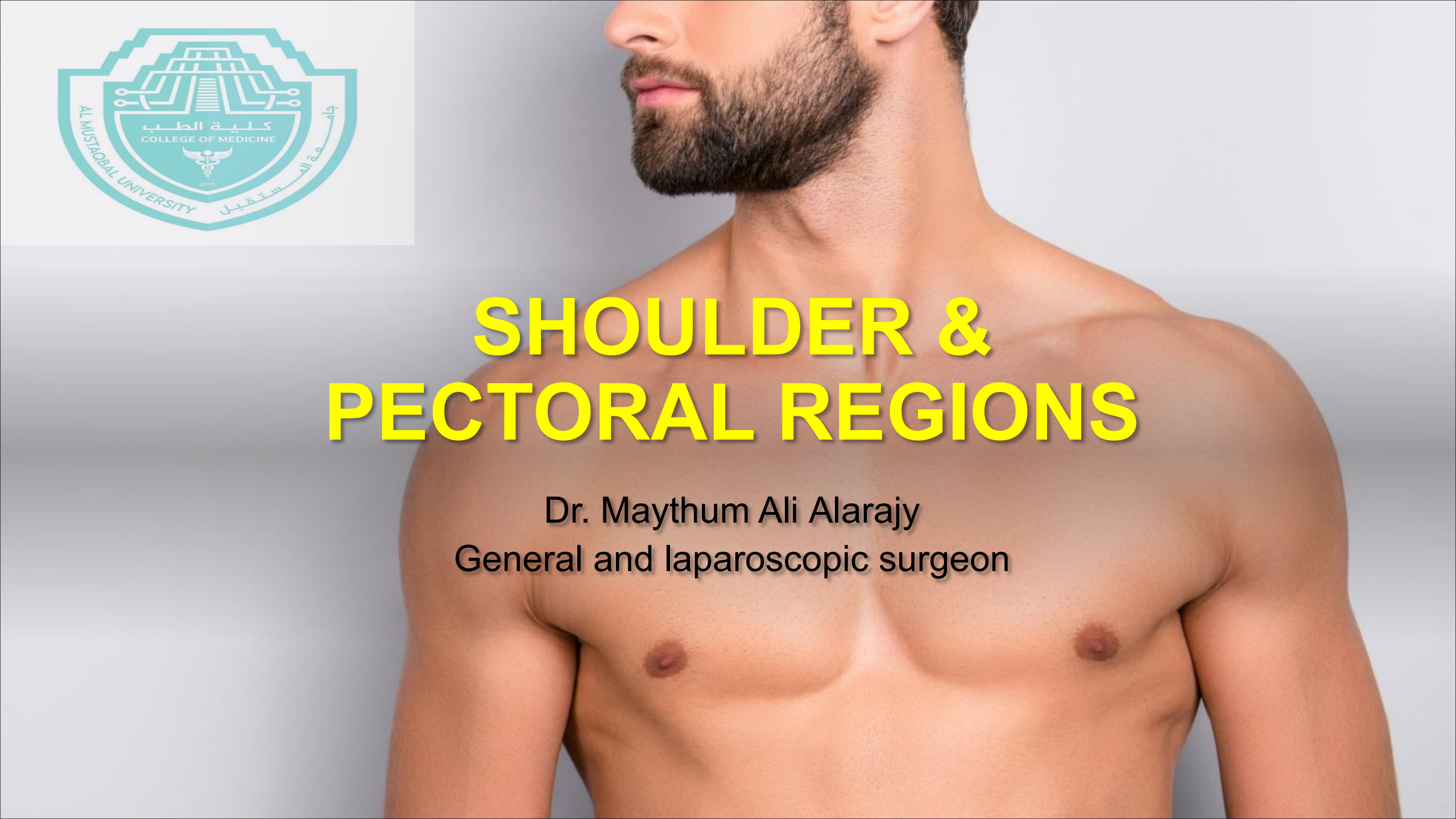


SHOULDER & PECTORAL REGIONS

Dr. Maythum Ali Alarajy
General and laparoscopic surgeon

Learning Outcome

At the end of this lecture, you should be able to:

a) Describe the attachments, actions and innervations of **muscles** of shoulder and pectoral regions

b) Describe the **rotator cuff muscles** and their functions

c) Describe the **spaces** at the posterior scapular region

d) Describe the **applied anatomy** of the shoulder and pectoral regions

Outline

a) Clavicle
b) Scapula

2. **Muscles**:
   a) Axioappendicular muscles
   b) Scapulohumeral muscles

3. **Rotator cuff**

4. **Posterior scapular spaces**

5. **Clinical correlations**

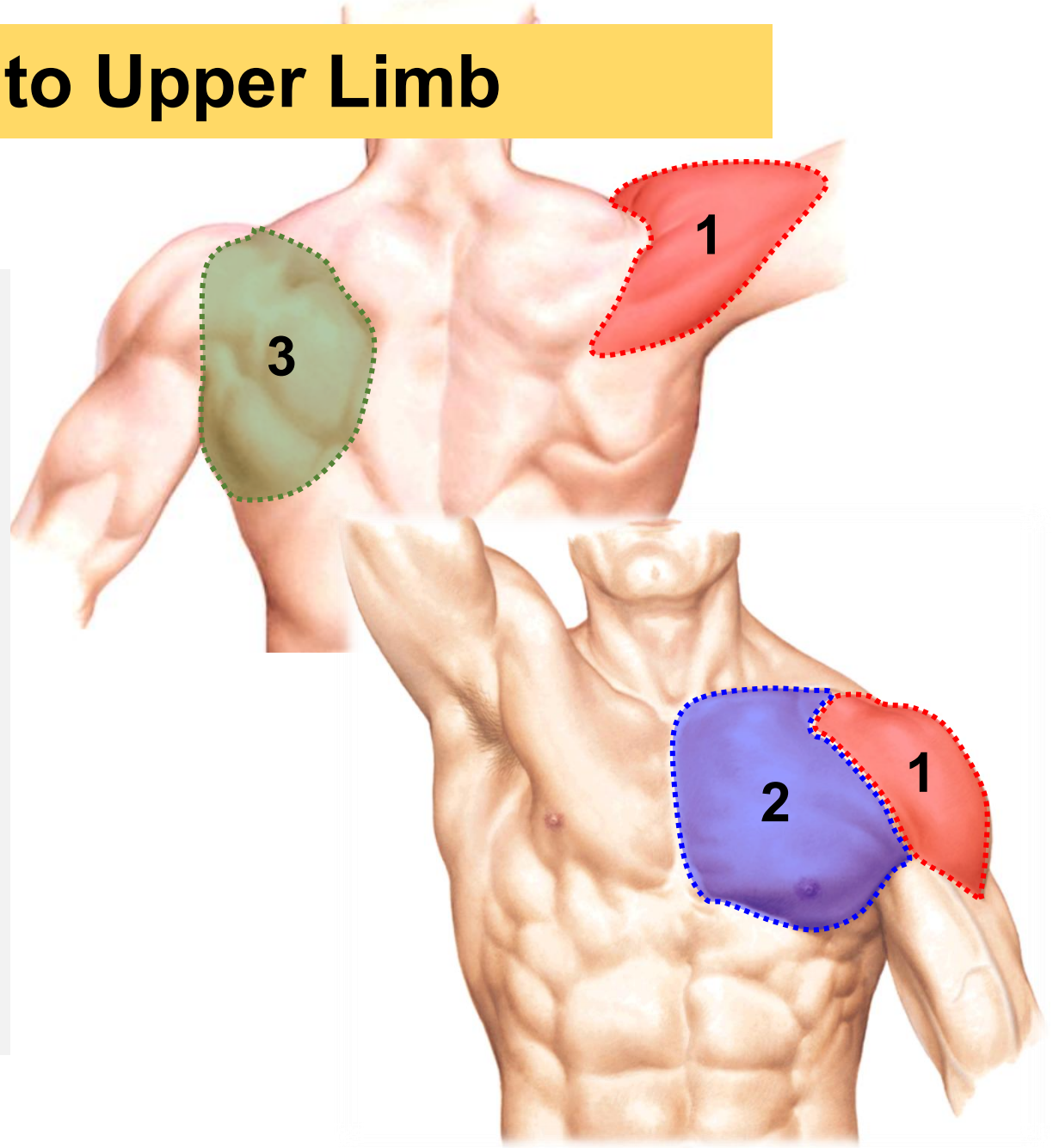
Introduction to Upper Limb

Upper limb (UL) consists of 4 parts:

- Shoulder – attachment site of UL to the trunk
- Arm/ upper arm
- Forearm
- Hand

Shoulder region consists of:

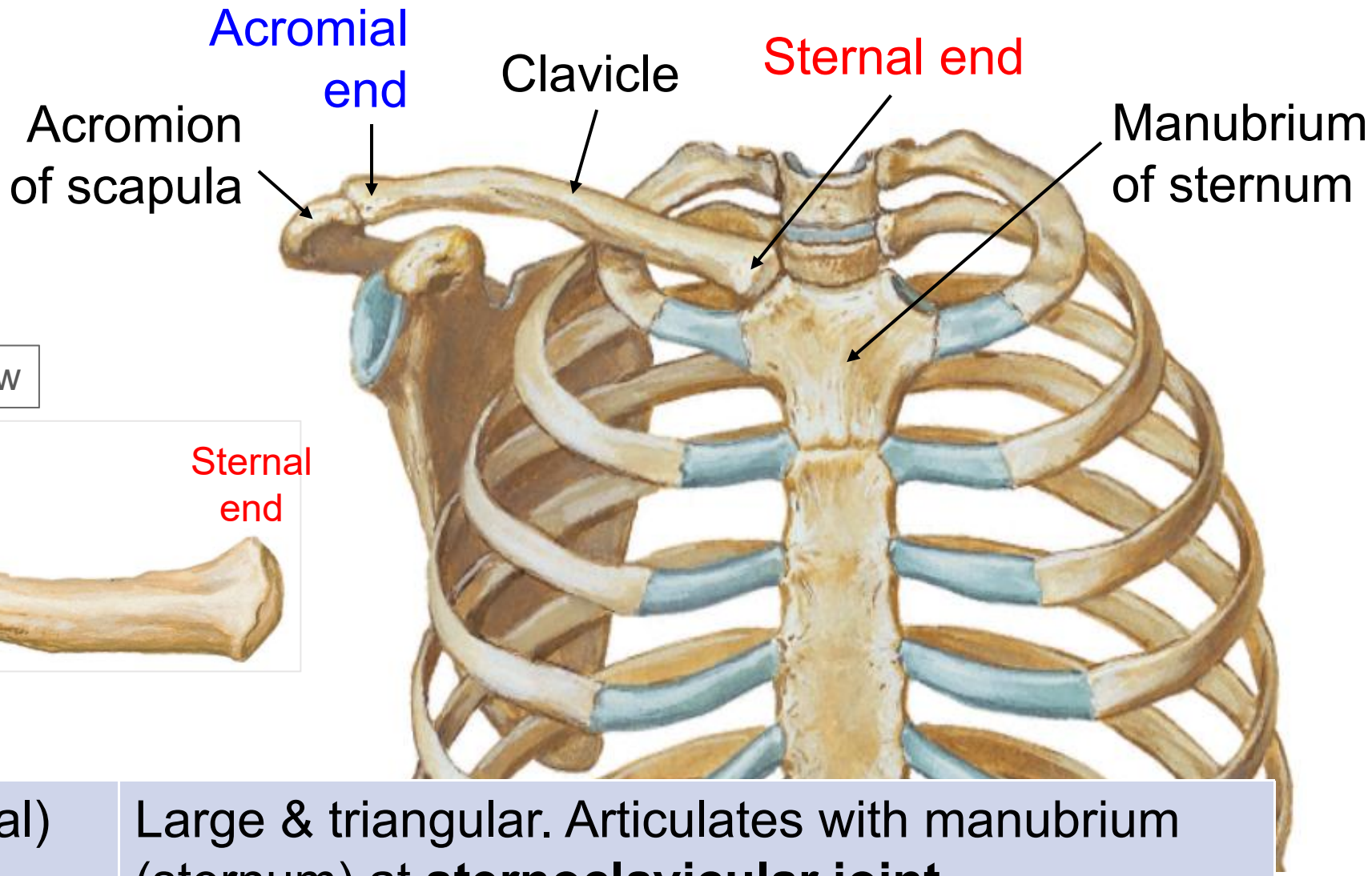
1. Deltoid region
2. Pectoral region
3. Scapular region



1. Bones in Shoulder and Pectoral Regions

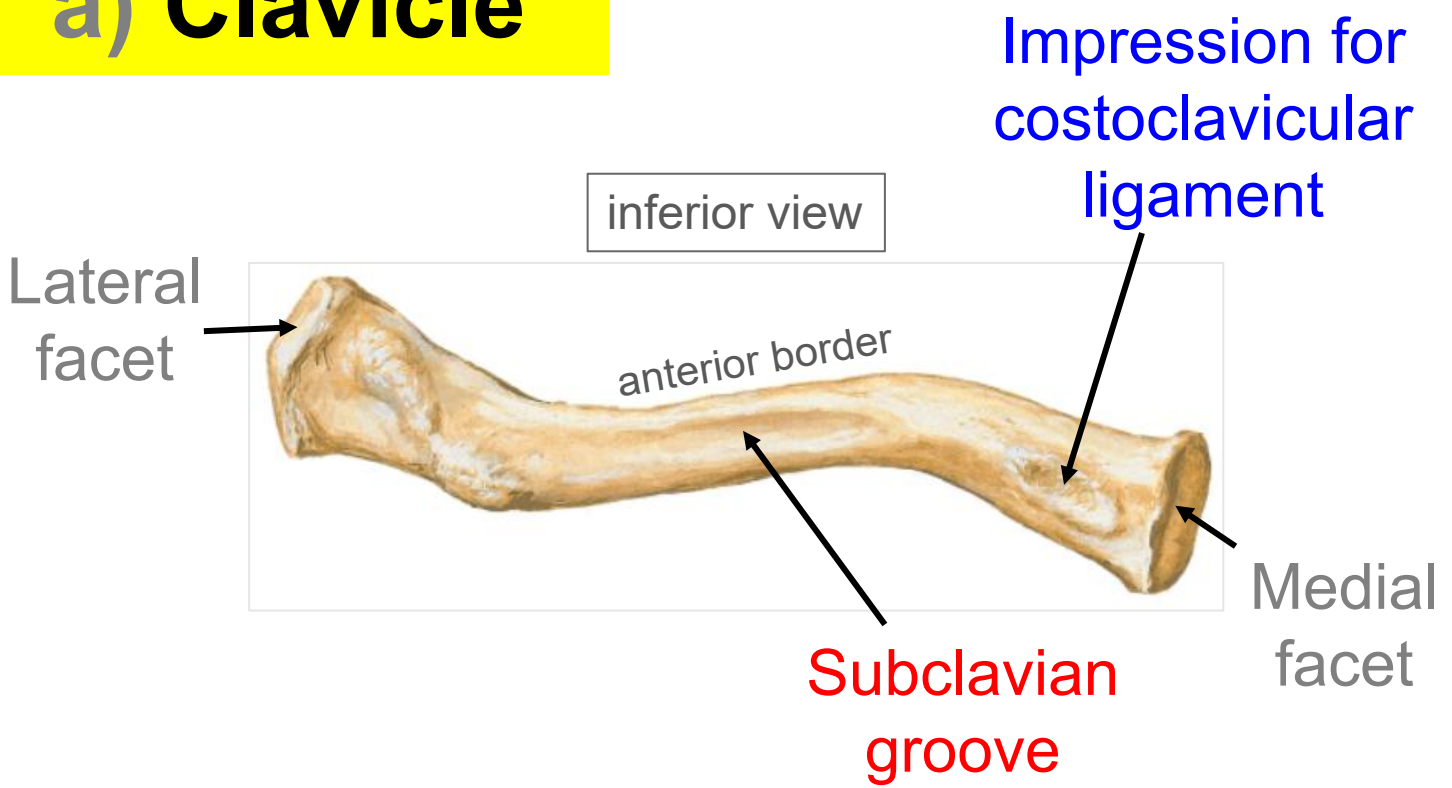
a) Clavicle
b) Scapula

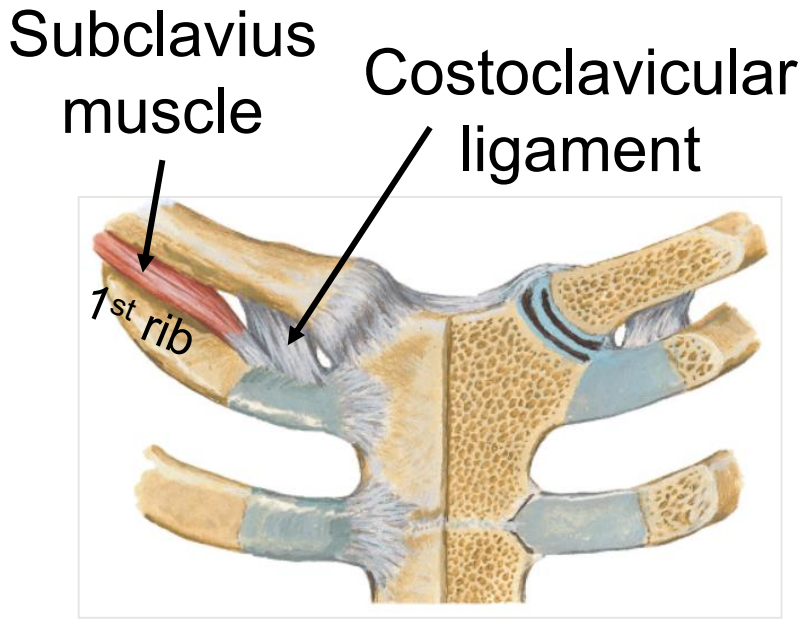
a) Clavicle



Sternal end (medial)	Large & triangular. Articulates with manubrium (sternum) at **sternoclavicular joint**
Acromial end (lateral)	Flat. Articulates with acromion (scapula) at **acromioclavicular joint**

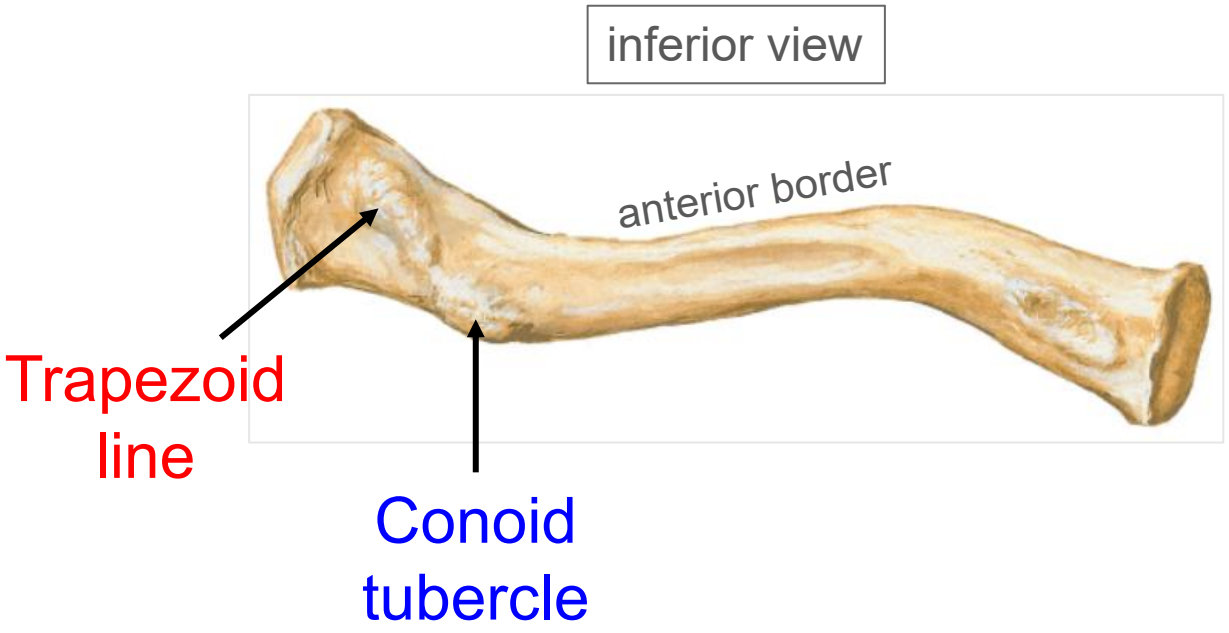
a) Clavicle

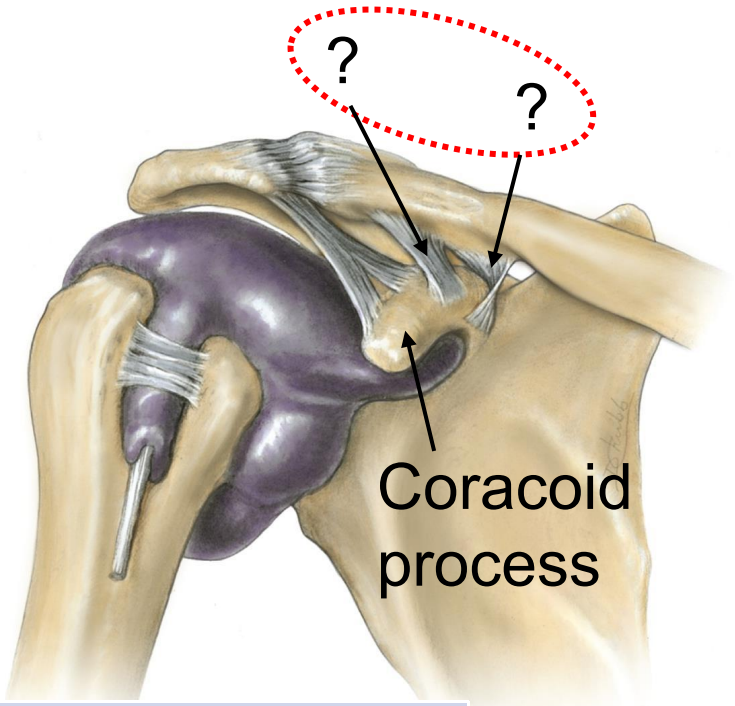




Impression for costoclavicular ligament	Attachment site of costoclavicular ligament (binds 1st rib & costal cartilage to clavicle)
Subclavian grove	Attachment site (distal) of subclavius muscle

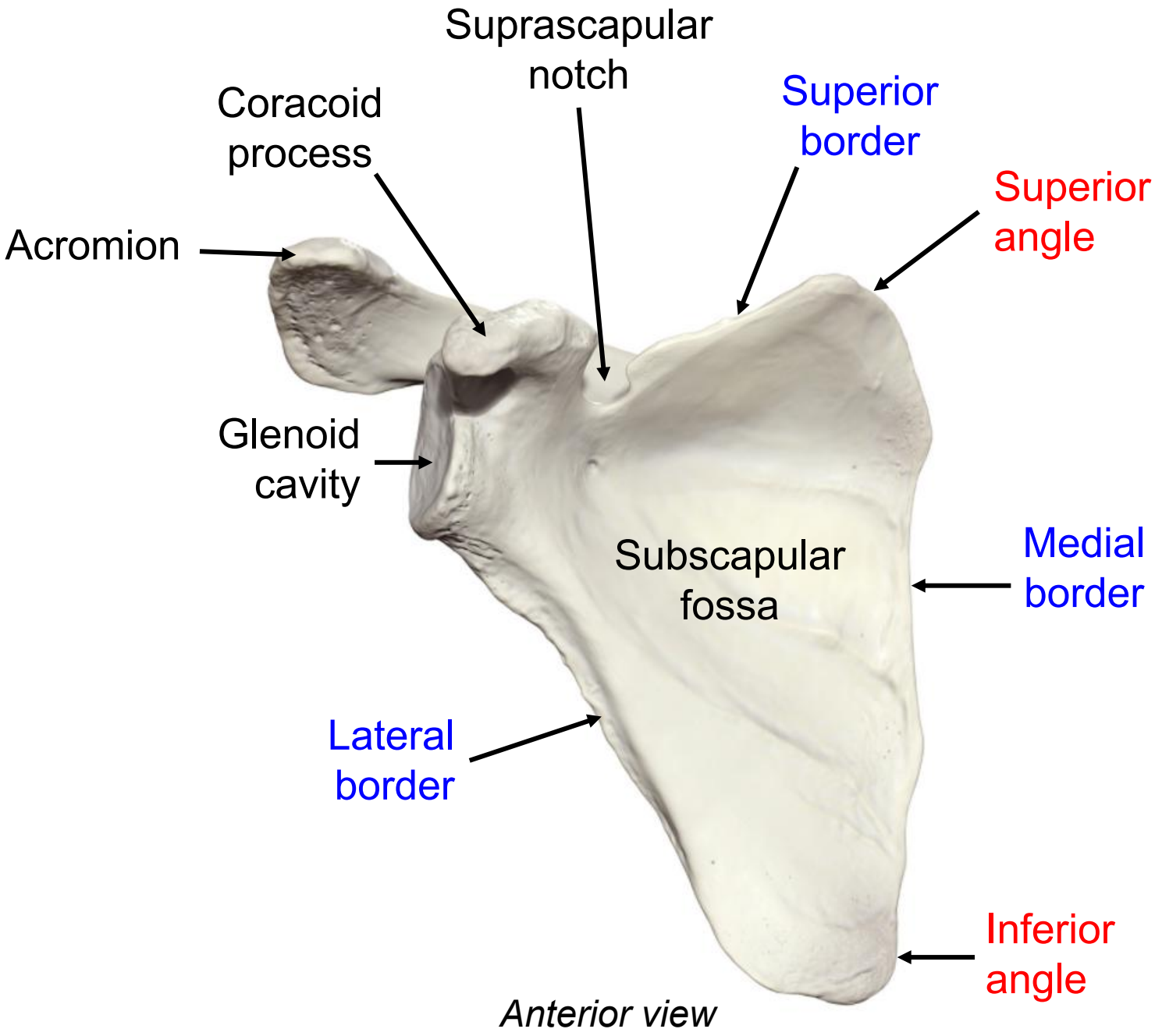
a) Clavicle





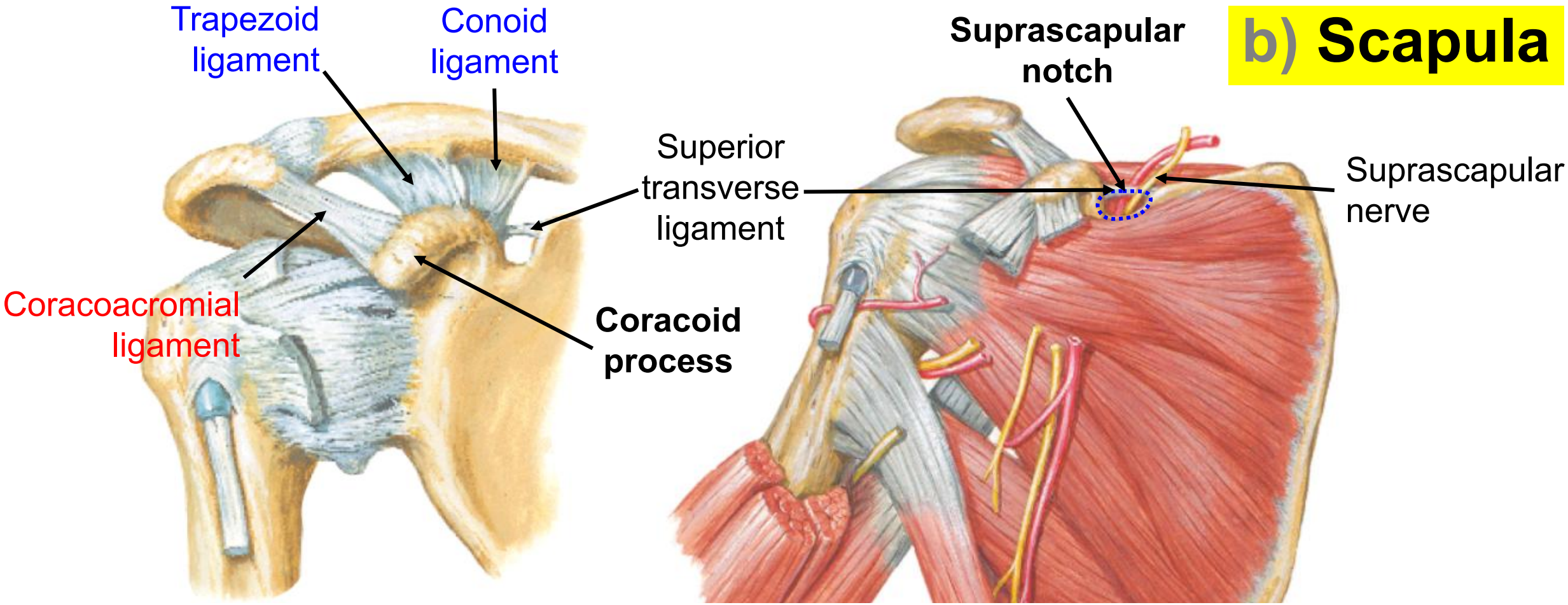
Conoid tubercle	Site of attachment of conoid ligament (**medial** part of coracoclavicular ligament)
Trapezoid line/ridge	Attachment site for trapezoid ligament (**lateral** part of coracoclavicular ligament)

b) Scapula



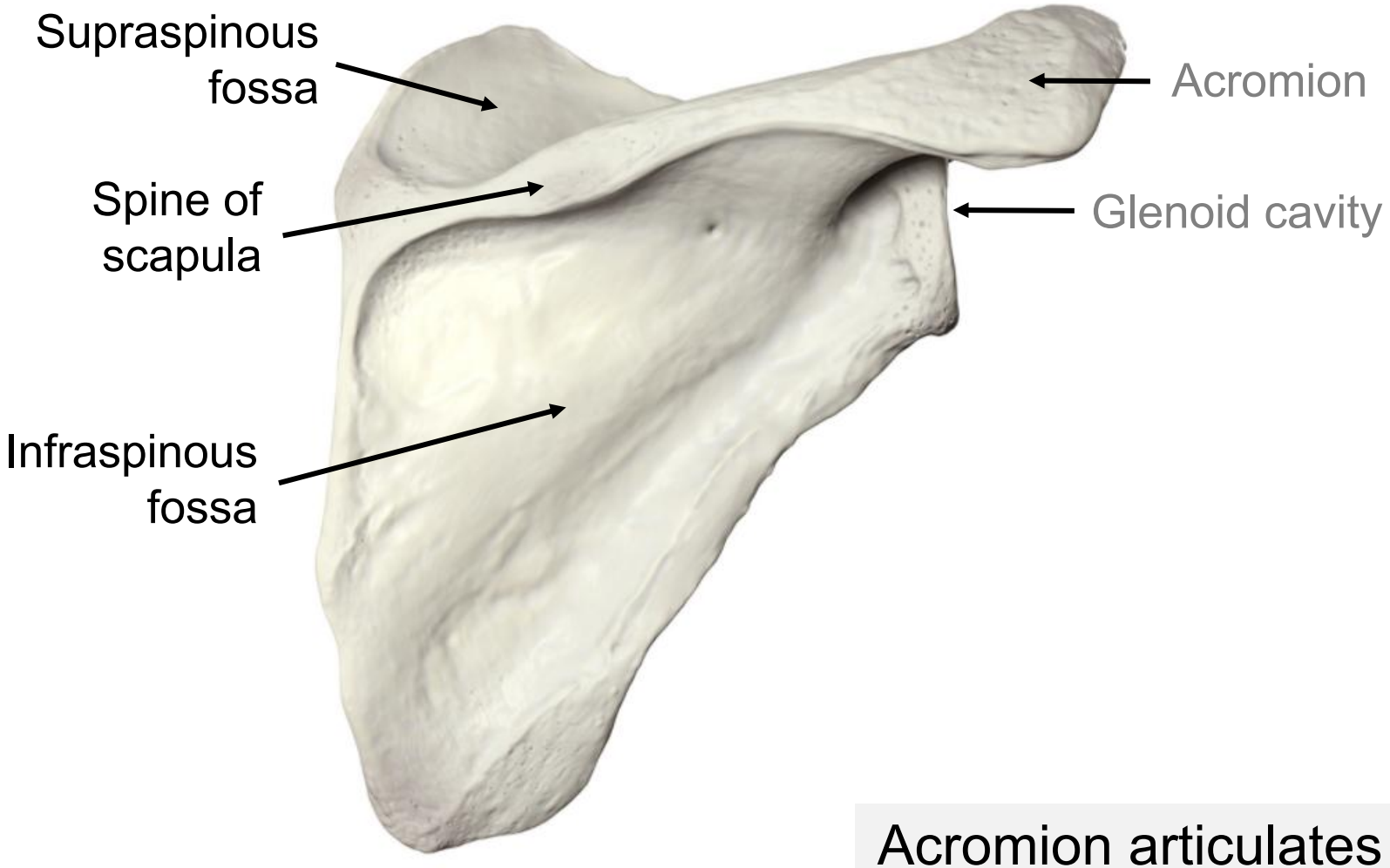
- Also known as **shoulder blade**
- Overlying 2nd – 7th ribs
- Anterior surface = **costal surface**

b) Scapula

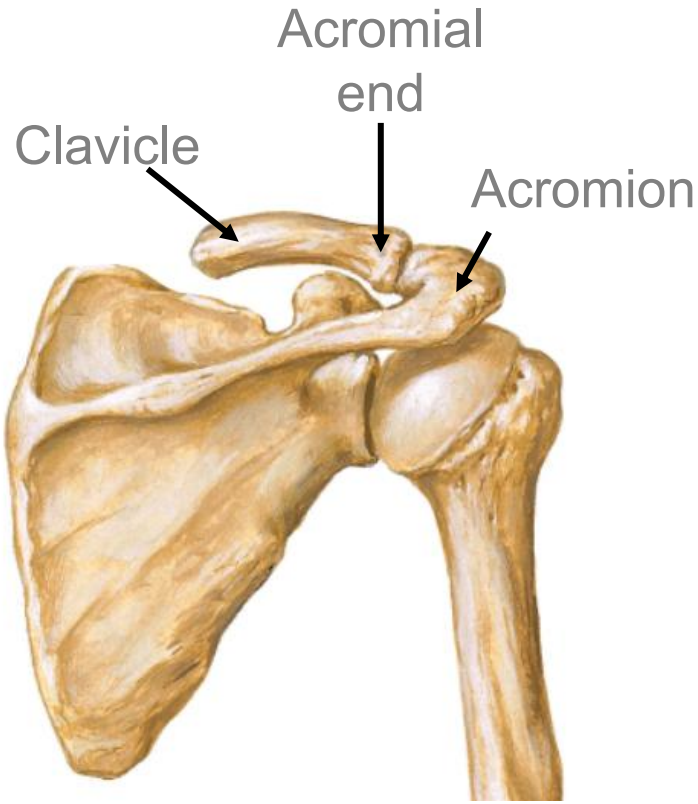


Coracoid process	• Attachment of coracoclavicular ligament • Attachment of coracoacromial ligament
Suprascapular notch	• Bridged by superior transverse scapular ligament • **Suprascapular nerve** passes through it

b) Scapula

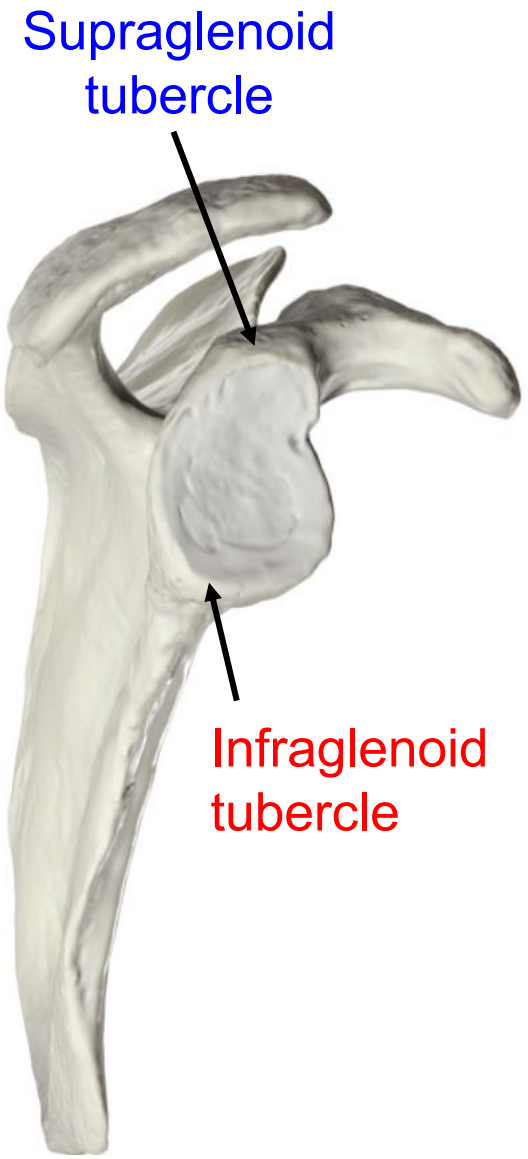


Posterior view



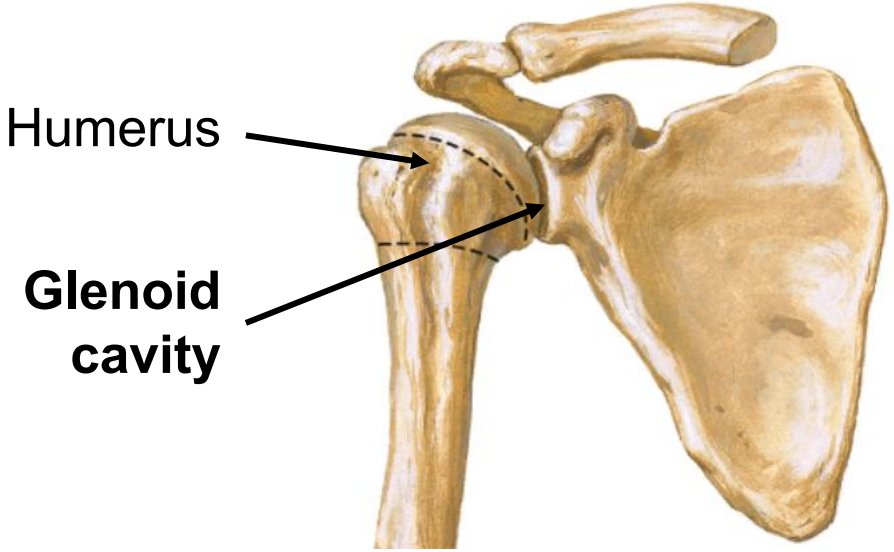
Acromion articulates with acromial end of clavicle

b) Scapula



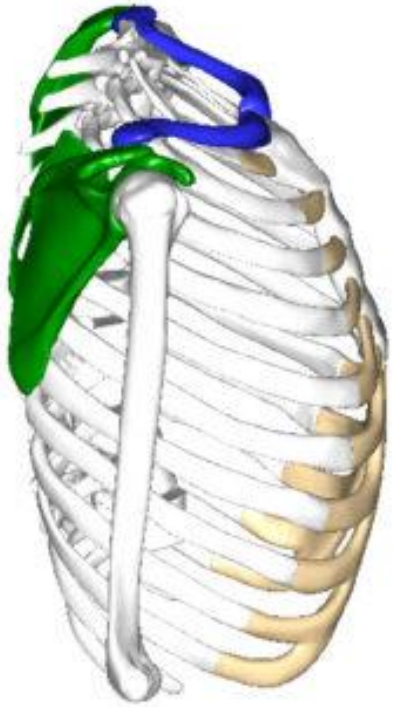
Lateral view

Glenoid cavity	Articulates with head of humerus at shoulder (glenohumeral) joint
Supraglenoid tubercle	Attachment site of long head of biceps brachii
Infraglenoid tubercle	Attachment site of long head of triceps brachii

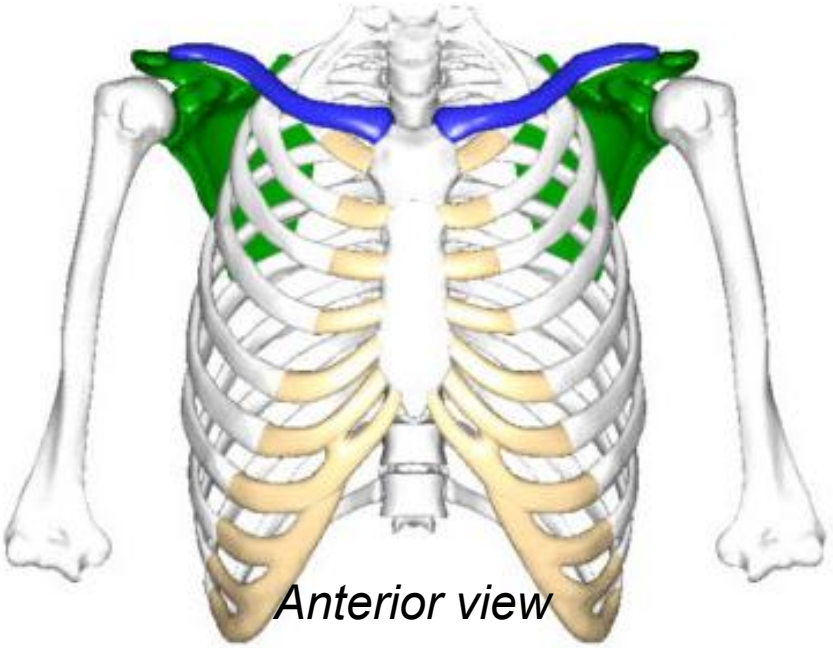


Pectoral (Shoulder) Girdle

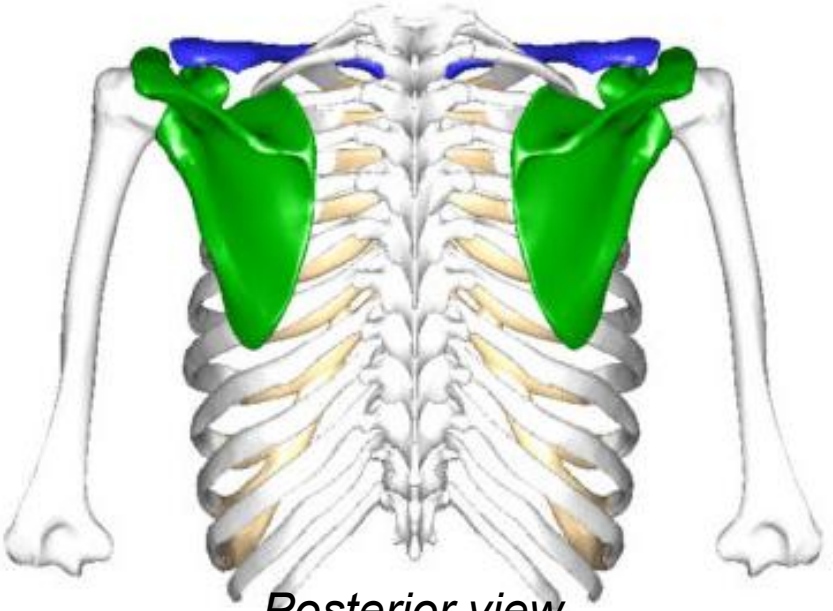
- Consists of:
  - 2 scapulae
  - 2 clavicles
- Connects UL to axial skeleton
- Forms a bony ring incomplete posteriorly. Completed anteriorly by sternum
- Pectoral girdle is connected to axial skeleton only anteriorly via sternum at sternoclavicular joint



Lateral view



Anterior view

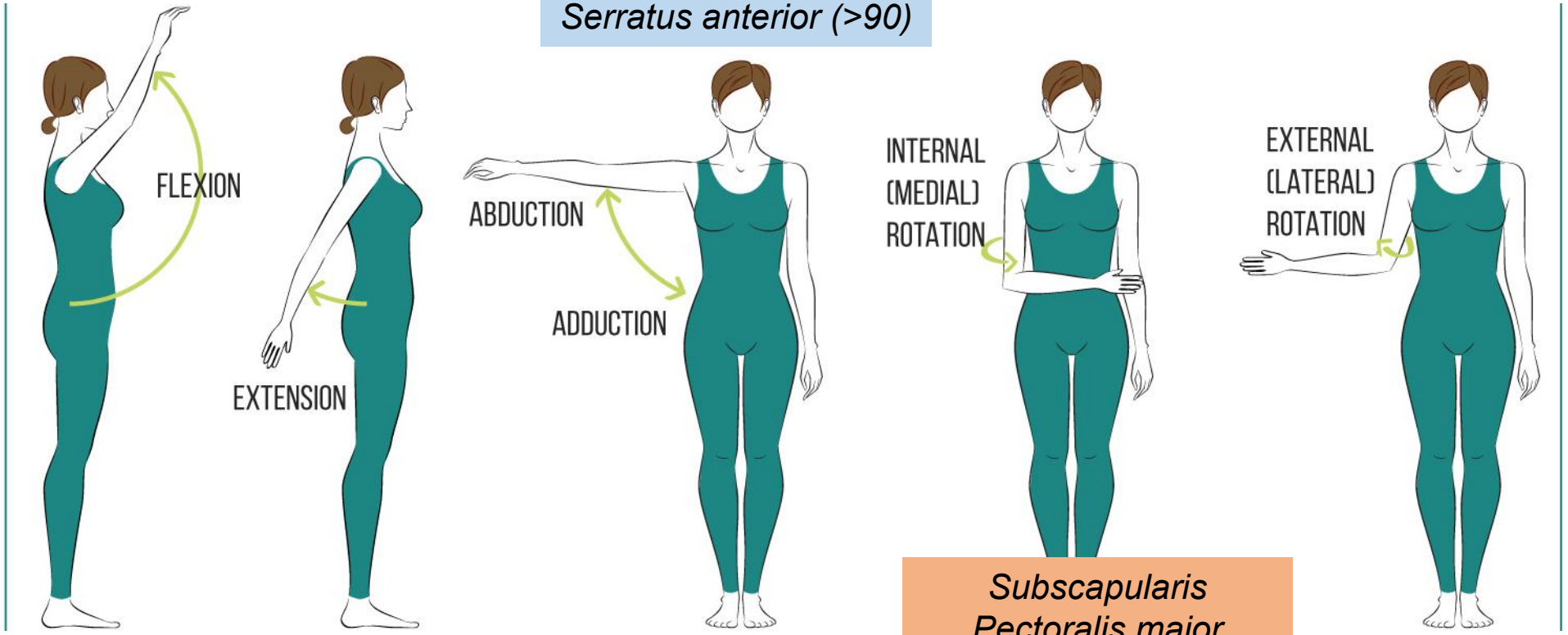


Posterior view

Clavicle
Scapula

Movements at shoulder joint

Supraspinatus (<15)
Mid deltoid (15-90)
Trapezius (>90)
Serratus anterior (>90)



Pectoralis major
Anterior deltoid
Coracobrachialis

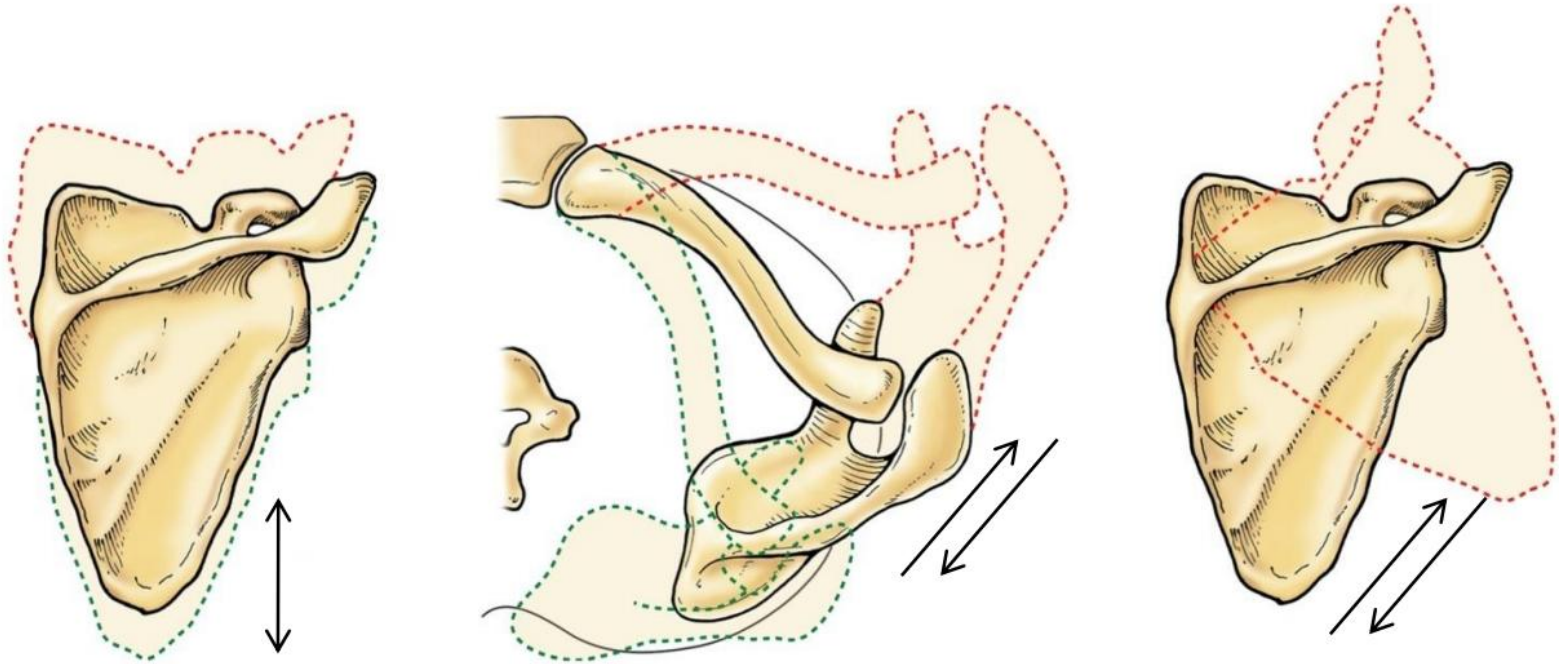
Posterior deltoid
Latissimus dorsi
Teres major

Pectoralis major
Latissimus dorsi
Teres major

Subscapularis
Pectoralis major
Latissimus dorsi
Teres major
Anterior deltoid

Infraspinatus
Teres minor

Movements of scapula



Trapezius (descending part)

Gravity

Elevation
Depression

Protraction
Retraction

Serratus anterior

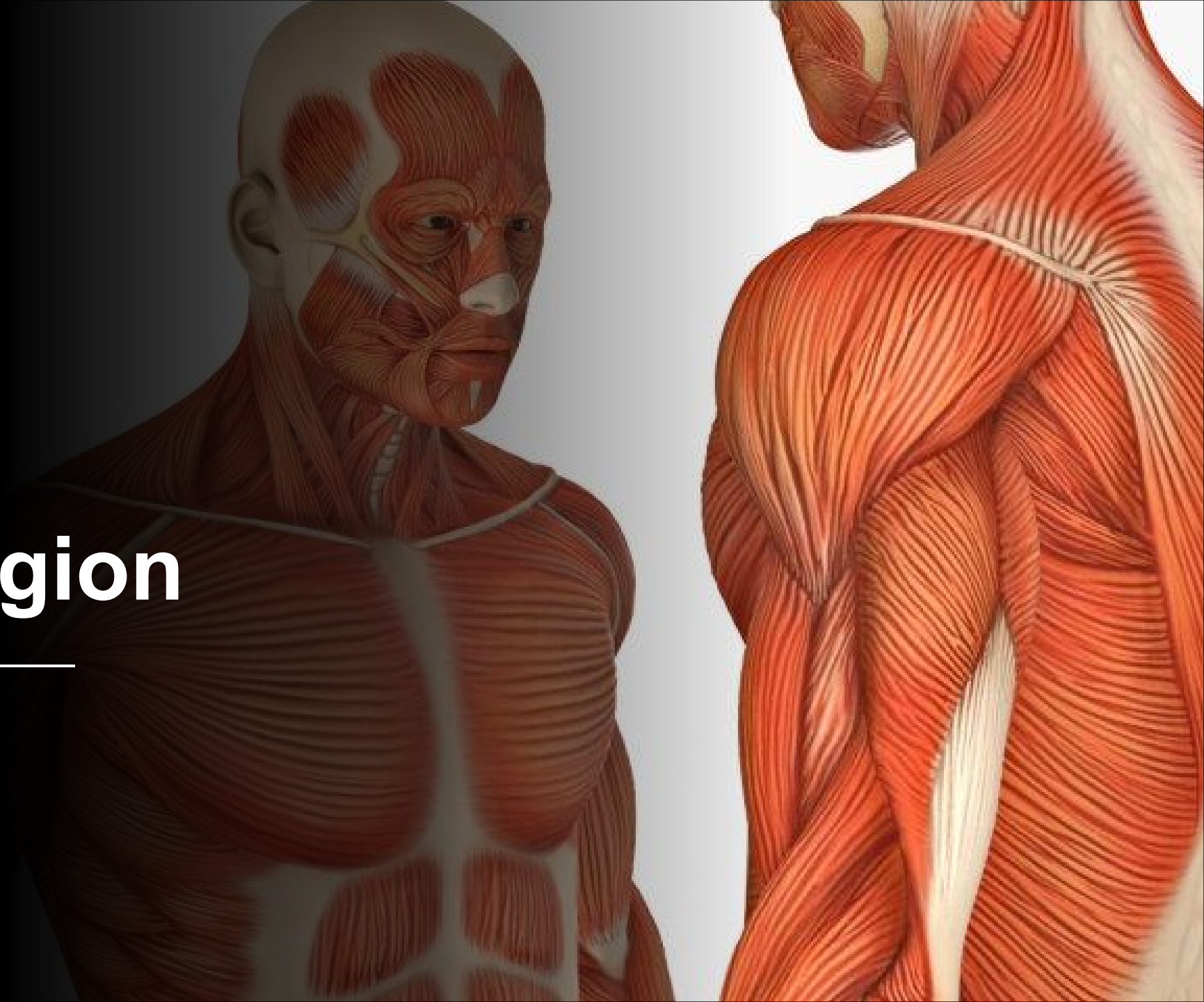
Trapezius (middle part)

Upward & Downward Rotation

Trapezius (descending part) & Serratus anterior

Latissimus dorsi

2.
Muscles in Shoulder & Pectoral Region



Classification: by layer

Muscles in shoulder & pectoral regions

Superficial muscles	Deep muscles
1. Deltoid 2. Pectoralis major 3. Trapezius 4. Latissimus dorsi	1. Pectoralis minor 2. Subclavius 3. Serratus anterior 4. Levator Scapulae 5. Rhomboid major 6. Rhomboid minor 7. Supraspinatus 8. Infraspinatus 9. Teres major 10. Teres minor 11. Subscapularis

Classification: by region

Muscles in shoulder & pectoral regions

Anterior axioappendicular muscles

1. Pectoralis major
2. Pectoralis minor
3. Subclavius
4. Serratus anterior

Posterior axioappendicular muscles

Superficial

5. Trapezius
6. Latissimus dorsi

Deep

7. Levator scapulae
8. Rhomboid major
9. Rhomboid minor

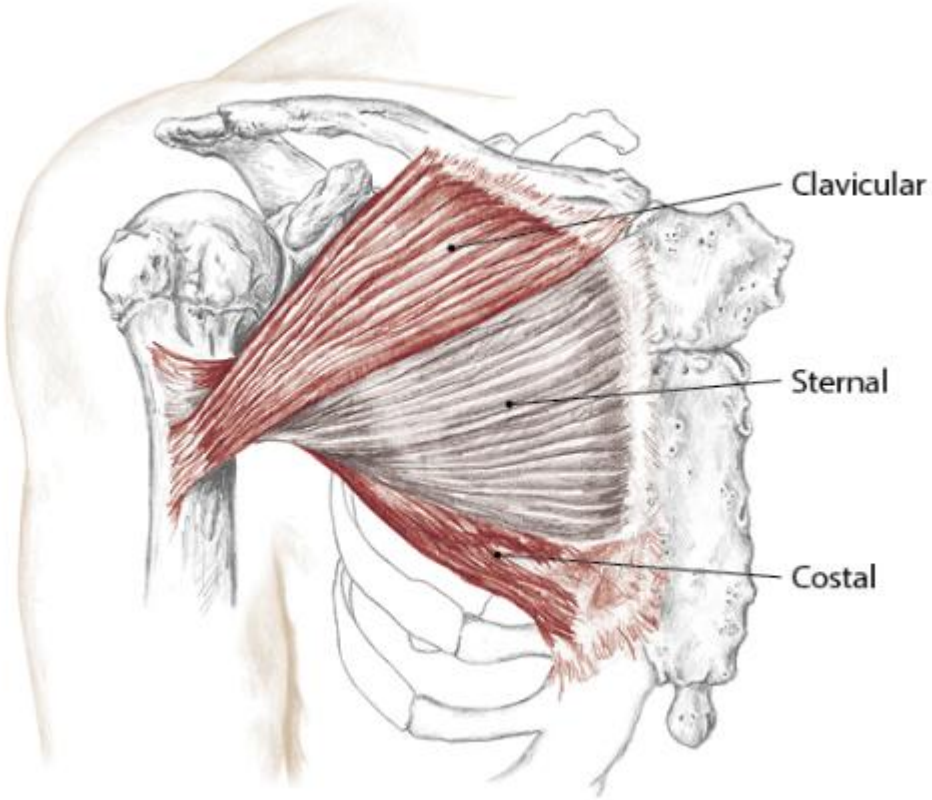
Scapulohumeral muscles

10. Deltoid
11. Teres major
12. Teres minor
13. Supraspinatus
14. Infraspinatus
15. Subscapularis

(1) Pectoralis major

PA	<u>Clavicular head</u> - Medial ½ of clavicle (anterior surface) <u>Sternocostal head</u> - Sternum (anterior surface) - Costal cartilage (superior six)
DA	Lateral lip of intertubercular groove (humerus)
Nerve	Lateral & medial pectoral n.
Action	Flexion, **ADD**uction & medial rotation

- Large, fan-like
- Covers superior part of thorax



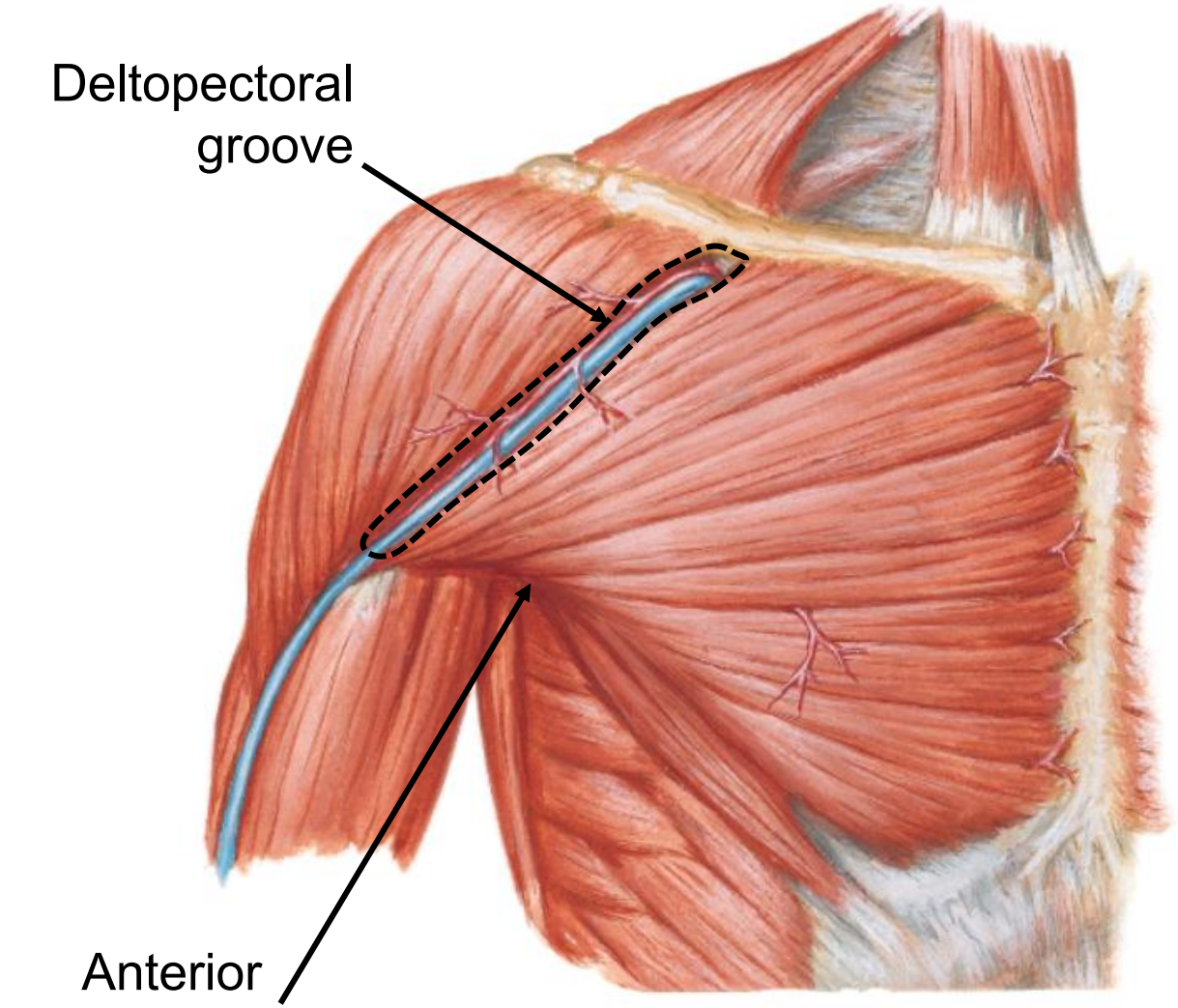
Anterior view

Deltopectoral groove:

- Cephalic vein runs through
- Deltoid and pectoralis major diverge slightly away superiorly, forming *deltopectoral triangle*

Anterior axillary fold:

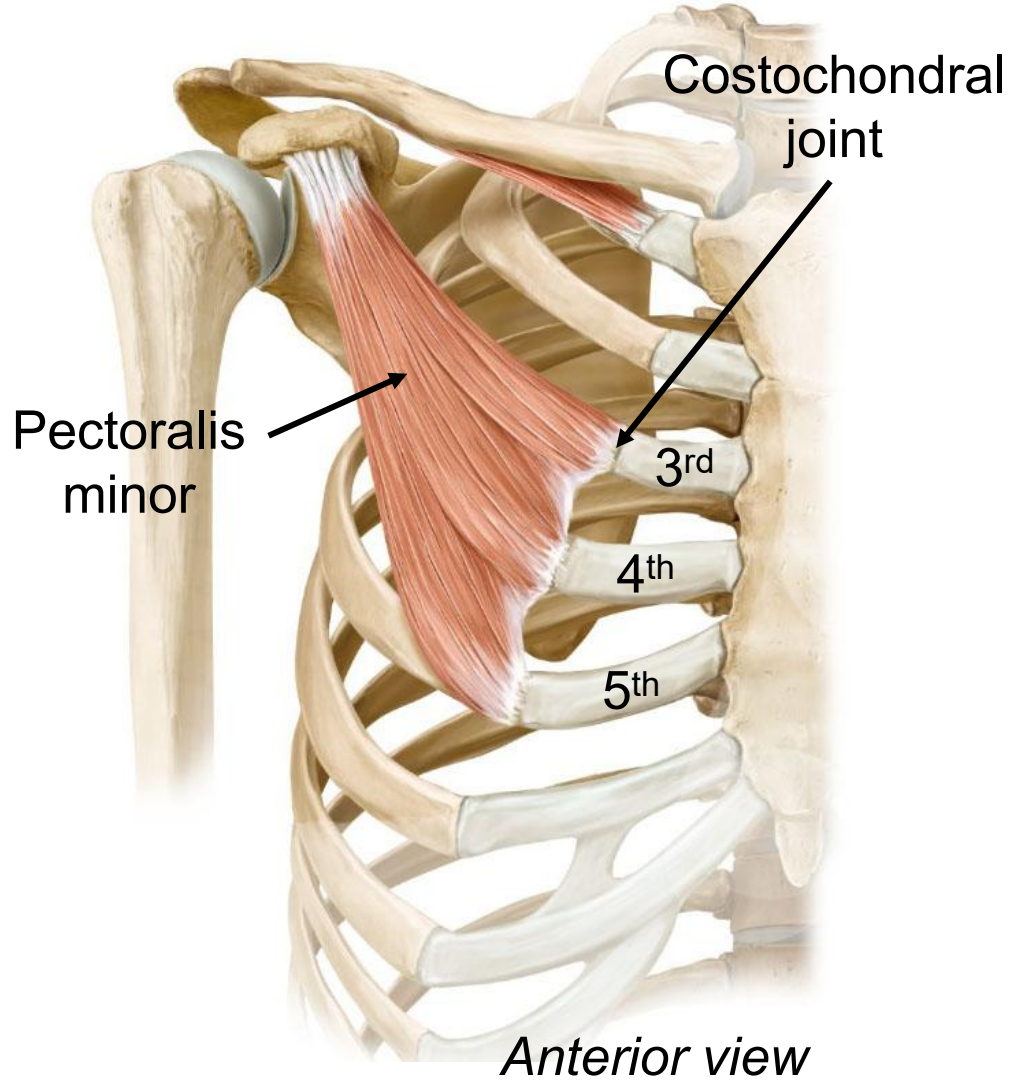
- Inferior border of pectoralis major



Anterior view

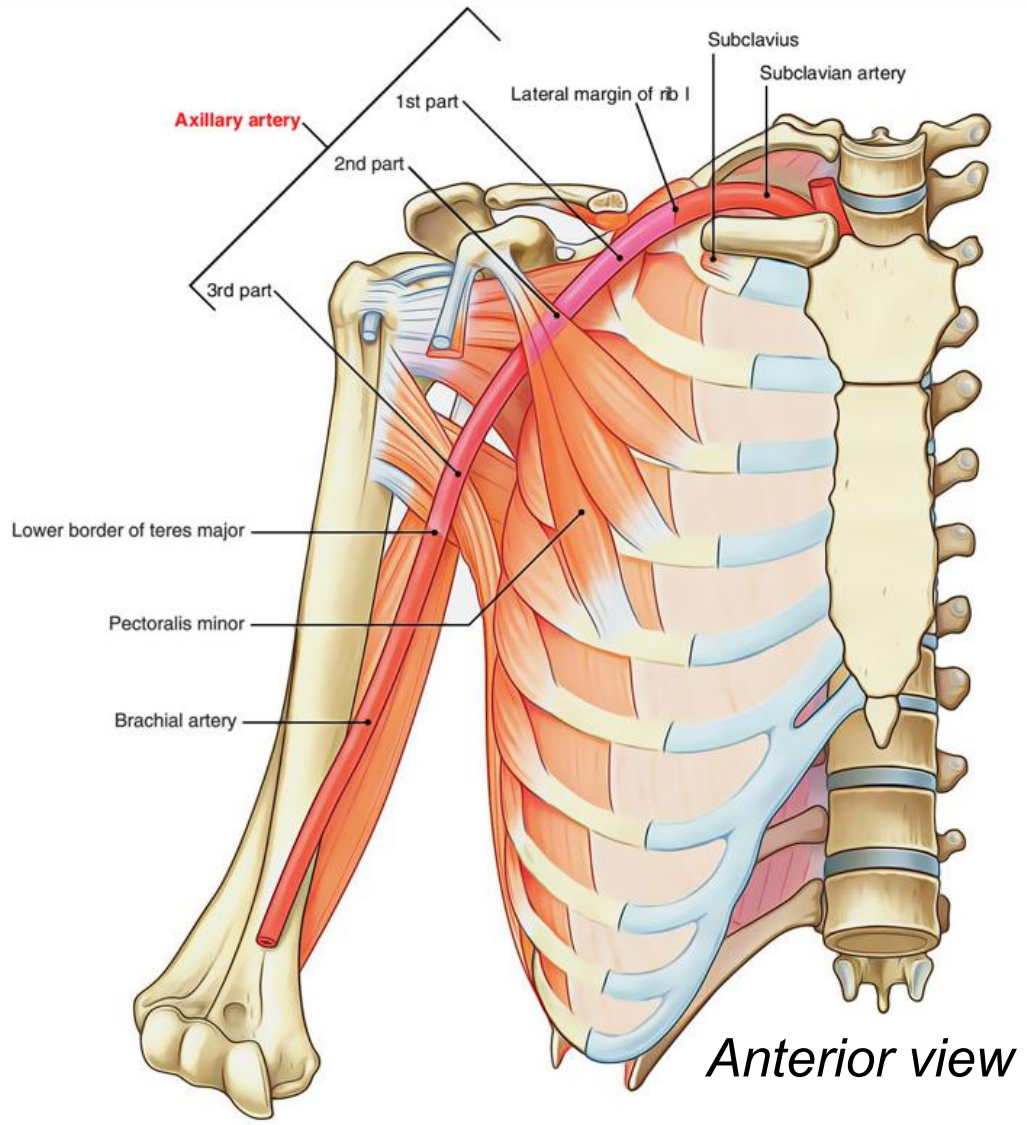
(2) Pectoralis minor

PA	3rd – 5th ribs (near costochondral joint)
DA	Coracoid process of scapula
Nerve	Medial pectoral n.
Action	Stabilizes scapula, assists ribs elevation



Anterior view

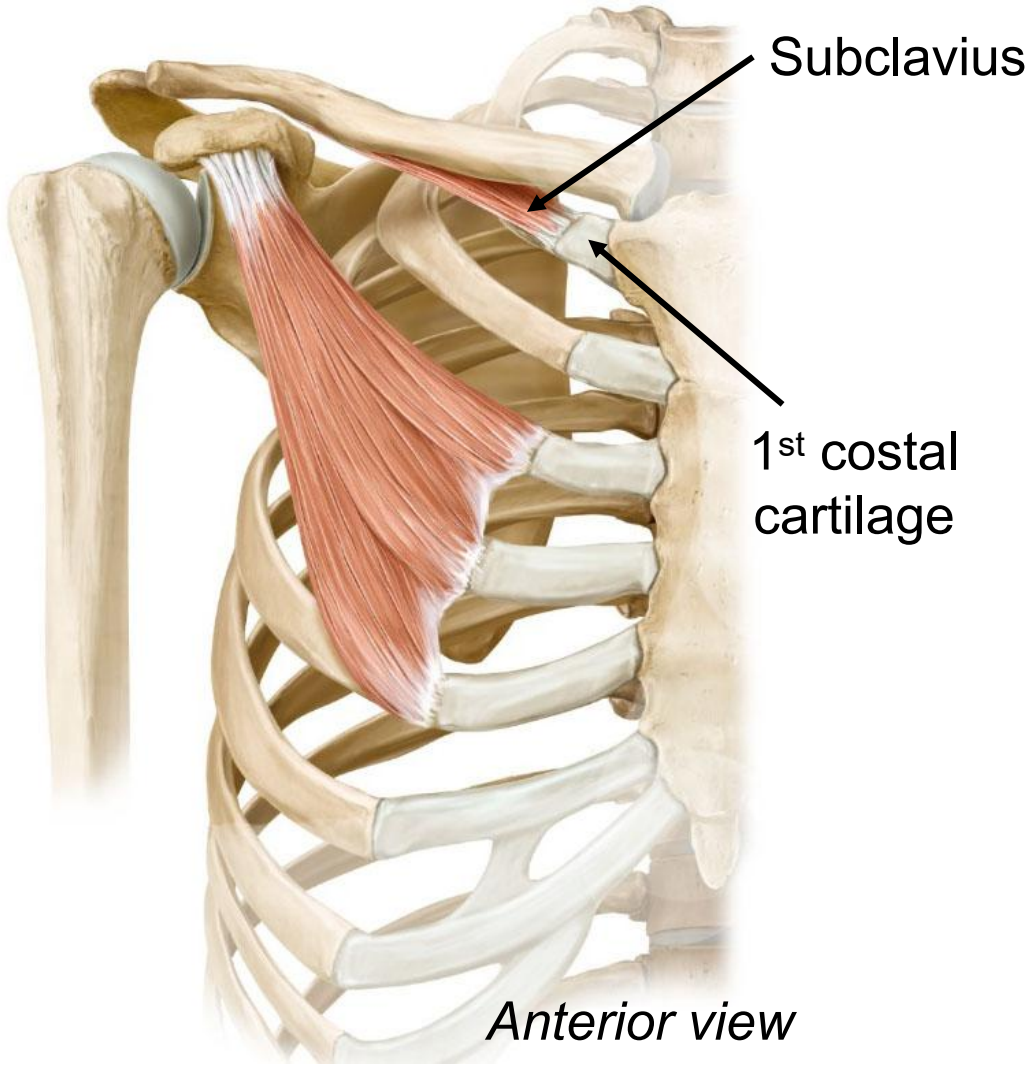
- An **important landmark** for structures in axilla.
- It is used as a landmark for dividing the axillary artery into 3 parts.



Anterior view

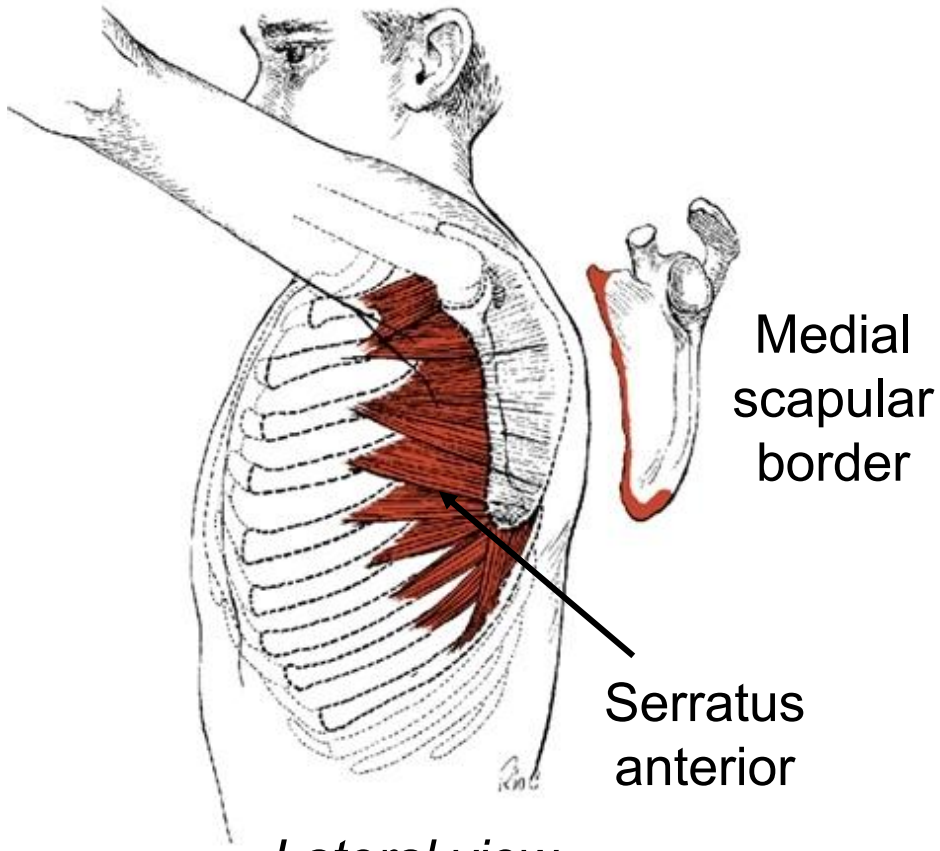
(3) Subclavius

PA	1st rib (near costochondral joint)
DA	Middle 3rd of clavicle (subclavian groove)
Nerve	Nerve to subclavius
Action	Stabilizes clavicle



(4) Serratus anterior

PA	1st – 8th ribs (lateral part)
DA	Medial border of scapula (anterior surface)
Nerve	Long thoracic n.
Action	Protracts & rotates scapula



Lateral view

Classification: by region

Muscles in shoulder & pectoral regions

Anterior axioappendicular muscles

1. Pectoralis major
2. Pectoralis minor
3. Subclavius
4. Serratus anterior

Posterior axioappendicular muscles

Superficial

5. Trapezius
6. Latissimus dorsi

Deep

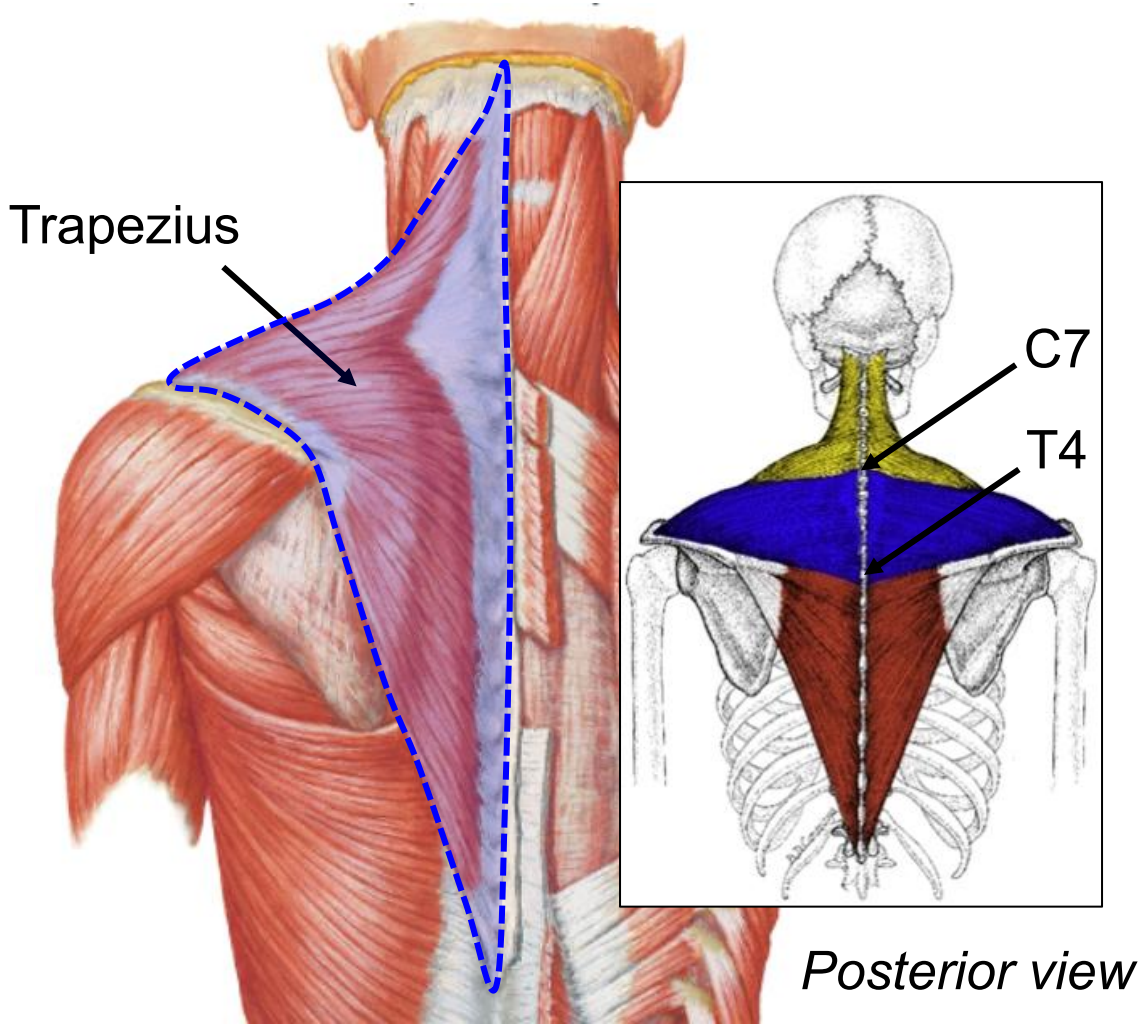
7. Levator scapulae
8. Rhomboid major
9. Rhomboid minor

Scapulohumeral muscles

10. Deltoid
11. Teres major
12. Teres minor
13. Supraspinatus
14. Infraspinatus
15. Subscapularis

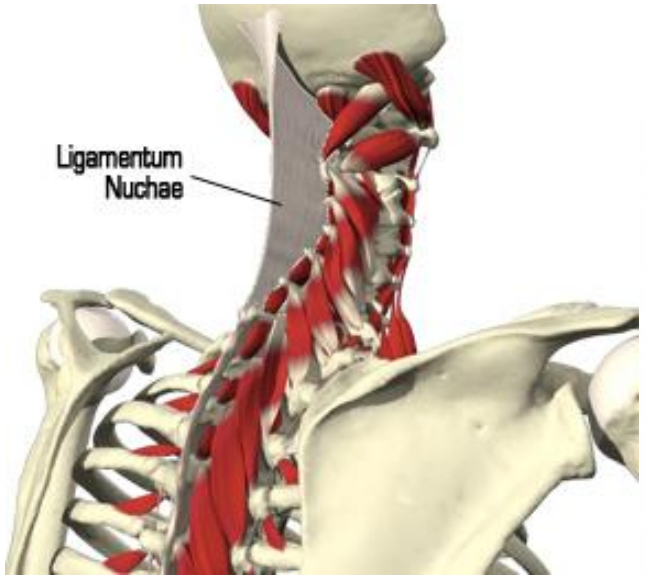
(5) Trapezius (superficial layer)

- Large & triangular
- Covers posterior aspect of neck & superior part of trunk
- Has **3 part**:
  - Descending (superior)
  - Middle
  - Ascending (inferior)
- Attaches pectoral girdle to cranium & vertebral column

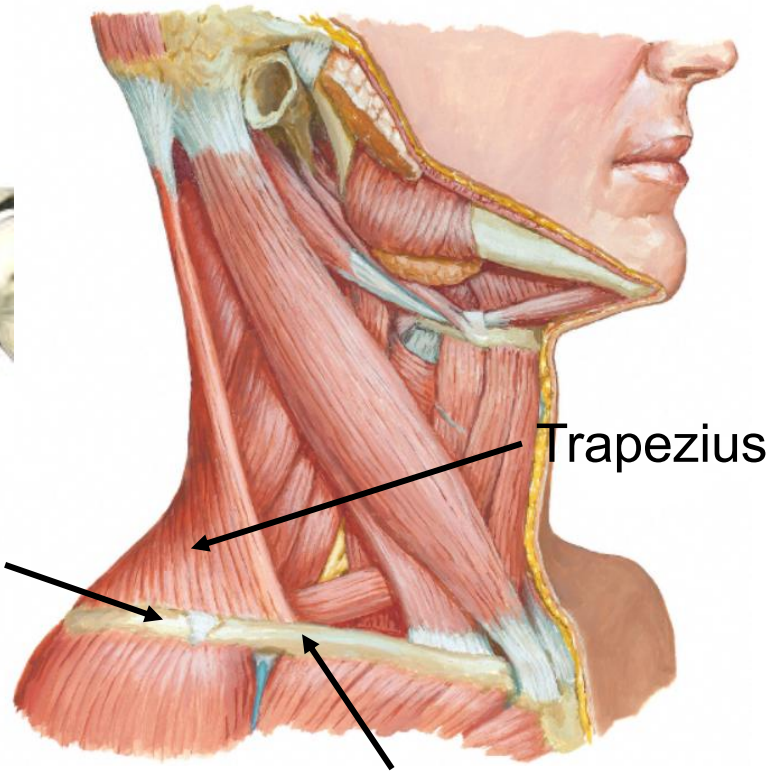


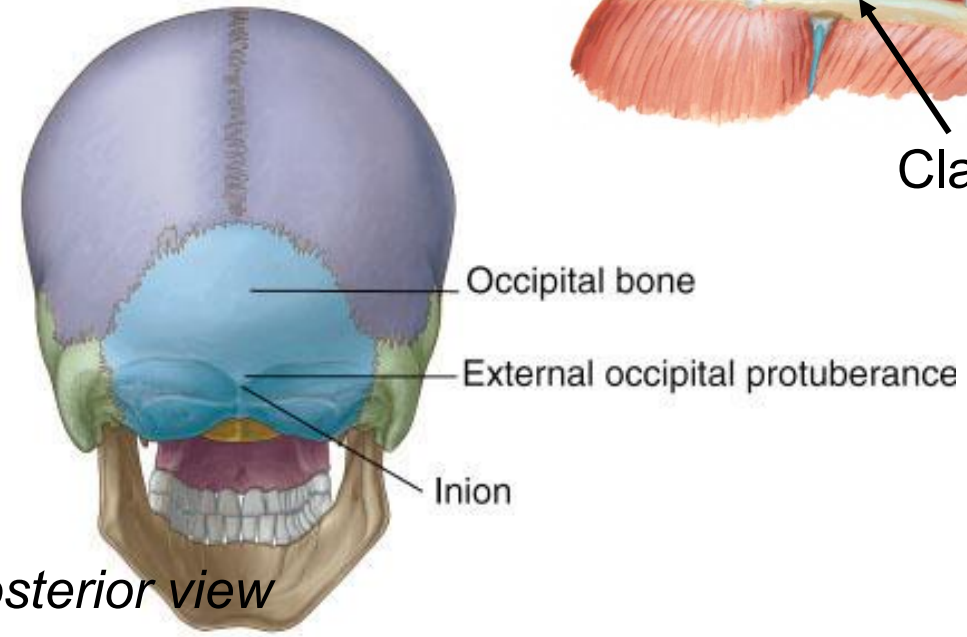
Posterior view

PA	• External occipital protuberance • Ligamentum nuchae • C7 – T12 spinous processes
DA	• Lateral 3rd clavicle • Acromion & spine of scapula
Nerve	Spinal accessory n. (CNXI)
Action	**Descending part**: elevate scapula **Middle part**: retract scapula **Ascending part**: depress scapula



Lateral view



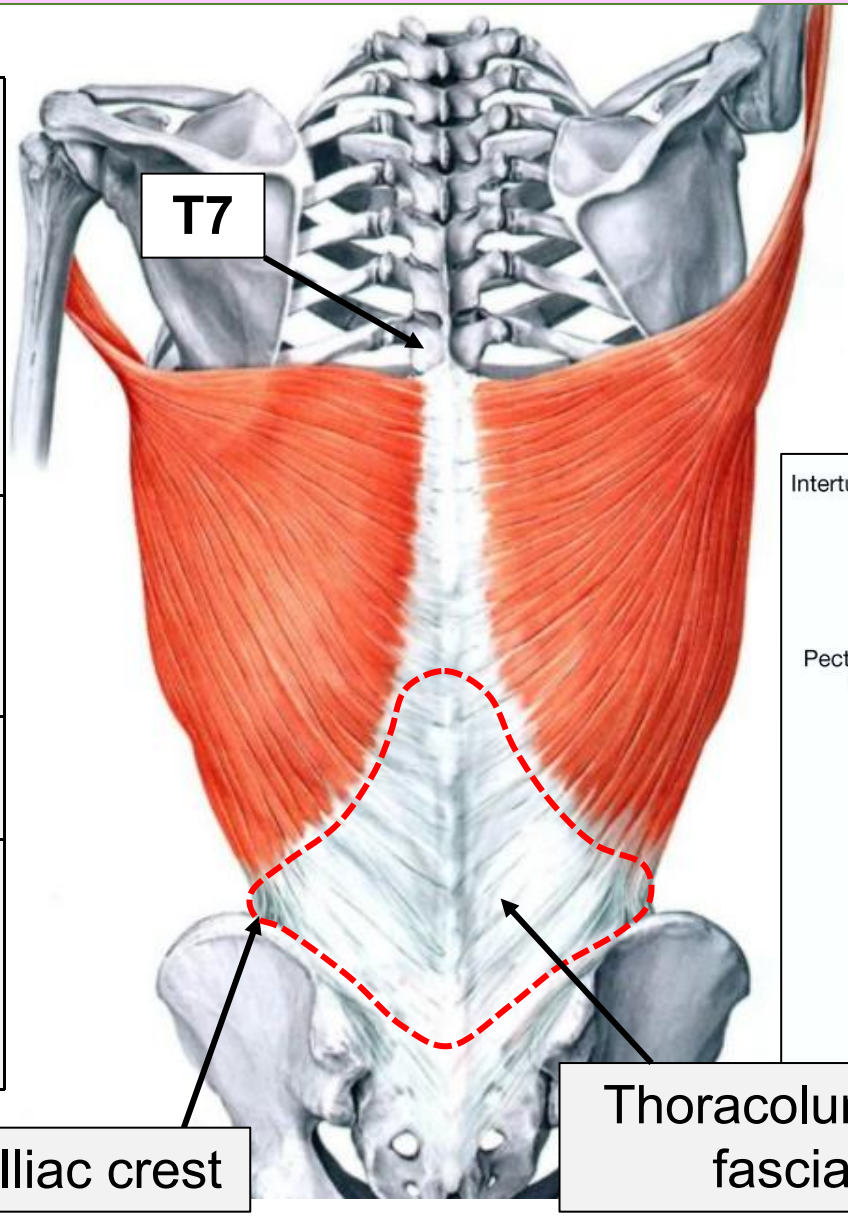


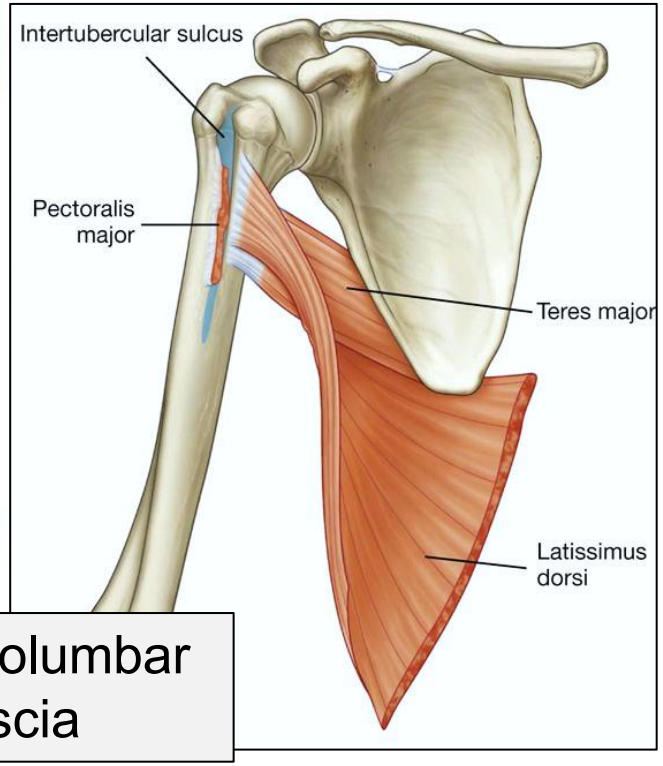
Posterior view

(6) Latissimus dorsi (superficial layer)

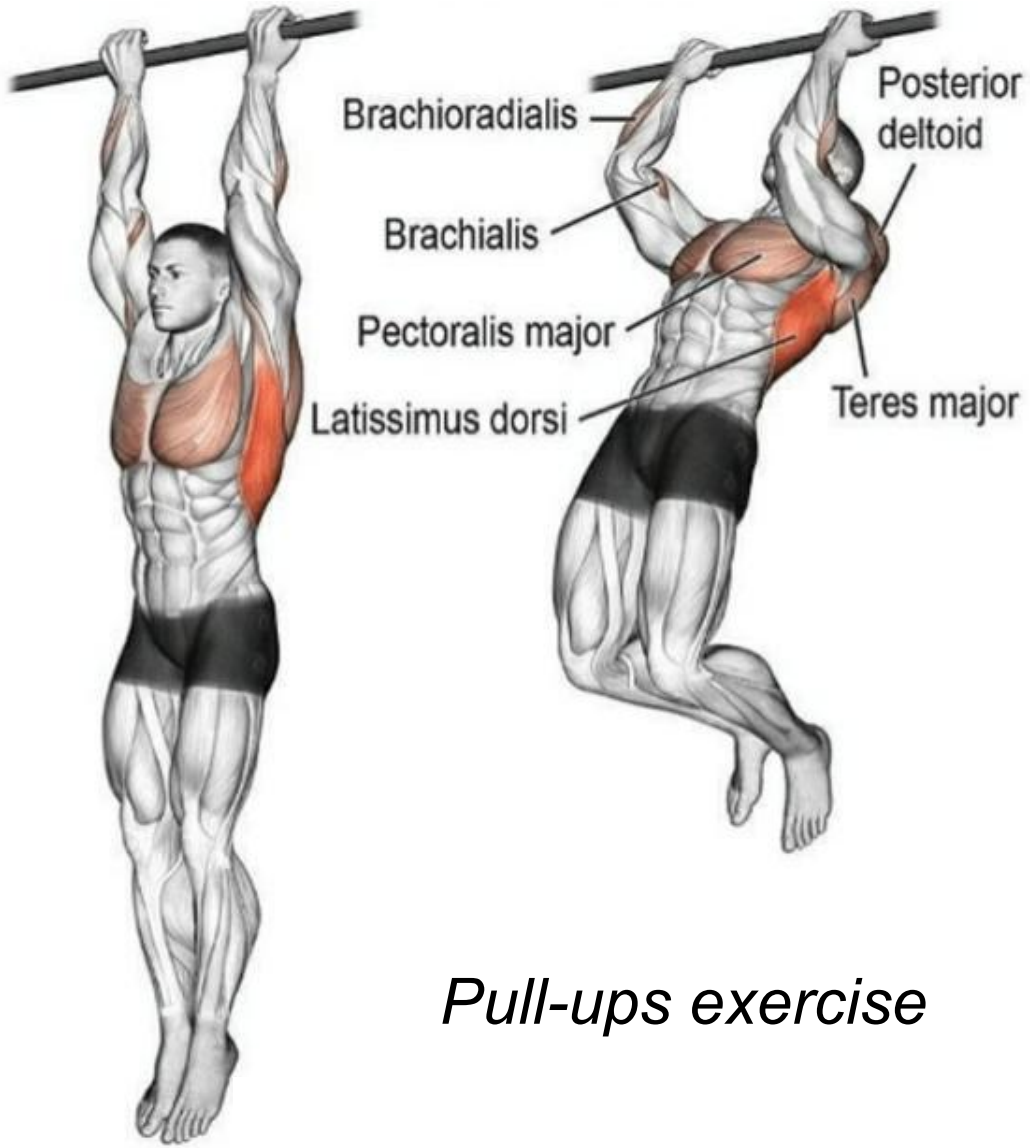
PA	• T7-T12 vertebrae (spinous process) • Thoracolumbar fascia • Iliac crest
DA	Floor of intertubercular groove (humerus)
Nerve	Thoracodorsal n.
Action	Extension, **ADD**uction, medial rotation of humerus

Posterior view





Latissimus dorsi works best with the **pectoralis major** and some other muscles as powerful **ADD**uctor of humerus at glenohumeral joint

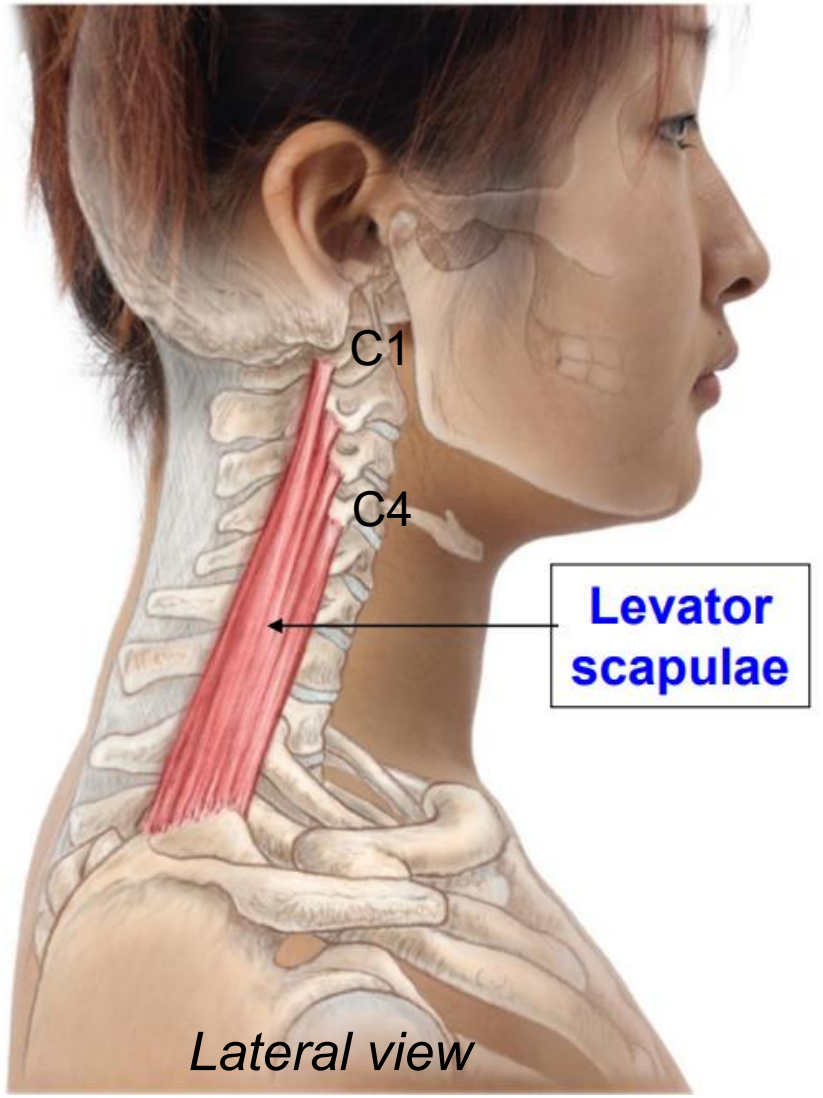


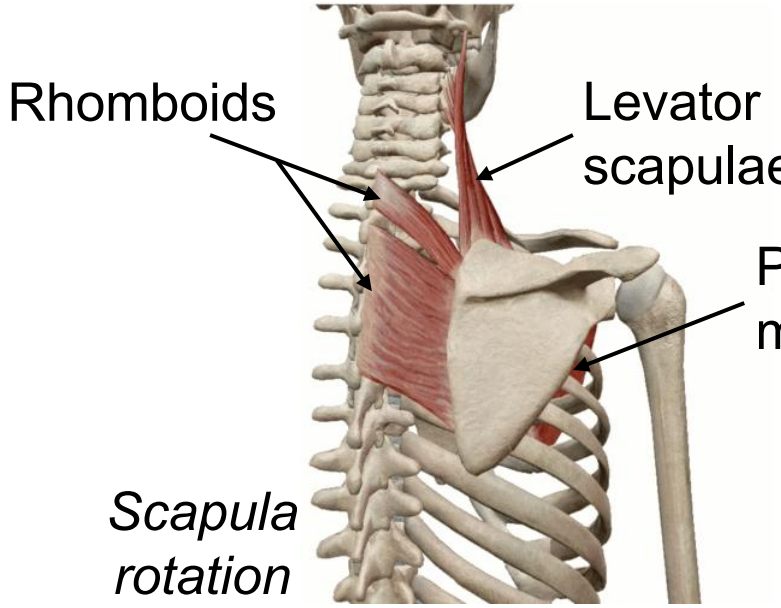
Pull-ups exercise

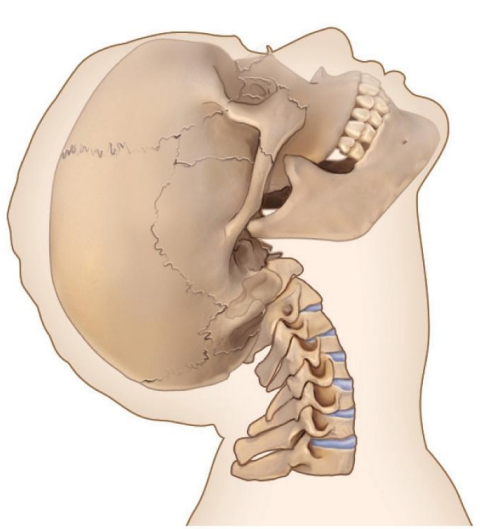
(7) Levator scapulae (deep layer)

- Strap-like, lies deep to sternocleidomastoid muscle
- Covers superior part of thorax

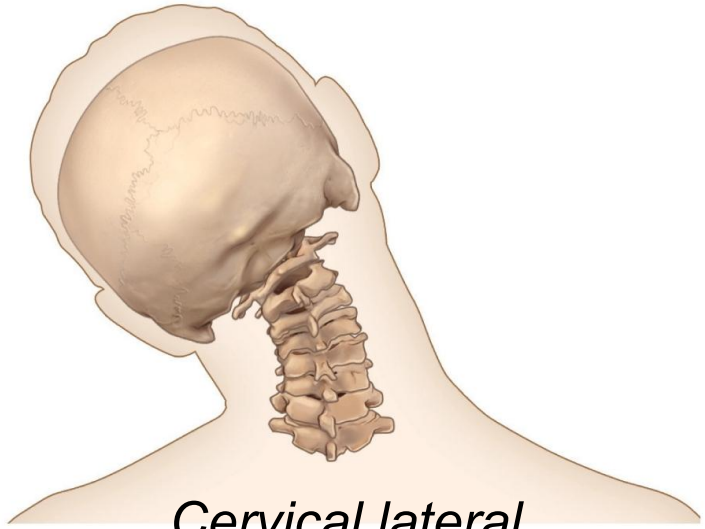
PA	Transverse processes of C1-C4 vertebrae
DA	Medial border of scapula, superior to root of scapula spine (close to superior angle)
Nerve	Dorsal scapula n. Cervical n.
Action	Elevates scapula







Cervical extension



Cervical lateral extension

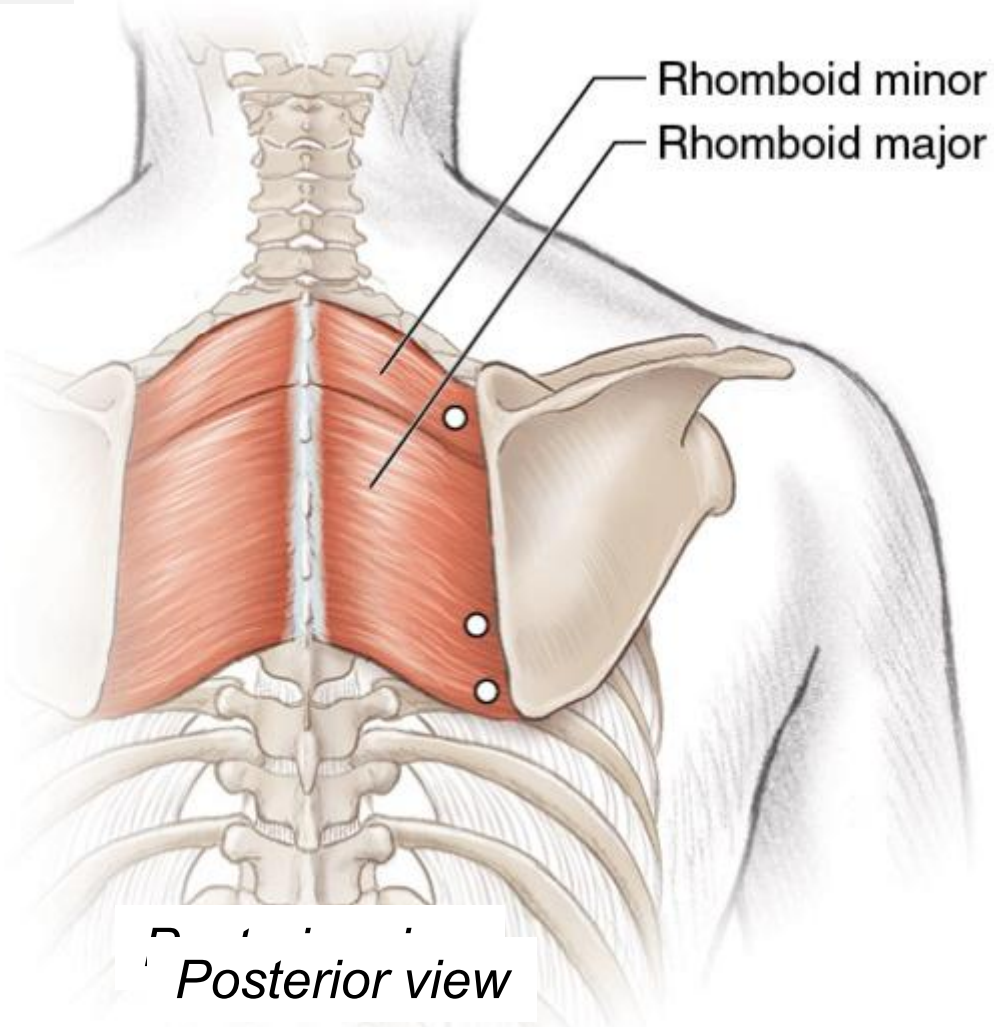
Other actions of levators:

- Levator scapulae + rhomboids + pectoralis minor → rotates scapula, depressing glenoid cavity
- Bilateral levators + trapezius → neck extension
- Unilateral levators → lateral flexion on neck

(8&9) Rhomboid major & minor (deep layer)

- Located deep to the trapezius
- Rhomboid minor is superior to rhomboid major

	Rh. **Minor**	Rh. **Major**
PA	Spinous processes C7-T1	Spinous processes T2-T5
DA	Medial border of scapula	
Nerve	Dorsal scapular n.	
Action	Retract scapula Rotate (glenoid cavity inferiorly) scapula	



Posterior view

Classification: by region

Muscles in shoulder & pectoral regions

Anterior axioappendicular muscles

1. Pectoralis major
2. Pectoralis minor
3. Subclavius
4. Serratus anterior

Posterior axioappendicular muscles

Superficial

5. Trapezius
6. Latissimus dorsi

Deep

7. Levator scapulae
8. Rhomboid major
9. Rhomboid minor

Scapulohumeral muscles

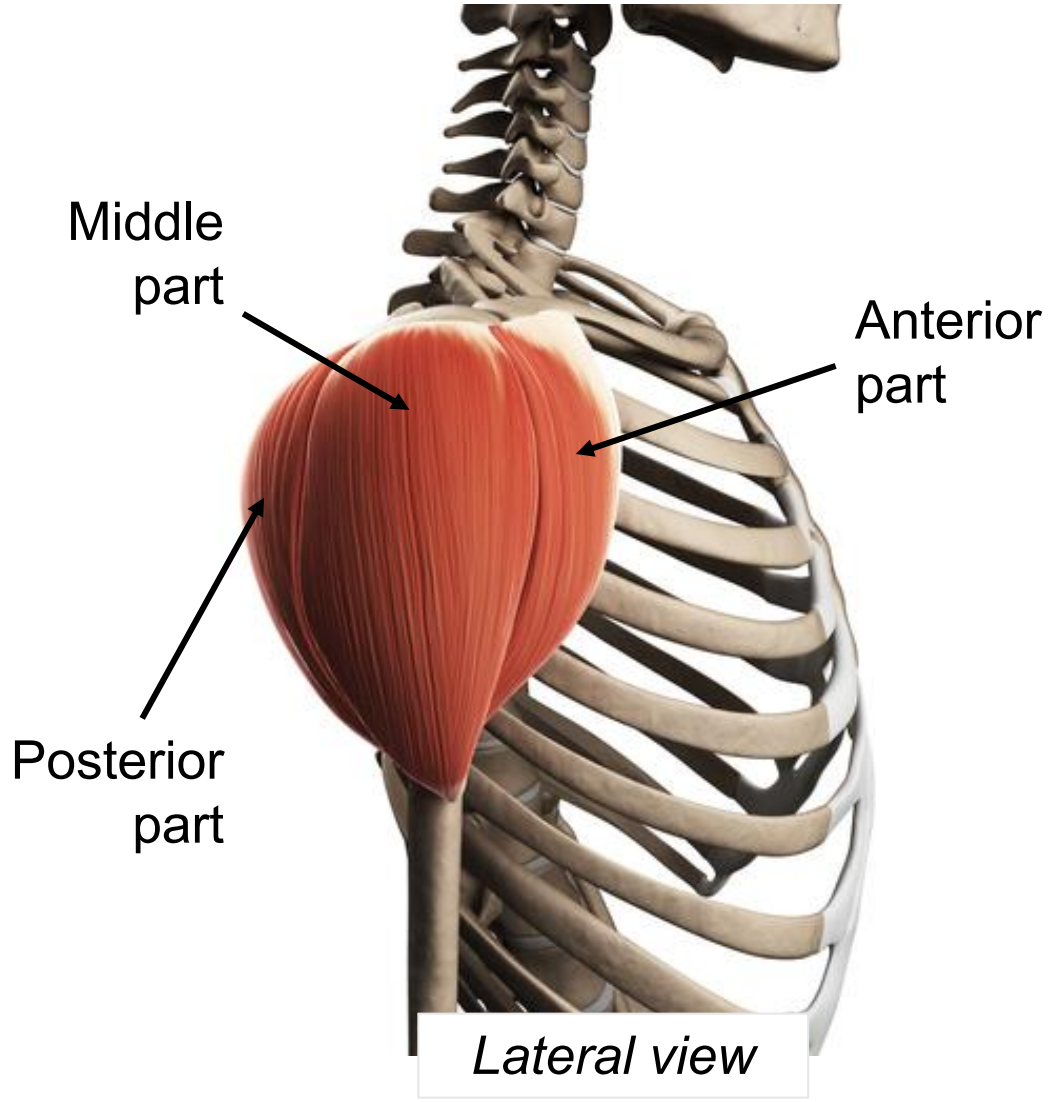
10. Deltoid
11. Teres major
12. **T**eres minor*
13. **S**upraspinatus*
14. **I**nfraspinatus*
15. **S**ubscapularis*

(Rotator cuff muscles*)

(10) Deltoid

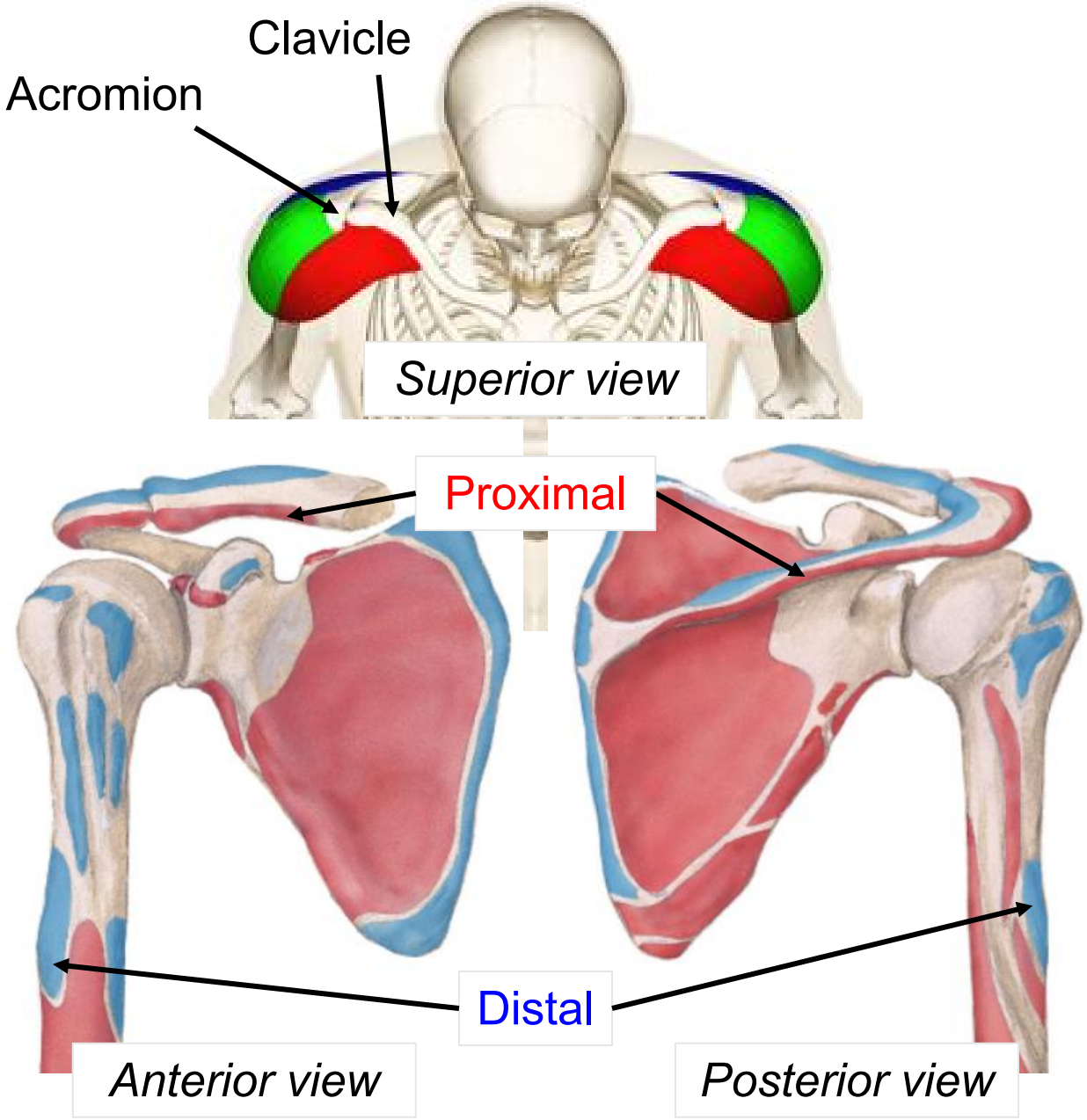
- Thick, powerful, coarse-textured
- Forming shoulder contour
- Inverted delta (Greek letter)

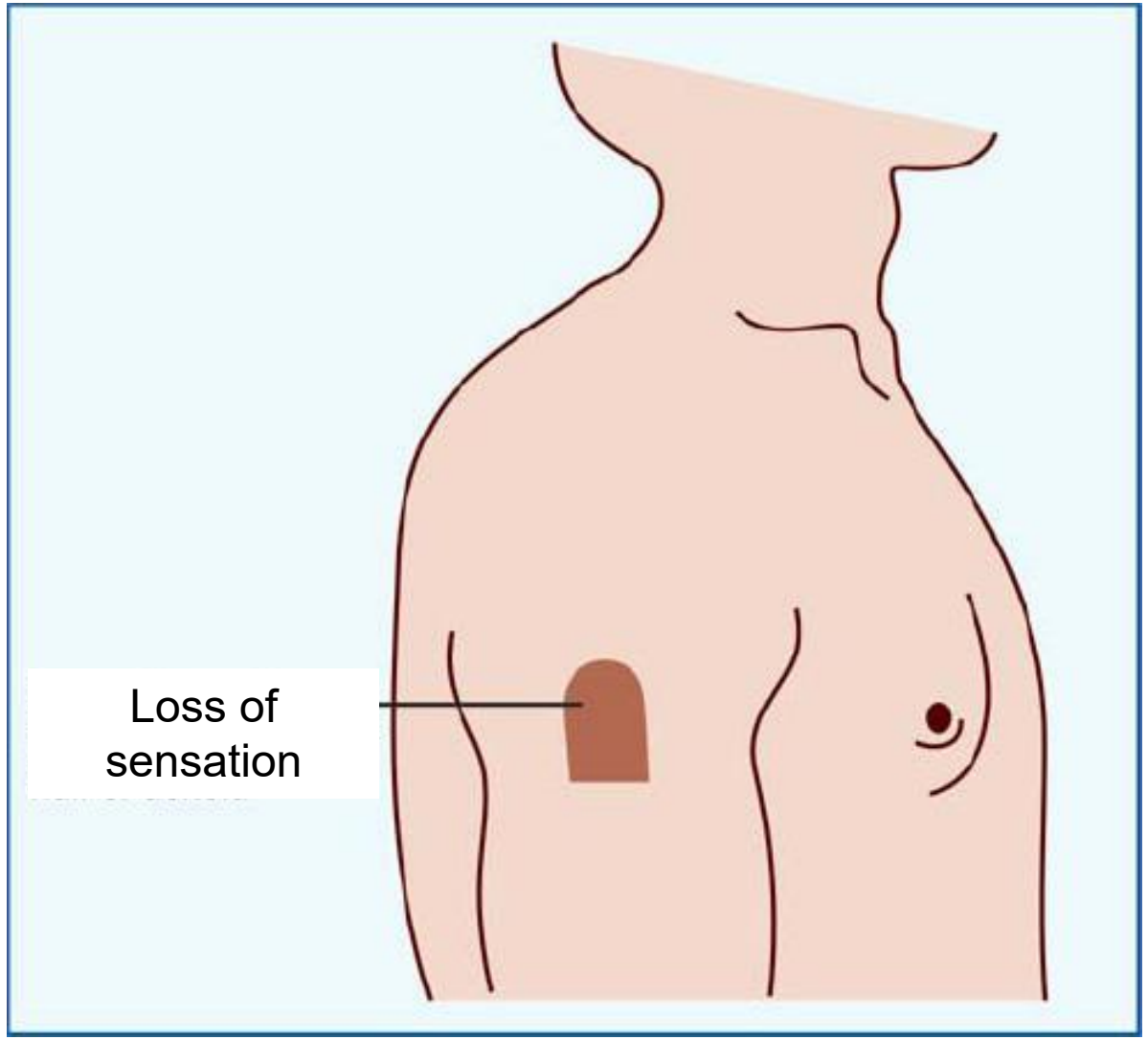
- Has 3 parts:
  i. Anterior (unipennate)
  ii. Middle (bipennate)
  iii. Posterior (unipennate)
- All parts may act simultaneously



Deltoid

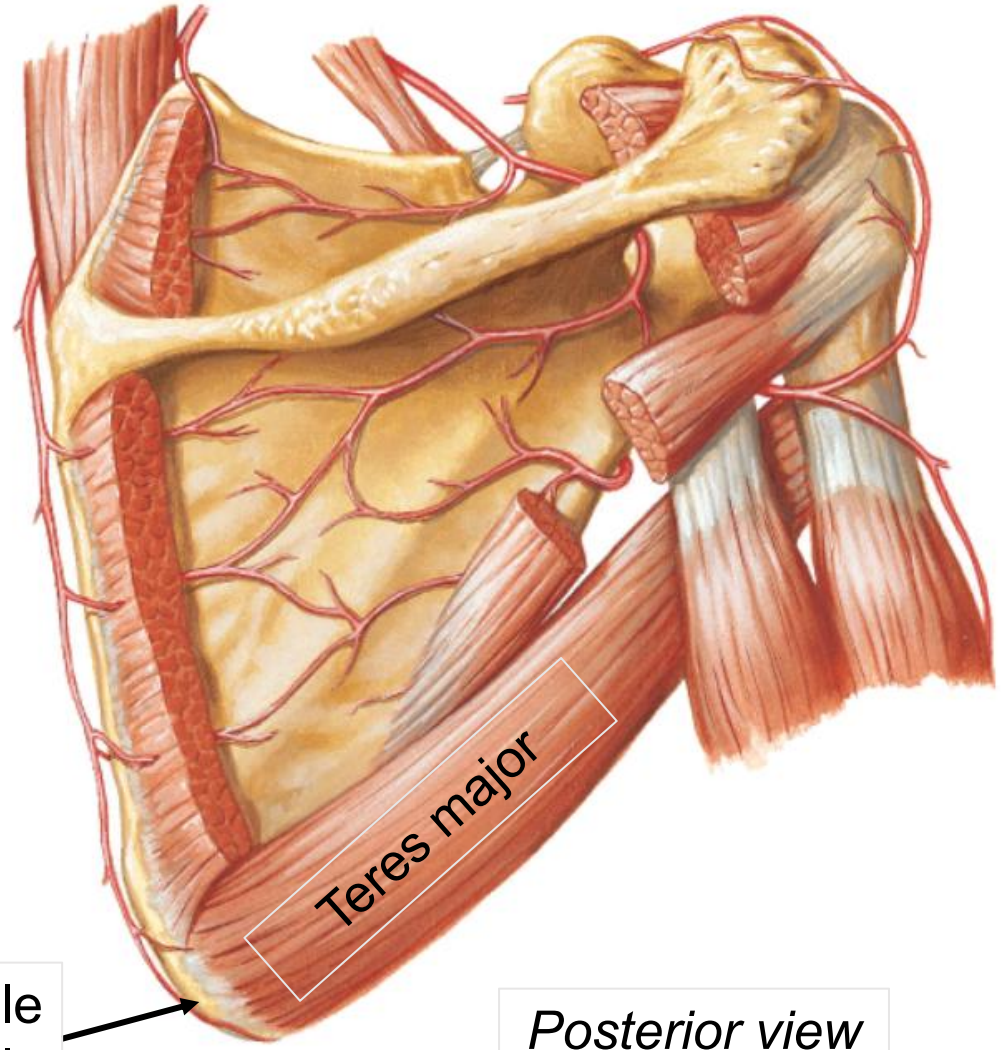
PA	• Lateral clavicle • Acromion • Spine of scapula
DA	Deltoid tuberosity (humerus)
Nerve	Axillary n.
Action	Anterior: flexion & medial rotation (arm) Middle: **ABD**uction Posterior: extension & lateral rotation (arm)

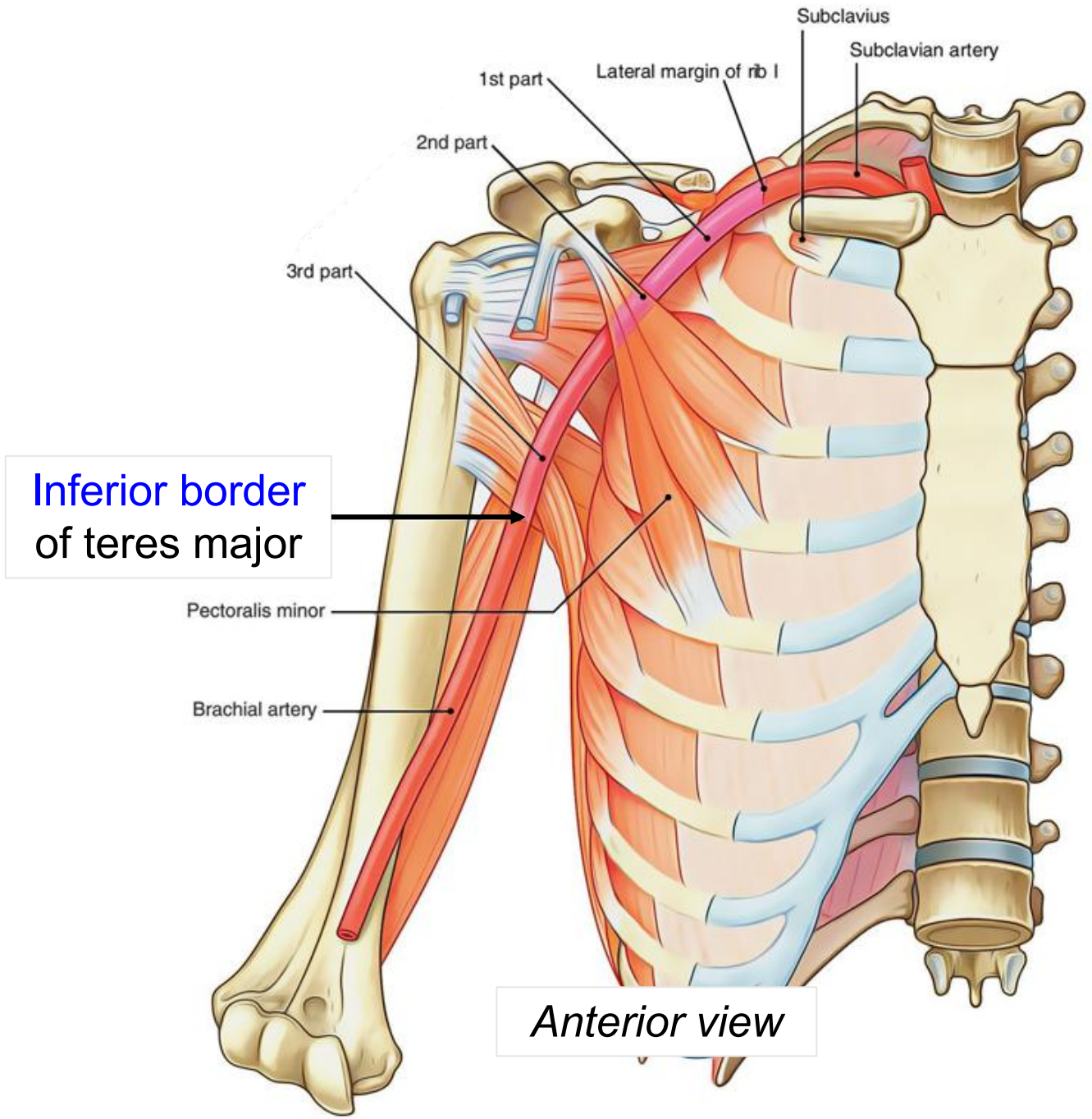



Loss of
sensation

(11) Teres major

PA	Inferior angle (scapula)
DA	Medial lip of intertubercular groove (humerus)
Nerve	Lower subscapular n.
Action	**ADD**uction & medial rotation (arm)





Significance of teres major

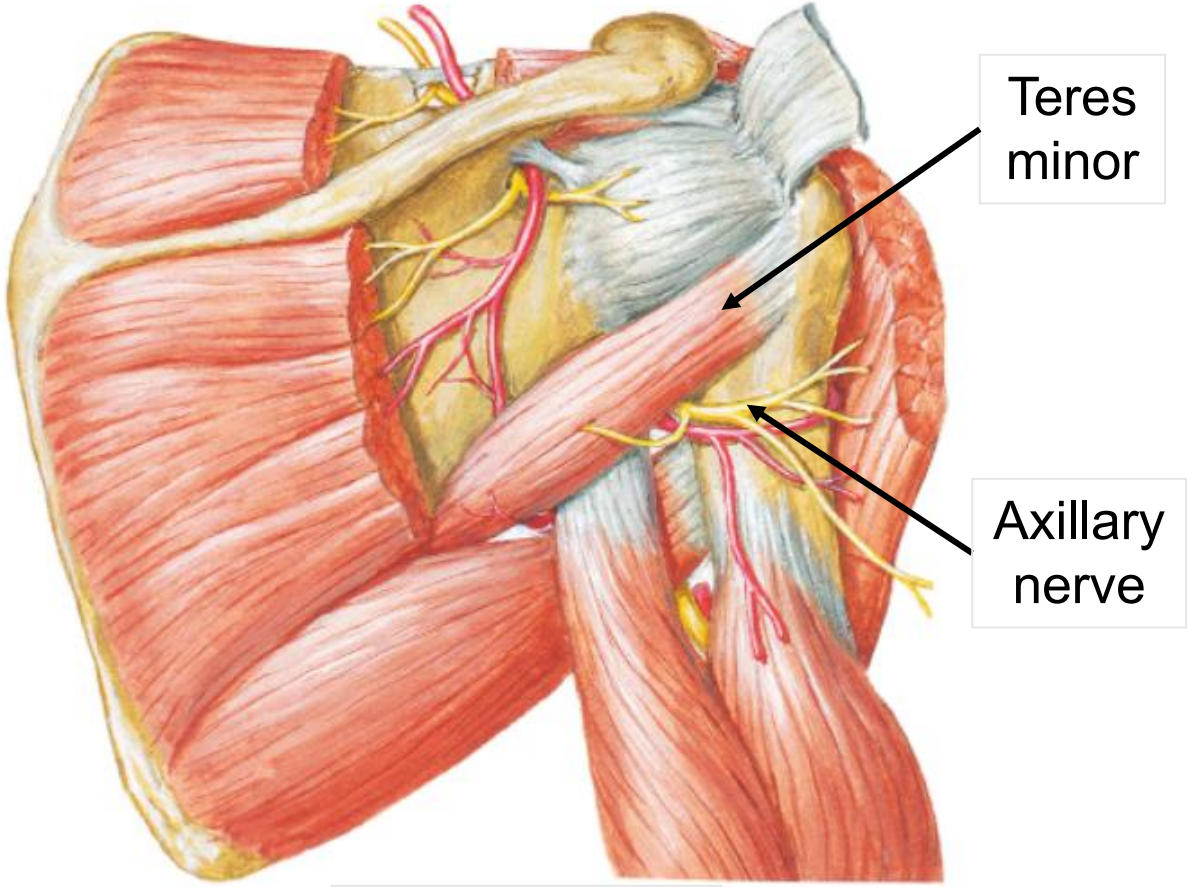
Gives a landmark for axillary artery

Axillary artery changes its name to brachial artery passing the inferior border of teres minor

(12) Teres minor

PA	Lateral border of scapula
DA	Greater tubercle (humerus)
Nerve	Axillary n.
Action	Lateral rotation & assists in **ADD**uction (arm)

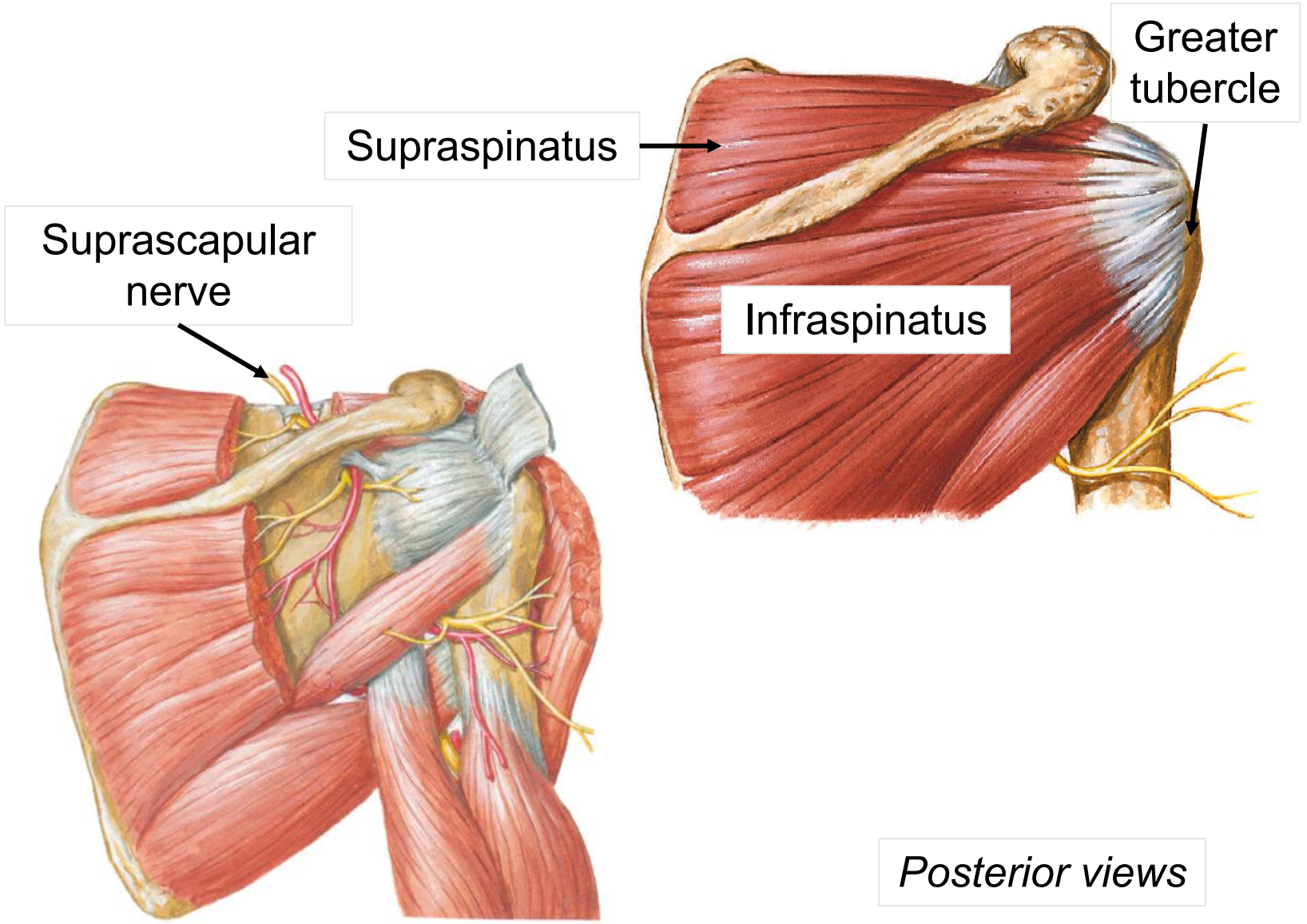
Located deep to the deltoid



Posterior view

(13) Supraspinatus

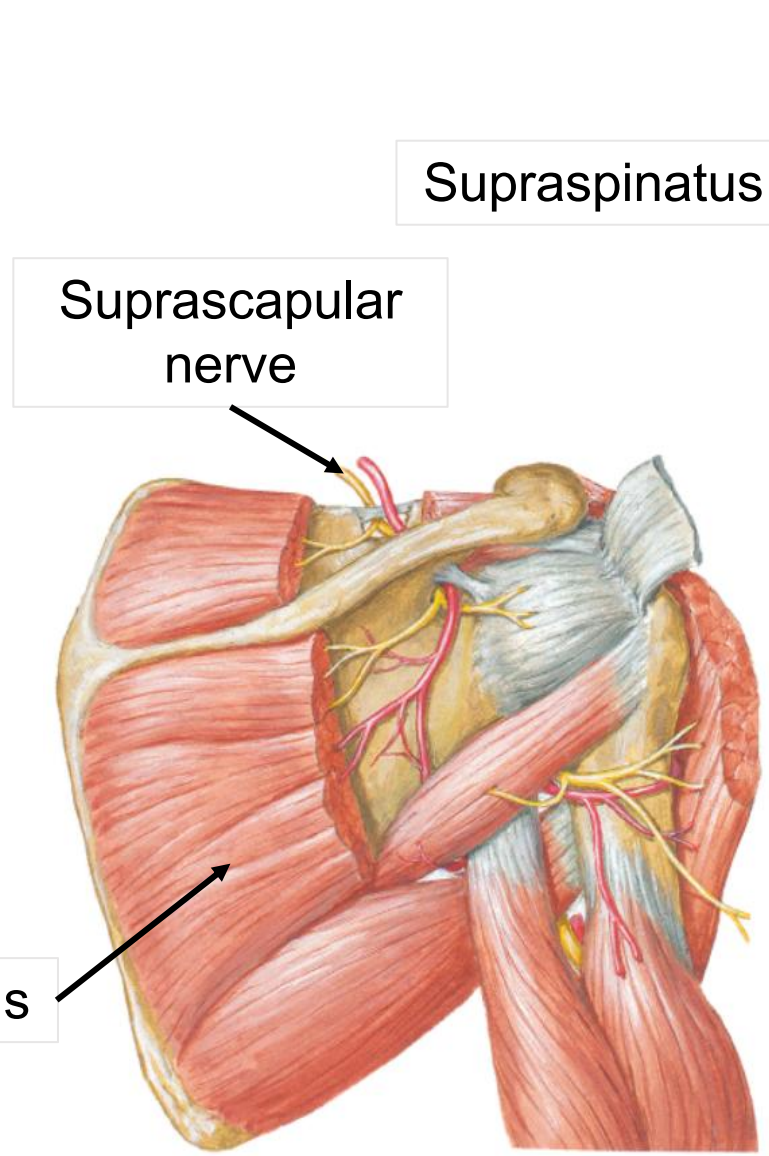
PA	Supraspinous fossa (scapula)
DA	Greater tubercle (humerus)
Nerve	Suprascapular n.
Action	Initiates & assists deltoid in **ABD**uction of arm

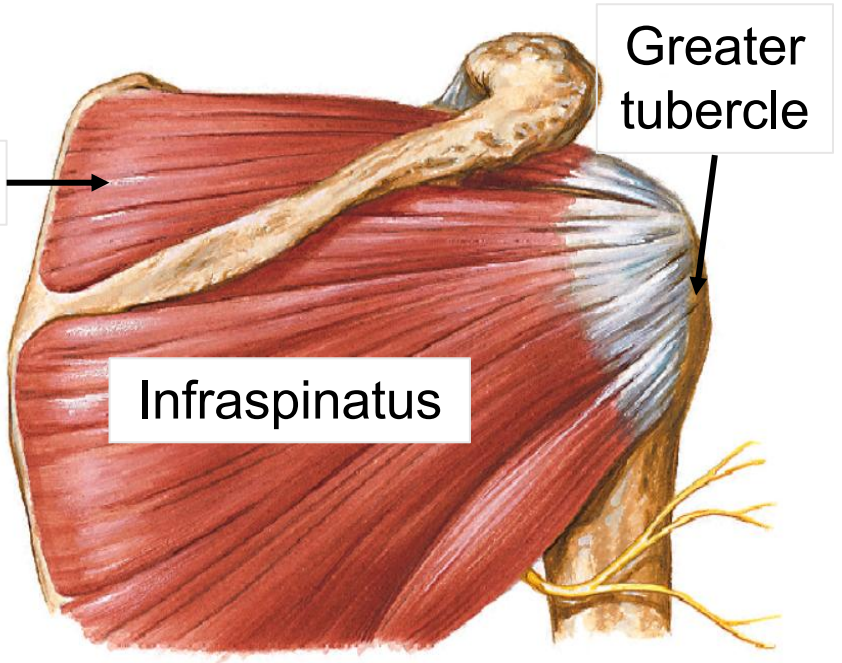


Posterior views

(14) Infraspinatus

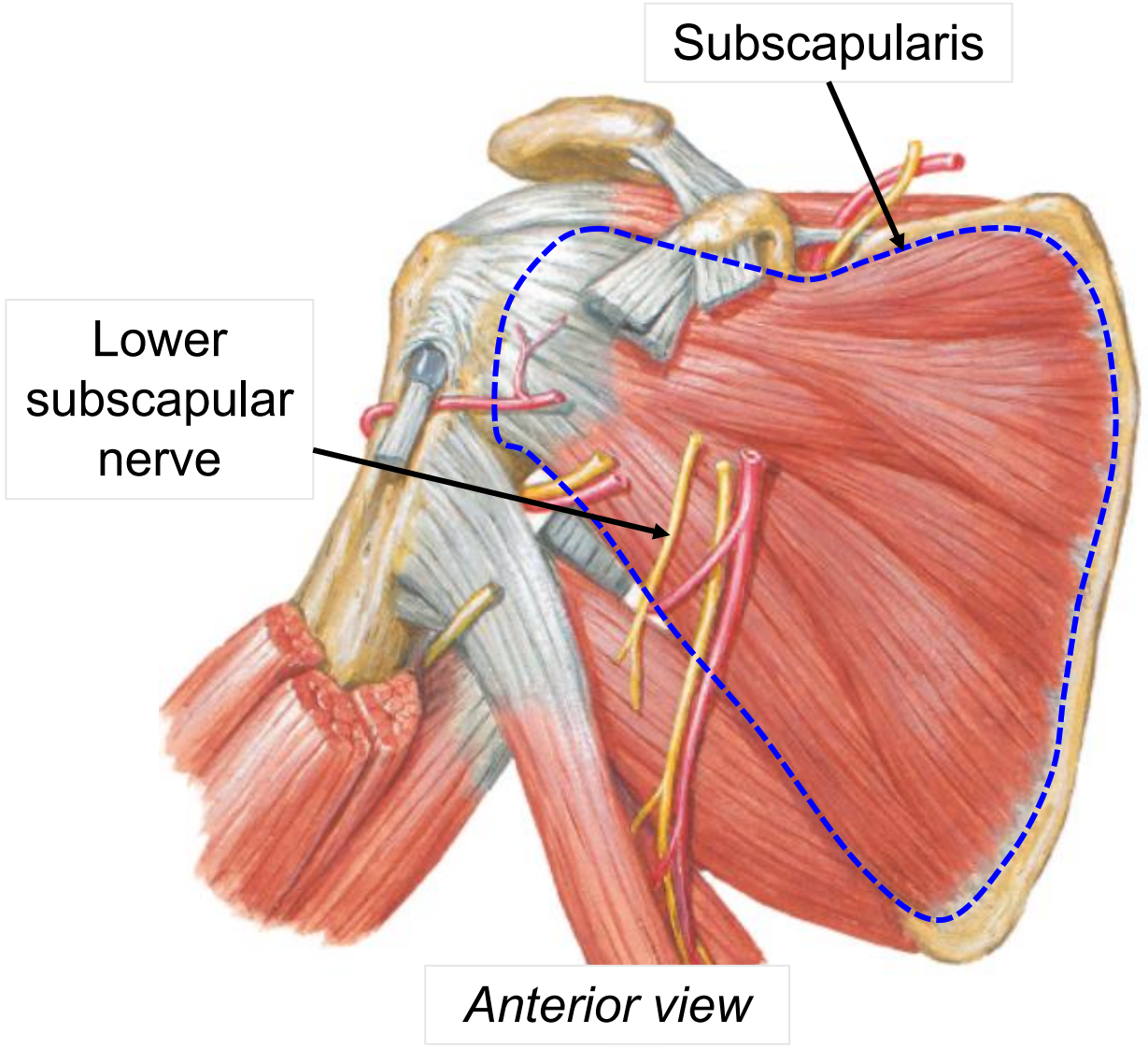
PA	Infraspinous fossa (scapula)
DA	Greater tubercle (humerus)
Nerve	Suprascapular n.
Action	Lateral rotation (arm)





(15) Subscapularis

PA	Subscapular fossa (scapula)
DA	Lesser tubercle (humerus)
Nerve	Upper & lower subscapular n.
Action	Medial rotation (arm)



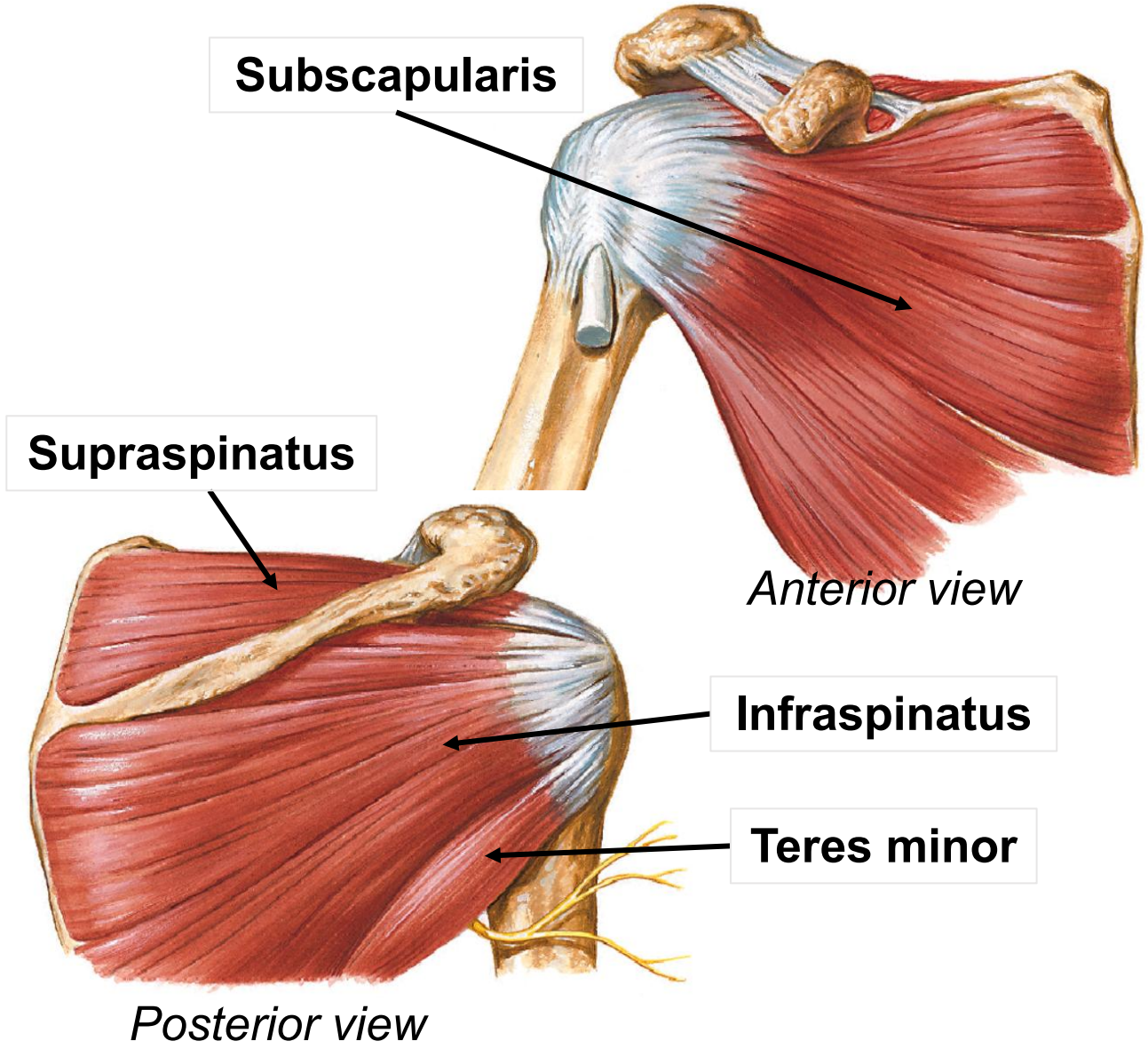
Rotator cuff muscles

- A musculotendinous cuff around the glenohumeral joint

- Formed by 4 of the scapulohumeral muscles (**SITS**):

i. **S**upraspinatus
ii. **I**nfraspinatus
iii. **T**eres minor
iv. **S**ubscapularis

- All are rotators of the shoulder joint except supraspinatus – initiates & assists deltoid (<15°)



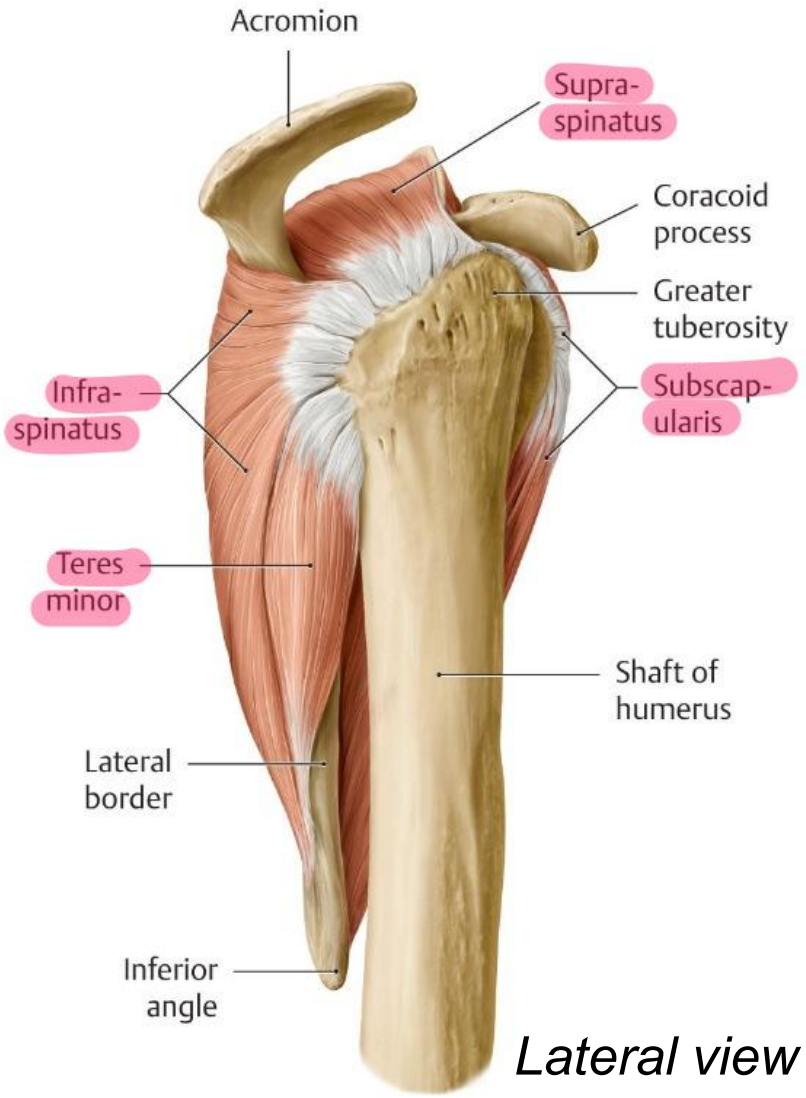
Characteristics of rotator cuff muscles (4S)

Sits on tubercles

Distal attachment – tubercles of humerus

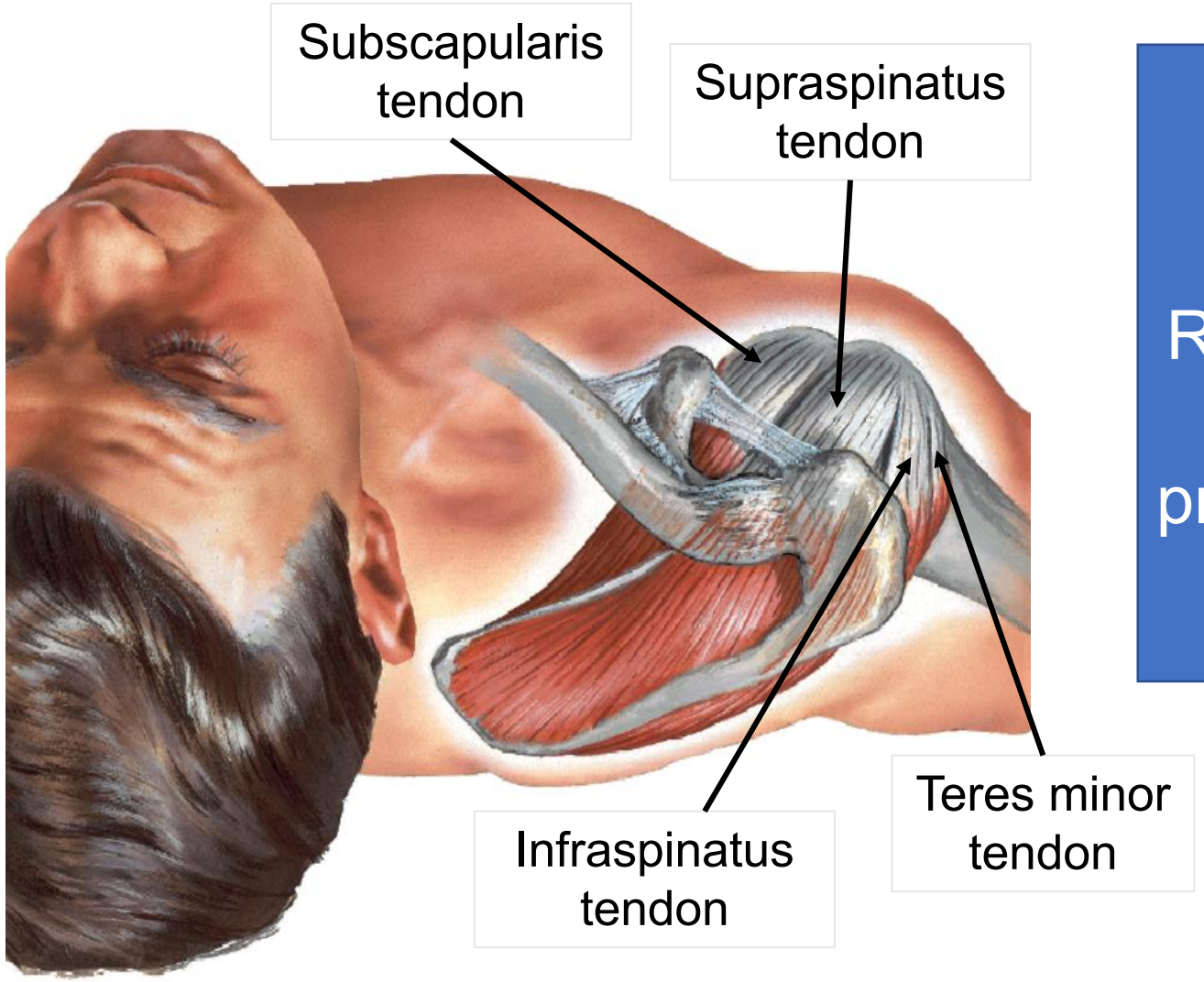
Stabilizes head of humerus

Tonic contraction of these muscles holds the head of the humerus in the small glenoid cavity of scapula during arm movements.



Lateral view

Characteristics of rotator cuff muscles (4S)



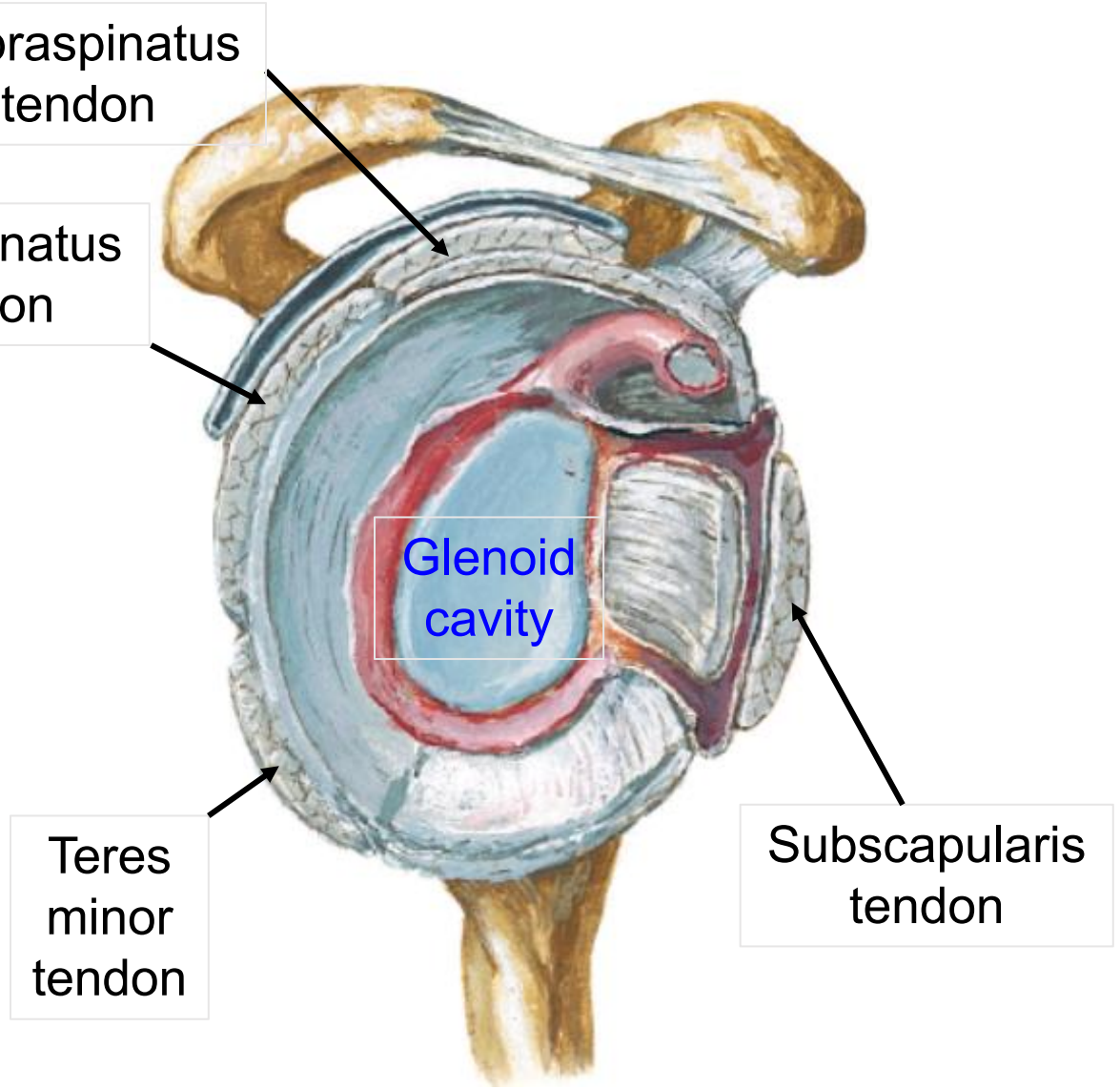
Superior view

Sticks to capsule of shoulder joint

Rotator cuff tendons blends with the joint capsule – provide protection & stability to the shoulder joint

Characteristics of rotator cuff muscles (4S)

Strengthens the shoulder joint
(EXCEPT inferiorly)



SUMMARY

Muscles in shoulder & pectoral regions

Anterior axioappendicular muscles

1. Pectoralis major
2. Pectoralis minor
3. Subclavius
4. Serratus anterior

Posterior axioappendicular muscles

Superficial

5. Trapezius
6. Latissimus dorsi

Deep

7. Levator scapulae
8. Rhomboid major
9. Rhomboid minor

Scapulohumeral muscles

10. Deltoid
11. Teres major
12. **T**eres minor*
13. **S**upraspinatus*
14. **I**nfraspinatus*
15. **S**ubscapularis*

(Rotator cuff muscles*)

SUMMARY

Rotator cuff muscles

Muscle	PA	DA	Nerve	Action
Supraspinatus	Supraspinous fossa	**Greater** tubercle of humerus	**Supra**scapular n.	Initiates **ABD**uction of arm
Infraspinatus	Infraspinous fossa			**Lateral** rotation of arm
Teres minor	Lateral border of scapula		Axillary n.	
Subscapularis	Subscapular fossa	**Lesser** tubercle of humerus	Upper & lower **sub**scapular n.	**Medial** rotation of arm

SUMMARY

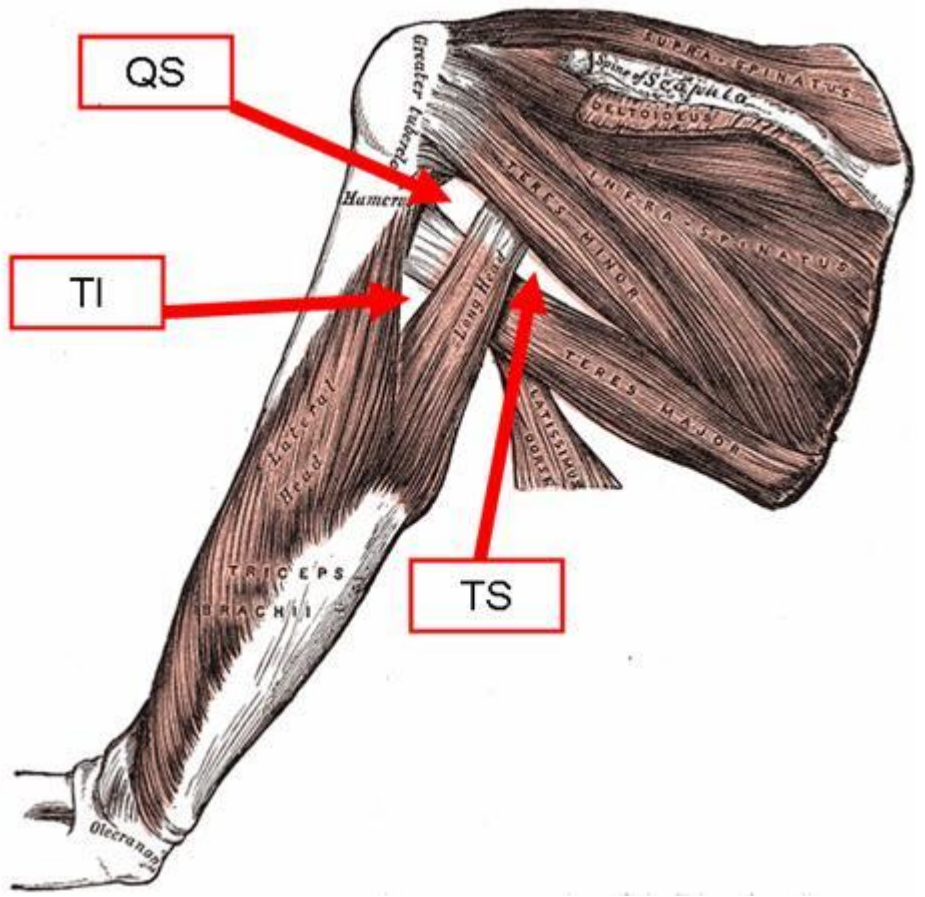
	Movement	Muscles
1	**ABD**uction	Deltoid (middle fibres) Supraspinatus
2	**ADD**uction	Latissimus dorsi Pectoralis major
3	Flexion	Pectoralis major (clavicular part) Deltoid (anterior fibres)
4	Extension	Teres major Deltoid (posterior fibres)
5	Medial rotation	Subscapularis
6	Lateral rotation	Infraspinatus

3.
Posterior scapular spaces

- Quadrangular space
- Triangular space

Posterior scapular spaces

- Provides **passageway** for nerves & vessels passing from the axilla to the posterior scapular region
- Bounded by the scapulohumeral muscles and humerus
- **3 spaces**:
  i. Quadrangular space
  ii. Upper/medial triangular space
  iii. Lower/lateral triangular space



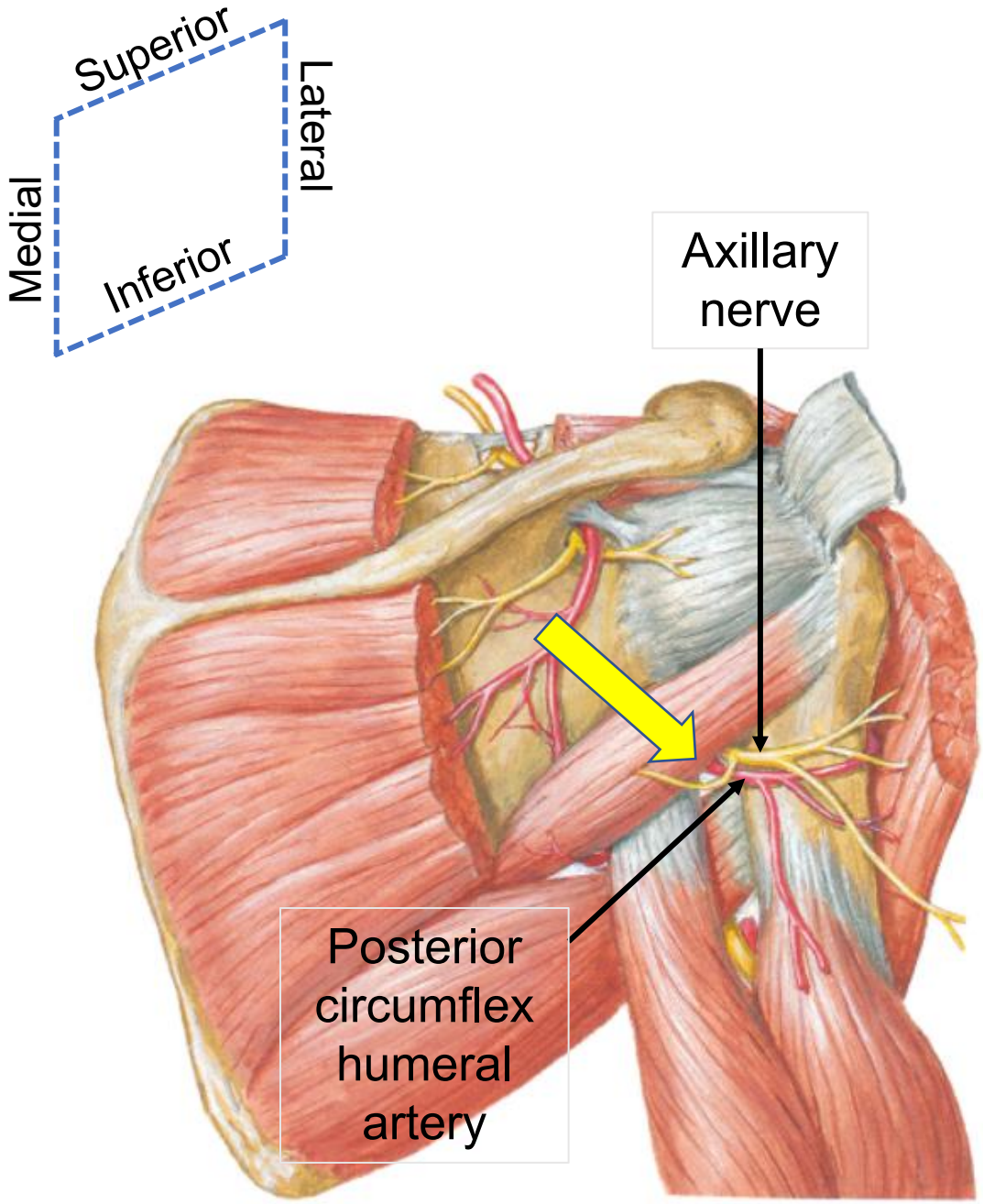
i. Quadrangular space

Boundaries:

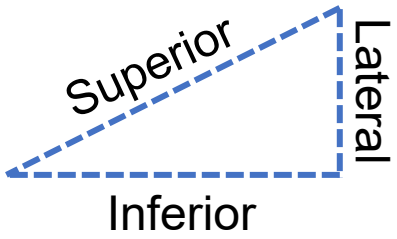
- Superiorly : Subscapularis, teres minor
- Inferiorly: Teres major
- Medially: Long head of triceps
- Laterally: Surgical neck of humerus

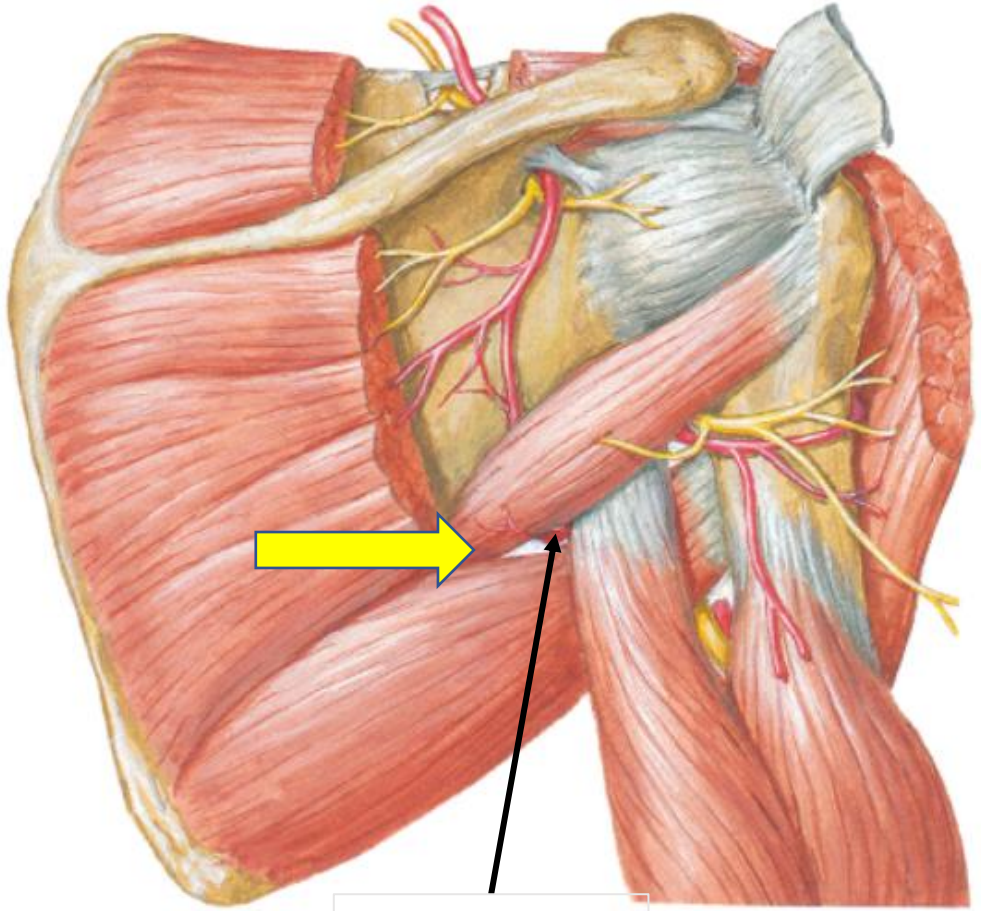
Structures passing through it:

- Axillary nerve
- Posterior circumflex humeral artery



ii. Upper triangular space





Boundaries:

- Superiorly : Teres minor
- Inferiorly: Teres major
- Laterally: Long head of triceps

Structures passing through it:

- Circumflex scapular artery

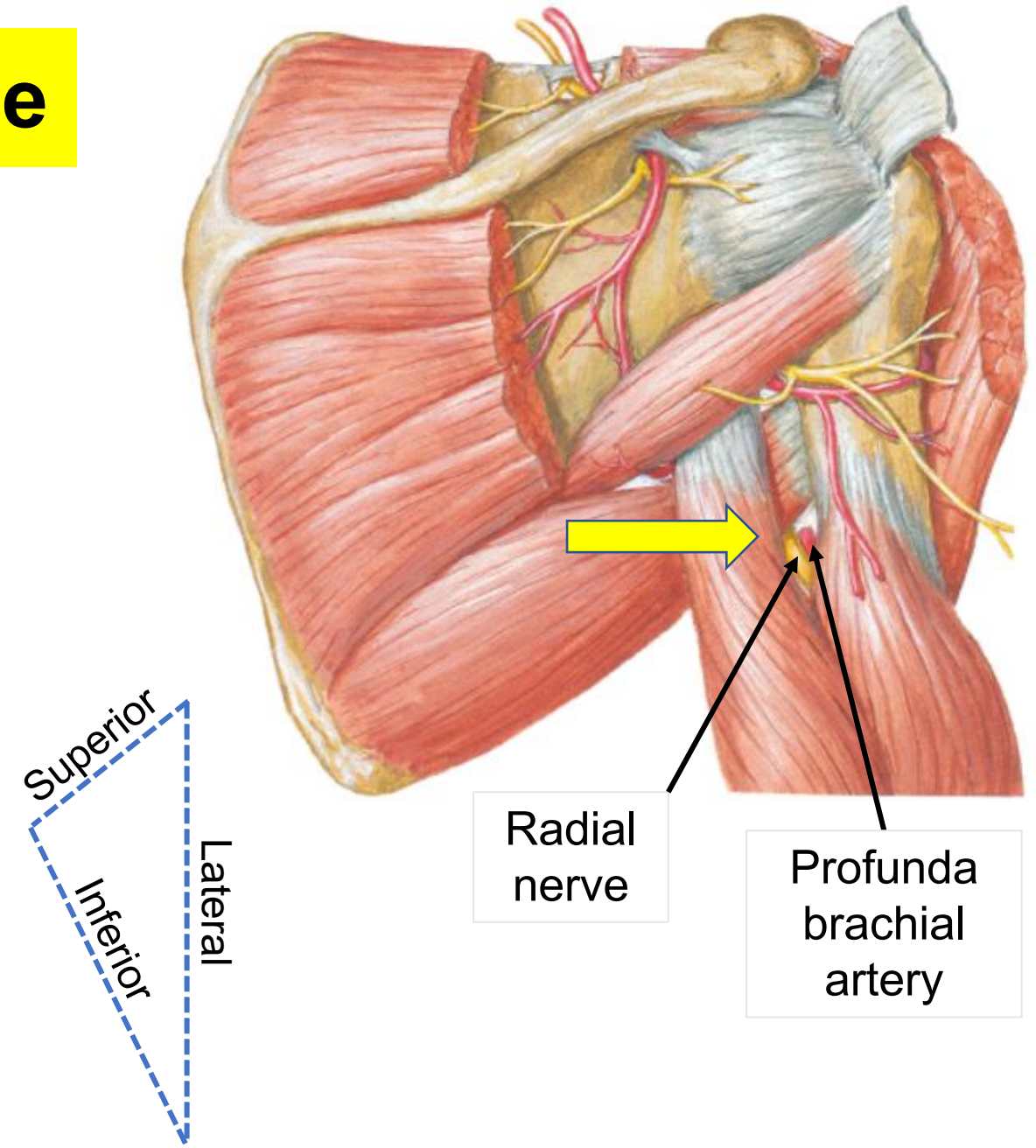
ii. Upper triangular space

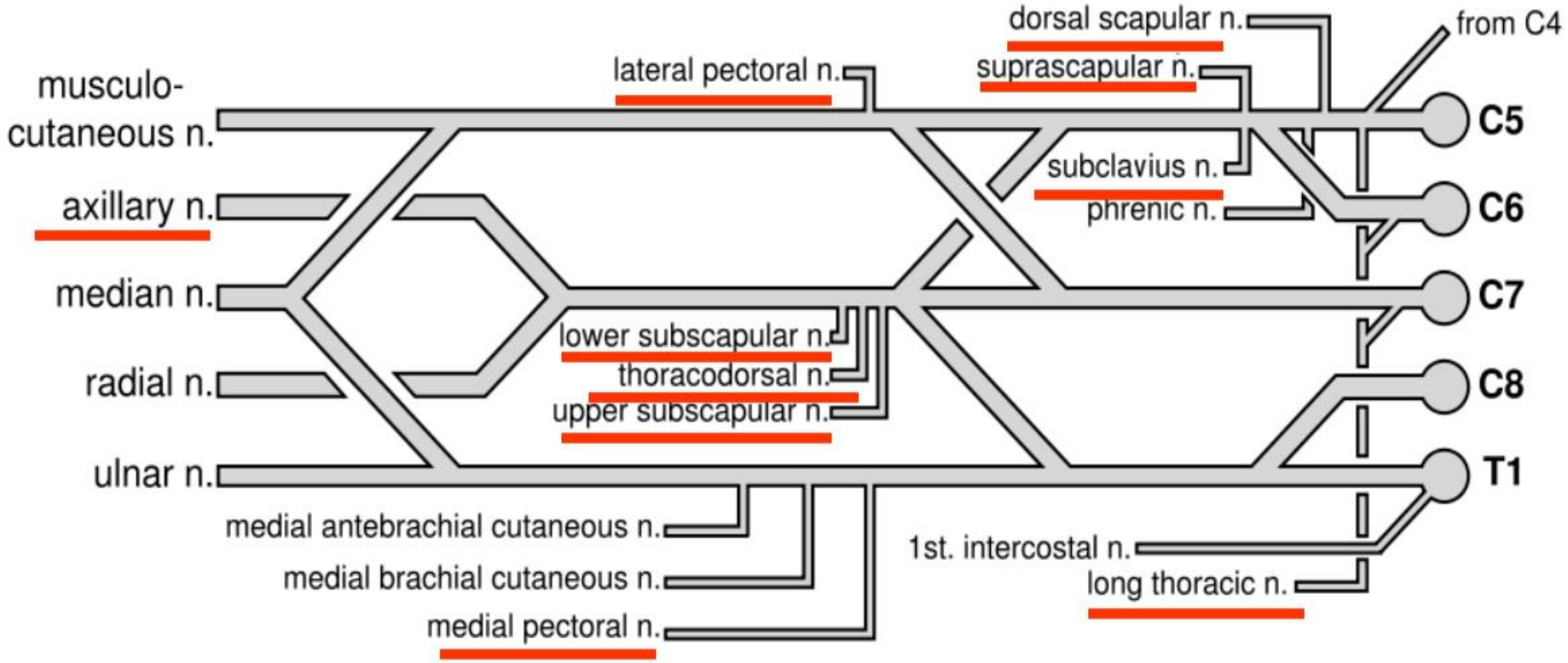
Boundaries:

- Superiorly : Teres major
- Medially: Long head of triceps
- Laterally: Shaft of humerus

Structures passing through it:

- Radial nerve
- Profunda brachial artery

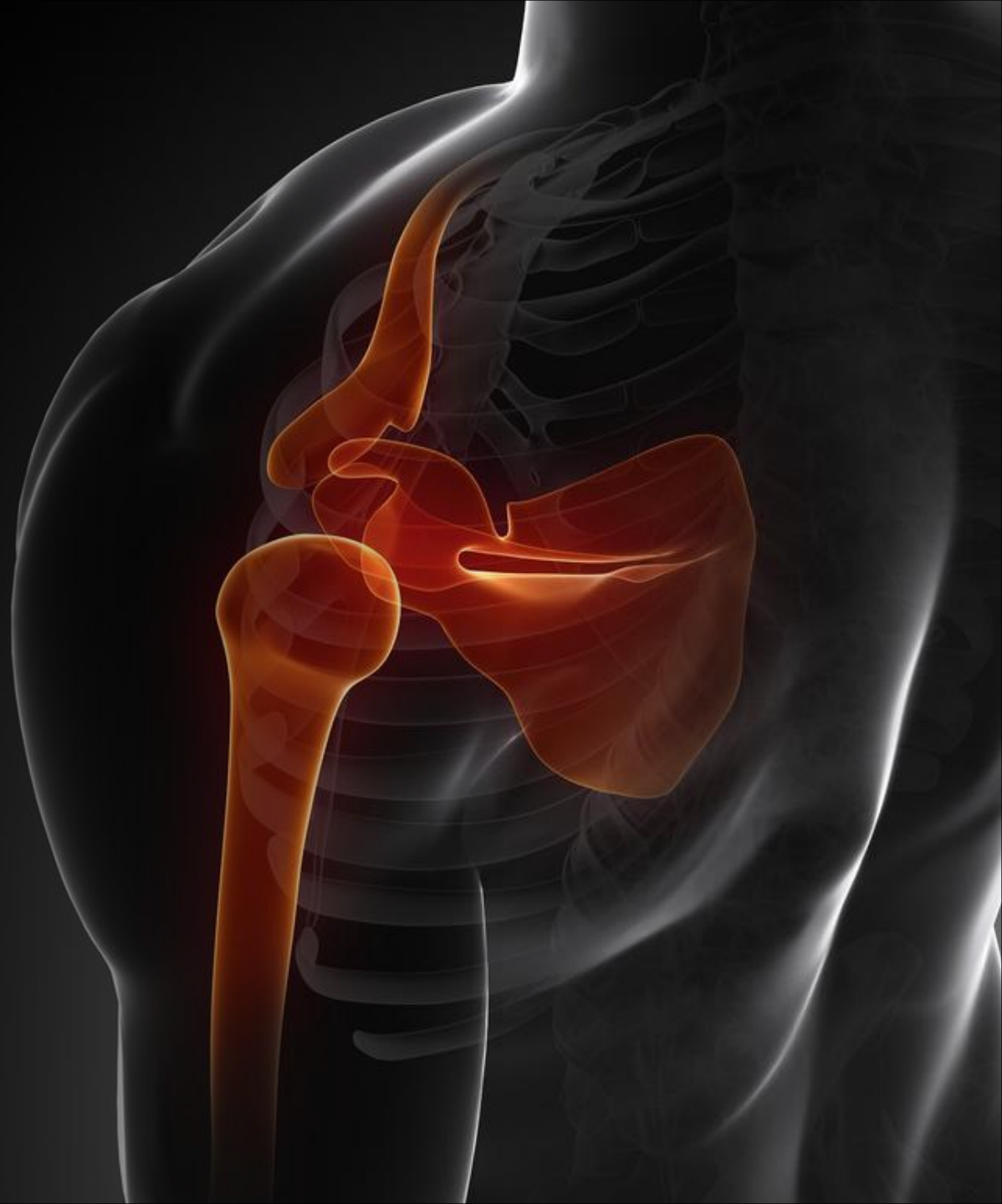




Brachial plexus

4. Clinical correlations

- Paralysis of serratus anterior
- Deltoid atrophy



Muscle actions

What rotation action is his shoulder performing as he continues to hit the shuttlecock?

Internal rotation

External rotation

What rotation action is his shoulder performing as he continues to throw the ball?

Internal rotation

What is the muscle action of his right shoulder?

Flexion

What rotation action is his shoulder performing as he continues to swim?

Circumduction

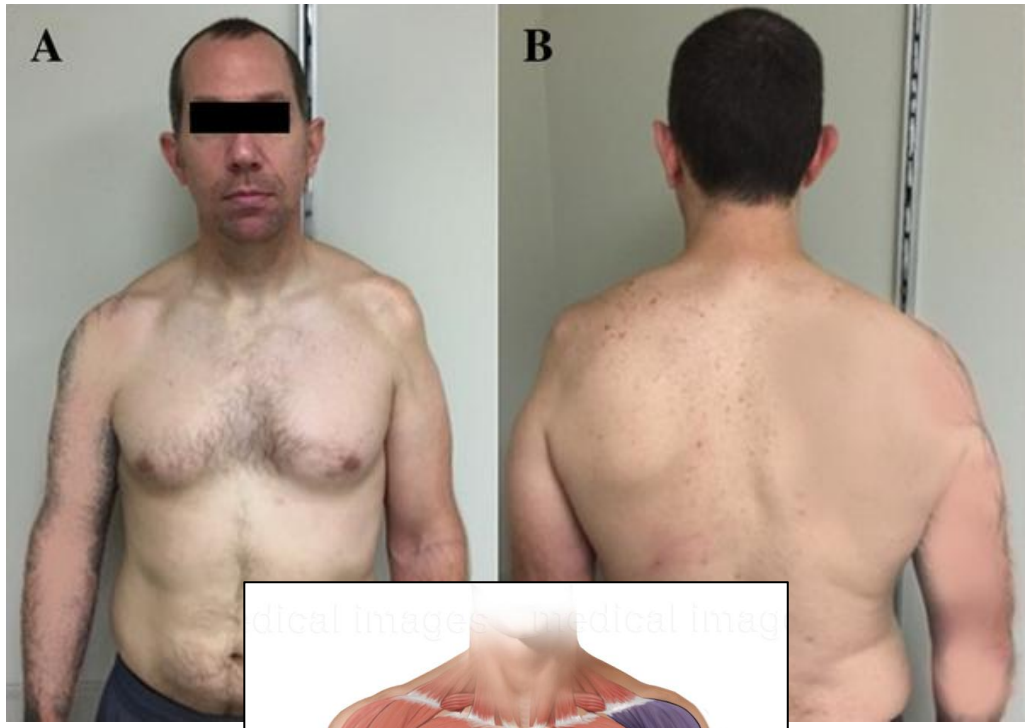
Deltoid atrophy

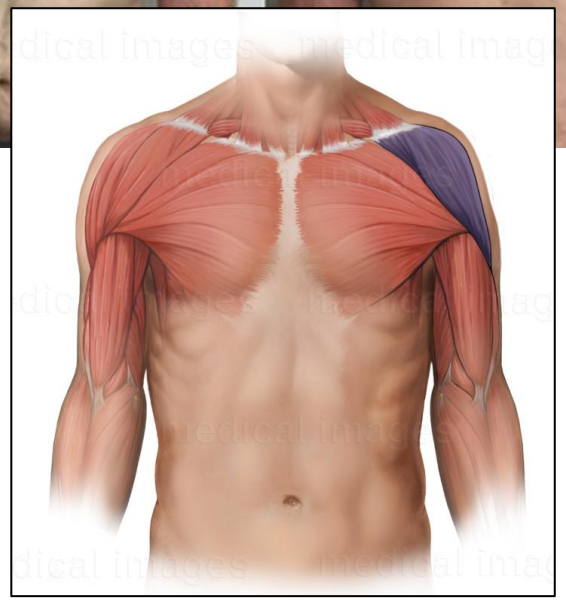
Definition: muscle wasting that results in a smaller, weaker muscle

Causes: sport injury, fracture of surgical neck of humerus

Condition:

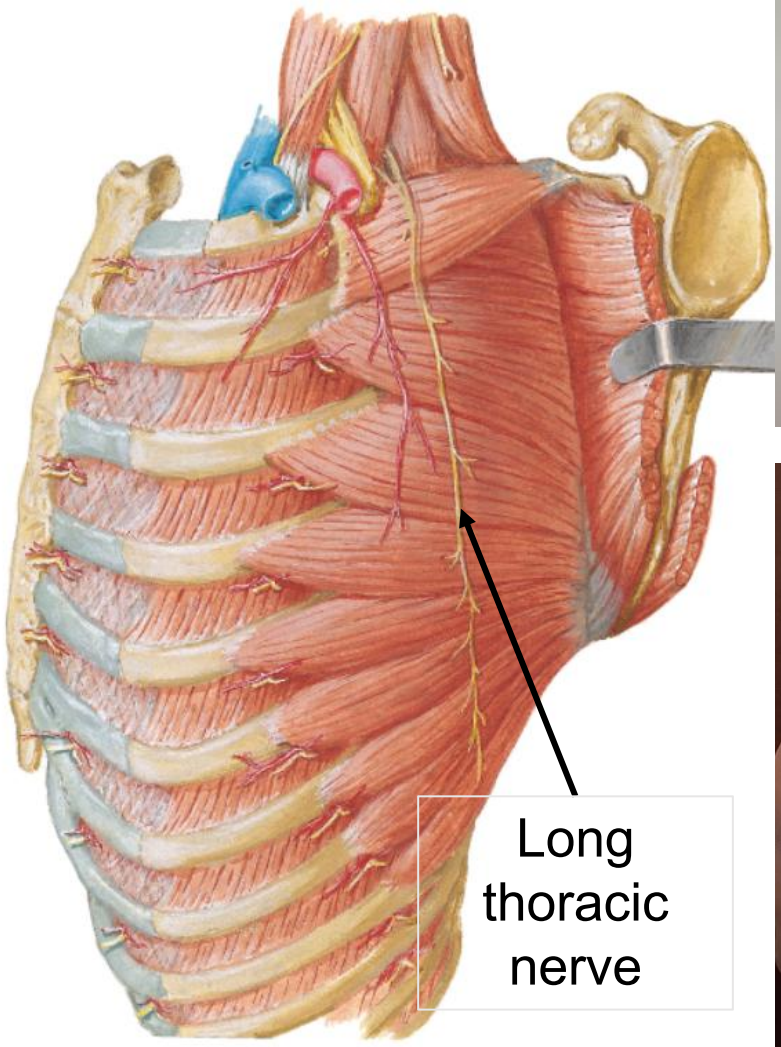
- Injury during sport/fall/MVA
- Acute onset of intense pain with resolution in 1–2 wks followed by weakness and **atrophy** of the arm/shoulder girdle muscles
- Sensory loss in the **axillary nerve** distribution (shoulder contour area)

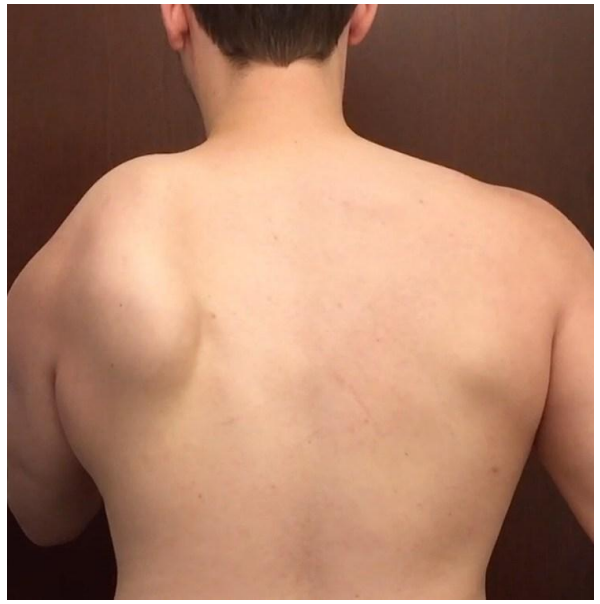




Paralysis of serratus anterior

- Deformity known as **winged scapula** (*scapula alata*)
- Due to injury to long thoracic nerve
- Long thoracic nerve are vulnerable when the upper limbs are elevated **eg**: in a knife fight
- The medial border of scapula moves posteriorly away from thoracic wall when upper limb is pressed against a wall





Axillary nerve injury

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1. Essential Clinical Anatomy. 4th edition. 2011. Keith L. Moore, Anne M. R. Agur & Arthur F. Dally. Lippincott Williams & Wilkins

2. Clinically Oriented Anatomy. 6th edition. 2010. Keith L. Moore & Arthur F. Dally. Lippincott Williams & Wilkins

3. Atlas of Human Anatomy. 4th edition. 2006. Frank H. Netter. Saunders Elsevier