

Second lectures

Osteology

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OSTEOLOGY : Study the anatomical structures of bones.

The word anatomy is mean Osteon= bone and logos= science

THE SKELETON

The term skeleton is applied to the framework of hard structures which supports and protects the soft tissues of animals.

- Functions of the bones
- Support of the body .
- To provides of the system of levers used in locomotion .
- Protections of the soft tissue like heart and brains .
- Mineral reservoir for calcium and phosphorus .

- The number of the bones of the skeleton are different between babies and adults
- Babies have 300 bones
- Adults have 206 bones.

Classification of bones

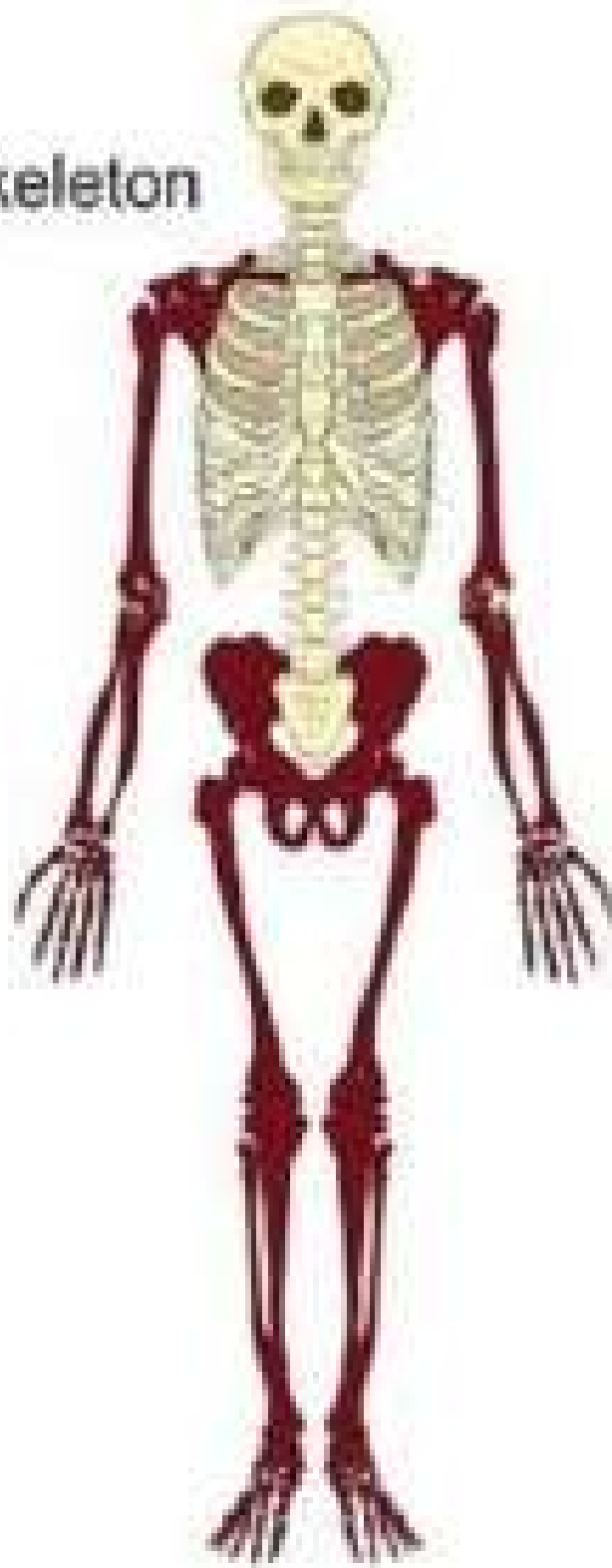
- According to the location.
- According to the shape.
- According to the structure

According to locations

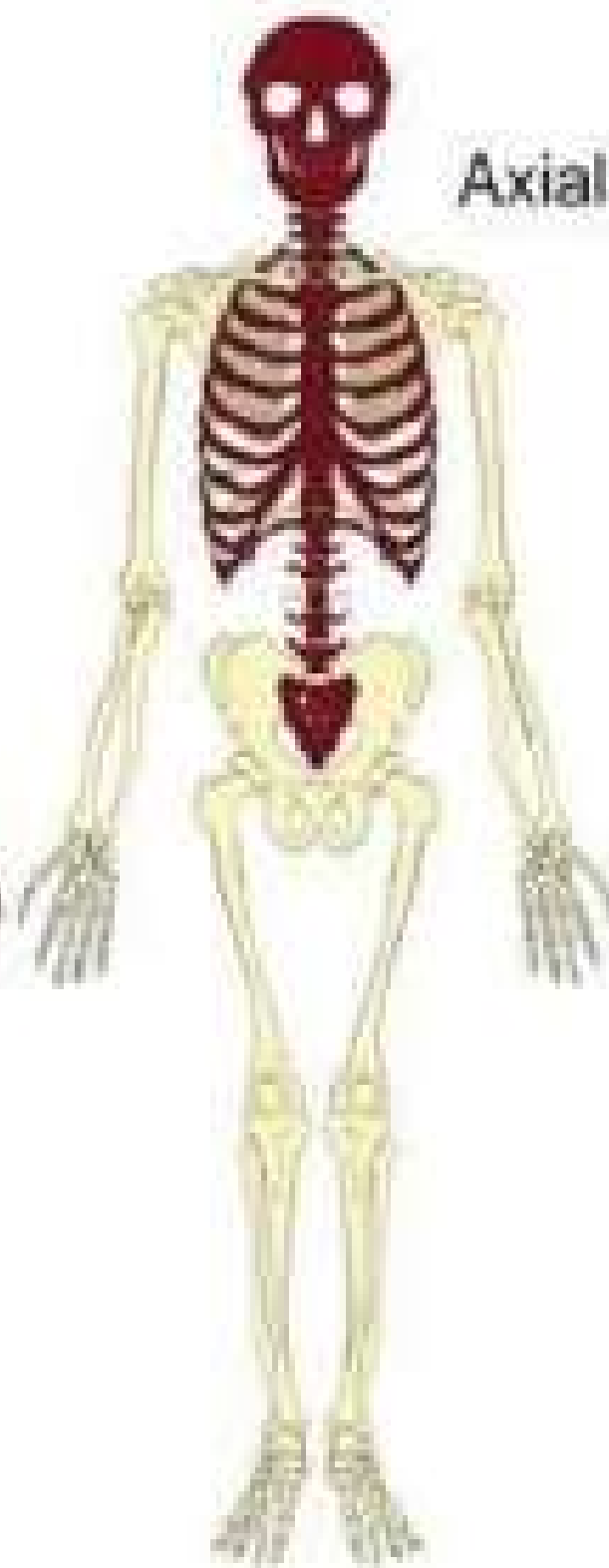
1- The axial skeleton comprises the vertebral column, ribs, sternum, and skull.

2-The appendicular skeleton includes the bones of the limbs.

Appendicular Skeleton



Axial Skeleton



- Classifications of the bones according to shape:
- (1) Long bones : Are typically of elongated cylindrical.
- They occur in the limbs e.g Femur , humerus etc
- The cylindrical part, called the shaft ,body, or diaphysis is tubular, and incloses the medullary cavity, which contains the medulla or marrow.
- Two ends(extremities) called Epiphyses

- (2) Flat bones :Thin flatted and curved bones. Examples: sternum, ribs, scapula, and most skull bones> Flat bones have two layers without Bone marrow cavity.
- (3) Short bones , such as those of the carpus and tarsus, present Somewhat similar dimensions in length, breadth, and thickness. Their chief function is diffusing concussion.
- 4-Sesamoid bones, which are developed in the capsules of some joints or in tendons, may be included in this group. They diminish friction or change the direction of tendons.

- (5) Irregular bones. This group would include bones of irregular shape, such as the vertebrae and some bones of face.

- Classified bones according to their structure:
 - 1- Compact bone (cortical).
 - 2- Spongy bone (cancellous)

- **STRUCTURE OF BONES'**

- The bone is a living substance with blood vessels , lymph vessels and nerves . The specific tissue of the bone is osseous tissue which composed from :-

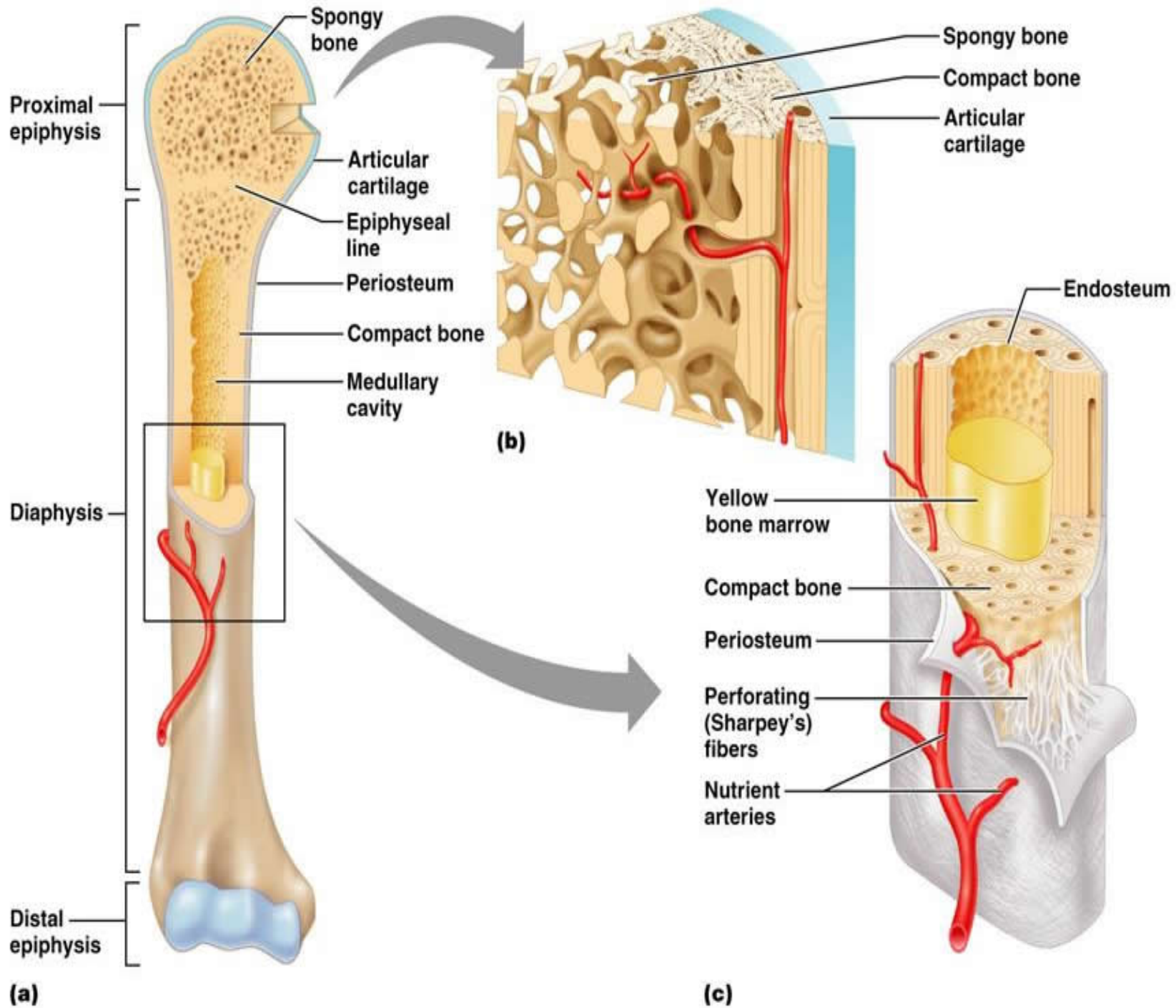
1 - The compact substance differs greatly in thickness in various situations. In the long bones it is thickest in the middle part of the shaft and thins out toward the extremities. It is a dense outer layer resist to bending.

2 - The spongy substance : consists of delicate tissue situated under the compact substance . It forms the bulk of short bones , extremities of long bone , the bulk of flat irregular bone and the sesamoid bones . It consist of bony plates and spicules which run in various directions called trabeculae. The intervals (marrow spaces) between the plates are occupied by marrow.

3- The periosteum is the membrane which invests the outer surface of bone, except where it is covered with cartilage. It consists of an outer protective fibrous layer, and an inner cellular osteogenic layer.

4- Endosteum : A thin fibrous membrane which line the medullary cavity and haversian canal . It responsible for bone and blood cells formations .

- The marrow : occupies the interstices of the spongy bone and the medullary cavity of the long bones. There are two varieties in the adult - red and yellow. In the young subject there is only red marrow , but later this is replaced in the medullary cavity by yellow marrow . The red marrow contains several types of cells and a blood-forming substance,
- while the yellow is practically ordinary adipose tissue.

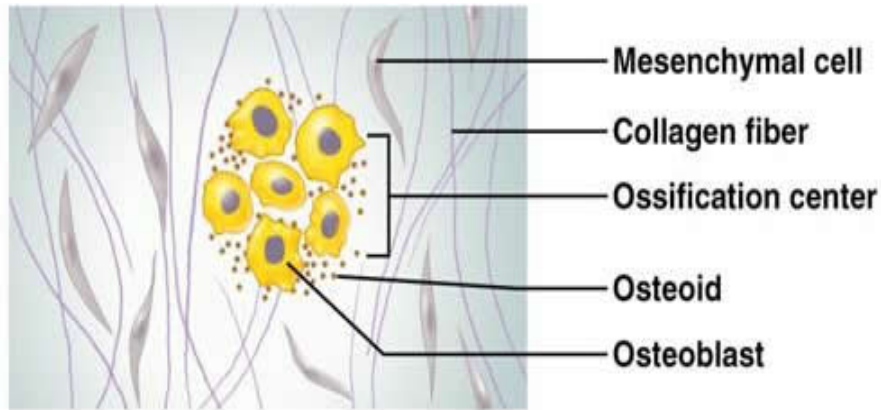


- Blood supply of the bones
- Two set of arteries
- 1 - Periosteal Arteries : Numerable small branches supplied the larger parts of compact substance of bone , also the spongy substance in the ends of long bones and bone marrow .
- 2- Nutrient or medullary artery : present in long bones . It usually divided in to two branches (proximal and distal) which are formed anastomosis with periosteal arteries .

- DEVELOPMENT AND GROWTH OF BONE'
- The primitive embryonal skeleton consists of cartilage and fibrous tissue, in which the bones develop. The process is termed ossification or osteogenesis, and is depend essentially on bone-producing cells that called osteoblasts . There are two type of ossification .

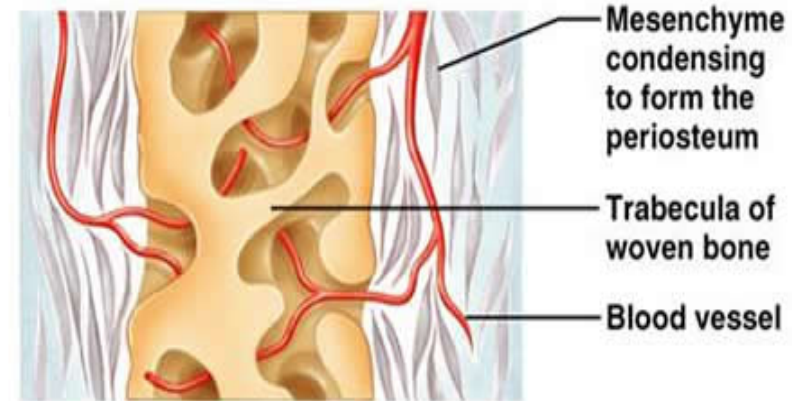
- . 1- Intramembranous ossification : The process begins at a definite center of ossification where the cells (osteoblasts) surround themselves with a deposit of bone. The process extends from this center to the periphery of the future bone, thus producing a network of bony trabecule. The trabeculse rapidly thicken and coalesce, forming a bony plate which is separated from the adjacent bones by persistent fibrous tissue.

- The superficial part of the original tissue
- becomes periosteum, and on the deep face of this successive layers of periosteal bone are formed by osteoblasts until the bone attains its definitive thickness.



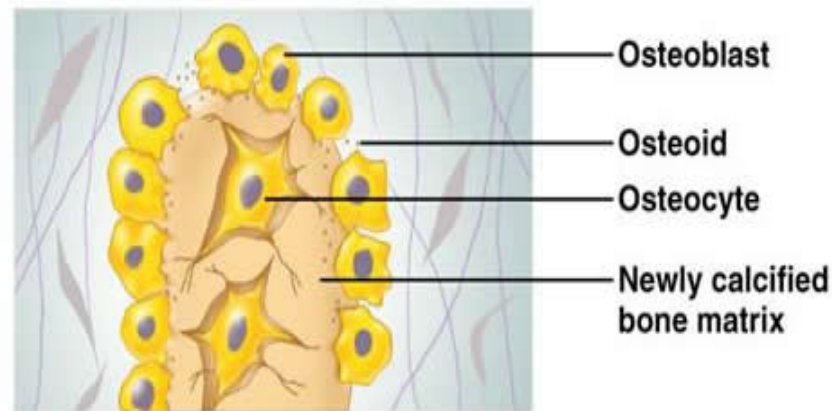
① An ossification center appears in the fibrous connective tissue membrane.

- Selected centrally located mesenchymal cells cluster and differentiate into osteoblasts, forming an ossification center.



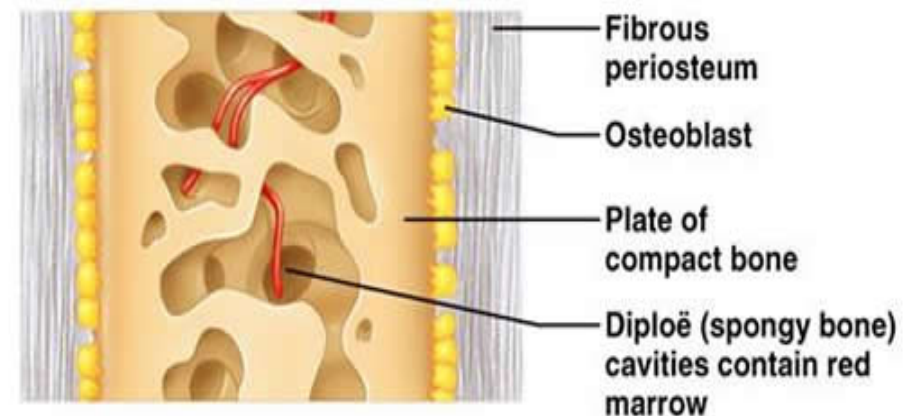
③ Woven bone and periosteum form.

- Accumulating osteoid is laid down between embryonic blood vessels, which form a random network. The result is a network (instead of lamellae) of trabeculae.
- Vascularized mesenchyme condenses on the external face of the woven bone and becomes the periosteum.



② Bone matrix (osteoid) is secreted within the fibrous membrane.

- Osteoblasts begin to secrete osteoid, which is mineralized within a few days.
- Trapped osteoblasts become osteocytes.



④ Bone collar of compact bone forms and red marrow appears.

- Trabeculae just deep to the periosteum thicken, forming a woven bone collar that is later replaced with mature lamellar bone.
- Spongy bone (diploë), consisting of distinct trabeculae, persists internally and its vascular tissue becomes red marrow.

- 2- Endochondrial ossification : the process is fundamentally the same, but not quite so simple. Osteoblasts emigrate from the deep face of the perichondrium or primitive periosteum into the cartilage and cause calcification of the matrix or ground-substance of the latter. Vessels extend into the calcifying area , the cartilage cells (chondrocytes) shrink and disappear, forming primary marrow cavities which are occupied by processes of the osteogenic tissue.

- There is thus formed calcareous trabeculae on which the bone is constructed by the osteoblasts. At the same time perichondral bone is formed by the osteoblasts of the primitive periosteum. The calcified cartilage is broken down and absorbed through the agency of large cells called osteoclasts, and is replaced by bone deposited by the osteoblasts.

- The osteoclasts also cause absorption of the primitive bone, producing the marrow cavities; thus in the case of the long bones the primitive central spongy bone is largely absorbed to form the medullary cavity of the shaft, and persists chiefly in the extremities. Destruction of the central part and formation of sub periosteal bone continue until the shaft of the bone has completed its growth.

- A typical long bone is developed from three primary centers of ossification, one for the diaphysis or shaft and one for each epiphysis or extremity. Increase in length may be explained briefly as continued ossification at either end of the diaphysis is made by a layer of actively growing cartilage the epiphyseal cartilage which intervenes between the diaphysis and the epiphysis.

