

Bone is a living tissue capable of changing its structure as a result of the stress to which it is subjected.

Bone is type of connective tissue consists of cells, fibers & matrix, one-third is organic; two-thirds are inorganic, { 25% of bones are water }.

Bones have an *organic* framework of fibrous tissue & cells among which *inorganic* salts, phosphate & calcium, are deposited in a characteristic fashion.

The fibrous tissue gives the bones resilience & toughness; the salts give them hardness & rigidity & make them opaque to x-rays.

**\* Functions of bones :**

1. The rigid supporting framework of the body.
2. Serve as levers for muscles as in the long bones of the limbs.
3. Protective function; the skull & vertebral column, for example, protect the brain & spinal cord from injury; the sternum & ribs protect the thoracic & upper abdominal viscera.
4. They houses & protects within its cavities the delicate marrow, which is the factory for blood cells.
5. They are the important store houses of calcium & phosphorus.

**Structure :** macroscopically, there are two forms of bony tissue :

(1) Compact or dense: appears as a solid mass.

(2) Cancellous or spongy: bone consist of a branching network of **trabeculae** which are arranged in such a manner to resist the stresses & strains to which the bone is exposed.

All bones have a complete outer casing of compact bone; the interior is filled with spongy bone except when replaced by a medullary cavity or an air sinus.

In a long bone, the compact bone is thickest near the middle of the shaft & it becomes progressively thinner as the bone expands toward its articular ends, these being covered with a shell of compact bone.

Conversely, spongy bone fills the expanded ends & extends for a variable distance along the shaft but leaves a tubular space, the **medullary cavity**. The **lamellae** or plates of the sponge work are arranged in lines of pressure & tension.

**\* Classification of bones :**

The bones of the body classified regionally or according to their general shape.

**[1] Regional classification:** the skeleton is divided into regions including the axial & appendicular bones. { see the Table 1-2 }

Total number of adult bones are 206, half of these bones are in hands & feet.

[2] **According to general shape classification:** bones are grouped as follows based on their general shape: long, short, flat, irregular, & sesamoid bones.

(1) **Long Bones:** they are *tubular* found in the limbs (e.g. humerus, femur, metacarpals, metatarsals, & phalanges). Their length is greater than their breadth. They have a tubular shaft called the **diaphysis**, & usually an **epiphysis** at each end. They serve as levers for muscles.

During the growing phase, the diaphysis is separated from the epiphysis by an **epiphyseal cartilage**. The part of the diaphysis that lies adjacent to the epiphyseal cartilage is called the **metaphysis**.

The shaft has a central **marrow cavity** containing **bone marrow**.

The outer part of the shaft is composed of compact bone that is covered by a connective tissue sheath called the **periosteum**.

The ends of long bones are composed of cancellous bone surrounded by a thin layer of compact bone. The articular surfaces of the ends of the bones are covered by hyaline cartilage.

(2) **Short Bones:** they are *cubical* or roughly cuboidal in shape, found in the hand & foot, confined to the carpals & tarsals (e.g. scaphoid, lunate, talus & calcaneum ). They are composed of cancellous bone surrounded by a thin layer of compact bone. They are covered with periosteum & the articular surfaces are covered by hyaline cartilage.

(3) **Flat Bones:** they resemble *sandwiches*, found in the vault of the skull (e.g. frontal & parietal bones ), the scapulae, (although irregular, are included in this group) & the sternum.

They are composed of thin inner & outer layers of compact bone called the **tables**, separated by a layer of cancellous bone called **diploe**.

(4) **Irregular Bones:** they have an *irregular* or *mixed* shape. They include bones not assigned to the previous groups (e.g. bones of the skull, vertebrae, & the pelvic bones ). They are composed of a thin shell of compact bone with an interior made up of cancellous bone.

(5) **Sesamoid Bones:** they are small *nodules* of bone that are found in certain tendons where they rub over convex bony surfaces. The greater part of a sesamoid bone is buried in the tendon, & the free surface is covered with cartilage.

The function of a sesamoid bone is to reduce friction on the tendon; it can also alter the direction of pull of a tendon.

The largest sesamoid bone is the patella, which is located in the tendon of quadriceps femoris. Other examples are found in the tendons of the flexor pollicis brevis ( two occur at the head of the 1<sup>st</sup>. metacarpal ) & flexor hallucis brevis ( two occur at the head of the 1<sup>st</sup>. metatarsal ).

### **\* Surface Markings of bones :-**

The surfaces of bones show various markings or irregularities.

The surface is raised or roughened where bands of fascia, ligaments, tendons, or aponeuroses are attached to bone.

These roughenings are not present at birth. They appear at puberty & become progressively more obvious during adult life.

The pull of these fibrous structures causes the periosteum to be raised & new bone to be deposited beneath.

\* In certain situations, the surface markings are large & are given special names, they take the form of:

1. Elevations
2. Facets
3. Depressions
4. Expanded ends for articulation.