

The connective tissues (skeletal tissues)

Bone

Bone is specialized connective tissues composed of intercellular calcified material the bone matrix and 3 different cell types: osteocytes (which are found activities)lacunae within the matrix , osteoblast which synthesized the organic components of matrix and osteoclast which are multinucleated giants cells involved in resorption in bone tissues.

Since metabolites are unable to diffuse through the calcified matrix of bone the exchanges between osteocytes and blood depend on cellular communication through canaliculi thin cylindrical spaces that perforate matrix .

All bones are lined on both internal and external surfaces by layers of tissues containing osteogenic cells endosteum on the inner surface and periostum on the outer.

Bone cells

1-osteoblasts:

Osteocytes are responsible for the synthesis of the organic components of bone matrix type I collagen (proteoglycans, glycoprotiens).

2-osteocytes :

Which derived from osteoblasts lie in the lacunae situated between lamella of matrix. Only one osteocytes found in each lacunae the thin cylindrical canaliculi cytoplasmic processes of osteocytes processes of adjacent cells make contact via gap junction and nutrients are pass through this way to the cells.

When compared with osteoblasts the flat , almond shape ,reduced rough endoplasmic reticulum and Golgi complex and more condensed nuclear chromatin death of osteocytes is followed by resorption of this matrix.

3-Osteoclasts:

Are very large, branched motile cells, have 5-50 or more nucli , the branched are irregular and vary in both thickness and shape , osteoclasts are derived from the fusion of blood derived monocytes and belong to the mononuclear phagocytes system , osteoclaste are acidophilic cytoplasm , some rough endoplasmic reticulum , mitochondria ,and Golgi complex are found in addition to the great number lysosomes present with the cell , osteoclasts secrete acid, collagenase, and other

proteolytic enzymes that are attack the bone matrix
librate the calcified ground substances

Periosteum and endosteum:

Each bone is ensheathed by a tough , vascular fibrous layer the periosteum its cover the bone except the articular surfaces , periosteum have 2 layers outer layer (collagenous fibers) with a small components of elastic fibers , the inner layer is highly vascular and cellular (osteogenic layer) that give rise the concentration rings of new bone.

The thin poorly defined cellular layer that lines the medullary cavity of the shaft and the spaces of spongy bone is the endosteum .

Bone formation or development

It is a complex process in which cartilage model serves as the precursor of the bone (enchondral ossification) that is mean, the continued growth of long bones is dependent on the presence of Epiphyseal cartilage through out the growth period.

As the diaphyseal marrow cavity enlarges, a distal zonation can be recognized in the cartilage at either end of the cavity.,they are (beginning with that most distal to the diaphyseal center of ossification and proceeding toward that center):-

1- Zona of reserve cartilage, which exhibits no cellular proliferation or active matrix production .

2- Zona of proliferation, which is adjacent to the zona of reserve cartilage in the direction of the diaphysis ,where the cartilage cells undergo division and are organized into distinct columns, these cells are larger than those in the reserve zona and are actively producing matrix.

3-Zona of hypertrophy, which contains cartilage cells that are greatly enlarged ,their cytoplasm is clear,the glycogen normally accumulates in.

4-Zona of calcified cartilage, in which the enlarged cells begin to degenerate and matrix becomes calcified

5-Zona of resorption , which is the zona nearest the diaphysis ,here a small blood vessels and connective tissue invade the region occupied by the dying chondrocytes and therefore whole region appear as a honeycomb

Types of bone:

There are 2 type of bone primary , immature ,or woven bone and secondary mature or lamellar bone primary bone is the first bone tissue to appear in embryonic development and in fracture and the other repair processes it is characterized by random of fine collagen fibers in contrast to organized lamellar disposition of

collagen in secondary bone primary bone is temporary and is replaced in adults by secondary bone. Gross observation of bone in cross section shows dense areas with out cavities –corresponding to compact bone and areas with numerous interconnecting in cavities corresponding to cancellous (spongy) bone in long bones the bulbous end called epiphyses are composed of spongy bone covered by thin layer of compact bone the cylindrical part diaphyses is composed of compact bone with small components of spongy bone on its inner surfaces around the bone marrow cavity , short bones usually have a core of spongy bone completely surrounding by compact bone the flat bones that form the calvaria have 2 layers of compact bone called plates separated by layer of spongy bone called the diploe the cavities of spongy bone and the marrow cavities in the diaphyses of long bones contain bone marrow of which there are 2 kinds red bon marrow in which blood cells are forming and yellow bone marrow composed of fat cells.

Primary bone tissue:

1-Is the first bone tissue to appear is primary bone , it is temporary and replaced in adults by secondary bone tissue except in a very few places in the body ex: near the structures of the flat bones of skull , in tooth sokeets , and in some tendons.

In addition to the irregular array of collagen fibers other features of primary bone tissue are a smaller mineral content and higher proportion of osteocytes than in secondary bone tissue.

Secondary bone tissue

Usually found in adults , it is show collagen fibers arranged in lamella , that are parallel to each other or concentrically organized a round a vascular canal, the whole complex of concentric lamellae of bone surrounding a canal containing blood vessels , nerve and loose connective tissues is called haversian system or osteon , lacunae containing osteocytes are found between and occasionally within the lamellae in each lamellae collagen fibers are parallel to each other surrounding each haversian system is a deposit of a amorphous material called the cementing substance that consist of mineralized matrix with few collagen fibers .