BHARATHIDASAN UNIVERSITY

Tiruchirappalli- 620024,
Tamil Nadu, India

Department of Physical Education and Yoga

Course Title : KINESIOLOGY AND BIOMECHANICS
Course Code : 21BPE42

Unit- (I)

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GUEST LECTURER

What is kinesiology?

Kinesiology is the study of human movement. (Or)

The study of the mechanics body movement.

Definition of kinesiology?

The Greek words kinesis meaning ‘movement’ And logia which means ‘study’ the scientific study of the body movements.

kinesiology is the study of human movement and muscle function.

Need and Importance of kinesiology

- to improve performance
- For safe movements
- Use movements for therapy
- Helps to evaluate exercise

Need and Importance of kinesiology

- Kinesiology is the branch of science which helps to detect the various imbalances in our body, which otherwise cannot be detected even by the most modern medicines.
- It helps to maintain the mental and emotional balance of a person.
- It helps to get rid of the back and neck pains, which is nowadays very common in all the professions.

Need and Importance of kinesiology

- The various learning disabilities of a child can be easily cured by using the method of kinesiology.
- The kinesiology therapy helps to boost the self confidence of person.
- Over stress and anxiety are the root cause of many diseases. This can be cured with the help of kinesiology.

Fundamental movements

Flexion – bending of a joint

Extension- straightening of a joint

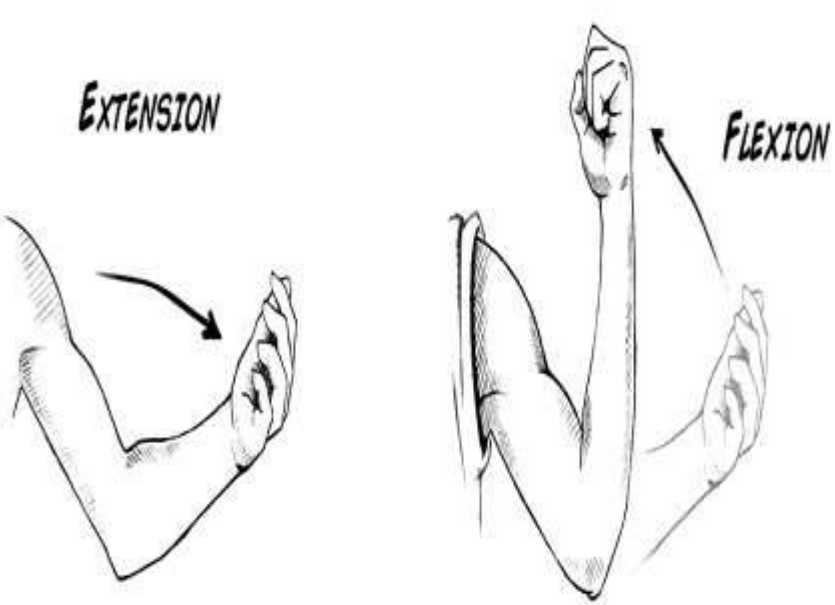
Abduction- movements is away from the mid line of the body

Adduction – movements is towards the mid line of the body

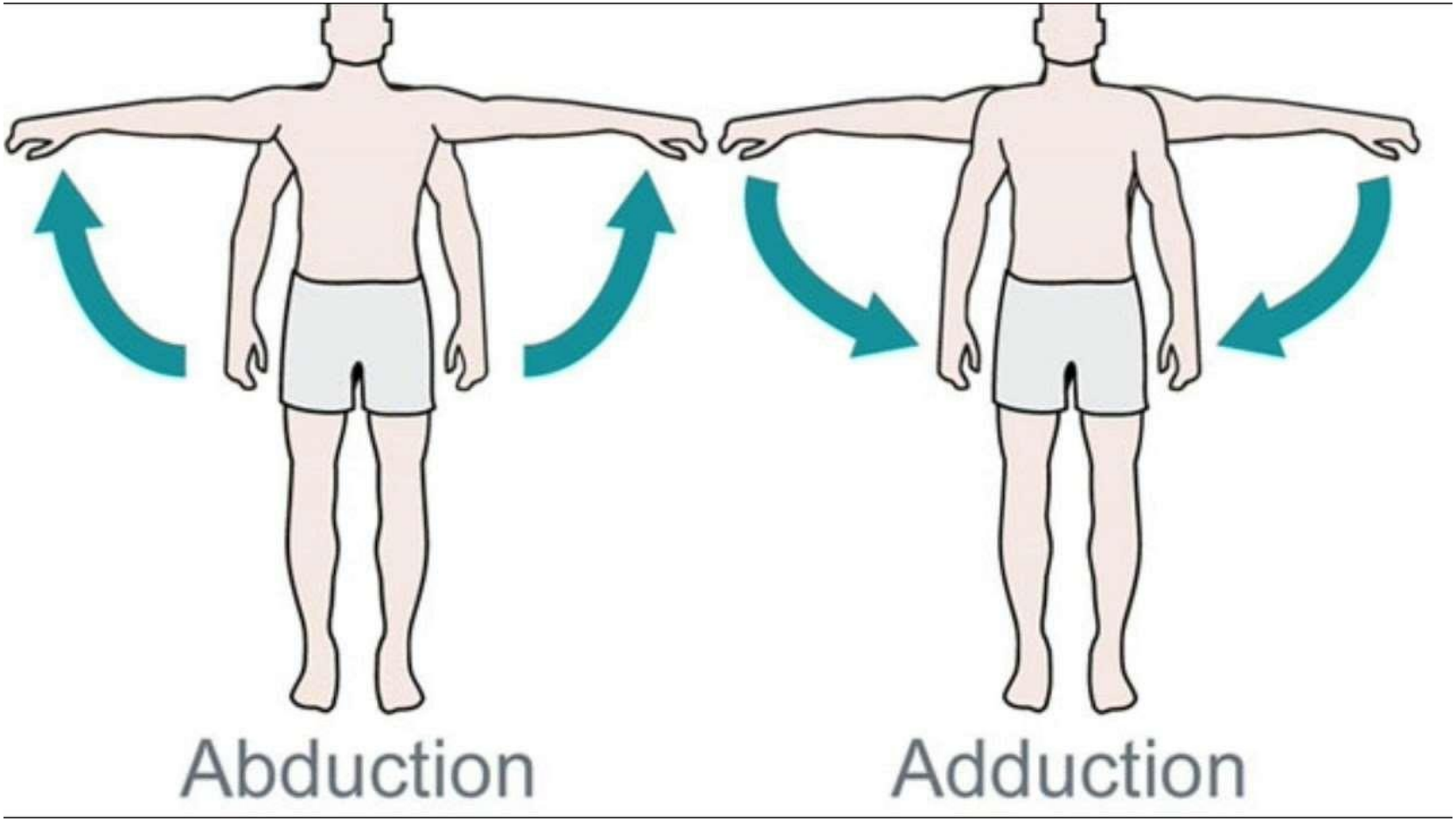
Rotation- movement of bone arround

Inversion- turning inwards of the foot

Eversion- turning outwards of the foot


EXTENSION
FLEXION


Inversion
Eversion


Abduction
Adduction

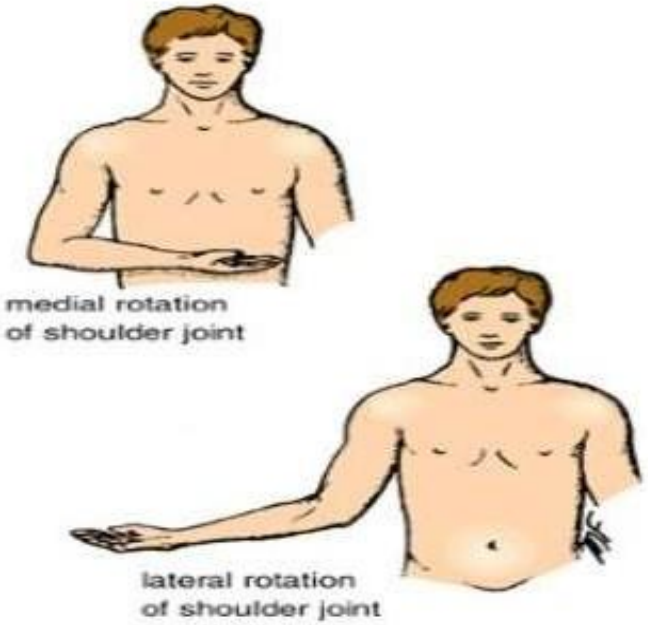
Medial & Lateral Rotation

- **Medial Rotation:**

  Inwards rotation

- **Lateral Rotation:**

  Outwards rotation



Centre of gravity

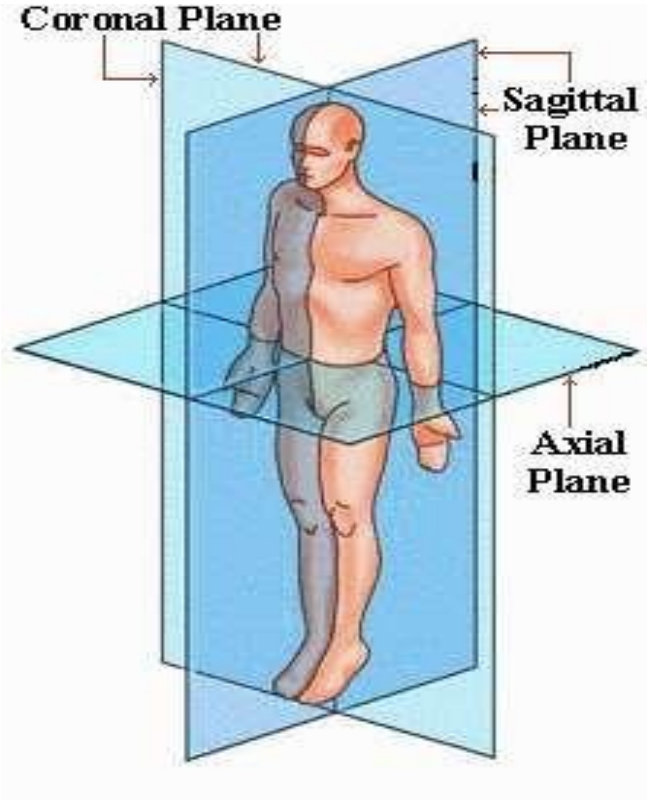
centre of gravity is the point through which the resultant of the weight of all the body acts.

line of gravity

- The location of this line in relation to the base of support has a huge influence on balance and stability. In the anatomical position (right) the line of gravity is between the legs and feet right under the person.

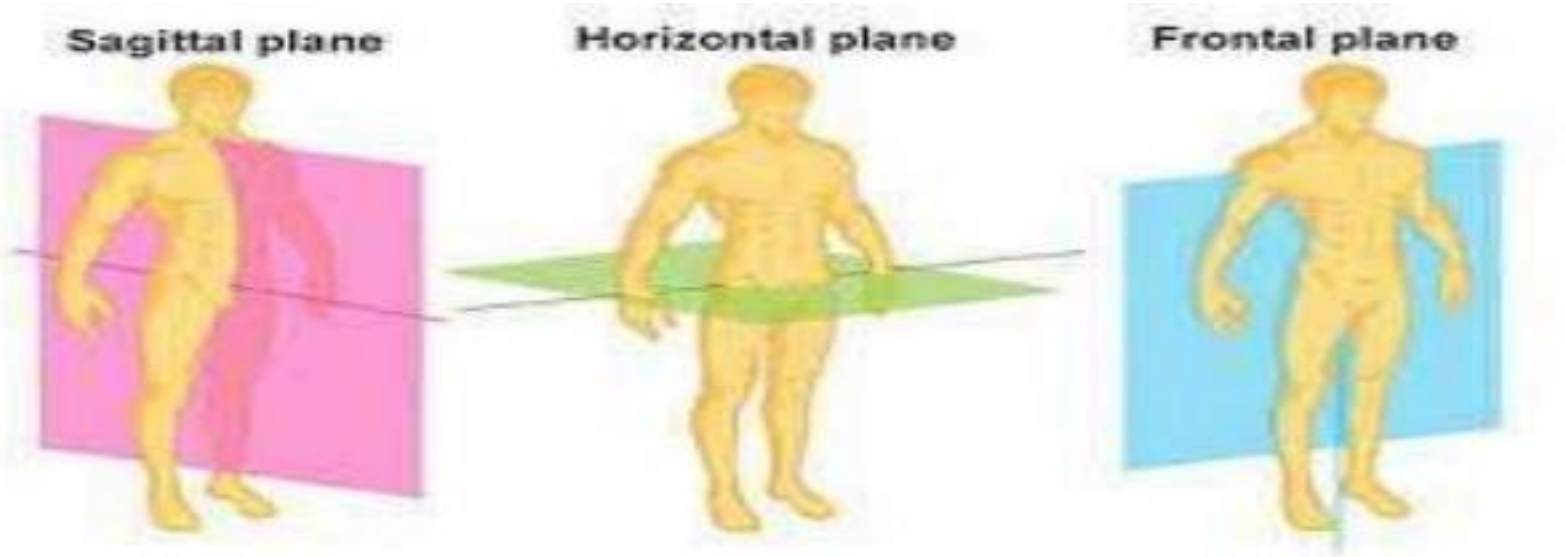
What is axis?

Axis its an imaginary line about which a body rotates.



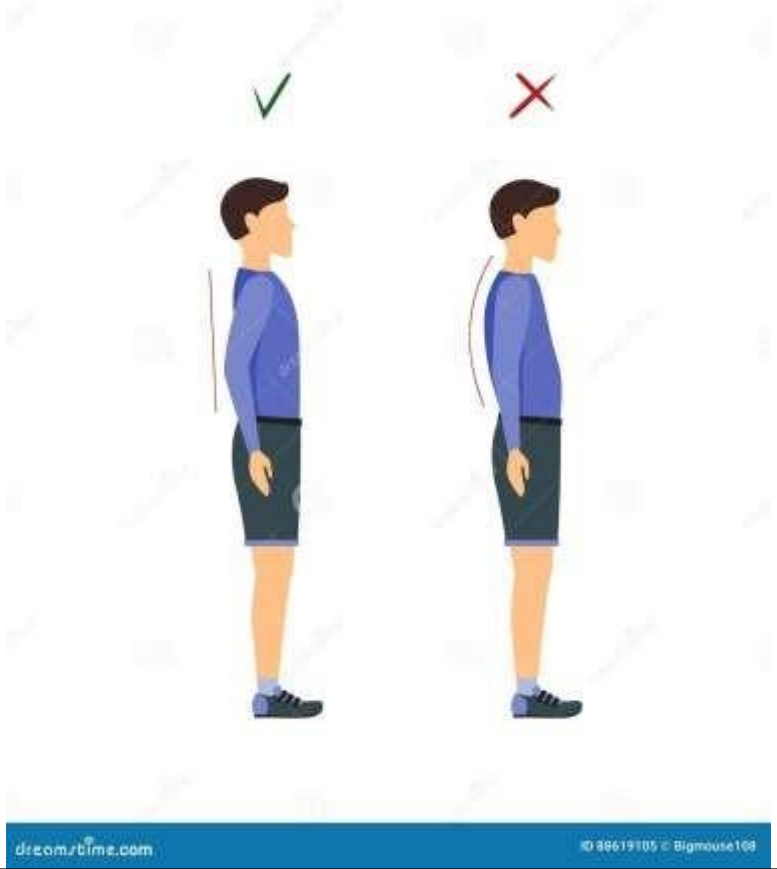
Plans of motion

Is the process of something moving or changing place , or event just change position.



POSTURE

The way a person holds and positions their body.



Good posture

Good posture is the attitude which, is assumed by body parts to maintain stability and balance with minimum effort and least strain during supportive position.

IMPORTANCE OF POSTURE

- For all health of the
- bones,
- joints and muscles.
- For the sake of the organs and general health.

Types of posture

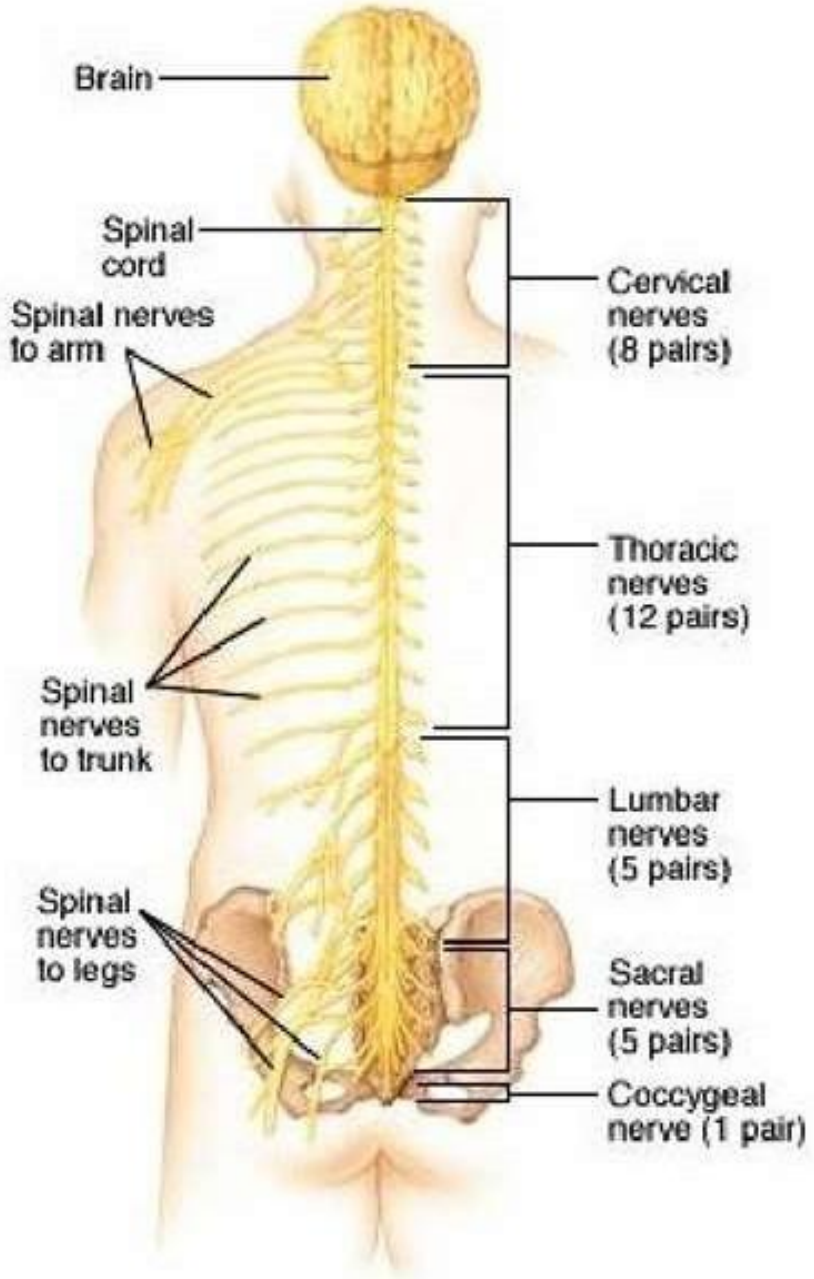
healthy- good posture

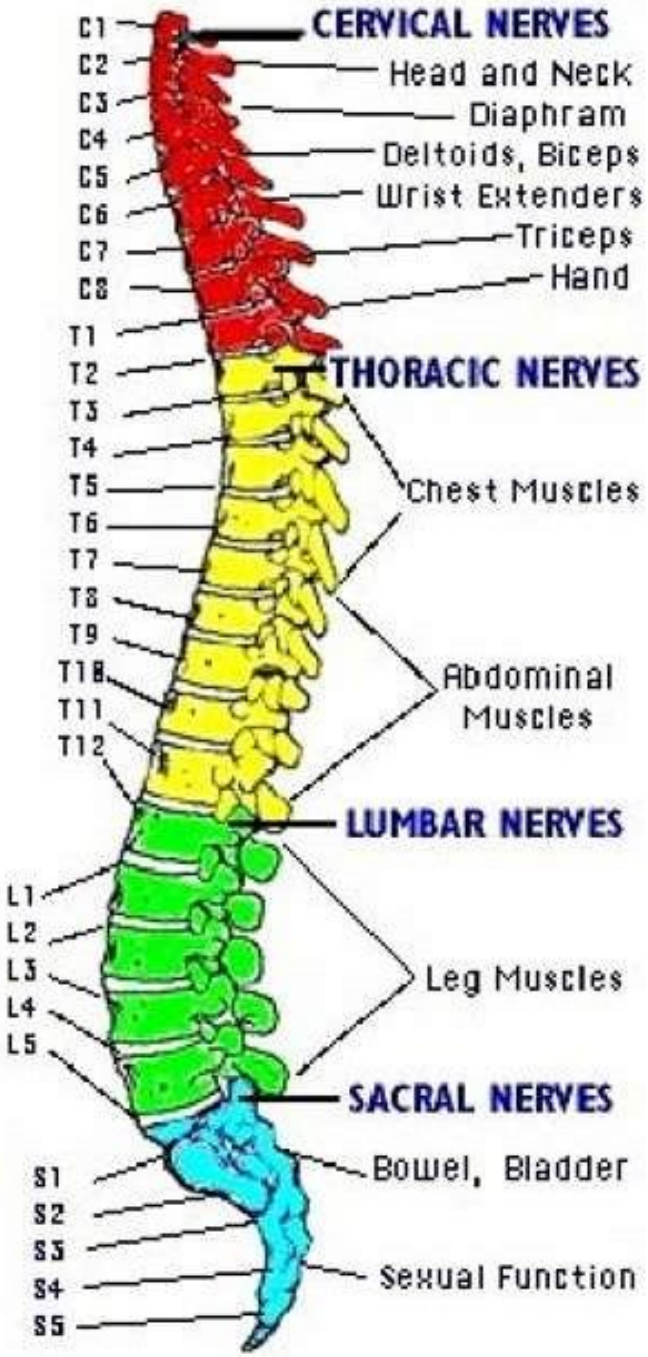
Kyphosis – a curve with thoracic spine backward convexity

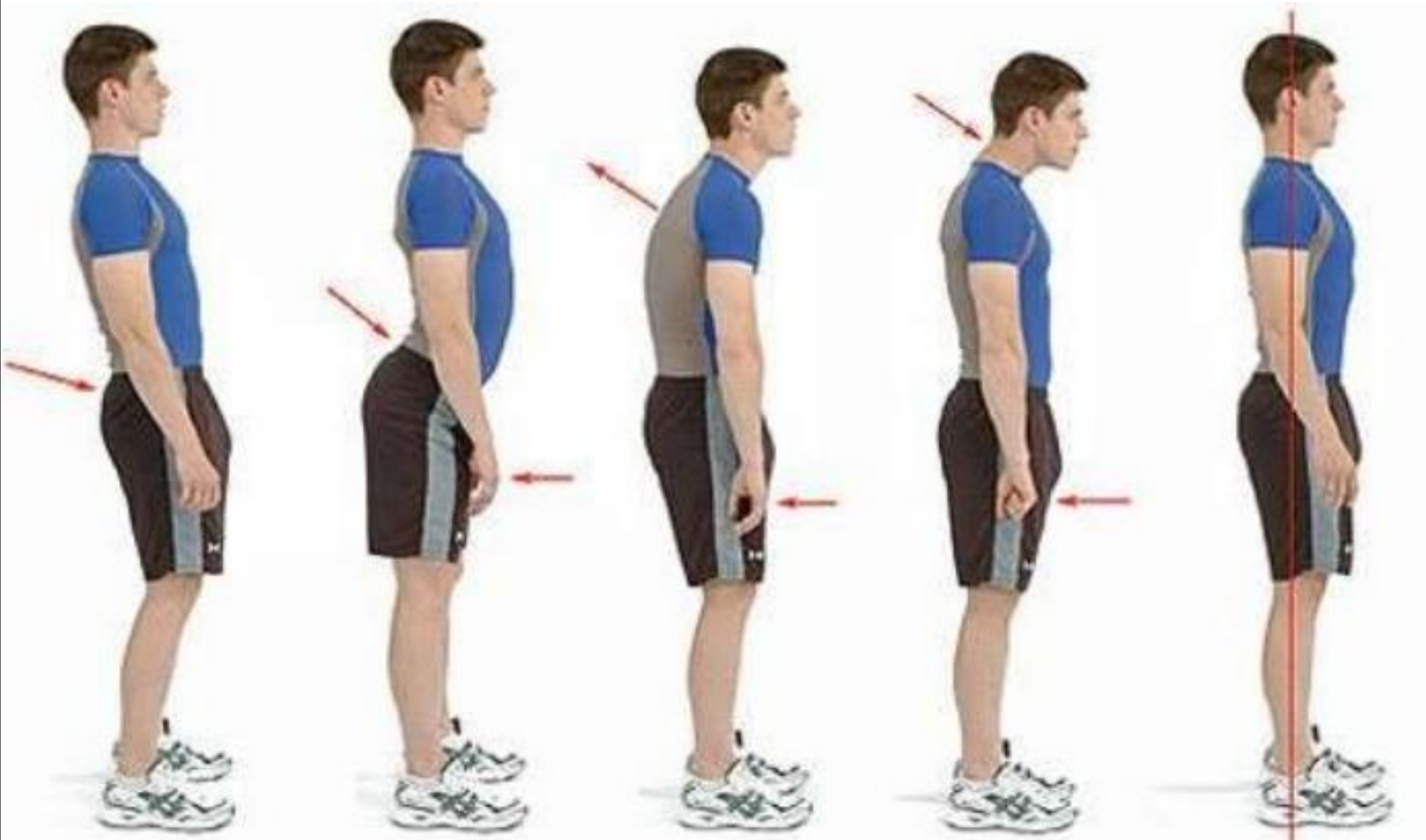
Flat back(scoliosis) – nature low back curve sacral nerves abnormal curveting.

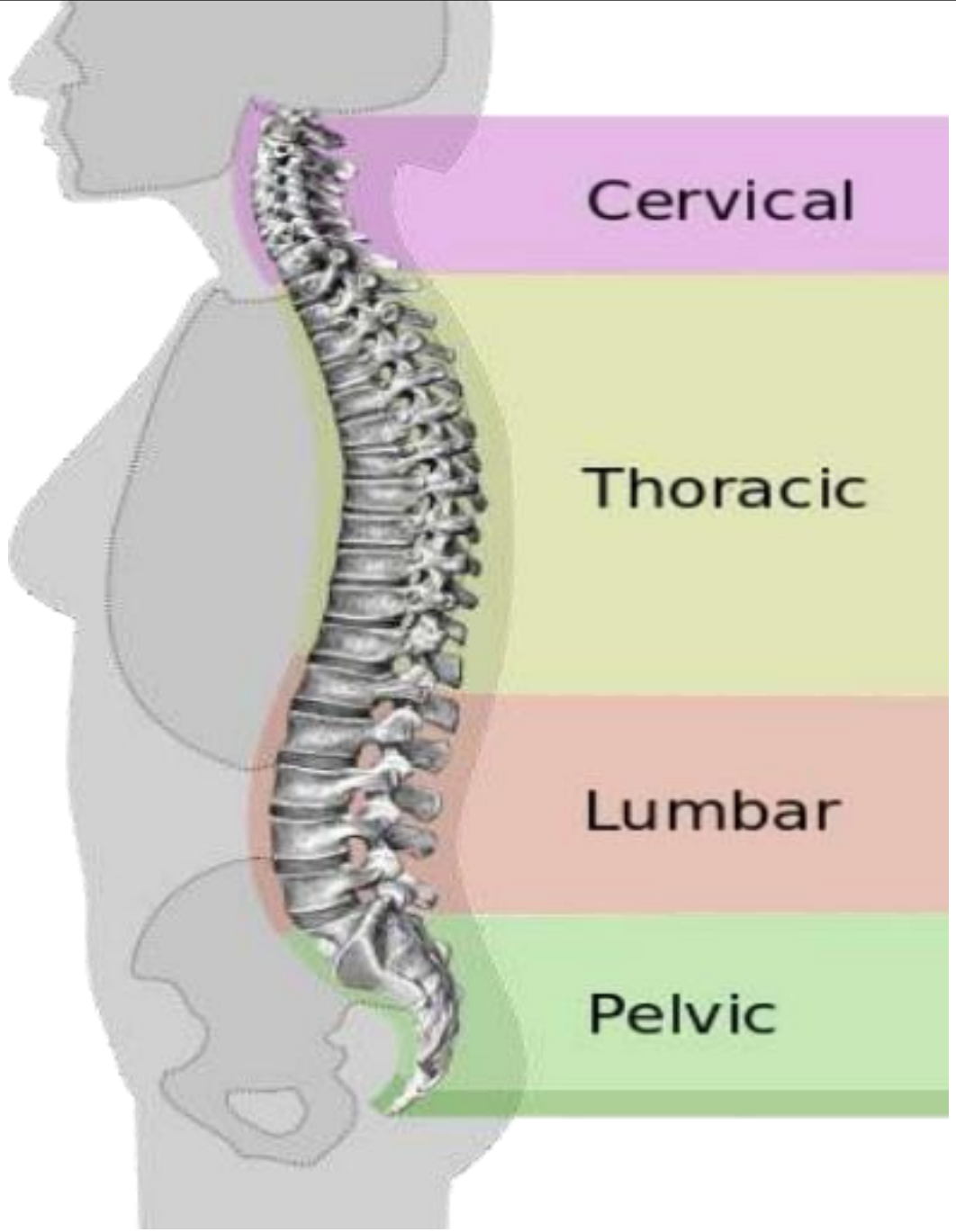
lordosis – a curve lumbar spine backward convexity.

Forward head - cervical spine

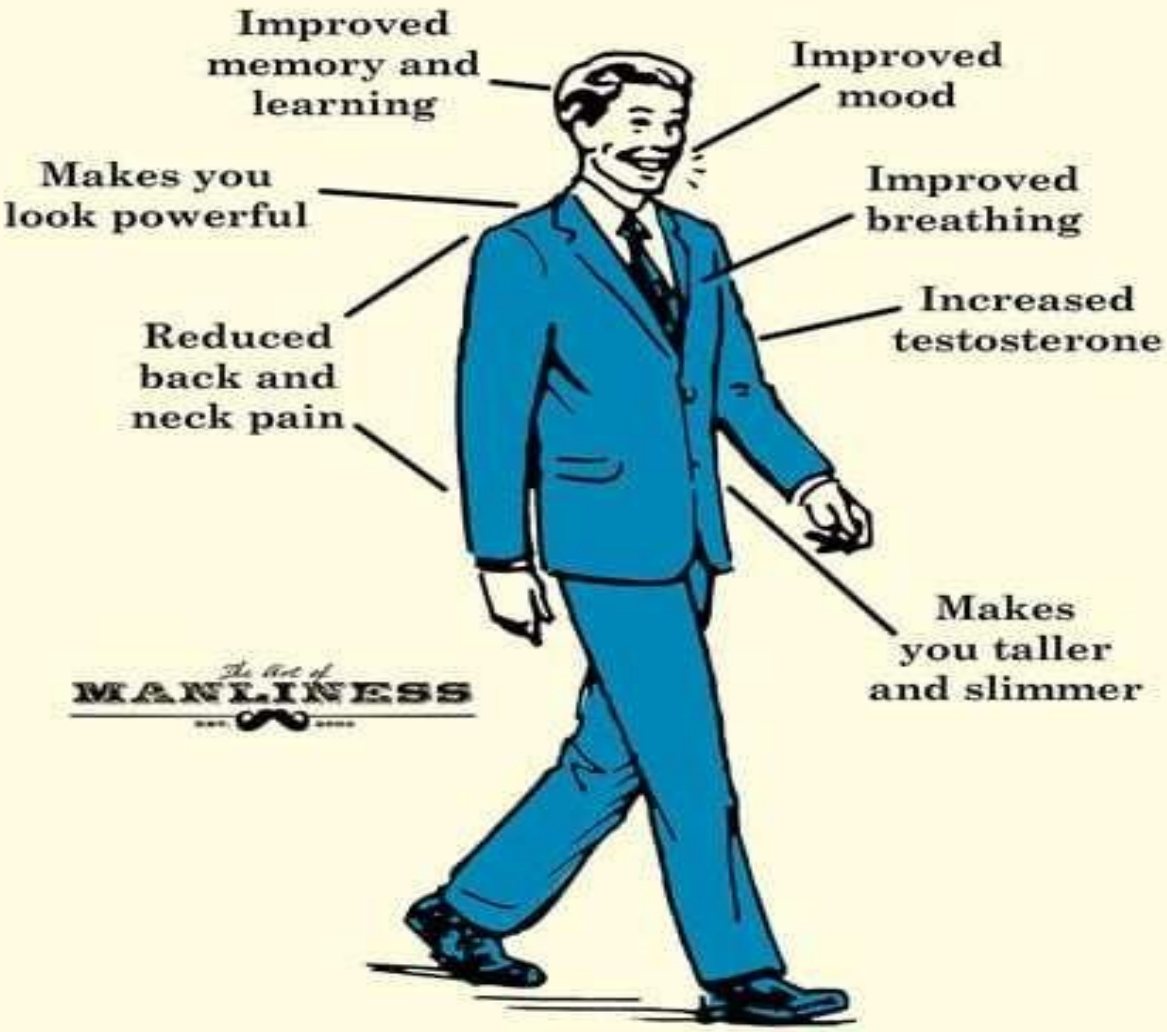

Brain
Spinal cord
Spinal nerves to arm
Spinal nerves to trunk
Spinal nerves to legs
Cervical nerves (8 pairs)
Thoracic nerves (12 pairs)
Lumbar nerves (5 pairs)
Sacral nerves (5 pairs)
Coccygeal nerve (1 pair)


C1
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
CERVICAL NERVES
Head and Neck
Diaphram
Deltoids, Biceps
Wrist Extenders
Triceps
Hand
THORACIC NERVES
Chest Muscles
Abdominal Muscles
LUMBAR NERVES
Leg Muscles
SACRAL NERVES
Bowel, Bladder
Sexual Function


Sway Back
Lumbar Lordosis
Thoracic Kyphosis
Forward Head
Good Posture


Cervical
Thoracic
Lumbar
Pelvic

Benefits of Good Posture



UNIT II

joints

A part of the body where two bones fit together and are able to bend.

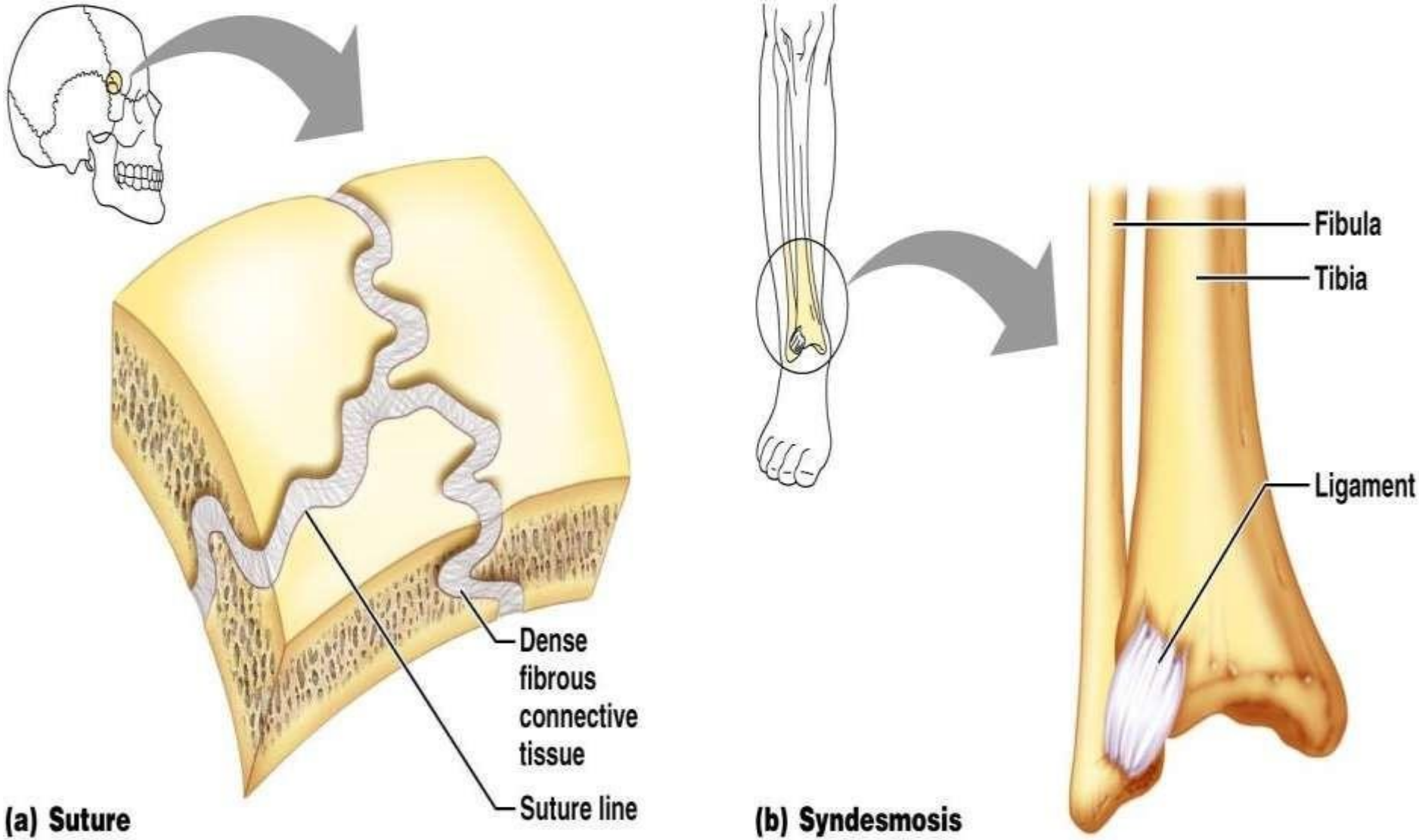
Classification of Joints

- 1. According to the type of tissue at the joint:
- a) **Fibrous joint** -- uses fibrous connective tissue to articulate bones.
- b) **Cartilaginous joint** -- uses hyaline cartilage and/or fibro- cartilage to articulate bones.
- c) **Synovial joint --** uses cartilage, synovial membrane, joint capsule, and ligaments to articulate bones.

Fibrous Joints

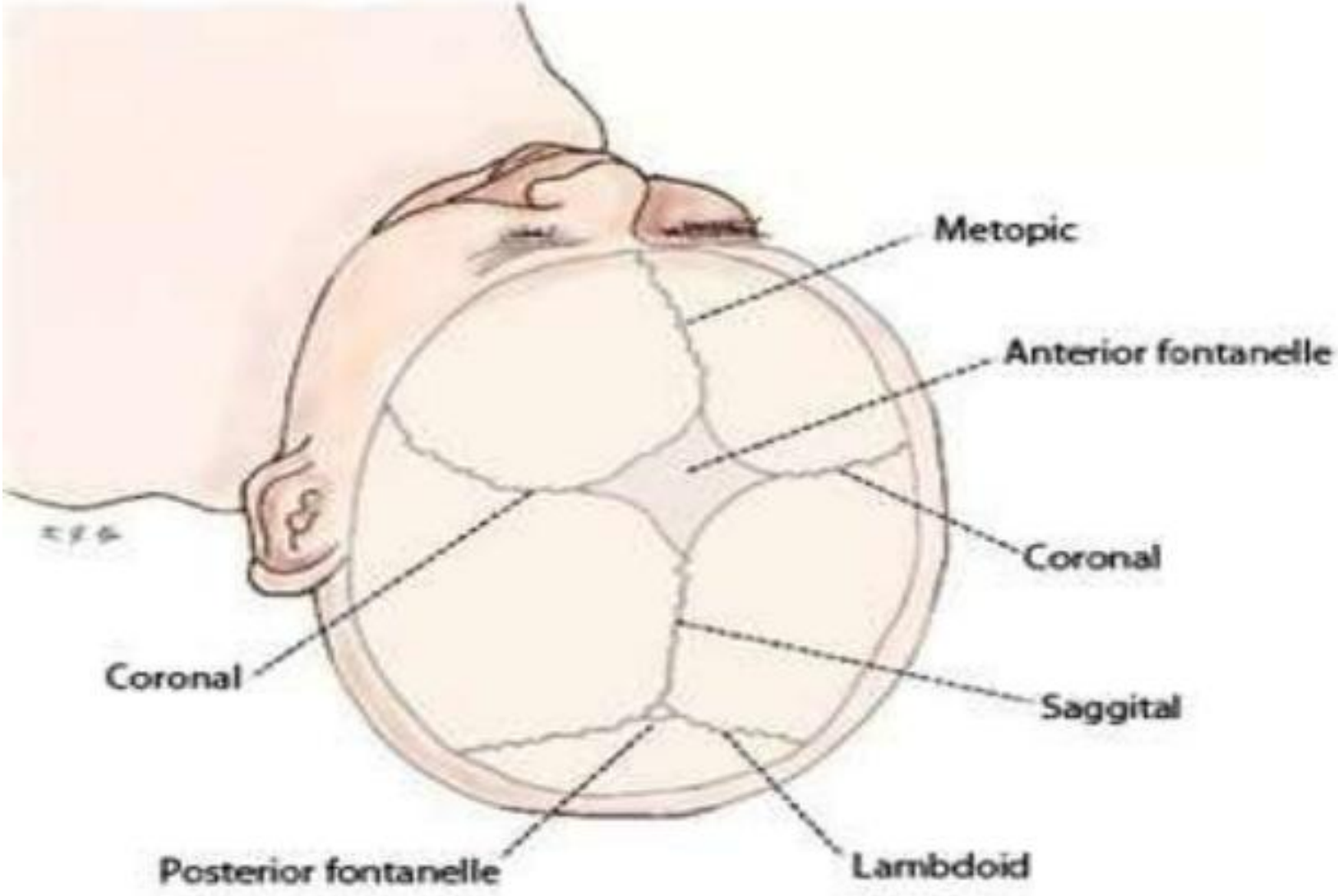
- a) Fibrous connective tissue fastens the bones tightly.
- b) Small amount of movement.

Fibrous Joints



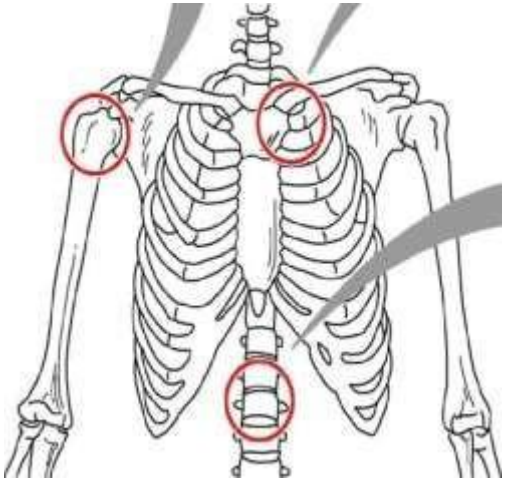
Cranial Sutures

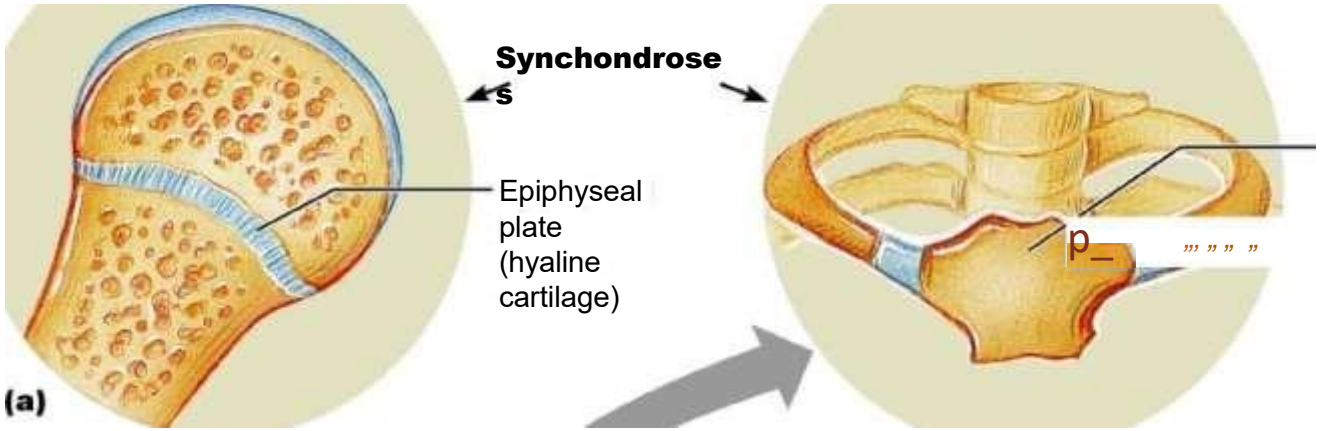
View from top of head



Cartilaginous joints

- **a) Hyaline cartilage and/or fibro cartilage form the joint.**
- b) Usually slightly movable and very strong.
- c) Subdivided into:
- -- **Synchondrosis**
- -- **Symphysis**



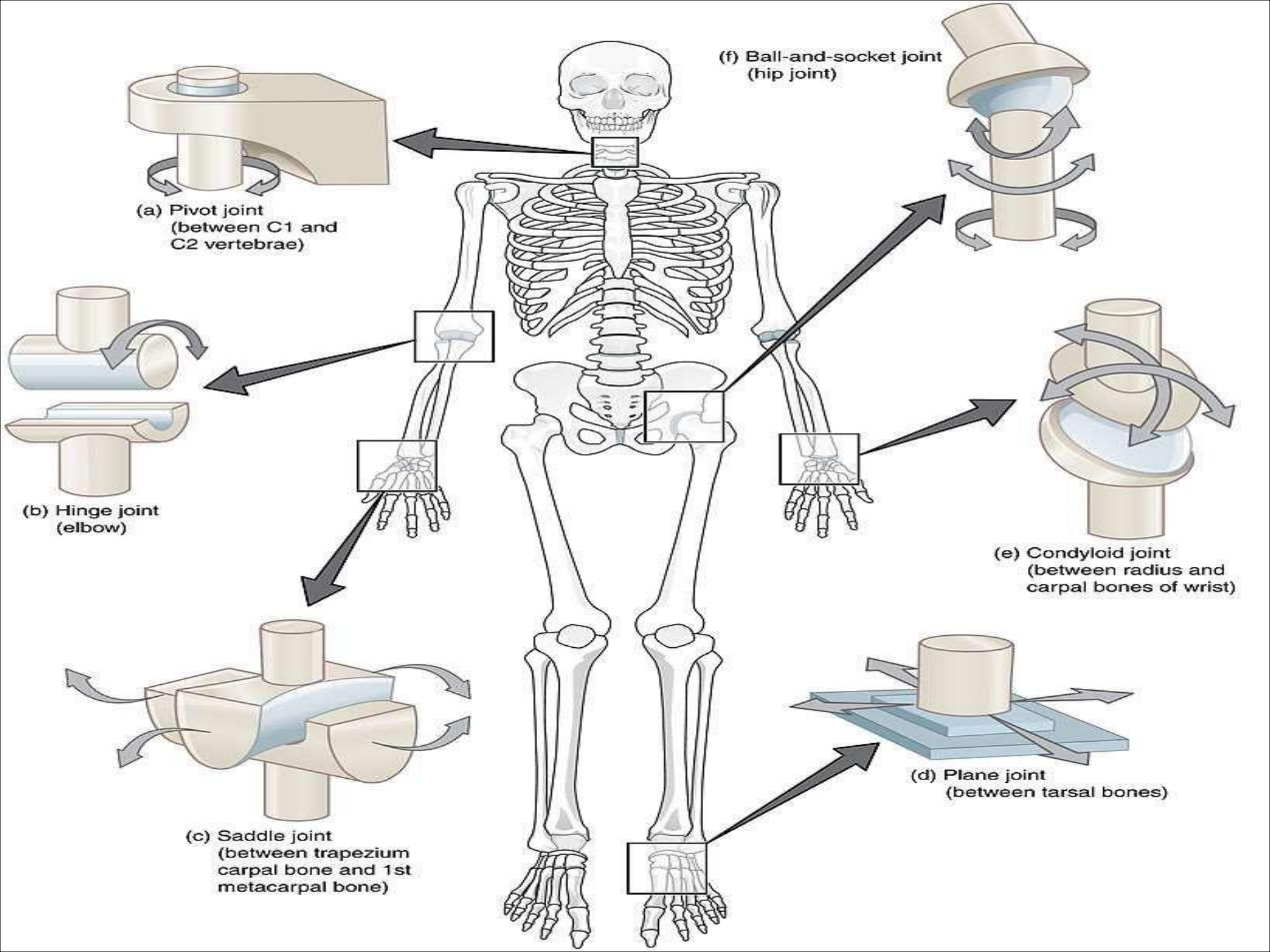

Synchondrose
s
Epiphyseal
plate
(hyaline
cartilage)
(a)

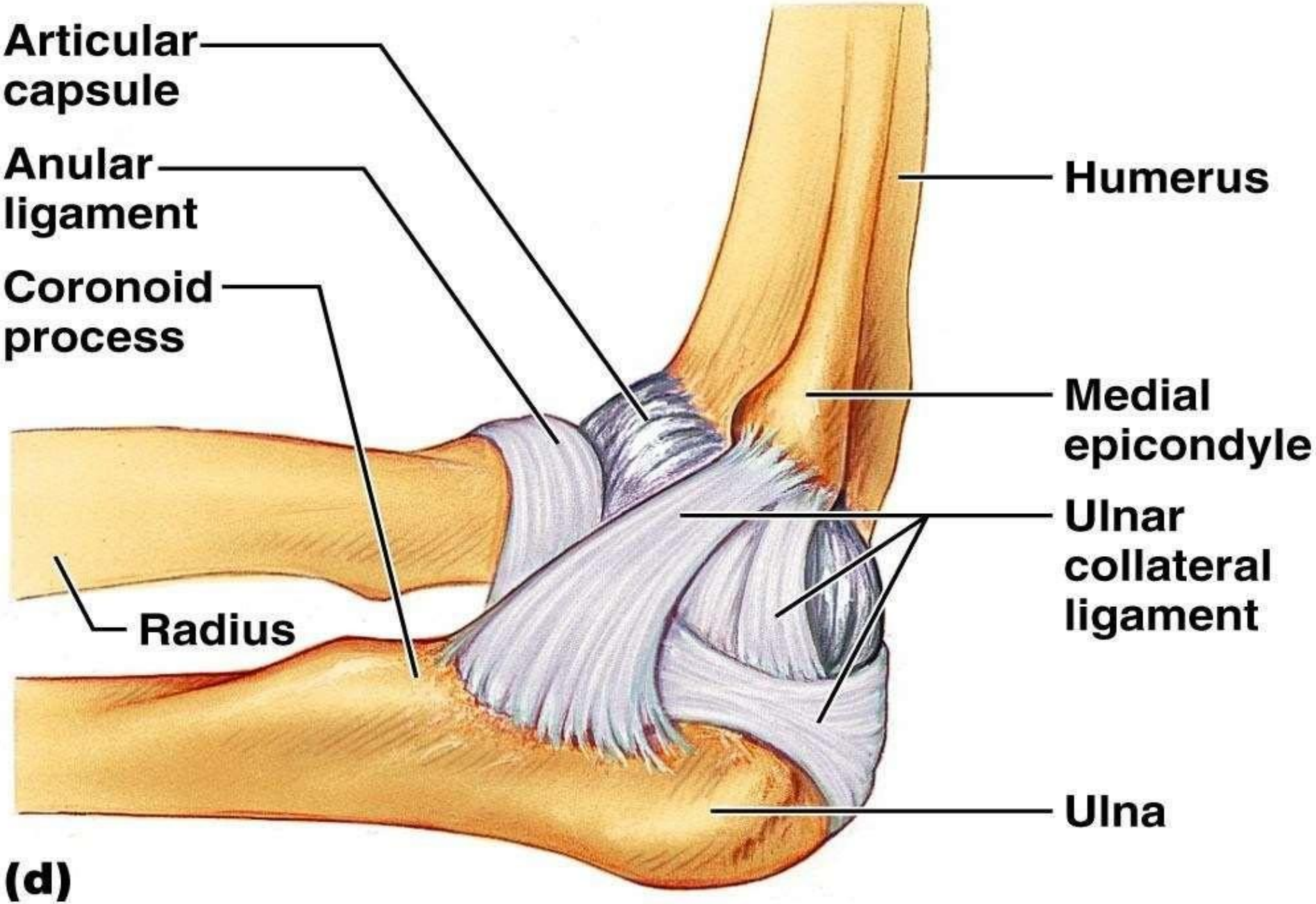
Synovial Joints

- a) Most joints are synovial joints.
- b) Usually freely movable .

- Subdivided into:
- -- **gliding** = allows back and forth movement (e.g.between tarsal bones).
- -- **hinge** = allows folding movement (e.g. elbow joint).
- -- **pivot** = allows rotation around an axis (e.g. between
- atlas and axis at the process).

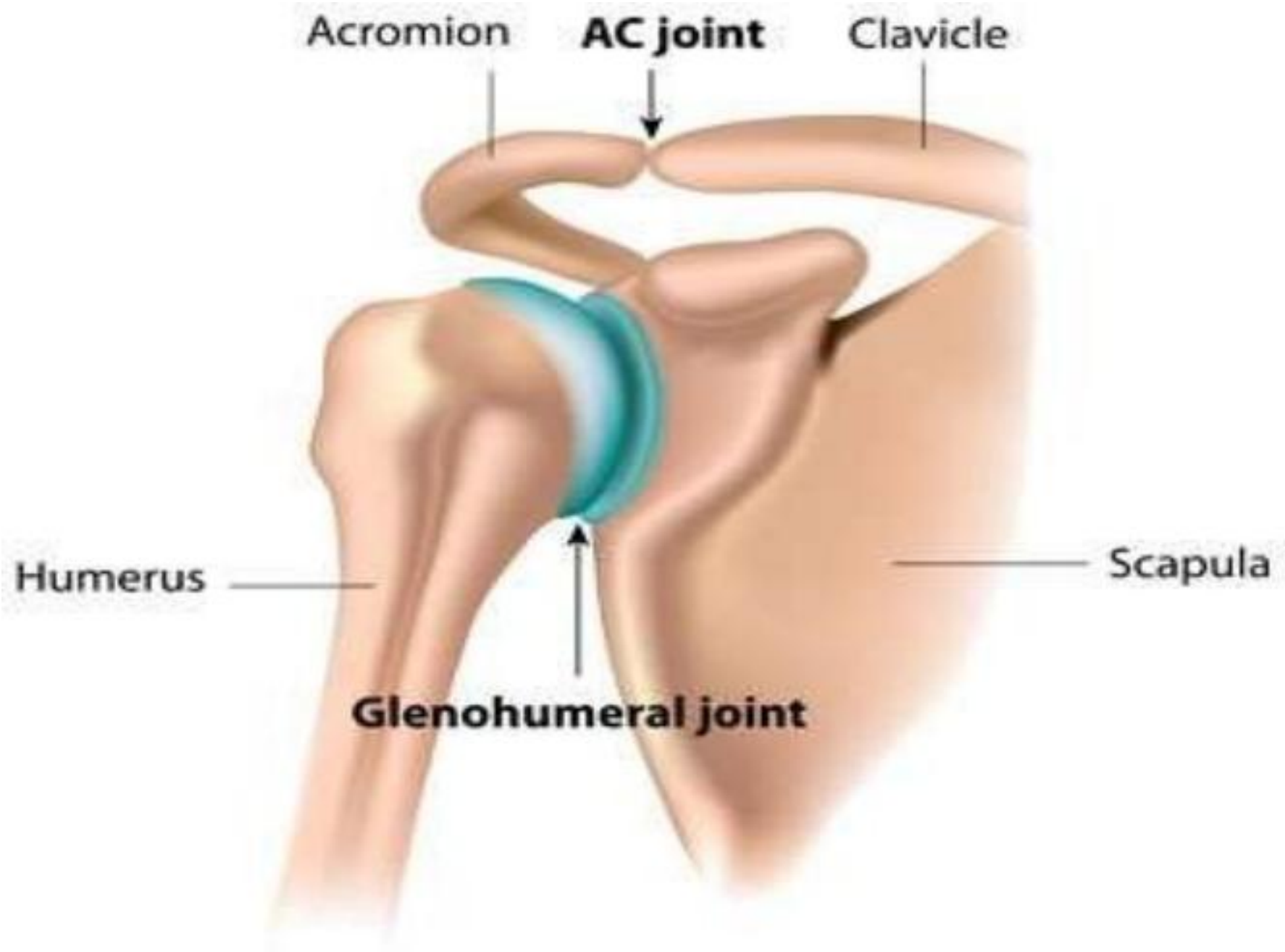
- -- **condyloid** = allows all movements except rotation (e.g. between radius carpal bones of wrist).
- -- **saddle** = allows all movements except rotation (e.g. between carpals and metacarpals).
- -- **ball - and - socket** = allows all movements (e.g. shoulder joint and hip joint).
-


(a) Pivot joint
(between C1 and
C2 vertebrae)
(b) Hinge joint
(elbow)
(c) Saddle joint
(between trapezium
carpal bone and 1st
metacarpal bone)
(d) Plane joint
(between tarsal bones)
(e) Condyloid joint
(between radius and
carpal bones of wrist)
(f) Ball-and-socket joint
(hip joint)



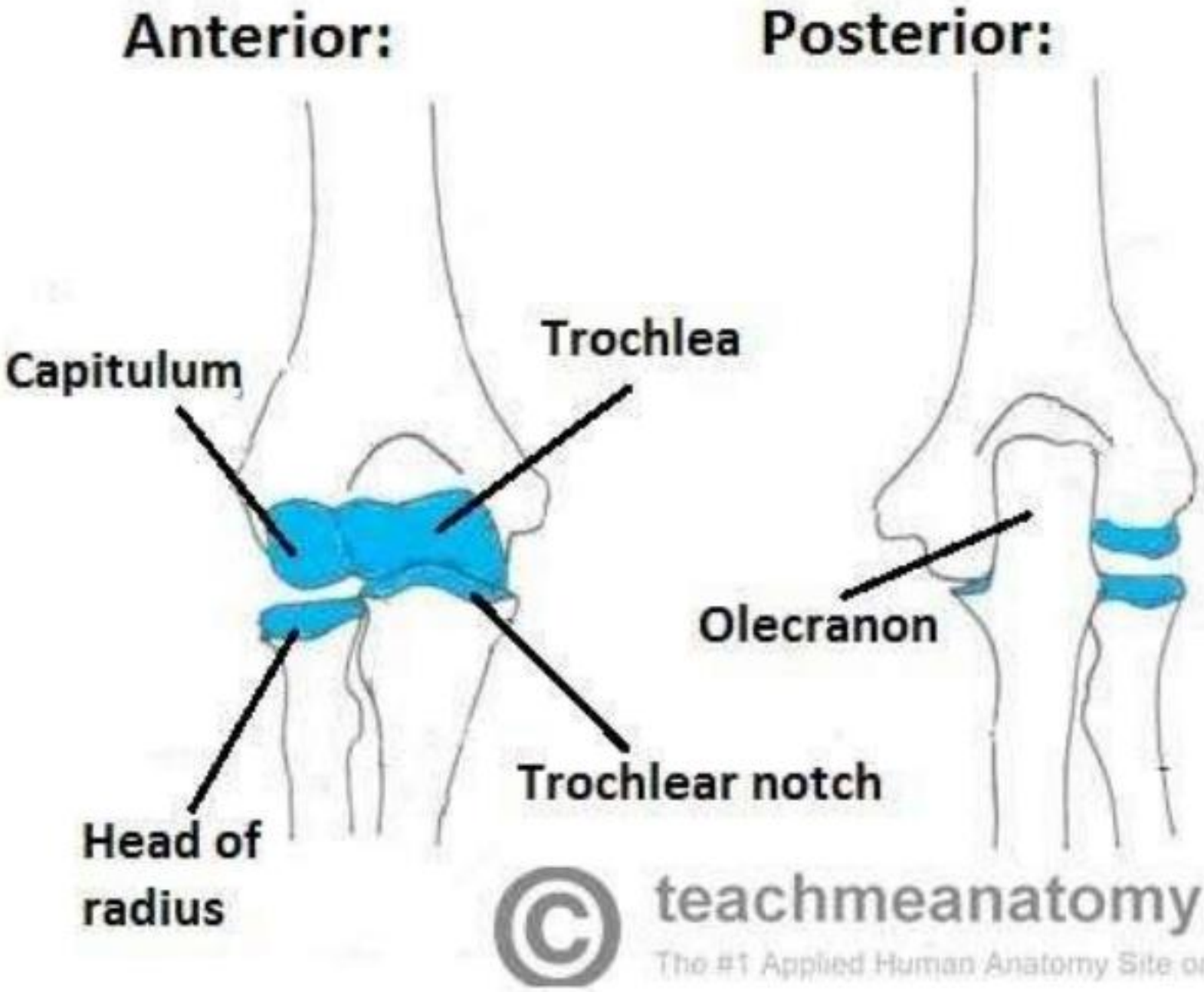
shoulder joint

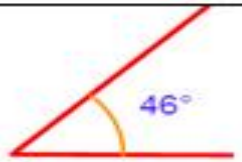
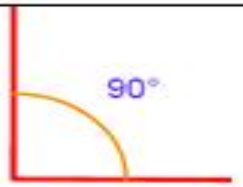
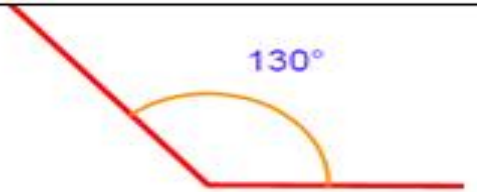
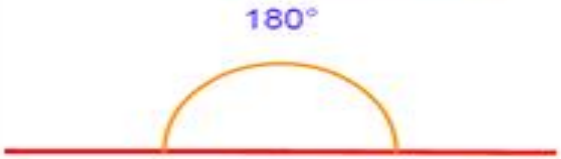
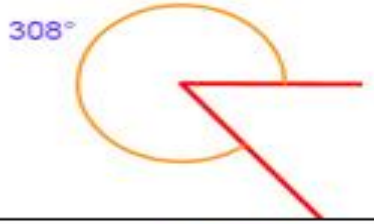
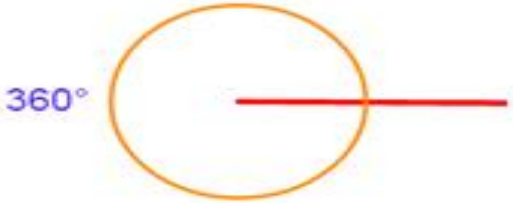
- The **shoulder joint** (**glenohumeral joint**) is a ball and socket **joint** between the scapula and the humerus. It is the major **joint** connecting the upper limb to the trunk. It is one of the most mobile **joints** in the human body, at the cost of **joint** stability.


Acromion
AC joint
Clavicle
Humerus
Scapula
Glenohumeral joint

Elbow joint

- Hinge joint
- Ligaments:
- The **elbow joint** is a complex hinge **joint** formed between the distal end of the humerus in the upper arm and the proximal ends of the ulna and radius in the forearm. The **elbow** allows for the flexion and extension of the forearm relative to the upper arm, as well as rotation of the forearm and wrist.



Type of Angle	Description	Example
Acute Angle	An angle that is less than 90°	
Right Angle	An angle that is exactly 90°	
Obtuse Angle	An angle that is greater than 90° and less than 180°	
Straight Angle	An angle that is exactly 180°	
Reflex Angle	An angle that is greater than 180° and less than 360°	
Full Angle	An angle that is exactly 360°	

Pectoralis major

Origin- sternal end of clavicle, ribs 1-6

insertion – greater tubercle of hummers

action- flexes arm at shoulder rotates arm medially

adducts arm

Pectoralis minor

- Origin- ribs 1-3
- insertion – process of the scapula
- action- scapula downward rotates scapula

Pectoralis Major

Origins: Sternum & Clavicle

Insertion: Humerus, Ribs

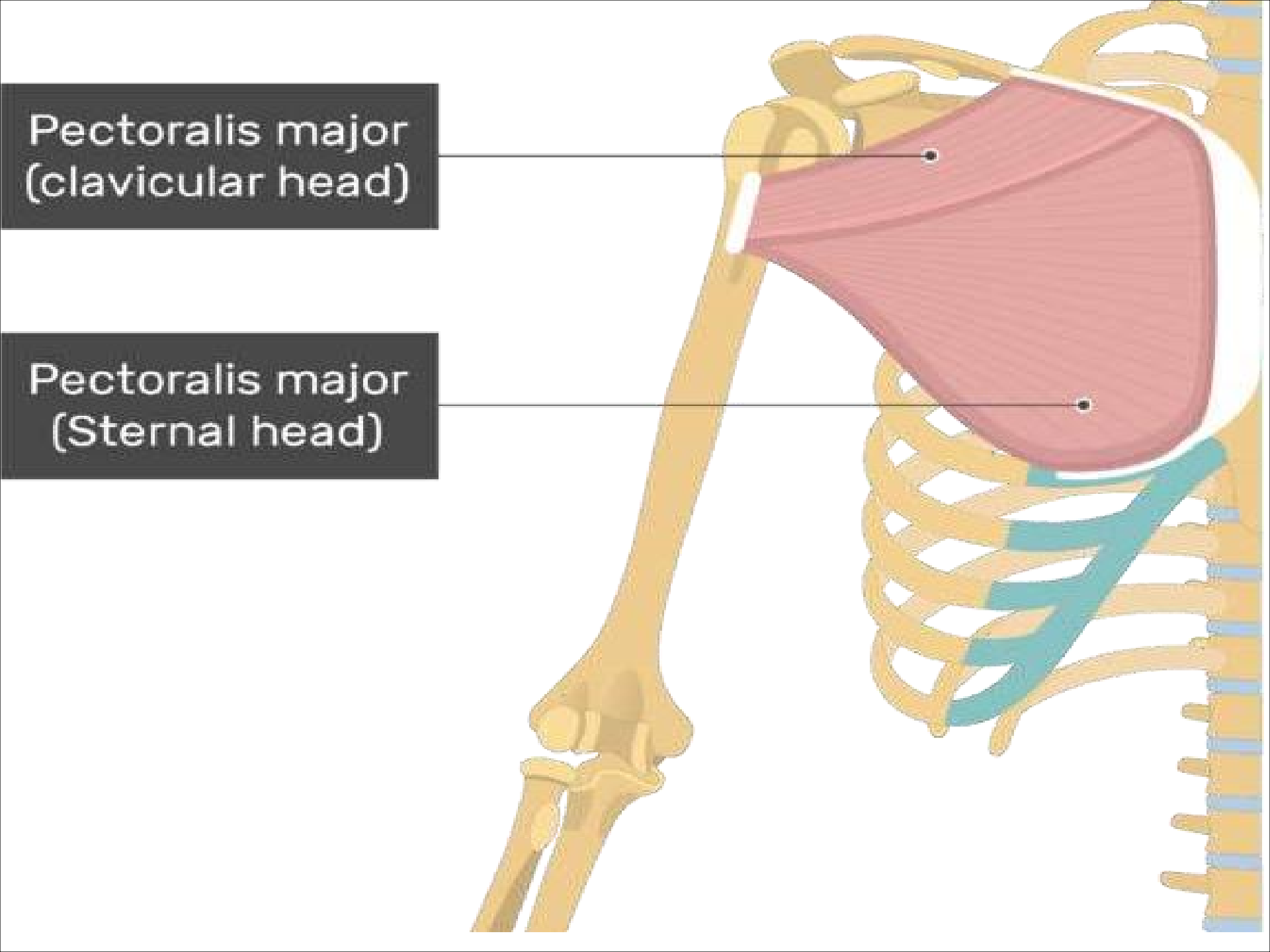
Actions: Shoulder flexion, Horizontal shoulder flexion, Upward diagonal flexion & Downward diagonal flexion

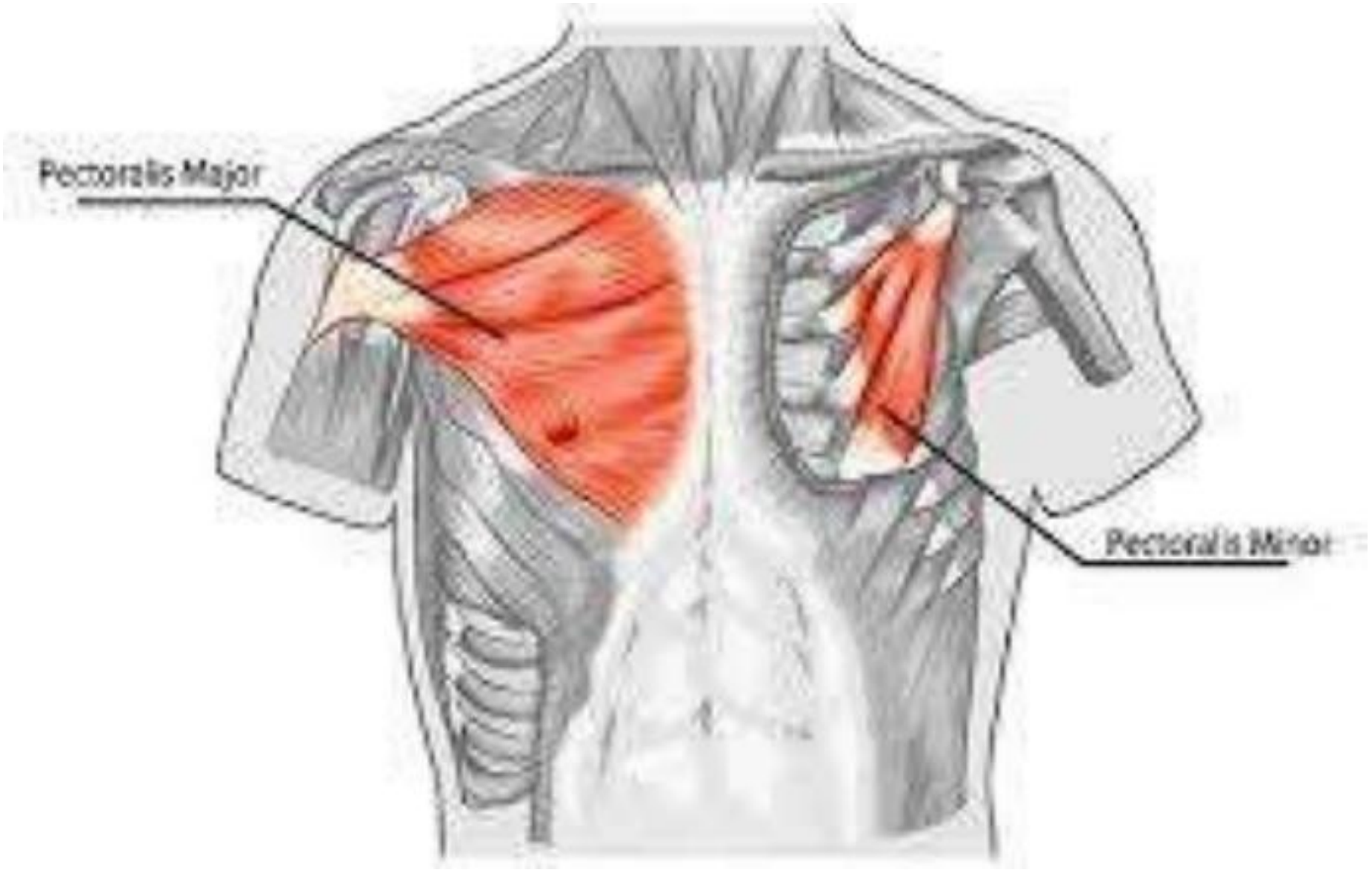
Pectoralis Minor

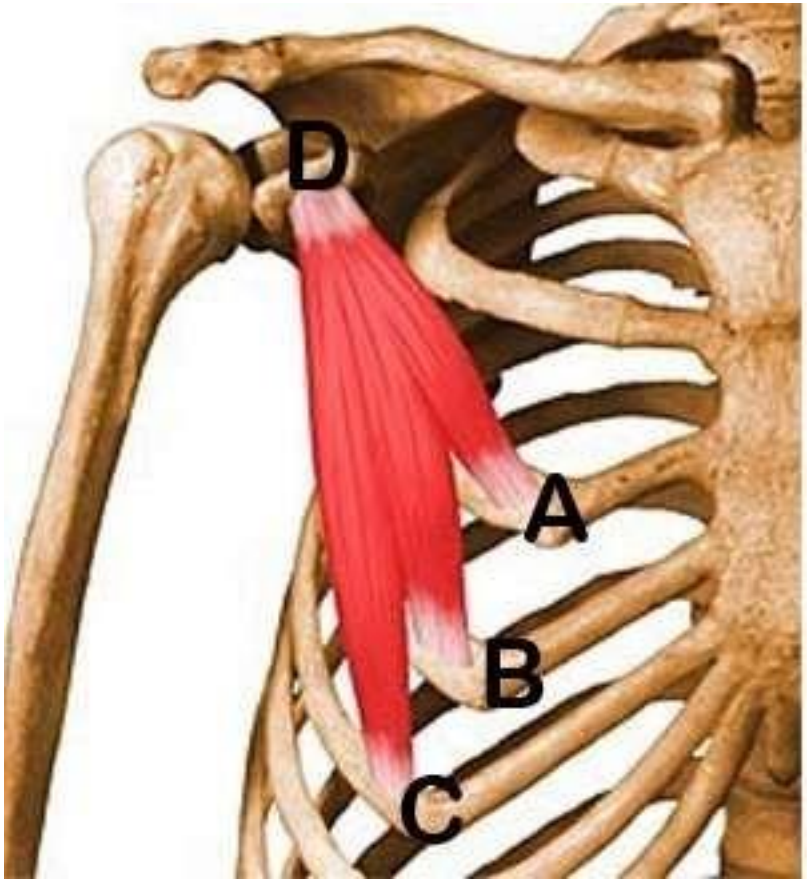
Insertion: Scapula

Action: Scapula depression

Origin: Ribs


Pectoralis major
(clavicular head)
Pectoralis major
(Sternal head)


Pectoralis Major
Pectoralis Minor



Origin point of the Pectoralis Minor

A. 3rd Rib
B. 4th Rib
C. 5th Rib

Insertion point of Pectoralis Minor

D. Upper surface of the Scapula (shoulder blade)

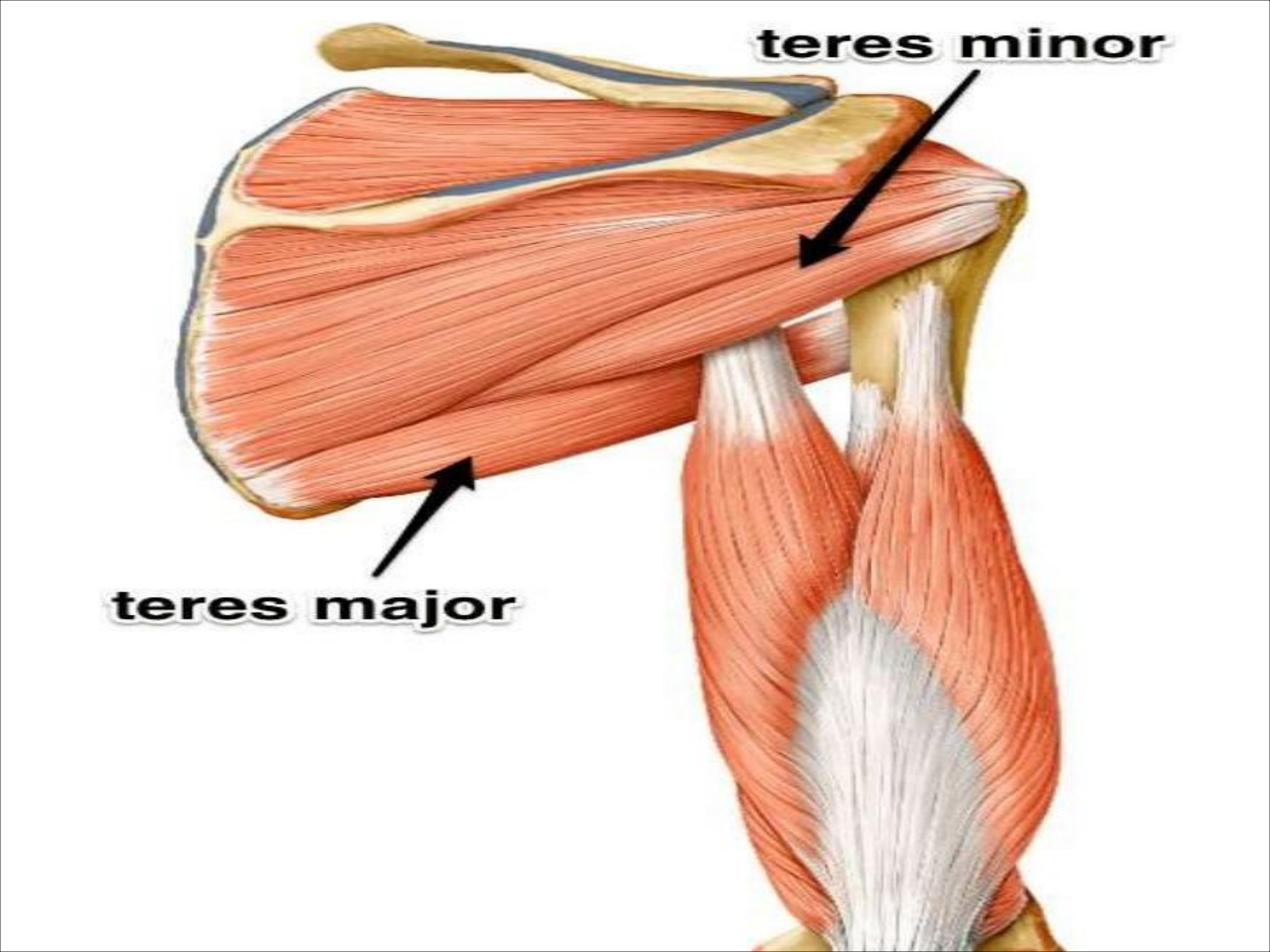
musclesused.com

Teres minor

- Origin- interior angle of the scapula
- insertion – lesser tubercle of the hummers
- action- adducts arm rotates arm extends arm at shoulder.

Teres Minor

- Origin: Axillary border of scapula
- Insertion: Greater tubercle of humerus
- Action: Rotates humerus laterally

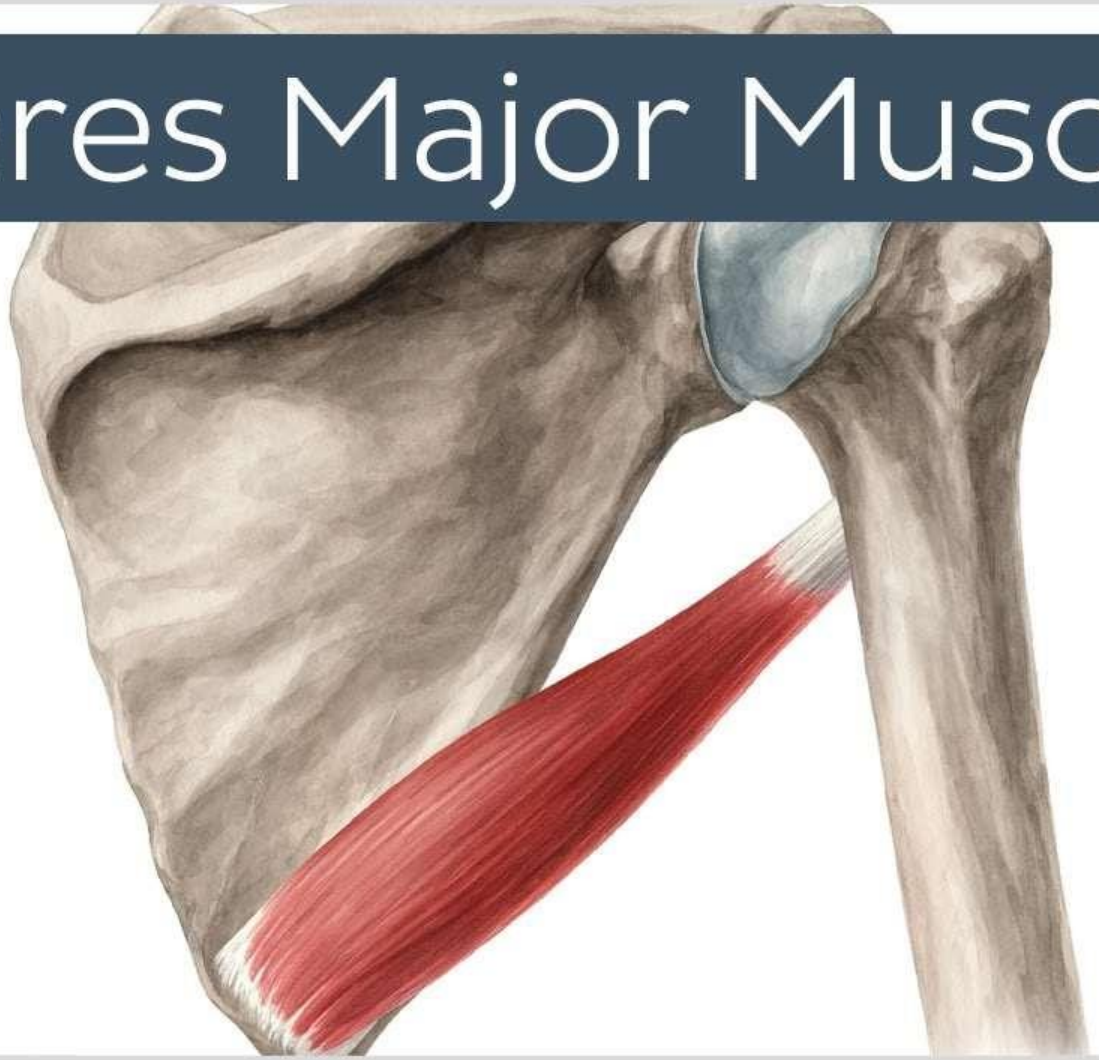

teres minor
teres major

Teres major

- Origin- sternal end of clavicle, ribs 1-6
- insertion – greater tubercle of hummers
- action- flexes arm at shoulder rotates arm

  medially adducts arm

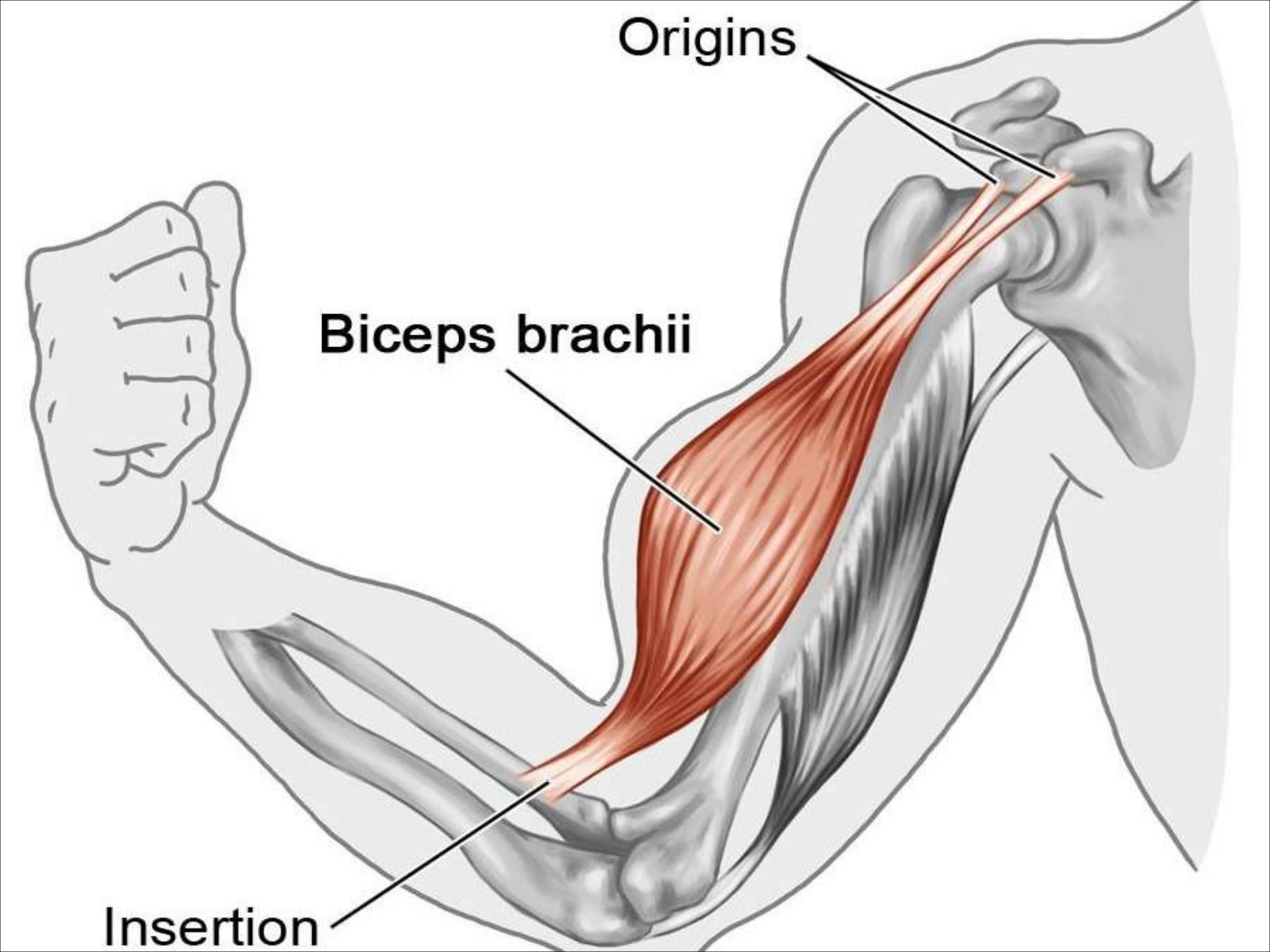
Teres Major Muscle

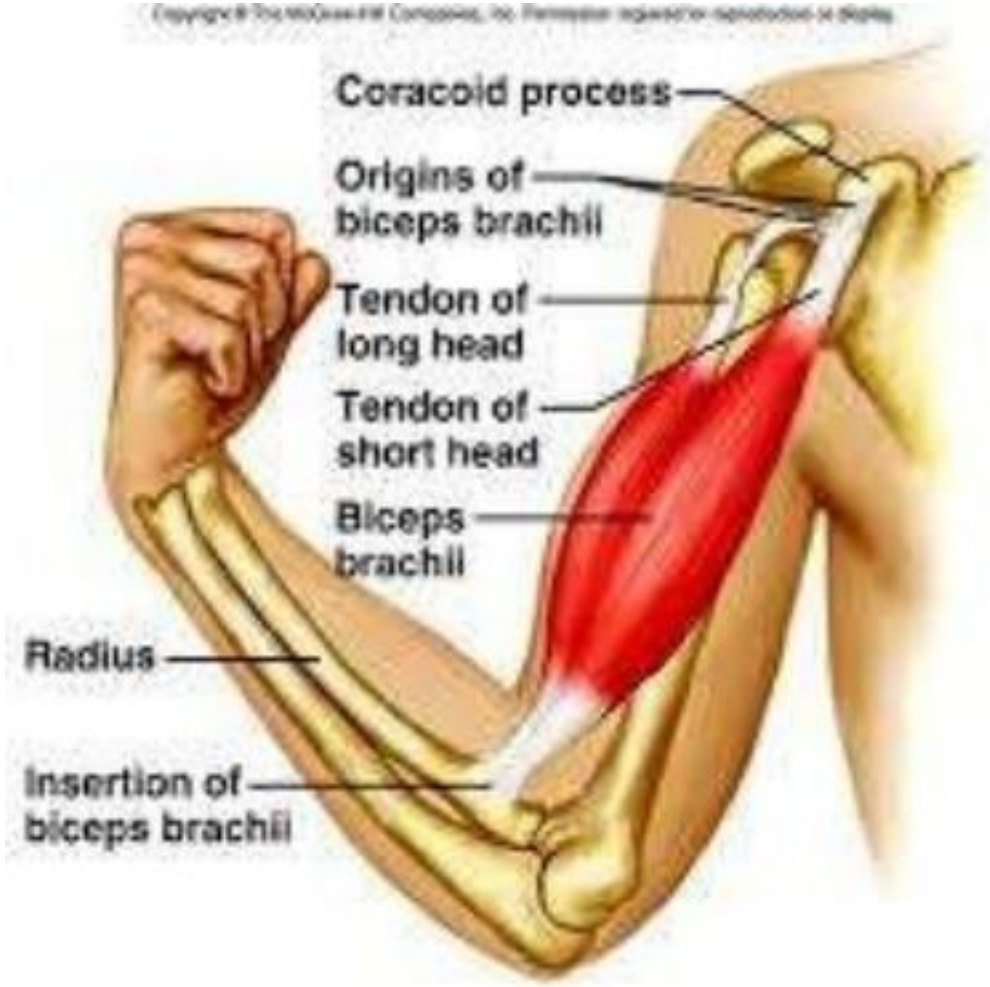


K

biceps

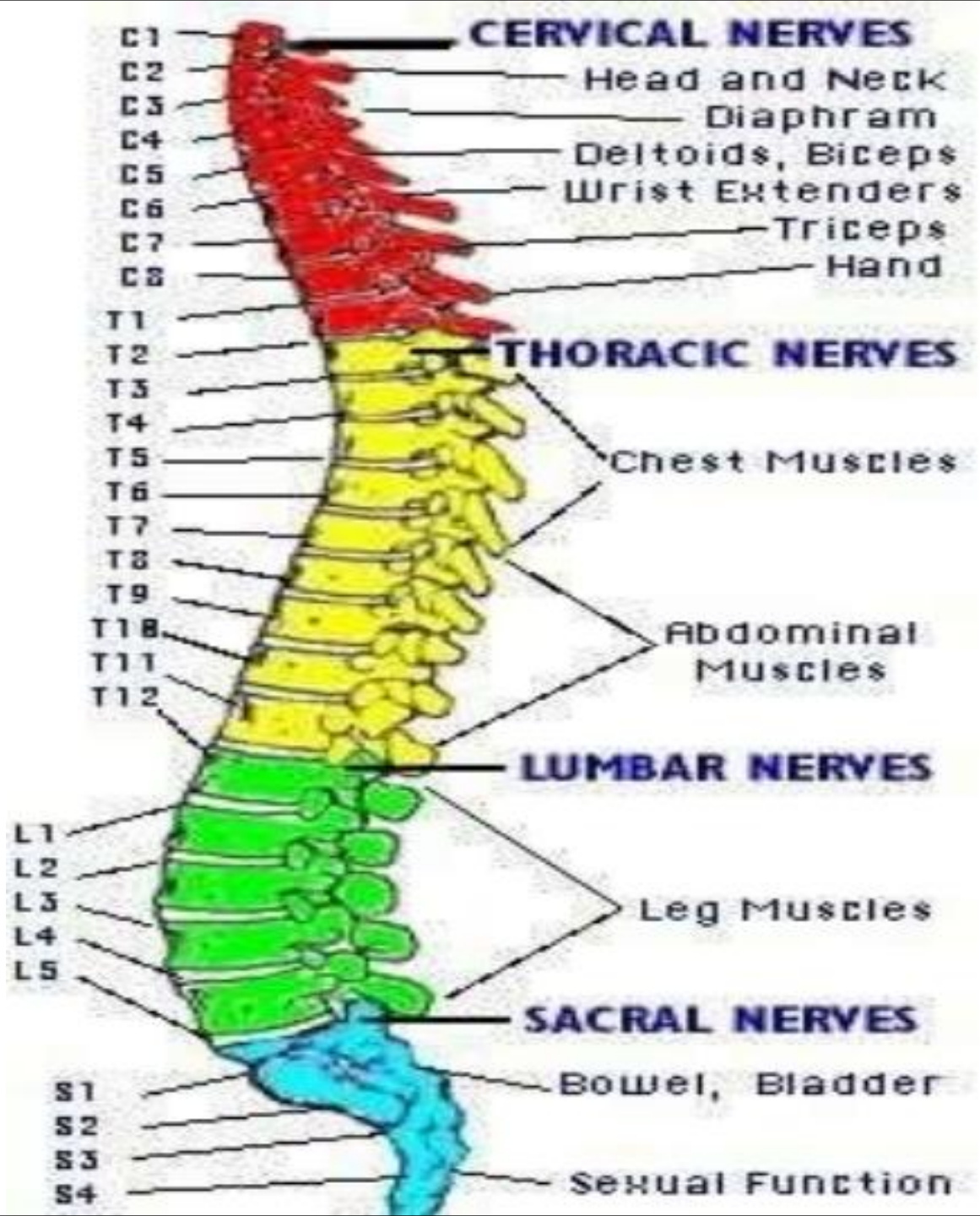
- Origin- tendon of long head – tendon of short head
- insertion – radial tuberosity
- action- flexion and extension

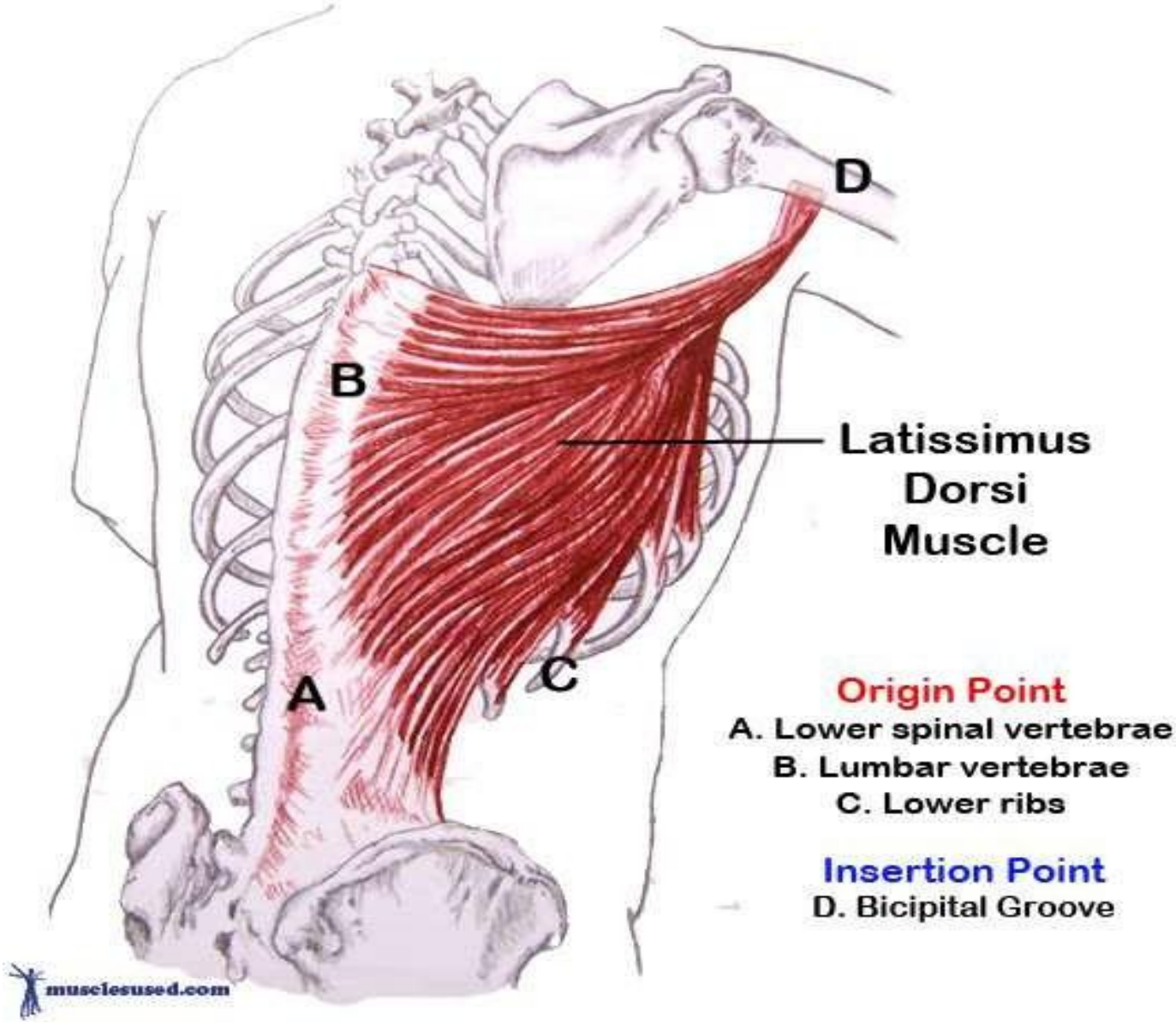

Origins
Biceps brachii
Insertion


Coracoid process
Origins of biceps brachii
Tendon of long head
Tendon of short head
Biceps brachii
Radius
Insertion of biceps brachii

Latissimus dorsi

- Origin- spinous process of t7-t12, ribs 9-12
- insertion – inter tubercular groove of the hummerus
- action- extends arm at shoulder


C1
C2
C3
C4
C5
C6
C7
C8
CERVICAL NERVES
Head and Neck
Diaphram
Deltoids, Biceps
Wrist Extenders
Triceps
Hand
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
THORACIC NERVES
Chest Muscles
Abdominal Muscles
LUMBAR NERVES
L1
L2
L3
L4
L5
Leg Muscles
SACRAL NERVES
S1
S2
S3
S4
Bowel, Bladder
Sexual Function



Origin Point

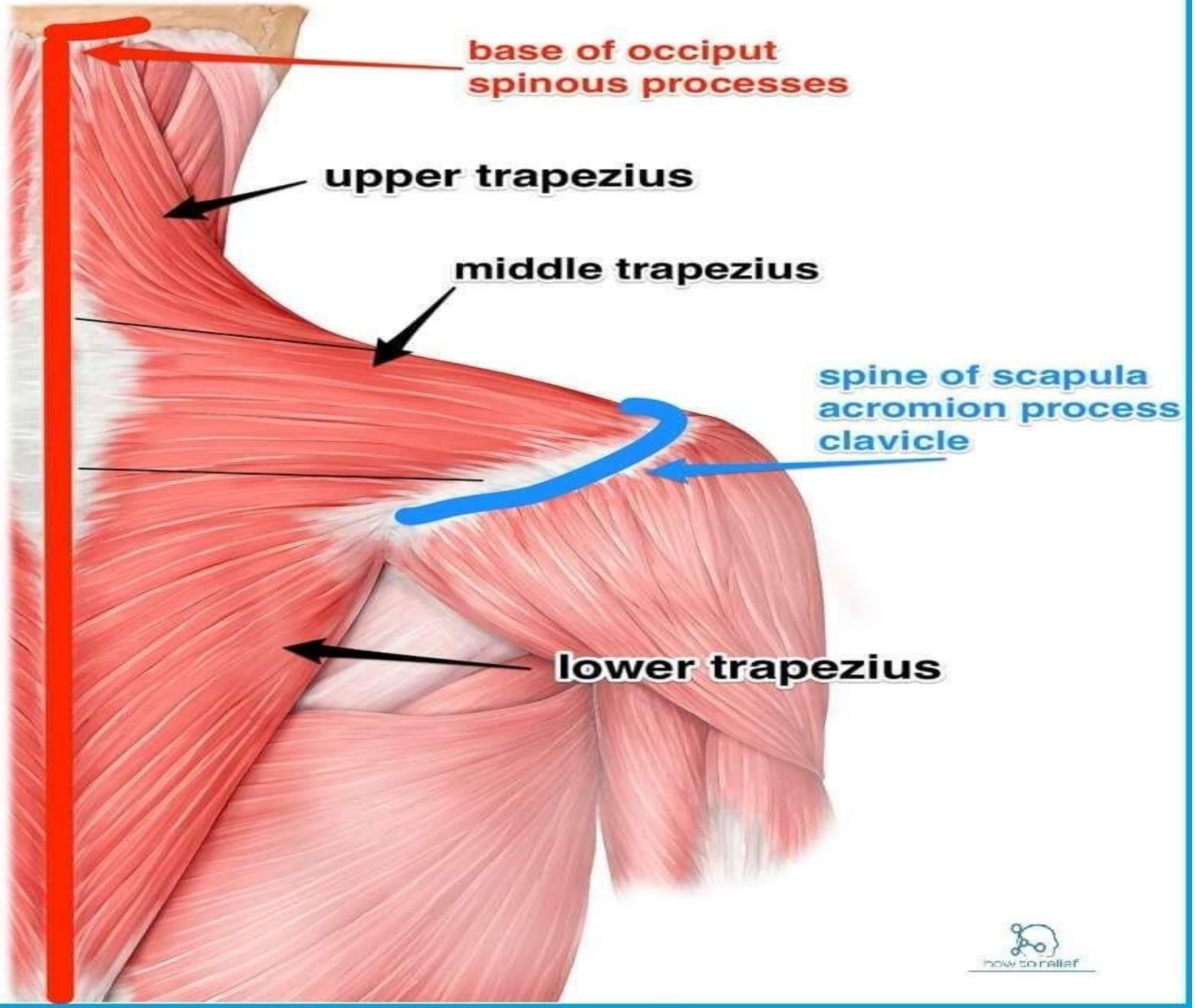
A. Lower spinal vertebrae
B. Lumbar vertebrae
C. Lower ribs

Insertion Point

D. Bicipital Groove

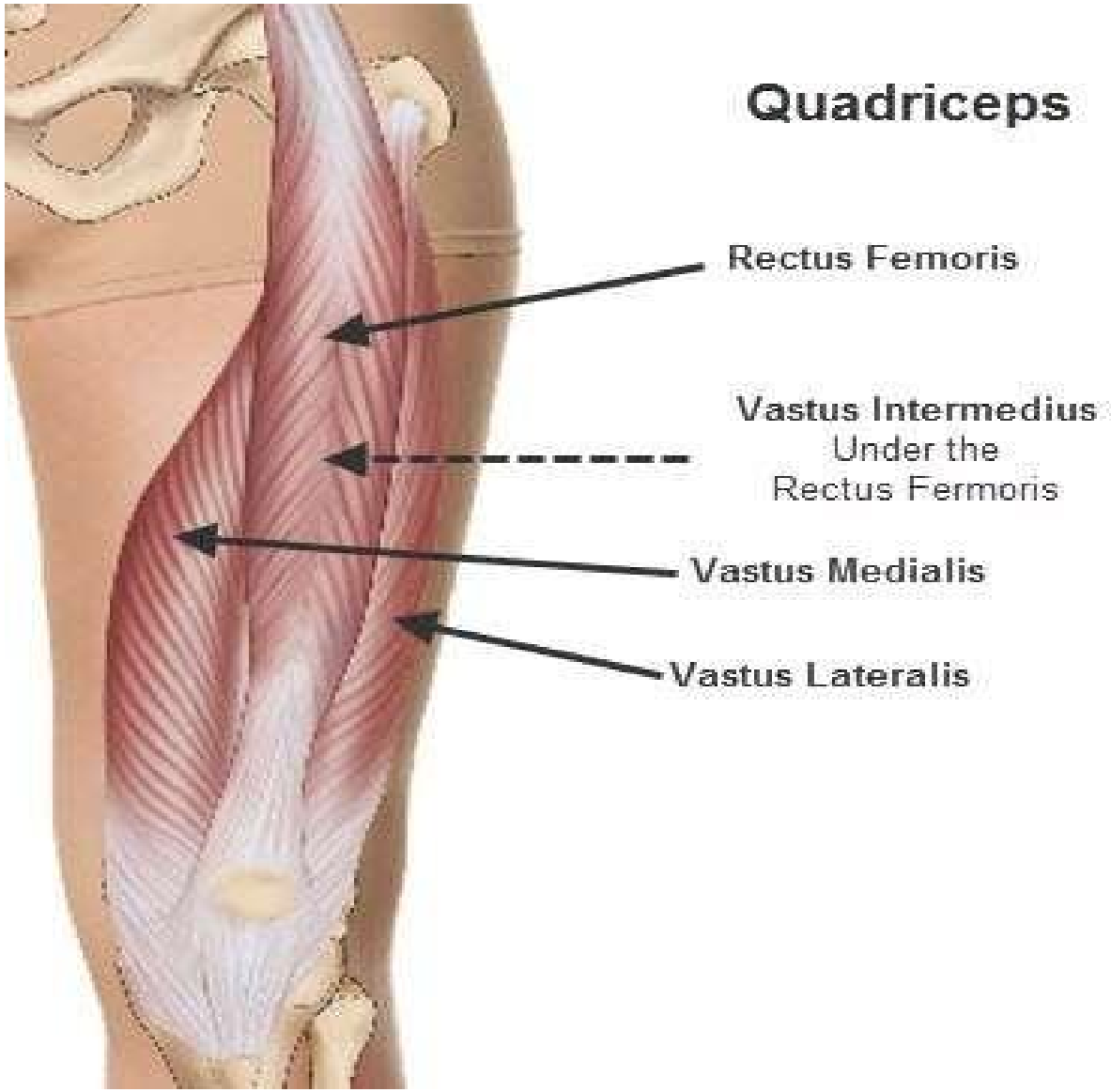
trapezius

- Origin- spinous process of c7-t12
- insertion – lateral clavicle spine of scapula
- action- rotates scapula


base of occiput
spinous processes
upper trapezius
middle trapezius
spine of scapula
acromion process
clavicle
lower trapezius
how to relief

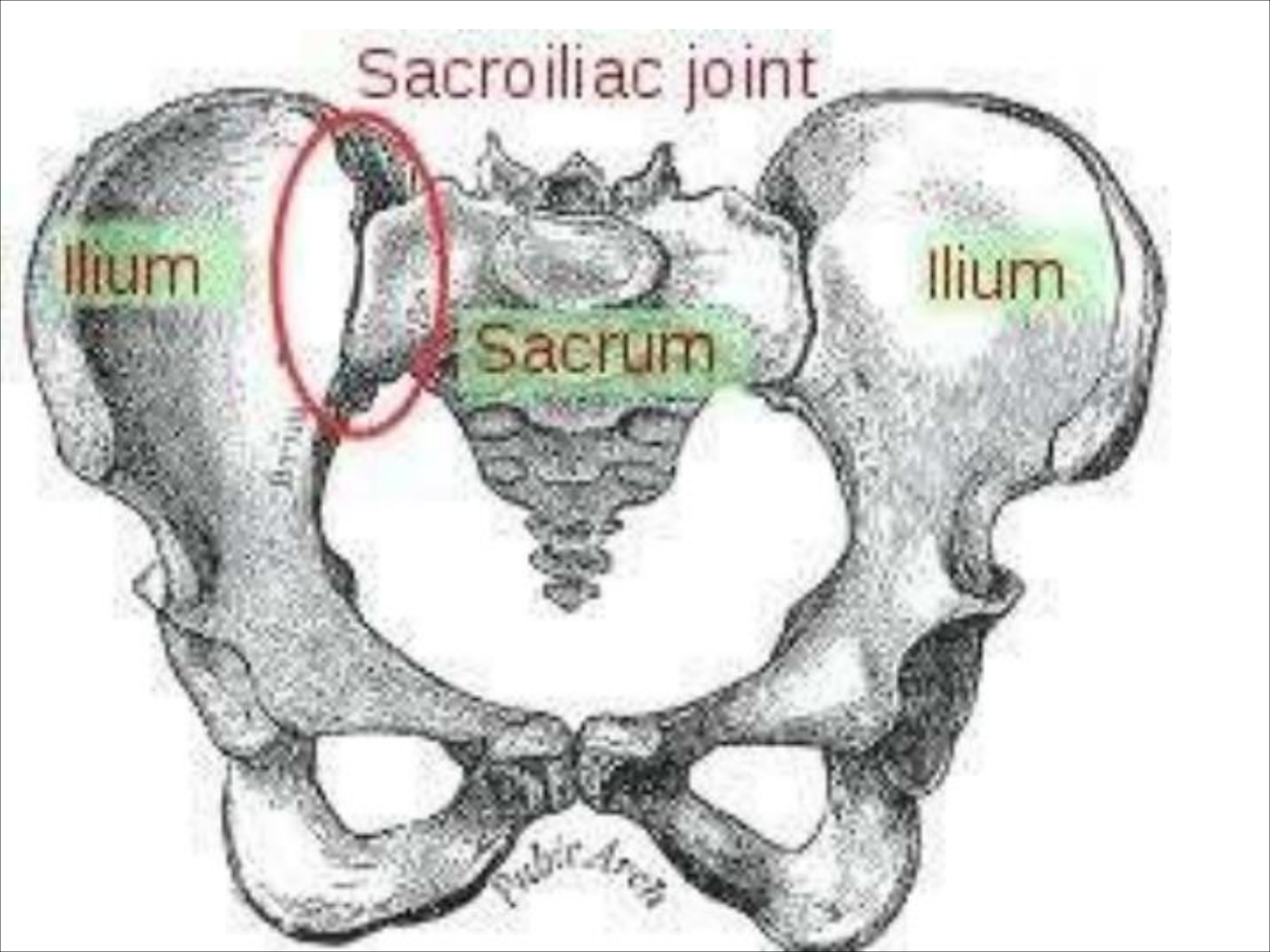
quardriceps

- Origin- combines rectus femoris and muscles
- insertion – tibia tuberosity
- action- knee extension and flexion


Quadriceps
Rectus Femoris
Vastus Intermedius
Under the
Rectus Fermoris
Vastus Medialis
Vastus Lateralis

Gluteus maximus

- Origin- posterior illium, sacrum
- insertion – gluteal tuberosity of femur
- action- extend thigh at hip rotates

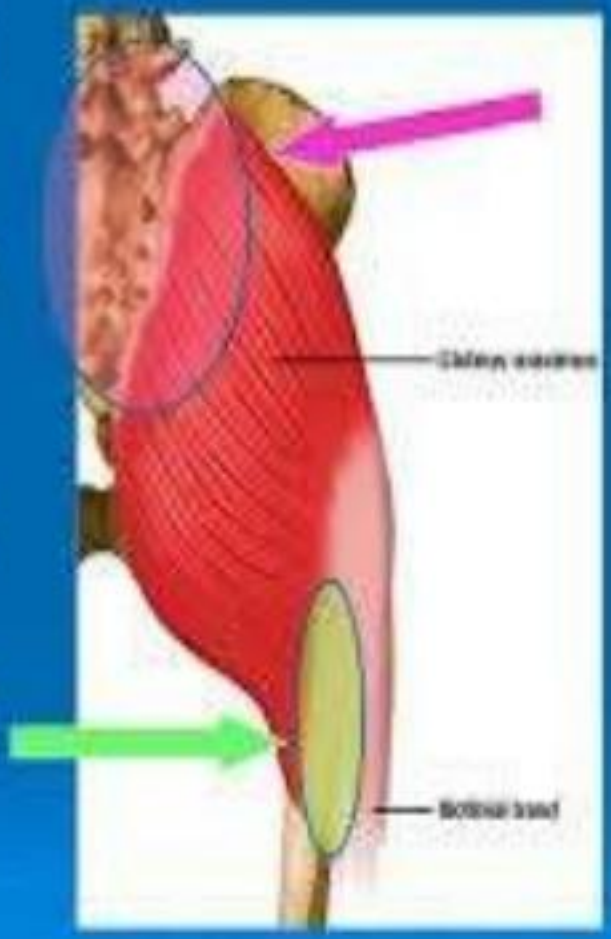

Sacroiliac joint
Ilium
Sacrum
Ilium
Pubic Arch

10. Gluteus Maximus

Origin – iliac, sacrum, coccyx

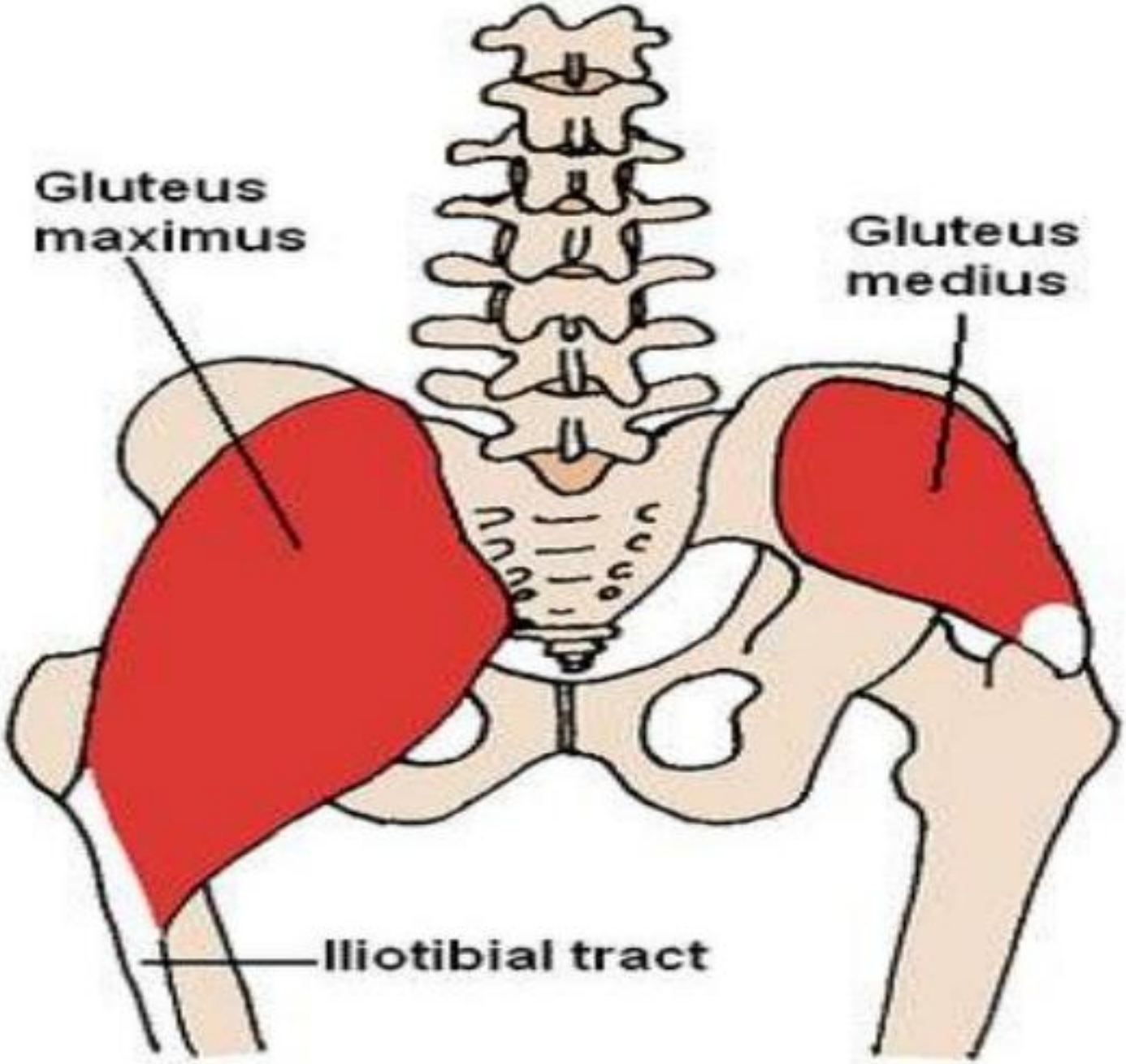
Insertion – gluteal tuberosity, IT band

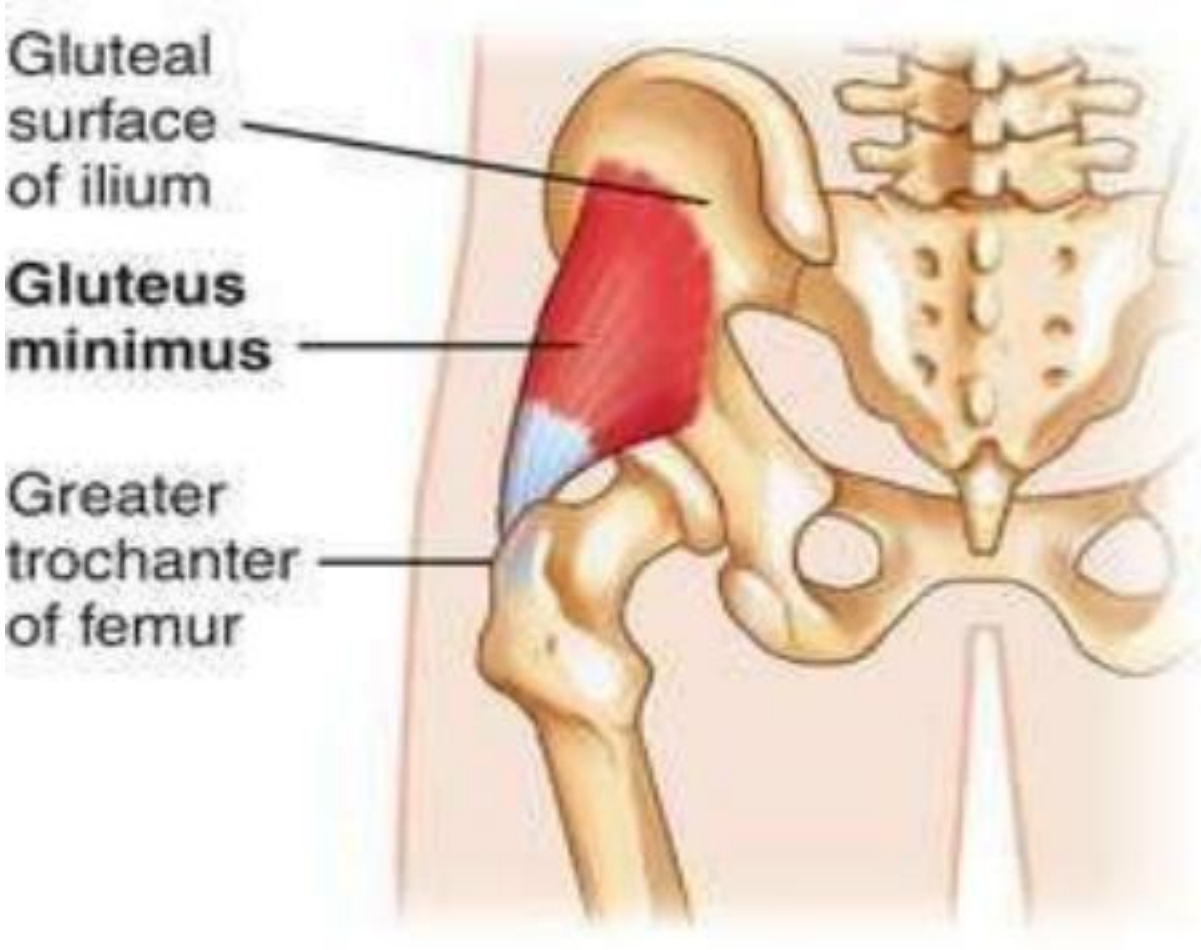
Action – extension of thigh



Gluteus minimus

- Origin- lateral surface of ilium
- insertion – greater trochanter of femur
- action- rotates thigh

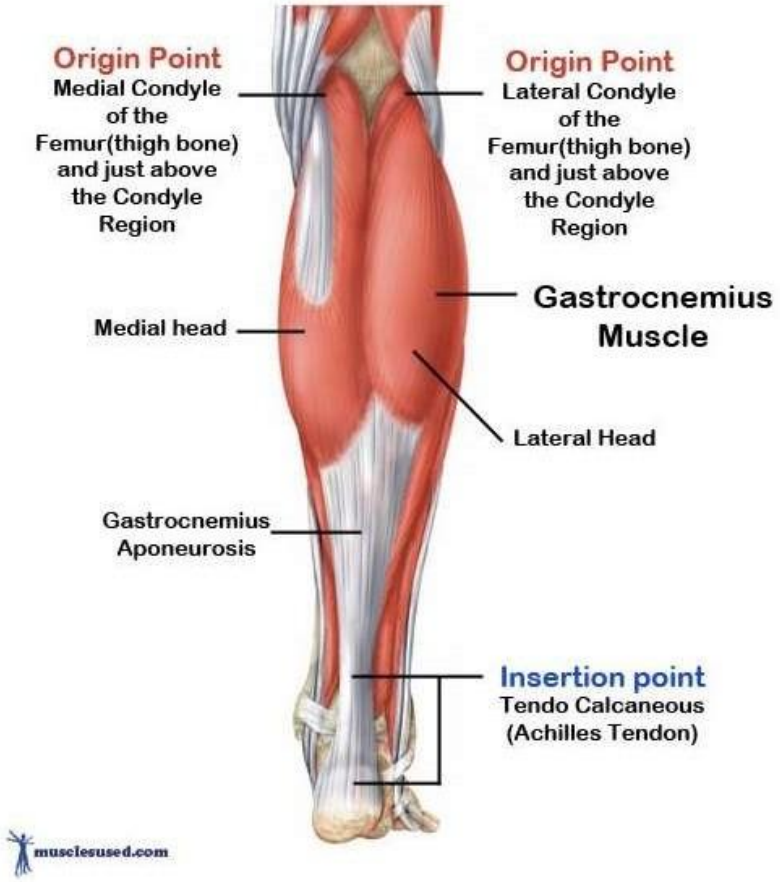

Gluteus maximus
Gluteus medius
Iliotibial tract


Gluteal surface of ilium
Gluteus minimus
Greater trochanter of femur

Gasterocnemius

- Origin- lateral condoyle of femur
- insertion – calcaneus
- action- flexes foot at angle

Origin & Insertion Sites

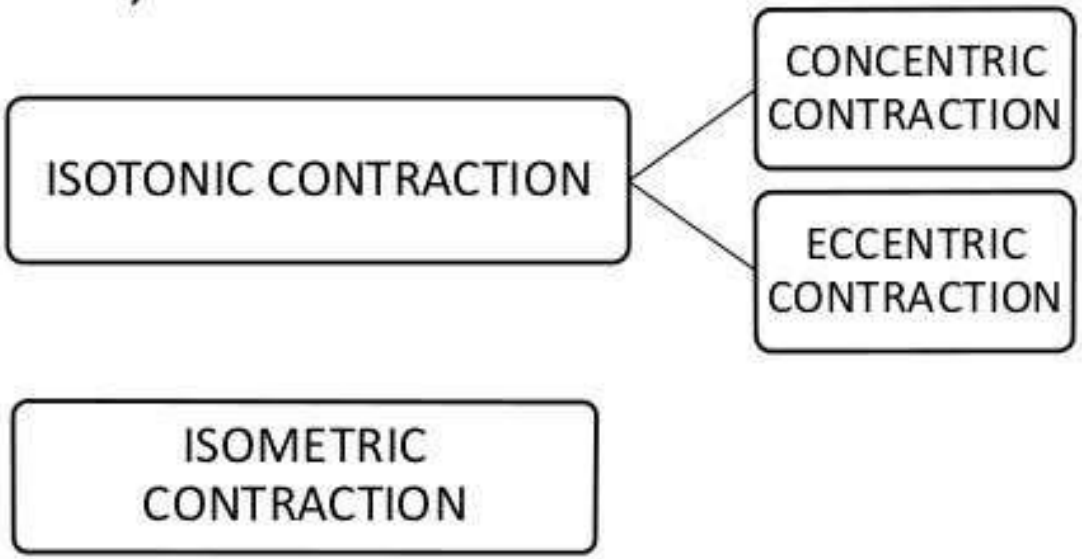


ORIGIN: Medial and lateral condyles of the femur just above the condyle region.

Insertion: Achilles Tendon (Calcanal tendon)

TYPES OF CONTRACTIONS

There are two main types of muscle contractions which are ;



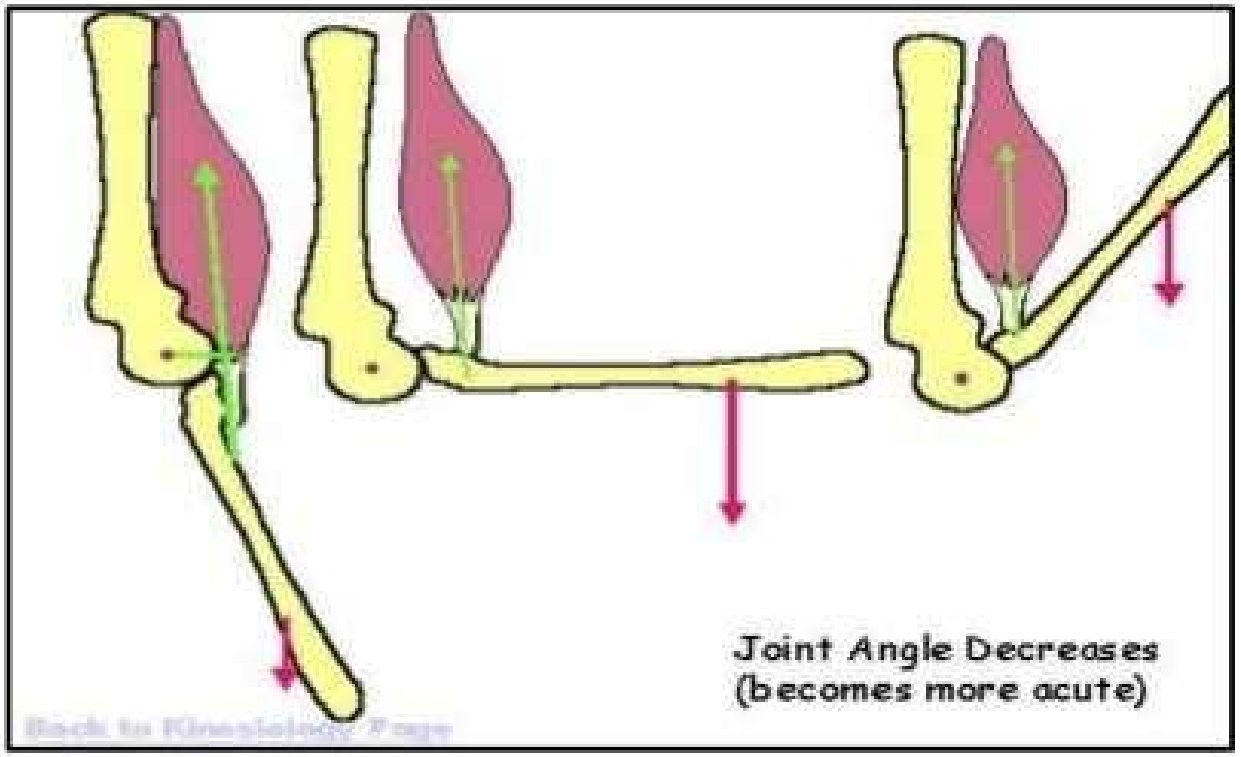
Isokinatic Contraction

What is isotonic contraction

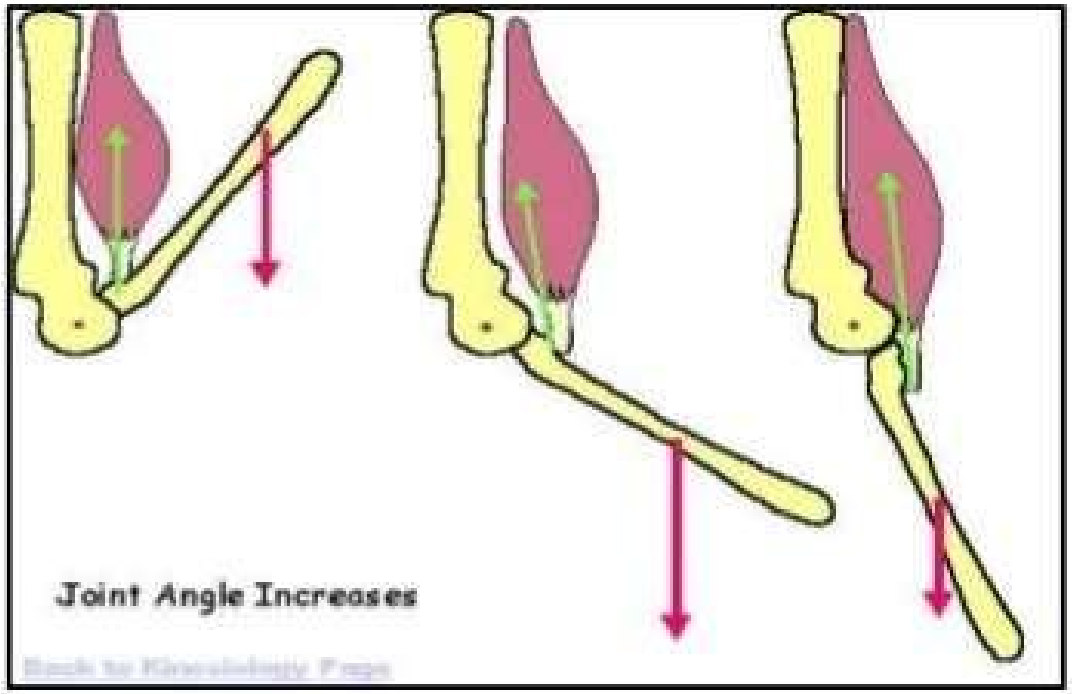
- These occur when a muscle contracts and changes length

TWO TYPES OF ISOTONIC CONTRACTIONS

- Concentric contraction occurs when the muscles shortens
- In the act of curling, the muscle shortens when the arm flexes at the elbow and this is known as concentric contraction



- Eccentric contraction occurs when the muscles lengthens
- Eccentric contraction helps in the control of the rate of movement.



MUSCULAR CONTRACTIONS

- **Isometric contractions** generate force without changing the length of the muscle opposing force

- **Isokinetic contractions -** the muscle changes length during the contraction and produce movements of a constant speed. To measure this a special piece of equipment known as an Isokinetic Dynamometer is required

Reciprocal Innervation

Reciprocal Innervation Sensory neuron stimulates motor neuron and interneuron.Interneurons inhibit motor neurons of antagonistic muscles. When limb is flexed, antagonistic extensor muscles are passively stretched.

Muscle fatigue

Muscle fatigue is a symptom that decreases your **muscles**' ability to perform over time. It can be associated with a state of **exhaustion**, often following strenuous activity or exercise. When you experience **fatigue**, the force behind your **muscles**' movements decrease, causing you to feel weaker.

- The principle that the strength by which a nerveor muscle fiber responds to a stimulus is notdependent on the strength of the stimulus• If the stimulus strength is above threshold, thenerve or muscle fiber will give a completeresponse or otherwise no response at all