Histology of Bone

Dr Punita Manik
Professor
Department of Anatomy
K G Medical University UP
Lucknow
Objectives

- Introduction
- Functions of Bone
- Composition of Bones
- Classification of Bones
- Histology of Bones
- Clinical
Bone

• Is a rigid form of scleral connective tissue in which the extracellular matrix is impregnated with inorganic salts mainly calcium, phosphate and carbonate, providing hardness

Rigidity and hardness is provided by the matrix which is impregnated with inorganic salts
Functions

• Forms skeletal framework
• Attachment to muscles
• Serves as lever for muscular actions
• Bears body weight
• Protects vital organs
• Stores calcium, phosphate and other ions
• Contains haemopoietic tissue, the bone marrow
Composition of Bone

1. Cells - Osteoprogenitor cells
   - Osteoblast
   - Osteocyte
   - Osteoclast

2. Fibres (95%)
   - Collagen fibre Type 1

3. Ground substance (5%)
   Inorganic Part
   - Calcium phosphate 85%
   - Calcium carbonate 10%

   Organic Part:
   - Collagen
   - Ground substance
Cells of Bone

- **Osteocytethe**: maintains bone tissue
- **Osteoblast**: forms bone matrix
- **Osteogenic cell**: stem cell
- **Osteoclast**: resorbs bone
Function of Bone Cells

Newly formed unmineralized bone... **OSTEOID**

Osteoclasts are seen in specialized depression....... **Howship’s Lacunae**
Osteoclast

osteoclast

osteocyte
Bone Membranes

- Periosteum
- Endosteum
Types of Bones

Morphologically:
- Compact Bone and Spongy or cancellous Bone

Arrangement of Collagen Bundles:
- Lamellar and Woven Bone

Developmentally:
- Cartilage Bone and membrane Bone
Compact and Spongy bone
Structure of Compact Bone

• **Circumferential System**
  • Periosteal
  • Endosteal

• **Haversian System**: Most Characteristic feature. Also Known as **OSTEON**: IS the Structural and Functional unit

• **Interstitial System**
Haversian and Volkmann’s Canal
Longitudinal section of Haversian Canals and Horizontal sections of Volkmann’s Canal

- Lacunae containing osteocytes
- Lamellae
- Canaliculi
- Osteon of compact bone
- Trabeculae of spongy bone
- Osteon
- Periosteum
- Haversian canal
- Volkmann's canal
**Compact bone**

- **Osteon** is a unit of structure consisting of **concentric lamellae** surrounding an **haversian canal**.

- **Lacunae** are spaces enclosing the bone cells, or osteocytes.

- **Haversian canals** run longitudinally through bone allowing passage of small blood vessels.

- **Interstitial lamellae** are non-circular remnants left behind from former osteons when new osteons replace them.

The tiny “hairs” are small canaliculi which allow extensions of the **osteocytes** to reach out and obtain nutrients and even form contacts with one another.
Compact Bone

- Osteon
- Central canal
- Osteocyte (within lacuna)
- Transverse canal
- Lamella
Compact Bone
Cancellous or Spongy Bone

• Slender bony trabeculae that branch and anastomose with one another.
• Enclose irregular marrow spaces containing blood vessels and haemopoietic tissue that give rise to new blood vessels.
• They receive nutrition from blood vessels in the bone marrow.
Examples of Cancellous bone

- Spongy Bone
- Compact Bone
- Epiphyseal (Growth) Plate
- Periosteum
- Marrow Cavity
- Articular Cartilage
Cancellous Bone

- *marrow space*
- *endosteum*
Spongy Bone

- bone matrix
- forming blood cells
- adipose cells
- megakaryocytes
- sinusoids (with RBC’s)
Important facts

VITAMINS
• Vit D - absorption of Ca from small intestine
• Vit C: Collagen synthesis
• Vit A - Ossification

HORMONES
• Parathyroid Hormone: activates osteoclasts to resorb bone, therefore increased Ca in blood.
• Calcitonin: inhibits bone resorption by osteoclasts. Decreased Ca in blood
MCQ

*Periosteum is absent over the following EXCEPT*

1. Articular surface of bone
2. Sesamoid bone
3. Site of attachment of tendons and ligaments to the bone
4. Shaft of long bones
MCQ

**Osteocytes may be identified by the presence of**

1. Many Nuclei
2. Lacuna around the cell
3. Lysosomes
4. Ingested particles
MCQ

Alkaline phosphatase activity can be demonstrated in

1. Osteoblasts
2. Osteocytes
3. Osteoclasts
4. Osteoprogenitor cells
MCQ

*Spongy bone can be identified histologically by the presence of*

1. Haversian canal and concentric bony lamellae
2. Bony trabeculae and marrow cavity
3. Interstitial Lamellae
4. Volkmann’s Canal
MCQ

The vitamin necessary for the absorption of calcium from small intestine is

1.A
2.B
3.C
4.D
Identify the given slide
Identify the slide
Fill in the Blank

• The Hardness and rigidity of bone is due to the presence of...
Fill in the Blank

- Newly formed unmineralized matrix is called

..................................................
Fill in the Blank

• The thin vascular membrane that lines the marrow cavity is

............................................
Fill in the Blank

• Osteoclasts are found in specialized depressions on the surface of the bone called

................................................
Identification Points

- Osteons
- Haversian Canal
- Different types of Lamelle