KINESIOLOGY

حرکت شناسی

مدرس : محمدمهدی قیامی

تعریف حرکت شناسی

- Kinein + logos
  - علم شناخت حرکات بدن
  - فیزیولوژی مفاصل

انواع حرکت

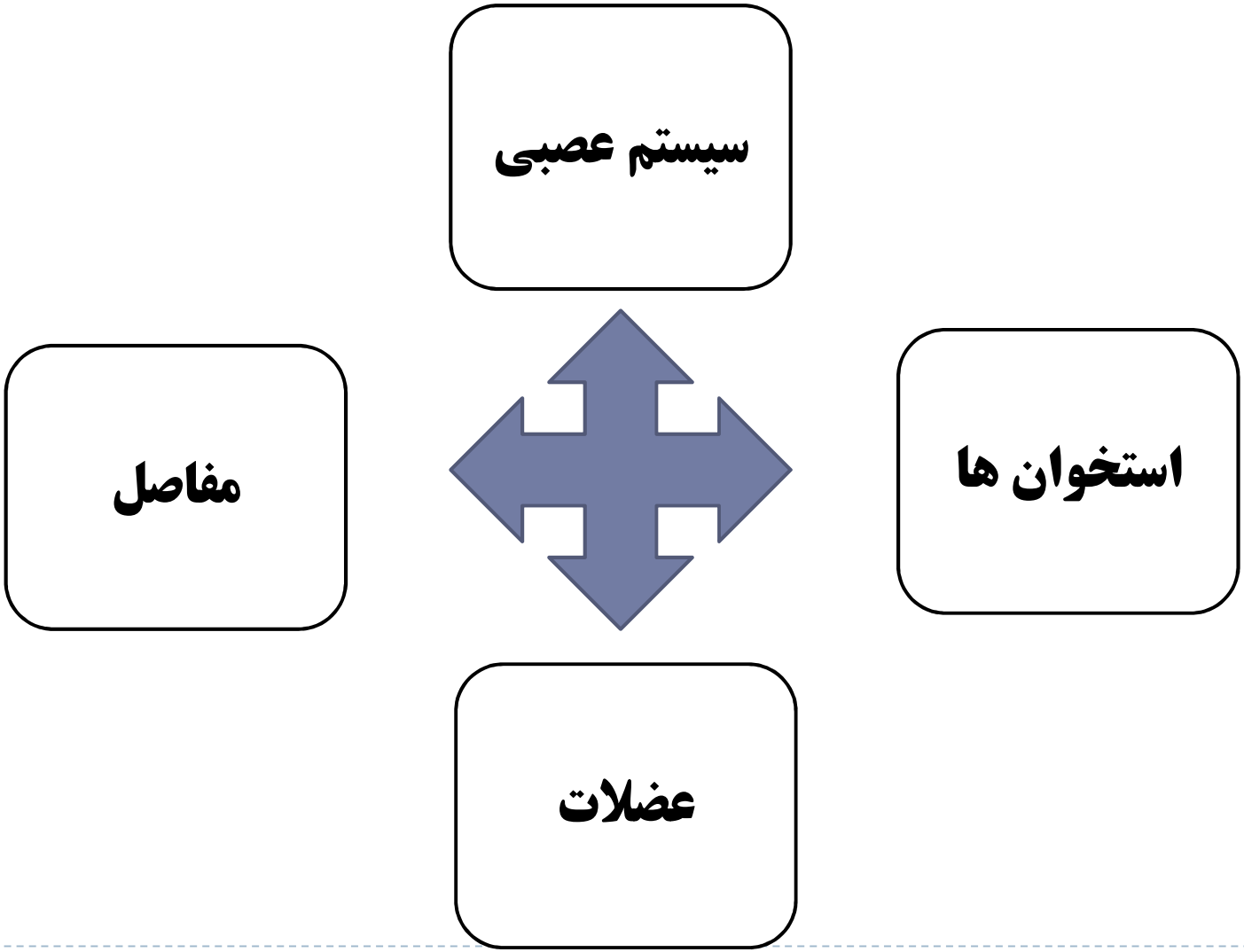
۱) درون سلولی (سیتوپلاسمی)

۲) حرکت آمیبی

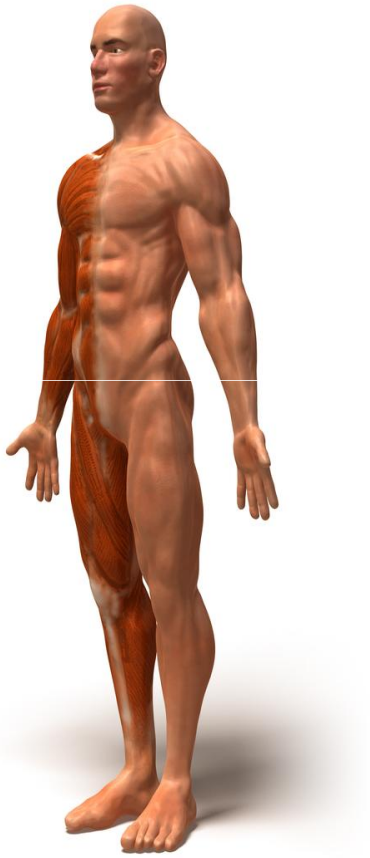
۳) حرکت مژکی

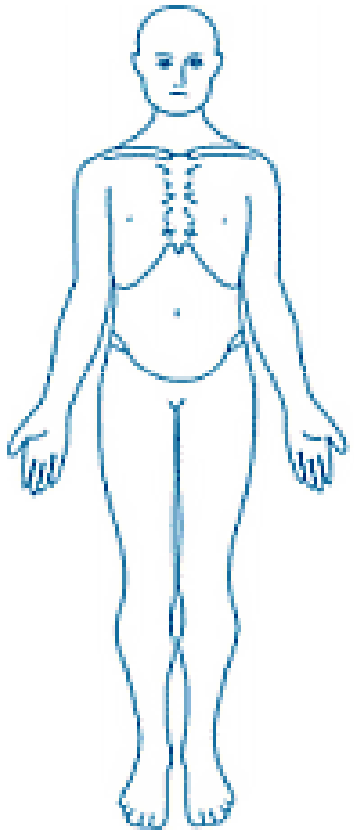
۴) حرکت عضلانی

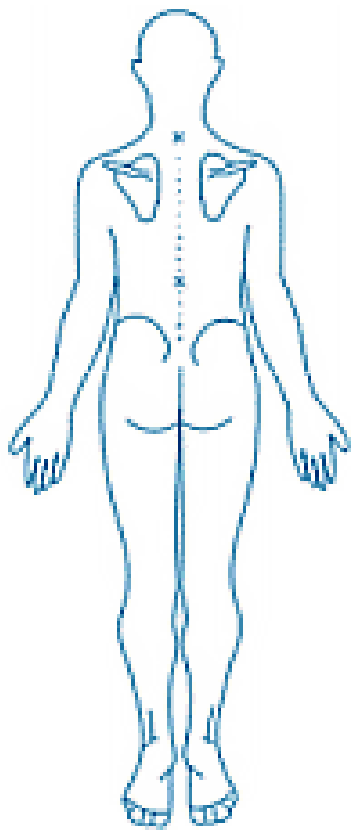
سیستم لکوموتور

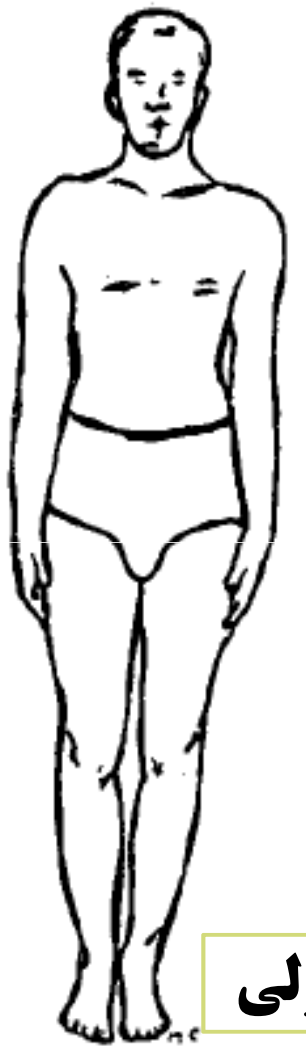


حالات ایستادن

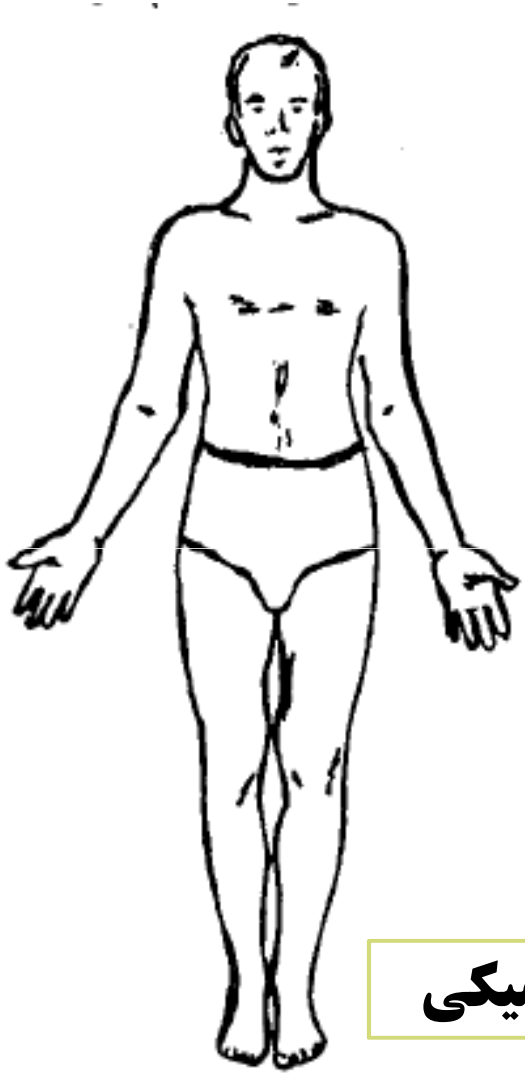




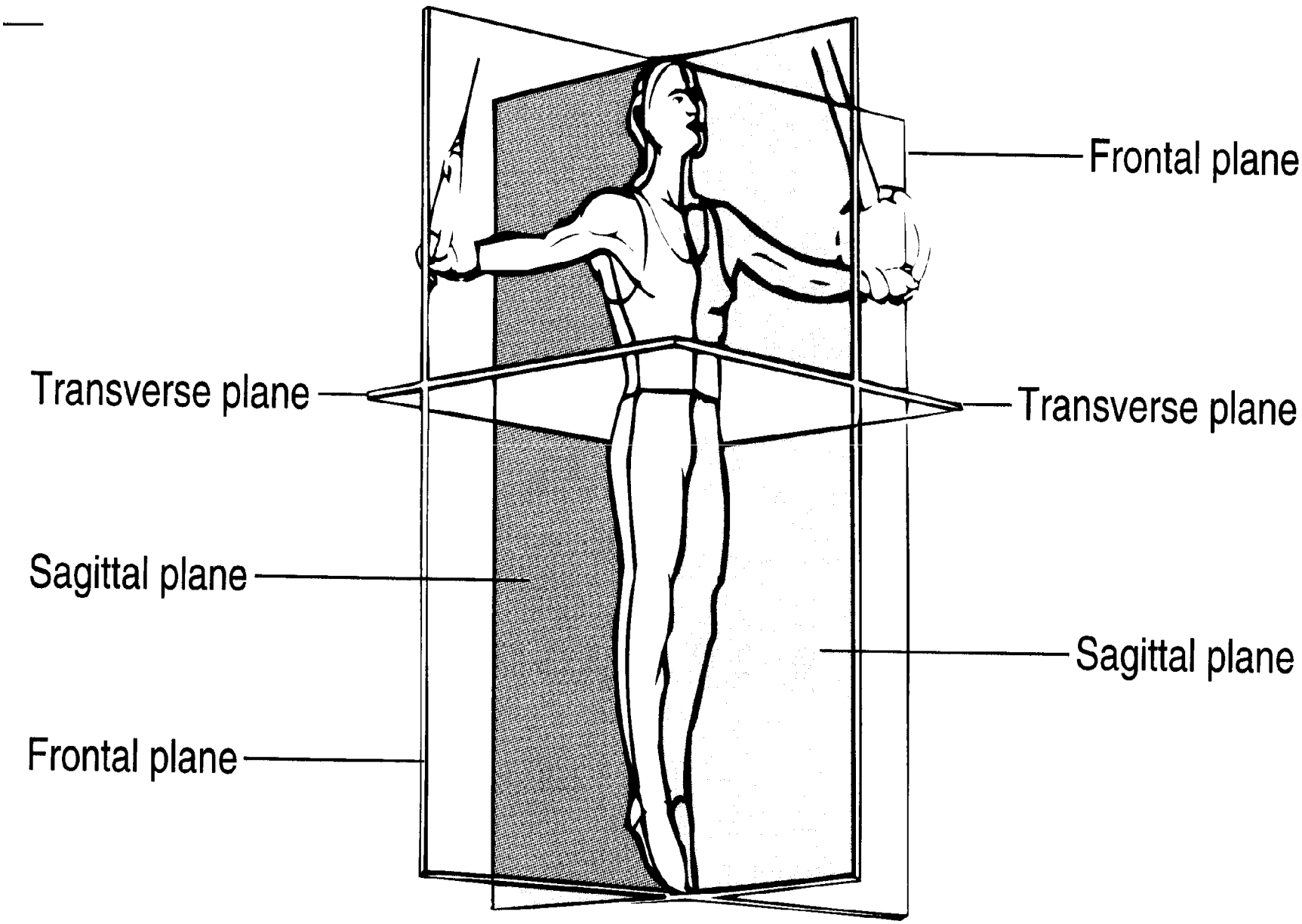


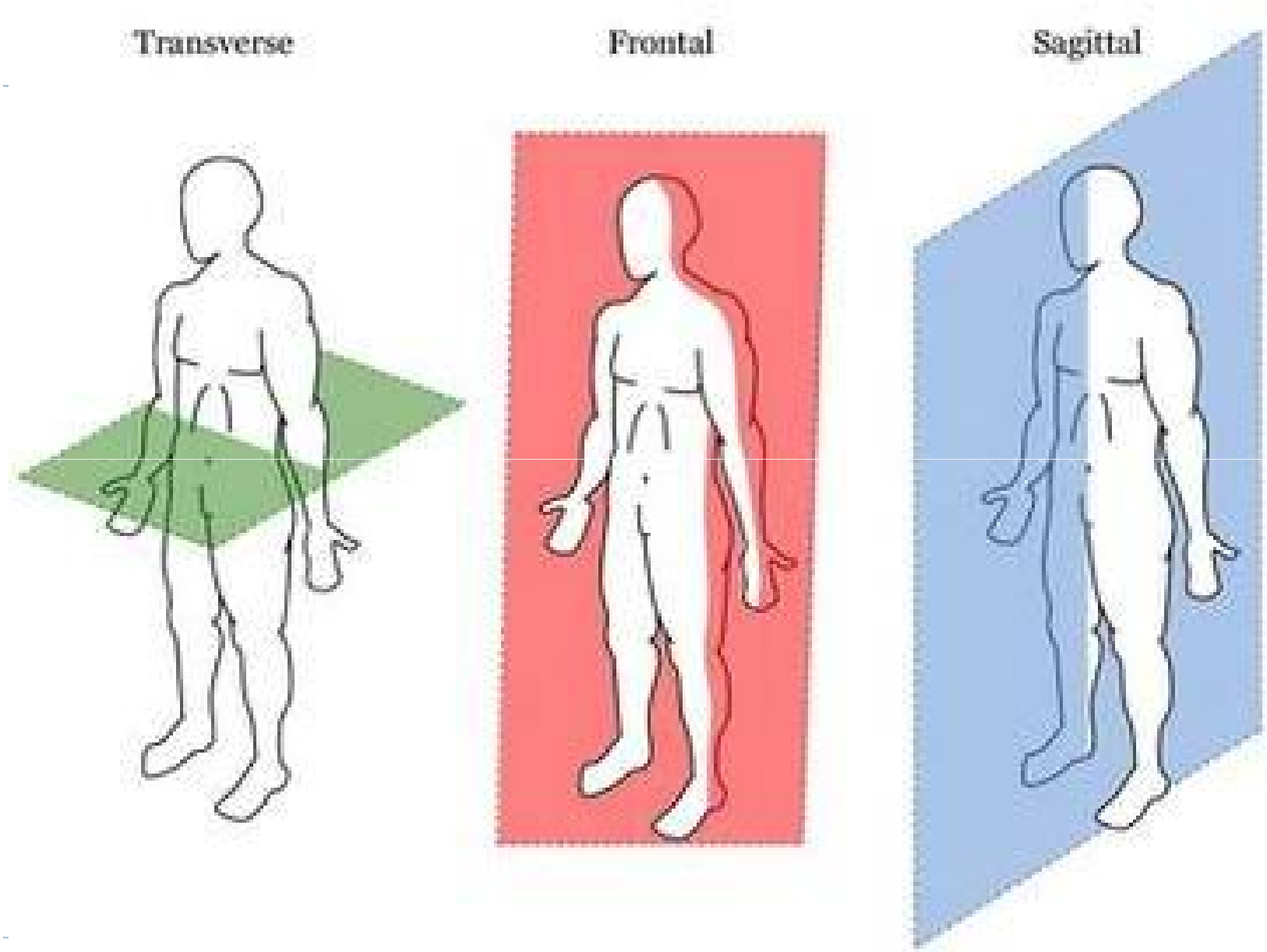


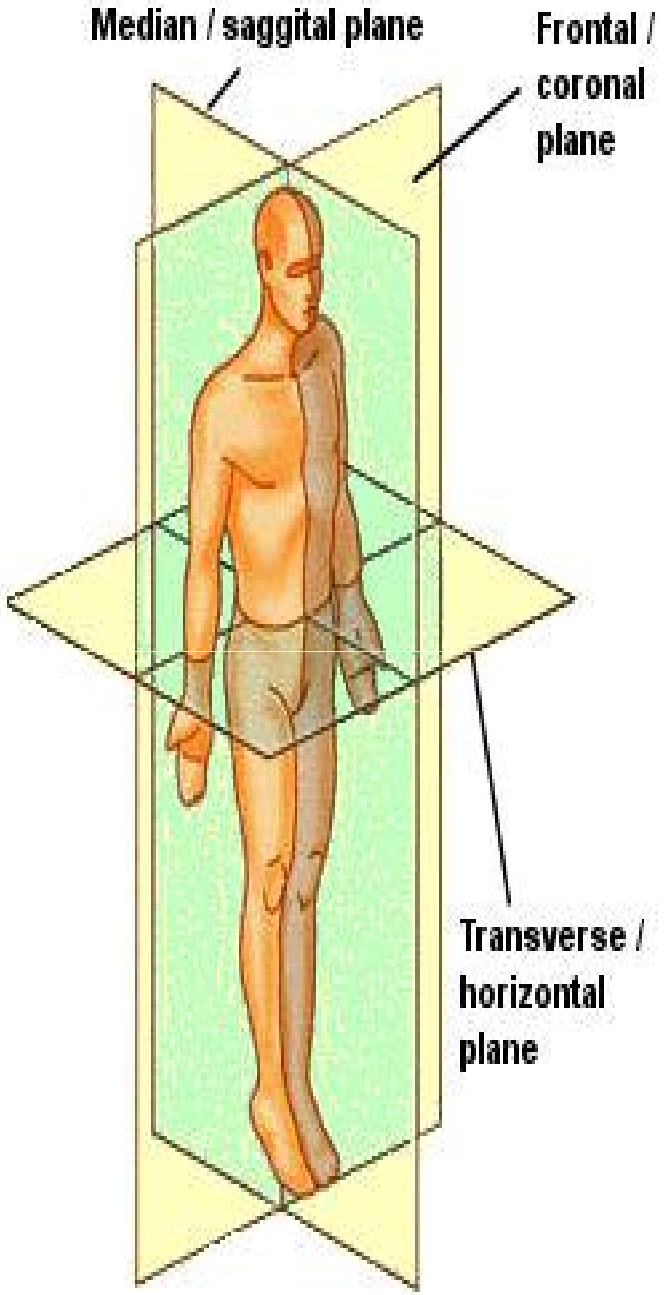
معمولی

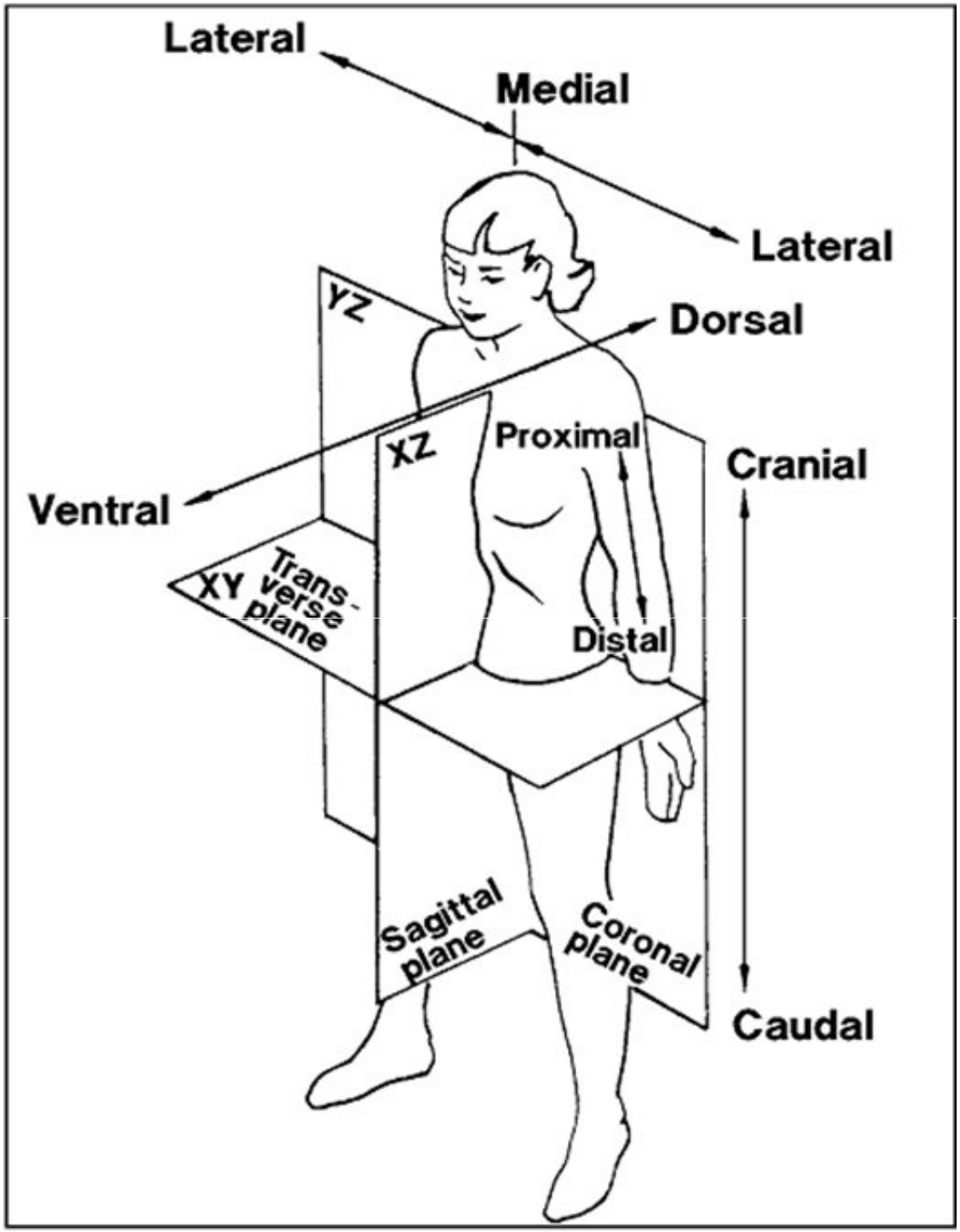


آناتومیکی


Frontal plane
Transverse plane
Transverse plane
Sagittal plane
Sagittal plane
Frontal plane


Transverse
Frontal
Sagittal


Median / saggital plane
Frontal / coronal plane
Transverse / horizontal plane


Lateral
Medial
Lateral
YZ
Dorsal
XZ
Proximal
Cranial
Ventral
Trans-verse plane
XY
Distal
Sagittal plane
Coronal plane
Caudal

مفاصل (Joints)

❖ تعریف : محل اتصال دو استخوان به هم را مفصل می گویند .

طبقه‌بندی مفاصل بدن.

۱ ــ مفاصل غیرمتحرک *Fibrous* Joint

۲ ــ مفاصل نیمه متحرک Cartilagionous Joint (خفیف / حقیقی)

۳ ــ مفاصل متحرک Synovial Joint

مفاصل متحرک خود به شش دسته زیر تقسیم میشوند

۱ ــ مفصل کروی Ball & Socket Joint — triaxial

۲ ــ مفصل لقمه‌ائی Condyloid Joint — biaxial

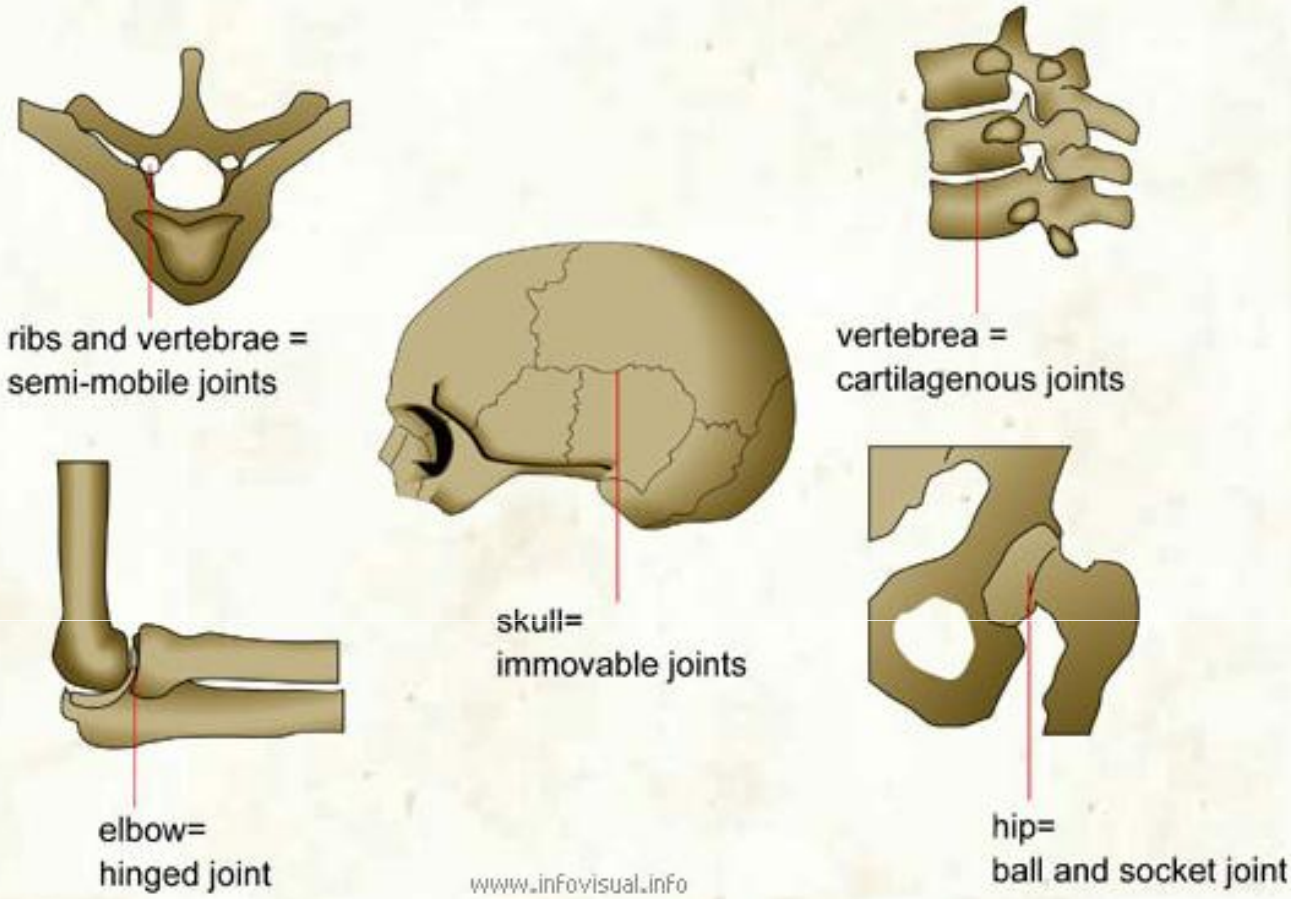
۳ ــ مفصل زینی Saddle Joint — biaxial

۴ ــ مفصل قرقره‌ائی Hinge Joint — unaxial

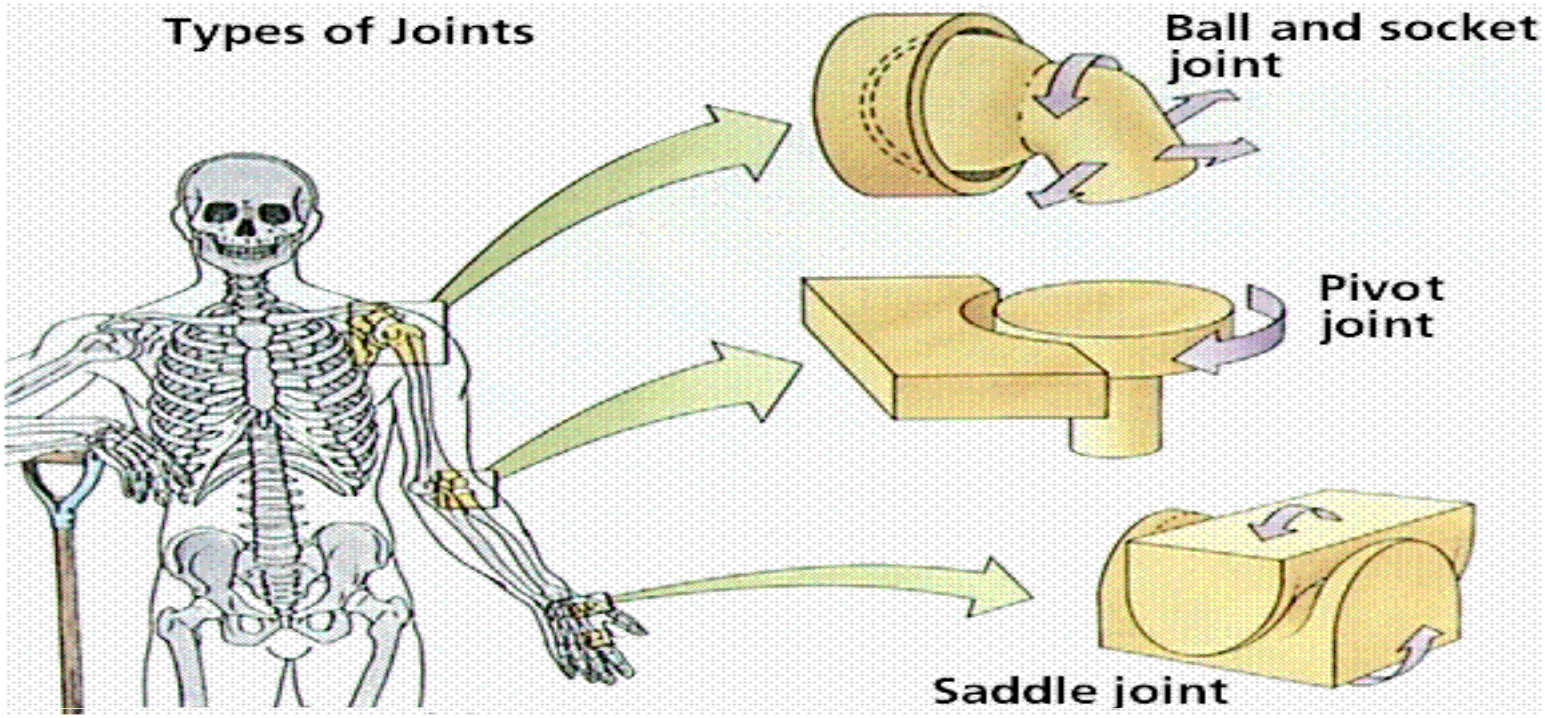
۵ ــ مفصل استوانه‌ائی Pivot Joint — unaxial

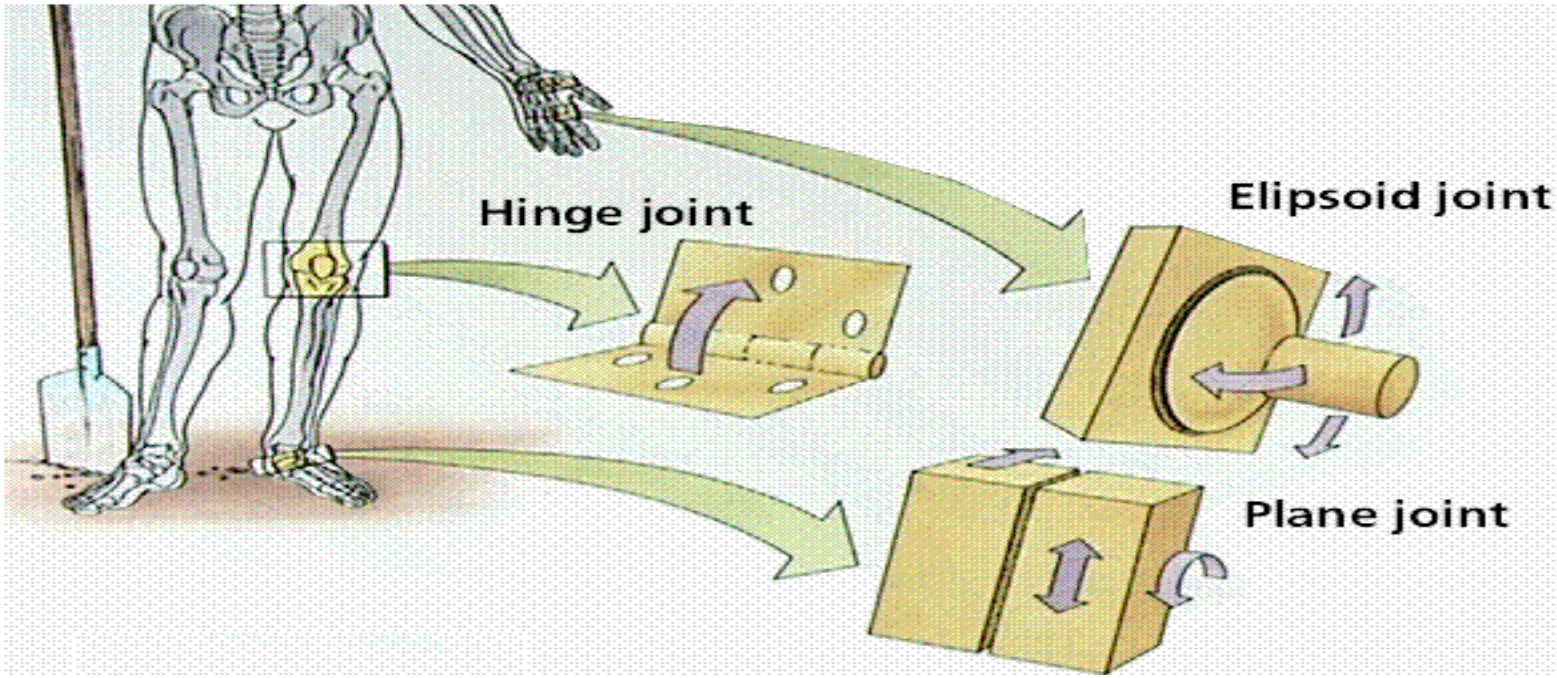
۶ ــ مفصل مسطح Gliding Joint — nonaxial

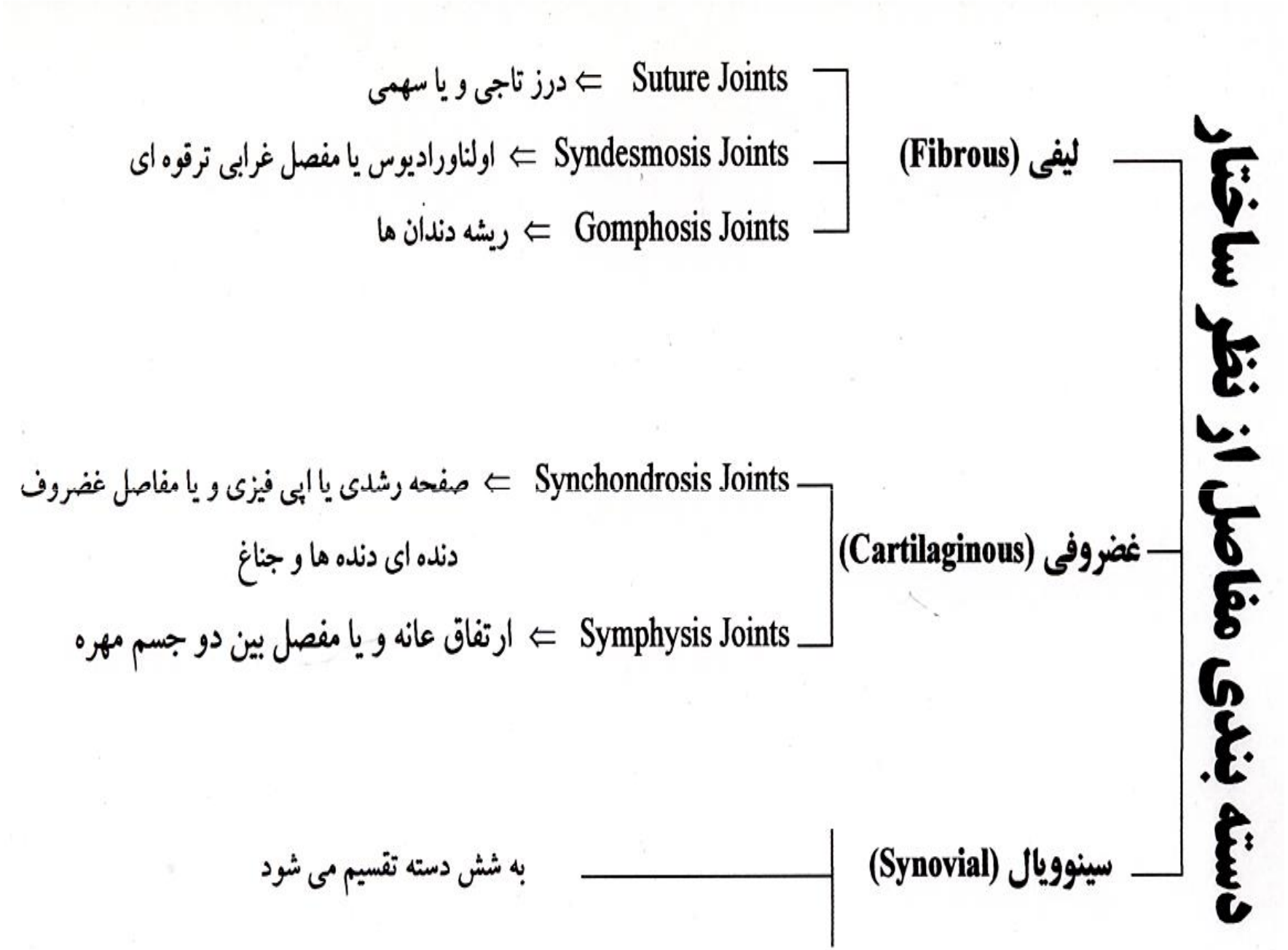
TYPES OF JOINTS FOUND IN THE HUMAN BODY

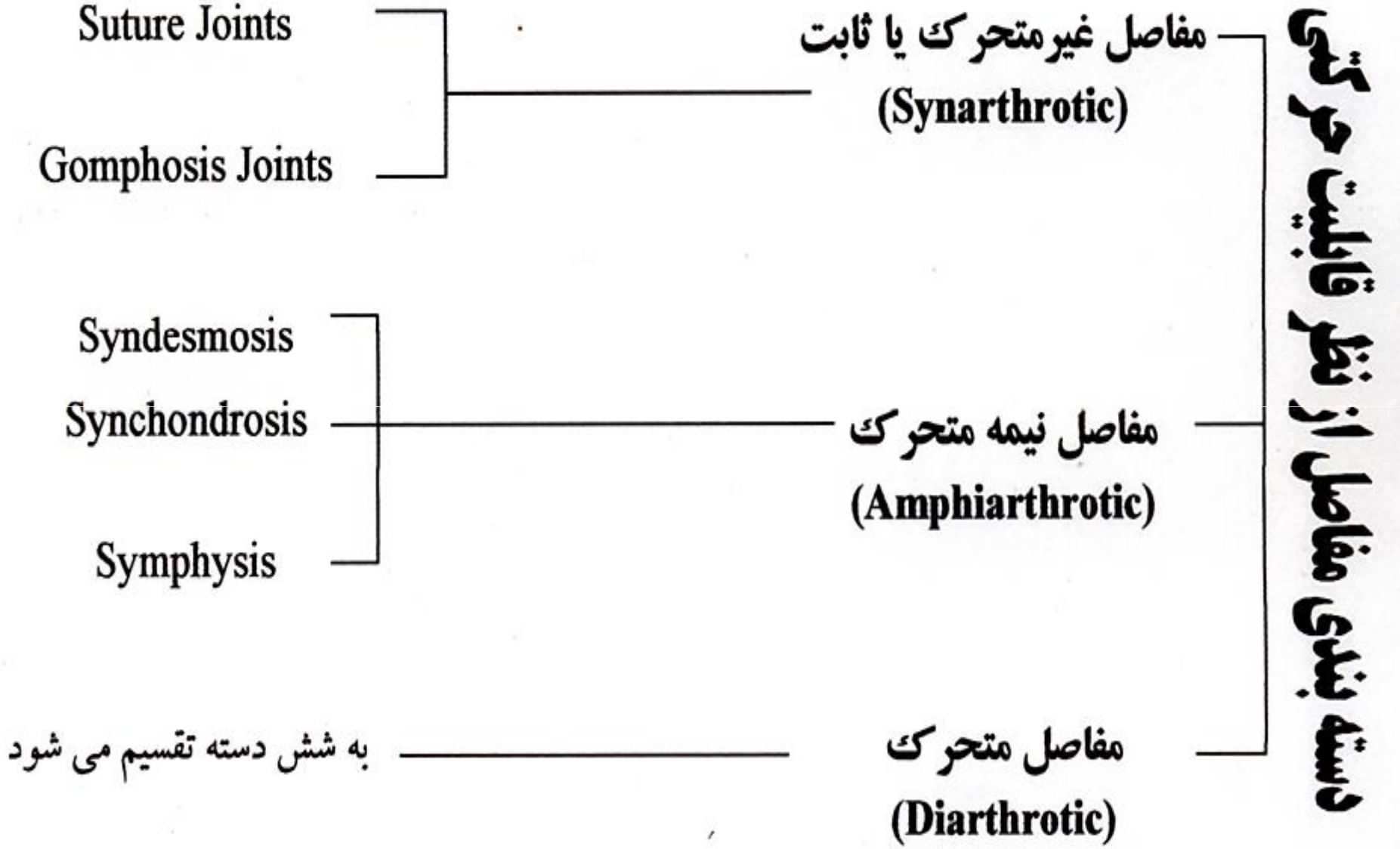


Types of joints found in the human body: junction of two bones that permits movement.
Ribs and vertebrae = semi-mobile joints: ribs: bones of the thoracic cage. Vertebra: each of the bones of the spinal column. Semi-mobile joints: very restricted flexibility.
Vertebrae = cartilaginous joints: vertebra: each of the bones of the spinal column. Cartilaginous joints: flexibility due to cartilage, an elastic tissue.
Skull = immovable joints: skull: bony case of the brain. Fixed joints: joints that do not allow flexibility.
Elbow = hinged joint: elbow: joint connecting the forearm to the upper arm. Hinged joint: flexible in only one direction.
Hip = ball and socket joint: hip: part on the side of the body, between the waist and the top of the thigh. Ball and socket joint: flexibility due to a domed bone that turns in a cavity of the same shape.

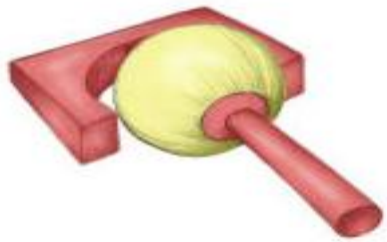

Types of Joints
Ball and socket joint
Pivot joint
Saddle joint

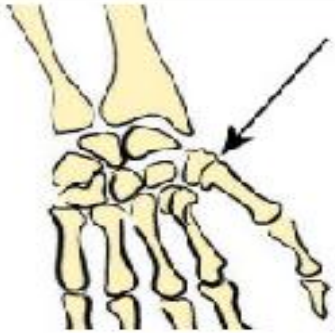
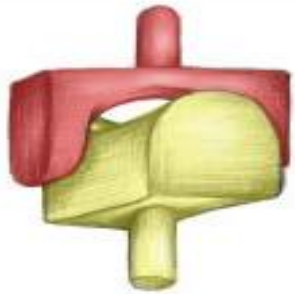
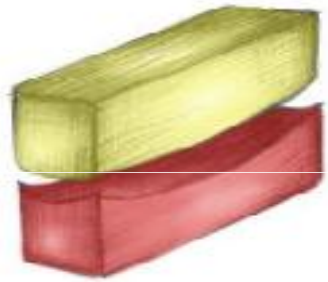
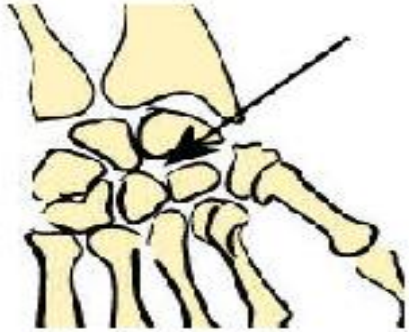

Hinge joint
Elipsoid joint
Plane joint

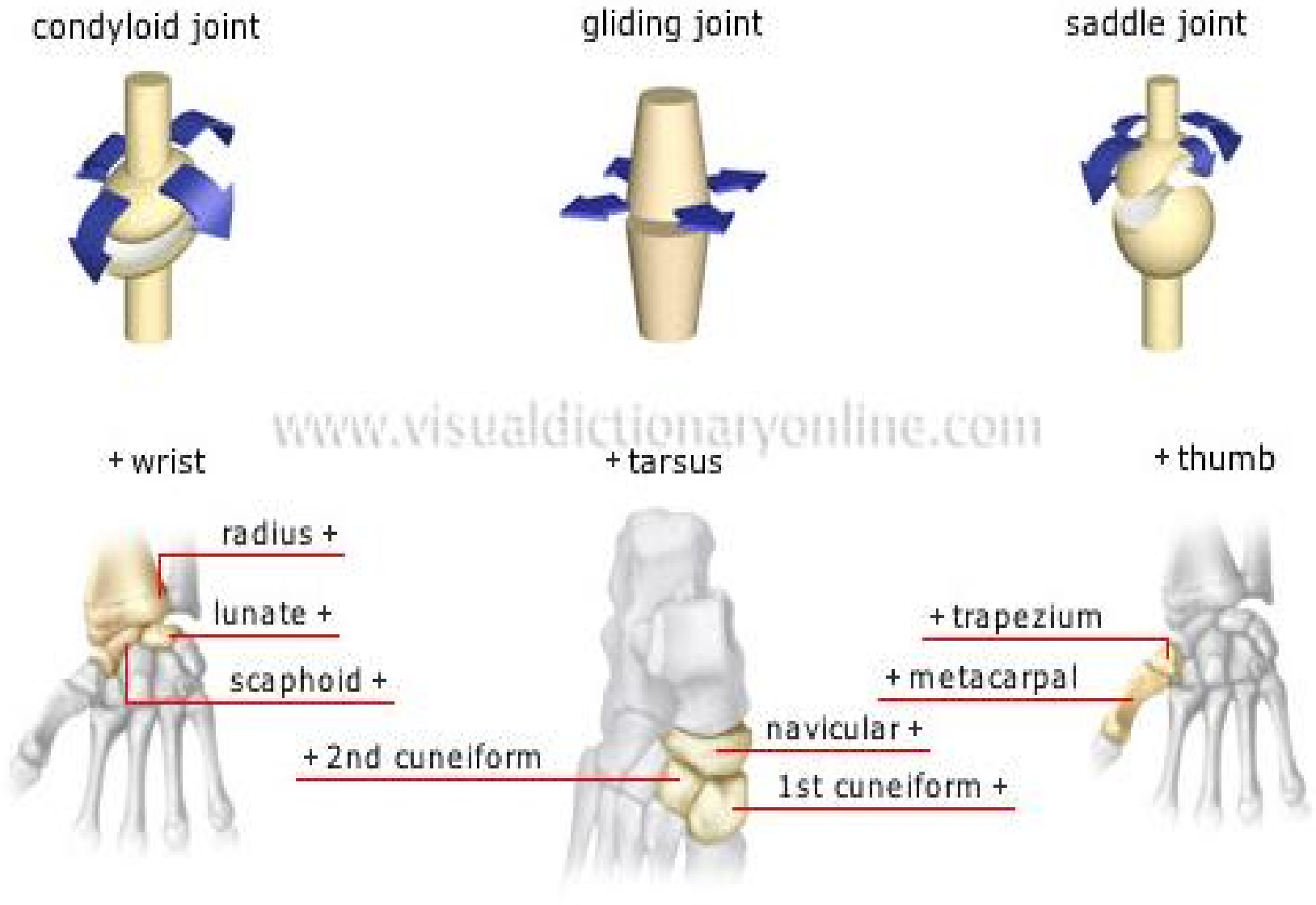

دسته بندی مفاصل از نظر ساختار
لیفی (Fibrous)
Suture Joints ⇐ درز تاجی و یا سهمی
Syndesmosis Joints ⇐ اولناورادیوس یا مفصل غرابی ترقوه ای
Gomphosis Joints ⇐ ریشه دندان ها
غضروفی (Cartilaginous)
Synchondrosis Joints ⇐ صفحه رشدی یا اپی فیزی و یا مفاصل غضروف دنده ای دنده ها و جناغ
Symphysis Joints ⇐ ارتفاق عانه و یا مفصل بین دو جسم مهره
سینوویال (Synovial)
به شش دسته تقسیم می شود

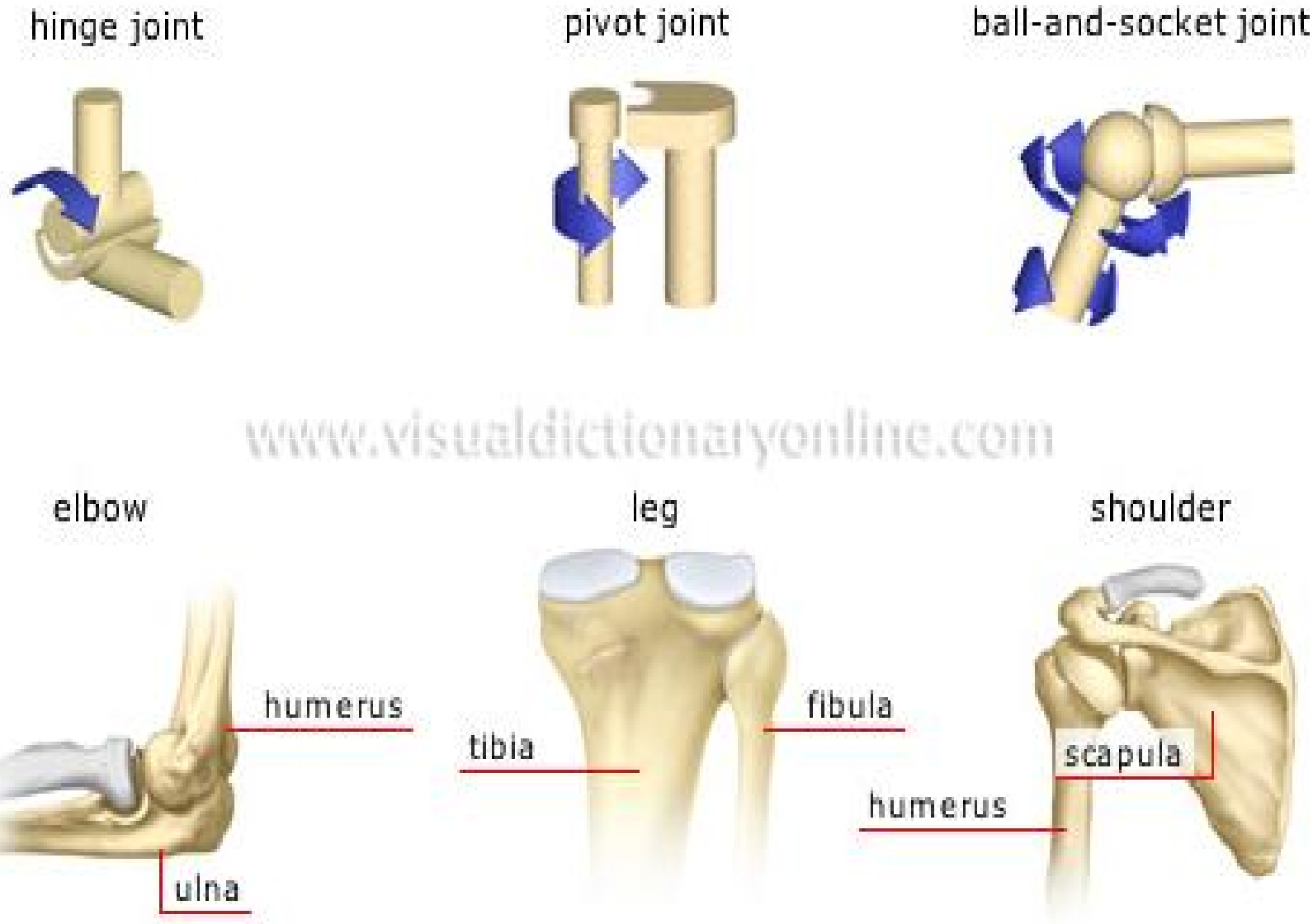

دسته بندی مفاصل از نظر قابلیت حرکتی
مفاصل غیرمتحرک یا ثابت
(Synarthrotic)
Suture Joints
Gomphosis Joints
مفاصل نیمه متحرک
(Amphiarthrotic)
Syndesmosis
Synchondrosis
Symphysis
مفاصل متحرک
(Diarthrotic)
به شش دسته تقسیم می شود

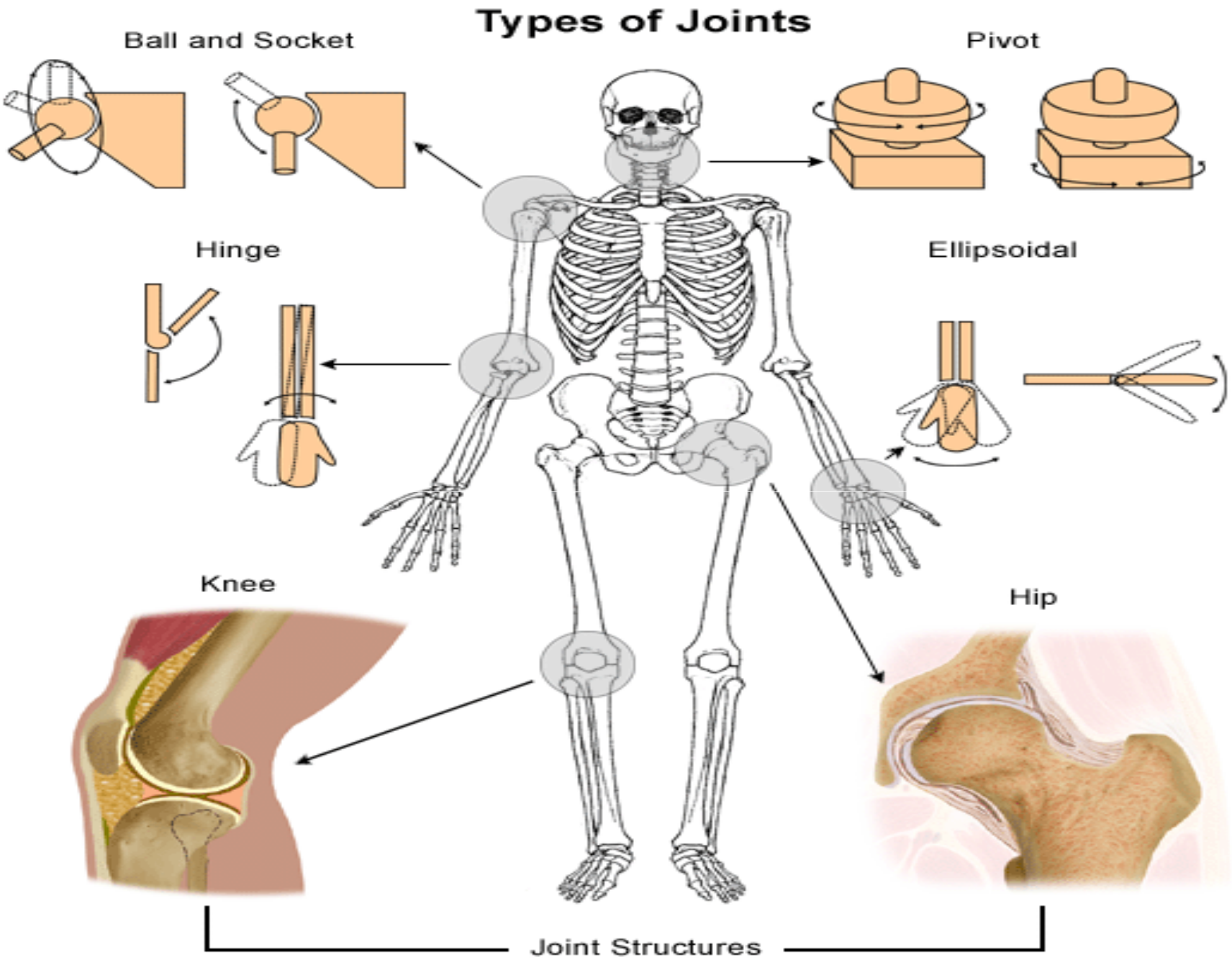
Types of Synovial Joint

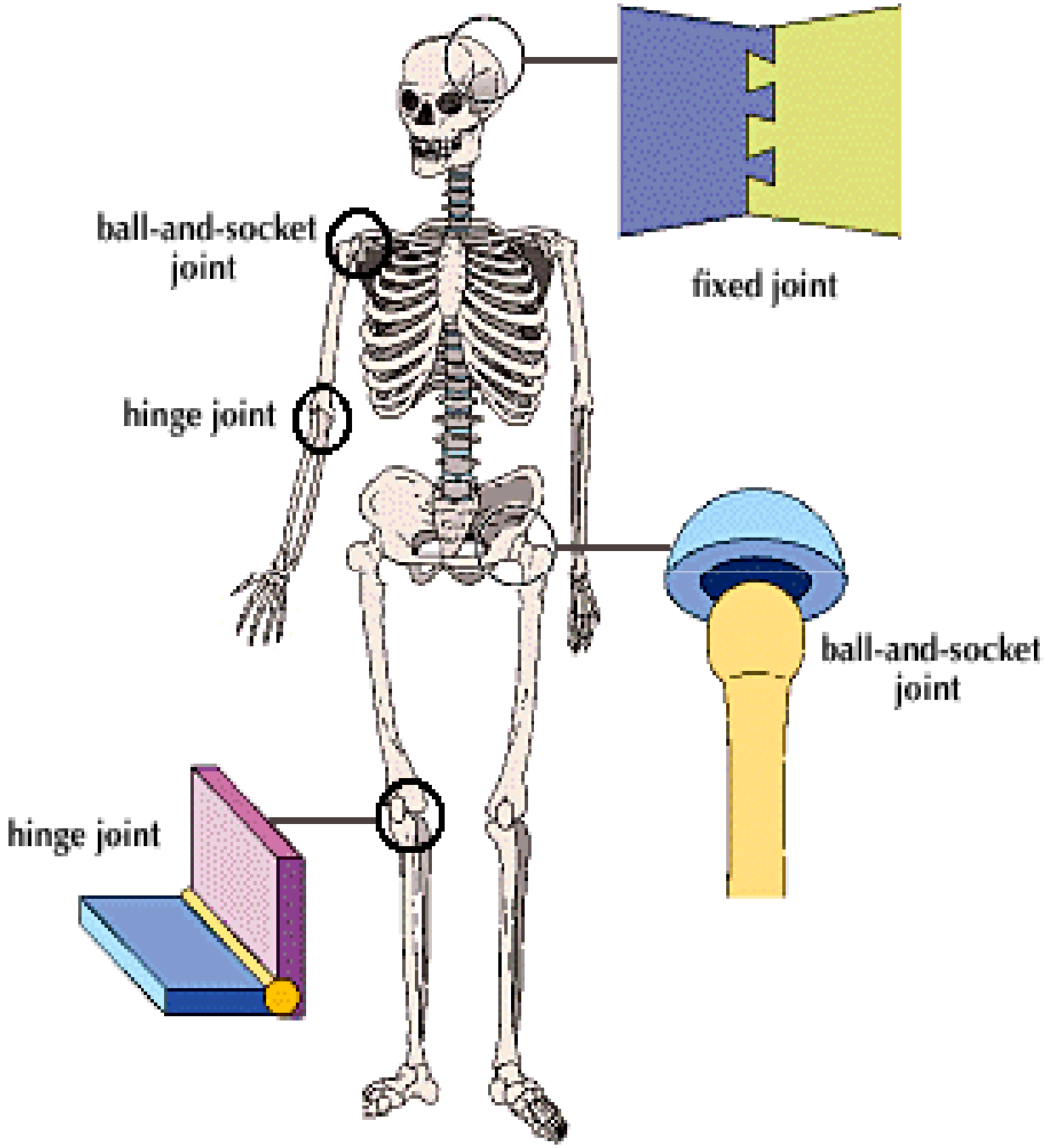
Joint Type	Movement at joint	Examples	Structure
Hinge	Flexion/Extension	 **Elbow/Knee**	 **Hinge joint**
Pivot	Rotation of one bone around another	 **Top of the neck** (atlas and axis bones)	 **Pivot Joint**
Ball and Socket	Flexion/Extension/Adduction/ Abduction/Internal & External Rotation		

Saddle	Flexion/Extension/Adduction/ Abduction/Circumduction	 **CMC joint of the thumb**	 **Saddle joint**
Condyloid	Flexion/Extension/Adduction/ Abduction/Circumduction	 **Wrist/MCP & MTP joints**	 **Condyloid joint**
Gliding	Gliding movements	 **Intercarpal joints**	 **Gliding joint**


condyloid joint
gliding joint
saddle joint
www.visualdictionaryonline.com
+ wrist
+ tarsus
+ thumb
radius +
lunate +
scaphoid +
+ 2nd cuneiform
navicular +
1st cuneiform +
+ trapezium
+ metacarpal


hinge joint
pivot joint
ball-and-socket joint
www.visualdictionaryonline.com
elbow
humerus
ulna
leg
tibia
fibula
shoulder
scapula
humerus


Types of Joints
Ball and Socket
Pivot
Hinge
Ellipsoidal
Knee
Hip
Joint Structures


ball-and-socket joint
fixed joint
hinge joint
ball-and-socket joint
hinge joint

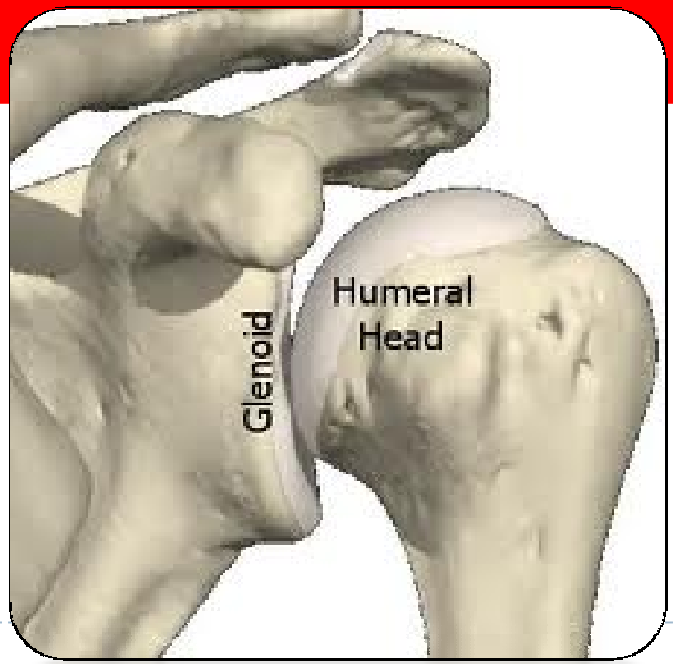
عوامل محدودکننده حرکات در مفاصل

۱)لیگامنتهای اطراف مفصل

۲)برخوردهای استخوانی

۳)حجم عضلات

SHOULDER COMPLEX

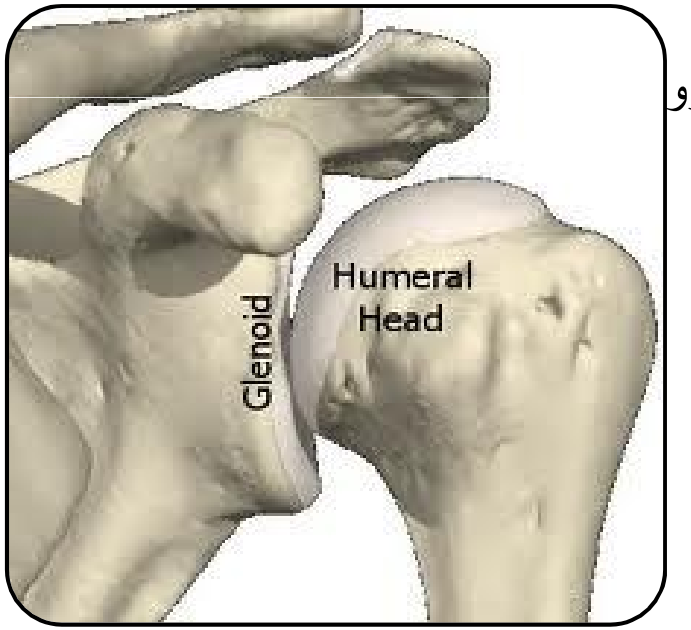


مقدمه

- شانه یا مفصل پروگزیمال اندام فوقانی ، متحرك ترین مفصل بدن انسان می باشد این مفصل می تواند آزادنه در سه جهت حرکت کند بنابراین اندام فوقانی را می توان در سه صفحه فضایی و حول سه محور اصلی به حرکت در آورده کمربند شانه شامل دو استخوان **کتف** و **تر قوه** می باشد. از طرف دیگر استخوان **بازو** از انتهای نزدیک به تنه (پروکزیمال) خود با استخوان کتف متصل شده و در ساختمان ناحیه شانه شرکت می کند.این مفصل داراي سه درجه آزادي است وقادر به حرکت حول هرسه محور مي باشد.
- حرکات شانه تنها در مفصل شانه انجام نمي شود بلکه در مجموعه اي از مفاصل که **کمپلکس چند مفصلی شانه** نامیده میشود صورت میگیرد.

دلایل تحرک زیاد در مفصل شانه

- وجود فاصله بین تنه استخوان بازو و تنه . به علت وجود سر و گردن استخوان کتف که به طرف خارج می باشد و از طرفی نیز سر و گردن استخوان بازو ، که زاویه حدود ۱۳۵ تا ۱۵۰ درجه با تنه استخوان داشته و به طرف داخل است، فاصله ای بین دو استخوان وجود دارد.
- شل و ضعیف بودن کپسول مفصلی
- کوچک بودن سطح مفصلی کتف نسبت به سطح مفصلی بازو



Bones

:It is made up of three bones

1-Clavicle(collarbone)

2-Scapula(shoulder blade)

٣-Humerus

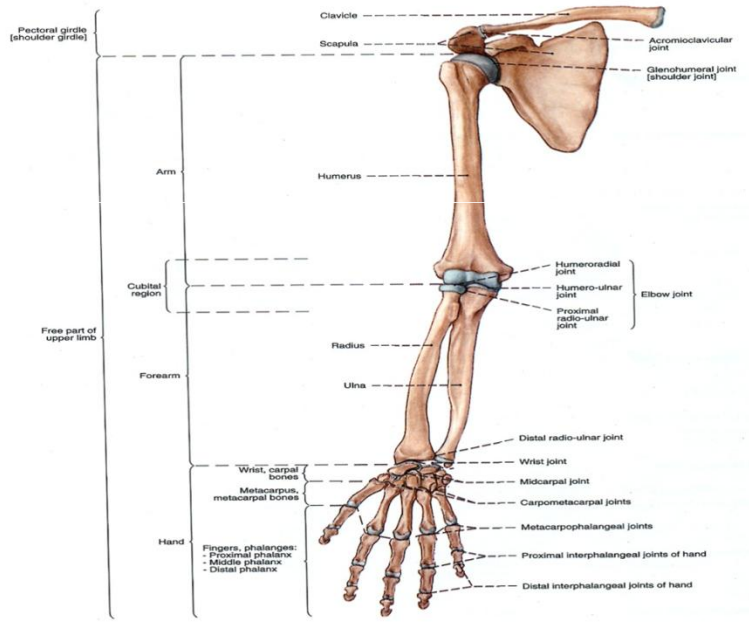
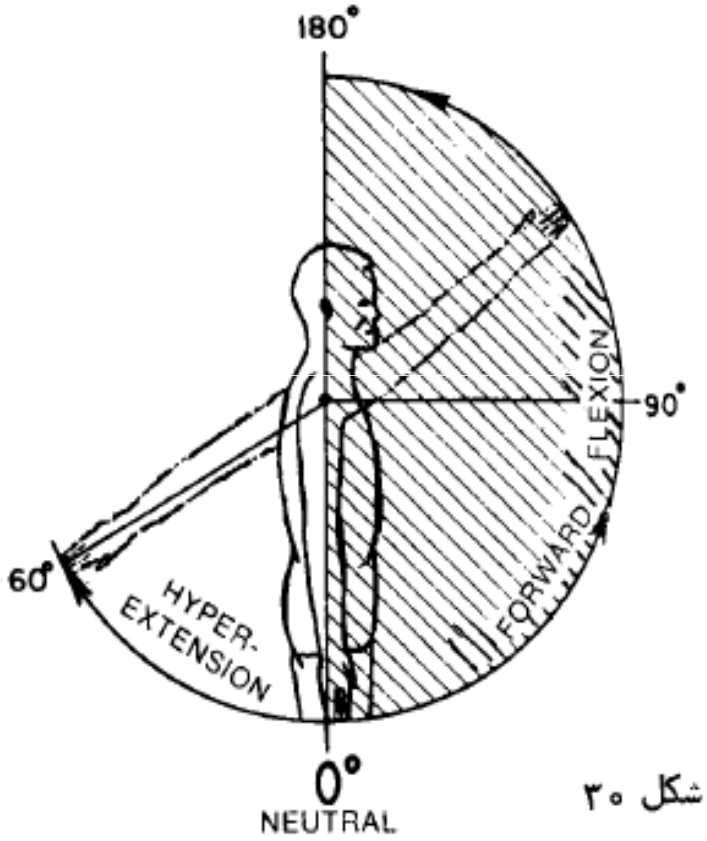


Fig. 289 Upper limb; bones and joints; right anterior aspect (25%).

حرکات مفصل شانه

فلکشن و اکستنشن



شکل ۳۰

❖ عضلات اصلی در فلکشن :

۱) دلتوئید قدامی

۲) سینه ای بزرگ (بخش ترقوه ای)

۳) دوسربازویی (سرکوتاه)

۴) غرابی – بازویی

❖ عضلات اصلی در اکستنشن :

۱. پشتی بزرگ
۲. گرد بزرگ
۳. سینه ای بزرگ (بخش جناغی)
۴. دلتوئید خلفی
۵. تحت خاری
۶. گرد کوچک
۷. سر دراز عضله سه سر

حرکات مفصل شانه

آبداکشن و اداکشن

❖ عضلات اصلی در ابداکشن :

۱) دلتوئید

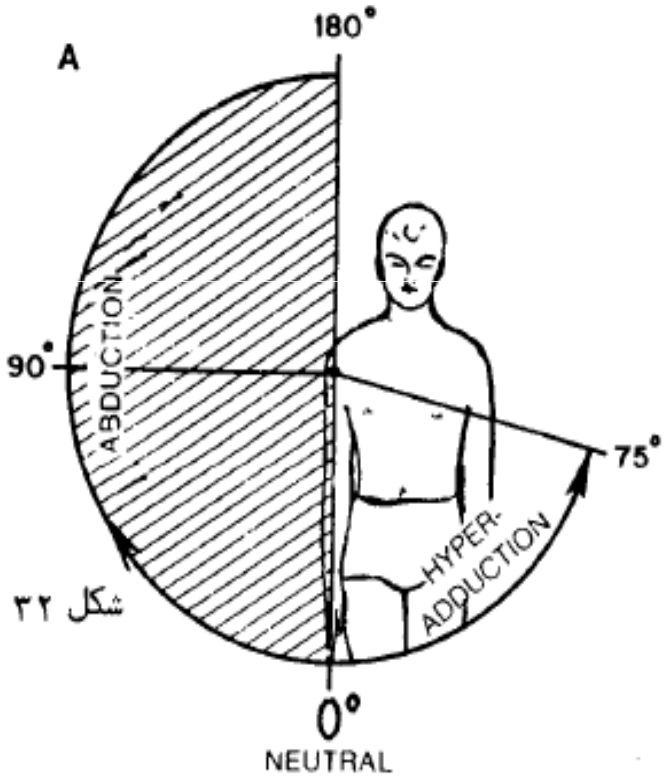
۲) فوق خاری

۳) دوسربازویی (سردراز)

۴) عضله سینه ای (در بالاتر از سطح افق)

❖ عضلات اصلی در اداکشن:

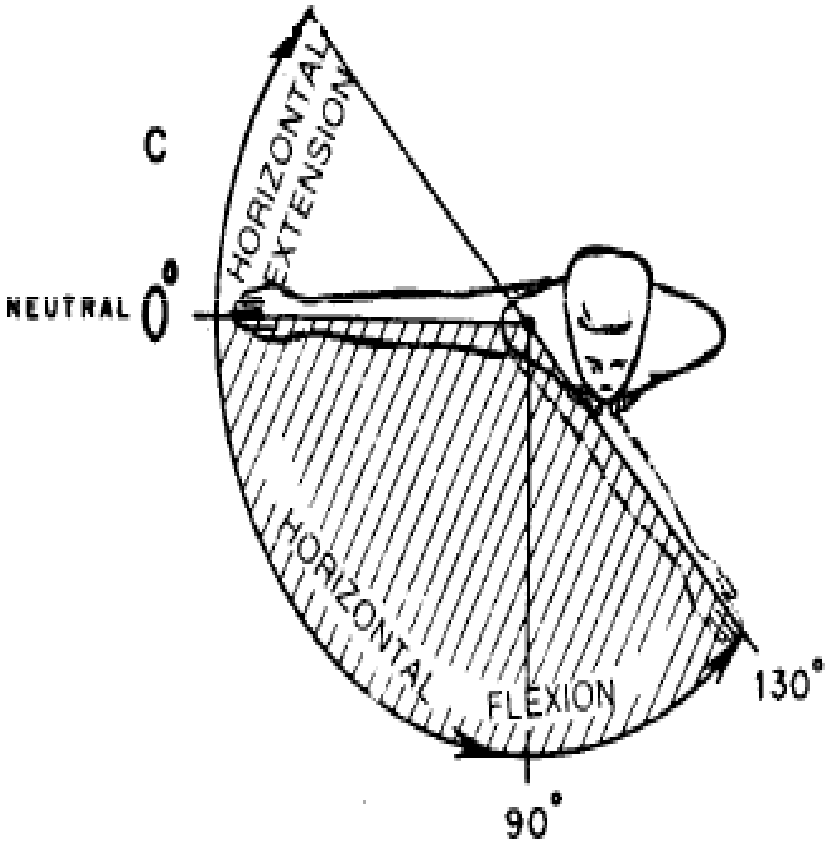
۱. پشتی بزرگ
۲. گرد بزرگ
۳. سینه ای بزرگ
۴. تحت کتفی
۵. سه سر بازویی
۶. غرابی بازویی

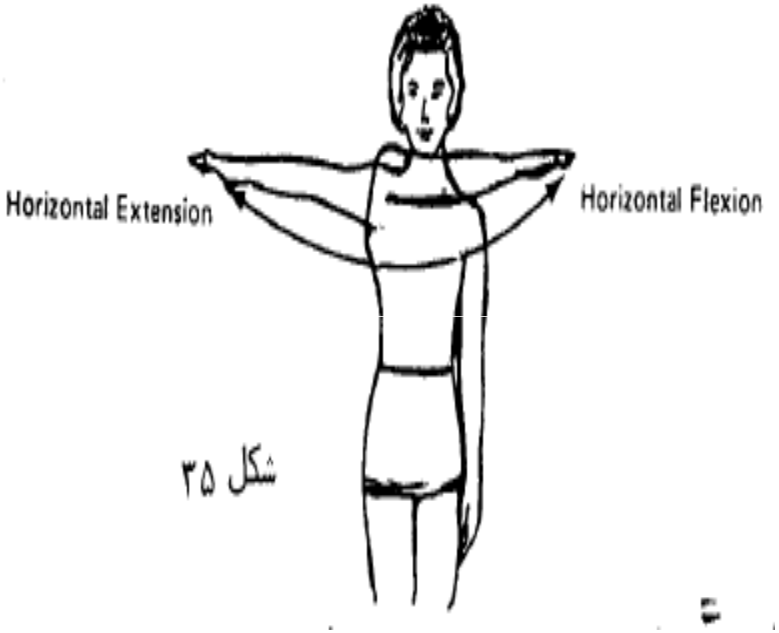


شکل ۳۲

حرکات مفصل شانه

فلکشن و اکستنشن افقی





شکل ۳۵

حرکات مفصل شانه

❖ عضلات اصلی در چرخش داخلی :

۱) دلتوئید قدامی

۲) گرد بزرگ

۳) پشتی بزرگ

۴) سینه ای بزرگ

۵) دوسربازوئی (سرکوتاه)

۶) تحت کتفی

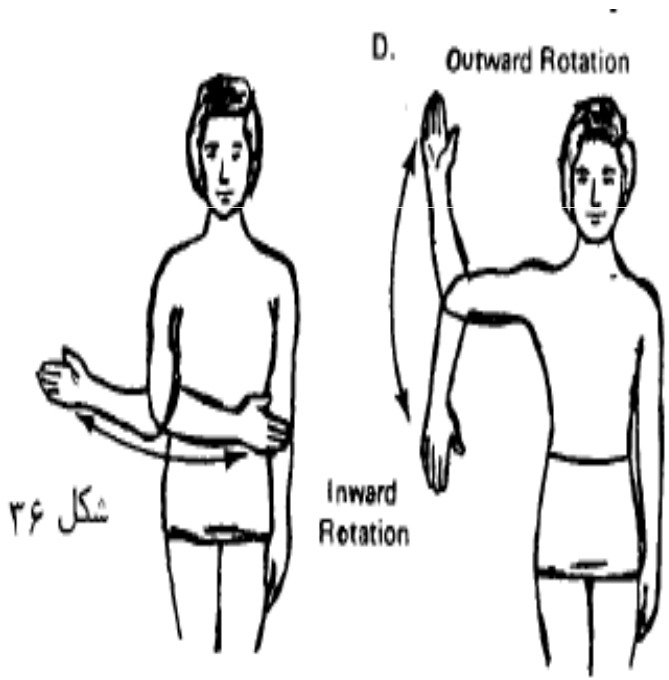
❖ عضلات اصلی در چرخش خارجی :

۱) تحت خاری

۲) گرد کوچک

۳) بخش خلفی دلتوئید

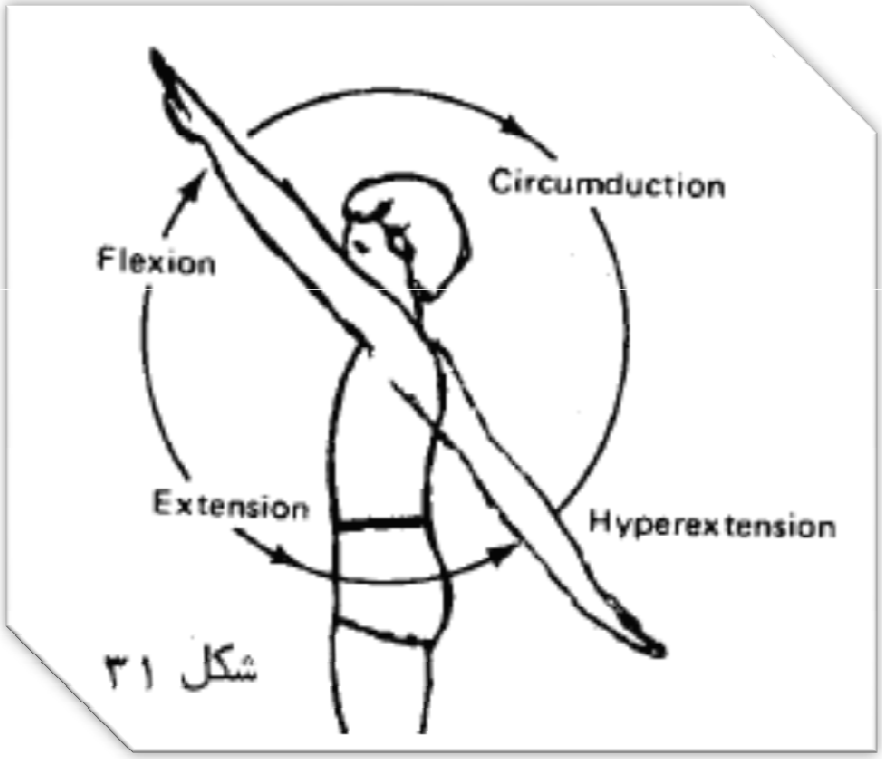
چرخش داخلی و چرخش خارجی



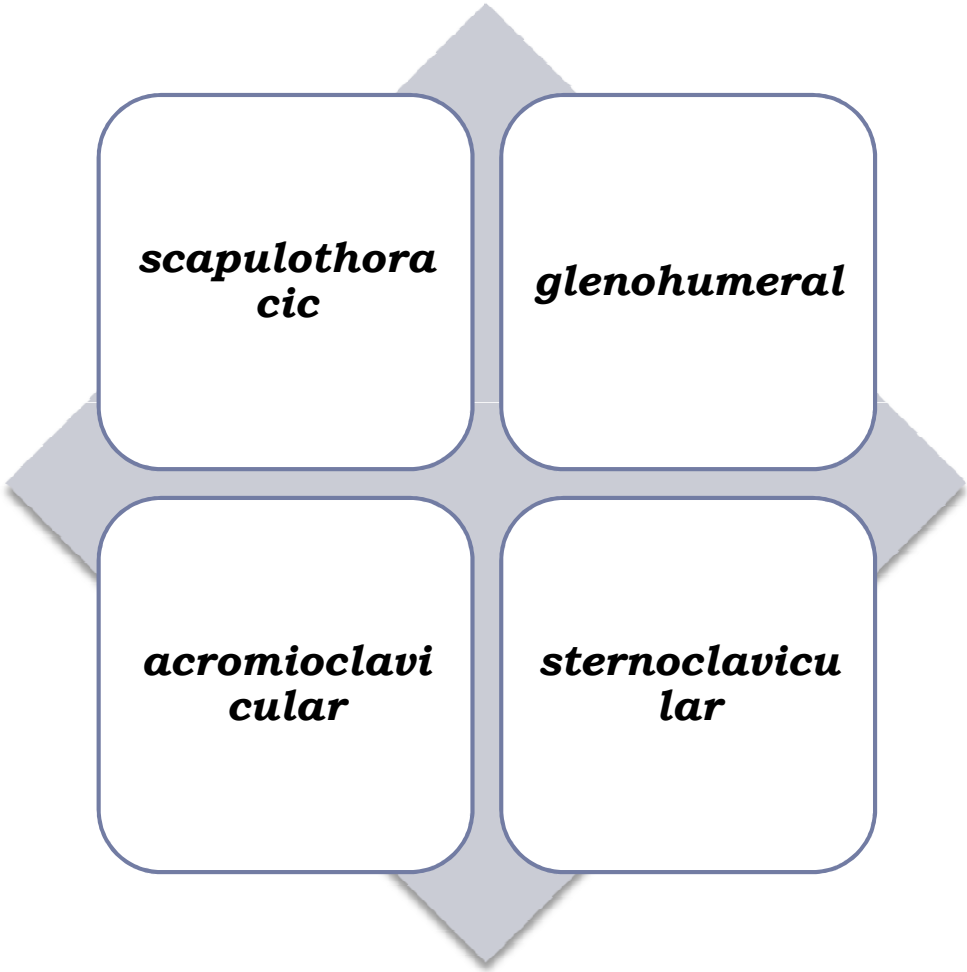
شکل ۳۶

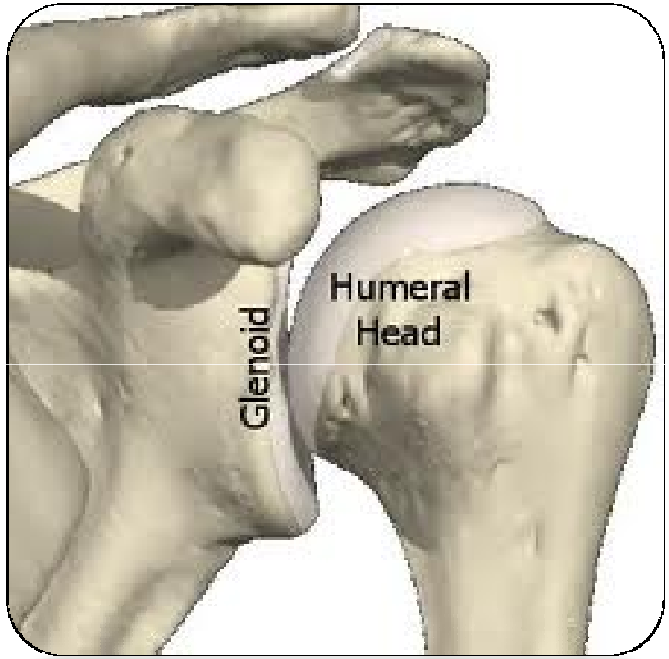
حرکات مفصل شانه

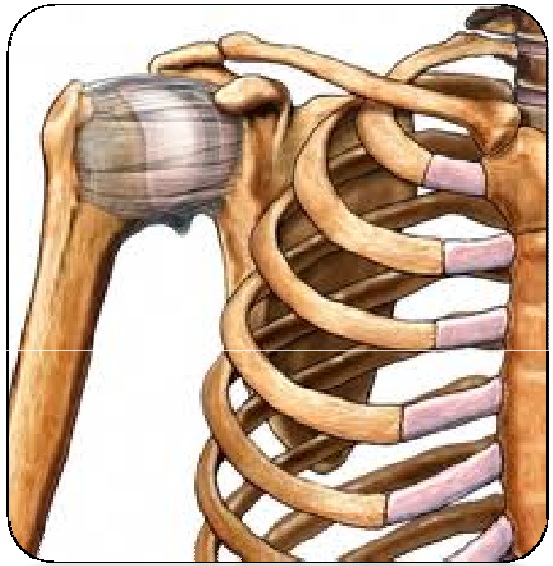
حرکت دورانی (سیرکامداکشن)



Joints

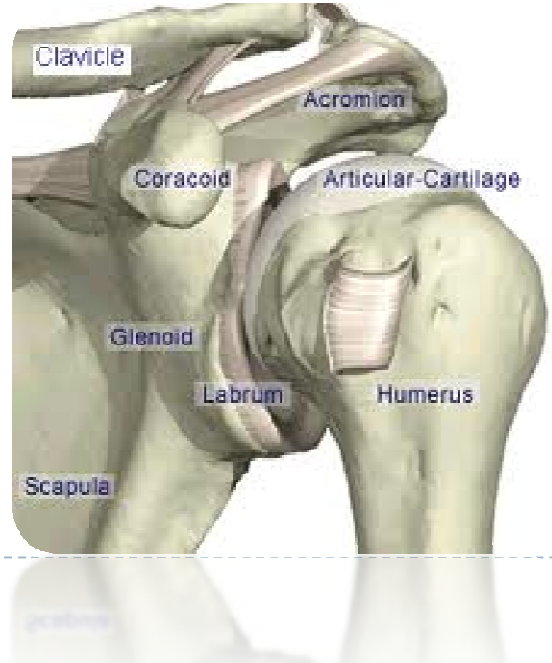

scapulothoracic
glenohumeral
acromioclavicular
sternoclavicular


Glenoid
Humeral
Head

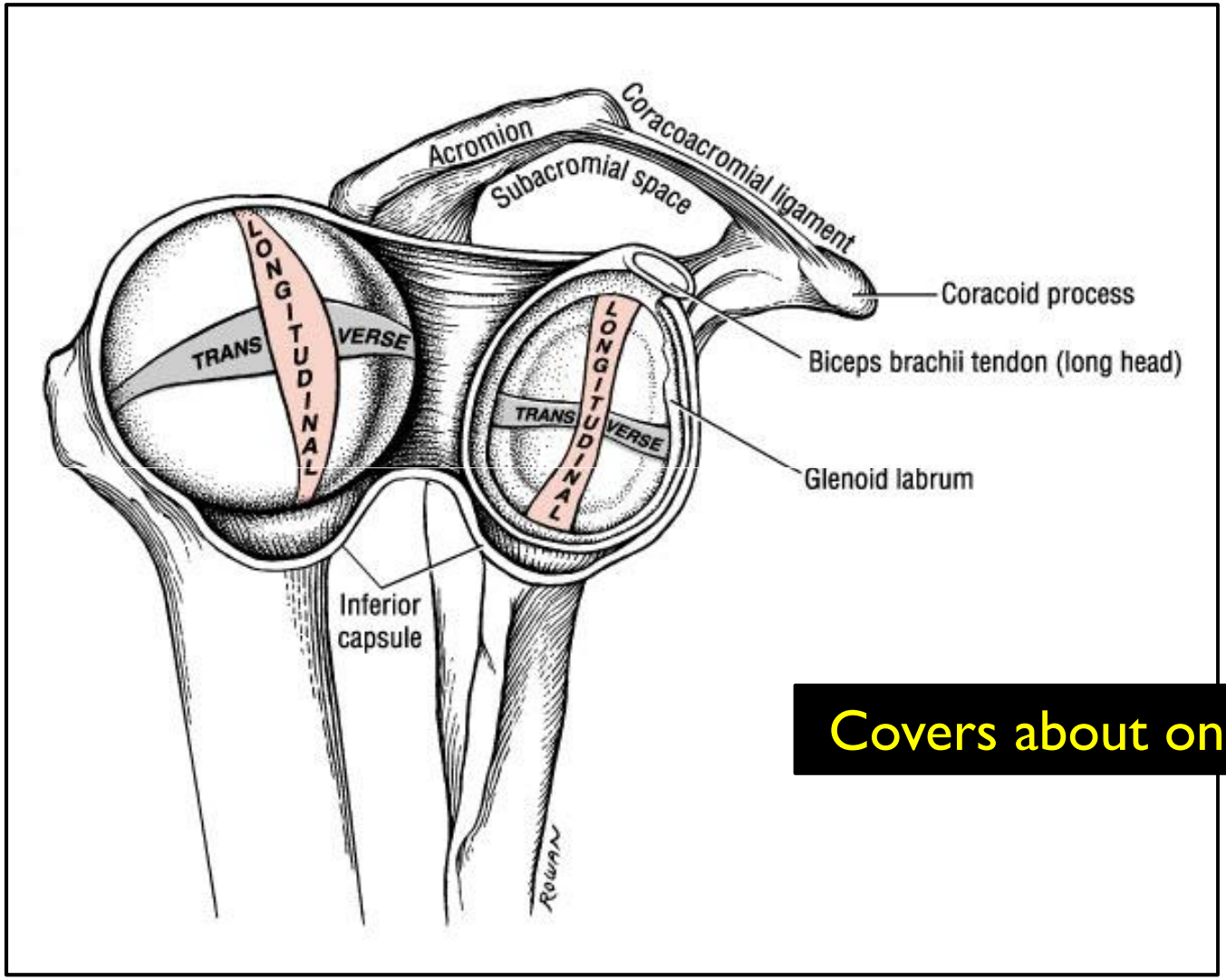


Glenohumeral Joint(GH)

- The major joint of the shoulder is the Glenohumeral joint,which "shoulder joint"generally refers to.
- The humerus attached to the scupula,the head sitting in the Glenoeid fossa.



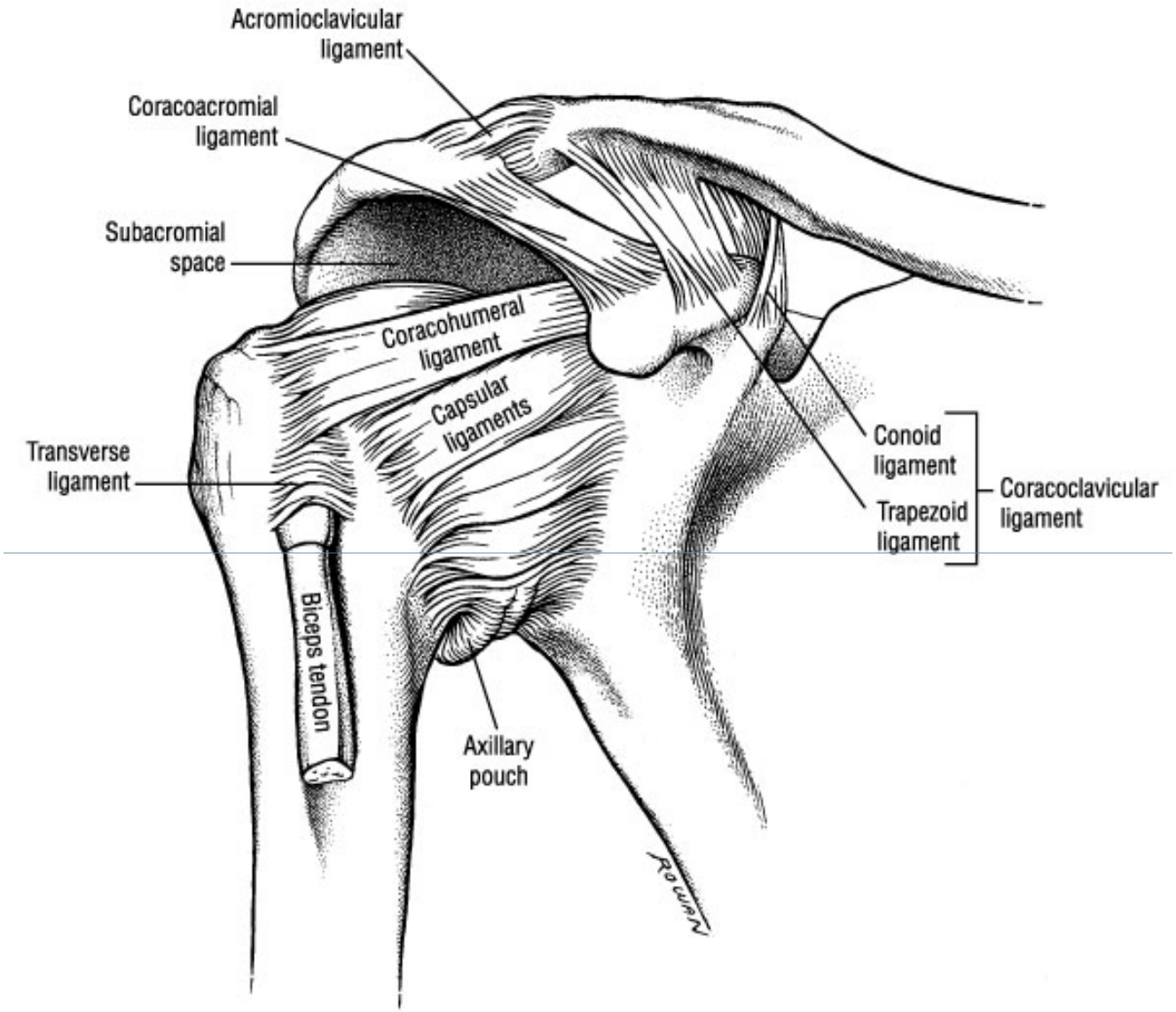
Loose-fit of the GH joint



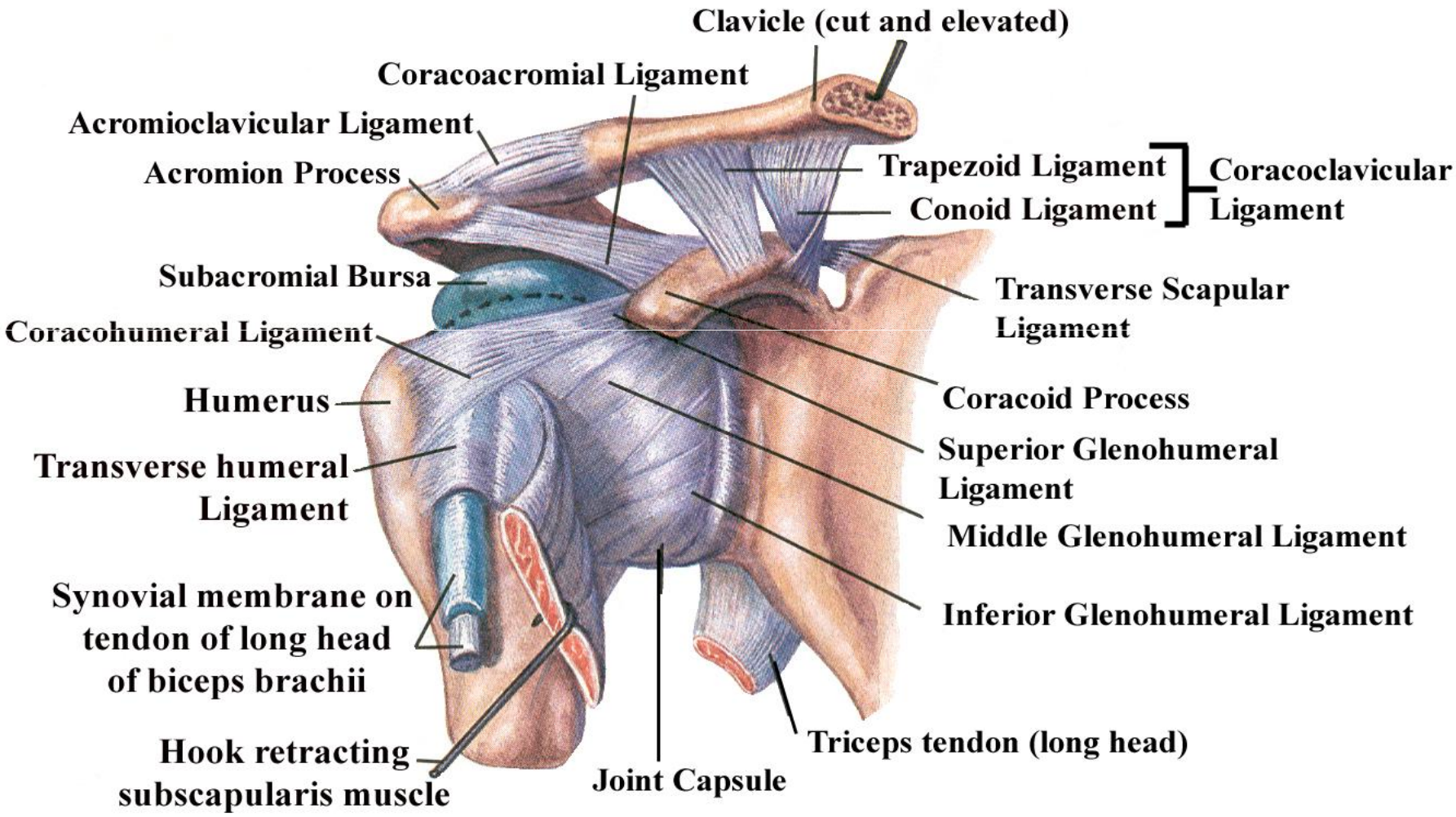
Covers about one third

GH stability

- ***Rotator Cuff*** – 4 muscles that blend into the joint capsule, providing stability and allowing for movement
- ***Capsular Ligaments*** – ligaments that blend into the joint capsule, reinforcing the capsule and providing stability
  - ***Glenoid Labrum*** – fibrous cartilage extension of glenoid, deepens the glenoid fossa
- ***Long Head of Biceps*** – attaches to supraglenoid tuberosity
- ***Coracohumeral ligaments*** – thickening of the joint capsule


Acromioclavicular ligament
Coracoacromial ligament
Subacromial space
Coracohumeral ligament
Capsular ligaments
Transverse ligament
Conoid ligament
Trapezoid ligament
Coracoclavicular ligament
Biceps tendon
Axillary pouch

Shoulder (Anterior View)

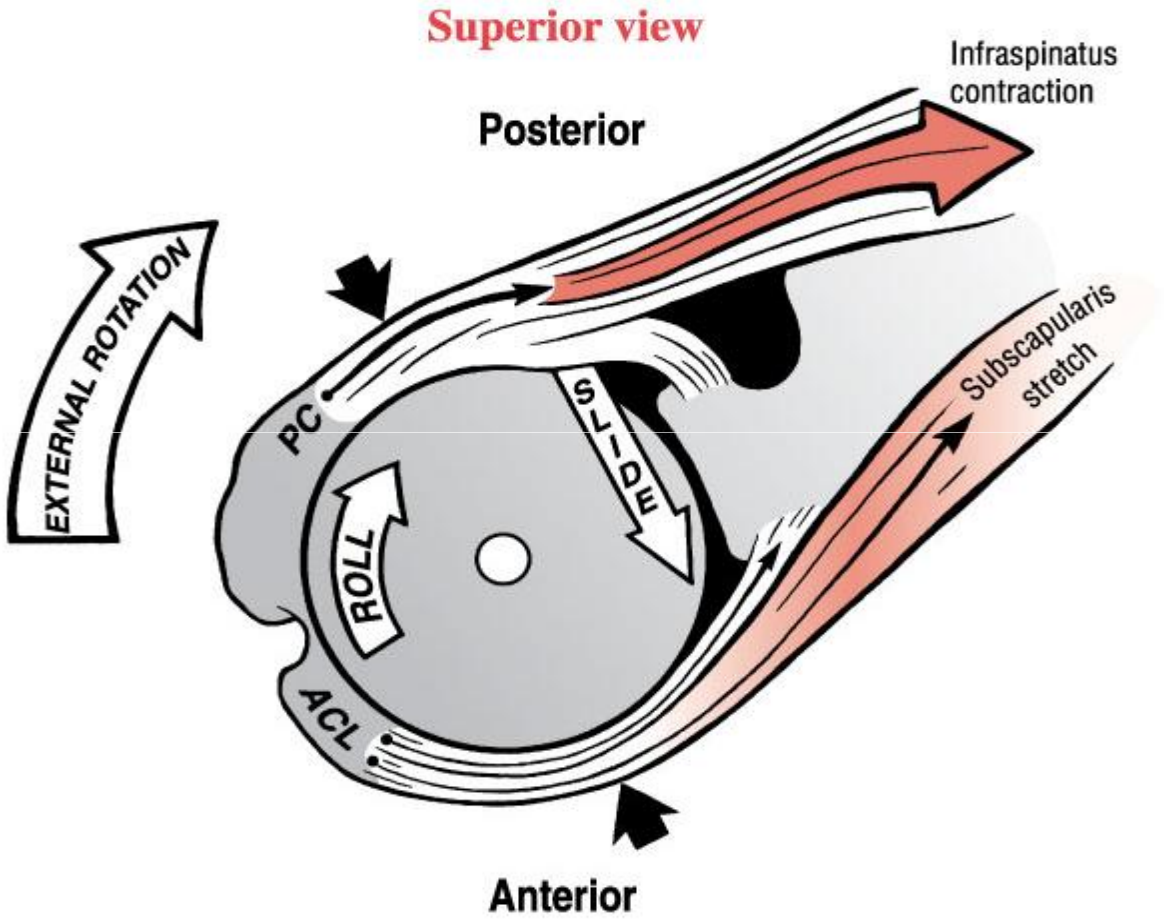


Rotator Cuff

- The rotator cuff is an anatomical term given to the group of muscles and their tendons that act to stabilize the shoulder.

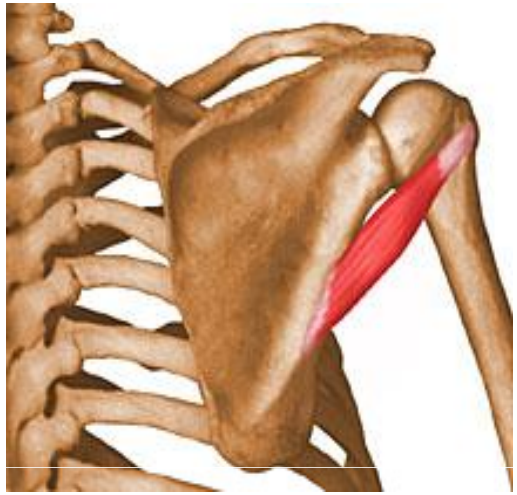
- Composed of the tendons and muscles (SITS)that hold the head of the humerus (*ball*) in the glenoid fossa (*socket*).

Rotator Cuff



Rotator Cuff

- "SITS" muscles
  - Supraspinatus
  - Infraspinatus
  - Teres Minor
  - Subscapularis



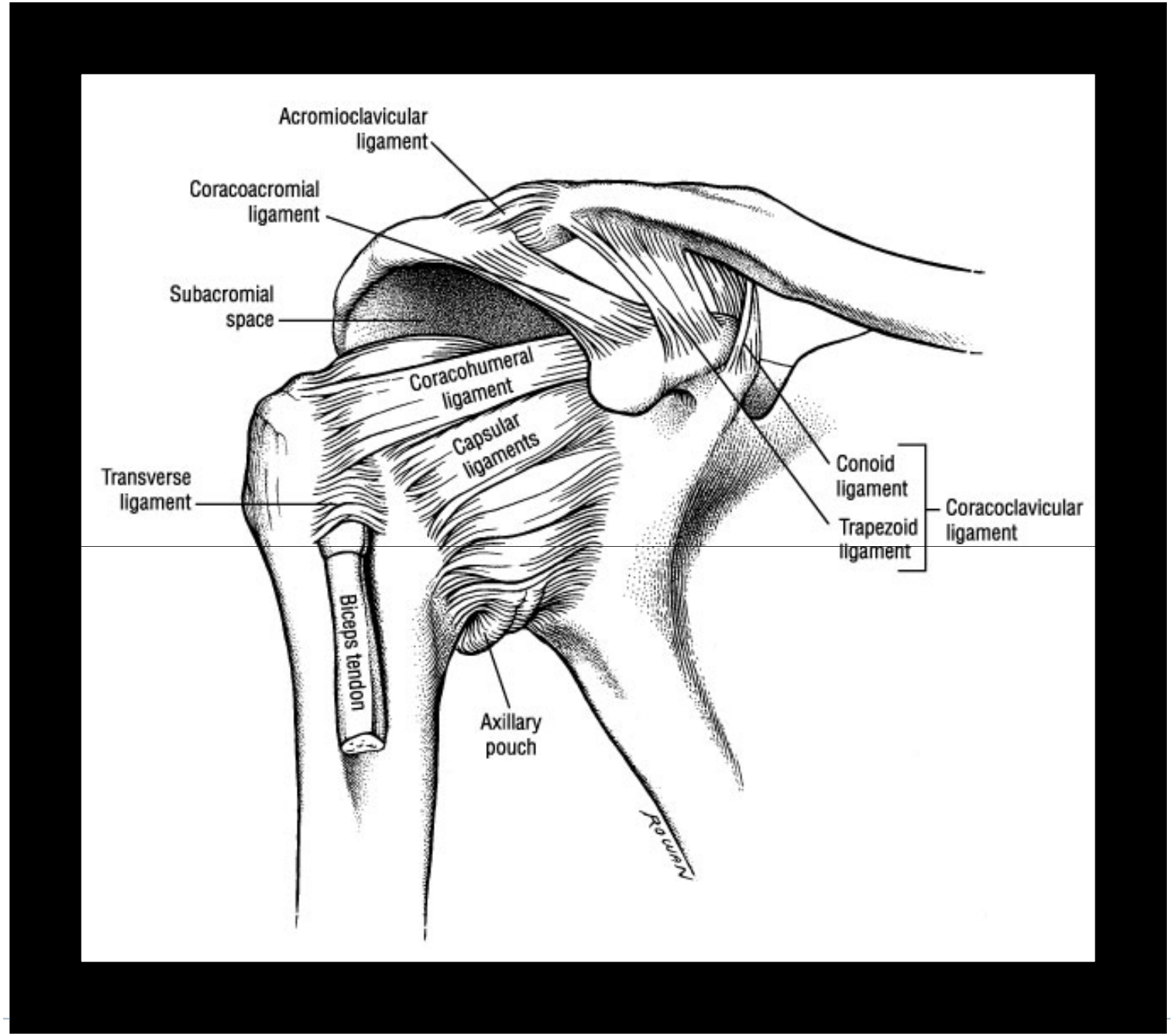
Static and Dynamic stability

- ✓ **Static Stability**

- ✓ superior capsular structure
- ✓ resting humeral head on upward sloping glenoid fossa
- ✓ Negative atmospheric pressure within the capsule.

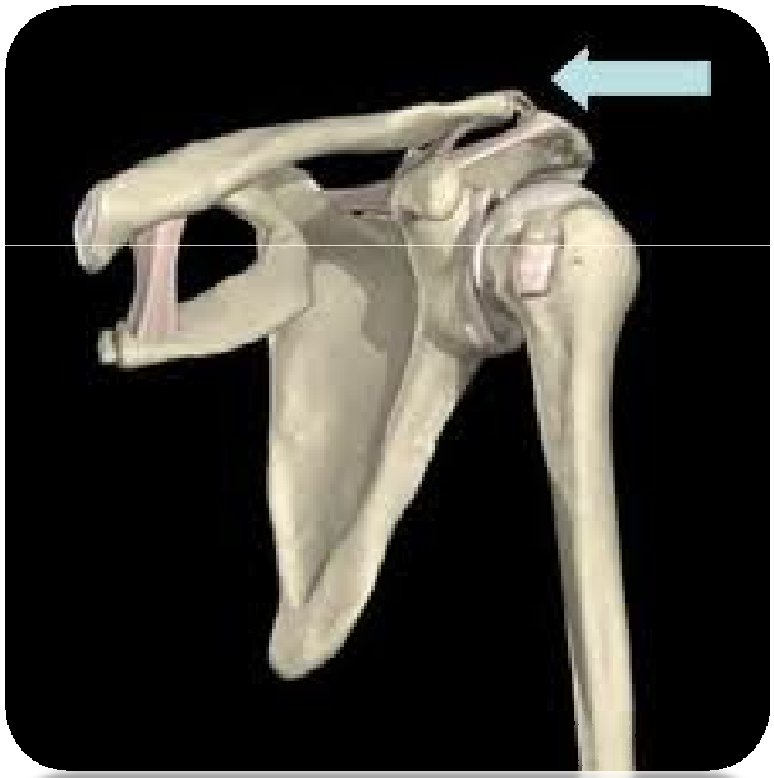
- **Dynamic Stability**

- ✓ rotator cuff muscles


Acromioclavicular ligament
Coracoacromial ligament
Subacromial space
Coracohumeral ligament
Capsular ligaments
Transverse ligament
Conoid ligament
Trapezoid ligament
Coracoclavicular ligament
Biceps tendon
Axillary pouch

Acromioclavicular Joint

- arthrodial (gliding) joint
- Acromion process&Clavicle



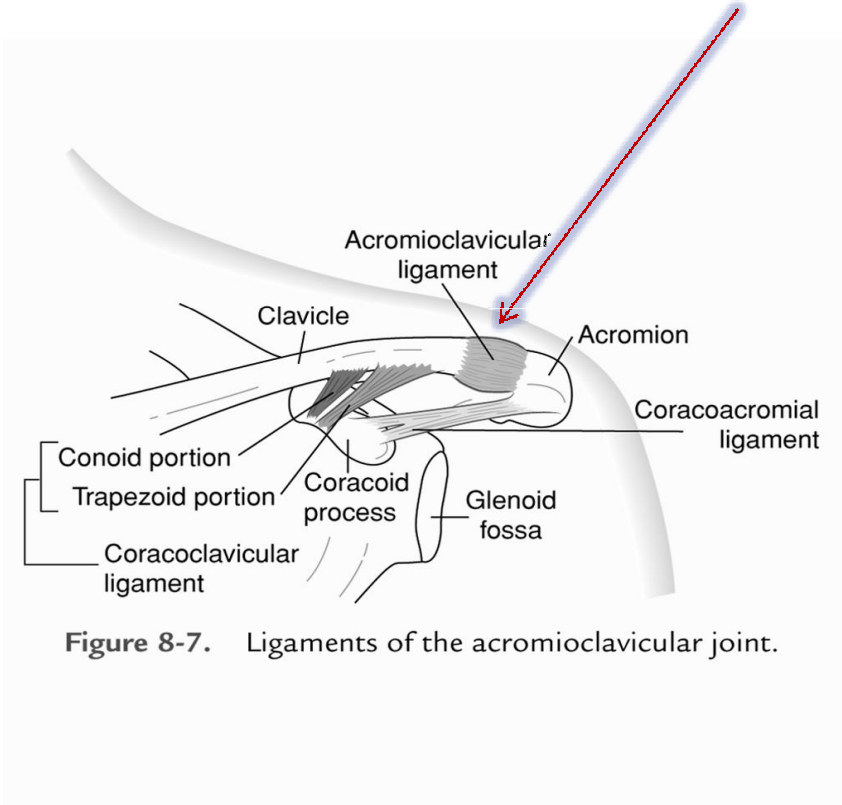
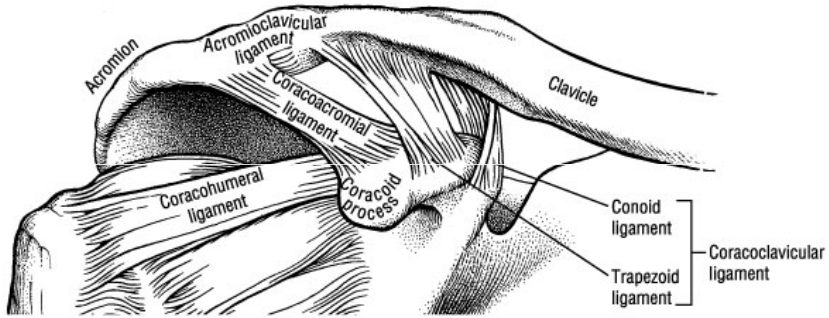


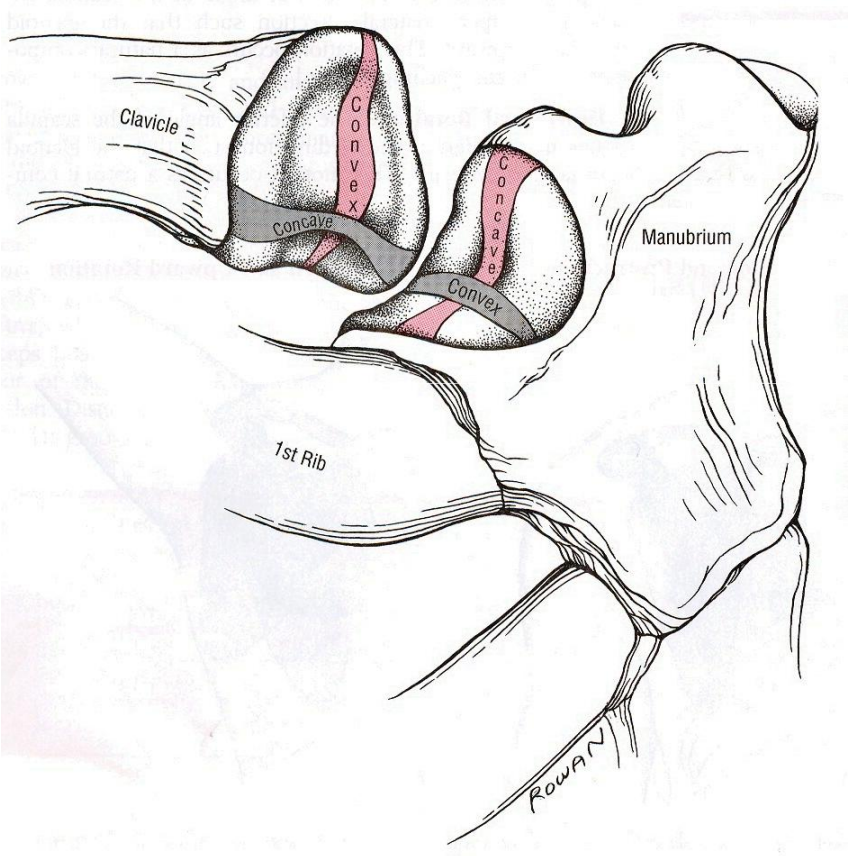
Figure 8-7. Ligaments of the acromioclavicular joint.

AC joint stability



- Suprerior and inferior AC joint capsular ligaments
- Deltoid and upper trapezius
- Coracoclavicular ligament
- Articular disc

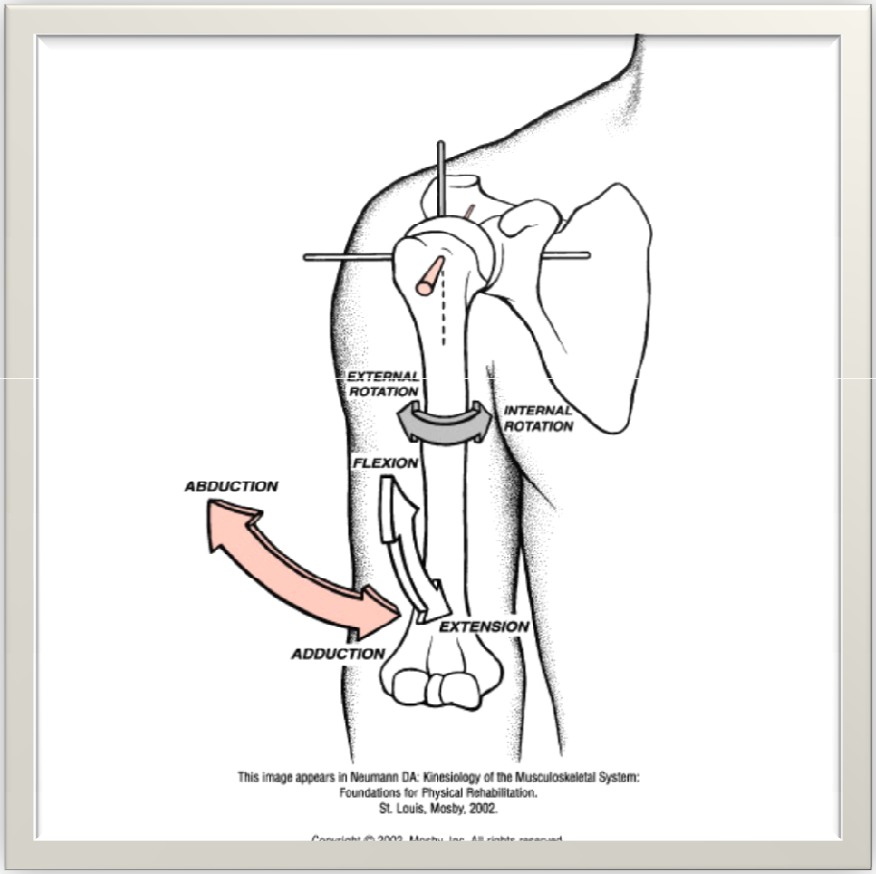
Sternoclavicular Joint



- a complex saddle-shaped articular surface .
- linking the axial skeleton with the appendicular skeleton.
- the medial end of the clavicle is usually convex along its longitudinal diameter and concave along its transverse diameter.
- Sternum is slightly concave longitudinal and convex transversal in their facet.


MOVEMENT

GH Kinematics



- Flexion/Extension
- Abduction/Adduction
- Internal/External Rotations

Table 7-1 Average Shoulder Range of Motion in Normal Subjects (Degrees)

Author	Boone and Azen (1979)		Murray et al (1985)		Brown et al (1988)	Chang, Buschbacher, and Edlich (1988)	
Subjects	109 M		20 M 20 F		41 M*	10 M 10 M†	
Age (yrs)	2-19	19-54	25-66		27 ± 4.2	21-35	
Flexion	168	165	167	171	163	171	157
Abduction	185	183	178	179	168	—	—
Extension	67	57	56	59	76	55	42
External rotation	108	100	88	97	136	82	78
Internal rotation	71	67	54‡	54‡	84	83	56
Glenohumeral abduction	—	—	122	126	99	—	—

NOTE: Notice the tendency for more flexibility in the younger males (Boone and Azen) and in the females versus the males (Murray et al), the decreased flexibility of the power lifters versus normal controls (Chang, Buschbacher, and Edlich), and the marked amount of external rotation in the baseball players (Brown et al).

*Major league baseball players.

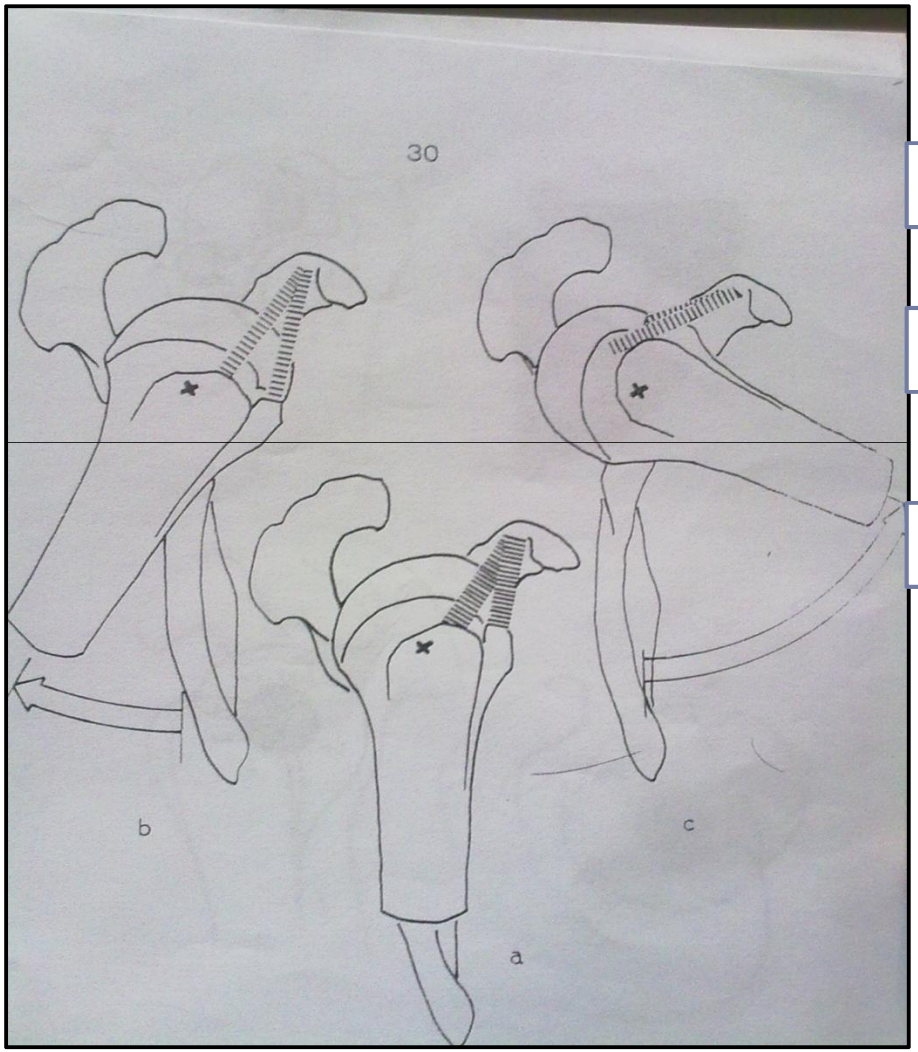
†Power lifters.

‡The goniometric positions were described as standard, except that the scapula was stabilized.

Shoulder range of motion

motion	ROM(degree)
Flexion(glenohumeral&scapula)	0-180
Flexion(glenohumeral)	0-120
Extension	0-60
Abduction(glenohumeral&scapula)	0-180
Abduction (glenohumeral)	0-(90-120)
Horizontal abduction	0-45
Horizontal adduction	0-135
Internal rotation	0-70
External rotation	0-90

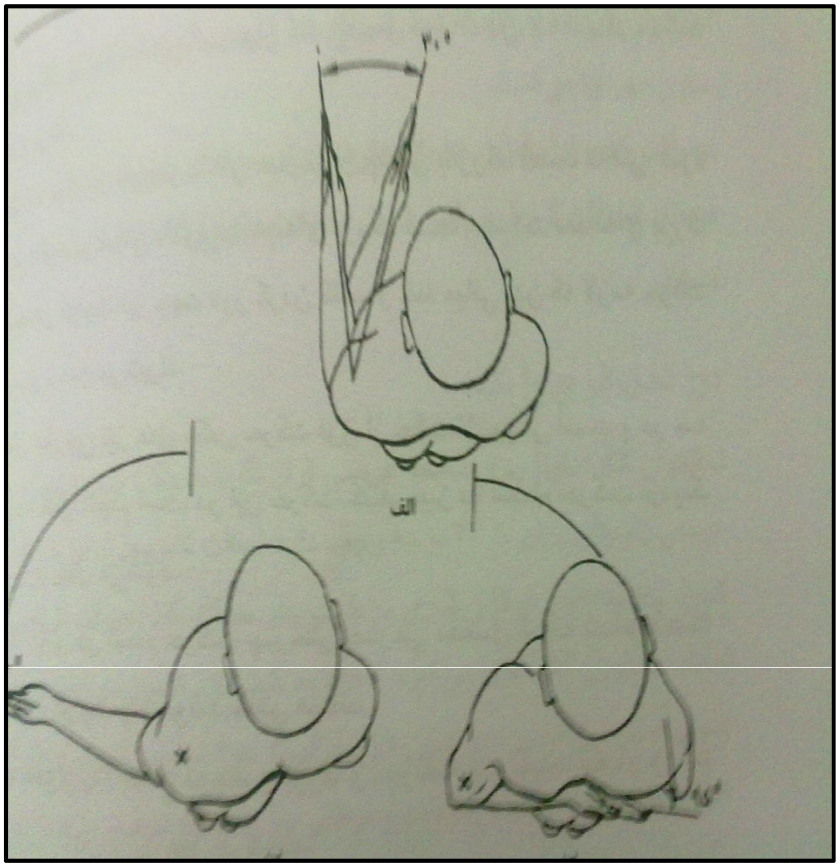
Flexion & extension vs coracohumeral ligaments



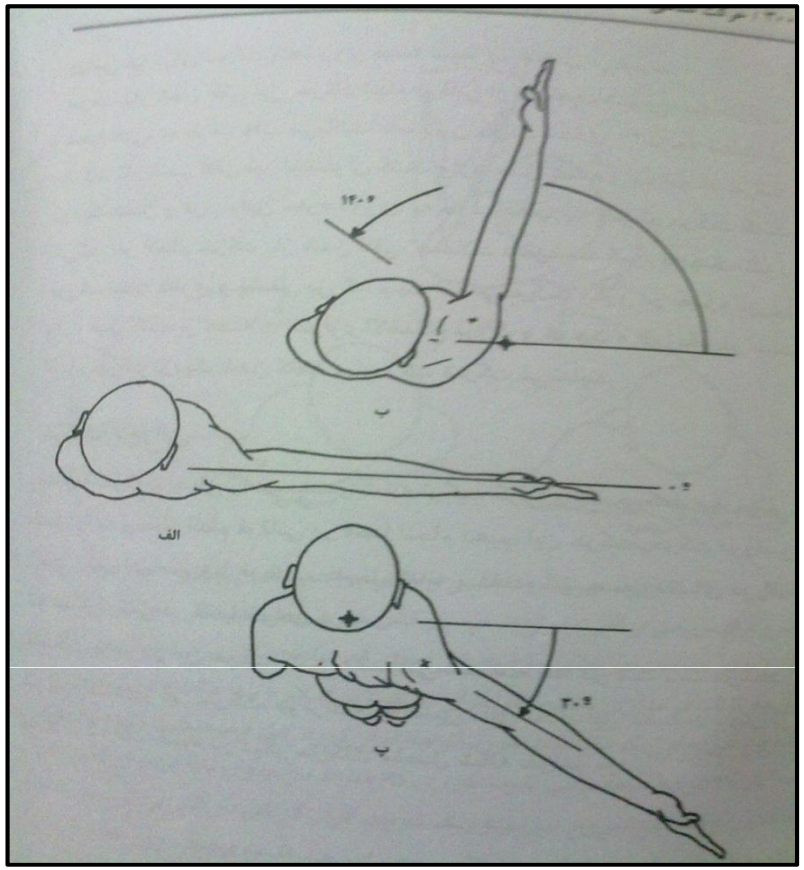
a-resting position

)b-extension(anterior band stretched more

c-flexion(posterior band stretched more)



Axial rotation



Horizontal flex&ext

دور شدن فیزیولوژیک

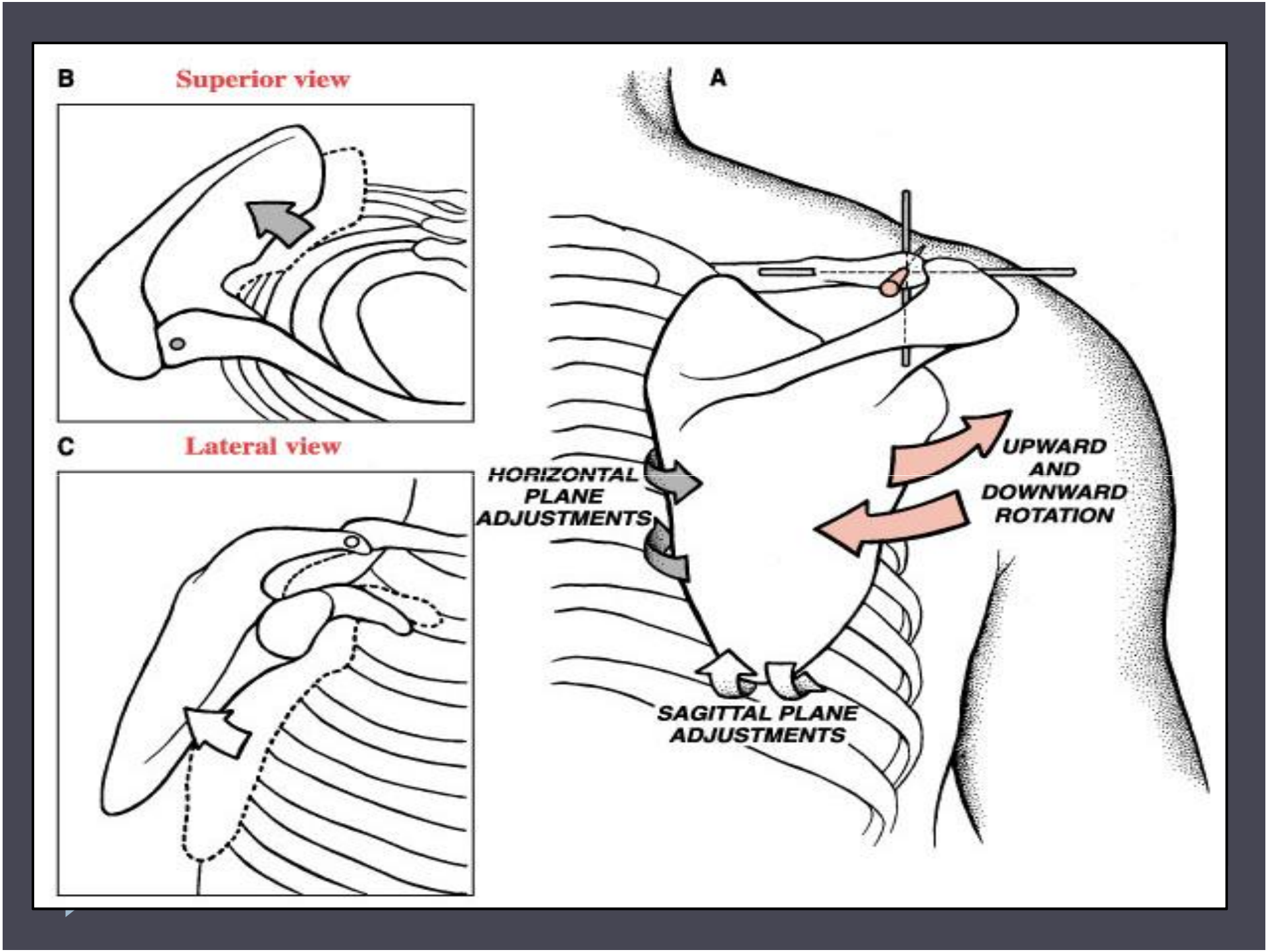
- استخوان کتف دقیقا روی صفحه عرضی قرار نگرفته ، بلکه بین آن و صفحه عرضی زاویه ای برابر با ۳۰ درجه وجود دارد. در حرکت دور شدن چنانچه اندام فوقانی قدری به طرف جلو حرکت کند (حرکت تا شدن) در امتداد استخوان کتف قرار می گیرد. انجام حرکت دور شدن در این وضعیت بسیار آسان تر است و دور شدن فیزیولوژیک خوانده می شود.

positions Closed-packed

- GH joint :abduction &external rotation,where the capsular structures are twisted tightly.

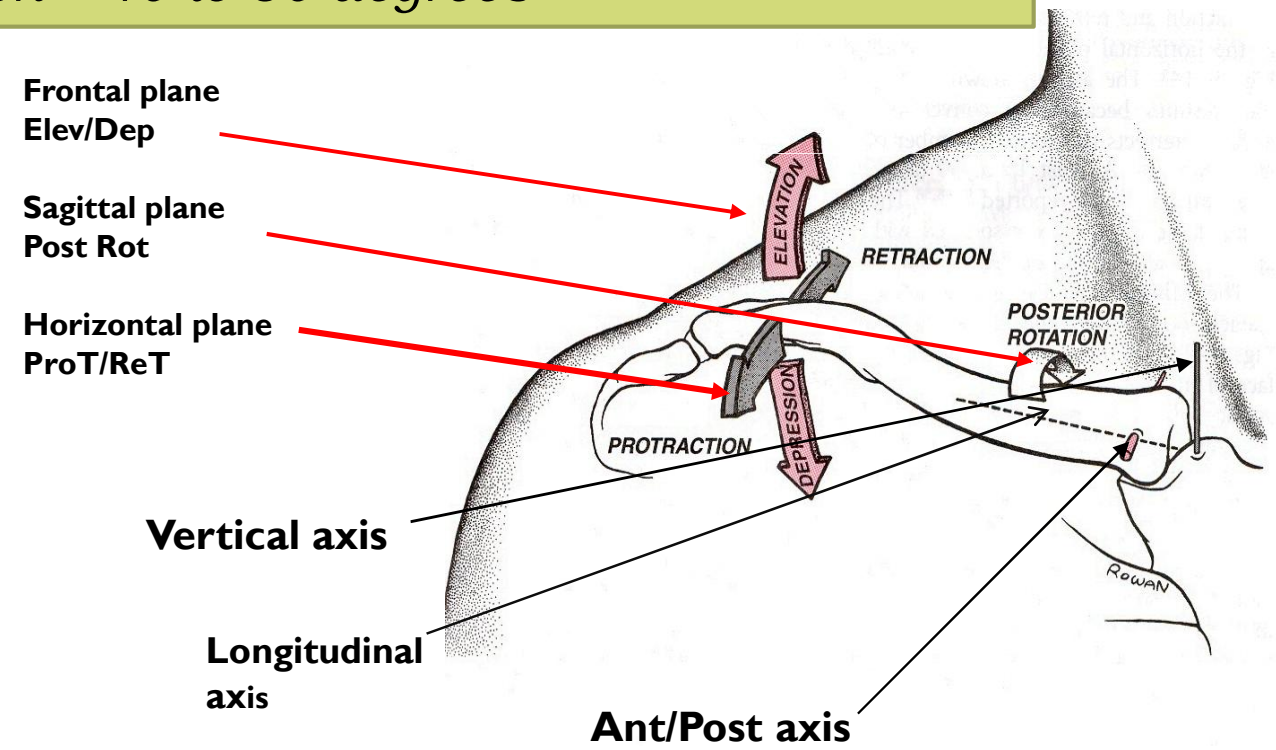
- Abduction starts *with internal rotation* of the humerus ▶ in 90 degrees.

- Abduction starts *with external rotation* of the humerus ▶ in 110 degrees


B
Superior view
C
Lateral view
A
HORIZONTAL PLANE ADJUSTMENTS
UPWARD AND DOWNWARD ROTATION
SAGITTAL PLANE ADJUSTMENTS

Osteokinematics at the SC joint

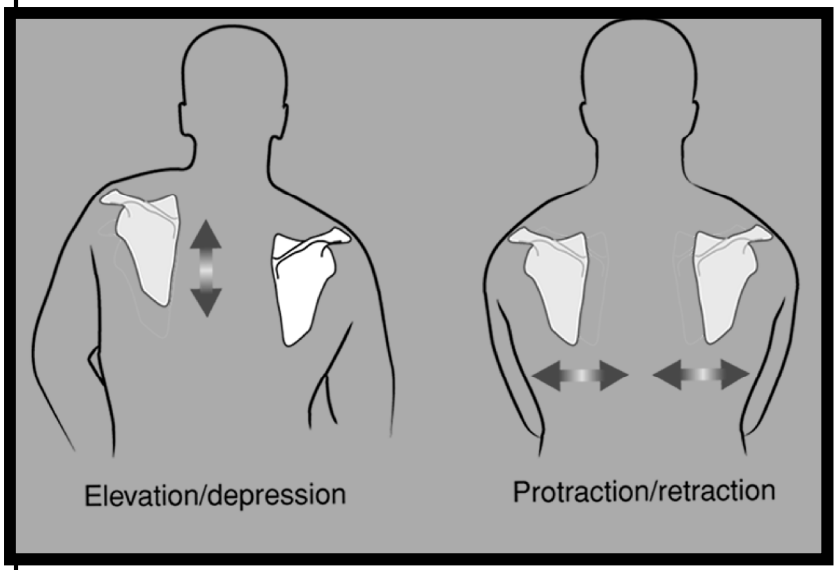
- ✓ *Elevation/ Depression – 45/ 10 degrees Max*
- ✓ *Protraction/ Retraction – 15 to 30 degrees in each direction*
- ✓ *Axial Rotation – 40 to 50 degrees*



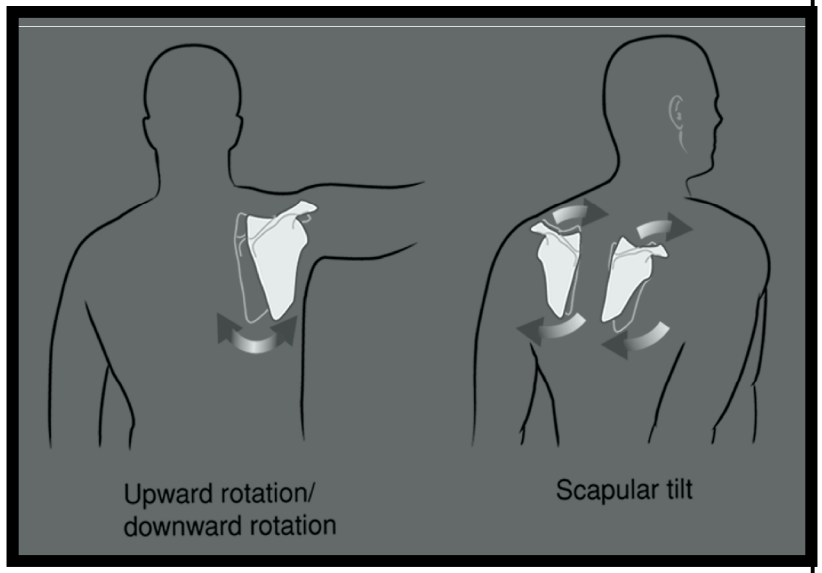
The right sternoclavicular joint showing the osteokinematic motions of the clavicle.

scapulothoracic movements

- Elevation and depression
- Protraction and retraction

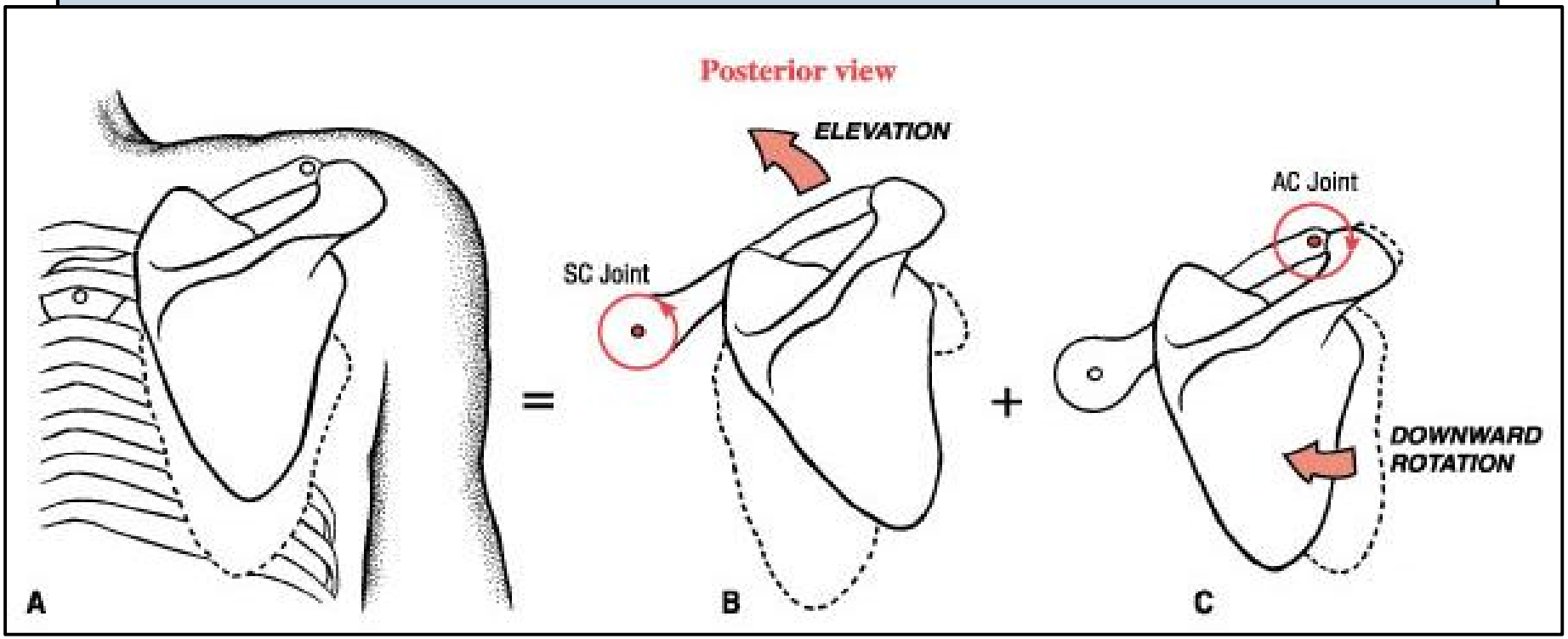


- Upward tilt
- Upward and downward rotation



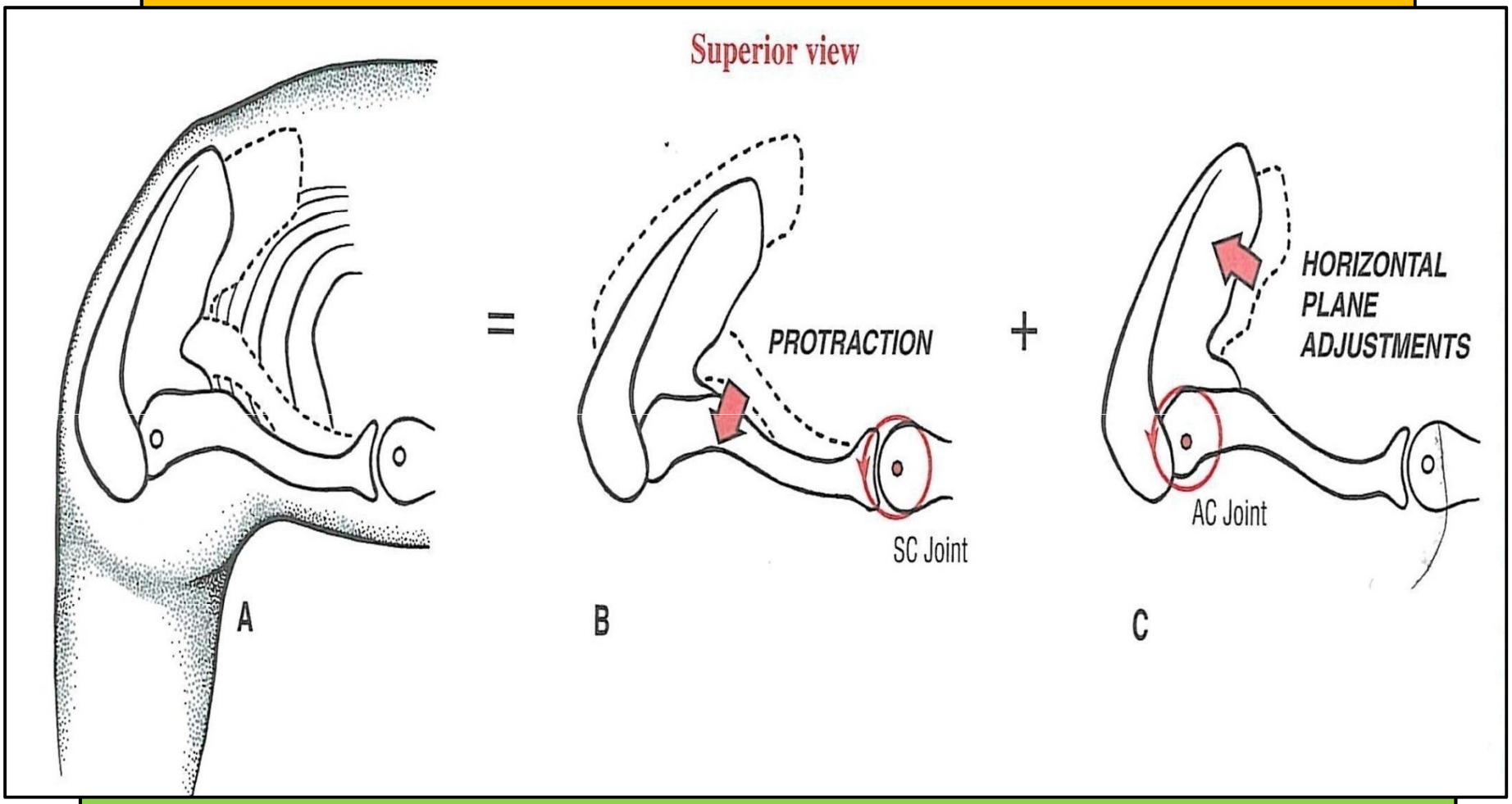
Elevation & depression

- Scapulothoracic elevation shown as a summation of elevation at the SC joint and downward rotation at the AC joint



ST Elevation = SC joint elevation + downward rotation at AC joint

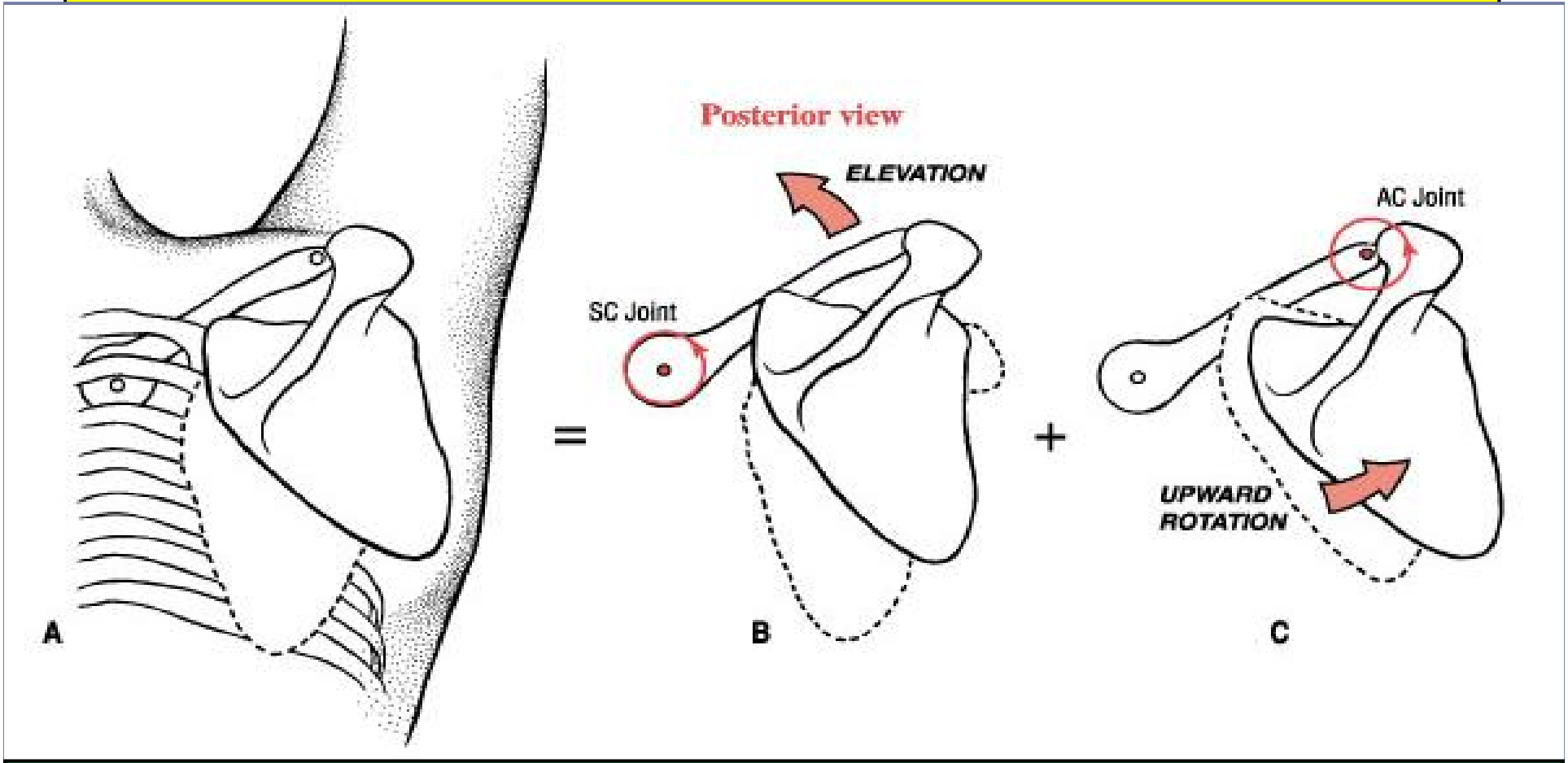
Protraction & retraction



- Scapulothoracic *Protraction* shown as a summation of protraction at the SC joint and slight horizontal plane adjustments at the AC joint

Upward & downward rotation

Scapulothoracic upward rotation shown as a summation of elevation at the SC joint and upward rotation at the AC joint



ST Upward Rotation = SC joint elevation + upward rotation at AC joint

MUSCLES

MUSCLES

A. From trunk to the shoulder girdle

B. From shoulder girdle to humerus

C. From trunk to humerus

Muscles from trunk to shoulder girdle

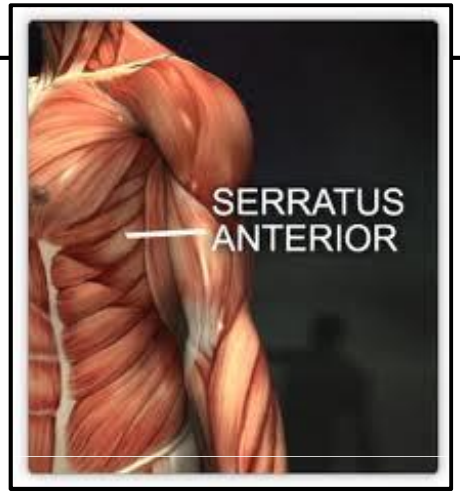
1-Serratus Anterior

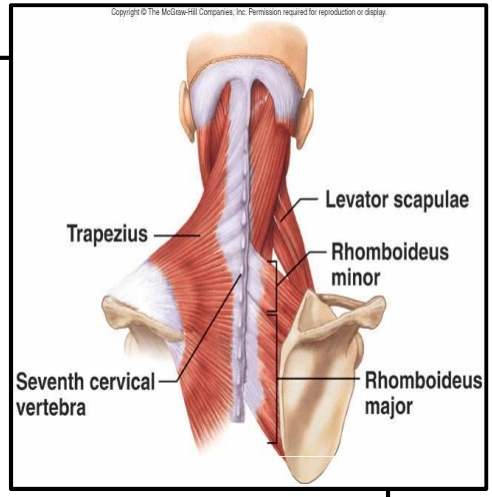
2-Terapezius

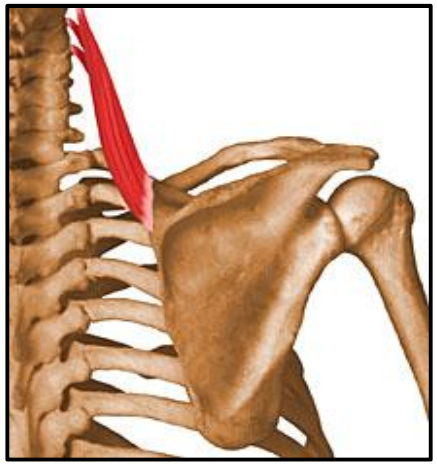
3-Rhomboid Major&Minor

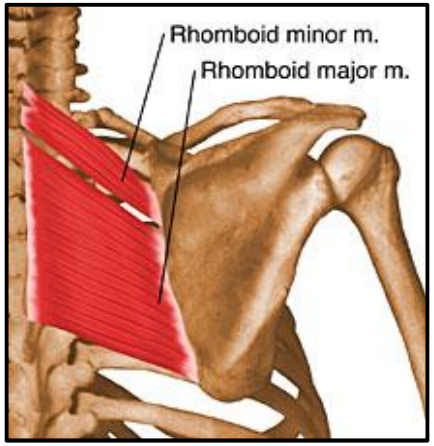
4-Pectoralis Minor

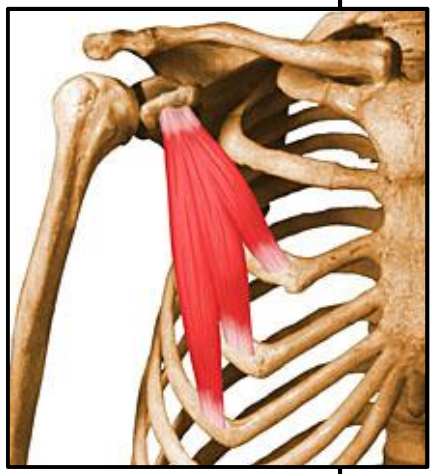
5-levator Scapula











Muscles from *shoulder* girdle to *humerus*

1-Deltoid
- anterior
- middle
- posterior

2-Suprasinatus (RC)

3-Infraspinatus (RC)

4-Terres minor (RC)

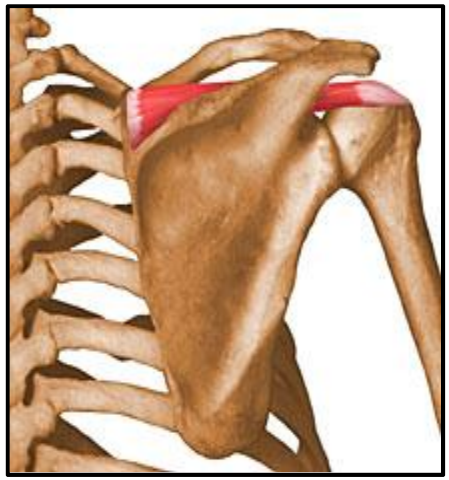
5-Subscapularis (RC)

6-Terres major

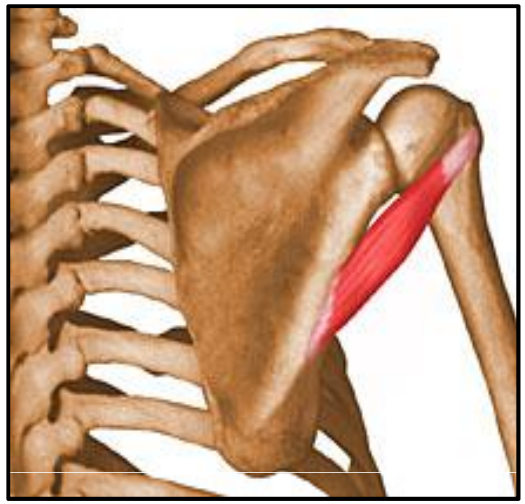
7-Coracobrachialis

► (RC)=Rotator Cuff

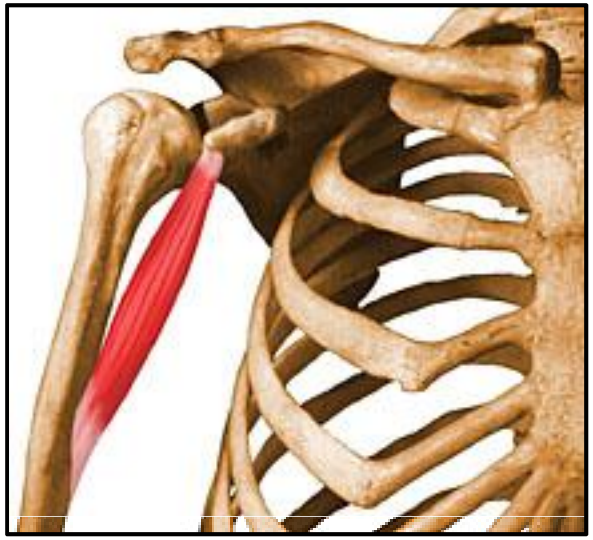
Rotator Cuff



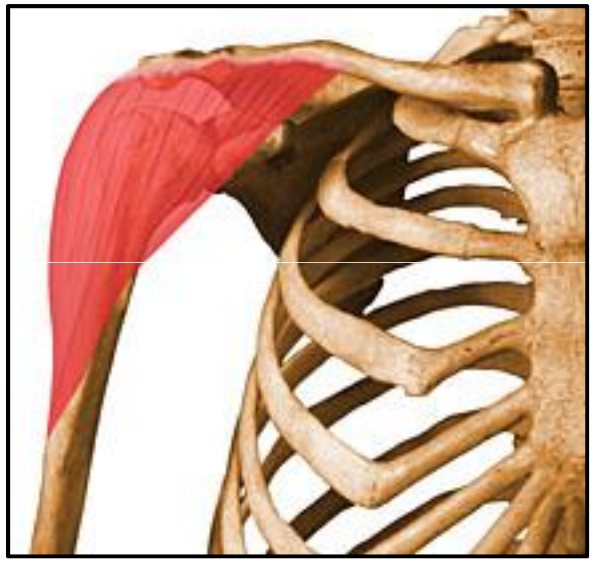
- "SITS" muscles
  - Supraspinatus
  - Infraspinatus
  - Teres Minor
  - Subscapularis



Coracobrachialis



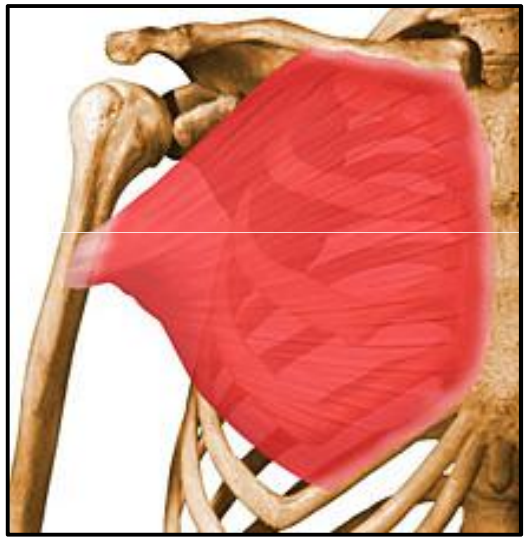
Deltoid



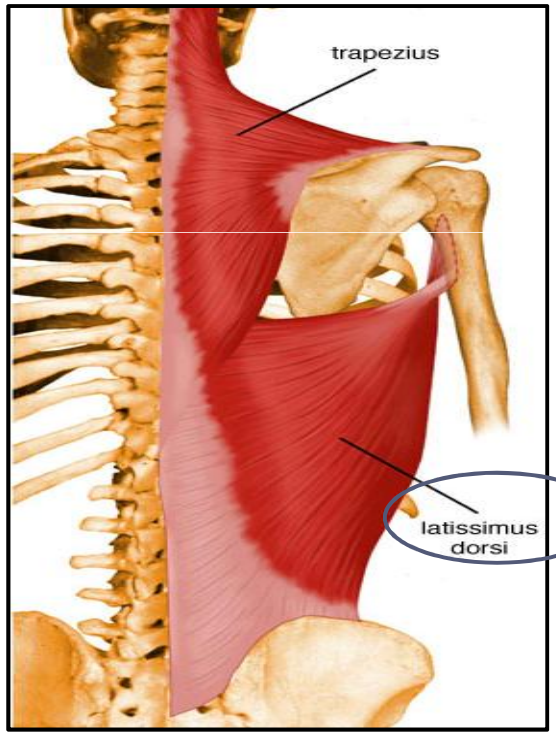
Teres Major

Muscles from trunk to humerus

Pectoralis Major



Latissmus Dorsi



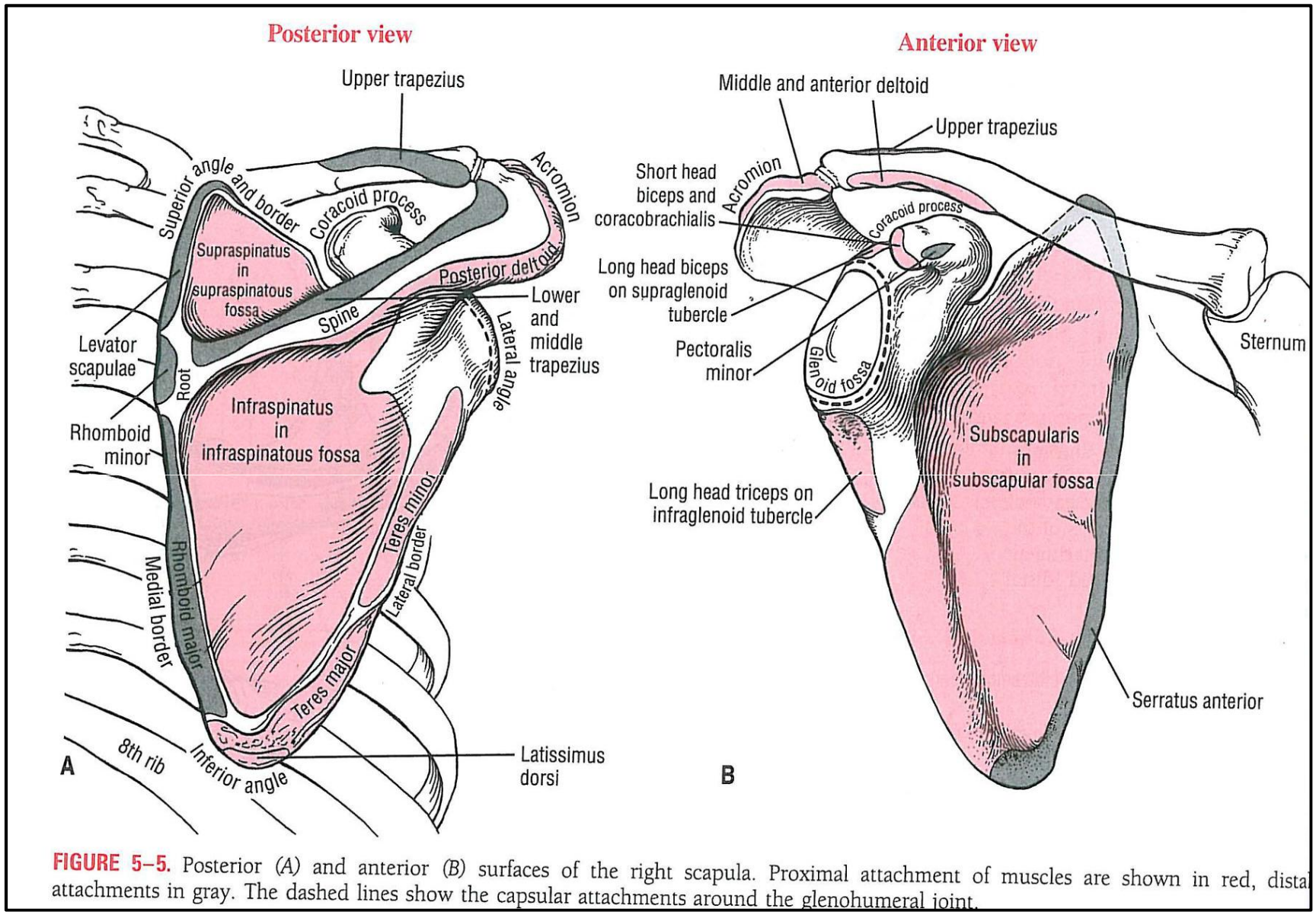
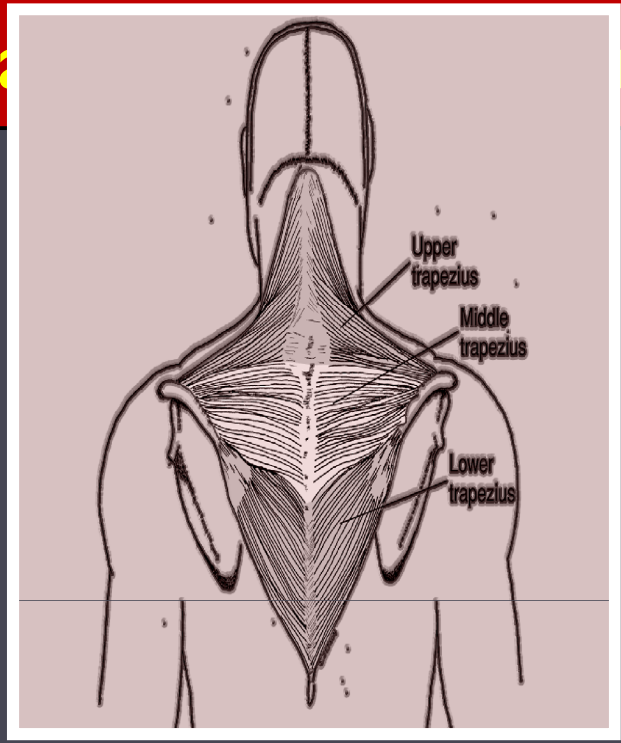
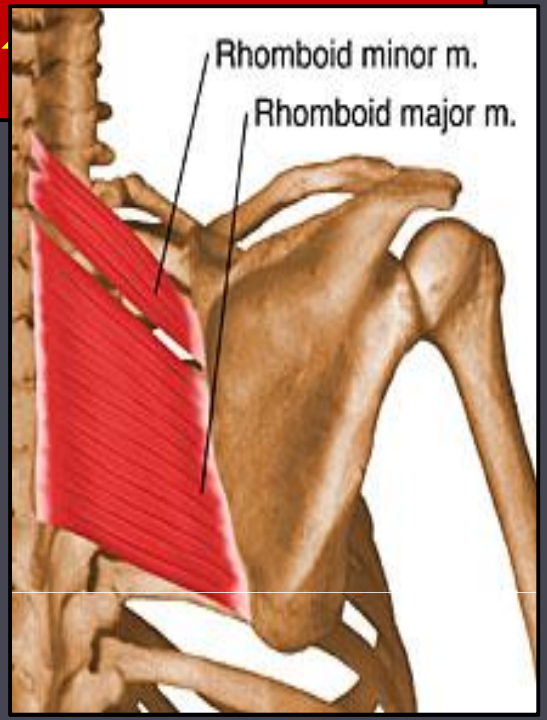


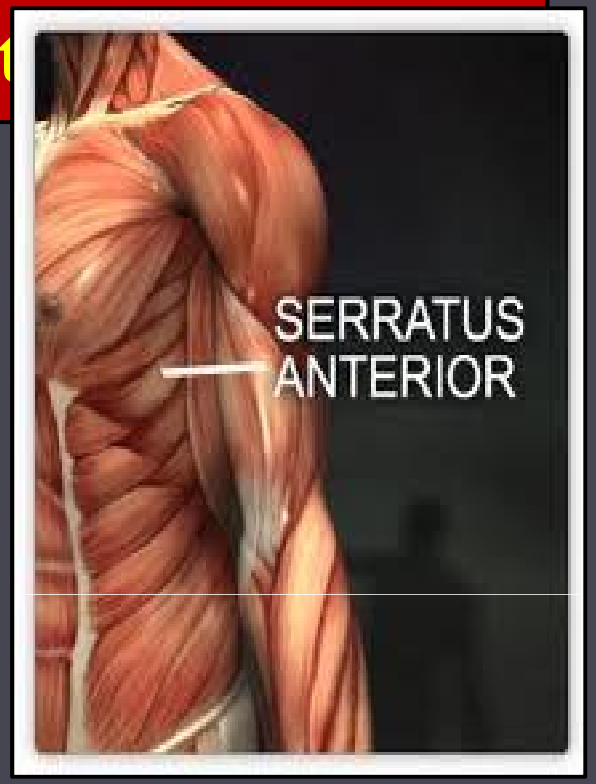
FIGURE 5–5. Posterior *(A)* and anterior *(B)* surfaces of the right scapula. Proximal attachment of muscles are shown in red, distal attachments in gray. The dashed lines show the capsular attachments around the glenohumeral joint.

Scapula

- Mid & lower trapezius,
- Rhomboids






SERRATUS
ANTERIOR

Upward Rotators –

Serratus, upper, mid & lower trapezius

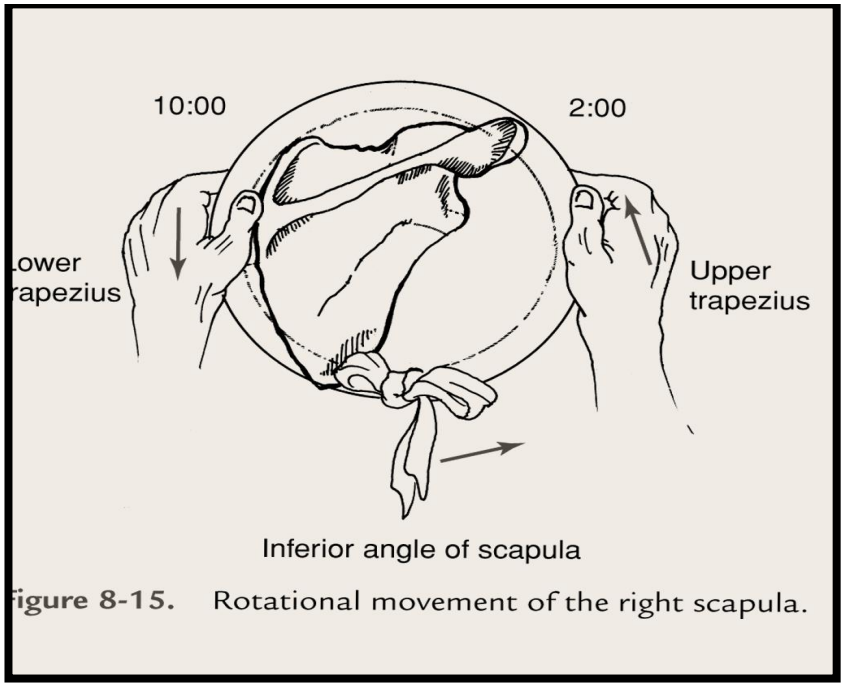
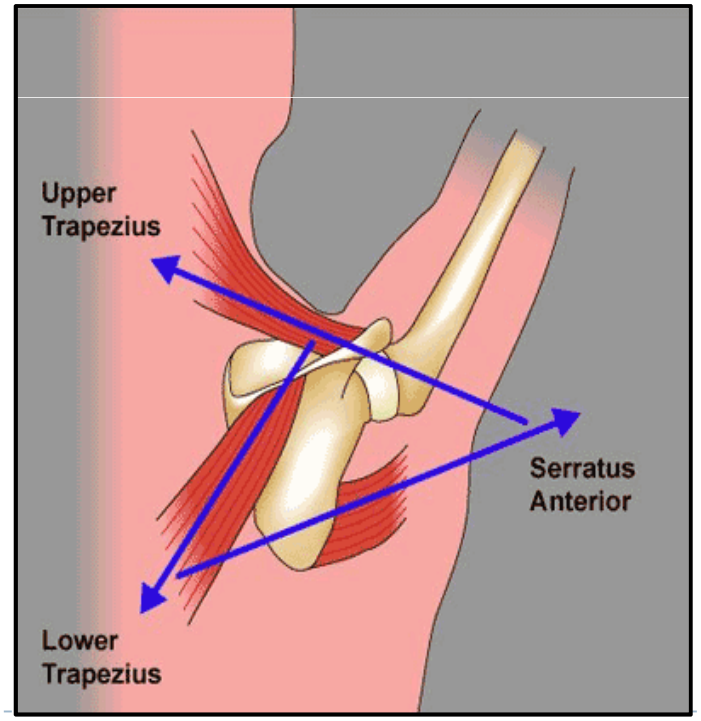
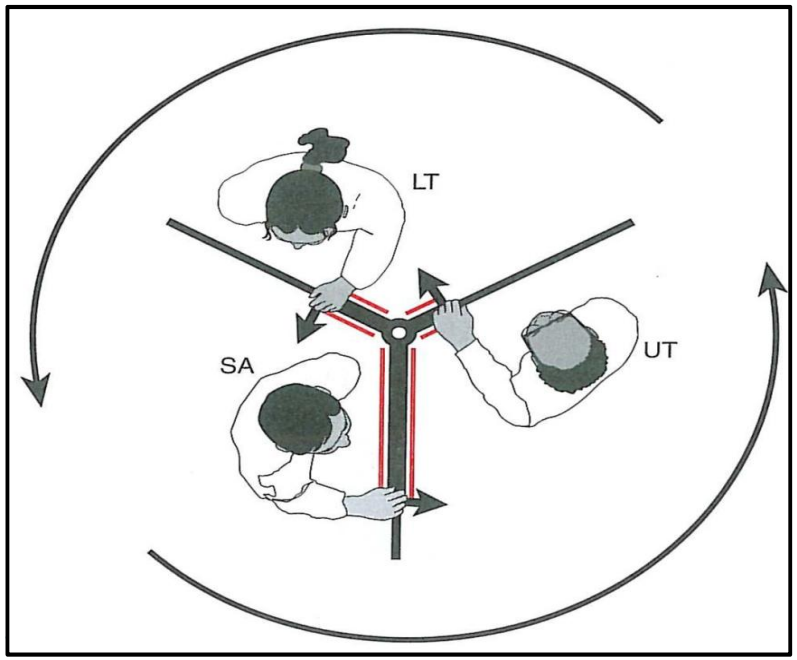


Figure 8-15. Rotational movement of the right scapula.





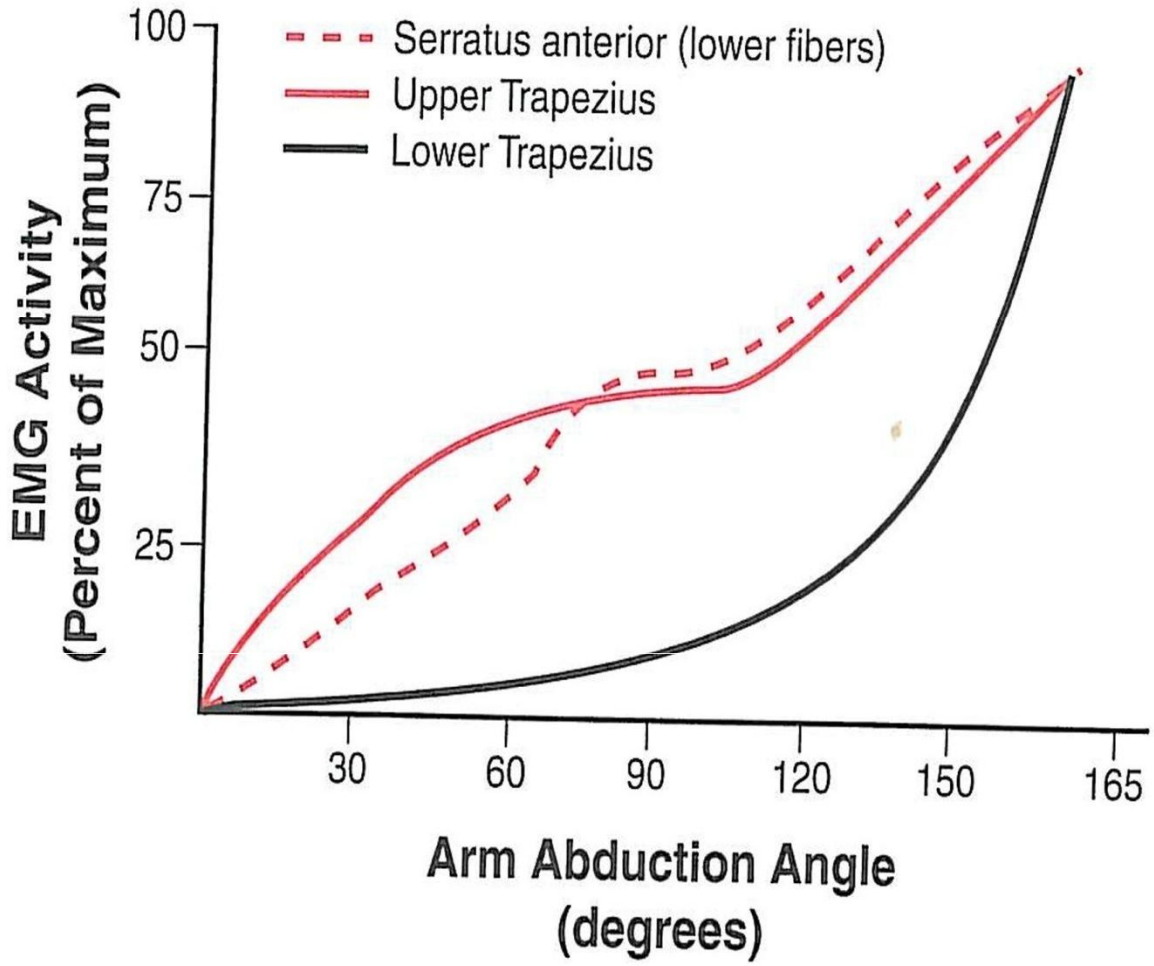
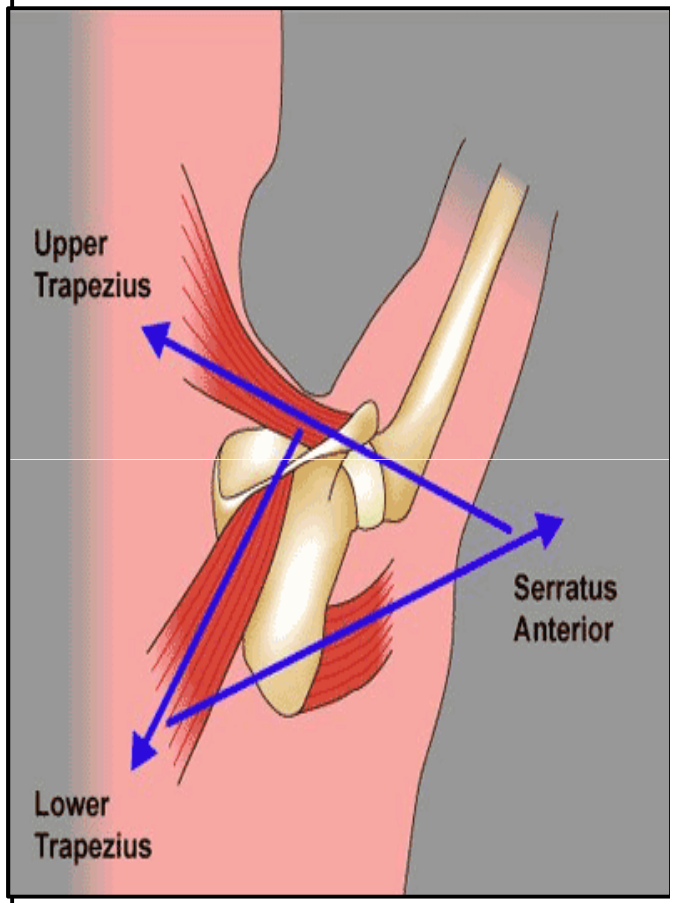
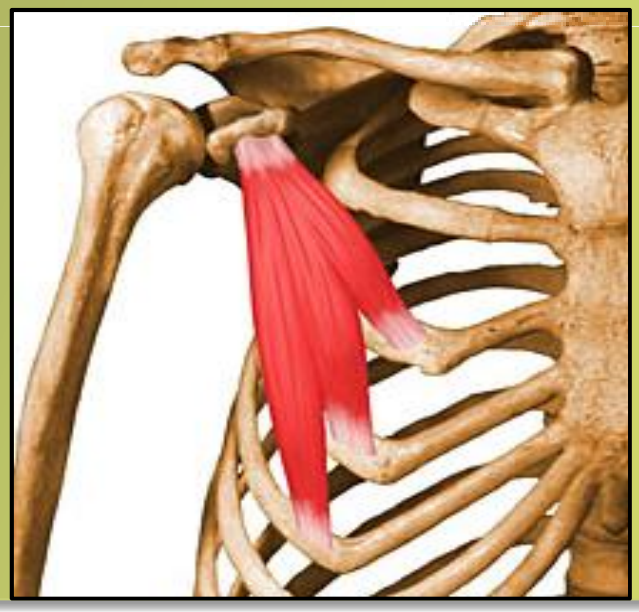


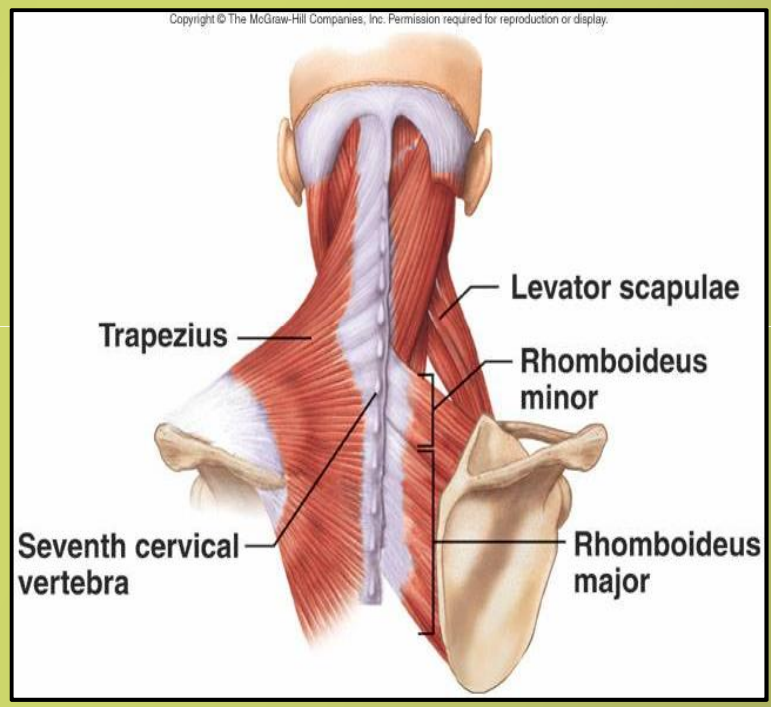
FIGURE 5–51. The EMG activation pattern of the upper trapezius and middle trapezius and the lower fibers of the serratus anterior during shoulder abduction in the scapular plane. (Data from Bagg SD, Forrest WJ: Electromyographic study of the scapular rotators during arm abduction in the scapula plane. Am J Phys Med 65: 111–124, 1986.)



Scapular downward rotation

- Rhomboids
- Levator scapula
- Pectoralis minor

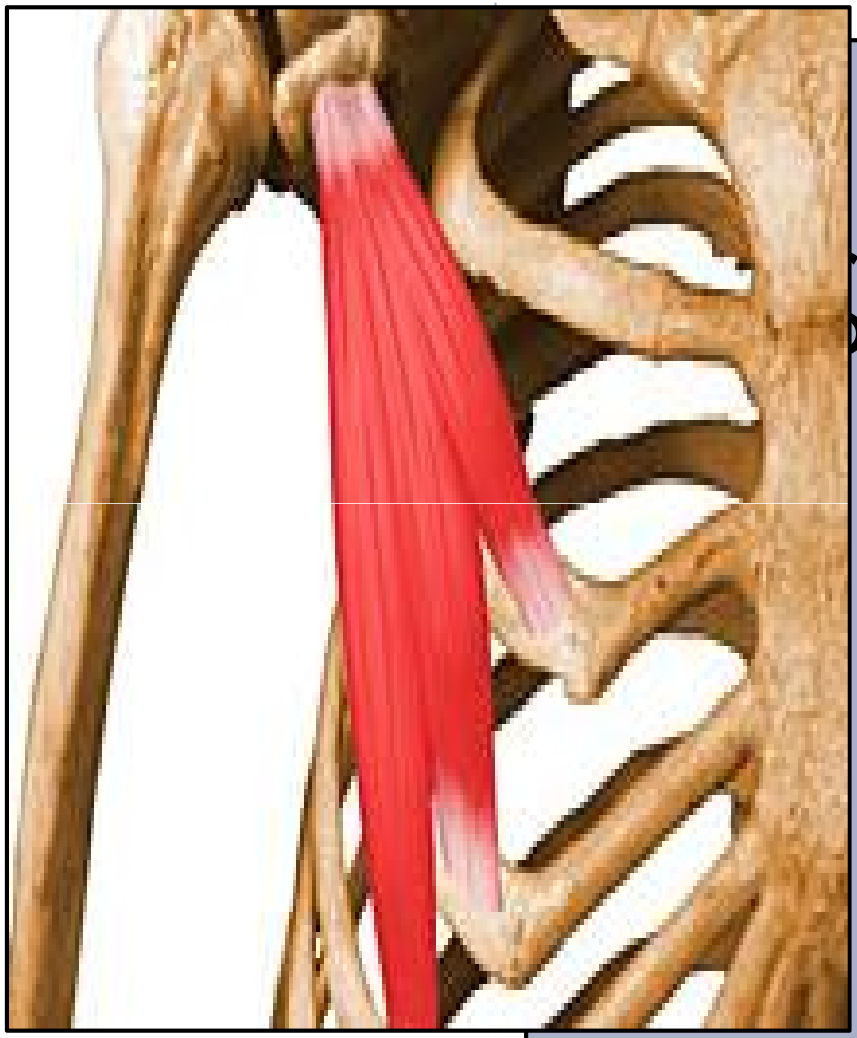




Scapular elevation&depression

elevation	depression
1-Levator scapula	1-Pectoralis minor
2-Trapezius(upper fibers)	2-Trapezius(lower fibers)
3-rhomboids	3-Subclavicle
	4-Latissmus dorsi

Upward tilt



alis
or

Muscles in humerus movement

Abductors: deltoid (3 divisions), supraspinatus

Adductors: pectoralis major, latissimus dorsi, teres major

Flexors: biceps brachii, coracobrachialis, anterior deltoid **Extensors:** triceps brachii, posterior deltoid, latissimus dorsi, teres major

Internal rotators: pectoralis major, subscapularis, anterior deltoid, latissimus dorsi, teres major

External rotators: – infraspinatus, teres minor, posterior deltoid

TABLE 7. Maximal Work Capacities of Muscles Acting on Glenohumeral Joint

Name of Muscle	Shortening (in meters)	Cross Section (in sq cm)	Work Capacity (in kg m)
IN FLEXION OF SHOULDER			
Subscapularis	0.011	25.2	2.77
Supraspinatus	0.031	7.7	2.39
Coracobrachialis	0.039	5.8	2.26
Infraspinatus and teres minor	0.014	16.5	2.21
Biceps, short head	0.048	3.2	1.54
Biceps, long head	0.030	3.3	0.99
			12.16
IN EXTENSION OF SHOULDER			
Teres major	0.101	9.8	9.90
Triceps, long head	0.054	4.7	2.54
			12.44

- ۶ تعداد عضلات عمل کننده درحالت فلکشن شانه:
- حداکثر ظرفیت کاري عضلات فلکسور:۱۲/۱۶
- مجموع سطح مقطع عضلات فلکسوربه سانتي متر مربع:۶۱/۷
- ۲:تعداد عضلات عمل کننده درحالت اکستنشن
- حداکثر ظرفیت کاري عضلات اکستنسور:۱۲/۴۴
- مجموع سطح مقطع عضلات به سانتي مترمربع:۱۲/۷
- اکستنسورها دارای ظرفیت کاری بیشتری می باشند اما سطح مقطع کمتری دارند

IN ADDUCTION OF THE SHOULDER			
Teres major	0.066	9.8	6.47
Coracobrachialis	0.052	5.8	3.01
Triceps, long head	0.041	4.7	1.92
Biceps, long head	0.019	3.2	0.61
			12.01

IN ABDUCTION OF THE SHOULDER			
Supraspinatus	0.033	7.7	2.54
Infraspinatus and teres minor	0.011	16.5	1.81
Subscapularis	0.004	25.2	1.01
Biceps, long head	0.012	3.3	0.40
			5.76

- ۴:تعداد عضلات عمل کننده درحالت اداکشن
- حداکثر ظرفیت کاري عضلات نزدیک کننده:۱۲/۰۱
- مجموع سطح مقطع عضلات نزدیک کننده به سانتي مترمربع:۲۳/۵
- ۴:تعداد عضلات عمل کننده درحالت ابداکشن
- حداکثر ظرفیت کاري عضلات دور کننده:۵/۷
- مجموع سطح مقطع عضلات دور کننده به سانتي مترمربع:۵۲/۷
- عضلات اداکتور ظرفیت کاری بیشتری ازابداکتورها دارند اما سطح مقطع انها کمتر است

# of muscles Palpation

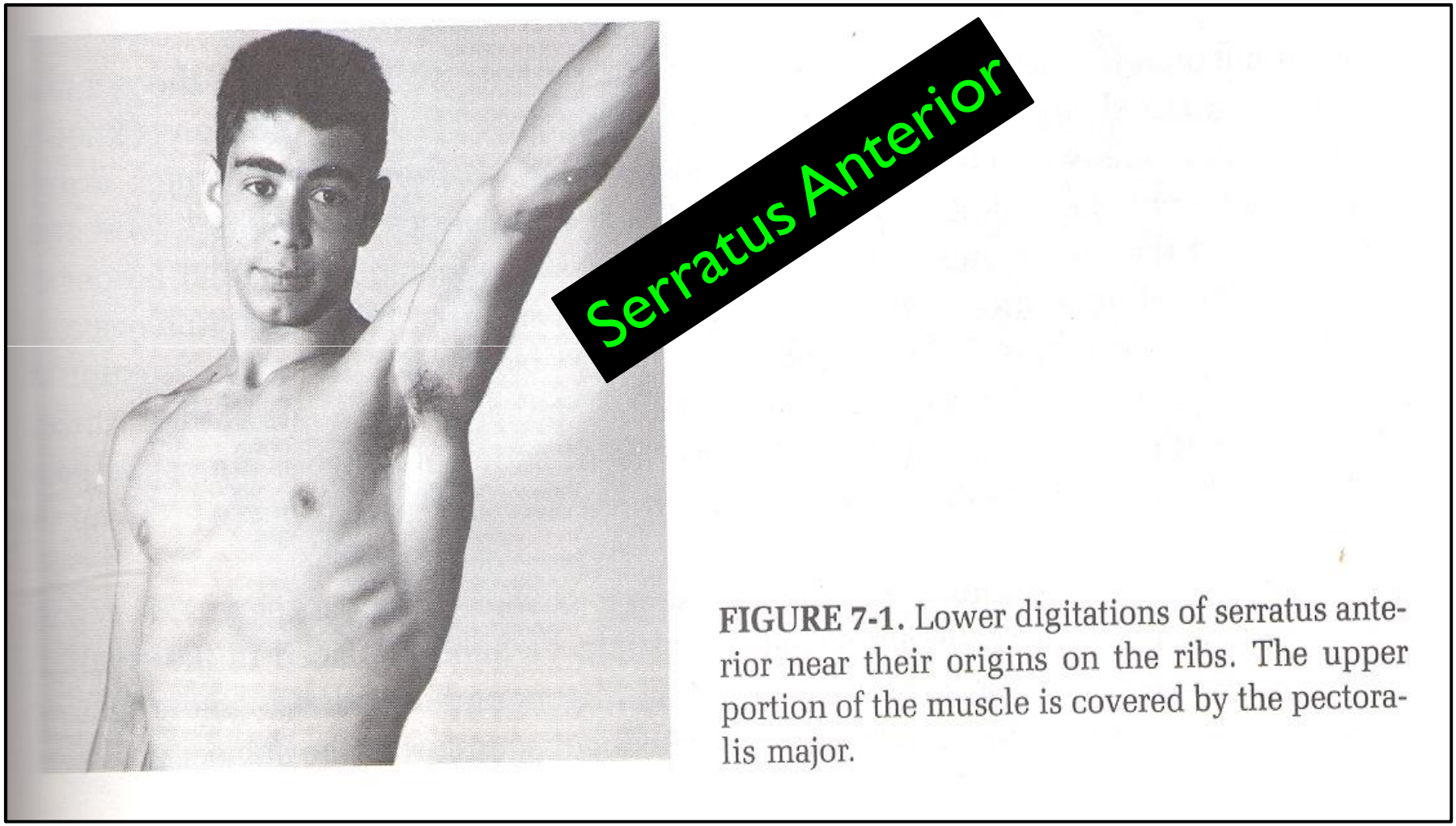


FIGURE 7-1. Lower digitations of serratus anterior near their origins on the ribs. The upper portion of the muscle is covered by the pectoralis major.

Pectoralis Minor

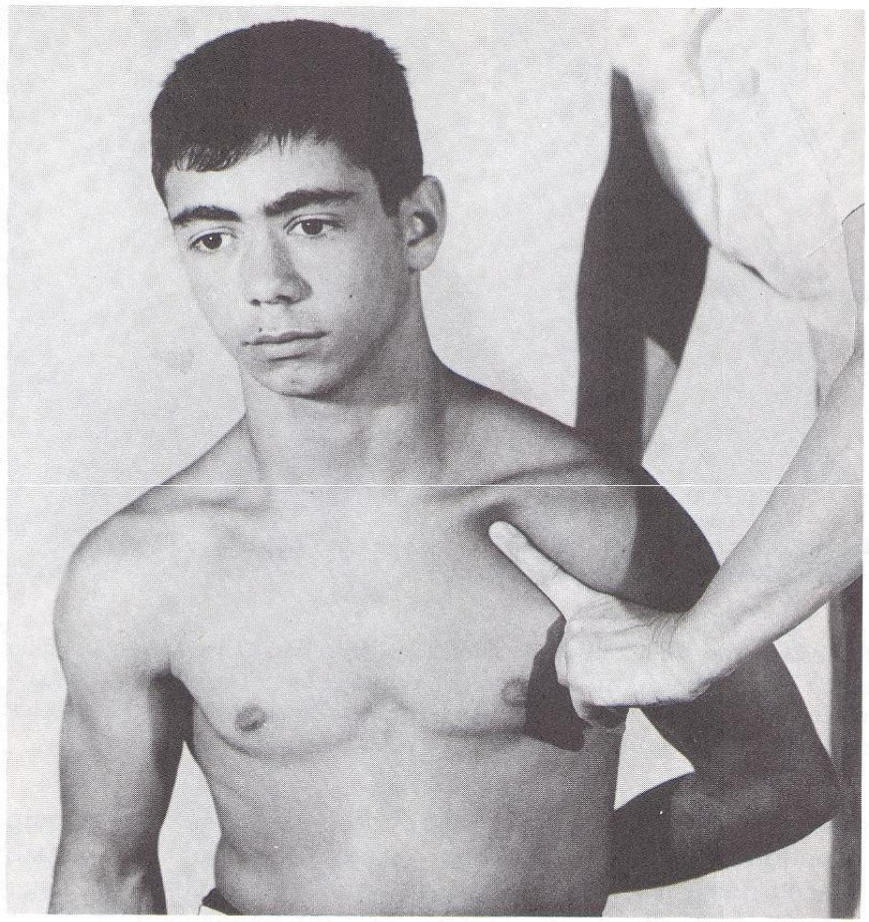


FIGURE 7-6. Palpation of pectoralis minor. With the subject's hand resting in the lumbar region of the back, both pectoralis major and pectoralis minor are relaxed. The tendon of pectoralis minor is palpated below the coracoid process when the subject raises the hand off the back.

Rhomboid

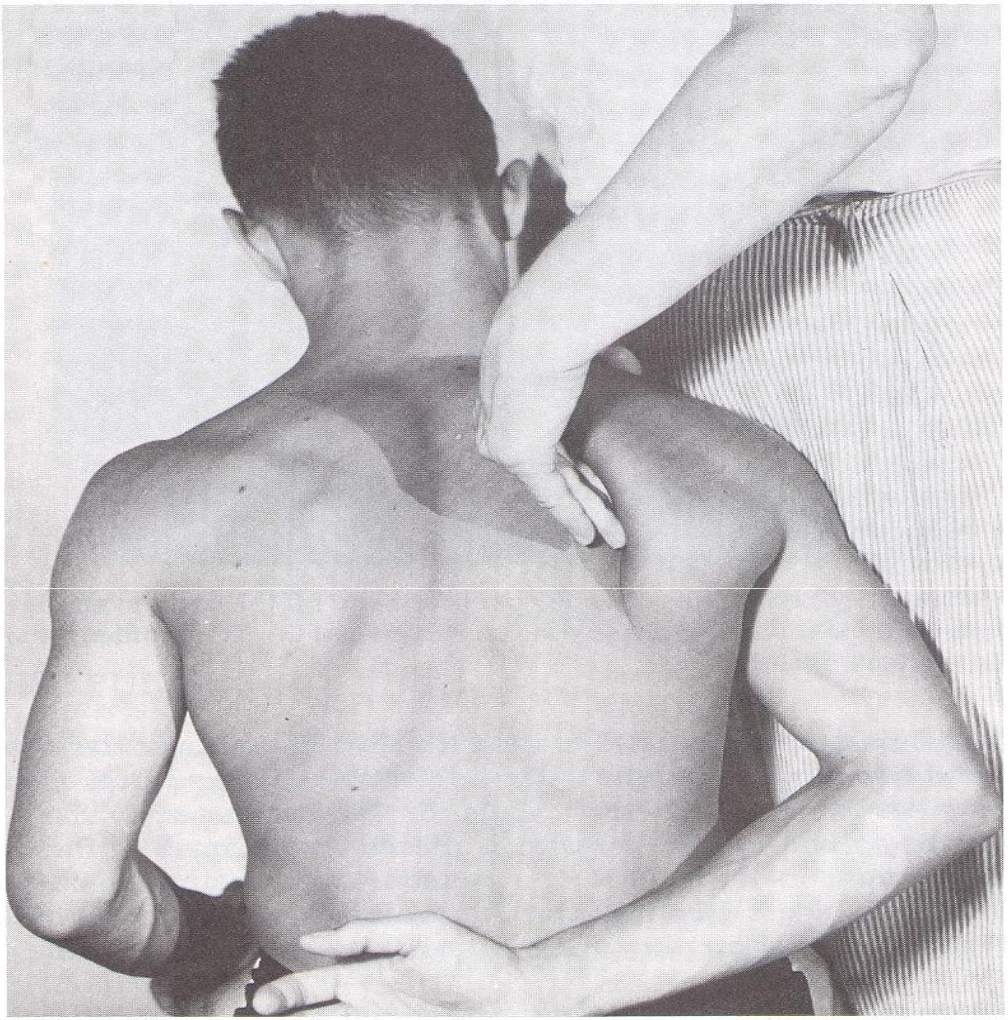
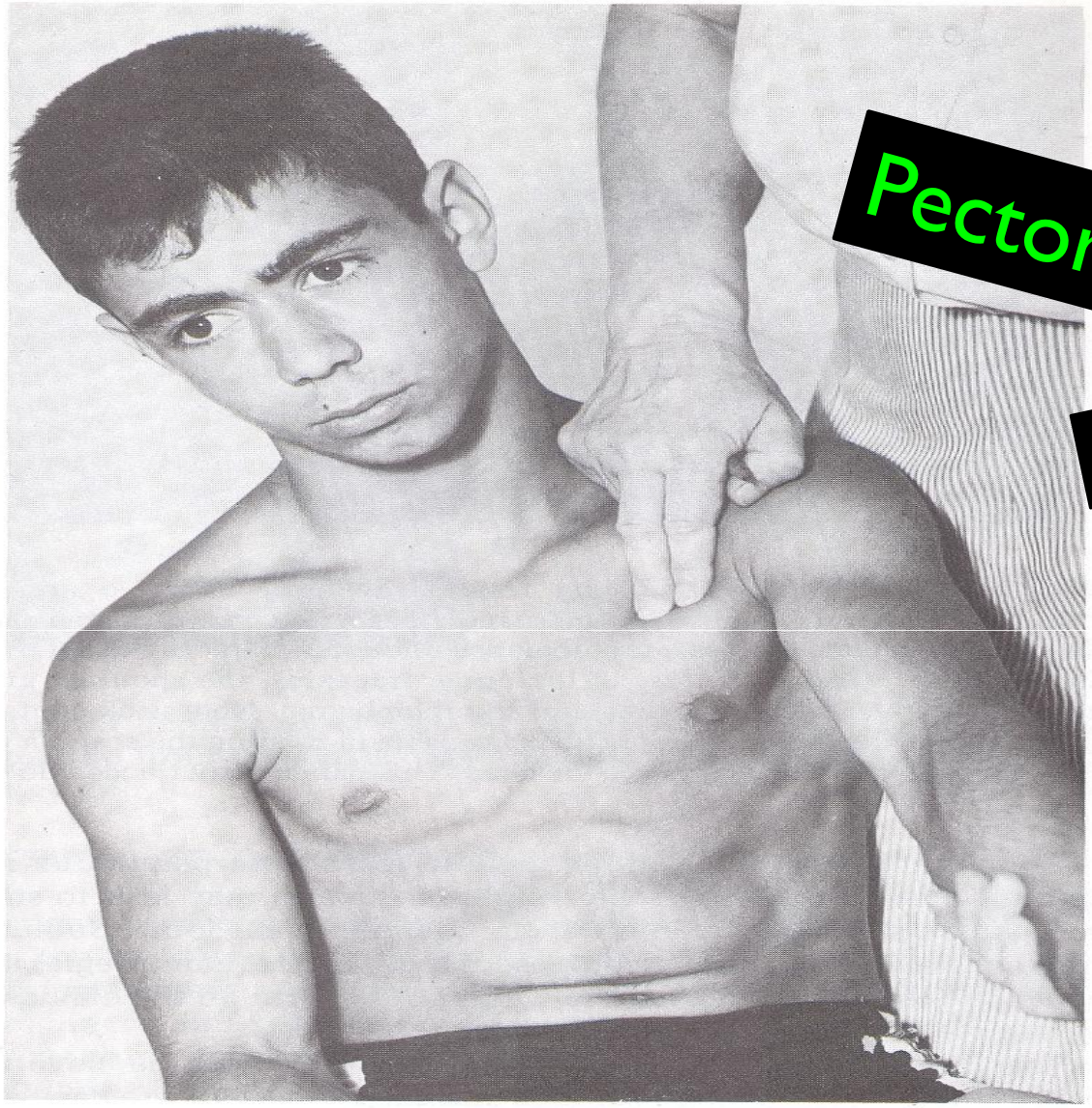


FIGURE 7-3. Palpation of rhomboids. When trapezius and rhomboids are relaxed, examiner's finger may be placed under medial border of scapula.



Pectoralis Major

Lower

FIGURE 7-14. The lower portion of the pectoralis major contracts as the subject adducts the arm against resistance. The examiner's fingers are separating the lower portion from the upper.

trunk is the sternoclavicular joint. Several muscles are involved in this extension

Pectoralis Major

upper

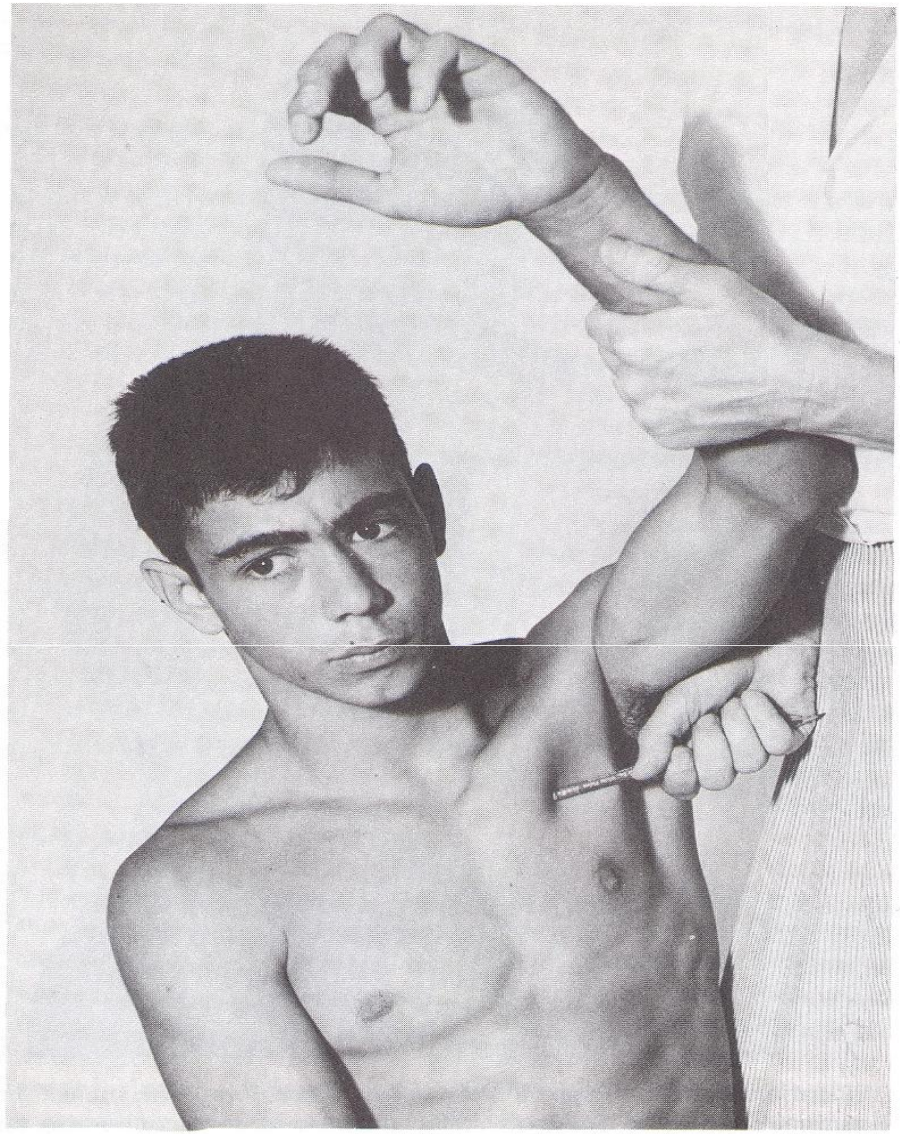


FIGURE 7-13. The upper portion of the pectoralis major is seen contracting as the subject is pulling the arm in direction toward the head against resistance. A pencil has been placed across the lower portion of pectoralis major to show that it is relaxed.

Coracobrachialis

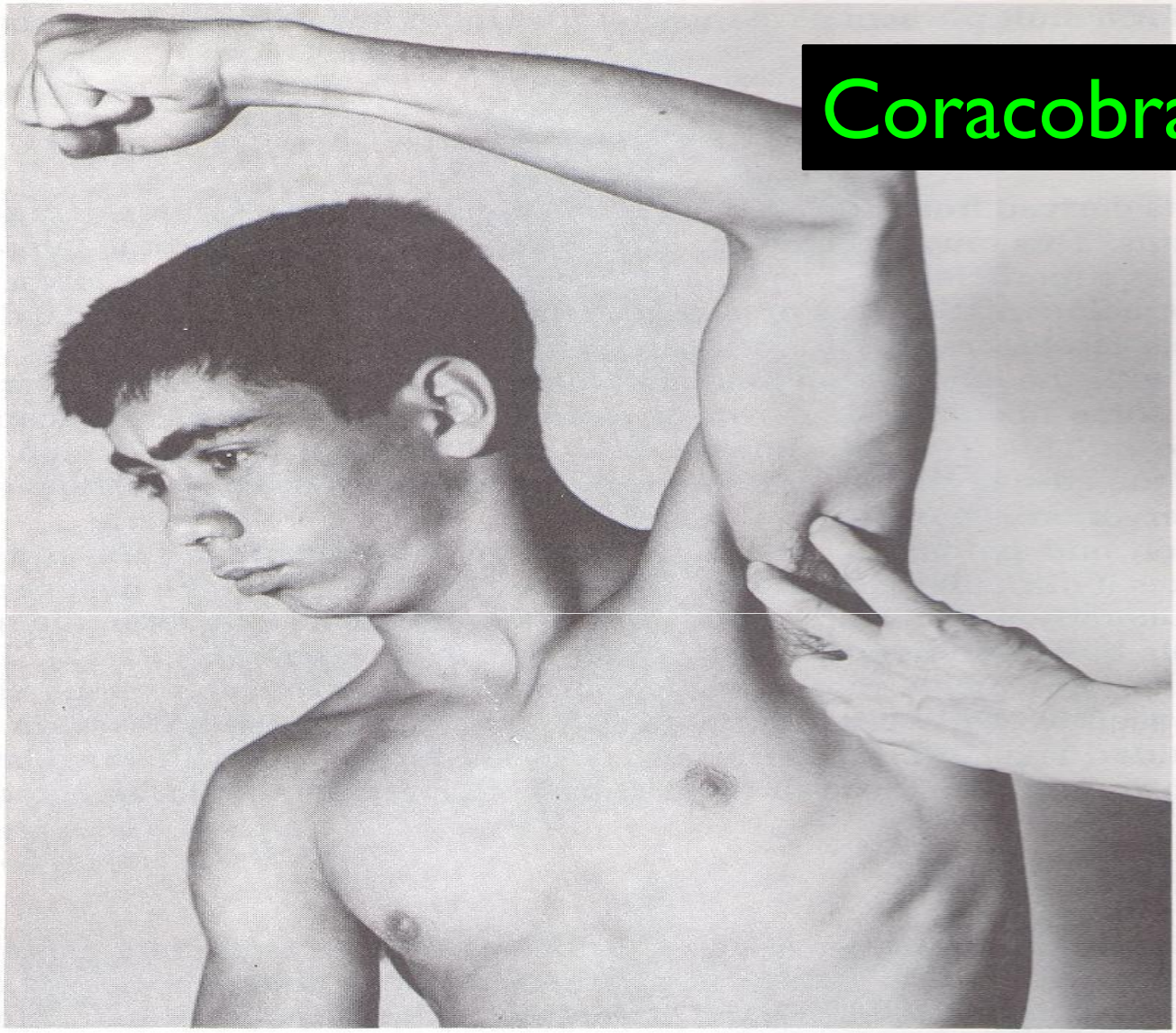


FIGURE 7-11. Identification of coracobrachialis. This muscle emerges from underneath the inferior border of the pectoralis major, where it lies close to the tendon of the short head of the biceps.

Deltoid

anterior

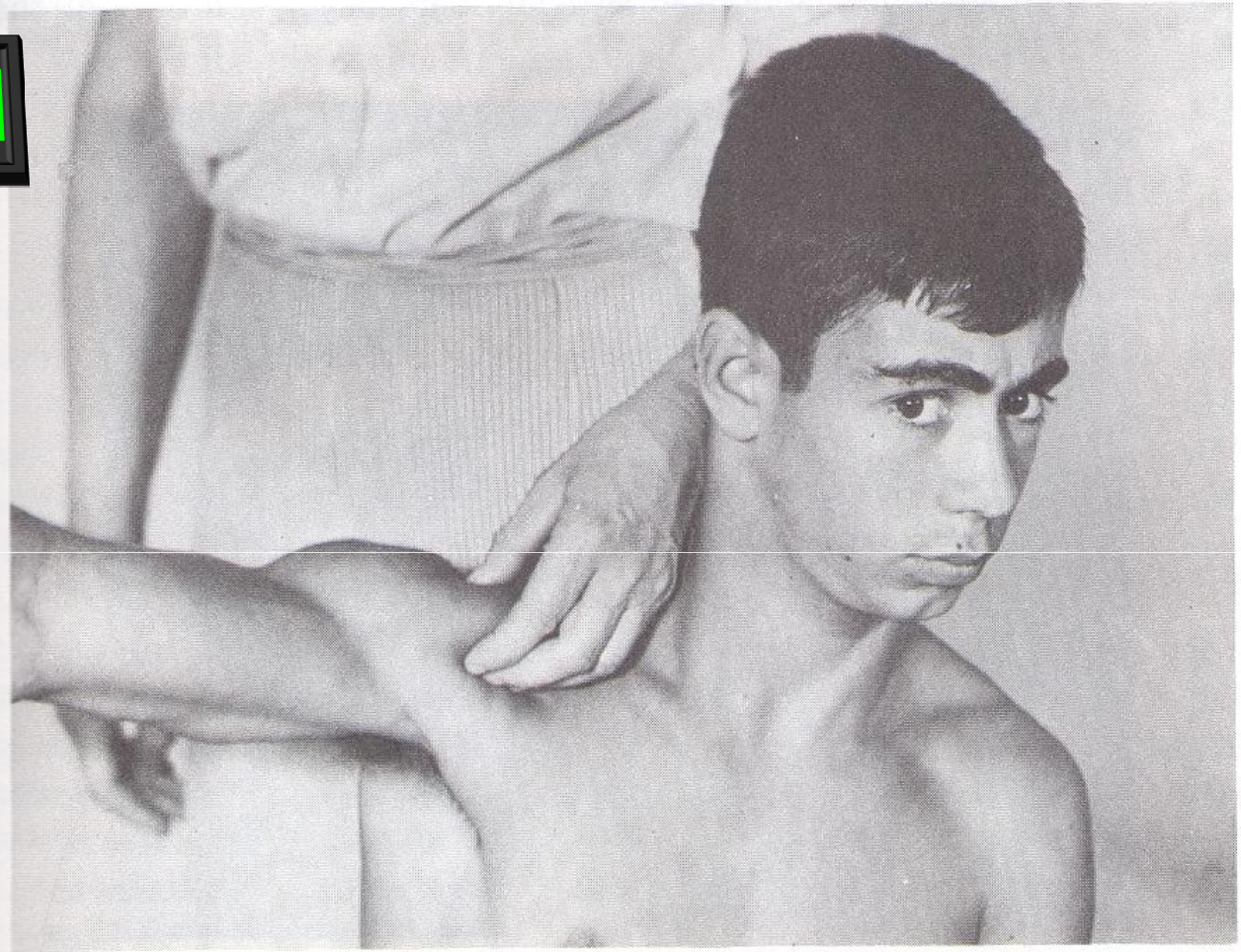


FIGURE 7-7. The examiner grasps around the anterior portion of the deltoid, separating it from the middle deltoid and from the pectoralis major.

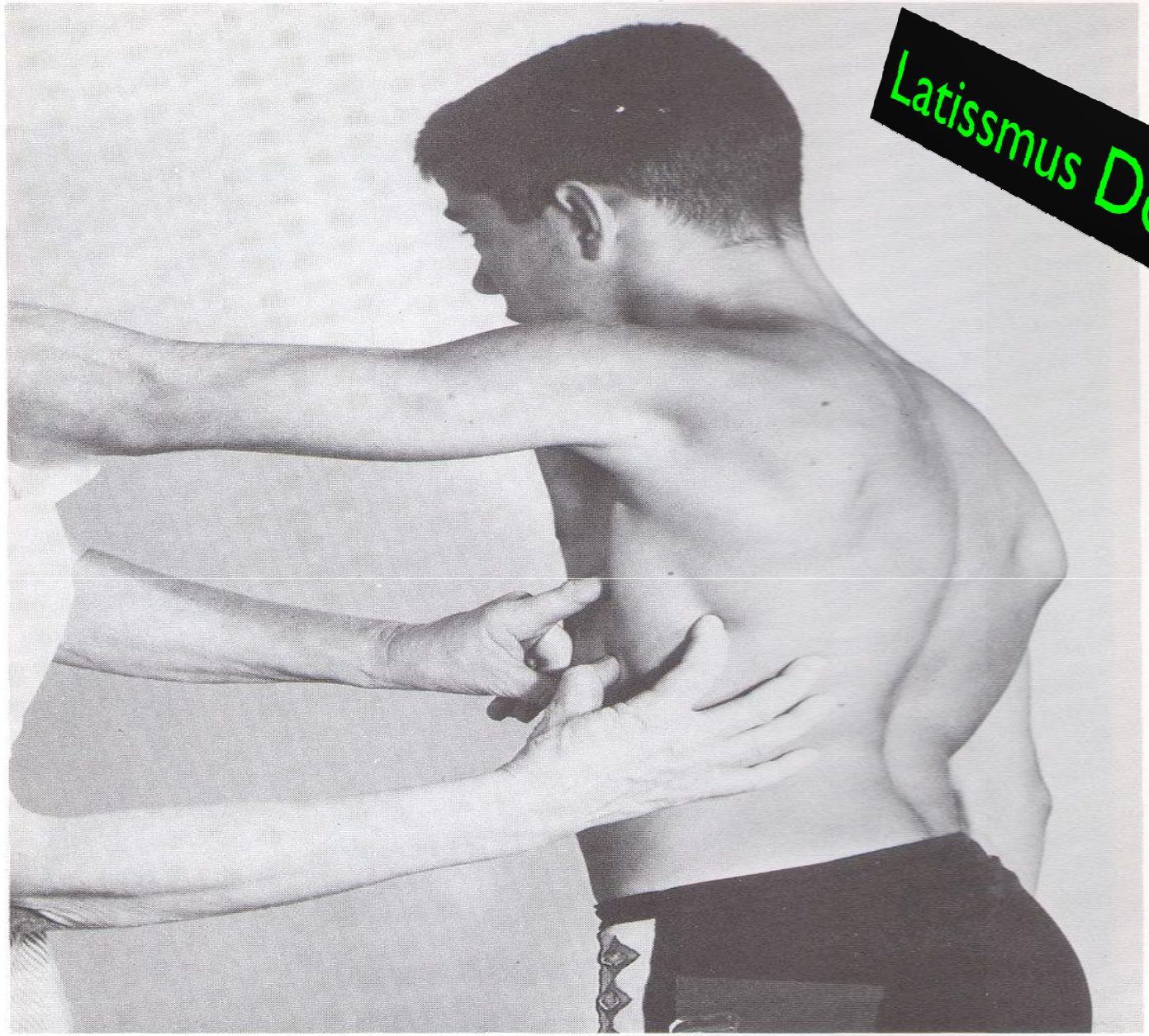


FIGURE 7-12. Palpation of the lower portion of the latissimus dorsi. The subject presses downward on the examiner's shoulder. The teres major may also be seen contracting strongly.

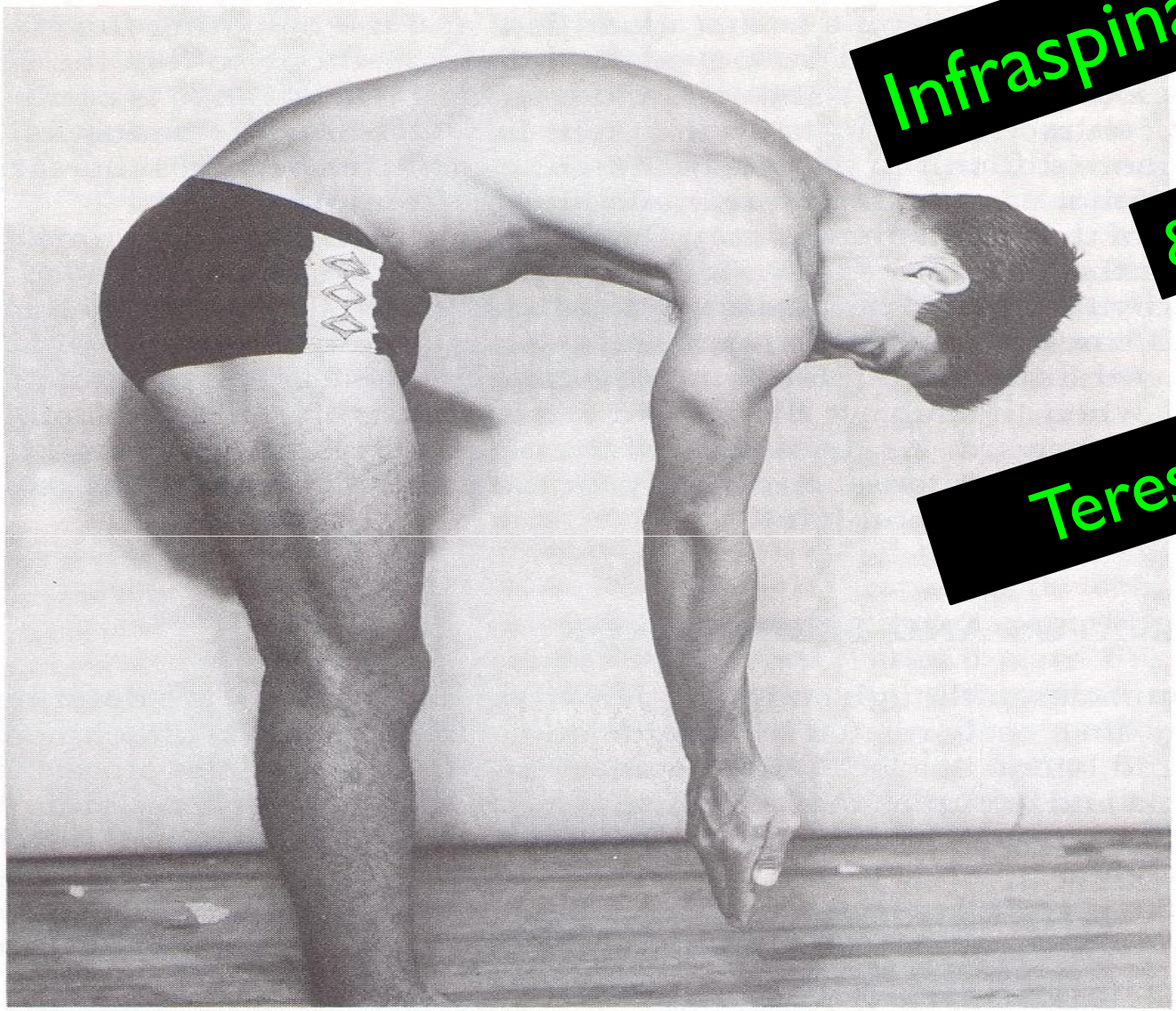


FIGURE 7-9. Infraspinatus and teres minor may be felt contracting near the lateral border of the scapula when the shoulder is externally rotated. Vertical position of arm allows activation of these two muscles in a rather isolated fashion.

Subscapularis

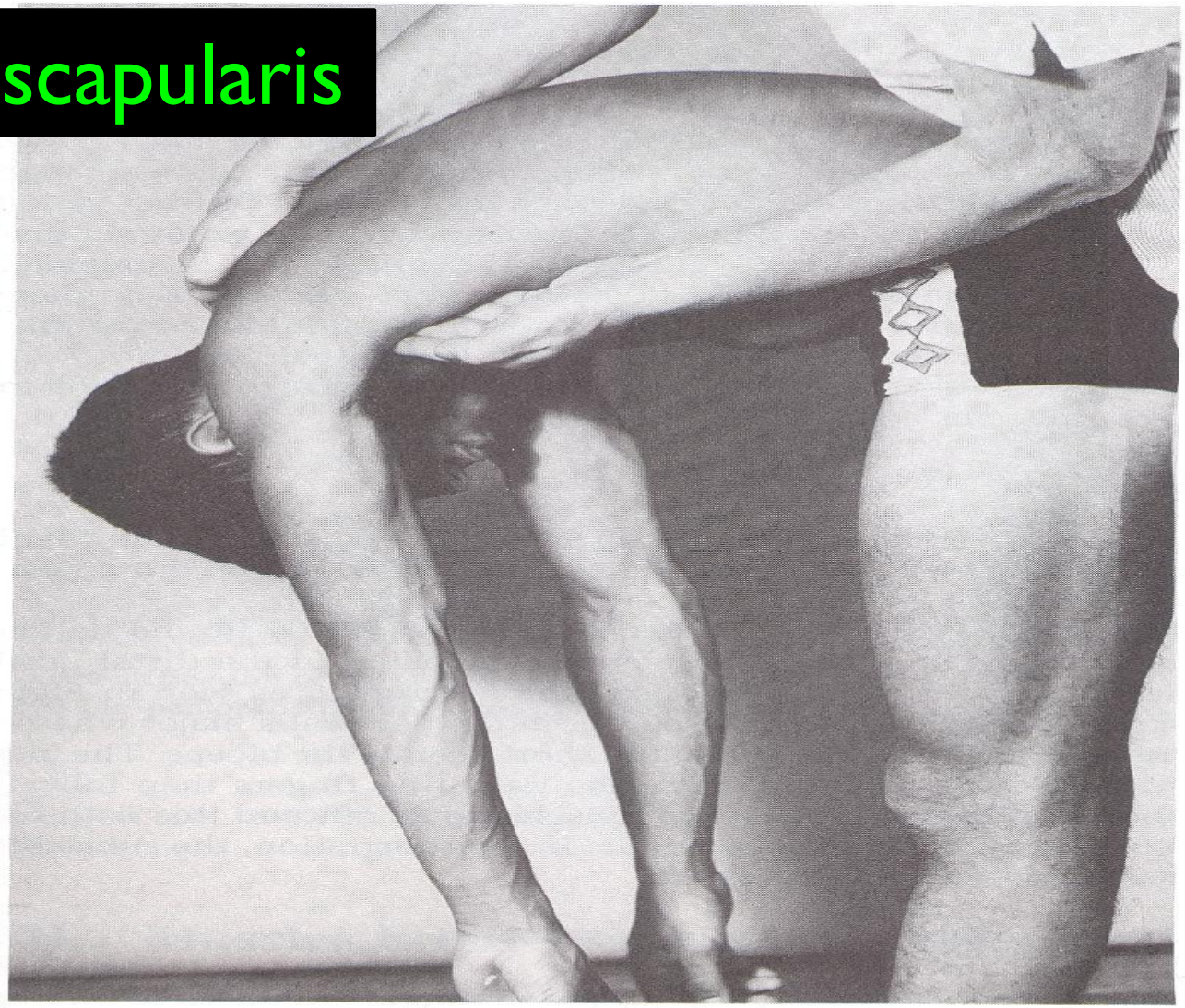


FIGURE 7-10. Subscapularis is palpated in internal rotation of the shoulder. The palpating fingers are placed in the axilla and are moved in direction toward the costal surface of the scapula.