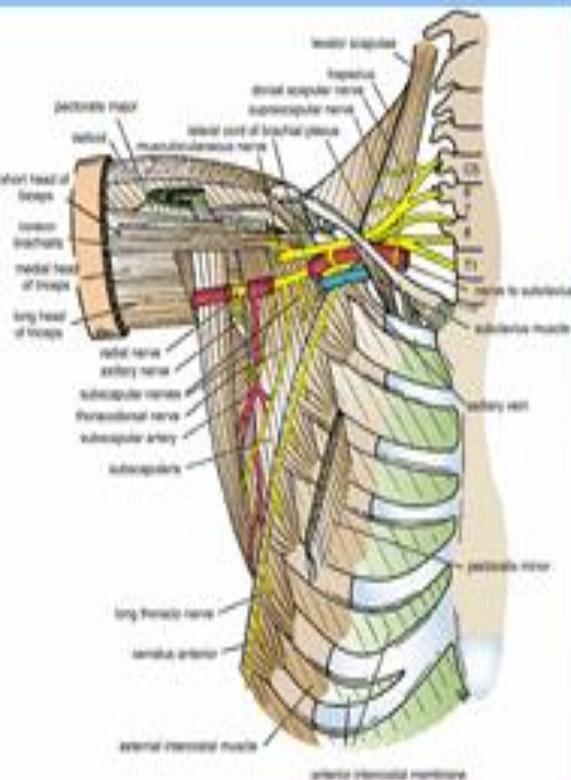
Walls of the Axilla

The walls of the axilla are made up as follows:

- Anterior wall: By the pectoralis major, subclavius, and pectoralis minor muscles.
- Posterior wall: By the subscapularis, latissimus dorsi, and teres major muscles from above down.
- Medial wall: By the upper four or five ribs and the intercostal spaces covered by the serratus anterior muscle.
- Lateral wall: By the coracobrachialis and biceps muscles in the bicipital groove of the humerus.

The base is formed by the skin stretching between the anterior and posterior walls.

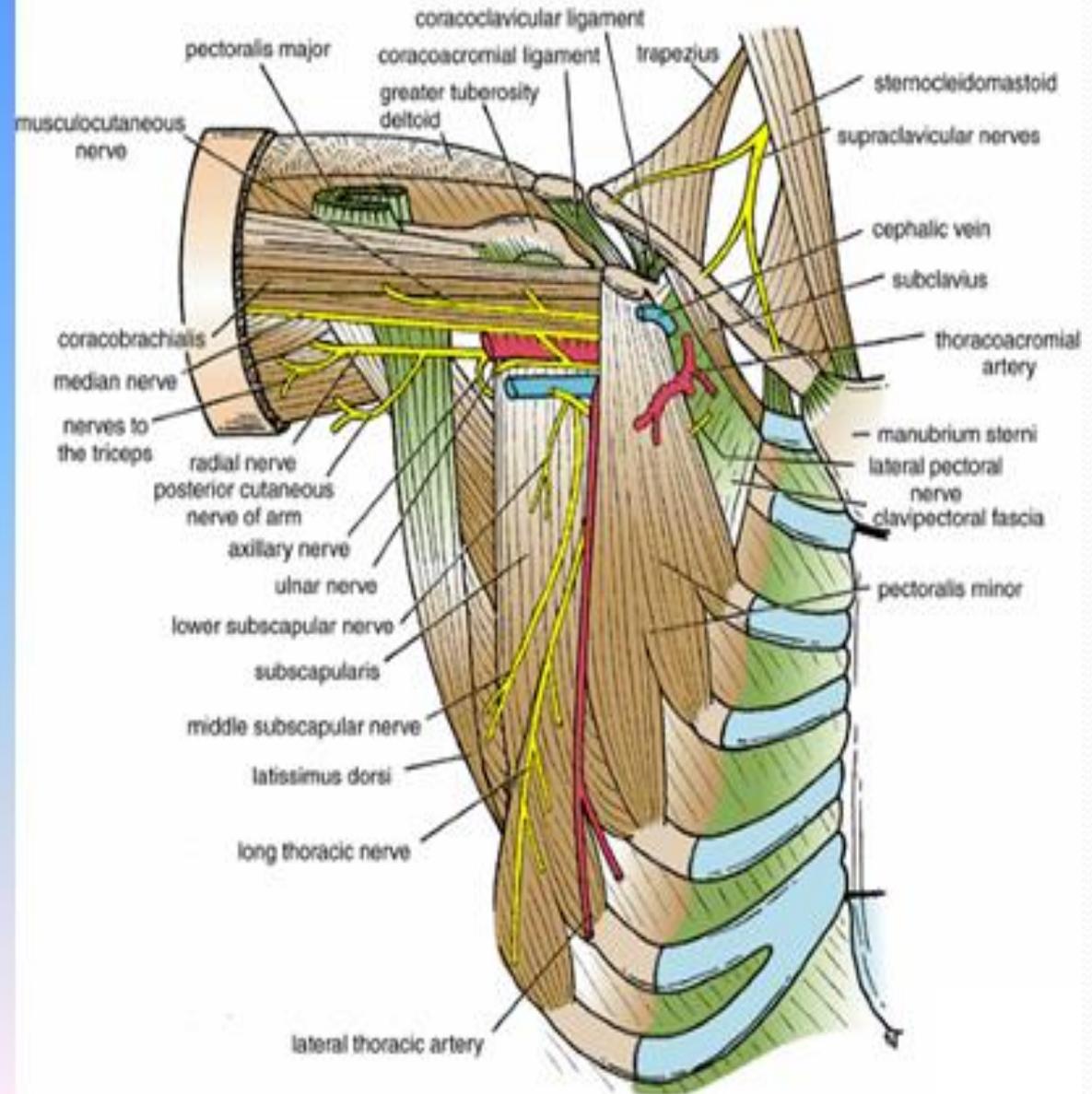
The axilla contains the principal vessels and nerves to the upper limb and many lymph nodes.



Key Muscles in the Axilla

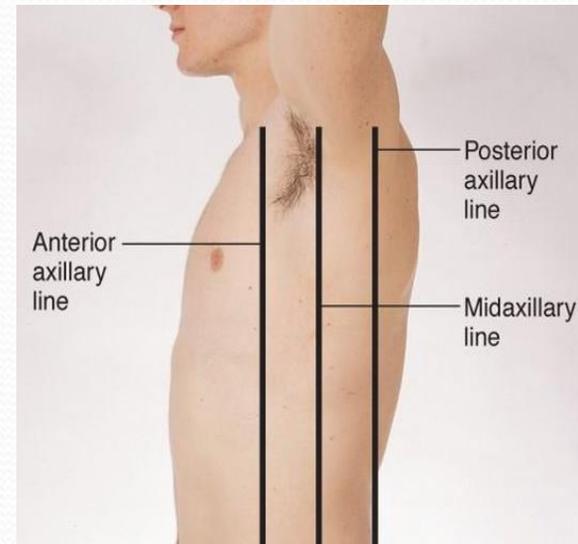
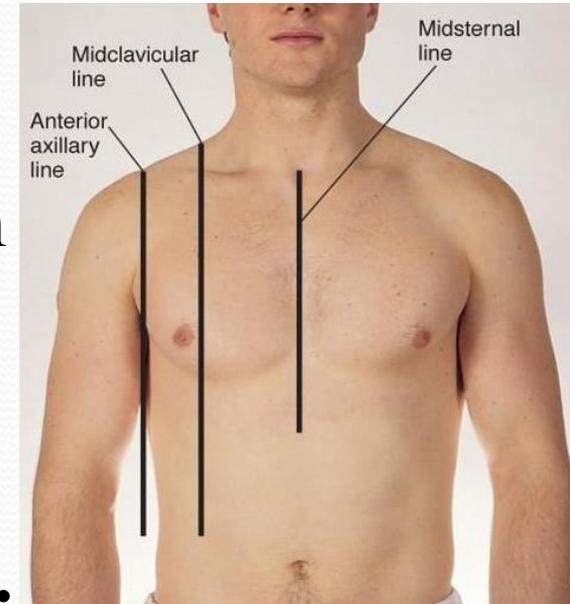
Pectoralis Minor

- The pectoralis minor is a thin triangular muscle that lies beneath the pectoralis major.
- It arises from the third, fourth, and fifth ribs and runs upwards and laterally to be inserted by its apex into the coracoid process of the scapula.
- It crosses the axillary artery and the brachial plexus of nerves.
- It is used when describing the axillary artery to divide it into three parts.



The following (imaginary) lines are used to describe surface anatomy of the pectoral region & axilla

1. **Midsternal line** runs vertically in the median plane on the front of the sternum.
2. **Midclavicular line** runs vertically from the midpoint of the clavicle to the midinguinal point.
3. **Anterior axillary line** runs vertically downwards from the anterior axillary fold.
4. **Posterior axillary line** runs vertically downwards from the posterior axillary fold.
5. **Midaxillary line** runs vertically downwards midway between the anterior and posterior axillary folds.

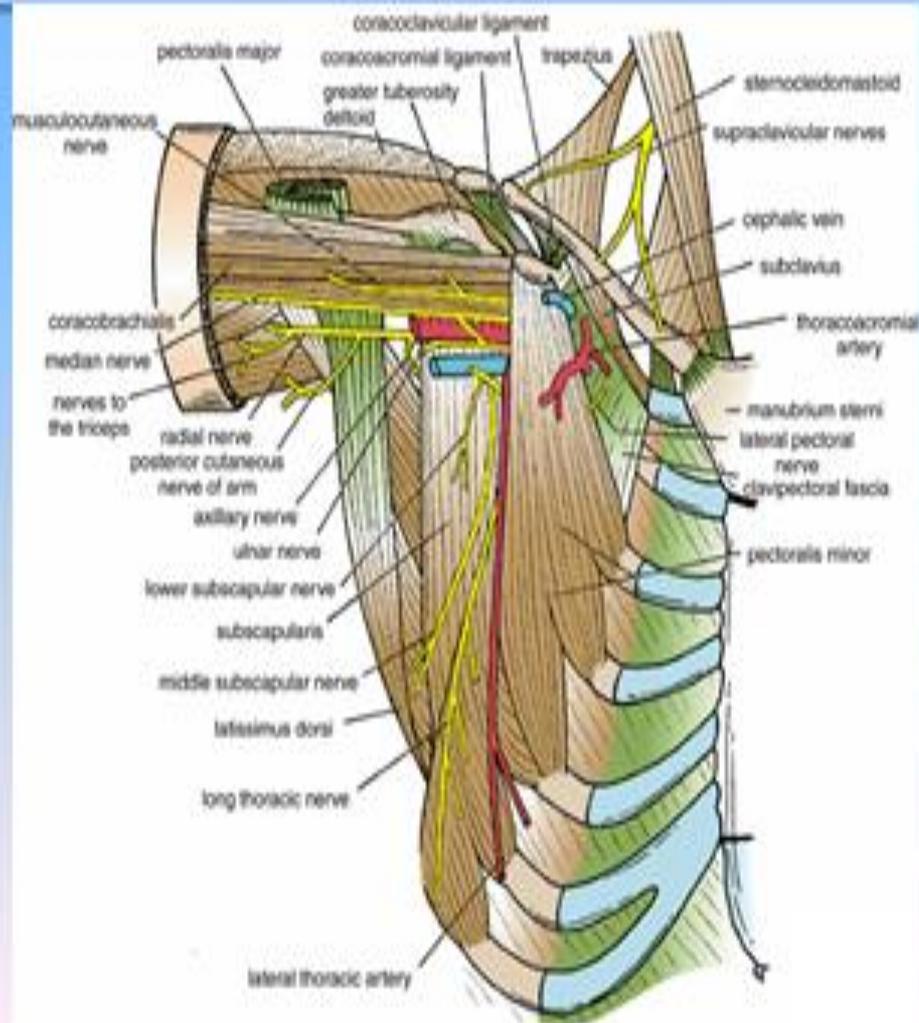
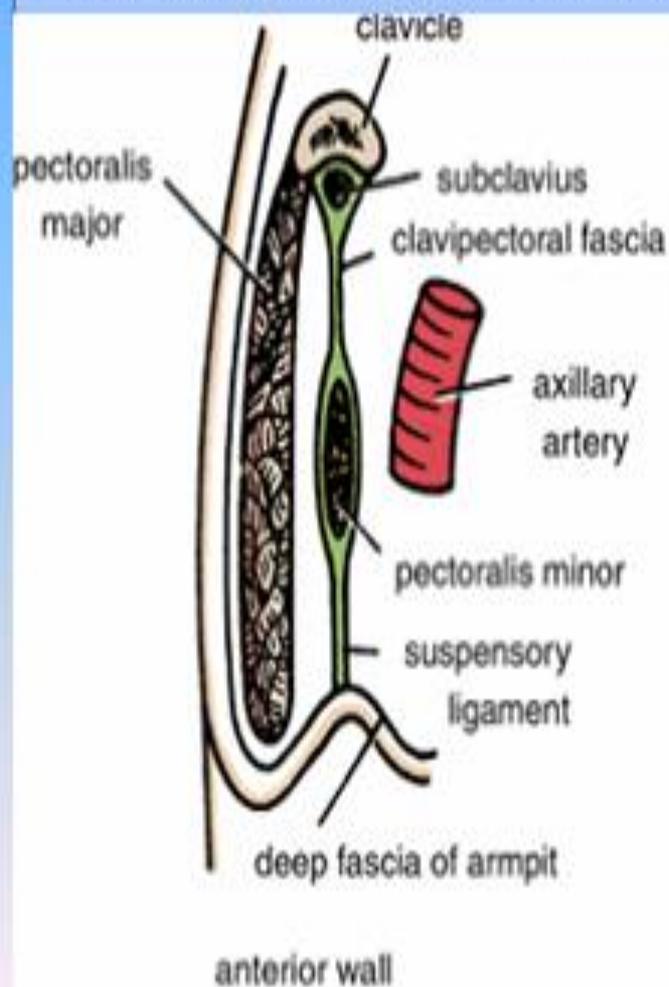


Contents of the Axilla

- The axilla contains the **axillary artery** and its **branches**, which **supply blood** to the upper limb
- The **axillary vein** and its **tributaries**, which drain blood from the upper limb;
- **Lymph vessels** and lymph **nodes**, which drain lymph from the upper limb and the breast and from the skin of the trunk, down as far as the level of the umbilicus.
- Lying among these structures in the axilla is an important **nerve plexus**, the **brachial plexus**, which innervates the upper limb.
- These structures are embedded in fat.

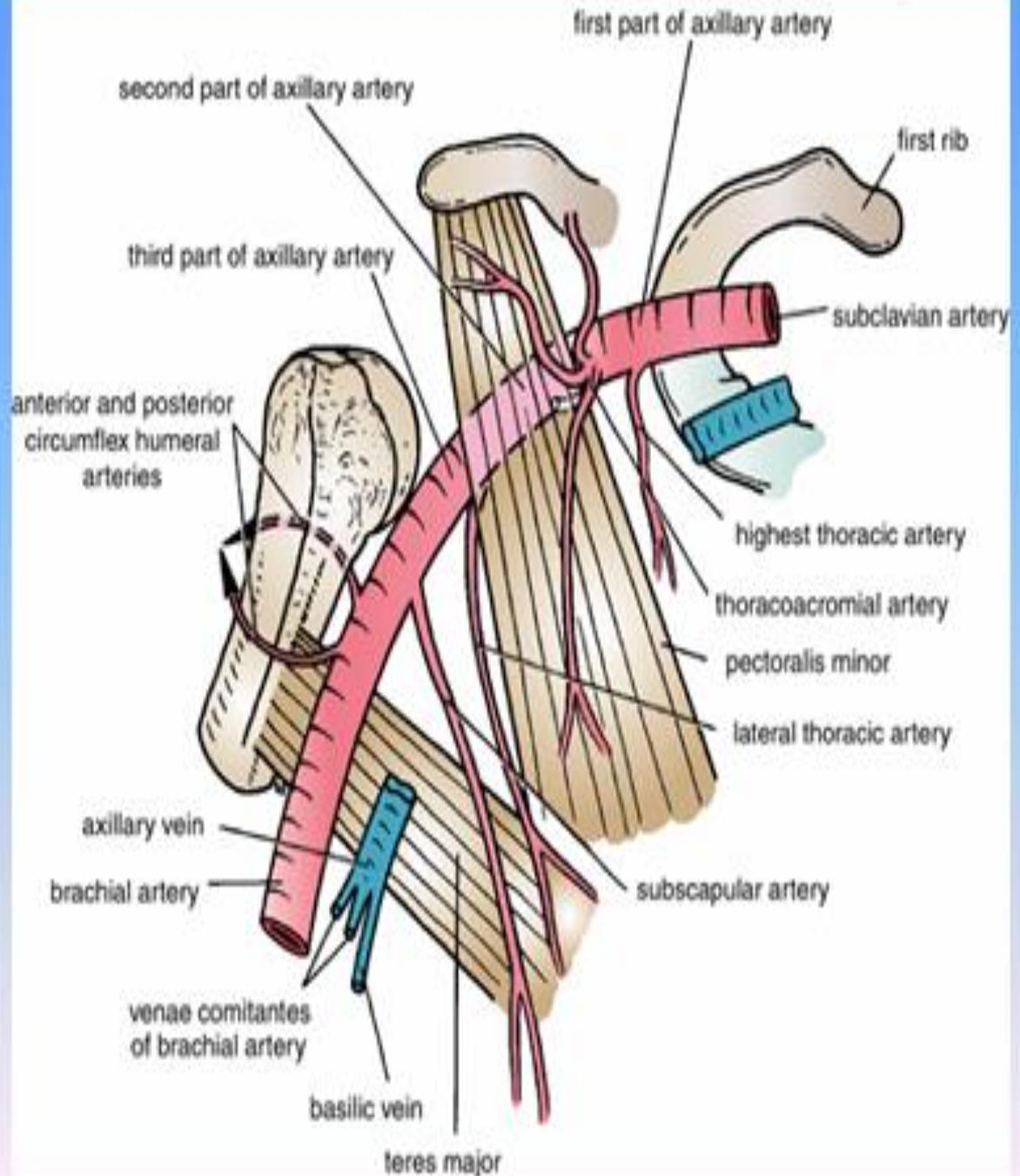
Clavipectoral Fascia

- The clavipectoral fascia is a strong sheet of connective tissue that is attached above to the clavicle.
- Below, it splits to enclose the pectoralis minor muscle and then continues downward as the suspensory ligament of the axilla and joins the fascial floor of the armpit. Structures piercing it:
- 1- Cephalic vein. 2- Lateral pectoral nerve.
- 3- Thoraco-acromial artery or its branches. 4- Lymph vessels



Axillary Artery

- The axillary artery begins at the lateral border of the first rib as a continuation of the **subclavian** and ends at the lower border of the teres major muscle, where it continues as the **brachial artery**.
- Throughout its course, the artery is closely related to the cords of the **brachial plexus** and their branches and is enclosed with them in a connective tissue sheath called the **axillary sheath**.
- If this sheath is traced upward into the root of the neck, it is seen to be continuous with the **prevertebral fascia**.
- The **pectoralis minor** muscle crosses in front of the axillary artery and divides it into three parts.

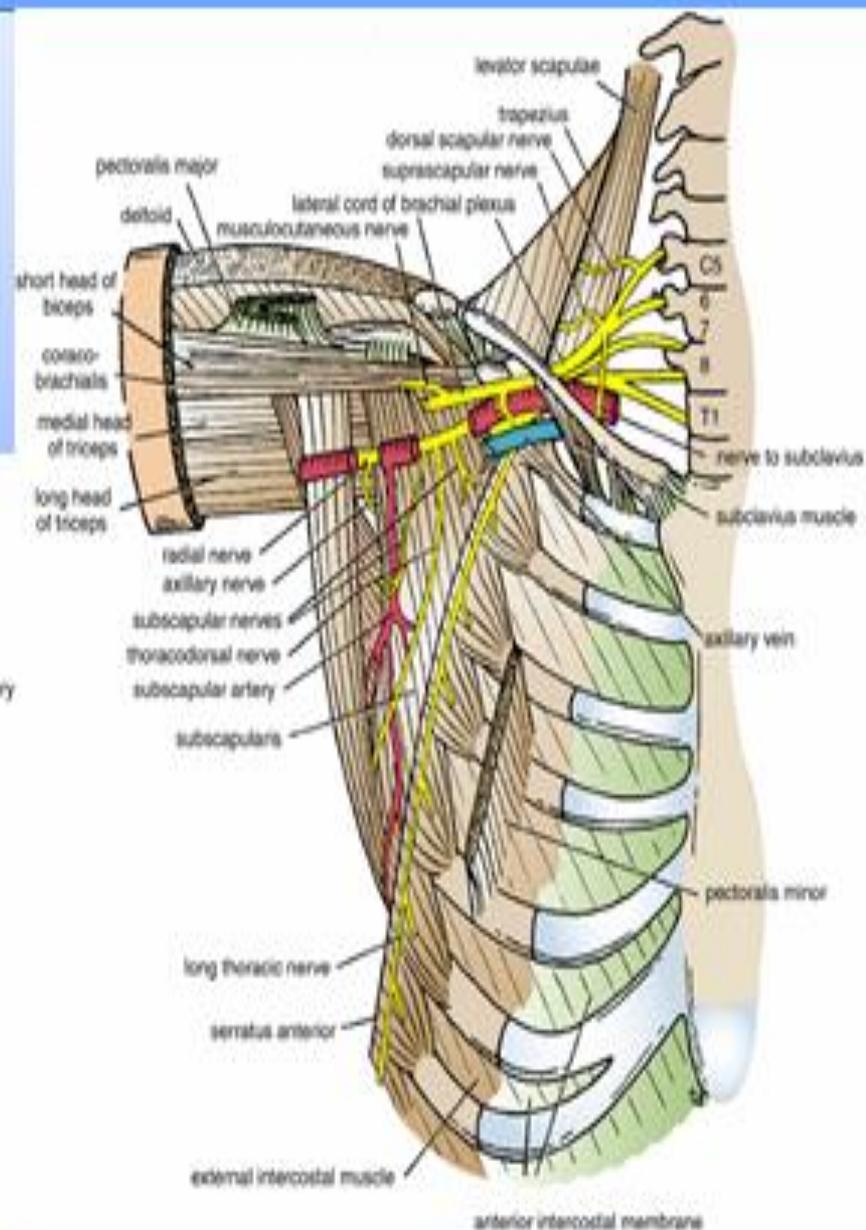
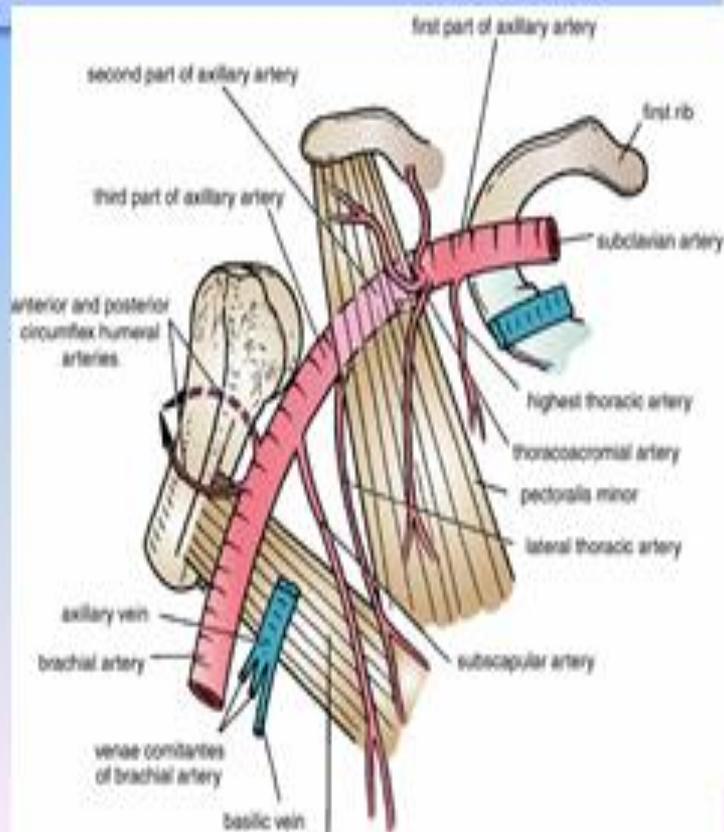


First Part of the Axillary Artery

This extends from the lateral border of the first rib to the upper border of the pectoralis minor.

Relations

- **Anteriorly:** The pectoralis major and the skin. The cephalic vein crosses the artery.
- **Posteriorly:** The long thoracic nerve (nerve to the serratus anterior).
- **Laterally:** The three cords of the brachial plexus.
- **Medially:** The axillary vein.

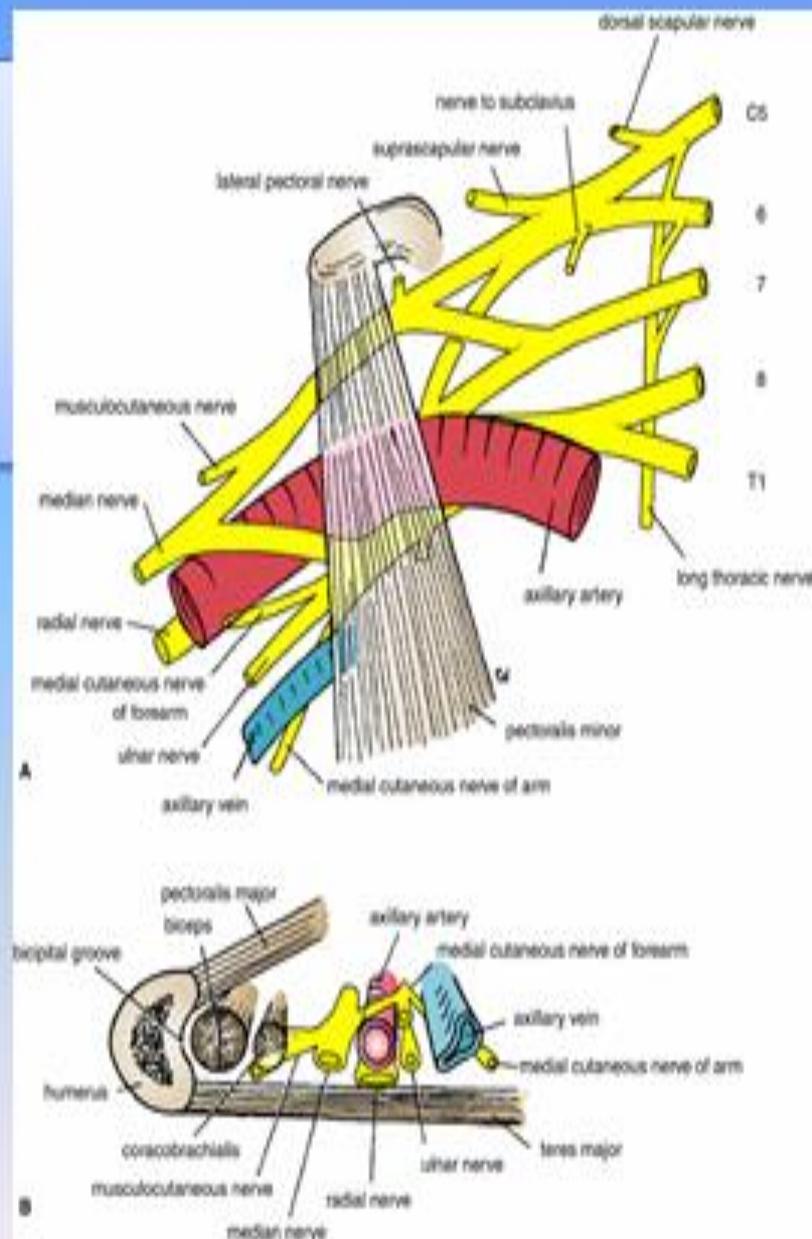
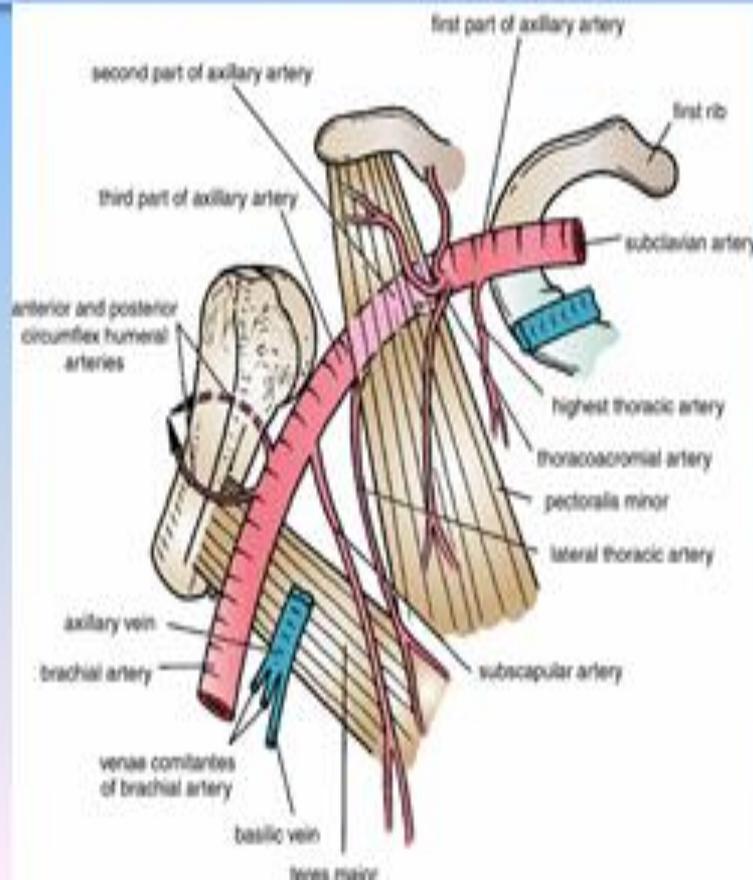


Second Part of the Axillary Artery

This lies behind the pectoralis minor muscle.

Relations

- **Anteriorly:** The pectoralis minor, the pectoralis major, and the skin.
- **Posteriorly:** The posterior cord of the brachial plexus, the subscapularis muscle, and the shoulder joint.
- **Laterally:** The lateral cord of the brachial plexus.
- **Medially:** The medial cord of the brachial plexus and the axillary vein.

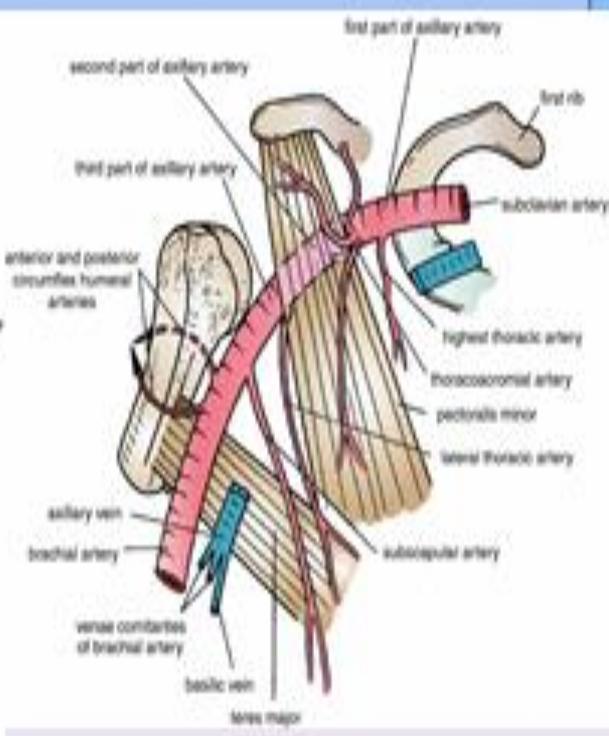
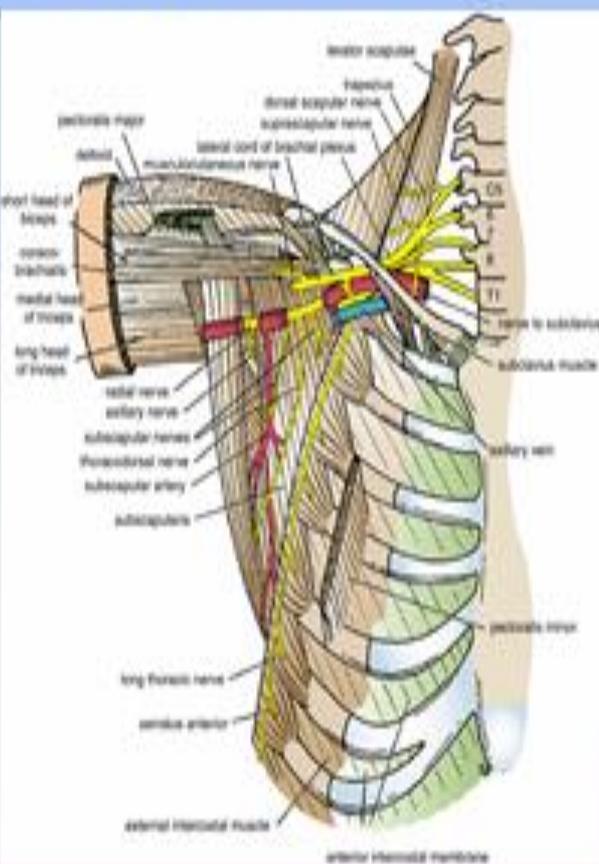
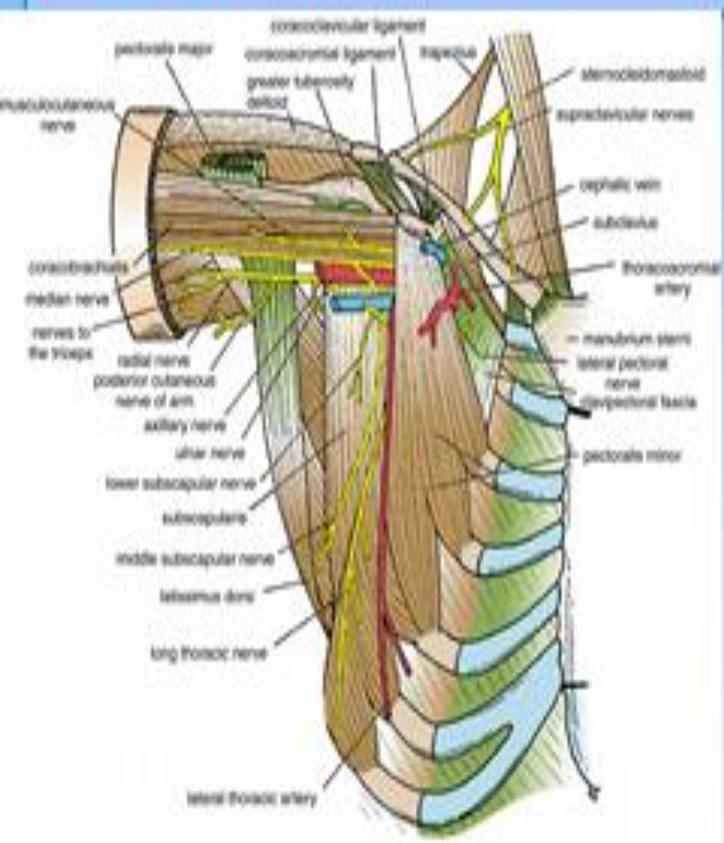


Third Part of the Axillary Artery

This extends from the lower border of the pectoralis minor to the lower border of the teres major.

Relations

- Anteriorly:** The pectoralis major for a short distance; lower down the artery it is crossed by the medial root of the median nerve.
- Posteriorly:** The subscapularis, the latissimus dorsi, and the teres major. The axillary and radial nerves also lie behind the artery.
- Laterally:** The coracobrachialis, the biceps, and the humerus. The lateral root of the median and the musculocutaneous nerves also lie on the lateral side.
- Medially:** The ulnar nerve, the axillary vein, and the medial cutaneous nerve of the arm



Branches of the Axillary Artery

From the first part:

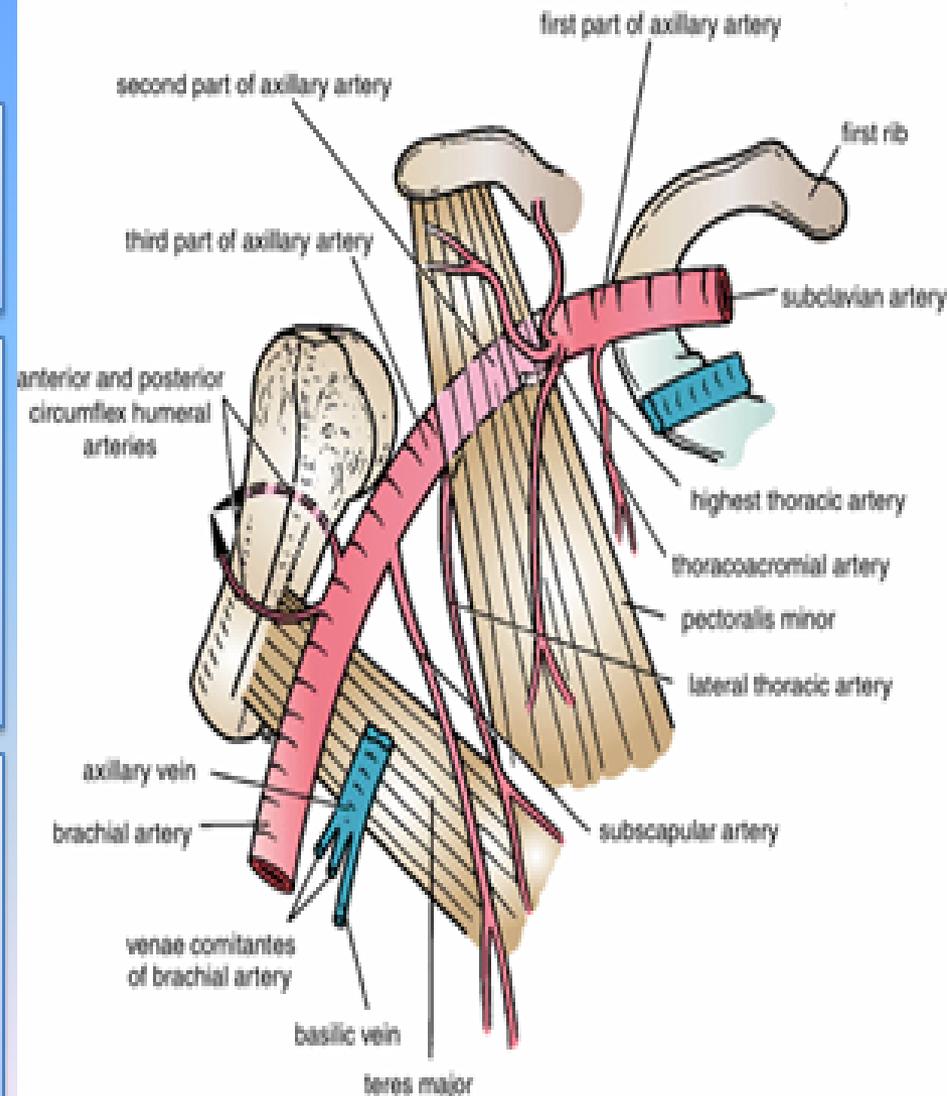
- The highest **thoracic artery** is small and runs along the upper border of the pectoralis minor.

From the second part:

- The **thoracoacromial artery** immediately divides into terminal branches
- The **lateral thoracic artery** runs along the lower border of the pectoralis minor.

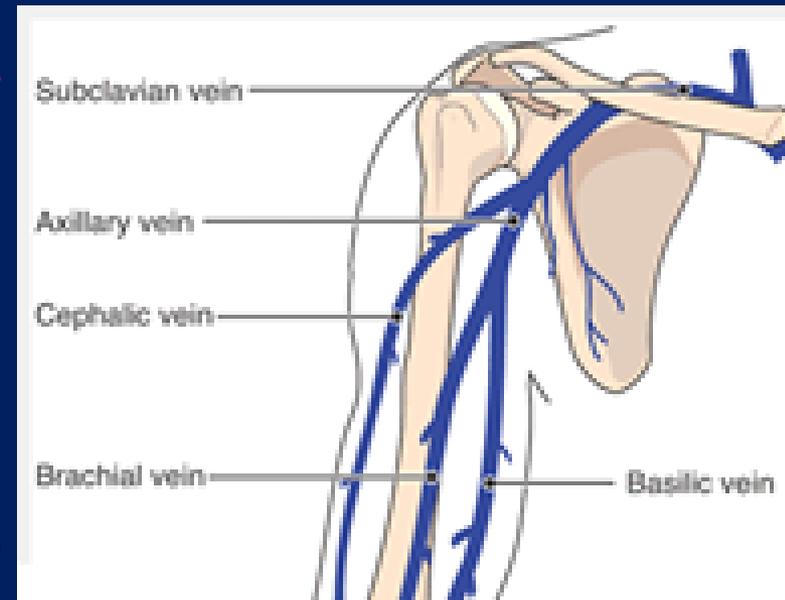
From the third part:

- The **subscapular artery** runs along the lower border of the subscapularis muscle.
- The **anterior** and **posterior circumflex humeral arteries** wind around the front and the back of the surgical neck of the humerus, respectively.



The axillary vein

■ The axillary vein is formed at the lower border of the teres major muscle by the union of the **venae comitantes** of the brachial artery and the **basilic** vein.



It runs upward on the medial side of the **axillary artery** and ends at the **lateral border** of 1st rib by becoming the **subclavian** vein. The vein receives tributaries, which correspond to the branches of the axillary artery, and the cephalic vein.

Brachial Plexus

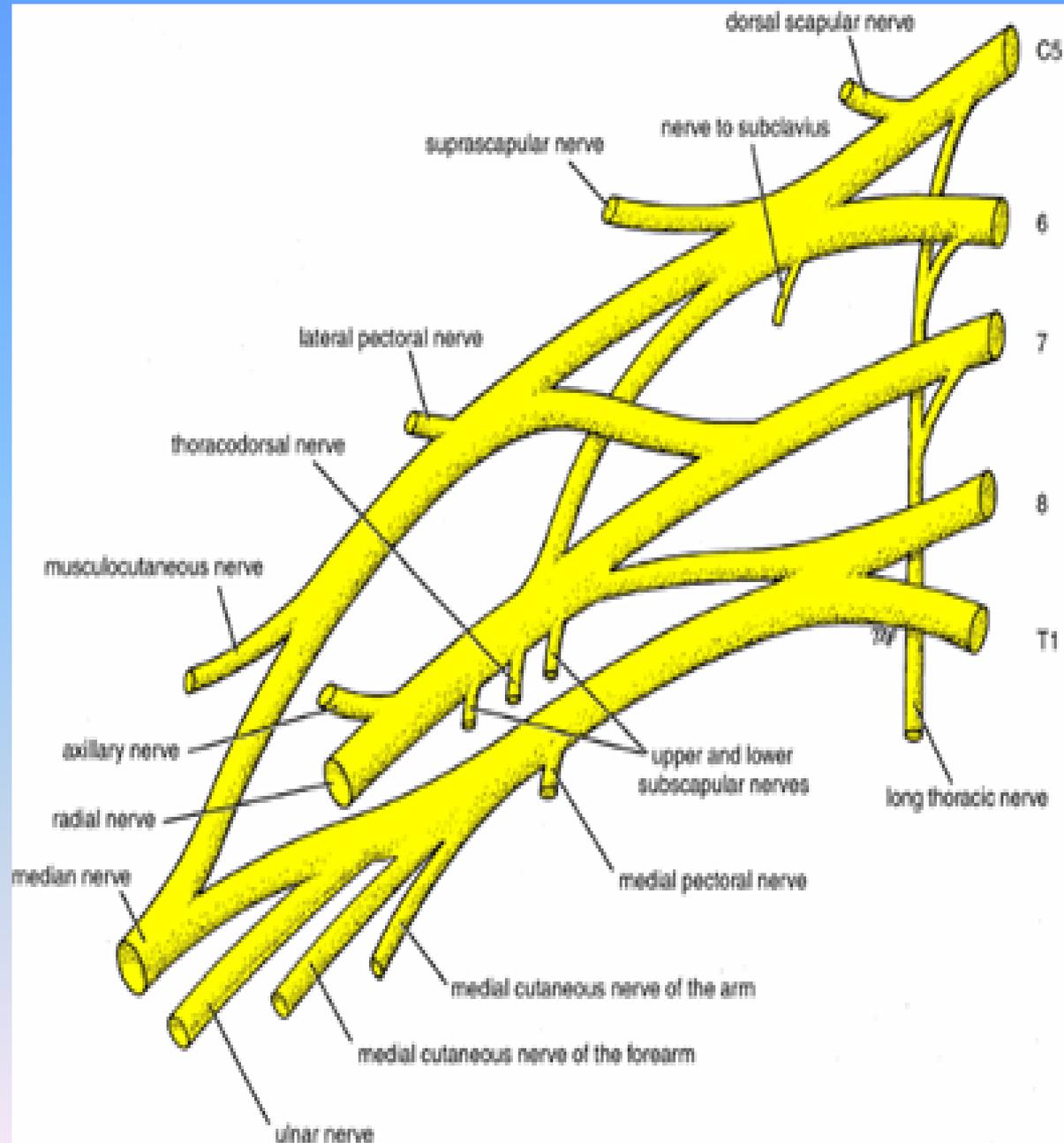
- Sensory innervation to the skin and deep structures, such as the joints;
- Motor innervation to the muscles;
- Influence over the diameters of the blood vessels by the sympathetic vasomotor nerves;
- Sympathetic secretomotor supply to the sweat glands.

Brachial Plexus

The nerves entering the upper limb provide the following important functions:

- **Sensory innervation** to the skin and deep structures, such as the joints;
- **motor innervation** to the muscles;
- **Influence over the diameters** of the blood vessels by the sympathetic vasomotor nerves; and sympathetic secretomotor supply to the sweat glands.

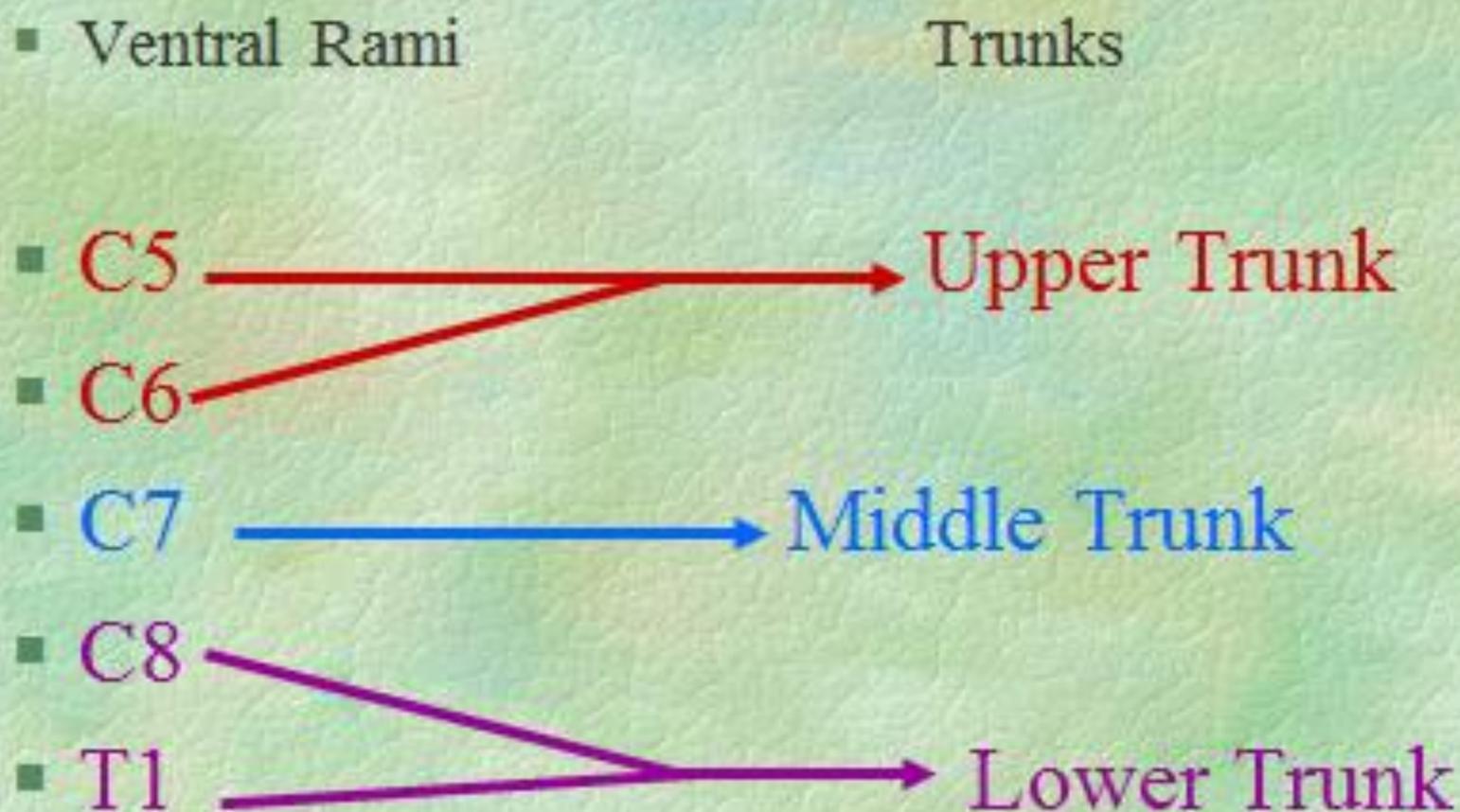
At the root of the neck, the brachial plexus is formed in the posterior triangle of the neck by the union of the anterior rami of the **fifth, sixth, seventh, and eighth cervical** and the **first thoracic** spinal nerves.



Parts of Brachial Plexus

- **R**eally **T**ired? **D**rink **C**offee **B**uddy!
- **R** = **ROOTS** (ventral rami)
- **T** = **TRUNKS**
- **D** = **DIVISIONS**
- **C** = **CORDS**
- **B** = **BRANCHES**

Roots join to form Trunks! (in neck)



Trunks Split to form Divisions! (in neck)

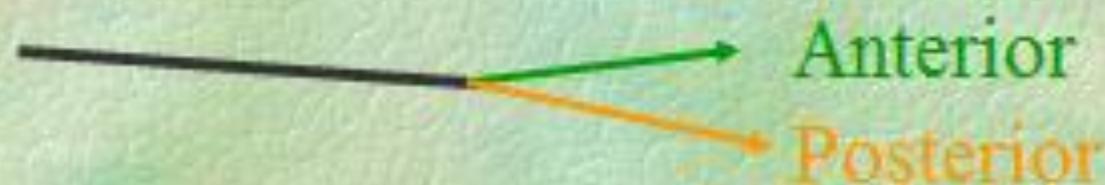
- Trunks

Divisions

- Upper



- Middle



- Lower

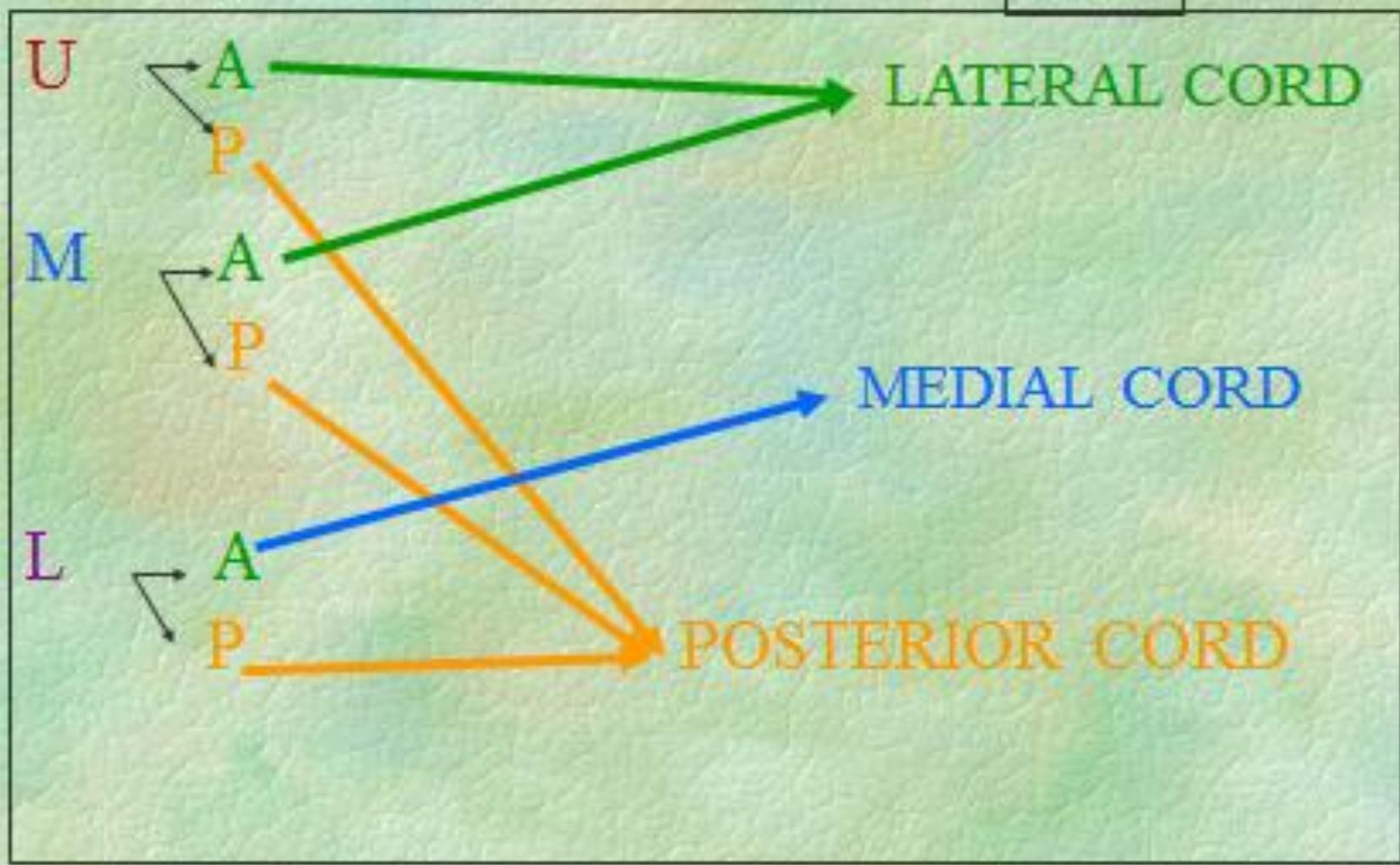


Divisions Join to form Cords! (in axilla)

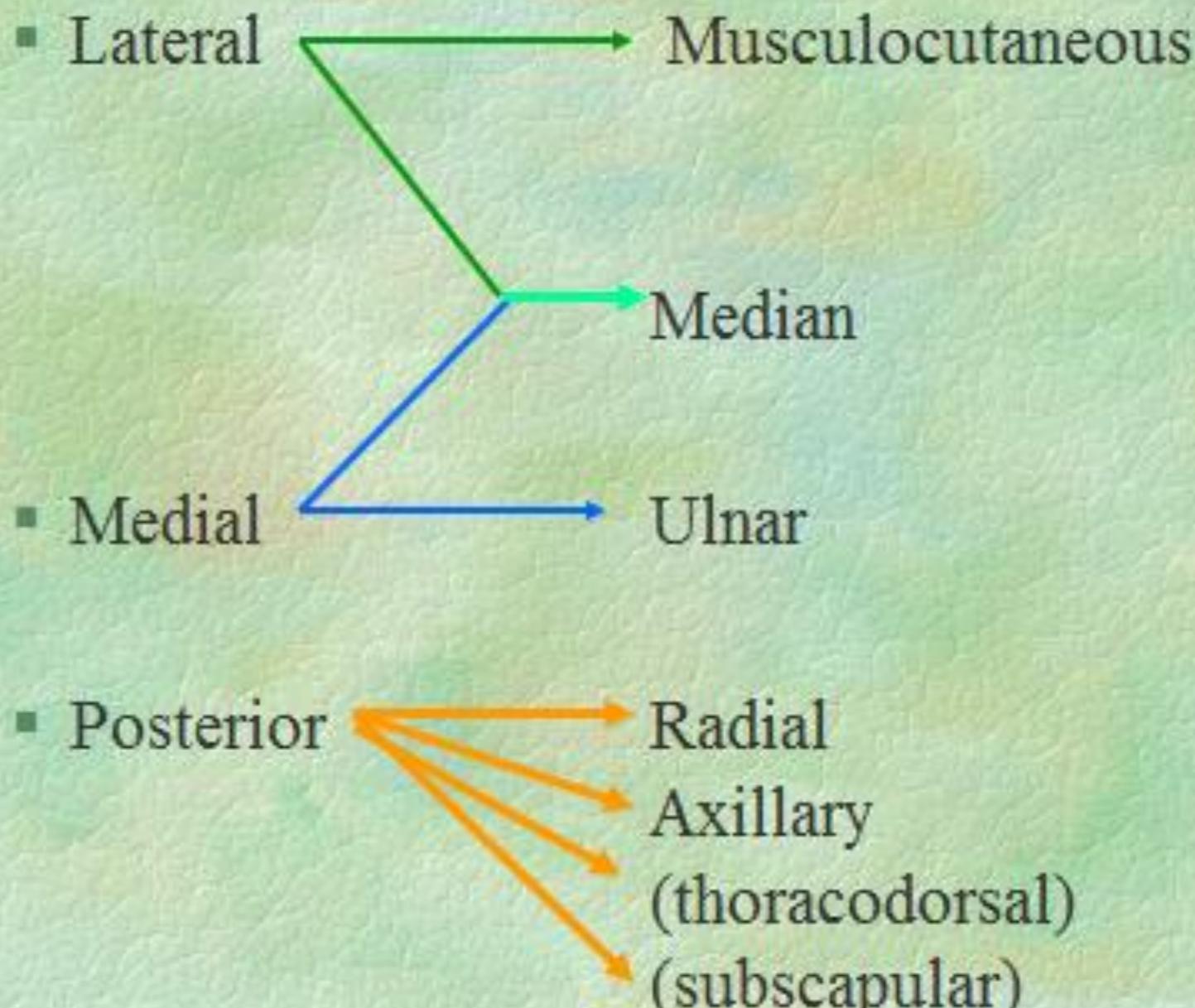
Trunks

Divisions

Cords

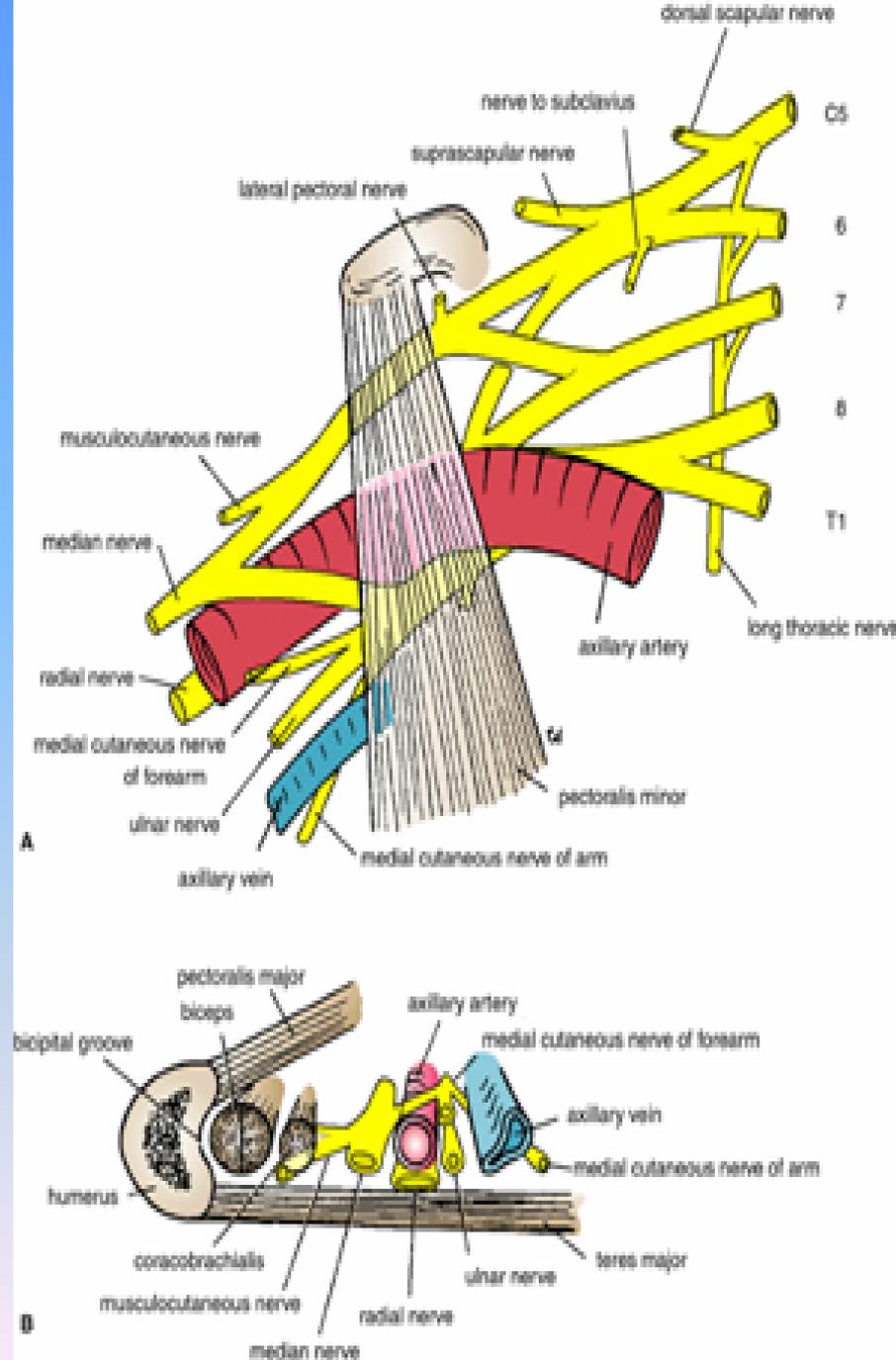


Cords Give off Branches!! (in axilla)



Cords of the Brachial Plexus

- All three cords of the brachial plexus lie above and lateral to the first part of the axillary artery.
- The medial cord crosses behind the artery to reach the medial side of the second part of the artery.
- The posterior cord lies behind the second part of the artery, and the lateral cord lies on the lateral side of the second part of the artery.
- Thus, the cords of the plexus have the relationship to the second part of the axillary artery that is indicated by their names.
- The branches of the different parts of the brachial plexus are as follows:



Branches of the Brachial Plexus

Roots

- Dorsal scapular nerve (C5)
- Long thoracic nerve (C5, 6, and 7)

Upper trunk

- Nerve to subclavius (C5 and 6)
- Suprascapular nerve (supplies the supraspinatus and infraspinatus muscles)

Lateral cord

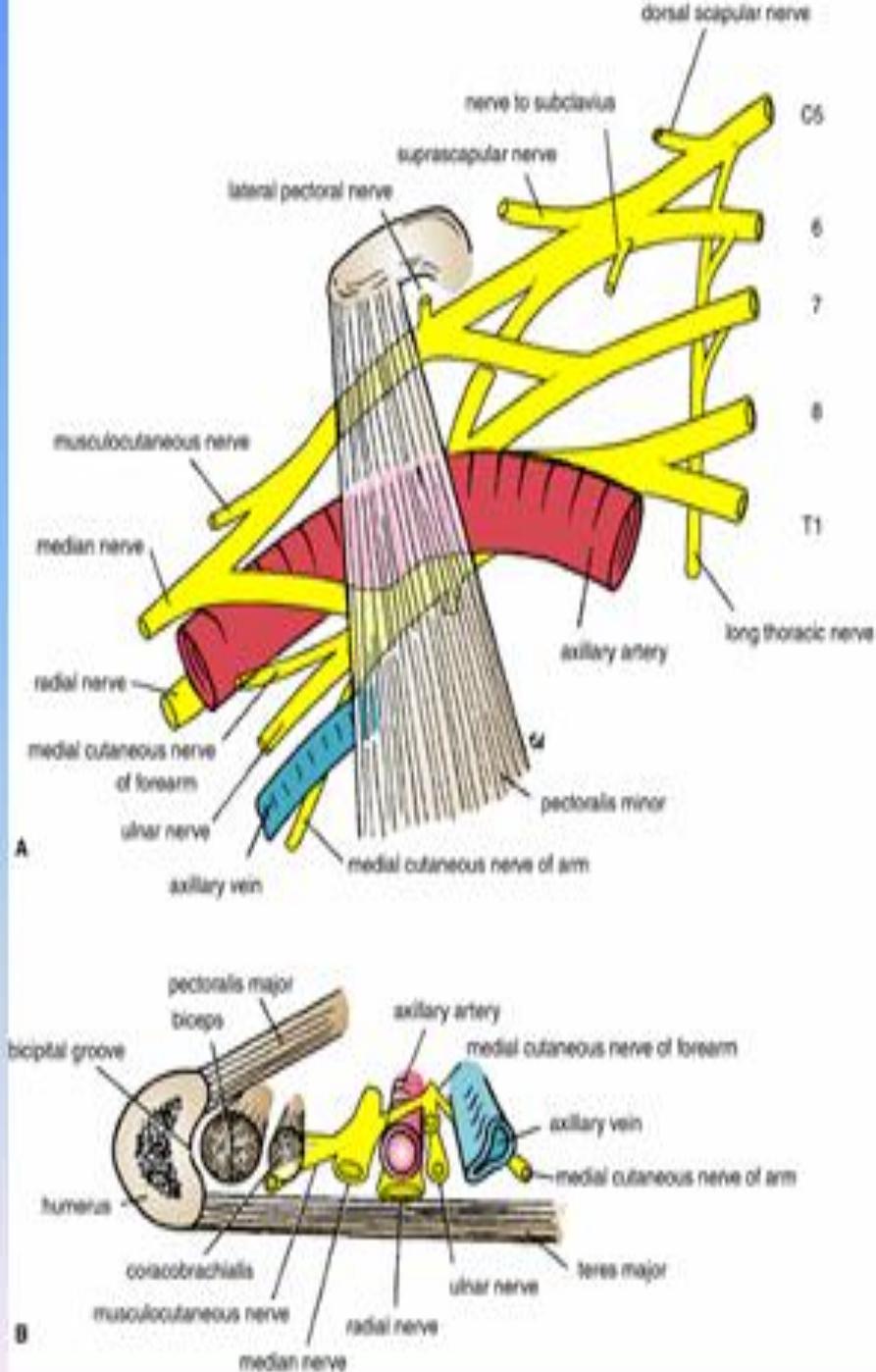
- Lateral pectoral nerve
- Musculocutaneous nerve
- Lateral root of median nerve

Medial cord

- Medial pectoral nerve
- Medial cutaneous nerve of arm and medial cutaneous nerve of forearm
- Ulnar nerve
- Medial root of median nerve

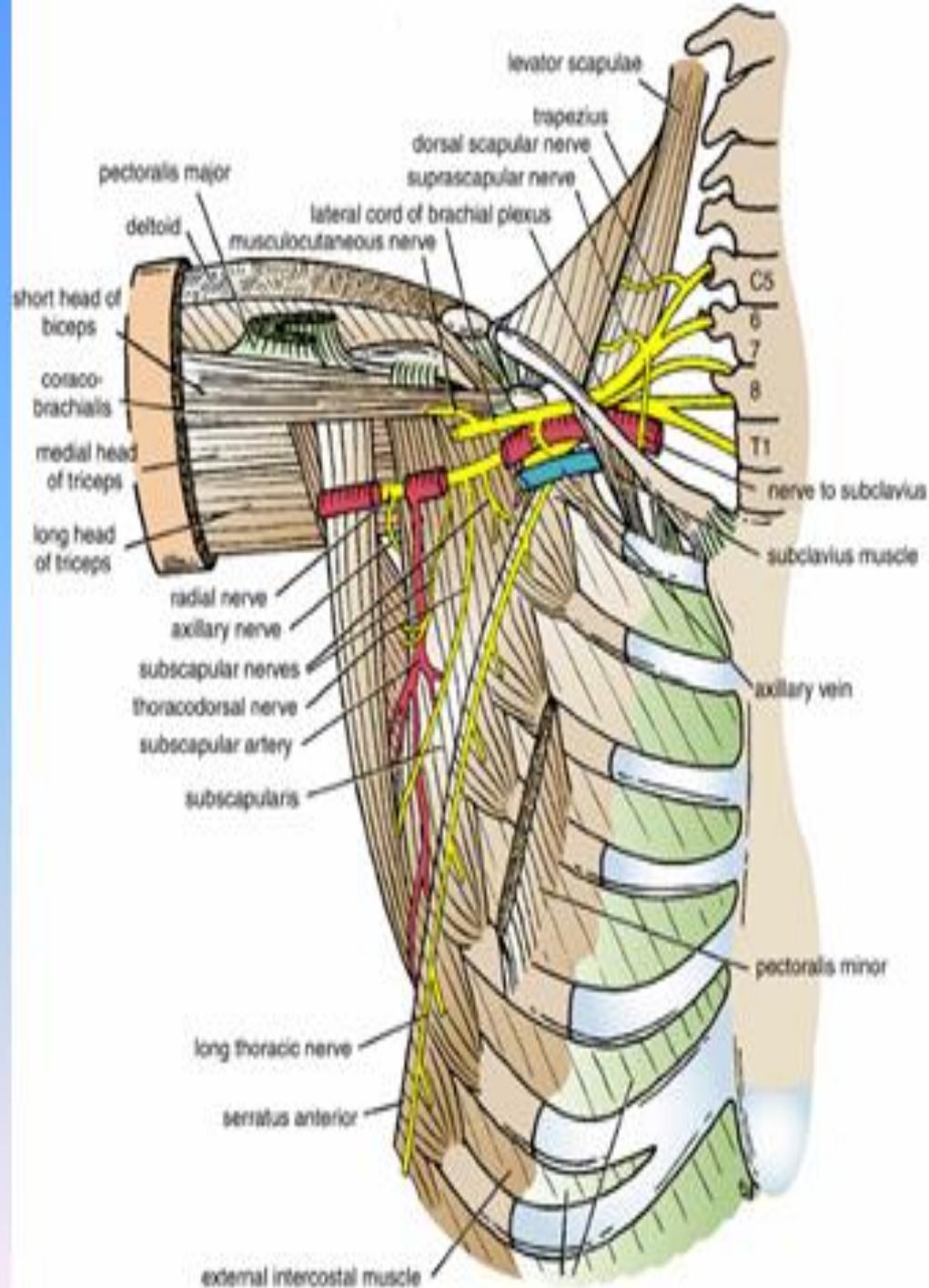
Posterior cord

- Upper and lower subscapular nerves
- Thoracodorsal nerve
- Axillary nerve
- Radial nerve

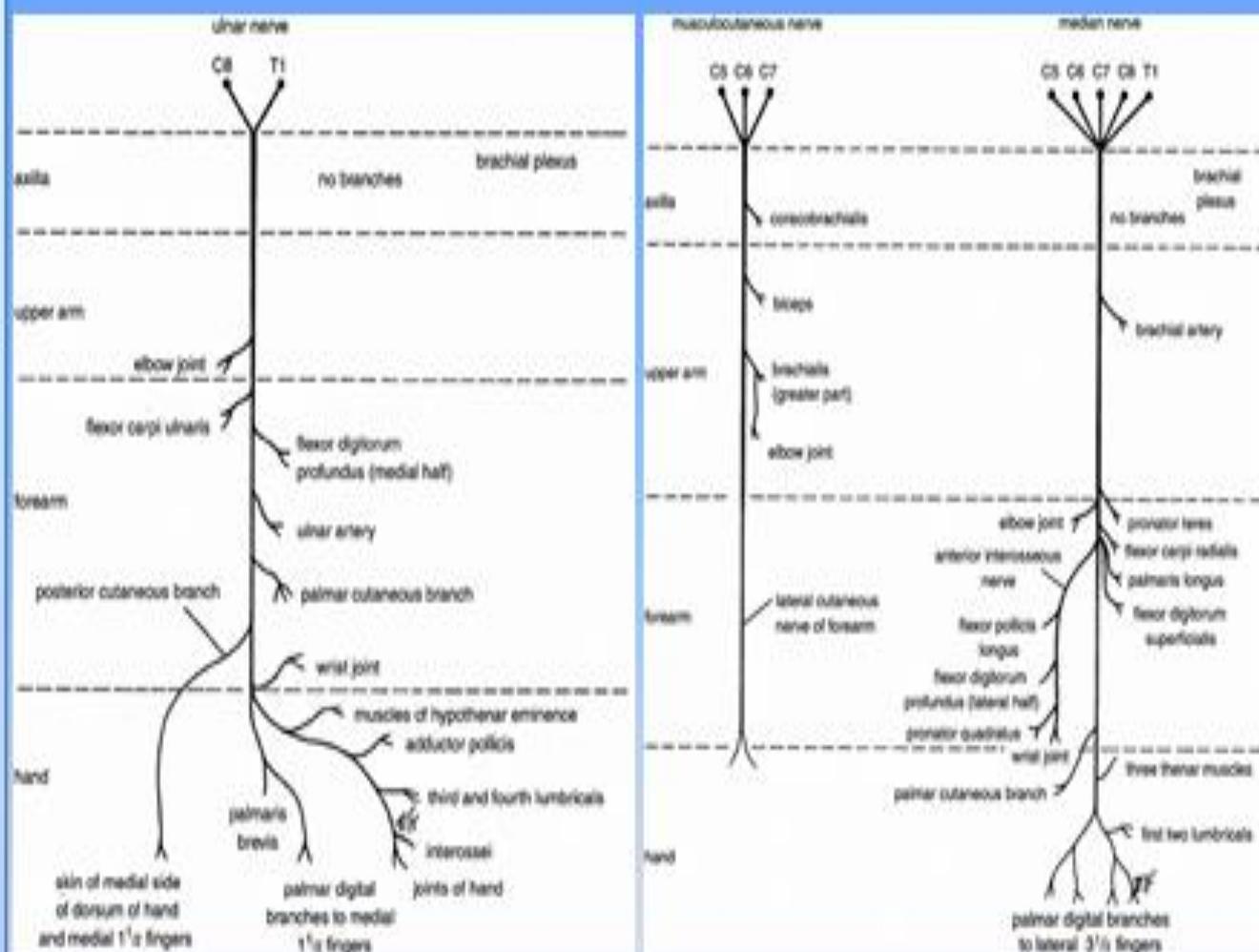


Branches of the Brachial Plexus in the Axilla

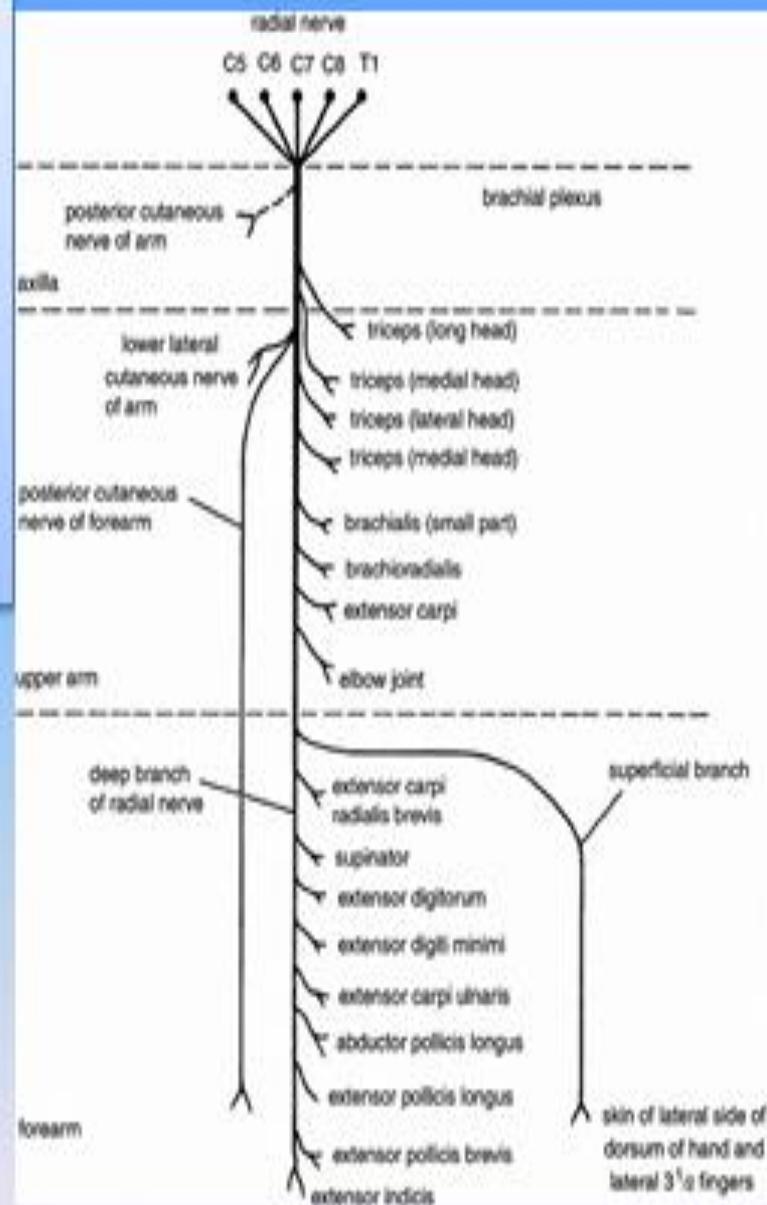
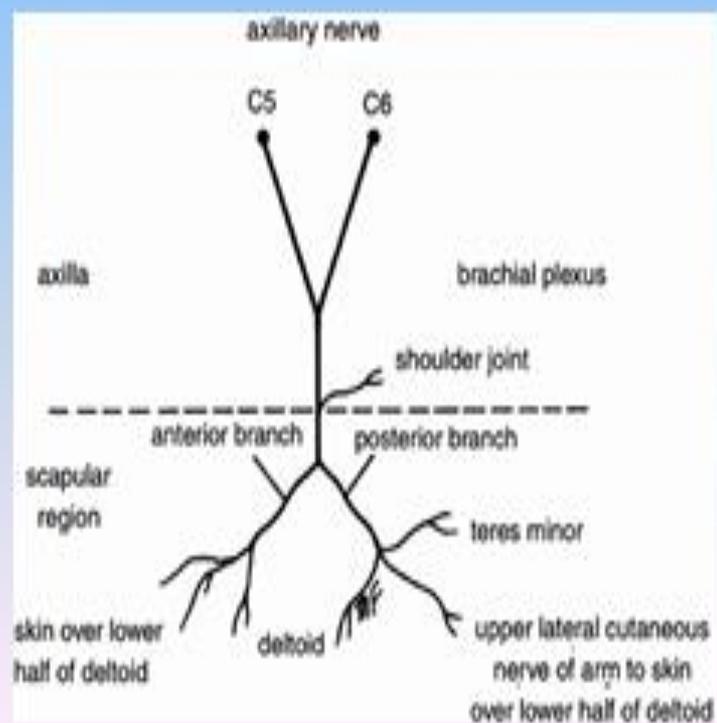
- The **nerve to the subclavius** (C5 and 6) supplies the subclavius muscle. It is important clinically because it may give a contribution (C5) to the phrenic nerve; this branch, when present, is referred to as the **accessory phrenic nerve**.
- The **long thoracic nerve** (C5, 6, and 7) arises from the roots of the brachial plexus in the neck and enters the axilla by passing down over the lateral border of the first rib behind the axillary vessels and brachial plexus. It descends over the lateral surface of the serratus anterior muscle, which it supplies.
- The **lateral pectoral nerve** arises from the lateral cord of the brachial plexus and supplies the pectoralis major muscle.
- The **musculocutaneous nerve** arises from the lateral cord of the brachial plexus, supplies the coracobrachialis muscle, and leaves the axilla by piercing that muscle.
- The **lateral root of the median nerve** is the direct continuation of the lateral cord of the brachial plexus. It is joined by the medial root to form the median nerve trunk, and this passes downward on the lateral side of the axillary artery. The median nerve gives off no branches in the axilla.



- The **medial pectoral nerve** arises from the medial cord of the brachial plexus, supplies and pierces the pectoralis minor muscle, and supplies the pectoralis major muscle.
- The **medial cutaneous nerve of the arm** (T1) arises from the medial cord of the brachial plexus and is joined by the intercostobrachial nerve (lateral cutaneous branch of the second intercostal nerve). It supplies the skin on the medial side of the arm.
- The **medial cutaneous nerve** of the forearm arises from the medial cord of the brachial plexus and descends in front of the axillary artery.
- The **ulnar nerve** (C8 and T1) arises from the medial cord of the brachial plexus and descends in the interval between the axillary artery and vein. The ulnar nerve gives off no branches in the axilla.
- The **medial root of the median nerve** arises from the medial cord of the brachial plexus and crosses in front of the third part of the axillary artery to join the lateral root of the median nerve.



- The **upper and lower subscapular nerves** arise from the posterior cord of the brachial plexus and supply the upper and lower parts of the subscapularis muscle. In addition, the lower subscapular nerve supplies the teres muscle.
- The **thoracodorsal nerve** arises from the posterior cord of the brachial plexus and runs downward to supply the latissimus dorsi muscle.
- The **axillary nerve** is one of the terminal branches of the posterior cord of the brachial plexus. It turns backward and passes through the quadrangular space. Having given off a branch to the shoulder joint, it divides into anterior and posterior branches.
- The **radial nerve** is the largest branch of the brachial plexus and lies behind the axillary artery. It gives off branches to the long and medial heads of the triceps muscle and the posterior cutaneous nerve of the arm. The latter branch is distributed to the skin on the middle of the back of the arm. A



Summary of the Branches of the Brachial Plexus and Their Distribution

Branches

Distribution

Roots

Dorsal scapular nerve (C5)	Rhomboid minor, rhomboid major, <u>levator scapulae</u> muscles
Long thoracic nerve (C5, 6, 7)	<u>Serratus anterior</u> muscle

Upper Trunk

<u>Suprascapular</u> nerve (C5, 6)	Supraspinatus and <u>infraspinatus</u> muscles
Nerve to <u>subclavius</u> (C5, 6)	<u>Subclavius</u>

Lateral Cord

Lateral pectoral nerve (C5, 6, 7)	<u>Pectoralis major</u> muscle
<u>Musculocutaneous</u> nerve (C5, 6, 7)	<u>Coracobrachialis</u> , <u>biceps brachii</u> , <u>brachialis</u> muscles; supplies skin along lateral border of forearm when it becomes the lateral cutaneous nerve of forearm
Lateral root of median nerve (C5, 6, 7)	See medial root of median nerve

Posterior Cord

Upper subscapular nerve (C5, Subscapularis muscle
6)

Thoracodorsal nerve (C6, 7, 8) Latissimus dorsi muscle

Lower subscapular nerve (C5, Subscapularis and teres major muscles
6)

Axillary nerve (C5, 6)

Deltoid and teres minor muscles; upper lateral cutaneous nerve of arm supplies skin over lower half of deltoid muscle

Radial nerve (C5, 6, 7, 8; T1)

Triceps, anconeus, part of brachialis, extensor carpi radialis longus; via deepradial nerve branch supplies extensor muscles of forearm: supinator, extensorcarpi radialis brevis, extensor carpi ulnaris, extensor digitorum, extensor digitiminimi, extensor indicis, abductor pollicis longus, extensor pollicis longus, extensor pollicis brevis; skin, lower lateral cutaneous nerve of arm, posteriorcutaneous nerve of arm, and posterior cutaneous nerve of forearm; skin onlateral side of dorsum of hand and dorsal surface of lateral three and a half fingers; articular branches to elbow, wrist, and hand

Medial Cord

Medial pectoral nerve (C8; T1) Pectoralis major and minor muscles

Medial cutaneous nerve of arm joined by intercostal brachial nerve from second intercostal nerve (C8; T1, 2) Skin of medial side of arm

Medial cutaneous nerve of forearm (C8; T1) Skin of medial side of forearm

Ulnar nerve (C8; T1) Flexor carpi ulnaris and medial half of flexor digitorum profundus, flexor digiti minimi, opponens digiti minimi, abductor digiti minimi, adductor pollicis, third and fourth lumbricals, interossei, palmaris brevis, skin of medial half of dorsum of hand and palm, skin of palmar and dorsal surfaces of medial one and a half fingers

Medial root of median nerve (with lateral root) forms median nerve (C5, 6, 7, 8; T1) Pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, abductor pollicis brevis, flexor pollicis brevis, opponens pollicis, first two lumbricals (by way of anterior interosseous branch), flexor pollicis longus, flexor digitorum profundus (lateral half), pronator quadratus; palmar cutaneous branch to lateral half of palm and digital branches to palmar surface of lateral three and a half fingers; articular branches to elbow, wrist, and carpal joints

Innervation by Posterior Cord

- Radial Nerve (largest branch)
 - Course: Through arm, around humerus, around lateral epicondyle, then divides
 - Innervates: all posterior muscles of arm and forearm
 - Triceps brachii, anconeus, supinator, brachioradialis
 - Divides in forearm:
 - Superficial = skin of arm and dorsolateral surface of hand
 - Deep = extensor muscles of forearm (eg E. carpi radialis L + B)
 - Damage to Radial Nerve = wristdrop
 - Inability to extend the hand, instability to fully extend forearm

Innervation by Posterior Cord (continued)

- Axillary Nerve (runs w/ caudal humeral circumflex a.)
 - Innervates:
 - Deltoid and Teres minor (motor inn)
 - Capsule of shoulder, skin of shoulder (sensory inn)
- Subscapular Nerve {branches of C5 + C6 rami}
 - Innervates: Subscapularis, Teres major
- Thoracodorsal Nerve (runs w/thoracodorsal a+v)
 - Innervates: Latissimus dorsi

Innervation by Lateral Cord

■ Musculocutaneous

- Course: branches to arm, distal to elbow becomes cutaneous for lateral forearm skin
 - Innervates
 - Biceps brachii, brachialis, coracobrachialis (motor inn)
 - Skin distal to elbow (sensory)
-

■ Suprascapular (runs w/suprascapular a+v) {C5, C6}

- Innervates: Supraspinatus, Infraspinatus

Innervation by Lateral Cord

■ Musculocutaneous

- Course: branches to arm, distal to elbow becomes cutaneous for lateral forearm skin
 - Innervates
 - Biceps brachii, brachialis, coracobrachialis (motor inn)
 - Skin distal to elbow (sensory)
-

■ Suprascapular (runs w/suprascapular a+v) {C5, C6}

- Innervates: Supraspinatus, Infraspinatus

Innervation by Medial Cord

■ Ulnar

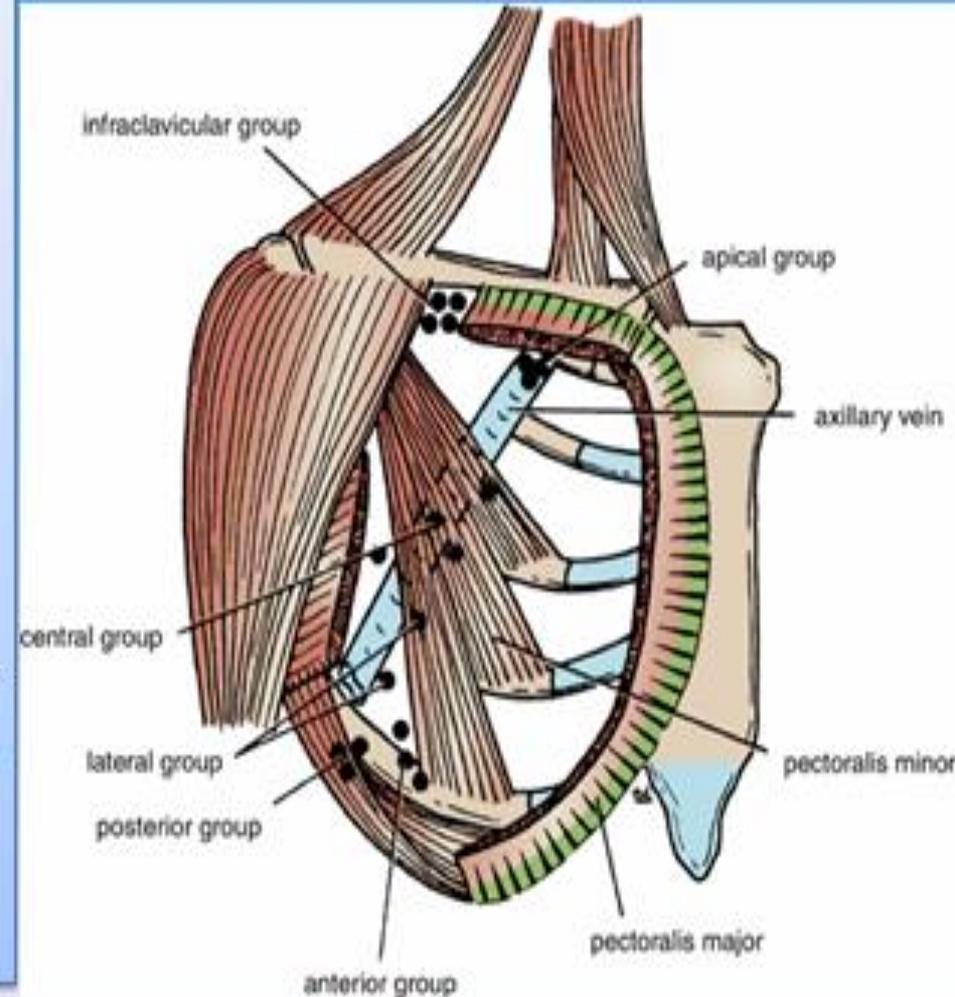
- Course: runs along medial side of arm, behind medial epicondyle, superficial to carpal tunnel into hand, branches to supply intrinsic and skin
- Innervates:
 - FCU and part of FDP, most intrinsic (motor inn)
 - Skin of medial 2/3 of hand A+P (sensory inn)
- Nerve Damage: Clawhand
 - Inability to extend fingers at interphalangeal joints, results in permanent flexion = claw

Lymph Nodes of the Axilla

- The axillary lymph nodes (20 to 30 in number) drain lymph vessels from the lateral quadrants of the breast, the superficial lymph vessels from the thoracoabdominal wall above the level of the umbilicus, and the vessels from the upper limb.

The lymph nodes are arranged in six groups.

1. **Anterior (pectoral) group:** Lying along the lower border of the pectoralis minor behind the pectoralis major, these nodes receive lymph vessels from the lateral quadrants of the breast and superficial vessels from the anterolateral abdominal wall above the level of the umbilicus.
2. **Posterior (subscapular) group:** Lying in front of the subscapularis muscle, these nodes receive superficial lymph vessels from the back, down as far as the level of the iliac crests.
3. **Lateral group:** Lying along the medial side of the axillary vein, these nodes receive most of the lymph vessels of the upper limb (except those superficial vessels draining the lateral side see infraclavicular nodes, below).
4. **Central group:** Lying in the center of the axilla in the axillary fat, these nodes receive lymph from the above three groups.
5. **Infraclavicular (deltopectoral) group:** These nodes are not strictly axillary nodes because they are located outside the axilla. They lie in the groove between the deltoid and pectoralis major muscles and receive superficial lymph vessels from the lateral side of the hand, forearm, and arm.
6. **Apical group:** Lying at the apex of the axilla at the lateral border of the first rib, these nodes receive the efferent lymph vessels from all the other axillary nodes.



Skin of Scapular Region

- The **sensory nerve** supply to the skin of the back is from the posterior rami of the spinal nerves.

The first and eighth cervical nerves do not supply skin and posterior rami of upper three lumbar nerves run downward to supply skin over the buttock.

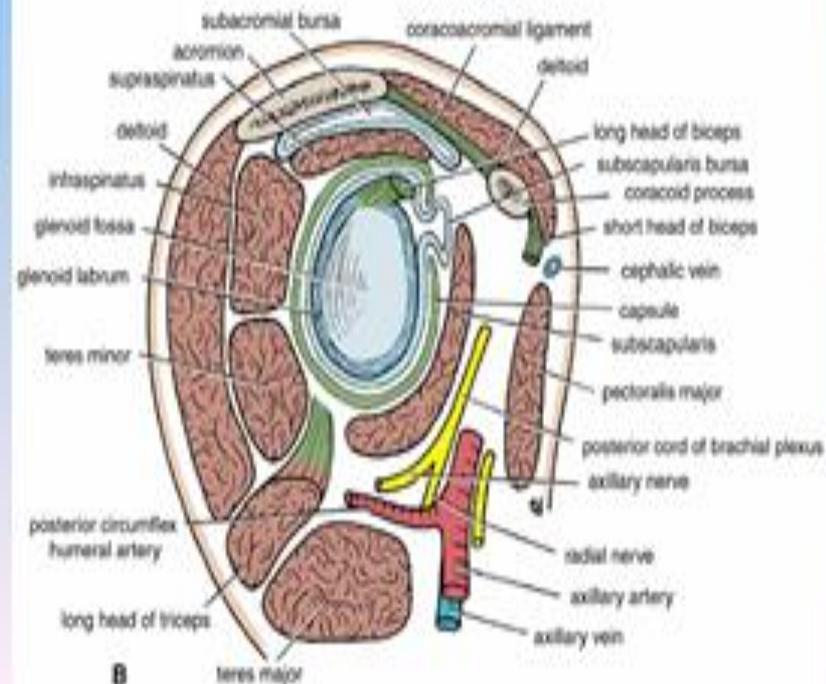
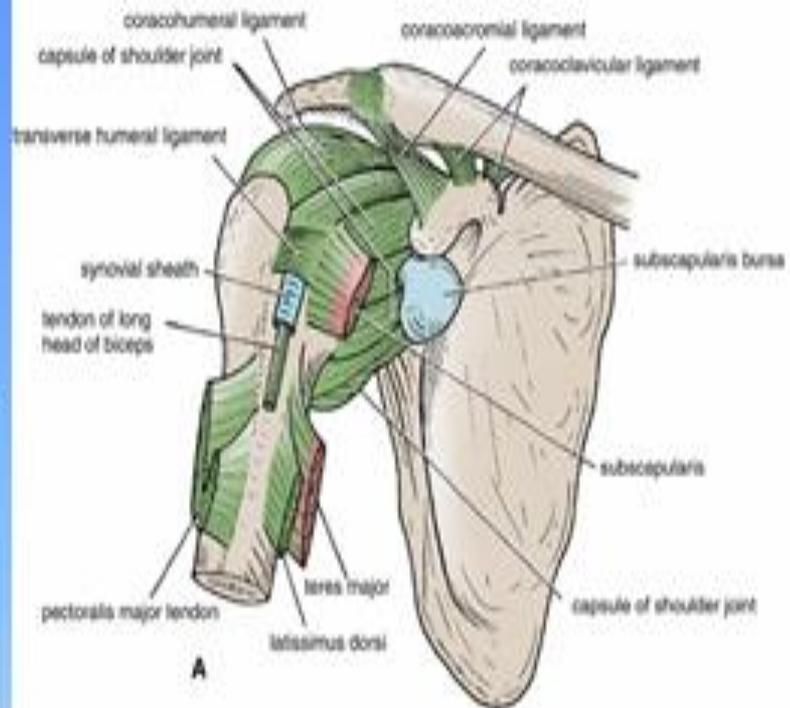
- The **blood supply** to the skin is from the posterior branches of the posterior intercostal arteries and the lumbar arteries. The veins correspond to the arteries and drain into azygos veins and inferior vena cava.

- The **lymph drainage** of the skin of the back above the level of the iliac crests is upward into the posterior group of axillary lymph nodes.

Muscles

Rotator Cuff

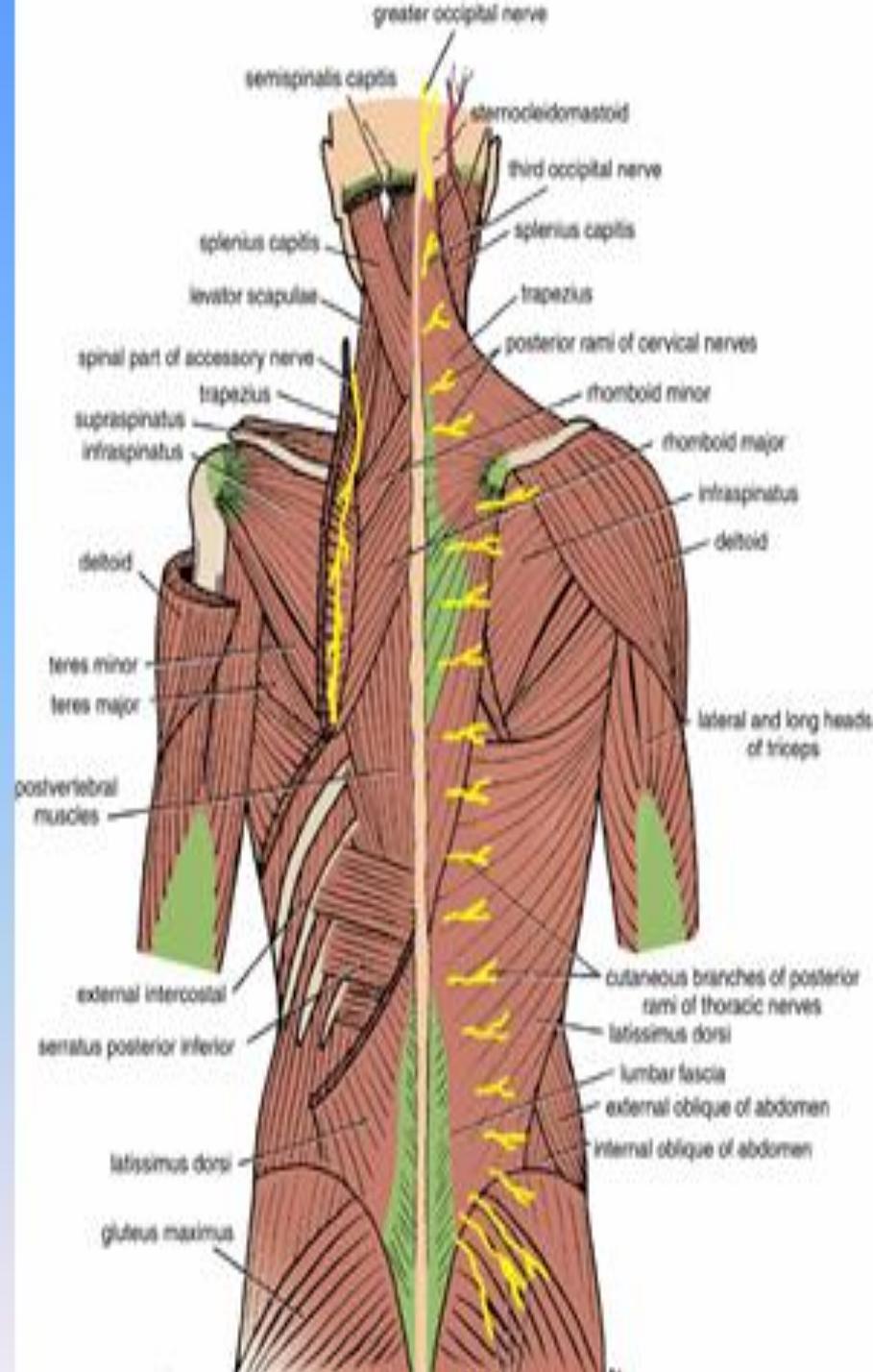
- The rotator cuff is the name given to the tendons of the **subscapularis**, **supraspinatus**, **infraspinatus**, and **teres minor** muscles, which are fused to the underlying capsule of the shoulder joint.
- The cuff plays a very important role in stabilizing the shoulder joint.
- The tone of these muscles assists in holding the head of the humerus in the glenoid cavity of the scapula during movements at the shoulder joint. The cuff lies on the anterior, superior, and posterior aspects of the joint. The cuff is deficient inferiorly, and this is a site of potential weakness.



Nerves

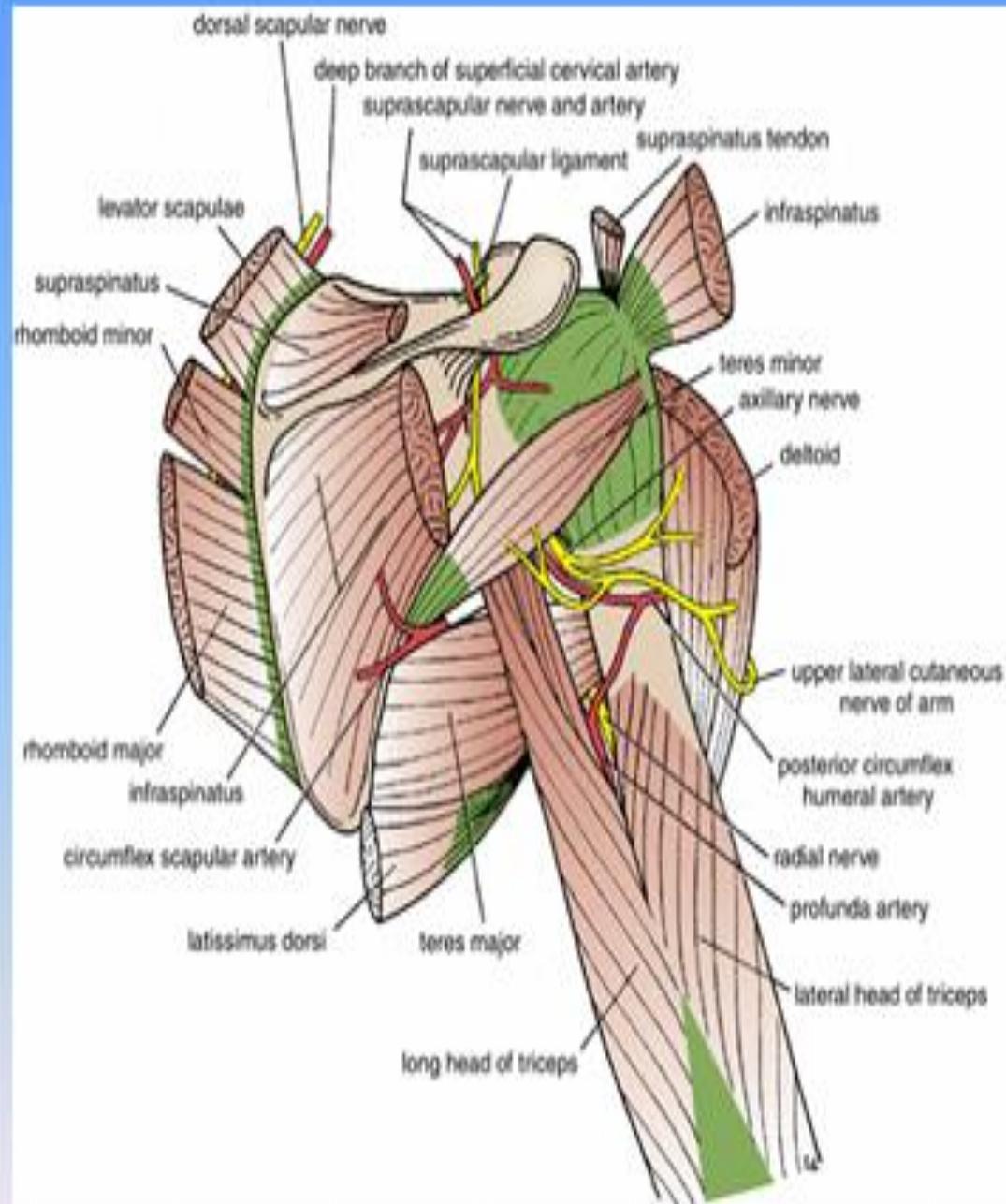
Spinal Part of the Accessory Nerve (Cranial Nerve XI)

- The spinal part of the accessory nerve runs downward in the posterior triangle of the neck on the levator scapulae muscle.
- It is accompanied by branches from the anterior rami of the third and fourth cervical nerves.
- The accessory nerve runs beneath the anterior border of the trapezius muscle at the junction of its middle and lower thirds and, together with the cervical nerves, supplies the trapezius muscle.



Axillary Nerve

- The **axillary nerve** arises from the posterior cord of the brachial plexus (C5 and 6) in the axilla.
- It passes backward and enters the quadrangular space with the posterior circumflex humeral artery.
- As the nerve passes through the space, it comes into close relationship with the inferior aspect of the capsule of the shoulder joint and with the medial side of the surgical neck of the humerus.
- It terminates by dividing into anterior and posterior branches.

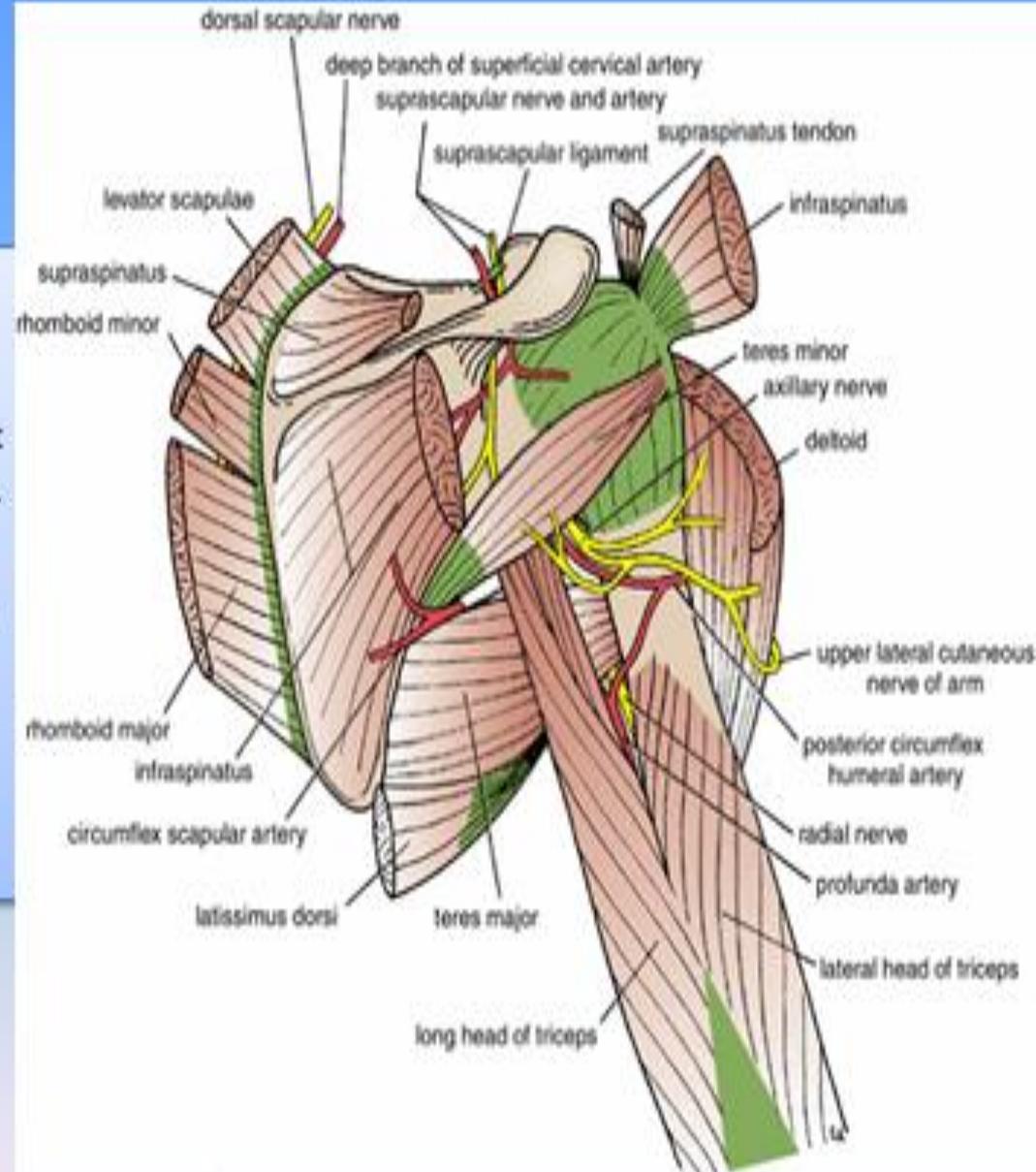


Branches of Axillary Nerve

The axillary nerve has the following branches:

- An **articular branch** to the shoulder joint
- An **anterior terminal branch**, which winds around the surgical neck of the humerus beneath the deltoid muscle; it supplies the deltoid and the skin that covers its lower part.
- A **posterior terminal branch**, which gives off a branch to the teres minor muscle and a few branches to the deltoid, then emerges from the posterior border of the deltoid as the **upper lateral cutaneous nerve of the arm**.

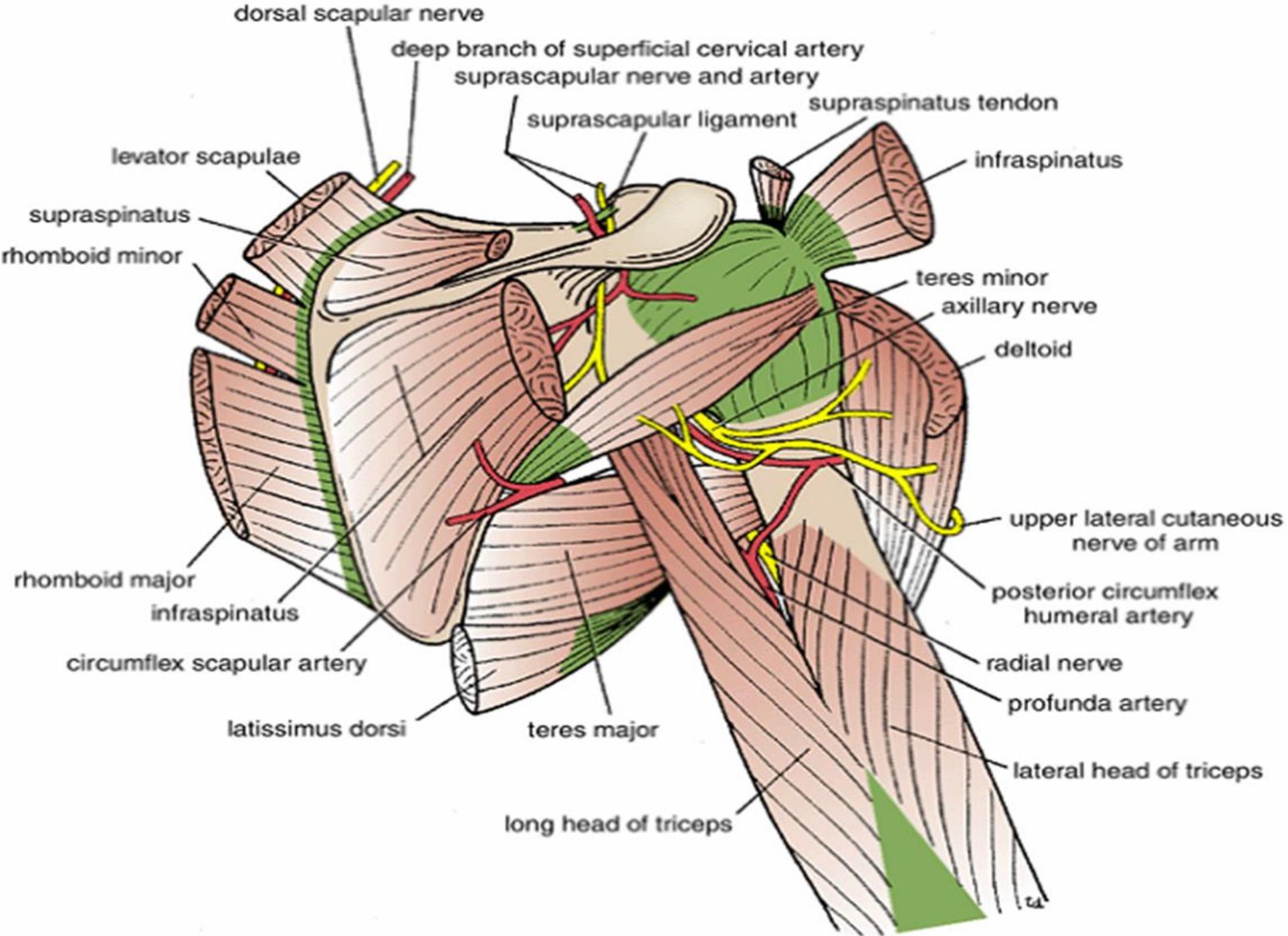
It is thus seen that the axillary nerve supplies the shoulder joint, two muscles, and the skin covering the lower half of the deltoid muscle.



* APPLIED ANATOMY : injury of axillary N. :-

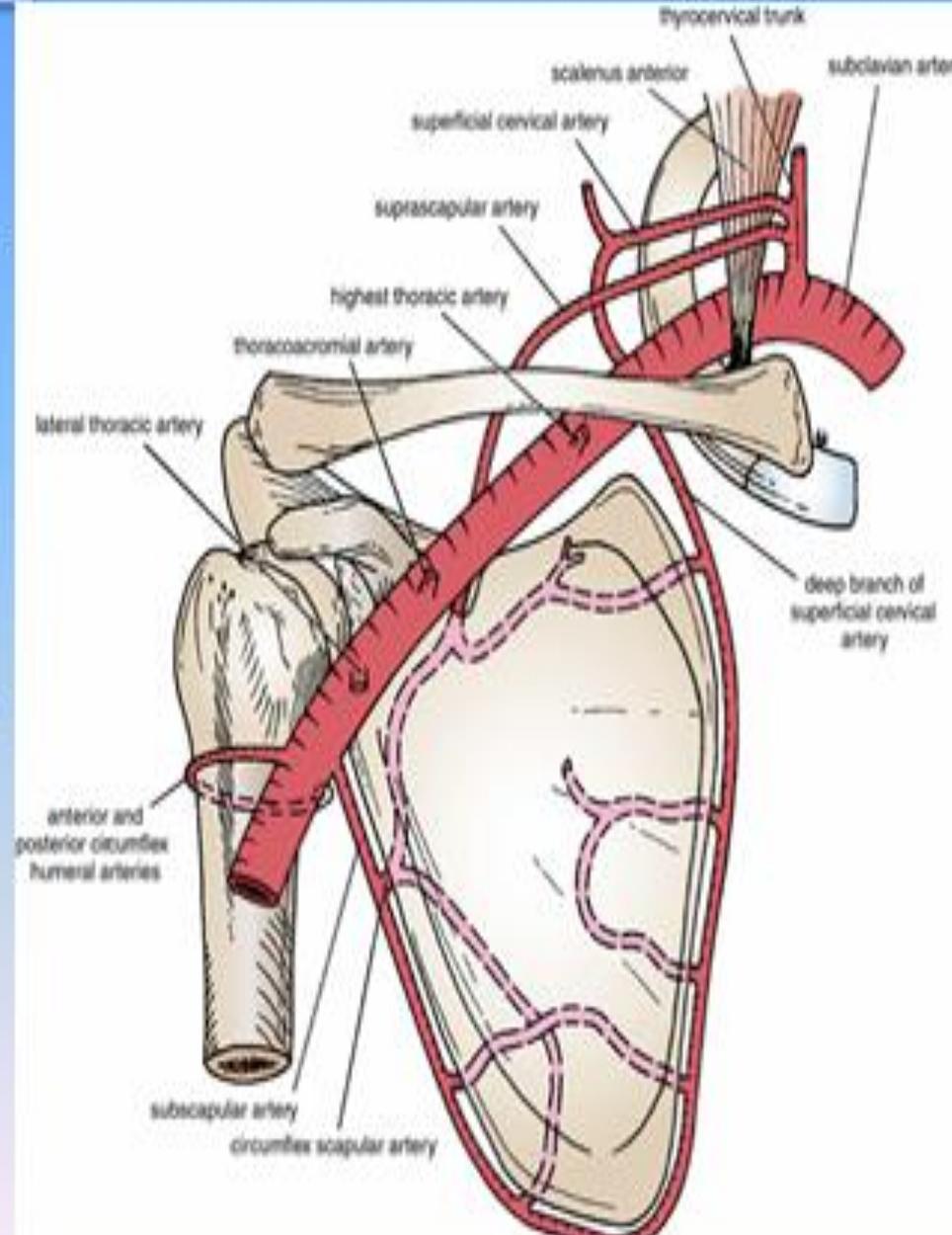
- **Mechanism:**
 - Fracture of surgical neck of humerus
 - Dislocation of shoulder.
 - Compression by crutches.

- **Effect:**
 - * Motor :- paralysis of deltoid & Teres minor
 - Loss of abduction from 15 to 90
 - **Flat shoulder** due to flattening of deltoid → prominent acromion.
 - * Sensory : loss of sensation over lower part of deltoid.



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.

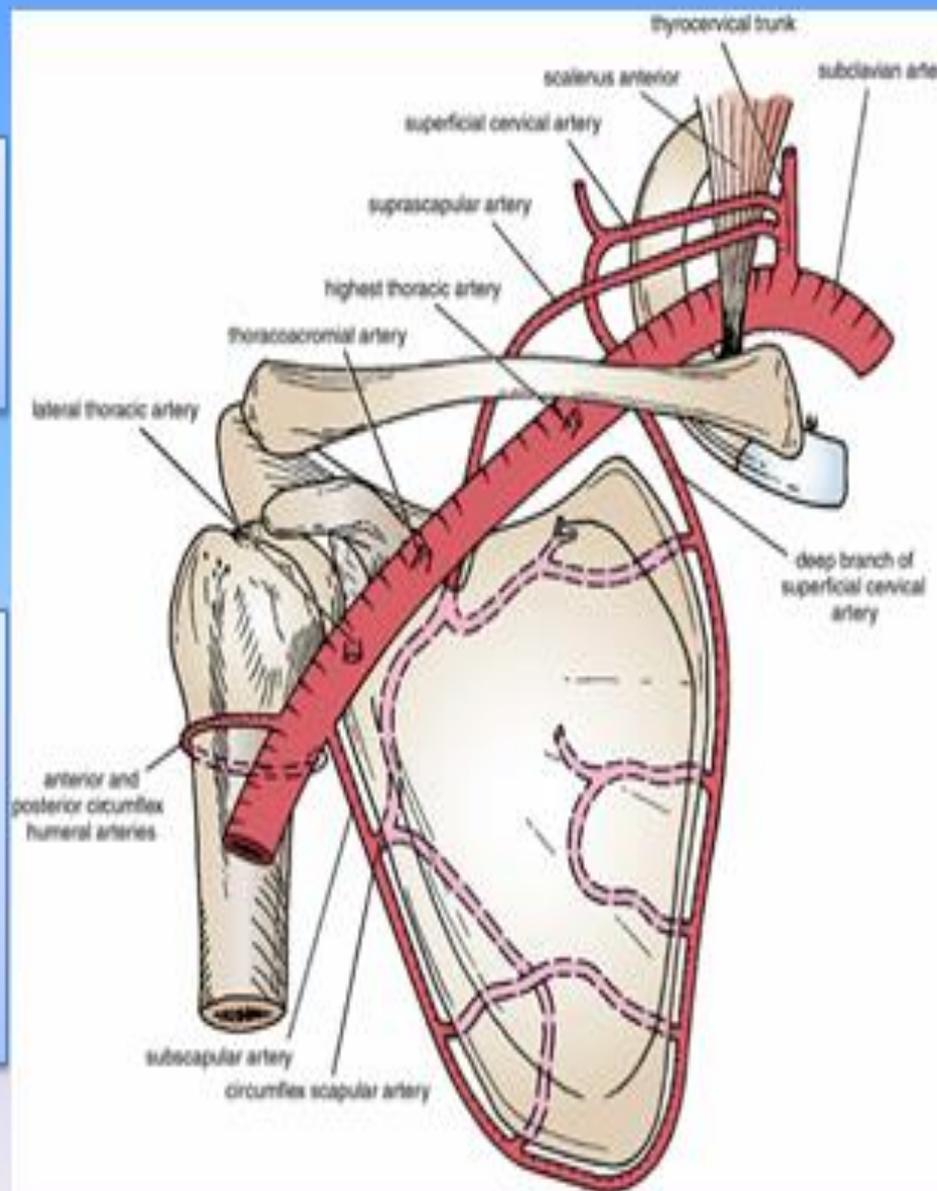


Branches from the Subclavian Artery

- 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 circle around the surgical neck of the humerus.



Thank You & Good Luck

