1. Skeletal Cartilages have solid matrix with spaces = lacunae; cells in lacunae = Chondrocytes; lot of water in matrix and covered with fibrous Perichondrium. **Fig 4.10** and table 4.3 – a comparison of bone and cartilage tissues.

<table>
<thead>
<tr>
<th></th>
<th>Hyaline C.</th>
<th>Elastic C.</th>
<th>Fibrocartilage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Characteristic</strong></td>
<td>Glassy, most abundant</td>
<td>Very elastic, branched</td>
<td>Most compressible but</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fibers visible</td>
<td>resist stretching</td>
</tr>
<tr>
<td><strong>2. Fibers</strong></td>
<td>Invisible thin collagen</td>
<td>Elastic</td>
<td>Thick collagen</td>
</tr>
<tr>
<td><strong>3. Location</strong></td>
<td>Ribs, articular caps</td>
<td>External ear</td>
<td>Vertebral discs</td>
</tr>
</tbody>
</table>

2. Cartilage growth – **Interstitial** = cartilages grow from within; **Appositional** – tissue deposited at periphery inner to perichondrium

3. 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.

4. Functions of Bones: Bones provide - Shape, protect and support body organs, Surface for attachment to muscles, also act as levers, stores minerals especially Calcium and phosphate, Formation of blood cells.

5. Bone Structure - Gross Anatomy: Bones have solid matrix with collagen fibers and minerals. Periosteum = outer tough fibrous membrane with blood vessels and Endosteum = delicate inner membrane lining the medullary cavity. **Fig 4.11** and 6.2. **Fig 6.3**

6. 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.

7. Bone markings indicate muscle attachment, articulation points and foramens for passage of nerves and blood vessels. Examples Tuberosity, head, Condyle, fossa, foramen.

8. **Shape of bones**: There are 4 kinds of bones on the basis of shape. Long, short, flat and irregular. **Fig 6-1**

9. **Long bone** has cylinder like **Diaphysis** = Shaft formed of compact bone having **Medullary cavity** with yellow bone marrow and swollen ends = **Epiphyses** formed of spongy bone covered with hyaline cartilage at articular = joint surfaces. These bones develop from cartilage and called Endochondral bones.

10. **Short and irregular bones** are like **flat bones** with compact bone sheet outside and spongy bone inside
11. **Hematopoietic Tissue** = red bone marrow which produces blood cells is present in the spongy bone = diploe of flat bones and heads of humerus and femur. Infants have hematopoietic tissue in all medullary cavities.

12. **Microscopic Anatomy** – **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.

13. **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.

14. **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.**

15. **Bone Development** – Formation of bones from other tissues is Ossification. Most bones are formed by **Endochondral Ossification** of hyaline cartilage. These bones are called Cartilage bones or endochondral bones. Fig 6.8. Most bones of skull and clavicles form by **Intramembranous Ossification** and form membrane bones. Fig 6.5

16. **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.

17. 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.

18. **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.