

The University Of Jordan
Faculty Of Medicine



Muscoskeletal system

BY

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The Musculoskeletal system includes:

عظام 1-Bones (skeleton)

مفاصل 2-Joints ↓ articulate

عضلات 3- Muscles ↓ moved by

غضاريف 4-Cartilages between joints

أربطة 5-Ligaments supports joints

The adult skeleton has **206** bones

It Divided into two divisions:

A-^{محوري} Axial skeleton (skull, ribs and vertebra)

B-^{طرفي} Appendicular skeleton (pelvis, extremities)

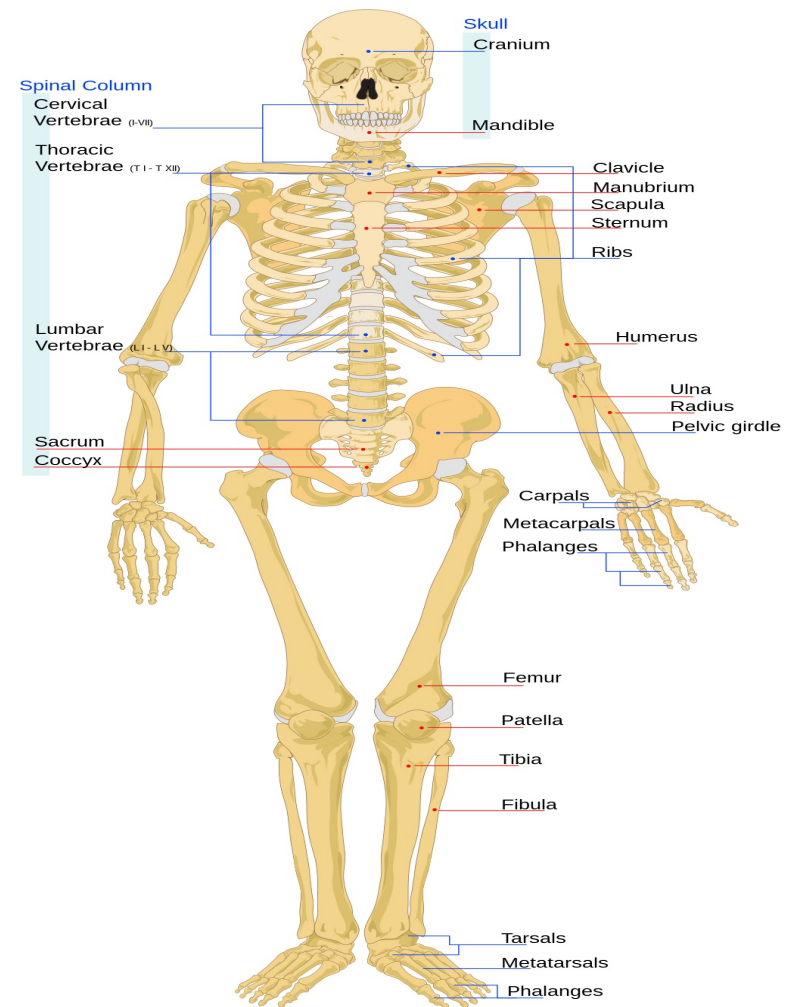


The skeleton is divided into Axial and appendicular skeleton

Axial skeleton contains

- ❖ Skull
- ❖ Vertebral column
- ❖ Ribs and sternum
- ❖ Hyoid Bone

The only bone that does not articulate
with another bone



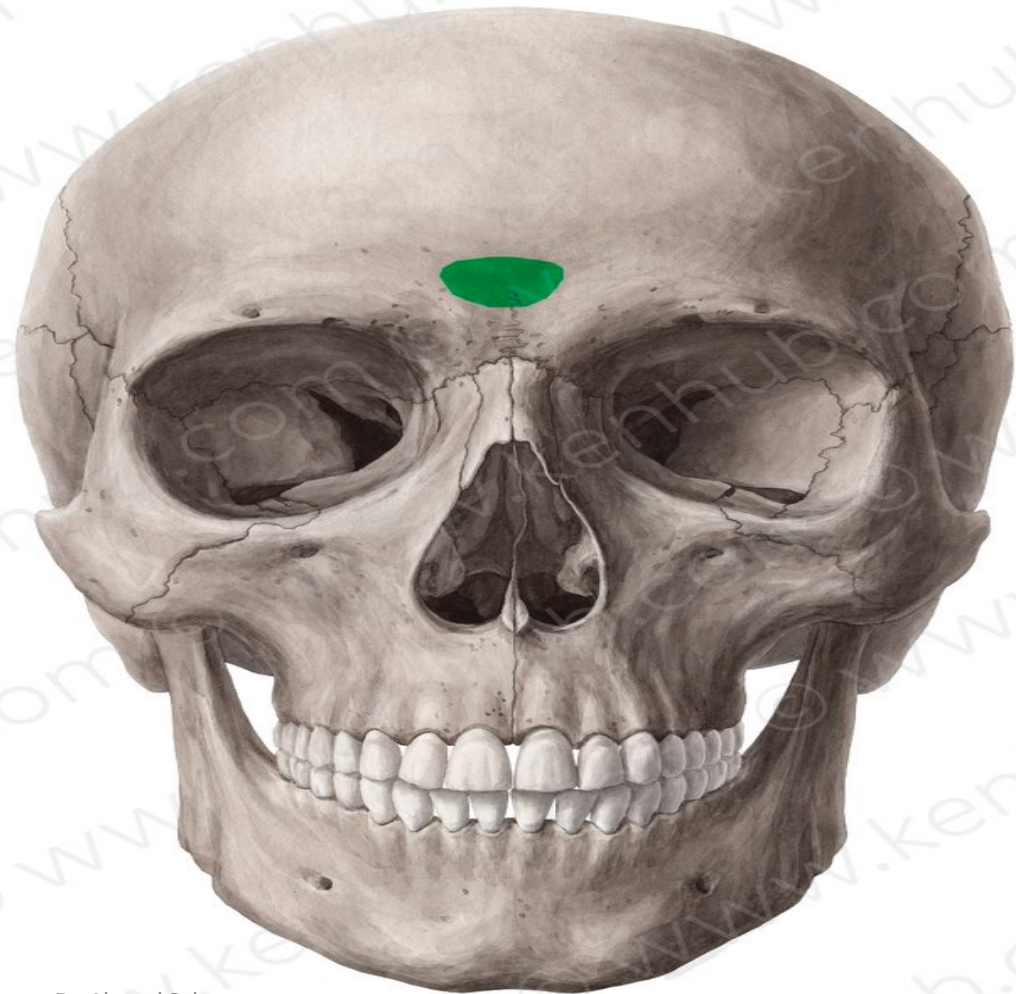
Skull

It is formed of (22) bones

Mandible separate bone

It is the lower Jaw

articulate with the skull

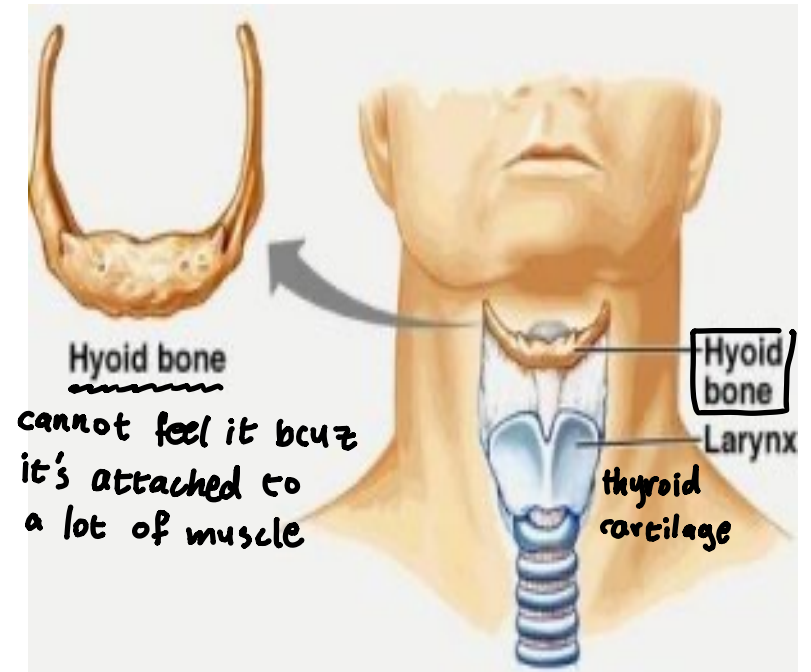
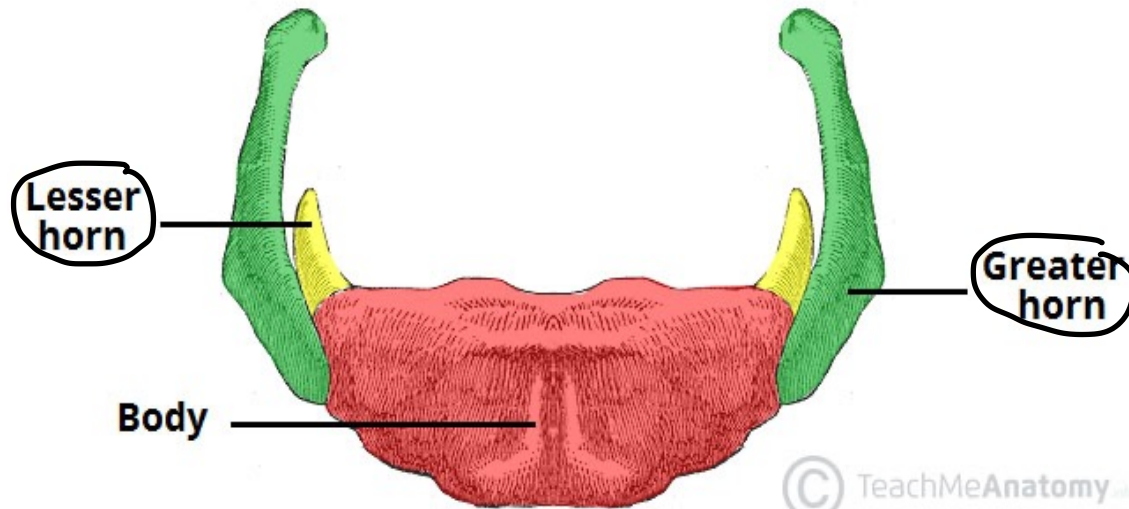


Dr. Ahmed Salman

Hyoid Bone

The only bone that does not articulate with another bone

it is a station for muscles to attach

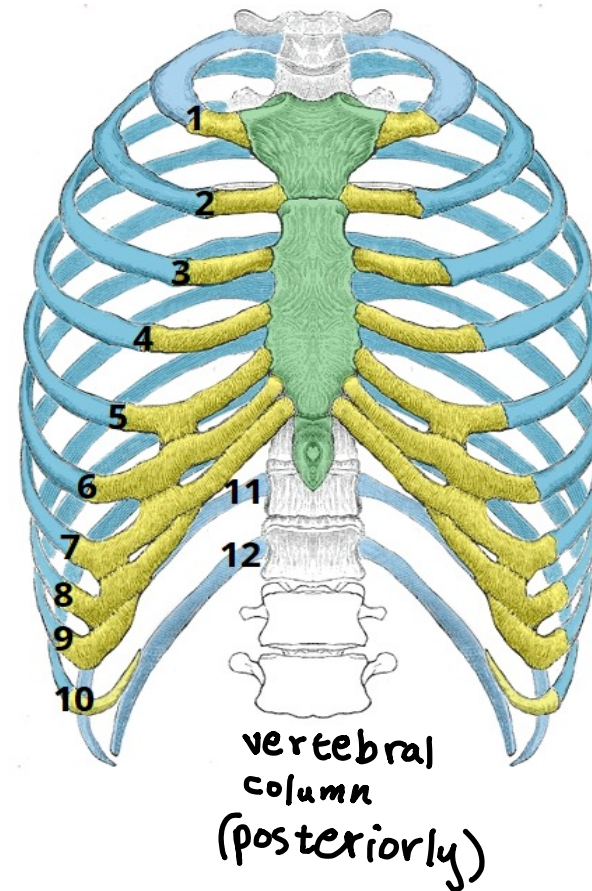


القفس الصدري
Skeleton of the thorax (thoracic cage)

This is an **Osseo cartilaginous cavity** composed of :

- 1- **Sternum** عظمة القفص
- 2- Ribs 12 pairs of ribs
- 3- Costal cartilage
- 4- **Thoracic Vertebra**

attaches the ribs to the sternum and provides flexibility to the thoracic cavity for its movement during respiration (inspiration and expiration)



- Ribs
- Costal Cartilage
- Sternum

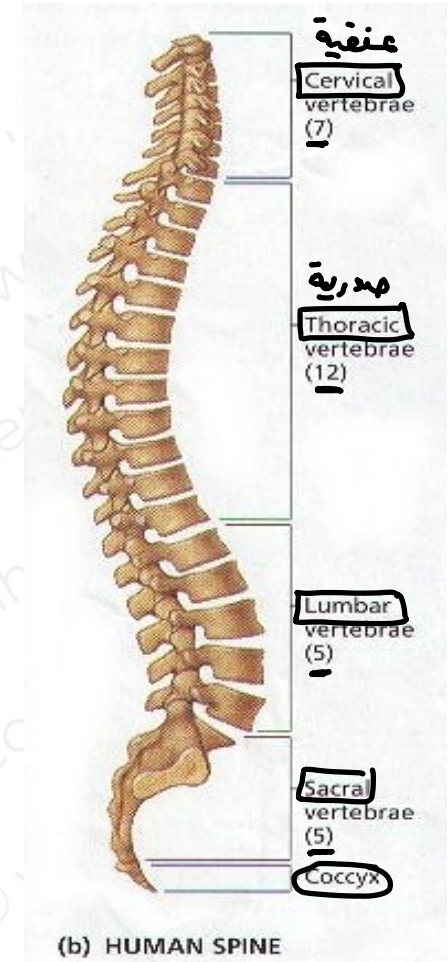
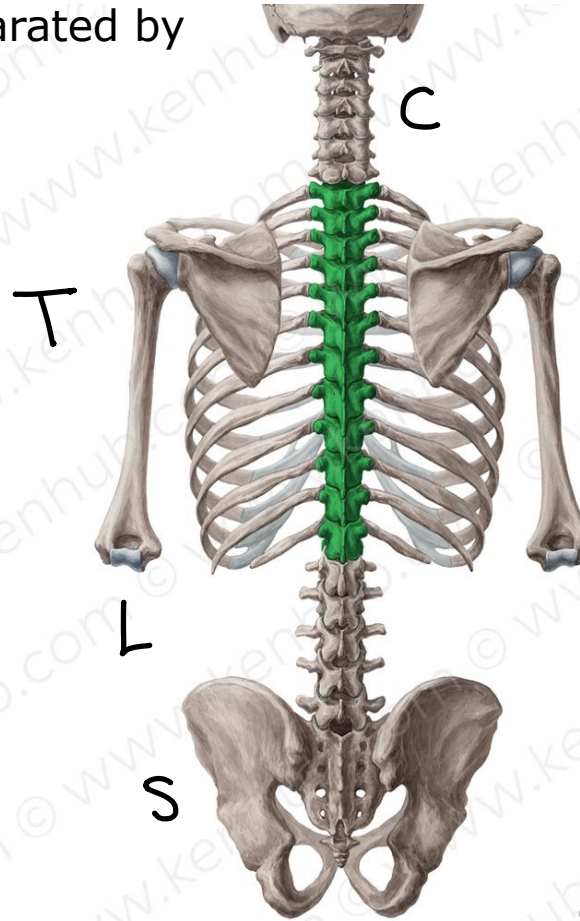
Vertebral Column

فقرات

It composed of 32-33 Vertebrae separated by intervertebral discs

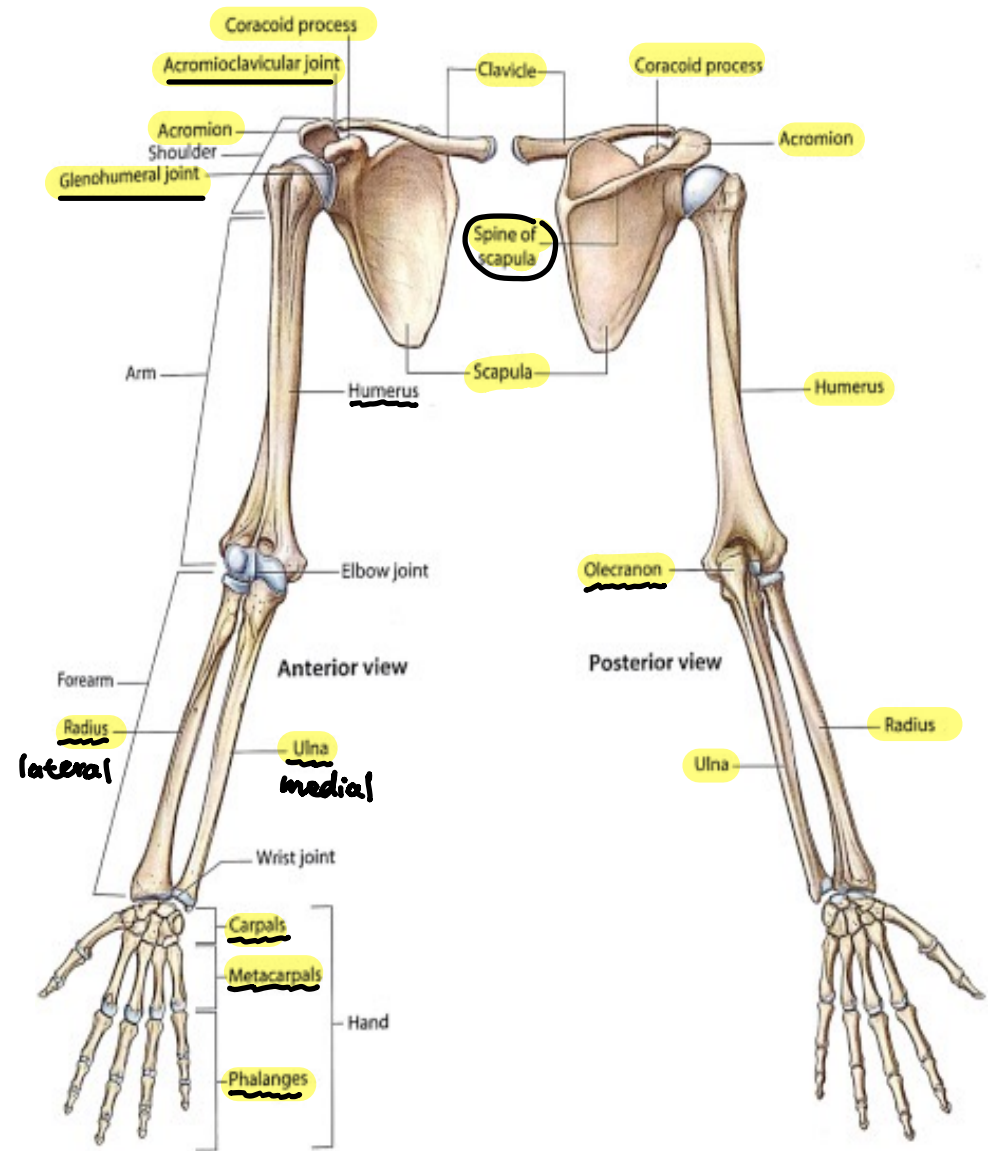
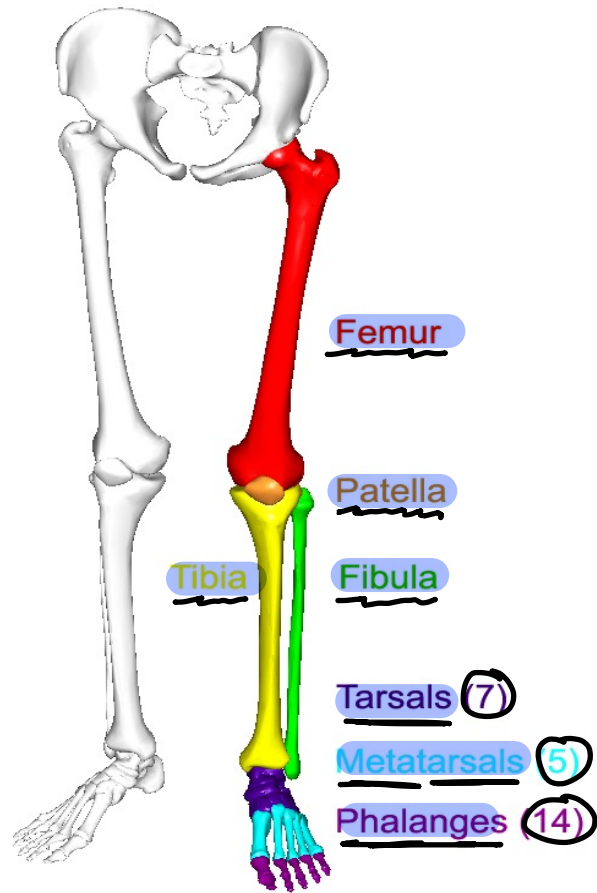
Axial Skeleton :

- * Skull & Mandible
- * Hyoid bone
- * Skeleton of the thorax
- * vertebral column



B. Appendicular skeleton contains

Bones of the upper and lower limbs

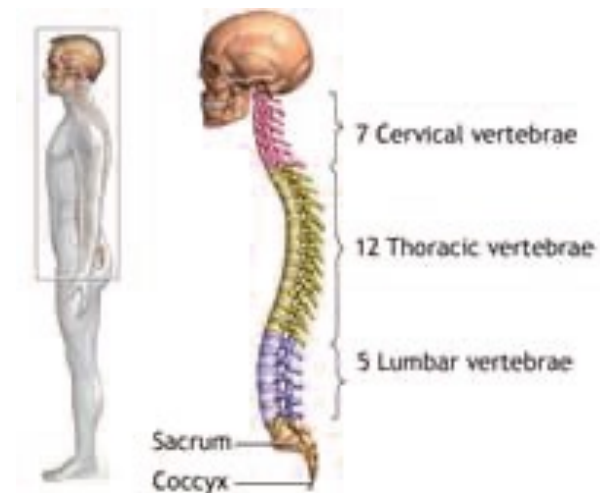


Functions of the Bone

1. **Movement:** Skeletal system provides points of attachment for muscles. *skeletal*



2. **Support:** The backbone is the main support center for the upper body.



*stands
erect*

of vital organs

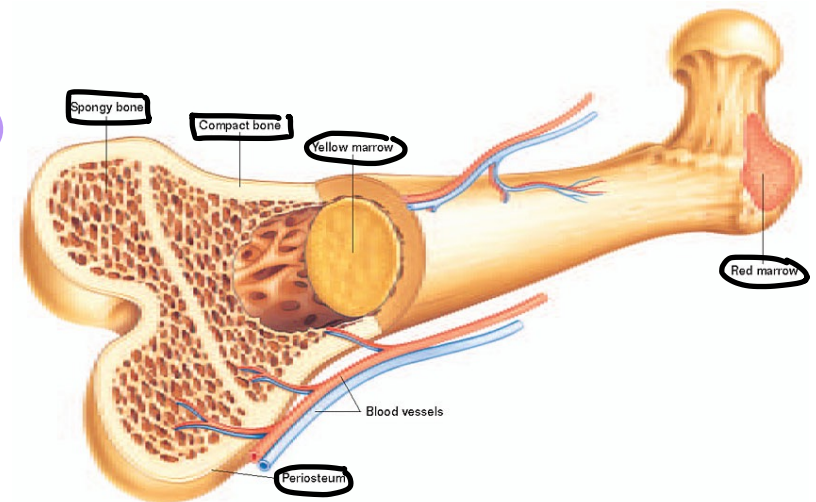
3. **Protection:** The bones of your skull protect your brain. Your ribs protect your lungs and heart from injury.
- thoracic cage
or trauma

4. **Makes Blood:** Red and white blood cells are formed by Bone marrow.
- inside the cavities of long bones



Lung
Vital organ

ADAM.



5. **Storage**: Bones store minerals, such as calcium and phosphorus.



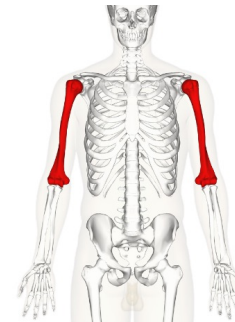
Protection – Support – Movement – Factory – Storage
of Blood cells

Types of Bone According Shape

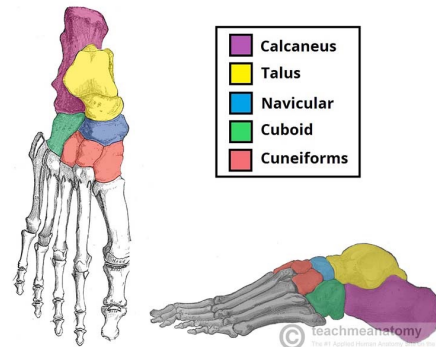
- 1- Long Bone
- 2- Short Bone
- 3- Flat Bone
- 4- Irregular Bone
- 5- Sesamoid Bone
- 6- Pneumatic Bone

+high arm

1- **Long Bone** e.g. Femur, Humerus
upper & lower limb

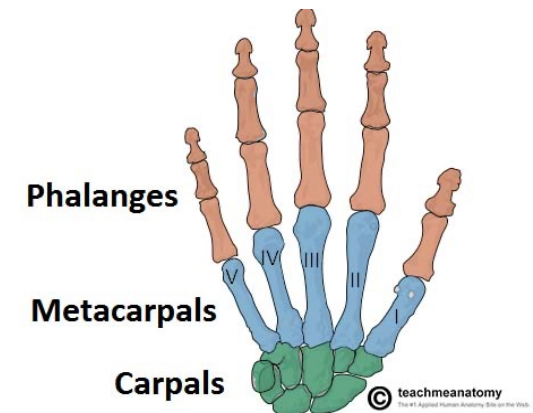
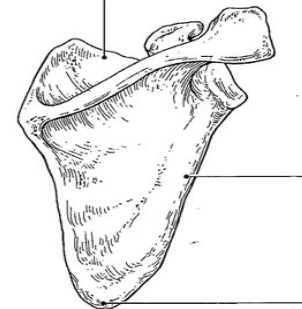


2- **Short Bone** e.g. carpal and tarsal bone



- Calcaneus
- Talus
- Navicular
- Cuboid
- Cuneiforms

3- **Flat Bone** e.g. Scapula

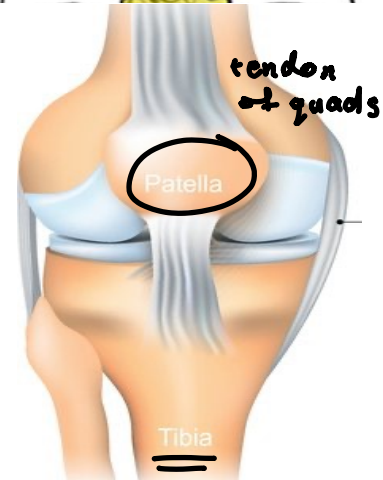
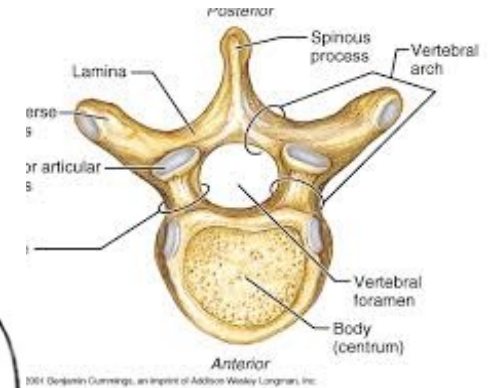
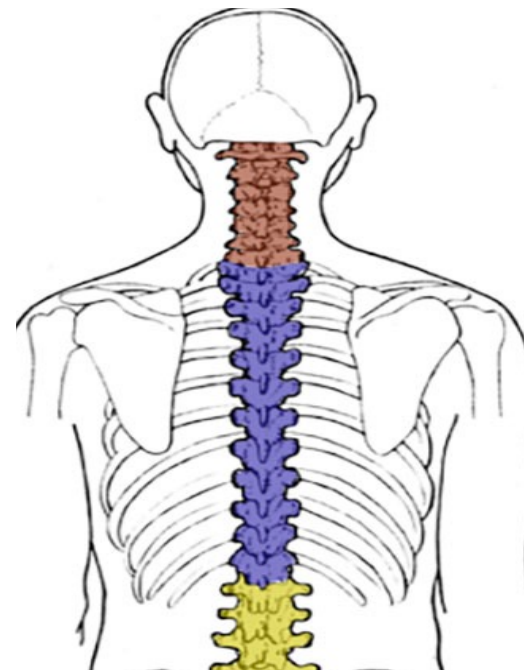


4- **Irregular Bone** e.g. **Vertebra**

front of the
knee

5- **Sesamoid Bone** e.g. **Patella**

Function: They diminish friction
between tendons and underlying
bones.



هوائي

nasal

6-Pneumatic bone e.g. skull contains air sinus

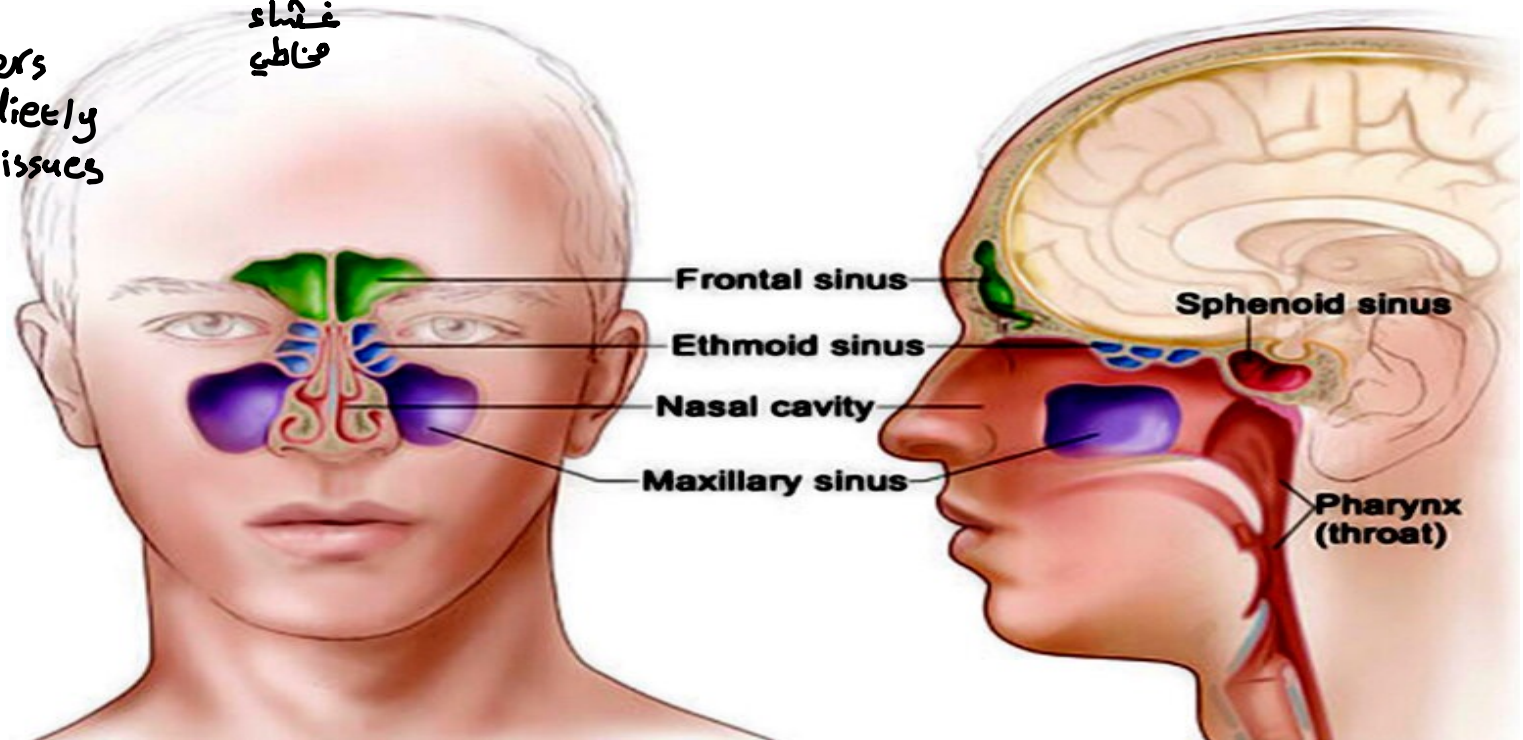
Function :

- 1.They decrease the weight of skull.
- 2.They lead to resonance of voice.
- 3.They have a highly vascular mucosa to warm the inspired air.

empty holes
inside the
skull

if cold air enters
the lungs immediately
it might cause issues

فتساء
مخاطبي



Parts of the Long Bone

above

1. **Epiphysis** [Ends] of the bone

It is used for **articulation** and its articular surface is covered with a layer of **hyaline cartilage** called **articular cartilage**

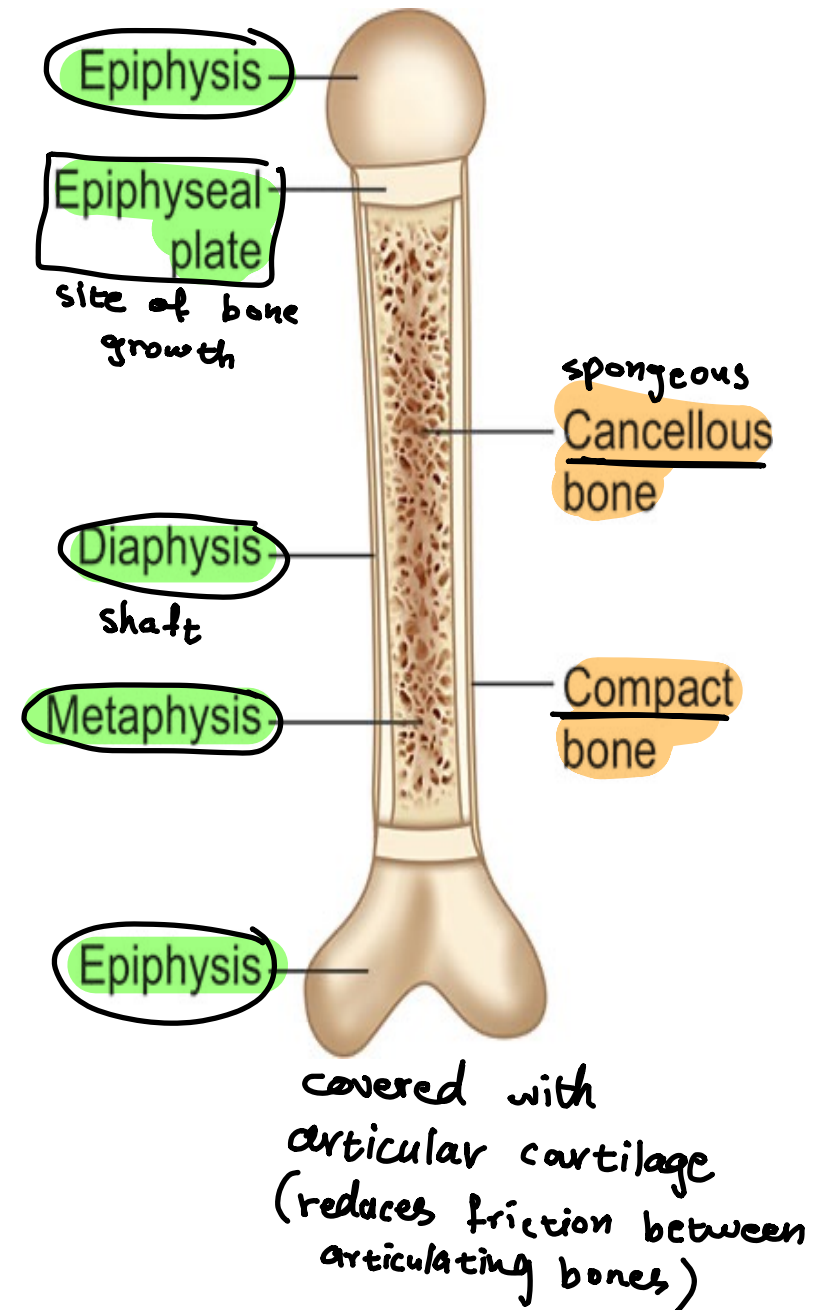
2. **Diaphysis** : Shaft which is covered externally by **periosteum**

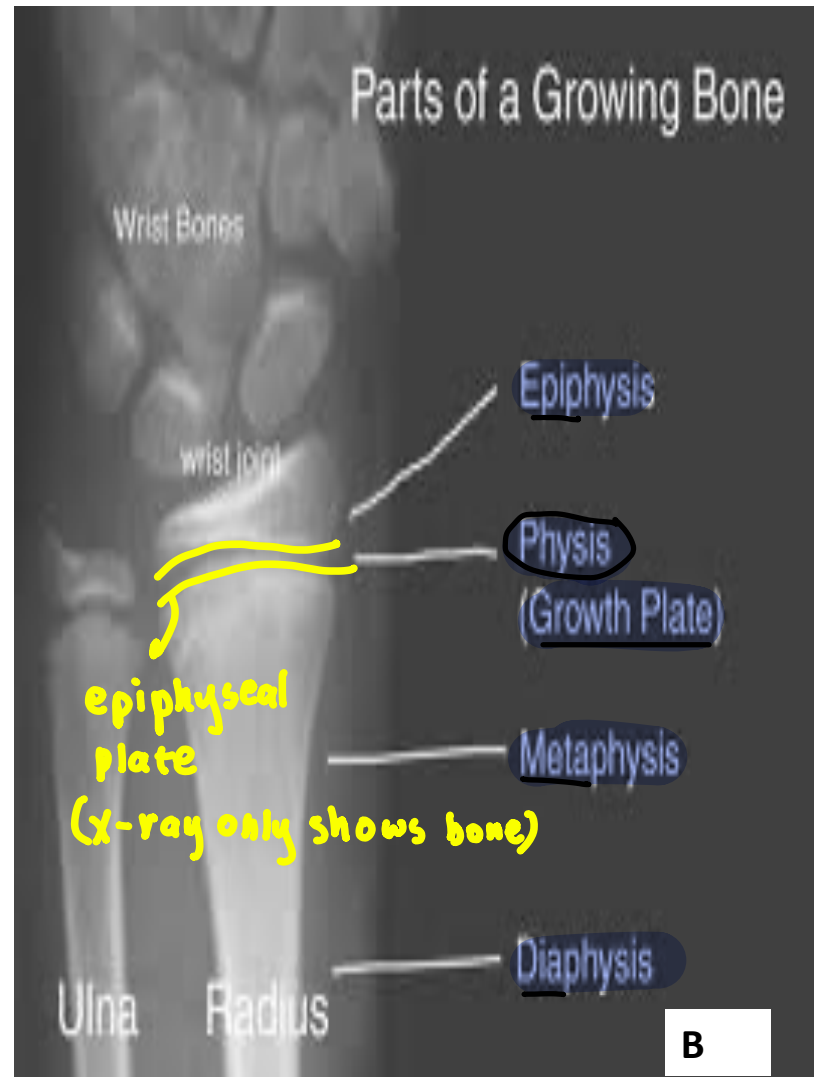
3. **Metaphysis** : Between Diaphysis and Epiphysis

4. **Epiphyseal plate (Cartilage)** : in the metaphysis at each end of a long bone

It is the site of **bone growth**

5. **Medullary cavity**: Cavity of the shaft which contains **bone marrow**





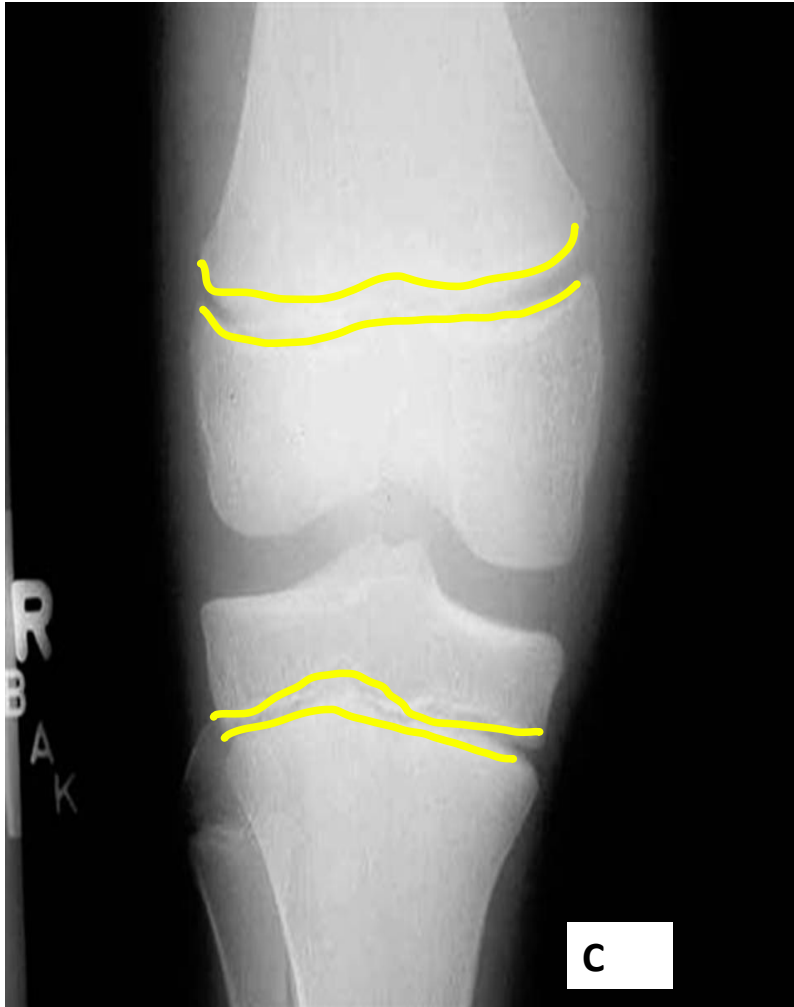


Figure 1



Figure 2

Terms of external features of bones



Bony Elevations

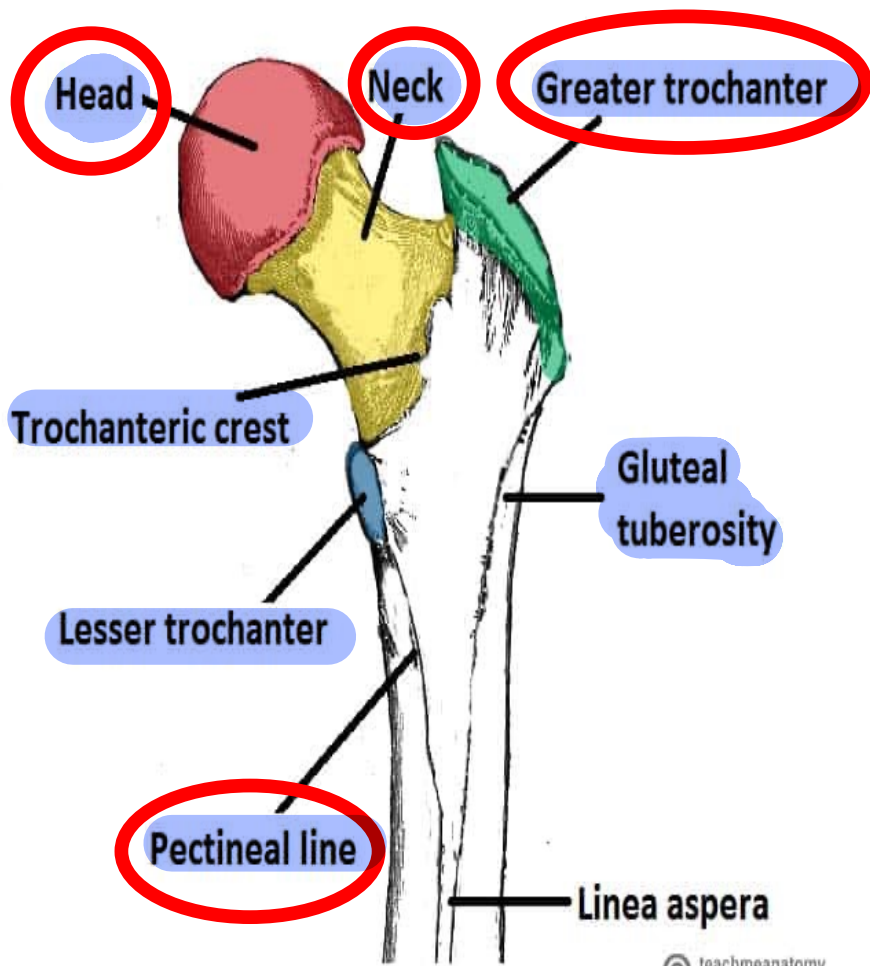
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1. **Head** : **Rounded end** of bone
2. **Neck** : **Constricted** bone follows the head.
3. **Process** : It is an **elongated projection** with a **blunt** end.
4. **Spine** : It is an **elongated projection** with a **pointed** tip.
5. **Tubercle, tuberosity and trochanter** :

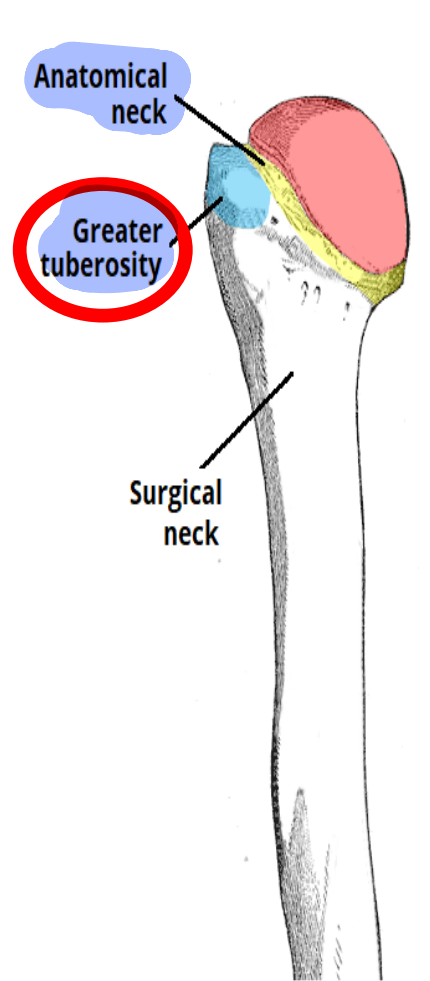
They are **localized rounded elevations**.

The tubercle is the smallest while the trochanter is biggest and tuberosity is medium-sized.

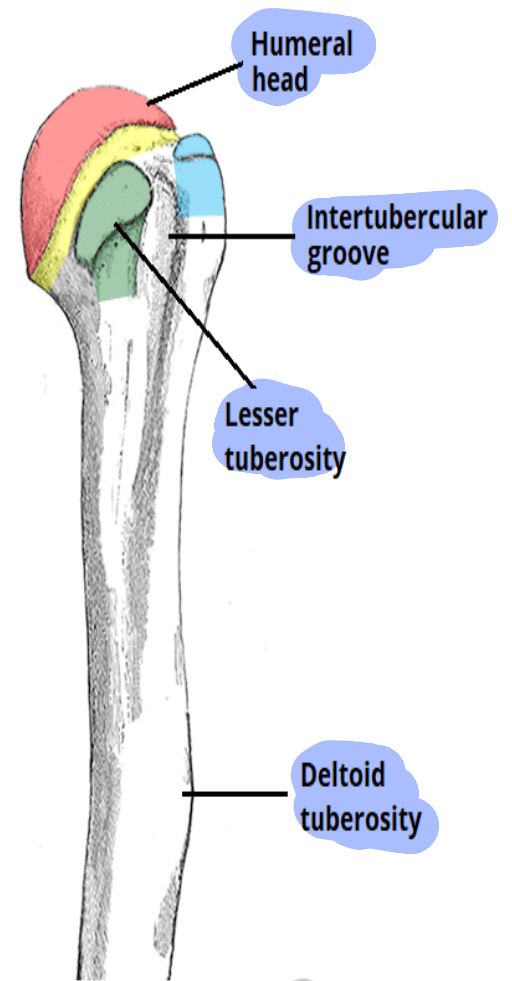
6. **Condyle** : It is a **convex elevated articular surface**.
7. **Epicondyle** : It is a **localized elevation of small size** situated **just above a condyle** or **articular surface**.
8. **Line** : Slightly **elevated** or just a **rough linear landmark**.
9. **Crest** : An **elongated ridge** which usually lies on the top of a bone.



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The #1 App for Medical Students

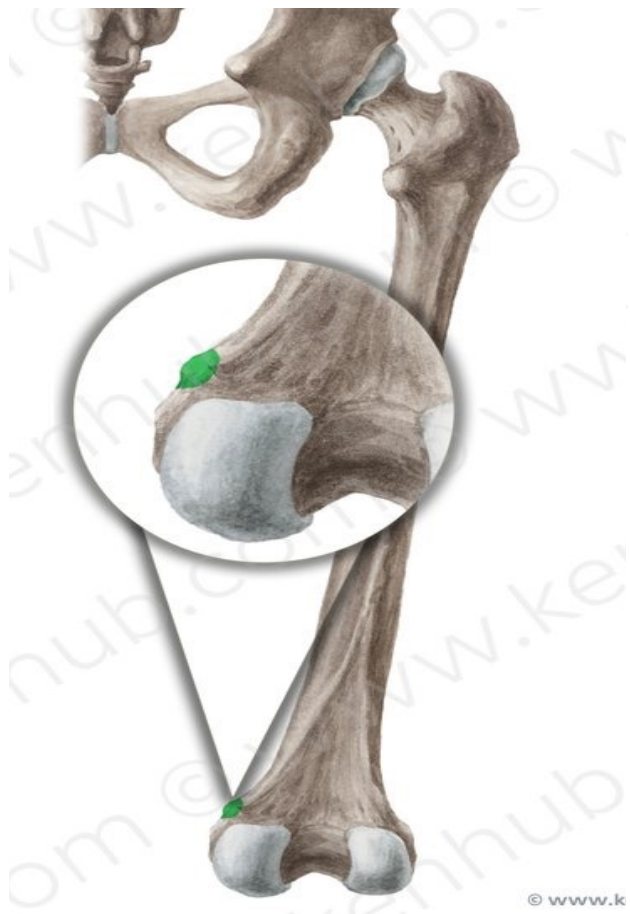


(i) Posterior Face

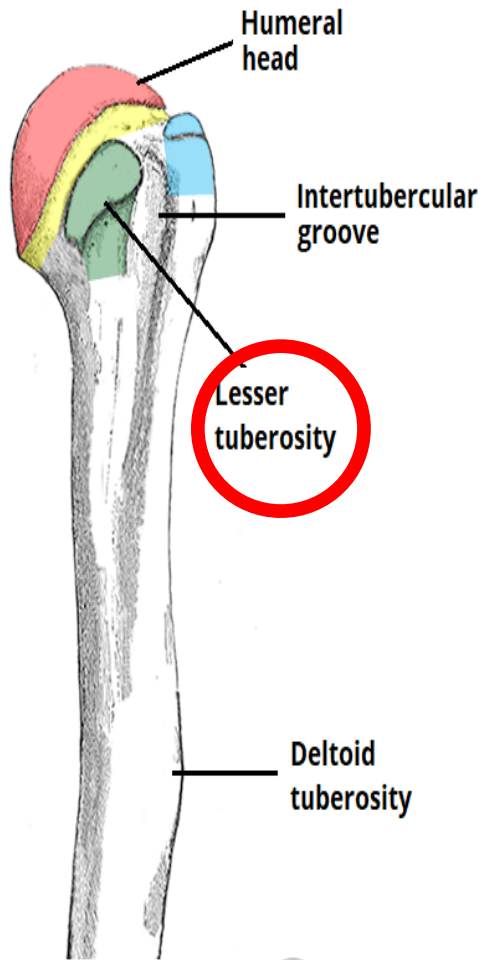


(ii) Anterior Face

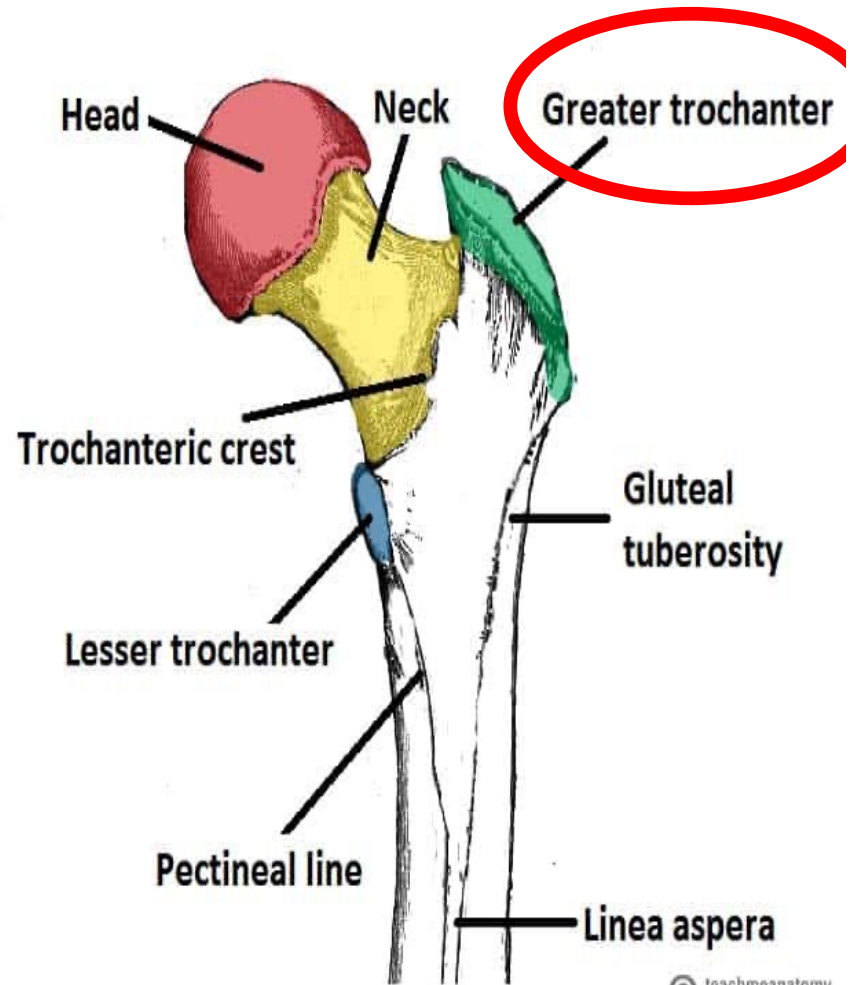
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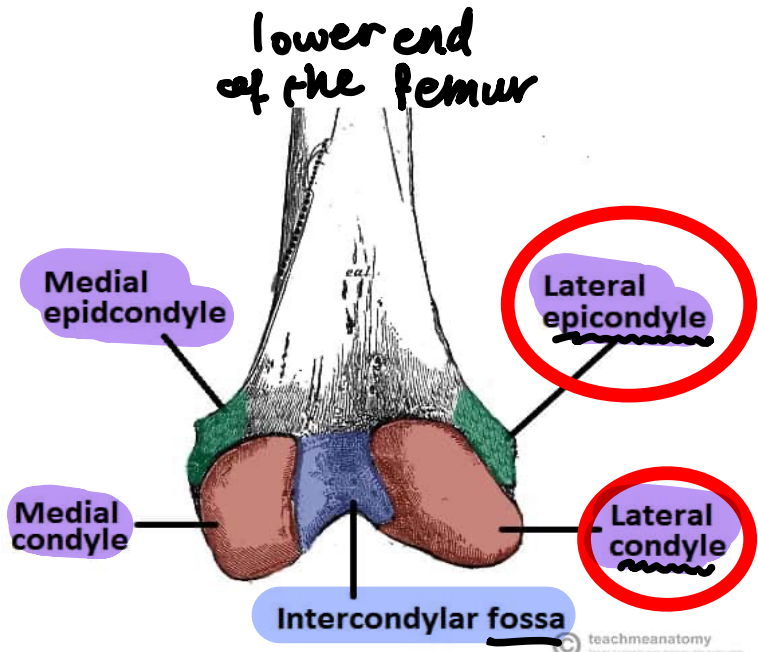


Adductor Tubercle

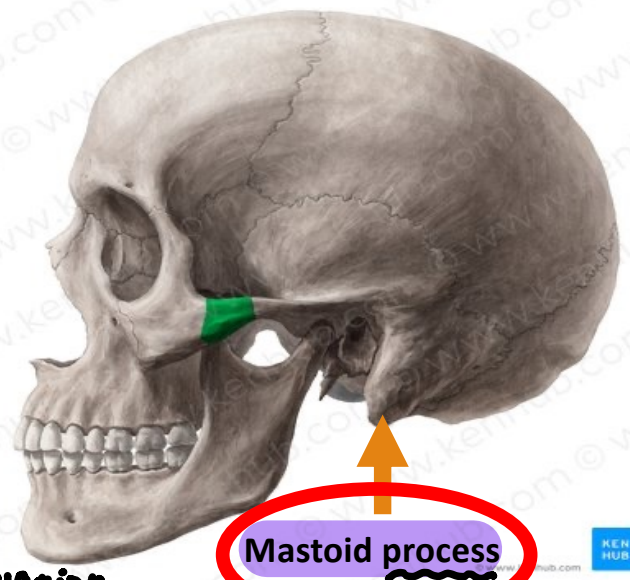


(ii) Anterior Face

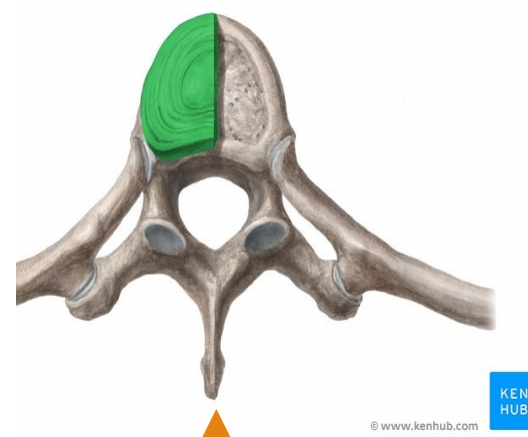




convex elevation
in the articular surface
of the bone

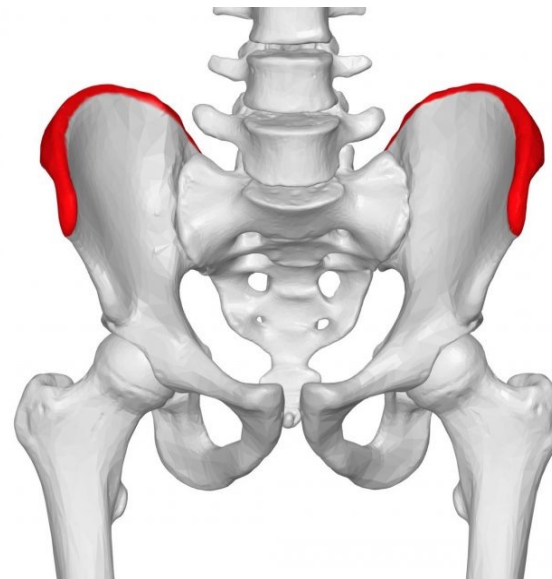
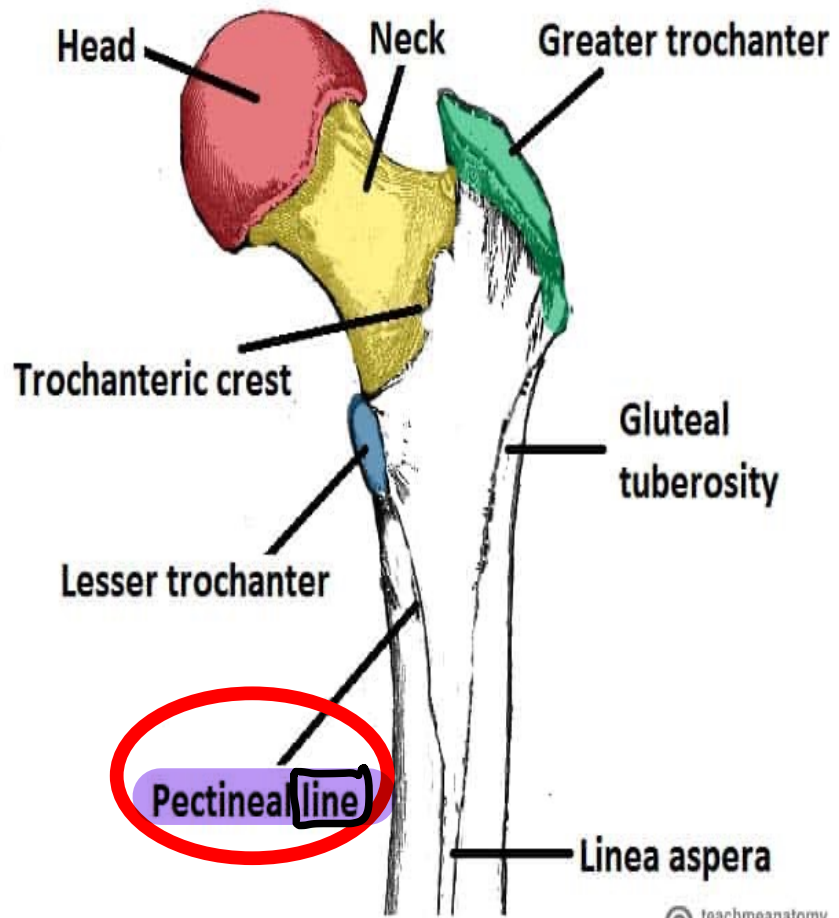


blunt projection



pointy tip





Iliac crest



انخفاض

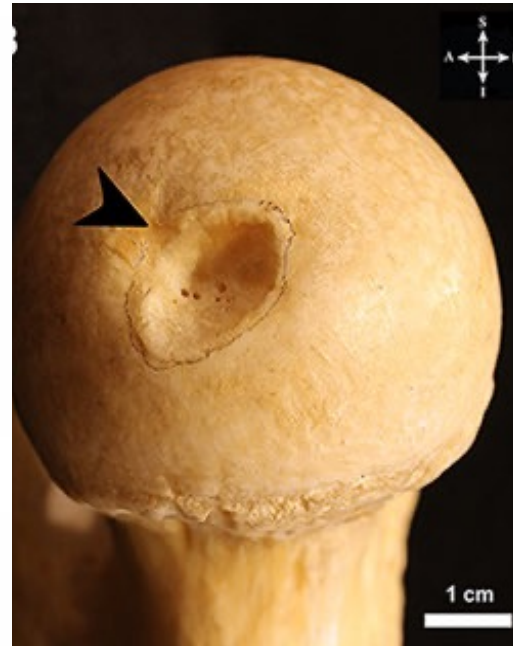
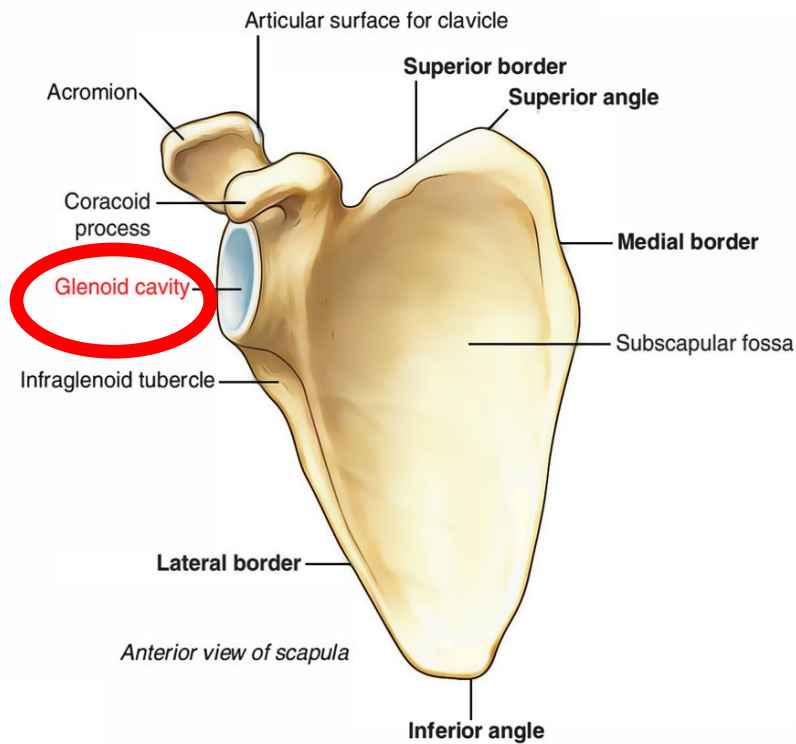
أخدود

قناة

Bony Depressions, Grooves and Canals

REED ONLY

1. **Fossa** : A depression on a surface. Fovea is a small fossa.
2. **Notch** : A semicircular depression, on a surface or a border. It has 2 limiting edges.
3. **Groove or sulcus** : An elongated depression
4. **Fissure** : A long cleft between flat bones, e.g. skull.
5. **Foramen** : It is a hole through a bone.
6. **Aperture** : It is a large hole
7. **Canal** : It is a track of some length in a bone having 2 open ends.
8. **Meatus** : A bony canal having one closed end
9. **Impression** : A slight indentation or depression.



Lateral:



- Olecranon
- Coronoid Process
- Trochlear Notch
- Radial Notch

1- Glenoid cavity (fossa)

depression on a surface

fovea

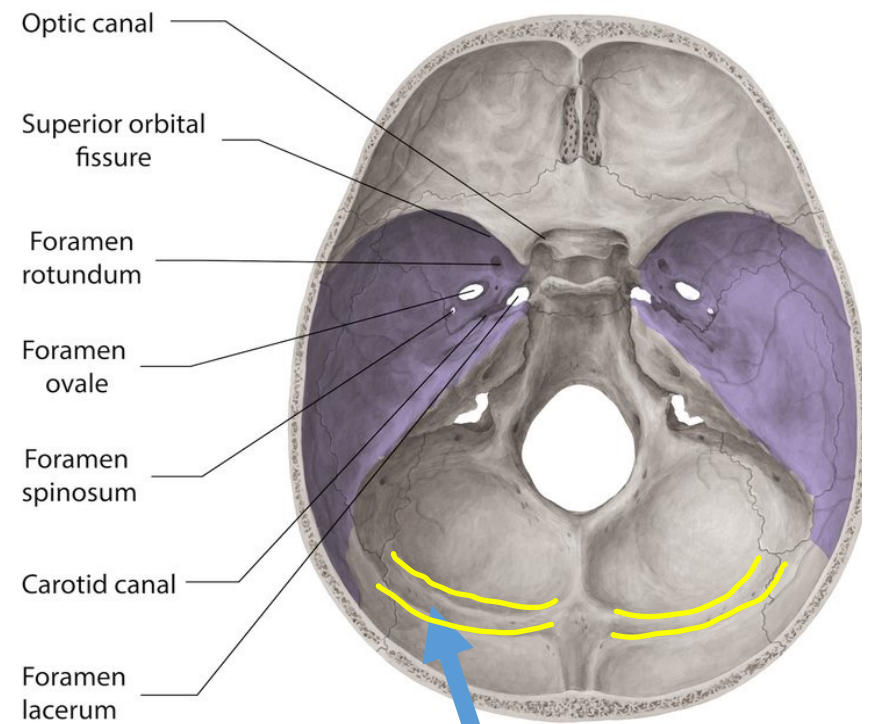
small fossa

2- Notch (surface)

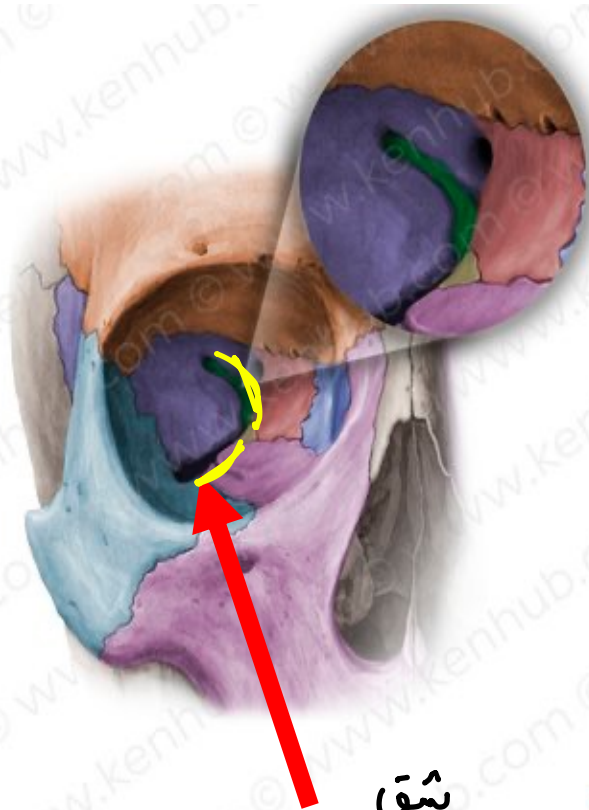
semicircular depression



2- **Suprascapular notch** (*border*)
(green)

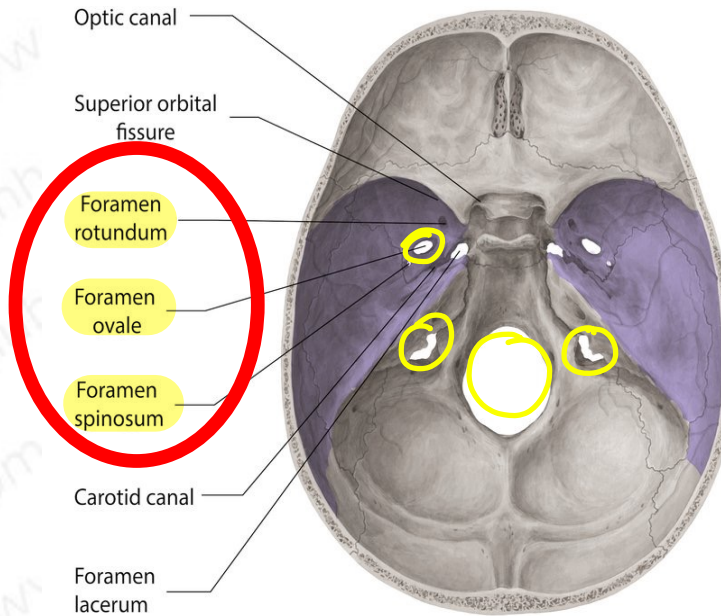


3- **Sulcus** / *groove*

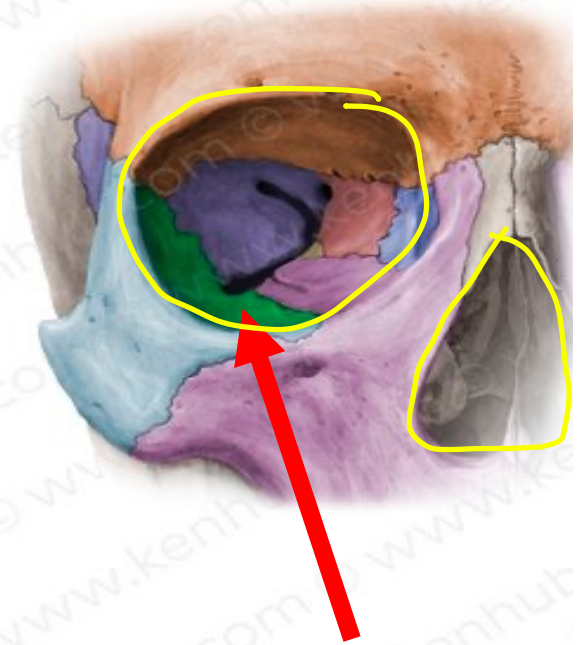


4- Orbital Fissures

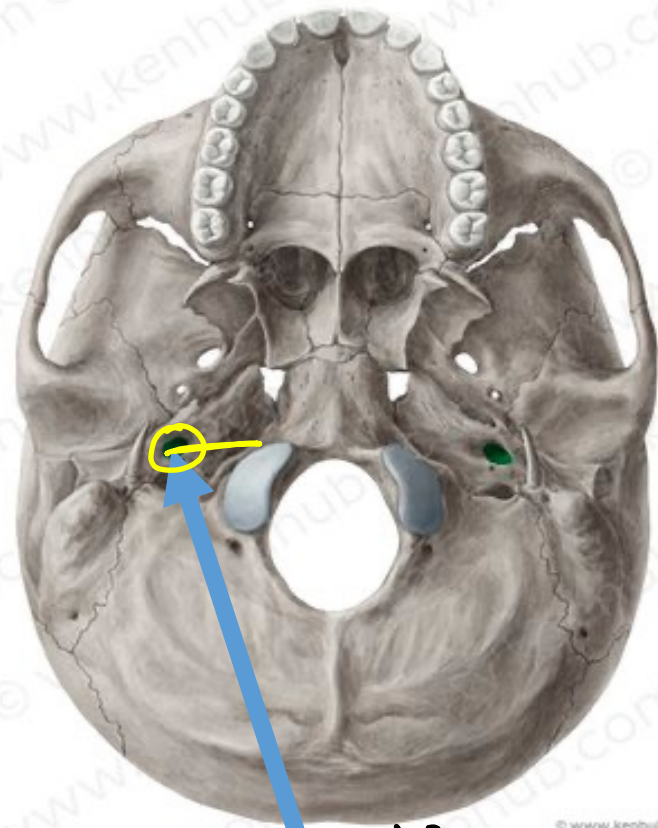
شَقَا



5-Foramen opening connecting two spaces

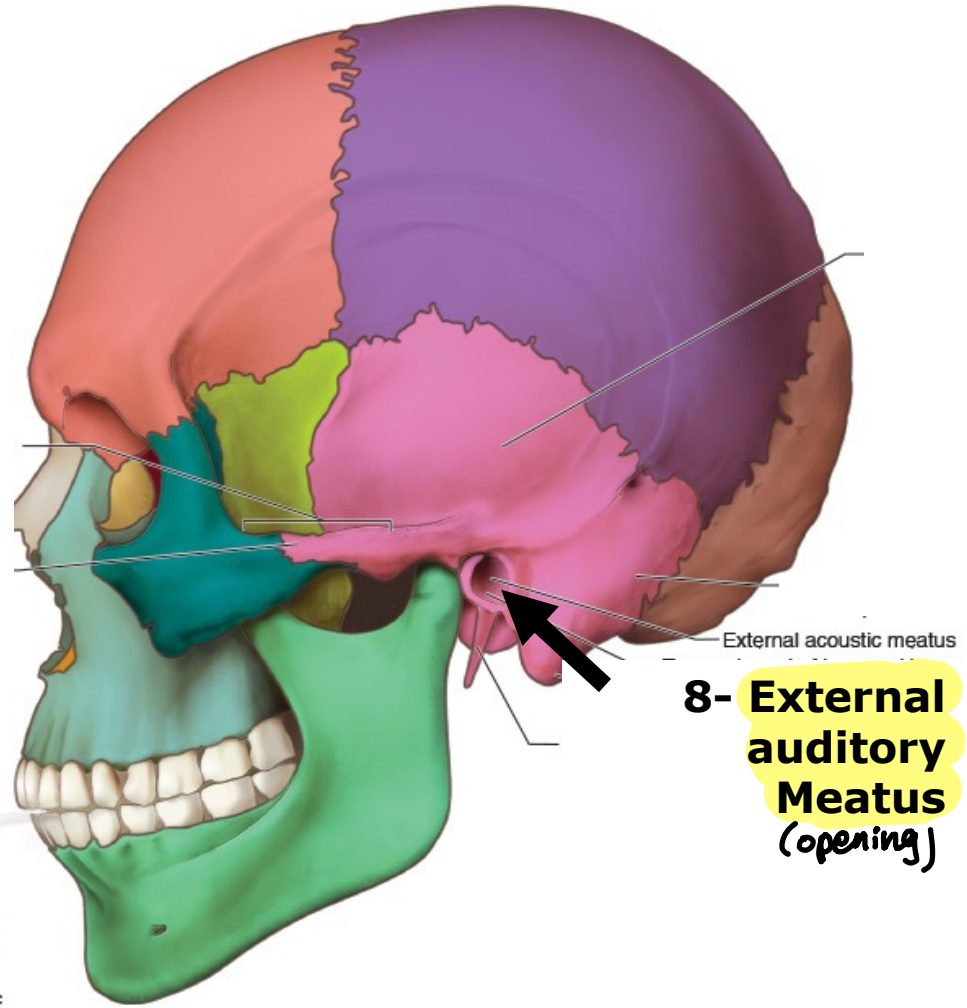


6-Orbital aperture large opening



قناة
7- Carotid canal

- Bones**
- Ethmoid
 - Frontal
 - Lacrimal
 - Mandible
 - Maxilla
 - Nasal
 - Occipital
 - Parietal
 - Sphenoid
 - Temporal
 - Vomer
 - Zygomatic



External acoustic meatus
8- External auditory Meatus (opening)



ligament
or muscle
attachment

عقبة

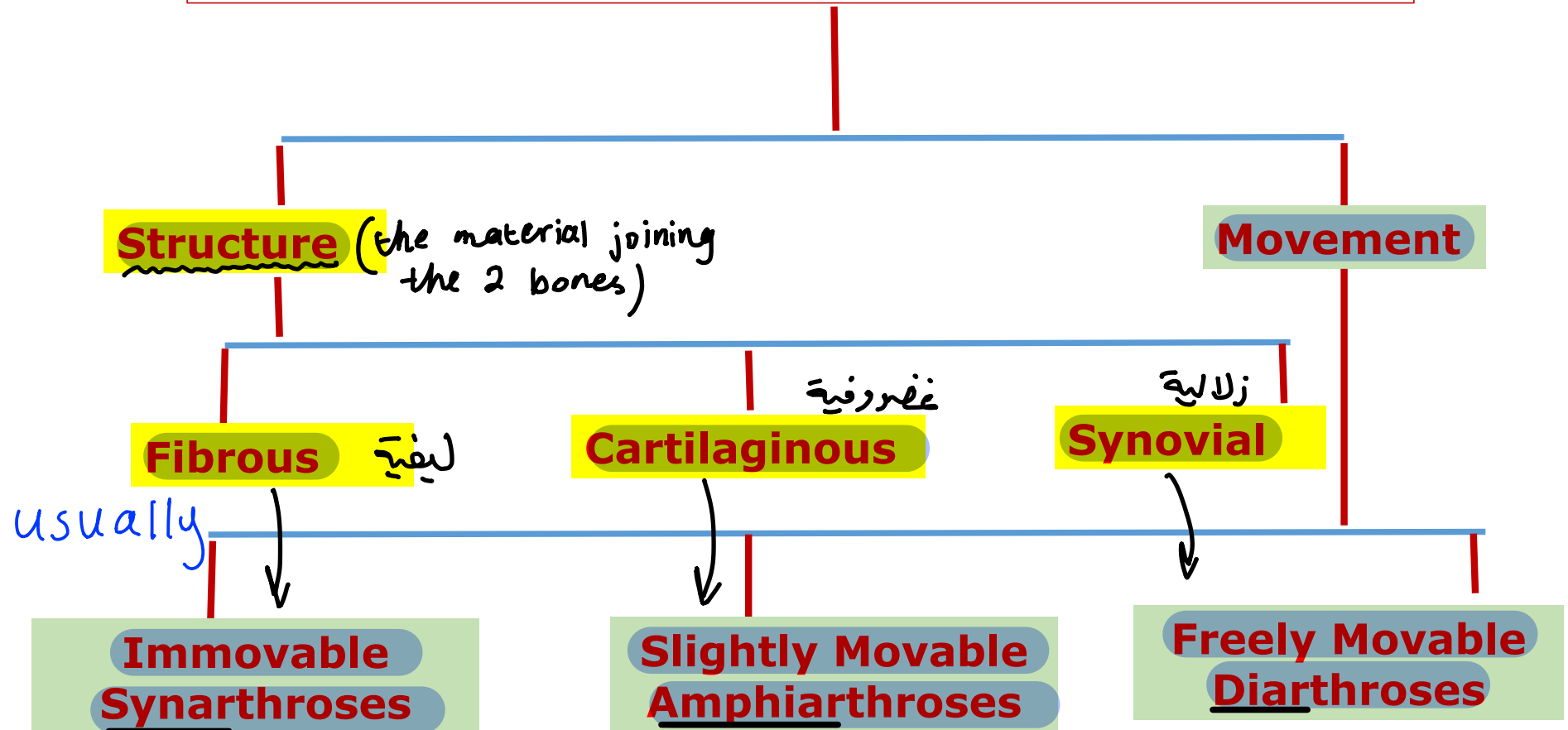
Impression for costoclavicular ligament

Joints

It is the site of articulation (joining) between bones



Classification of joints



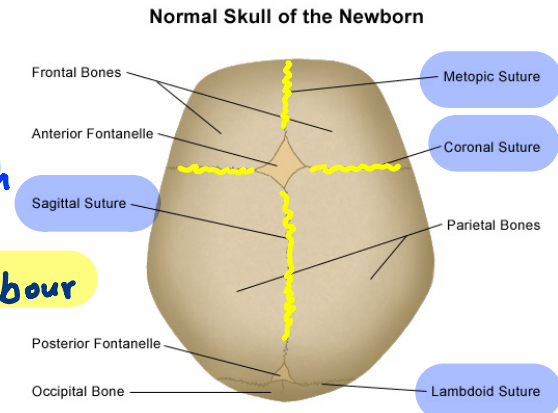
Fibrous Joints

Bones united by fibrous tissue

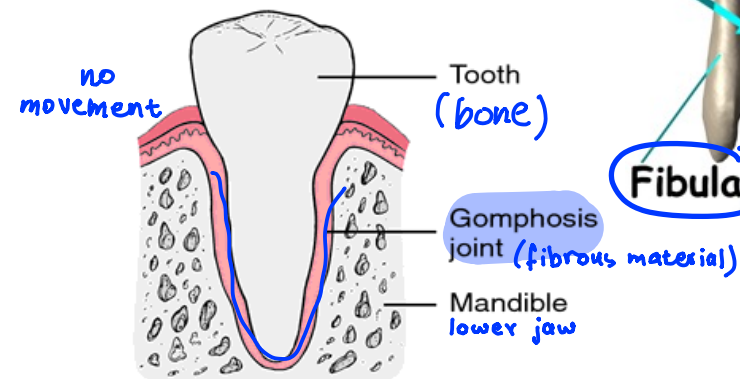
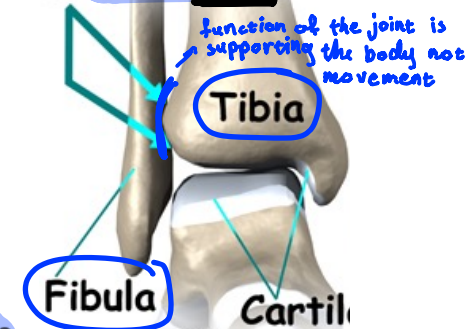
Examples :

- **Sutures** (Skull sutures) *only moves in babies & during labour*
- **Syndesmoses** e.g. *distal end of tibia and fibula*
- **Gomphosis** : *Between root of the teeth and socket of the jaw.*

for brain growth
getting out of the birth canal



Syndesmosis Joint of the Ankle



Socket of the tooth (gomphosis)

completely made out of cartilage

Cartilaginous Joints

Bones are connected by cartilage

Types *no movement*

• **Primary Cartilaginous (Synchondrosis)**

e.g. *rib cartilage* Chostochondral joint, *growth plate* Epiphyseal plate of cartilage.

minimal movement

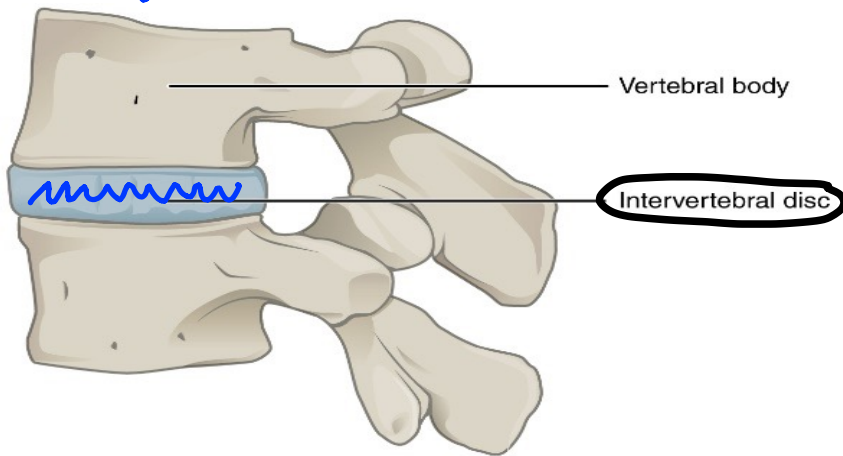
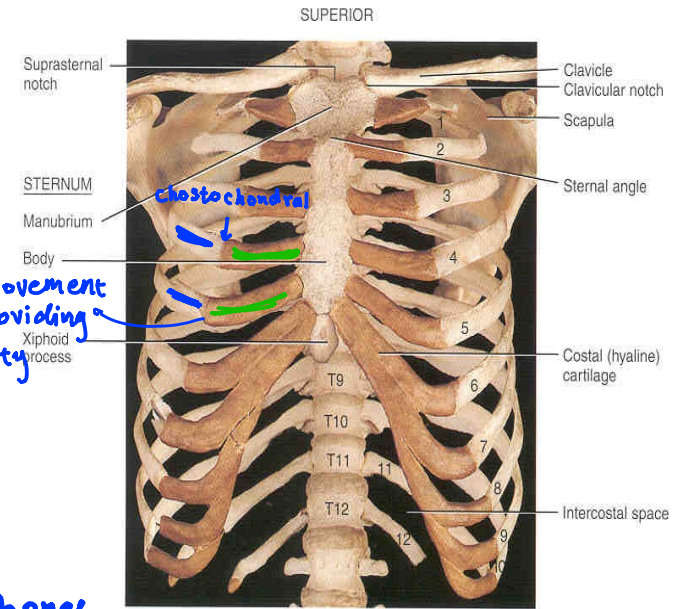
no movement function is providing flexibility

• **Secondary Cartilaginous (MIDLINE OF BODY)**

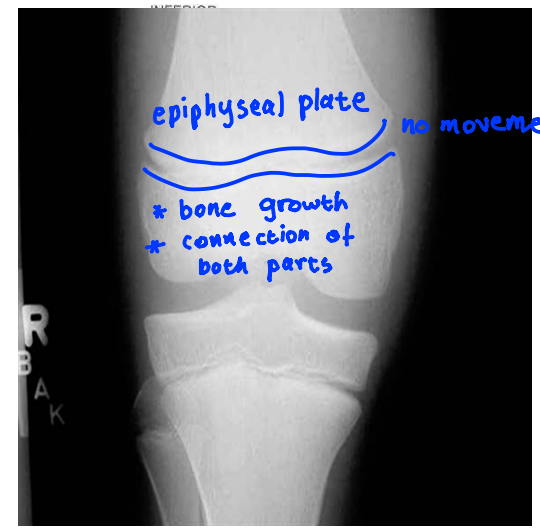
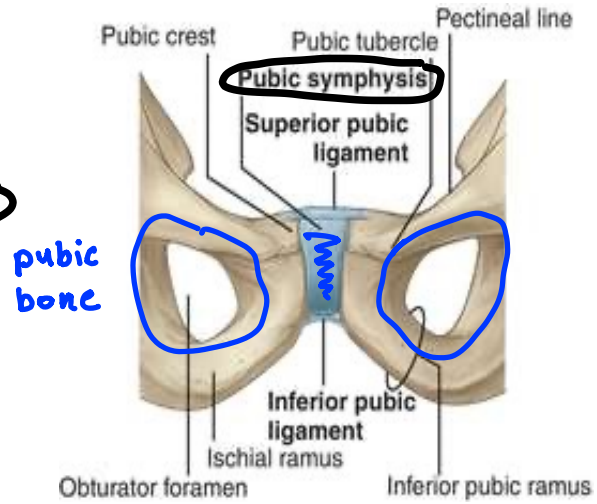
made out

of fibrocartilage

e.g. *between discs* Intervertebral disc joints, *joint between two pubic bones* symphysis pubis



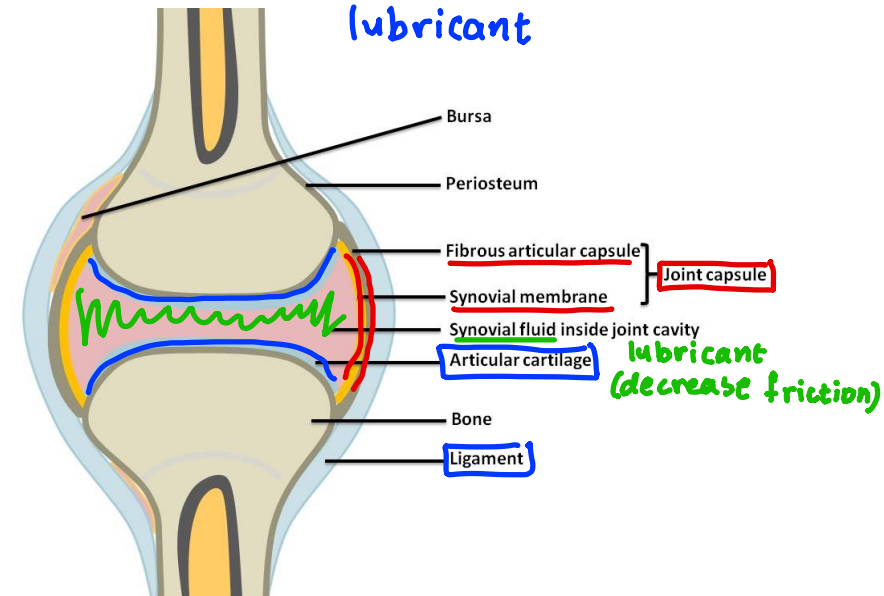
Lateral view



highly movable

Synovial Joints

- ❑ Articulating bones are separated by a joint cavity
- ❑ Articular cartilage (hyaline cartilage) covers the ends of bones to decrease friction
- ❑ Joint surfaces are enclosed by a fibrous articular capsule to keep the synovial fluid
- ❑ The Joint capsule is lined by synovial membrane → secretes the synovial fluid
- ❑ Have a joint cavity filled with synovial fluid → facilitates the movement as a lubricant
- ❑ Ligaments reinforce the joint



Types of Synovial Joint

according to the axis of movement

one axis

Uniaxial

Hinge (Elbow)

flexion & extension

Pivot (Radioulnar)

supination & pronation

Plane (Carpal Bone)

gliding movement

two axes

Biaxial

Condyloid (wrist joint)

flexion & extension +
adduction & abduction

Saddle

(carpometacarpal of
thumb)

more than 2

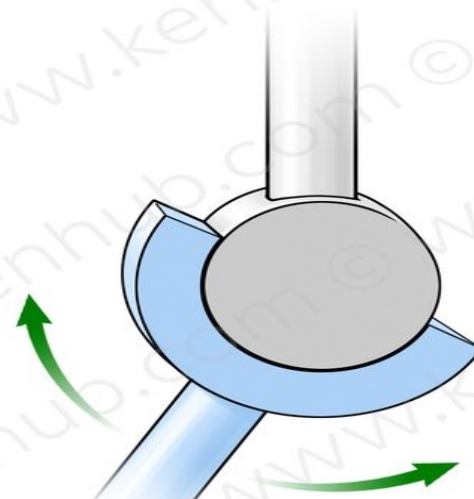
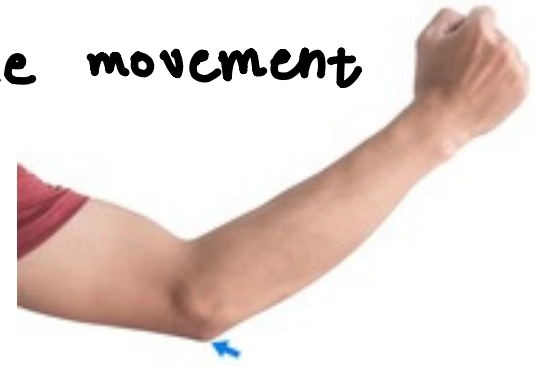
Multiaxial

Ball and
socket e.g
Shoulder
joint

Uniaxial only one movement

Hinge: permit flexion and extension only

- Elbow
- Ankle



Uniaxial

around the axis

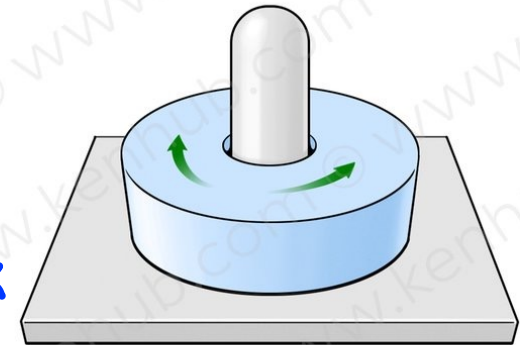
Pivot: Rotation movement

➤ Radioulnar (forearm) pronation & supination

➤ Atlantoaxial

Atlas - Axis

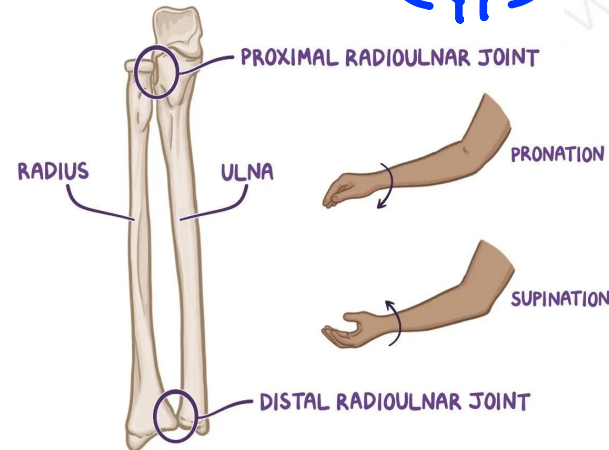
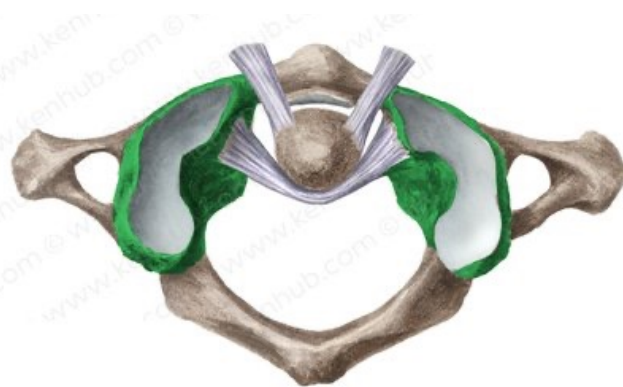
1st and 2nd cervical vertebrae → rotation of the neck



RADIOULNAR JOINTS



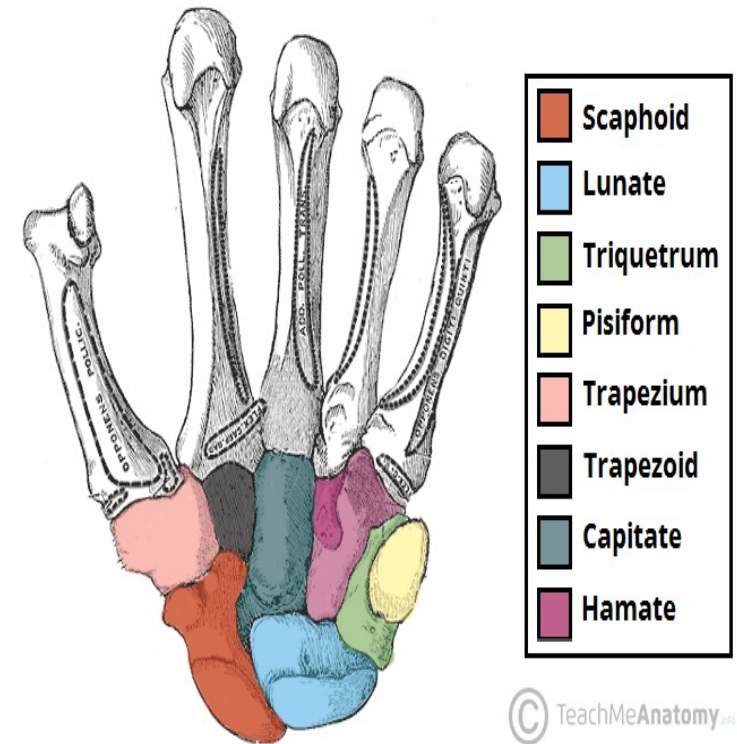
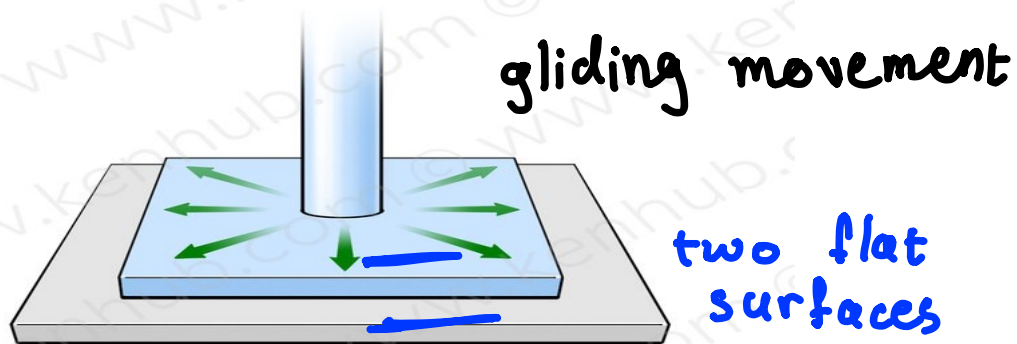
nodding
NO



Uniaxial

Plane : the articular surfaces are flat, and they allow gliding movement.

- Intercarpal carpal bones of the hand
- Between vertebral articular processes.



according to the **shape** of articular surfaces :

Biaxial

Condyloid between the shallow depression of one bone and the rounded structure of another bone or bones.

It permits : flexion/extension and abduction/adduction

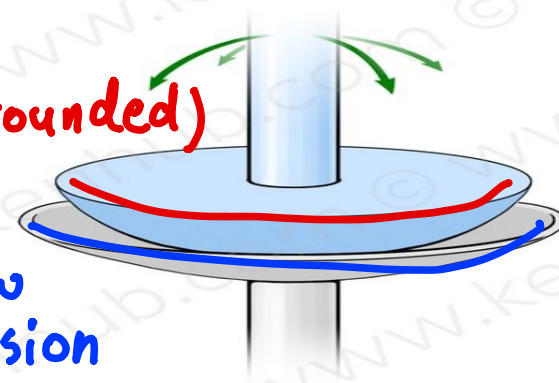
Example : **Wrist joint**



two movements

convex (rounded)

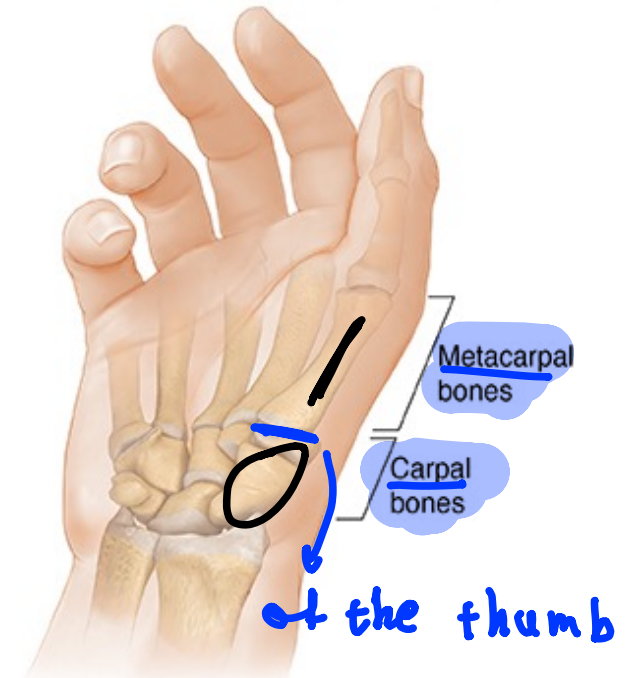
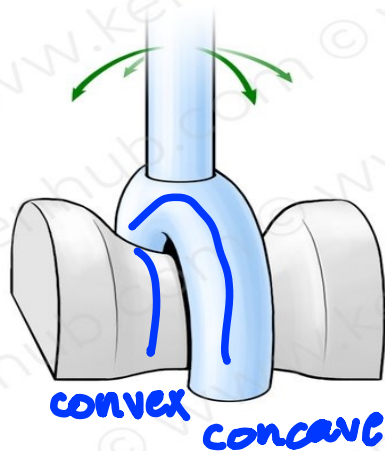
sh allow depression



Biaxial

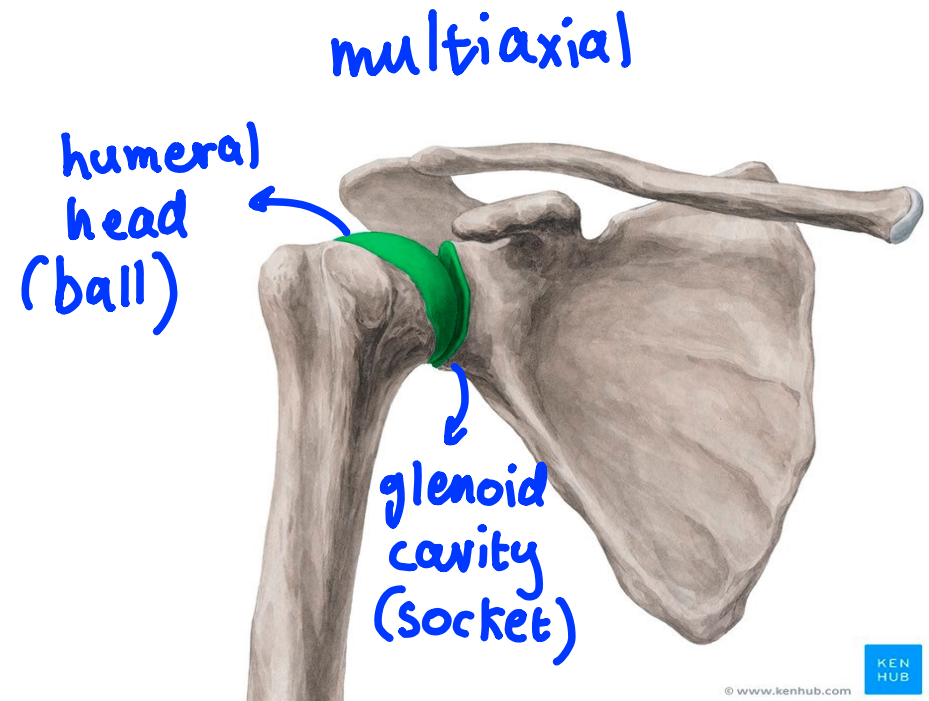
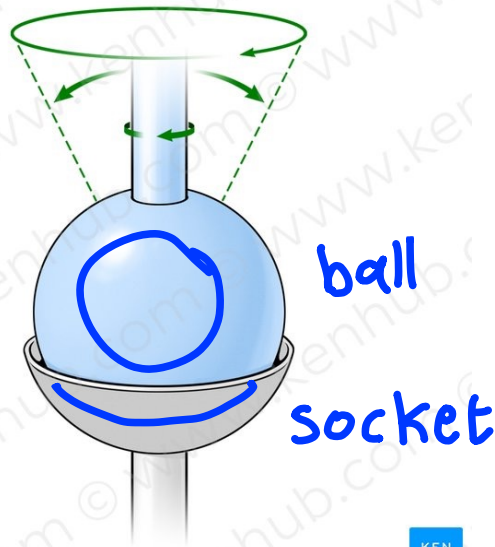
Saddle : Each articular surface has both concave and convex areas

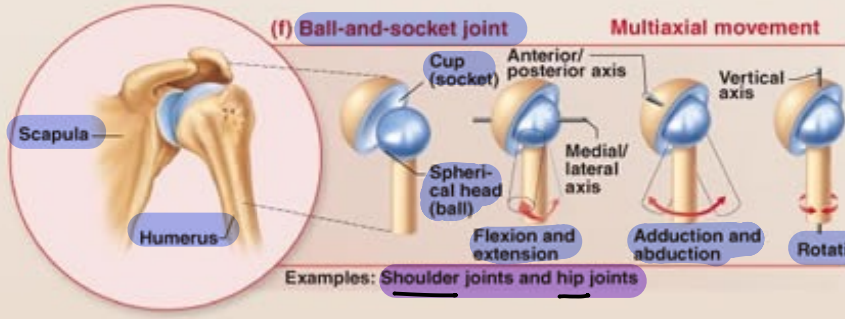
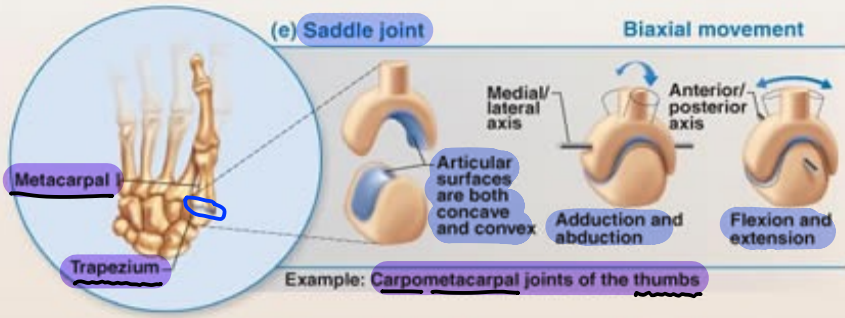
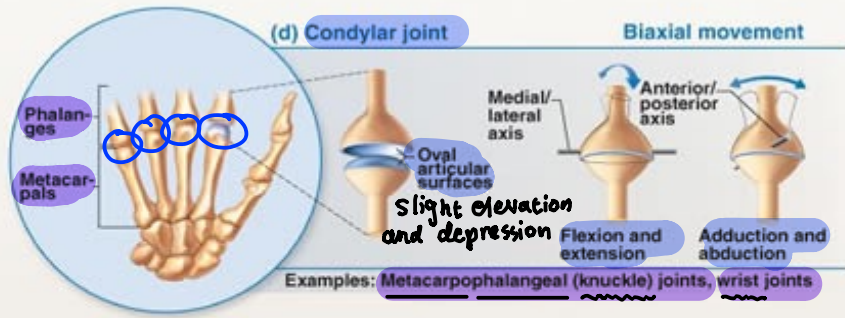
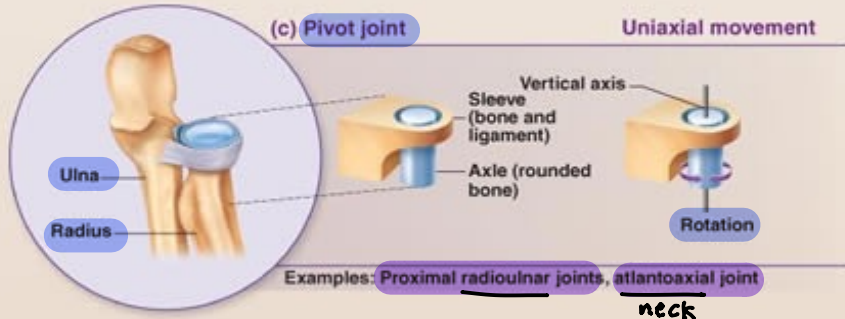
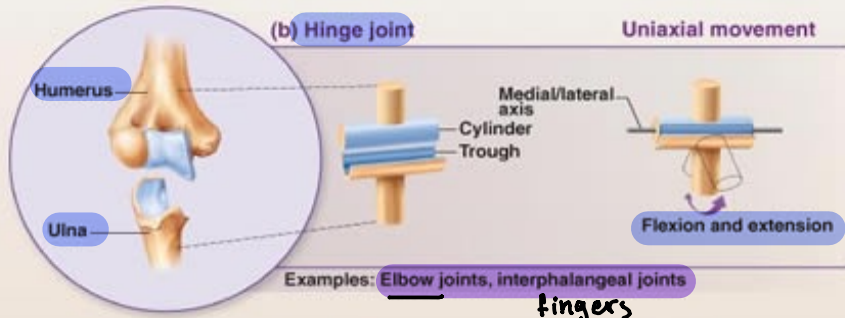
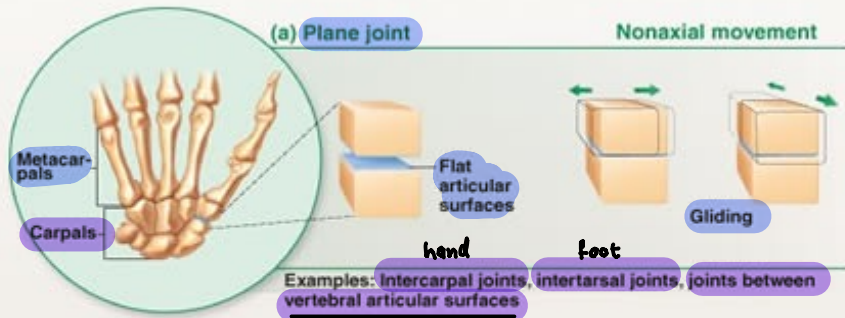
Example : (carpometacarpal of thumb) → other fingers do not have uniaxial saddle joints
between carpal and metacarpal

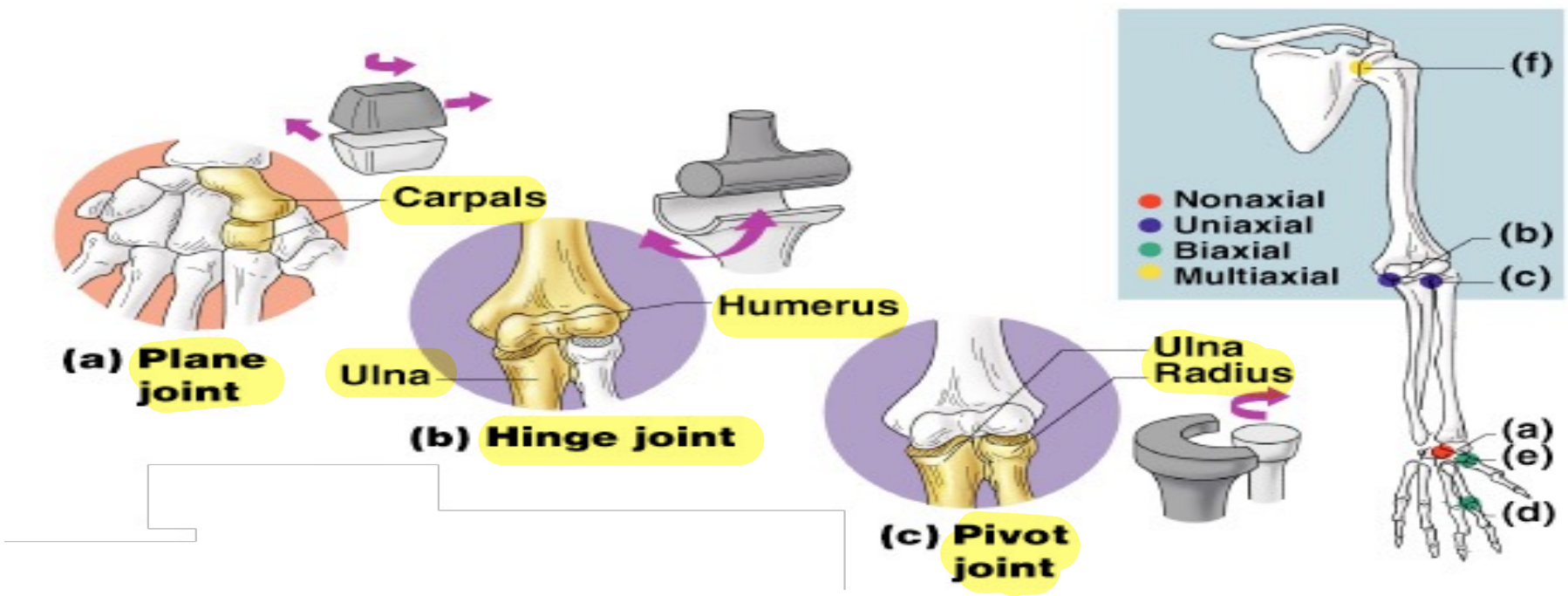


Multiaxial

Ball and socket adduction & abduction / elevation & depression / flexion & extension / rotation ...
Spherical or hemispherical head of one bone articulates with the cuplike socket of another
e.g. Shoulder joint / hip joint









Muscles



Muscles are classified into 3 types: skeletal, smooth and cardiac.

(1) Skeletal muscles:

❖ Attached to and produce movement of the skeleton.

❖ Voluntary muscles

❖ Nerve supply: Somatic nerves.

(2) Smooth muscles:

❖ Site: blood vessels & walls of viscera.

❖ Involuntary muscles

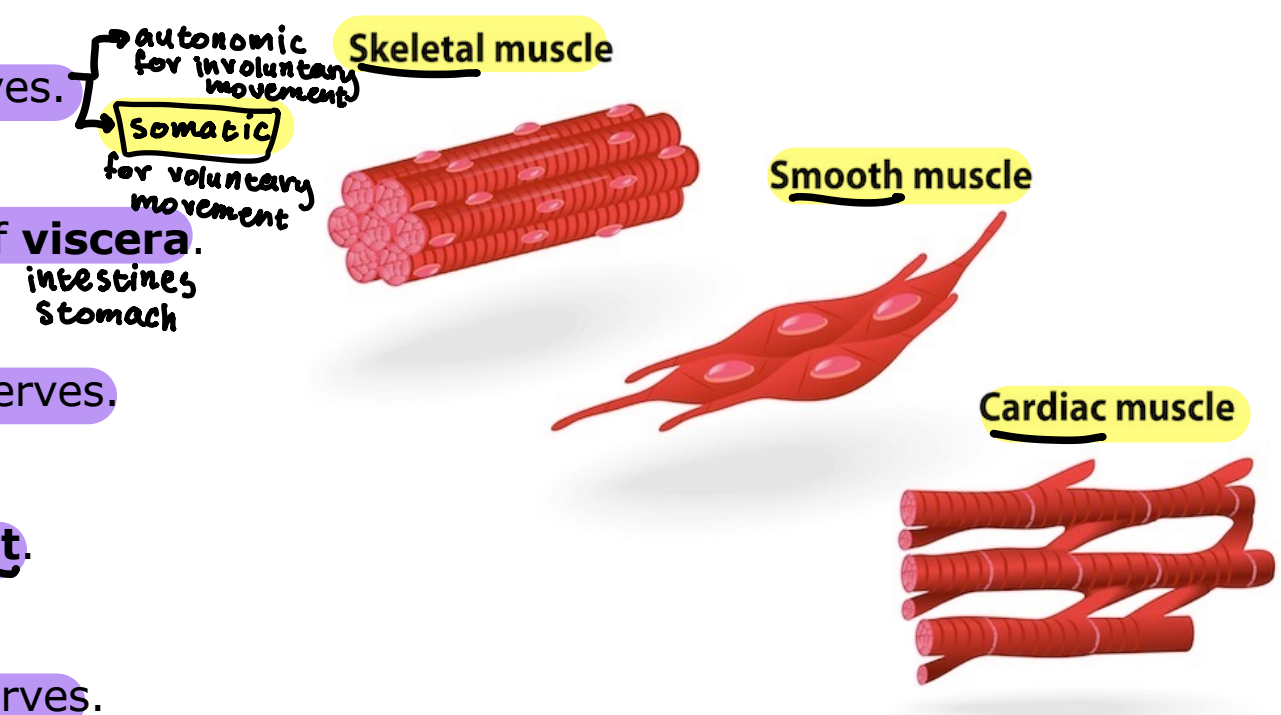
❖ Nerve supply: Autonomic nerves.

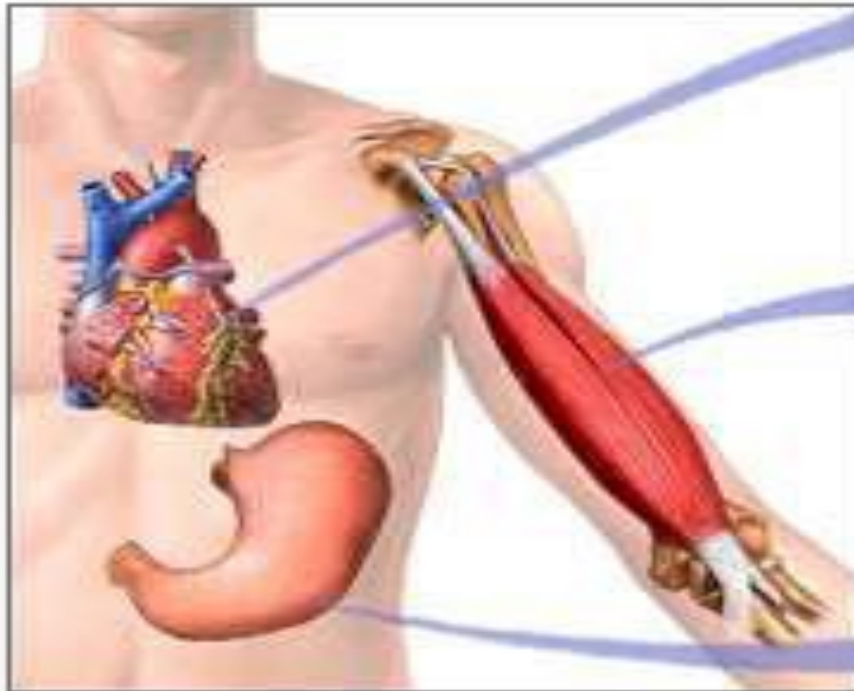
(3) Cardiac muscle:

❖ Site: Myocardium of the heart.

❖ Involuntary muscles

❖ Nerve supply: Autonomic nerves.





Cardiac muscle cell



Skeletal muscle cell



Smooth muscle cell

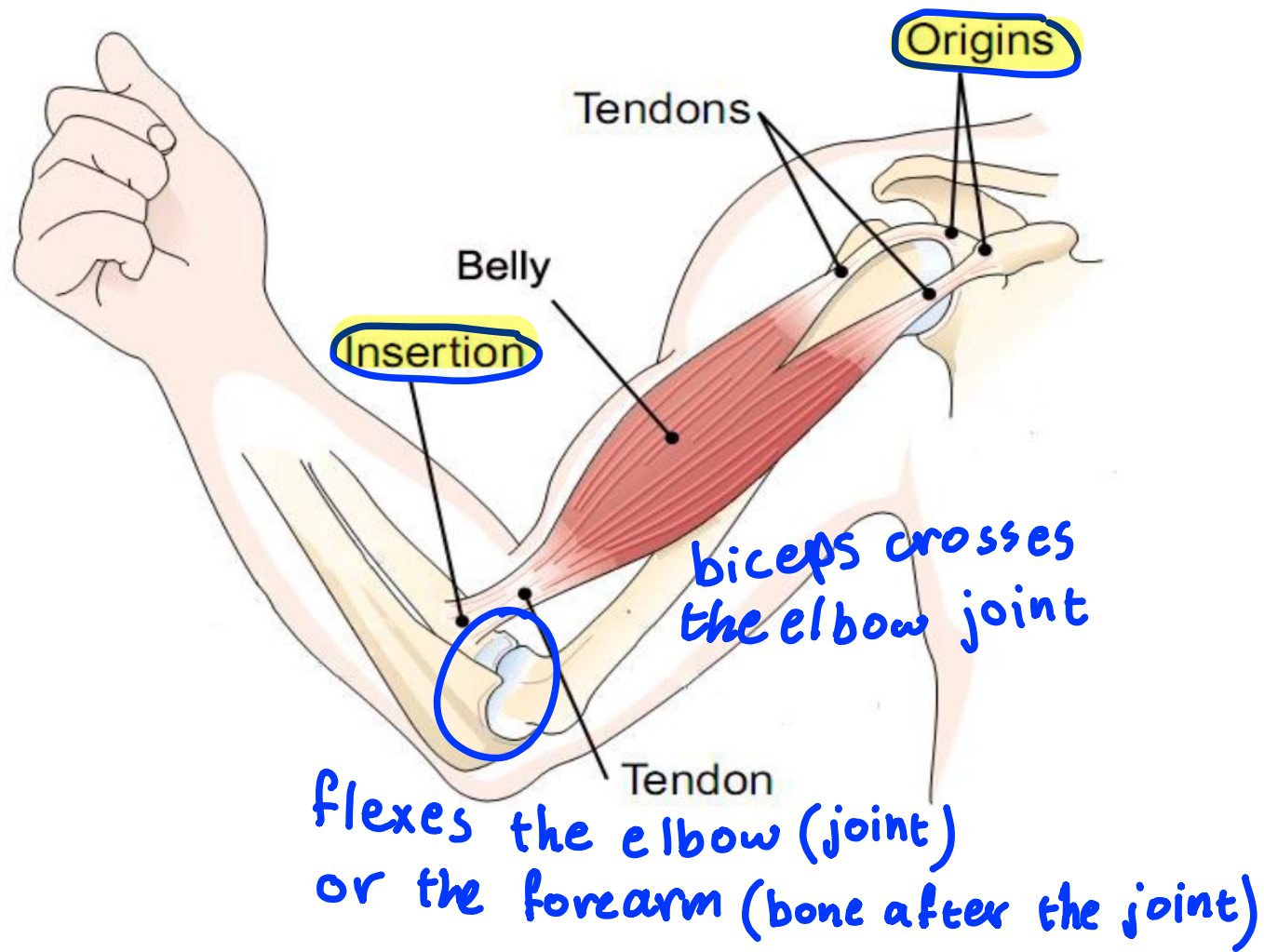
Skeletal Muscles

A muscle has 2 attachments:

1. **Origin**: is the more fixed attachment. *ALMOST always fixed*
2. **Insertion**: is the more mobile attachment.

When a muscle contracts, its fibers shorten and the insertion moves towards the origin, thus producing movement at the related joint.





Action of skeletal muscles:

- Muscles are classified according to their action (function) into:

Prime movers: (AGONISTS)

- There are muscles responsible for initiation of a particular movement.

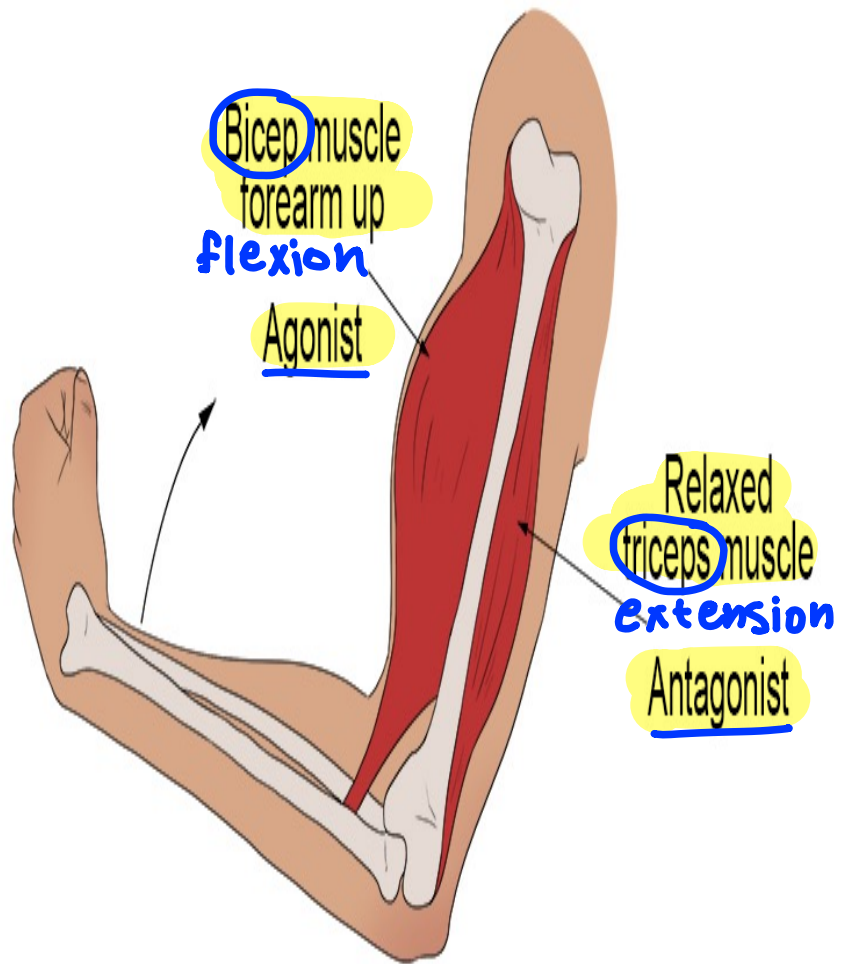
Antagonist:

- There are muscles, which oppose the action of prime movers.

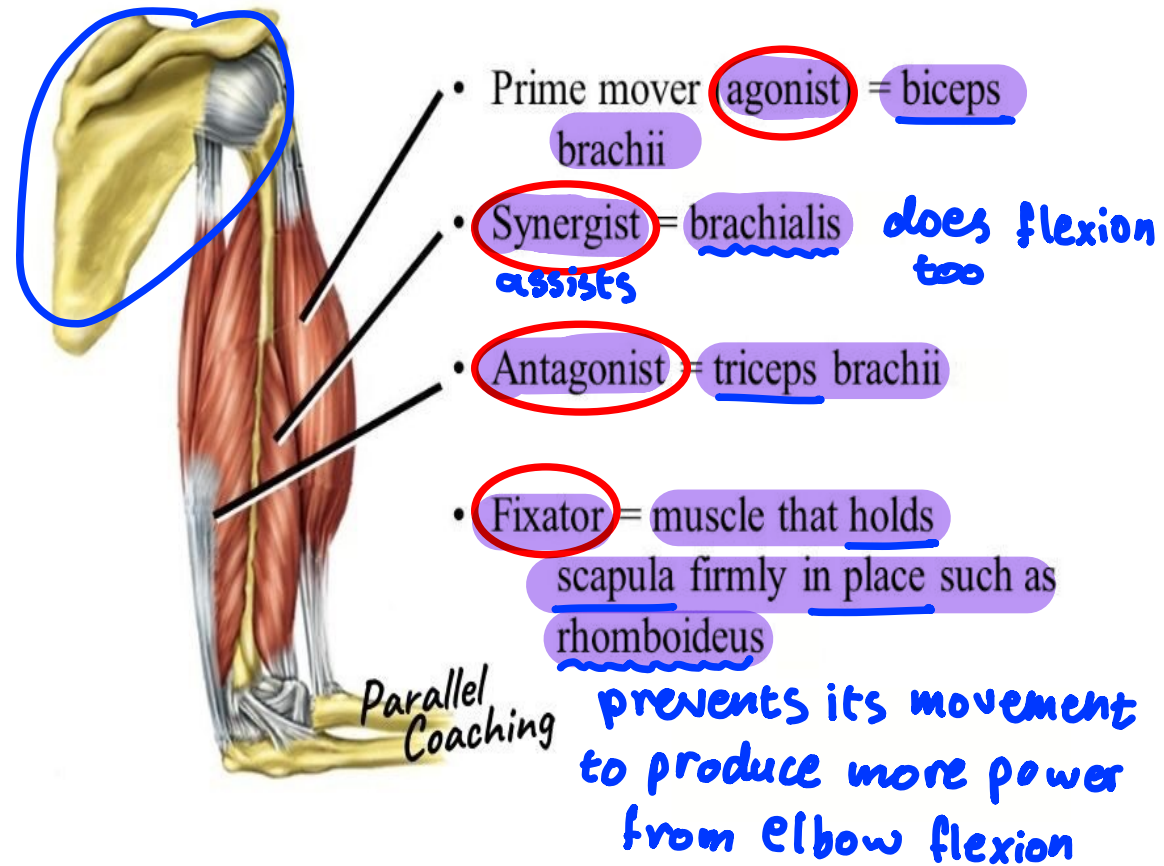
Synergists: assists

- Synergists are muscles that assist the prime mover in its role.

Fixators: (STABILIZERS):- Help the prime mover by fixing its origin or keep bones immobile when needed. *fixes the bone*



MUSCLE ACTIONS DURING A BICEPS CURL



THANK YOU