Introduction to Human Anatomy

Basics of Bones

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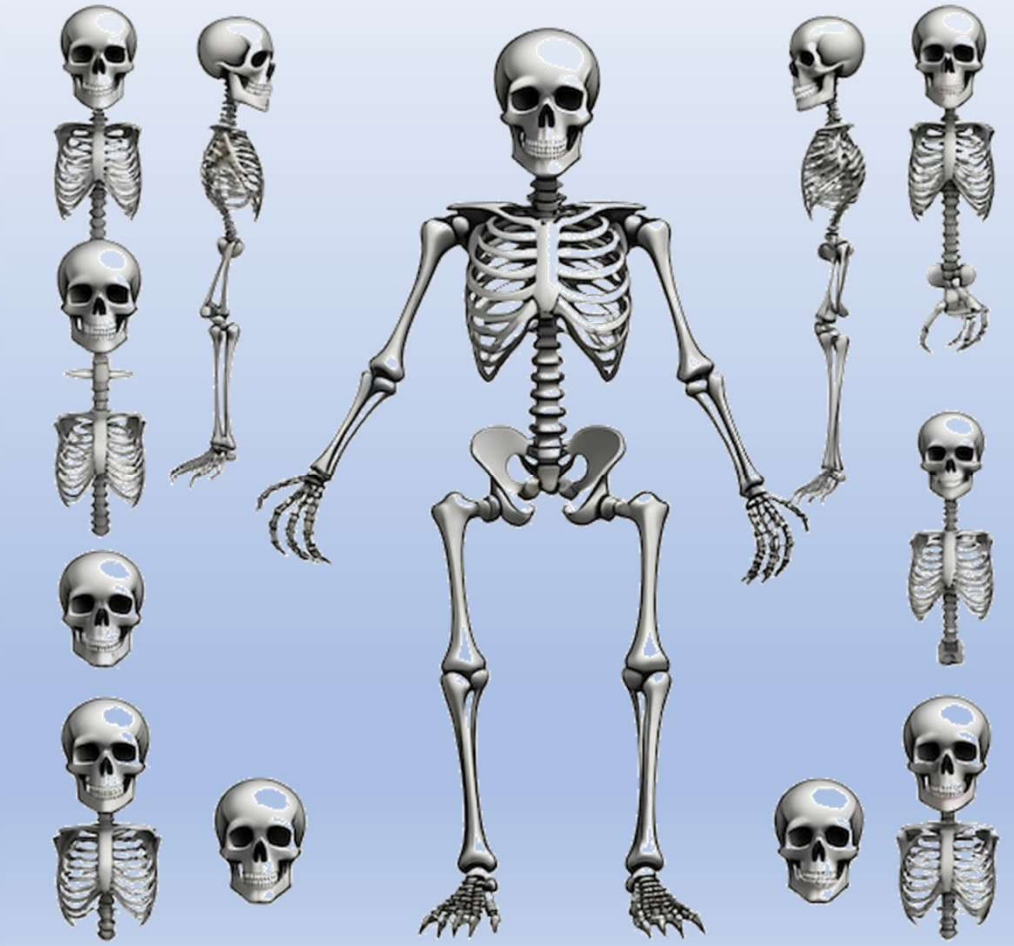
Objectives

By the end of this lecture students should:

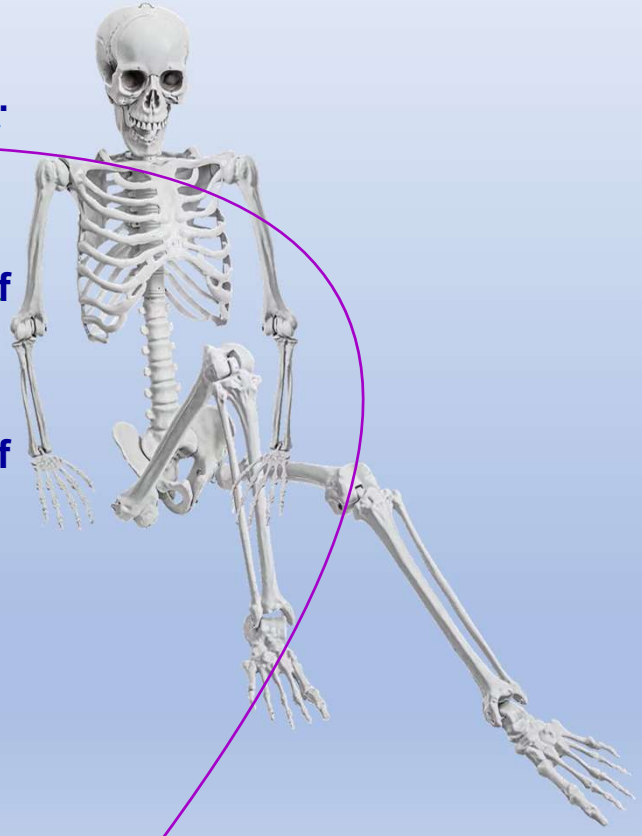
- **Define bone.**
- **Explain functions of bones.**
- **Classify bones of the body according to:**
  - ✓ **Position in the body.**
  - ✓ **Development (ossification).**
  - ✓ **Shape.**
  - ✓ **Structure.**
- **Distinguish parts of long bone.**
- **Describe the blood supply of long bone.**



Bones

❑ Definition, Structure & Characters:

- Bone is a calcified living connective tissue that forms the skeleton.
- It is formed of bone cells, fibers & matrix.
- It is hard due to calcification of its matrix & has a degree of elasticity due to presence of organic fibers.
- It is capable of changing its structure (remodeling) as the result of the stresses to which it is subjected.



❑ Number of bones in human body:

- There are 206 bones in the human body.

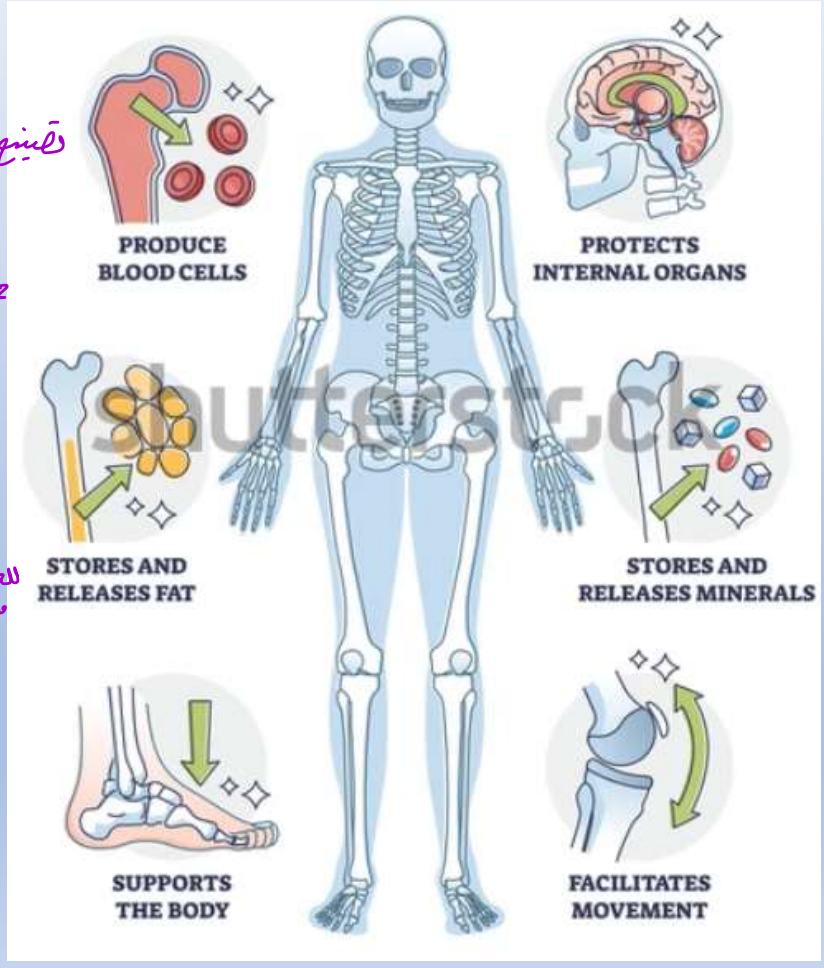
جزء غير عضوي (Inorganic): أملاح الكالسيوم والفوسفات، وهي اللي تعطي العظم الصلابة.

2. جزء عضوي (Organic): ألياف كولاجين وبروتينات، وهي اللي تعطي العظم درجة من المرونة

Bones

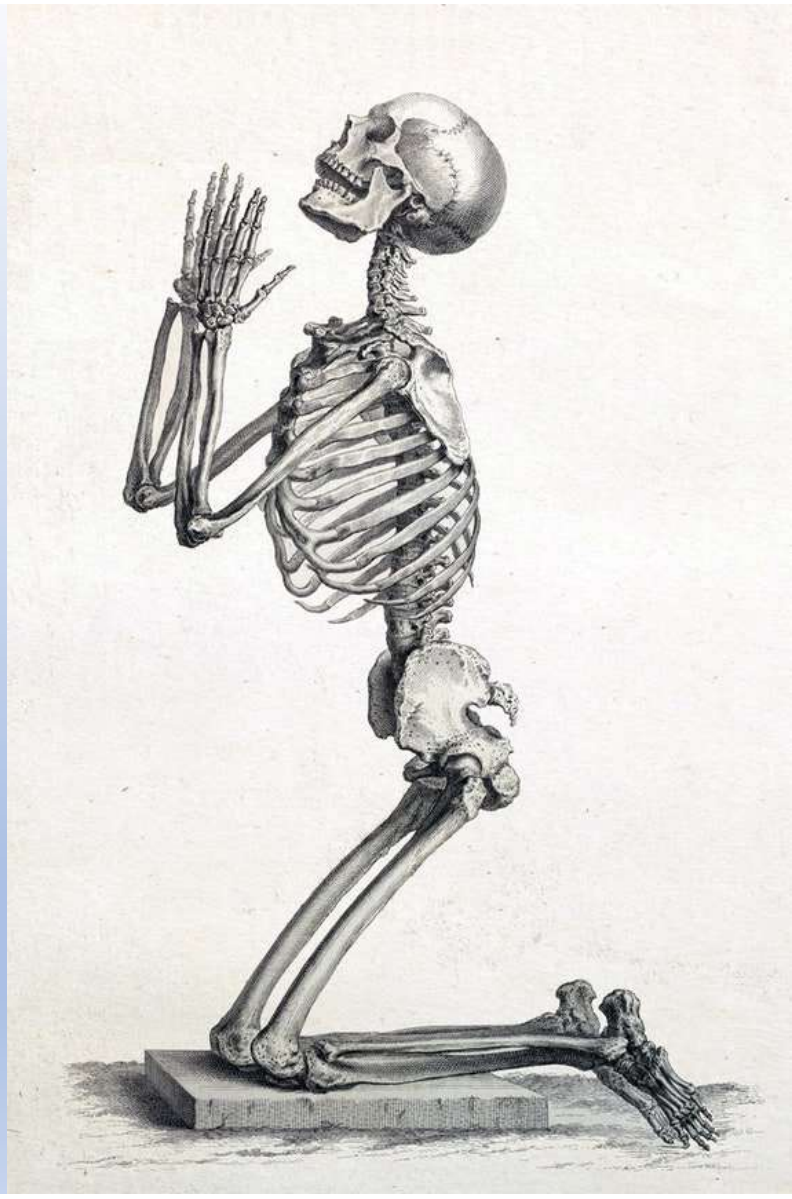
Functions of bones:

1. Formation of blood cells (Hematopoiesis).
2. Protects internal organs (skull protects the brain & thoracic cage protects the heart and lungs).
3. Stores and releases ions (Calcium & phosphorus) & fat.
4. Supports the body and gives its shape.
5. Gives attachment to muscles & ligaments.
6. Provide levers for muscles to move joints (Movement).



Bones

- **Classifications:**
  1. According to position (regional classification).
  2. According to ossification (development).
  3. According to structure.
  4. According to shape.



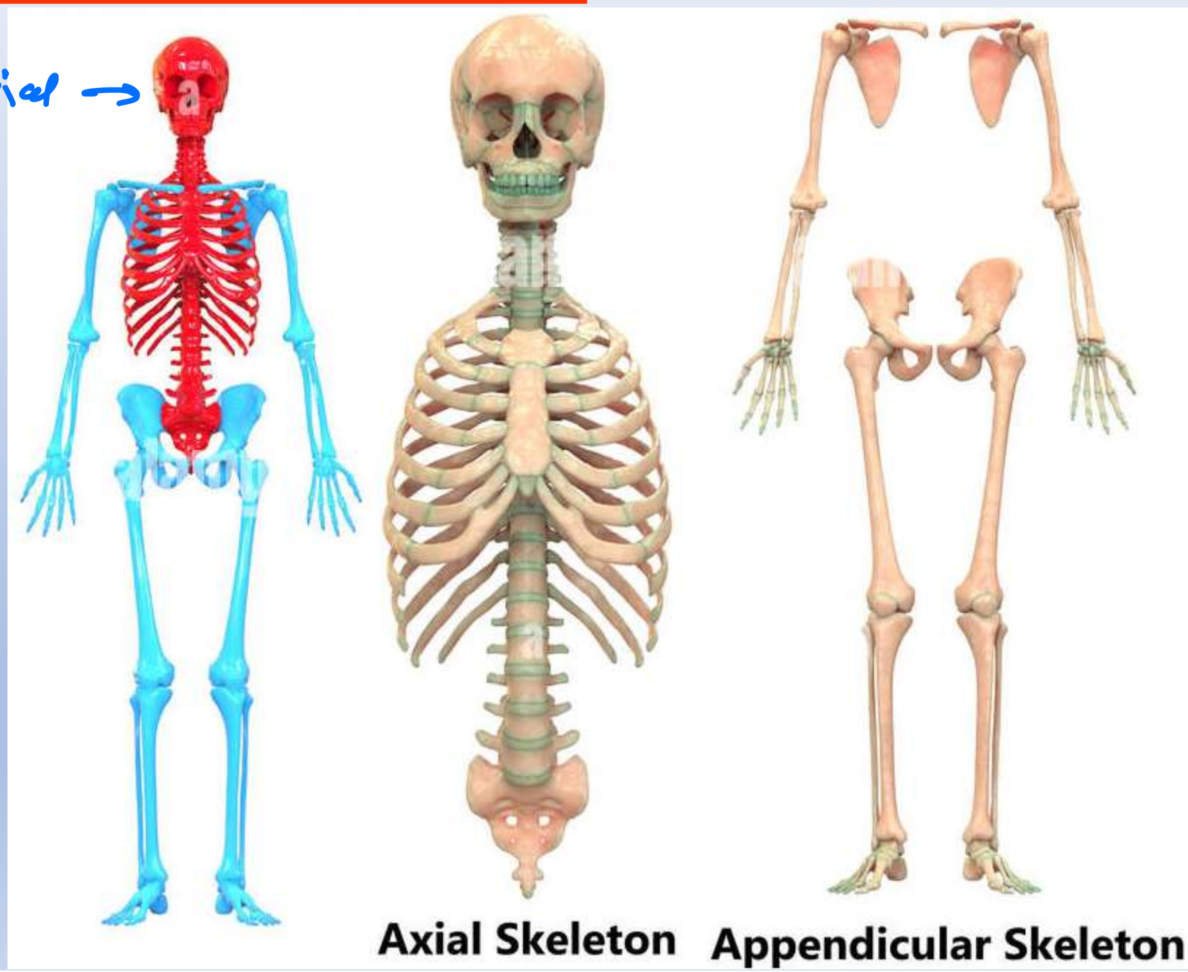
Classification of Bones According to Position (Regional Classification)

Axial Skeleton:

1. Skull. الجمجمة
2. Hyoid bone. العظم اللامي
3. Vertebral column. العمود الفقري
4. Ribs. الأضلاع
5. Sternum. عظم القص

Appendicular Skeleton:

1. Bones of upper limbs.
2. Bones of lower limbs.



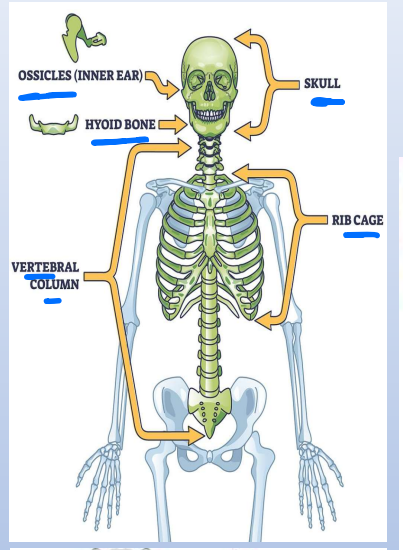
يساعد على تحريك اللسان

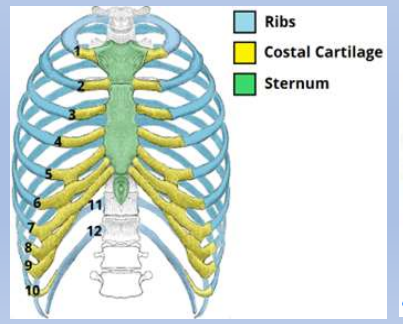
يساعد في البلع ← يختلف عن باقي العظام لأنه ما يتصل بأي عظم ثاني مباشرة، بل يكون معلق بالعضلات والأربطة

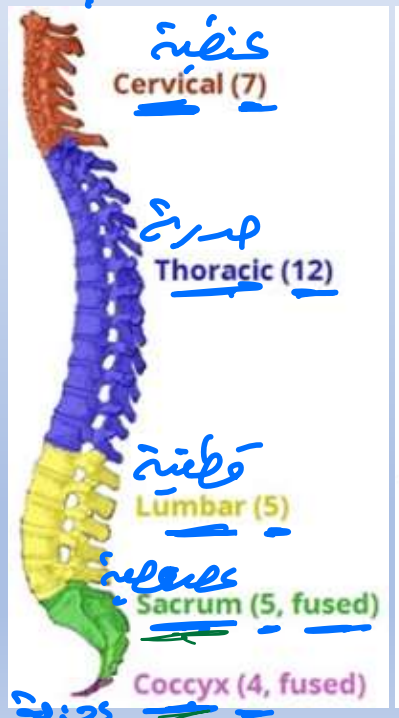
يثبت الحنجرة

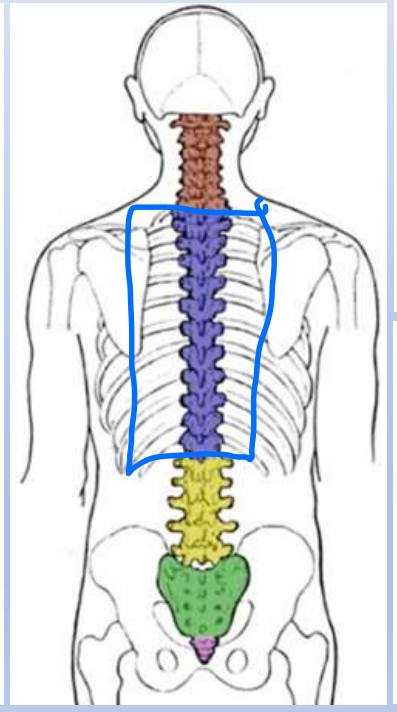
Classification of Bones According to Position (Regional Classification)

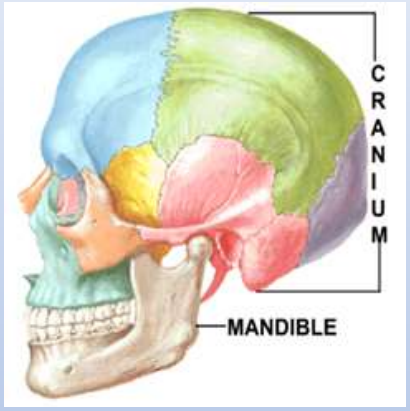
- **Axial Skeleton:**
  - Skull.
  - Hyoid bone.
  - Vertebral column.
  - Ribs.
  - Sternum.

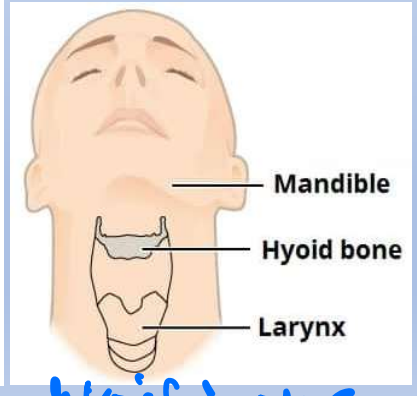








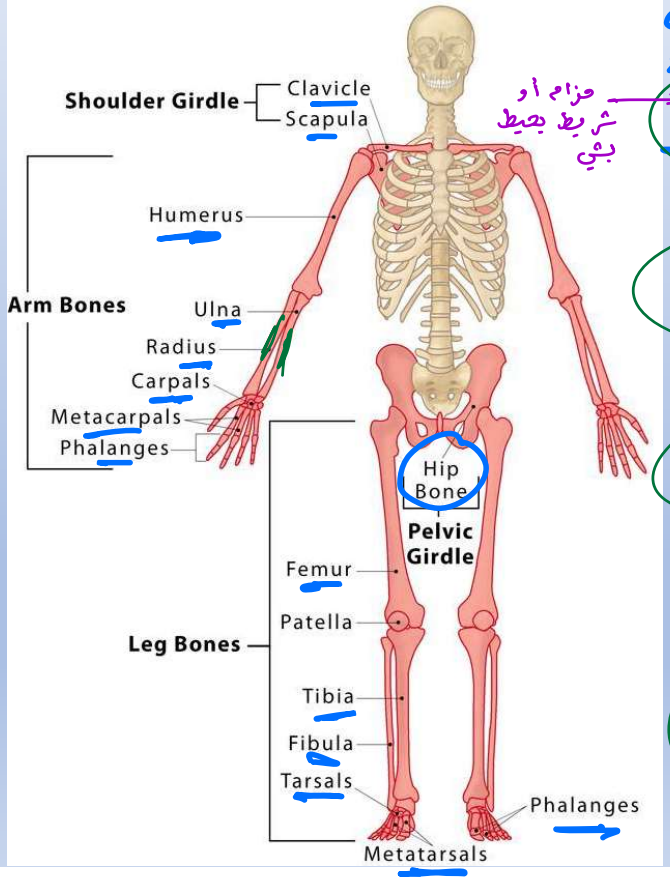




❖ **Thoracic cage is formed of:** Sternum, 12 pairs of ribs & 12 thoracic vertebrae.

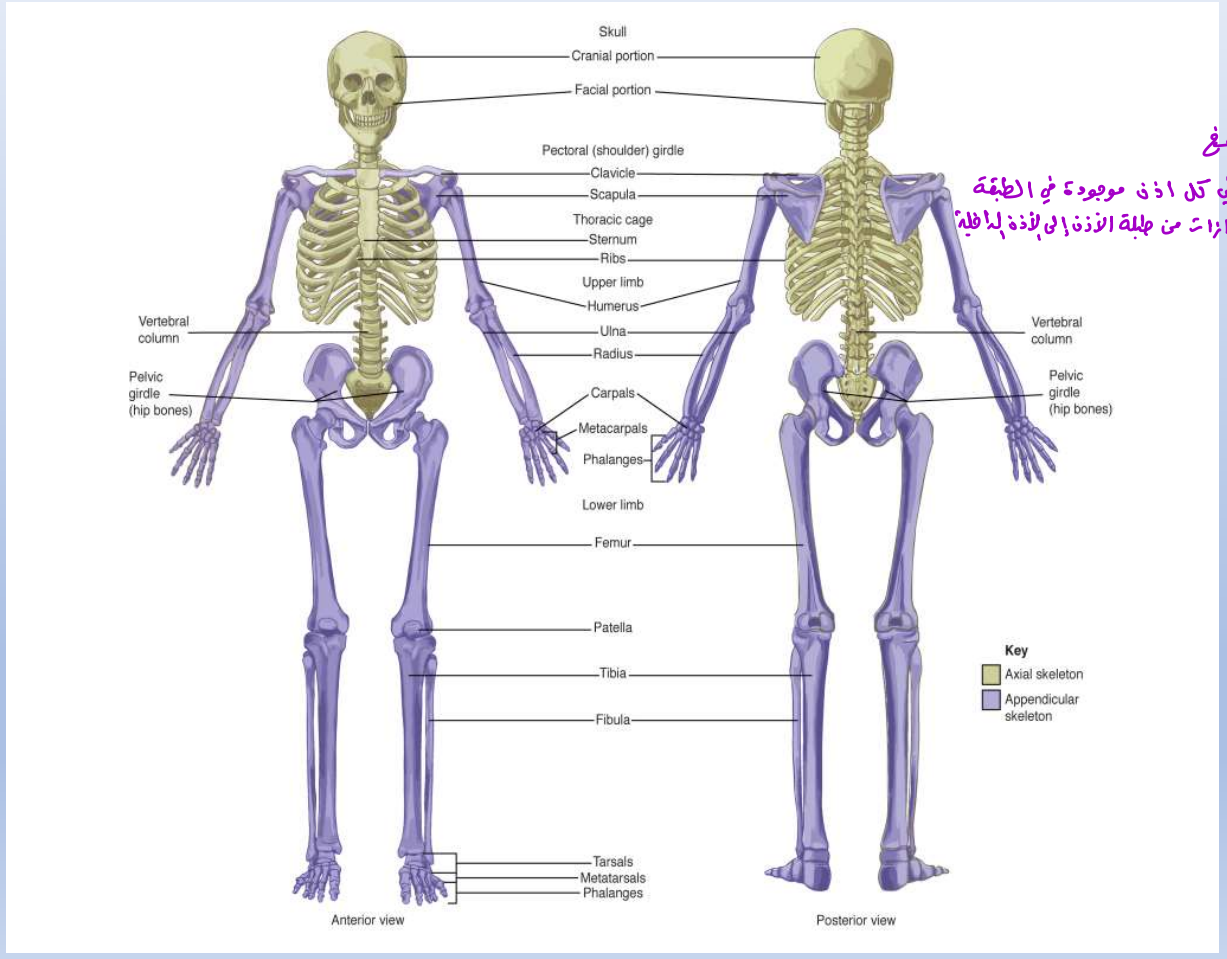
Classification of Bones According to Position (Regional Classification)

❑ Appendicular Skeleton:



Region (Part)	Upper Limb		Lower Limb	
Girdle	Shoulder girdle: Clavicle (anteriorly, posteriorly) & Scapula		Pelvic girdle: Hip bones	
Proximal segment	Arm	Humerus.	Thigh	Femur.
Middle segment	Forearm	Ulna (medial). Radius (lateral).	Leg	Tibia (medial). Fibula (lateral).
Distal segment	Hand	Carpal bones (8). Metacarpals (5). Phalanges (3 for each finger & 2 for the thumb). (14)	Foot	Tarsal bones (7). Metatarsals (5). Phalanges (3 for each toe, 2 for the big toe).

Classification of Bones According to Position (Regional Classification)



جزء من الجمجمة يحمي المخ
عظام الوجه
عضيمات السمع ـ ٣ في كل اذن موجودة في الطبقة الوسطى تنقل الاهتزازات من طبلة الاذن إلى الأذن الداخلية

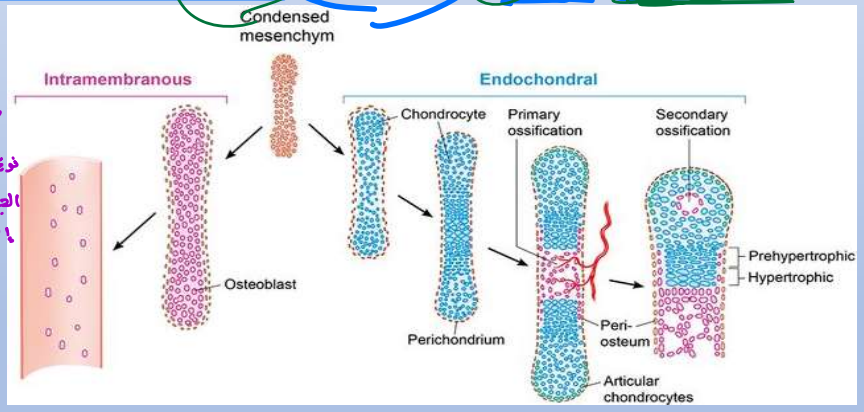
Regional Classification of Bones

Region of Skeleton	Number of Bones
Axial skeleton	
Skull	
Cranium	8
Face	14
Auditory ossicles	6
Hyoid	1
Vertebrae (including sacrum and coccyx)	26
Sternum	1
Ribs	24
Appendicular skeleton	
Shoulder girdles	
Clavicle	2
Scapula	2
Upper extremities	
Humerus	2
Radius	2
Ulna	2
Carpals	16
Metacarpals	10
Phalanges	28
Pelvic girdle	
Hip bone	2
Lower extremities	
Femur	2
Patella	2
Fibula	2
Tibia	2
Tarsals	14
Metatarsals	10
Phalanges	28
	206

Classification of Bones According to ossification (Development)

❑ Intracartilagenous (endochondral) ossification:

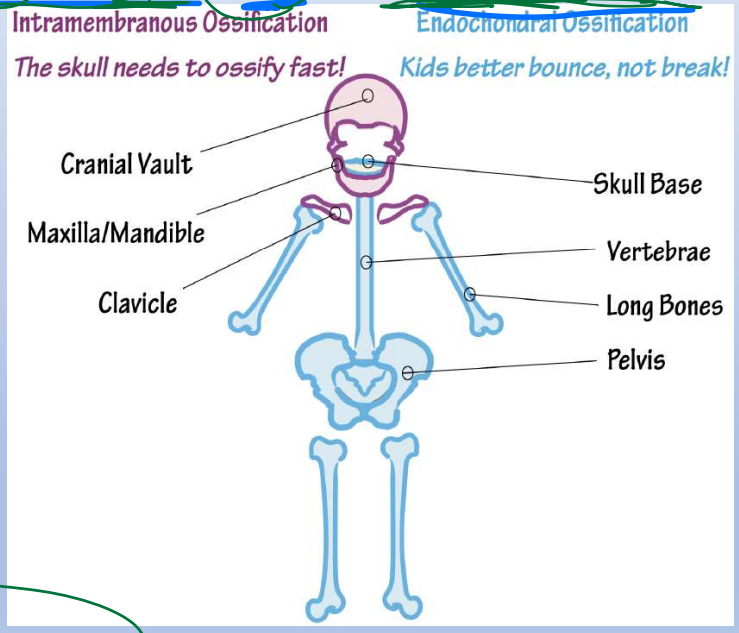
- ➢ Condensed mesenchymal tissue is transformed into cartilaginous model. Then, cartilaginous model is transformed into bone.
- ➢ Example; all bones of the limbs EXCEPT shaft of clavicle.



Condensed: متكاثف أو متراص

mesenchymal: نوع من الأنسجة الجنينية تتكون من خلايا غير متمايزة قادرة على التحول لعدة أنواع من الخلايا

عظم ← غضروف

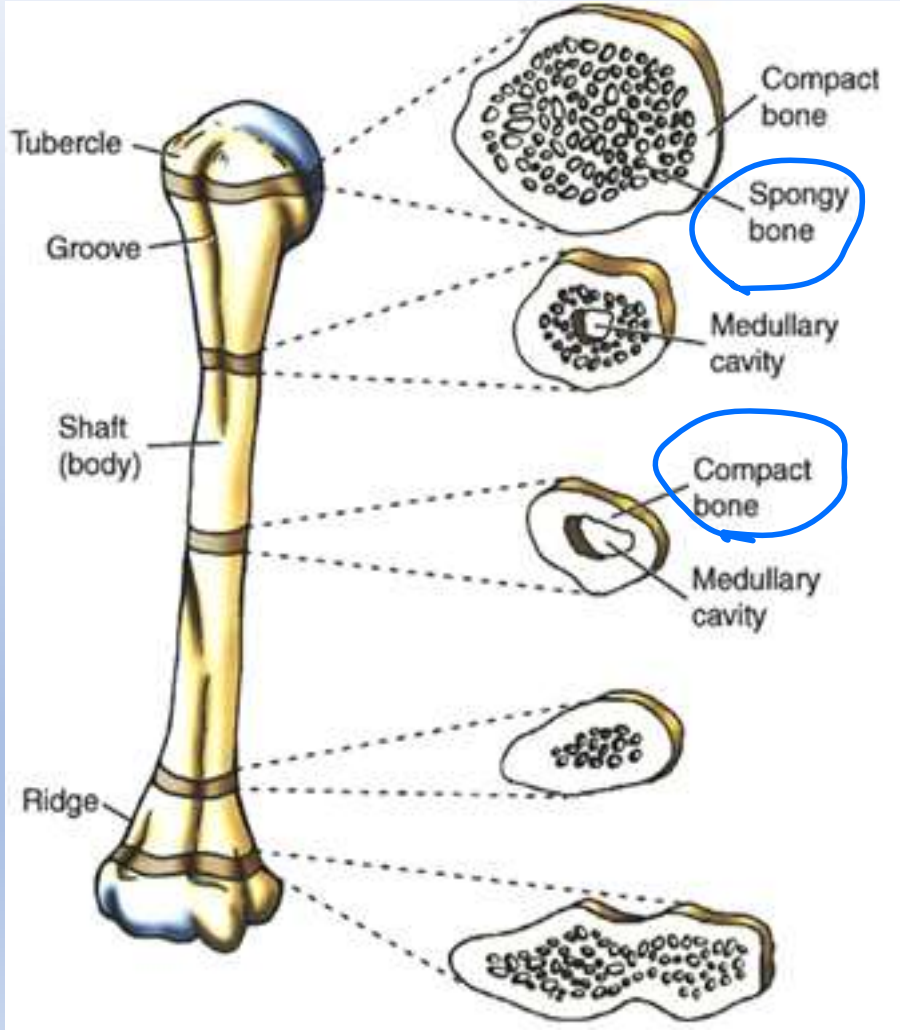


❑ Intramembranous ossification:

- ➢ Condensed mesenchymal tissue is transformed directly into bone.
- ➢ Example; shaft of clavicle, skull cap and bones of face.

Classification of Bones According to Structure

- **Compact Bone:**
  - Dense & ivory-like. صلب
  - Example; cortex of a long bone. القشرة للعظم الطويل
- **Cancellous (Spongy / Trabecular) Bone:**
  - Network of bone trabeculae separated by intercommunicating spaces containing bone marrow. نخاع العظم
  - Example; epiphyses of long bones. نهاية العظم الطويل



Classification of Bones According to Shape

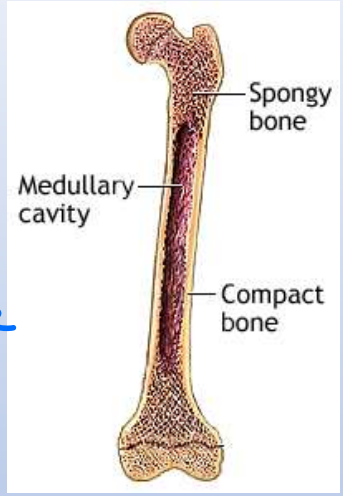
❑ Long bones:

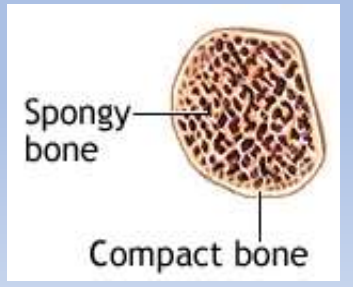
- ✓ Their length is longer that their breadth.
- ✓ Consists of 2 ends (spongy) and shaft (compact).
- ✓ Examples: bones of proximal and ~~distal~~ middle segments of limbs, metatarsals, metacarpals & phalanges.

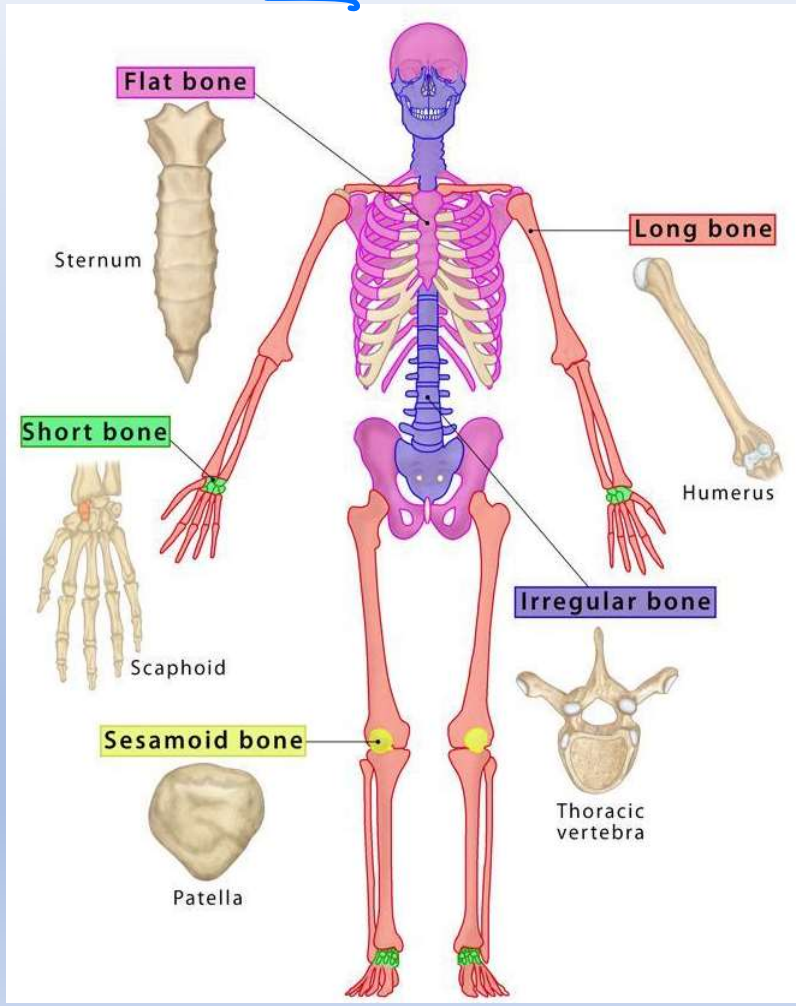
All bones of limbs expect: carpals, tarsals

❑ Short bones:

- ✓ Their length nearly equals their breadth (roughly cubical).
- ✓ Formed of cancellous bone surrounded by layer of compact bone.
- ✓ Examples: carpal and tarsal bones.

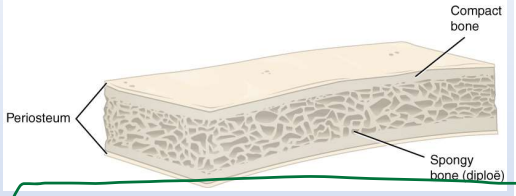


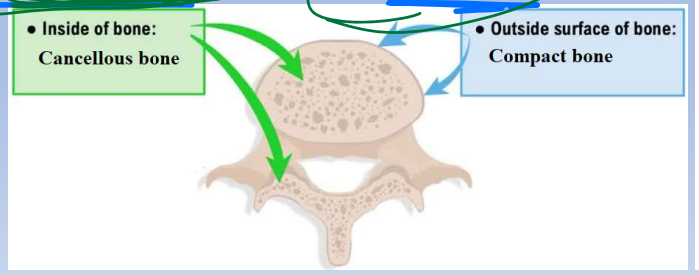


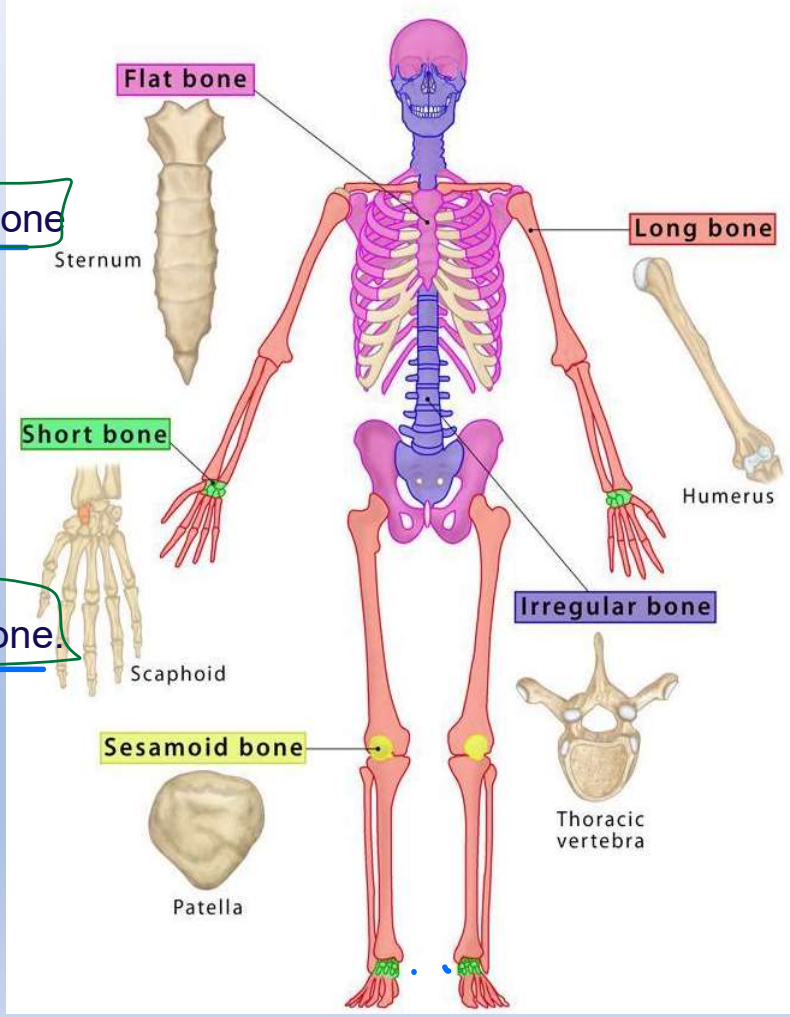


Classification of Bones According to Shape

- **Flat bones:**
  - ✓ Flat thin bones.
  - ✓ Formed of 2 layers of compact bone with a layer of cancellous bone in between.
  - ✓ Examples: skull cap, sternum, scapula and ribs.
- **Irregular bones:**
  - ✓ Irregular in shape.
  - ✓ Formed of cancellous bone surrounded by thin shell of compact bone.
  - ✓ Examples: skull base, bones of the face and the vertebrae.

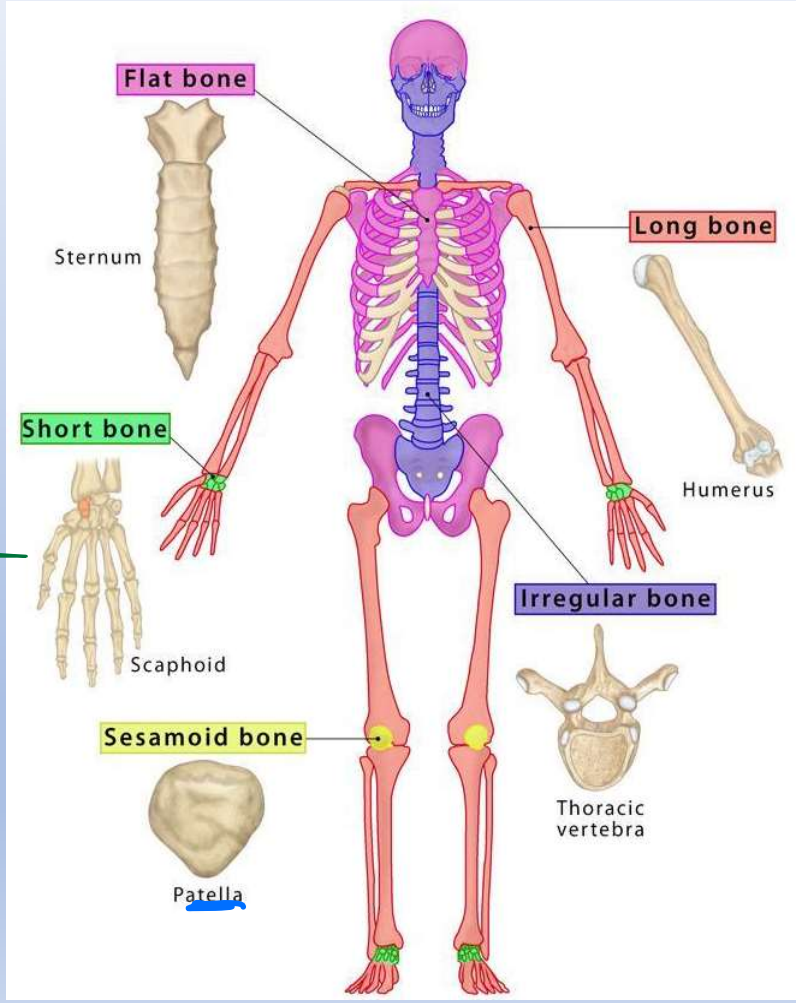






Classification of Bones According to Shape

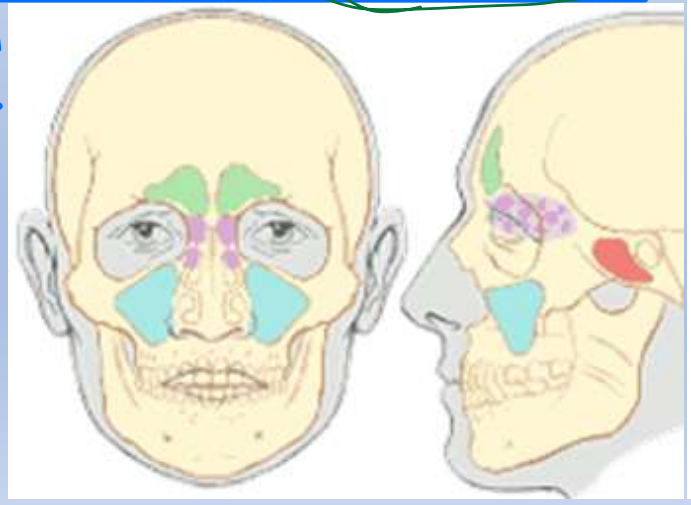
- **Sesamoid bones:**
  - ✓ Small bones that are found / develop inside tendons of some muscles where they rub over bony surfaces.
  - ✓ Functions:
    - Reduce the friction on the tendon.
    - Can change the direction of pull on the tendon.
  - ✓ Examples: Patella (in the tendon of quadriceps) is the largest sesamoid bone in the body & pisiform.

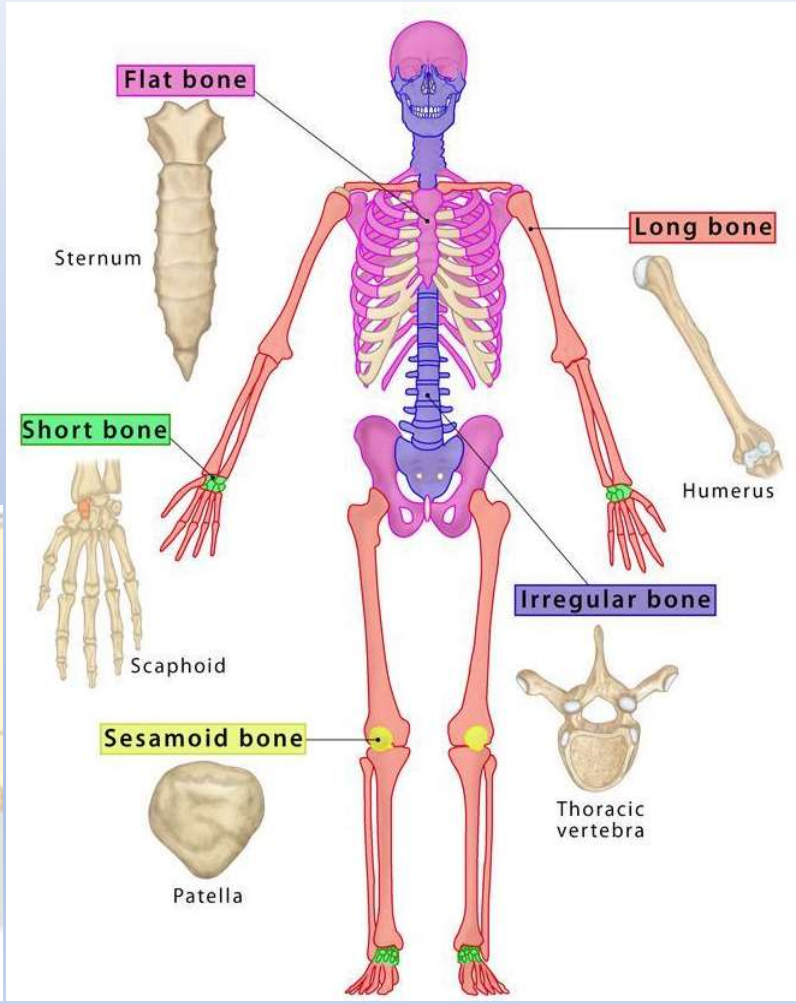


Classification of Bones According to Shape

- **Pneumatic bones:**
  - ✓ Bones which contain air-filled spaces.
  - ✓ Functions:
    - Reduce the weight of the bone.
    - Produce resonance of voice.
  - ✓ Examples: some bones of skull which contain paranasal sinuses.

الاعظام من الجمجمة التي تحتوي
على الجيوب الأنفية

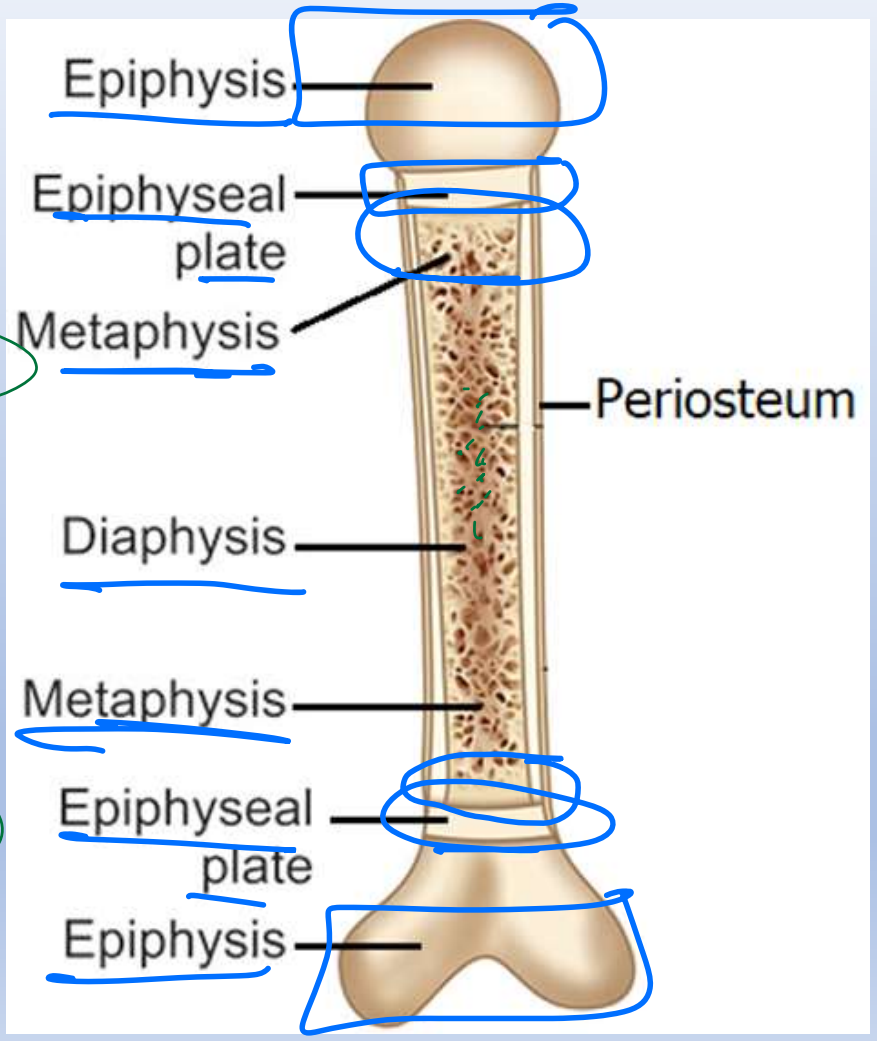




Parts of Long Bone

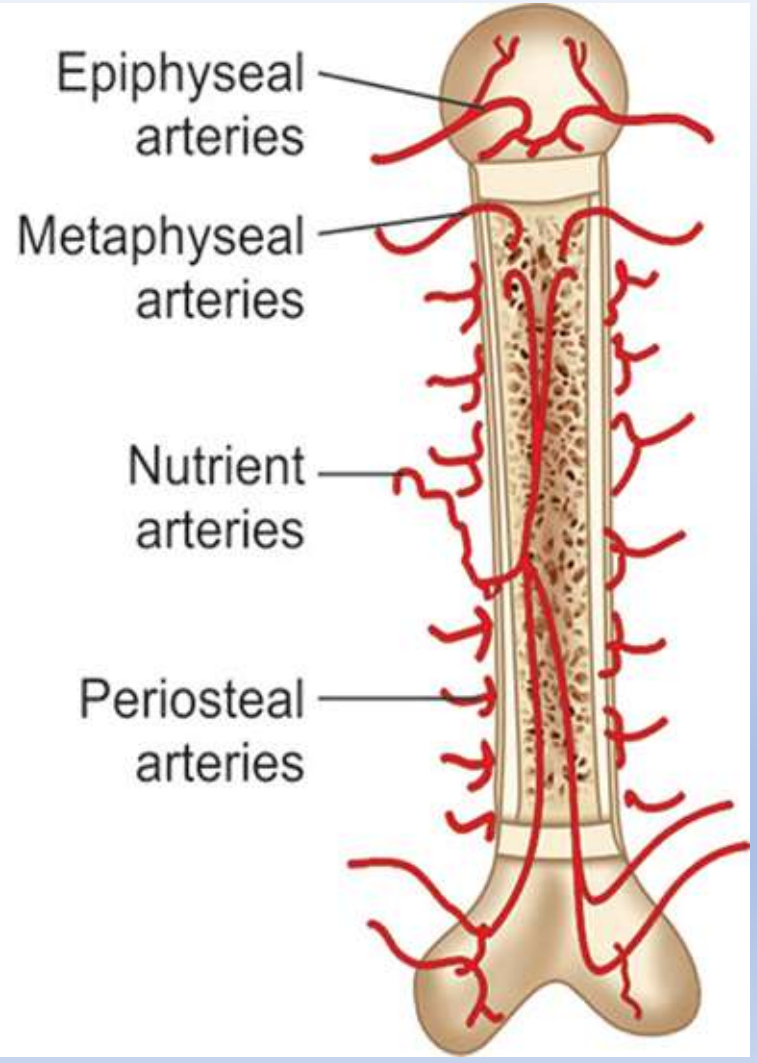
- **Long bone is formed of:**
  - **2 End:** each end is called epiphysis.
  - **Shaft:** tubular and is called diaphysis.

- During growth the epiphysis is separated from the diaphysis by epiphyseal plate of cartilage (site of growth in length).
- The part of the shaft adjacent to the epiphyseal cartilage is called metaphysis.
- The shaft has a cavity containing bone marrow.
- The outer surface of the shaft is covered by connective tissue sheath called periosteum (site of growth in width).



Blood & nerve Supply of Long Bone

- **Long bone is supplied by the following arteries:**
  - ✓ Epiphyseal arteries.
  - ✓ Metaphyseal arteries.
  - ✓ Nutrient artery. → Shaft
  - ✓ Periosteal arteries.
- **Nerve supply of bone:**
  - ✓ Bone itself has few sensory nerve fibers.
  - ✓ Periosteum is supplied with numerous sensory nerve fibers and is very sensitive to any type of injury .



Surface Markings of Bones

Surface Markings of Bones

Bone Marking	Example
Linear elevation	
Line	Superior nuchal line of the occipital bone
Ridge	The medial and lateral supracondylar ridges of the humerus
Crest	The iliac crest of the hip bone
Rounded elevation	
Tubercle	Pubic tubercle
Protuberance	External occipital protuberance
Tuberosity	Greater and lesser tuberosities of the humerus
Malleolus	Medial malleolus of the tibia, lateral malleolus of the fibula
Trochanter	Greater and lesser trochanters of the femur
Sharp elevation	
Spine or spinous process	Ischial spine, spine of vertebra
Styloid process	Styloid process of temporal bone

Bone Marking	Example
Expanded ends for articulation	
Head	Head of humerus, head of femur
Condyle	Medial and lateral condyles of femur (knucklelike process)
Epicondyle (a prominence situated just above condyle)	Medial and lateral epicondyles of femur
Small flat area for articulation	
Facet	Facet on head of rib for articulation with vertebral body
Depressions	
Notch	Greater sciatic notch of hip bone
Groove or sulcus	Bicipital groove of humerus
Fossa	Olecranon fossa of humerus, acetabular fossa of hip bone
Openings	
Fissure	Superior orbital fissure
Foramen	Infraorbital foramen of the maxilla
Canal	Carotid canal of temporal bone
Meatus	External acoustic meatus of temporal bone

Questions

Which of the followings bones is part of axial skeleton?

A. Clavicle.

B. Ribs.

C. Tibia.

D. Patella.

E. Hip bone.

Answer: B

Questions

The shaft of long bone is called:

A. Periosteum.

B. Metaphysis.

C. Epiphysis.

D. Diaphysis.

E. Epiphyseal cartilage.

Answer: D

References

- Drake, R., Vogl, A.W. and Mitchell, A.W., 2009. Gray's anatomy for students E-book. Elsevier Health Sciences.


Thank
YOU!
ربنا اغفر لى ولوالدى
وللمؤمنين يوم يقوم
الحساب