Bones and bone tissue

Chapter 6
Cartilages

Skeletal Cartilages have solid matrix with holes = lacunae
cells in lacunae = Chondrocyte
lot of water in matrix and covered with fibrous Perichondrium.
Fig 6.1

Cartilages
Structure of bones

Bone and cartilage are supportive C.T.
Bone has 2 % of cells in a flexible, solid matrix
Matrix is formed of Calcium Phosphate crystals and Collagen fibers

<table>
<thead>
<tr>
<th></th>
<th>Hyaline C.</th>
<th>Elastic C.</th>
<th>Fibrocartilage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Characteristic</td>
<td>Glassy, most abundant</td>
<td>Very elastic, branched fibers visible</td>
<td>resist Compression</td>
</tr>
<tr>
<td>2. Fibers</td>
<td>Invisible thin collagen</td>
<td>Elastic</td>
<td>Thick collagen</td>
</tr>
<tr>
<td>3. Location</td>
<td>Ribs, articular caps</td>
<td>External ear</td>
<td>Vertebral discs</td>
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Shapes of Bones
There are 4 kinds of bones on the basis of shape. Long, short, flat and irregular. Fig 6-1. Classification of Bones is done on the basis of their shape and proportion of compact versus spongy bone in them.

Long bones (longer than wide) = femur, tibia, humerus
Short bones (cube like) – tarsal or carpals
Flat (2 sheets of compact bone with thin spongy bone = diploe, in between) = frontal, parietal skull bones
Irregular bone (cannot be classified in above 3 categories) = vertebrae.

Bone Structure and Bone Cells

Bone Structure - Gross Anatomy: Bones have solid but flexible matrix with collagen fibers and minerals. Periosteum = outer tough fibrous membrane; inner cellular layer with blood vessels. Endosteum = delicate inner membrane lining the medullary cavity. Fig 4.11, fig. 6.2 and Fig 6.3
Bone Cells: Osteocytes are cells of mature bones and lie in lacunae. Osteoblasts make new bone tissue = Osteogenesis, during bone growth. Osteoclasts are giant cells with numerous nuclei that break down bone tissue by dissolving it and release minerals.

Microscopic Anatomy
Compact bone= Osteon is the structural unit of compact bone Fig 6.3. A Central Canal is surrounded by concentric rings of bone material = lamellae; inside lamellae open spaces = lacunae; adjacent
lacunae are joined with branched channels = canaliculi; inside lacunae are present Osteocytes. **Spongy bone** has bar or arch like Trabeculae of bone material with lot of air spaces. Trabeculae make a meshwork and this bone is strong but light weight.

**Chemical Composition of bone**
Organic contents include a) Living cells are Osteogenic, Osteoblasts, Osteocytes and Osteoclasts. Osteoblasts secrete both matrix and fibers. The matrix has organic substances called Osteoid which gives the bone tensile strength but the inorganic hydroxyapatites make the bone Strong.

**Appositional Bone Growth**
Osteoblasts deposit bone material just below Periosteum but at the same time osteoclasts dissolve bone material lining the marrow cavity. This way, bones of infants grow into bones of children and adults.

**Bone Repair and Homeostasis**
Bone Repair- Bone breaks = bone fractures; Complete fracture is when bone is completely broken or incomplete when not. Simple fracture has bone ends inside the skin. Comminuted when bone end is exposed through skin. Bone repair takes place by making hematoma, cartilage callus formation, bone callus formation followed by remodeling of bone.

**Homeostatic Imbalances**
Osteomalacia and Rickets is a disorder caused due to deficiency of Vitamin D or deficiency of Calcium in diet. Bones have less inorganic deposits and bones become soft and weak. Osteomalacia occurs in adults and Rickets in children and is more severe and causes bow-legs. **Osteoporosis** mainly occurs in elderly people and is due to faster bone absorption than bone deposition. Bones get easily fractured.

**Recap 1 Chapter 6**
1. Bones and cartilages form _______ connective tissue.
2. Phalanges the bones in fingers are _______bones (short, long, small)
3. ____________ cells form new bone; process is called ____________.
4. _______ cells are present in holes (lacunae) in a mature bone.
5. _______cells break-up bone tissue and send Ca²⁺ to blood.
6. Bone is covered by _________ and cartilage is covered by ____________
7. _______ bone has structural units called ____________ having a central canal and concentric rings of osteocytes and matrix around it.
8. _______bone has arch like bone material called trabeculae.
9. Ends of a long/short bone are _______ and are covered by _______cartilage.
10. Most bones in body are formed by _______ ossification.
11. Most Bones of the skull, mandible and clavicle are formed by _______ ossification.
12. After a fracture a large blood clot fracture _______is formed followed by _______formation to heal the bone injury.