

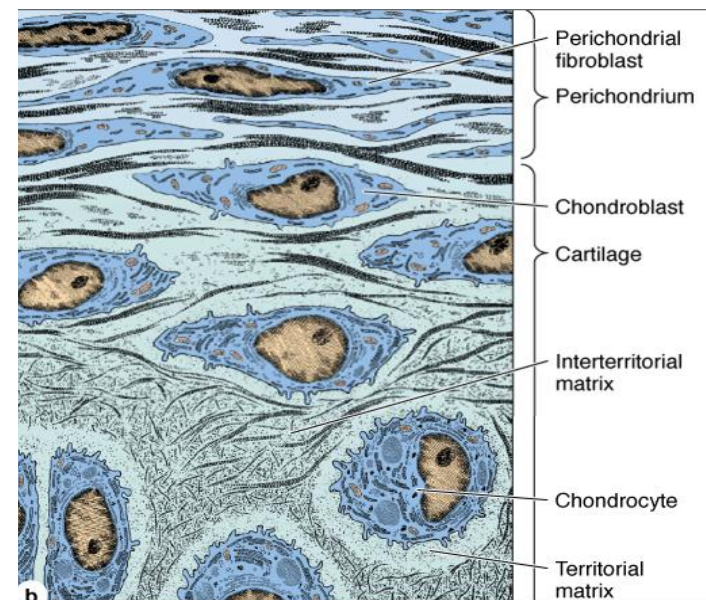
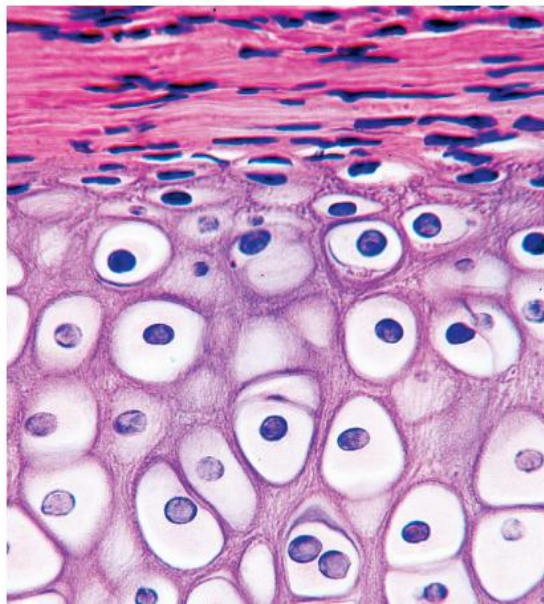
## Cartilage

Cartilage is a specialized form of connective tissue, consists of cells called **chondrocytes** and an extensive **extracellular matrix** composed of fibers and ground substance.

Variations in the composition of these matrix components produce three types of cartilage adapted to local biomechanical needs.

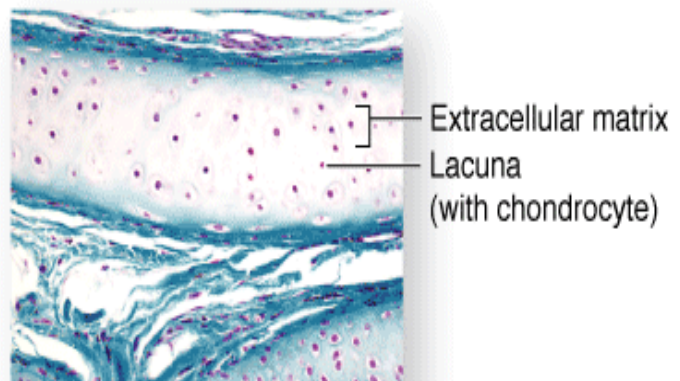
**Chondrocytes** synthesize and secrete the ECM and the cells themselves are located in matrix cavities called **lacunae**.

The **perichondrium** is a sheath of dense connective tissue that surrounds cartilage in most places, forming an interface between the cartilage and the tissue supported by the cartilage.

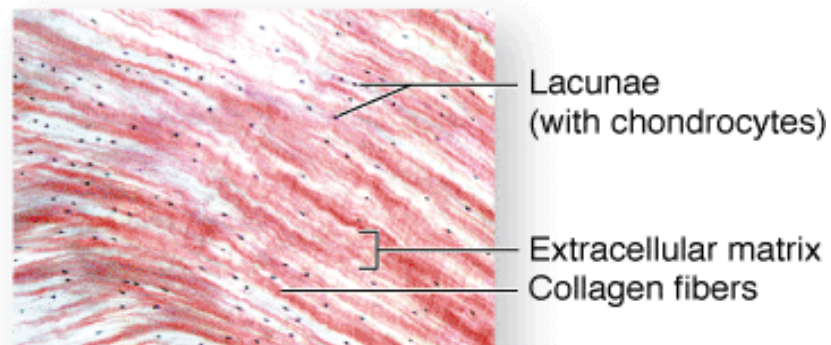


## There are three different types of cartilage

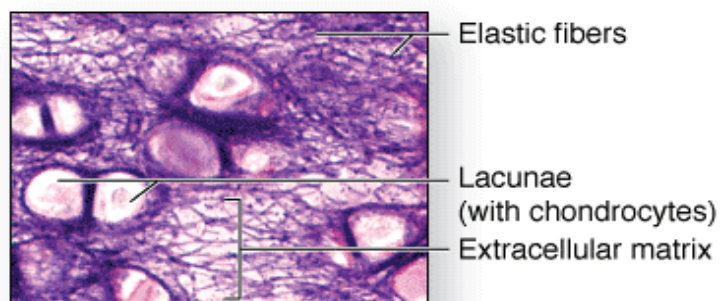
**1- Hyaline cartilage** is the most common type and is found in areas such as the trachea, ribs, at the ends of bones and nose. It is a glossy, bluish - white flexible material which has a gel like matrix. Hyaline cartilage is surrounded by a dense membrane called perichondrium.



**2- Fibrocartilage** is the strongest type of cartilage and composed of hyaline and dense collagen fibers. It is inflexible, tough, and located in the discs between vertebrae, in some joints, and in heart valves. Fibrocartilage does not have perichondrium.



**3- Elastic cartilage** contains elastic fibers and is the most flexible type of cartilage because it contains yellow elastic fibers. It is found in locations such as the ear and larynx (voice box). Elastic cartilage possesses a perichondrium.

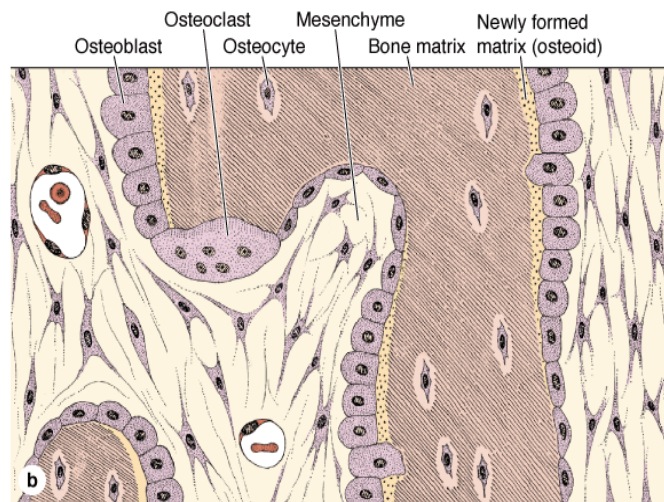


## Bone Tissue

Is the main constituent of the adult skeleton, bone tissue supports fleshy structures, protects vital organs such as those in the cranial and thoracic cavities, and harbors the bone marrow, where blood cells are formed.

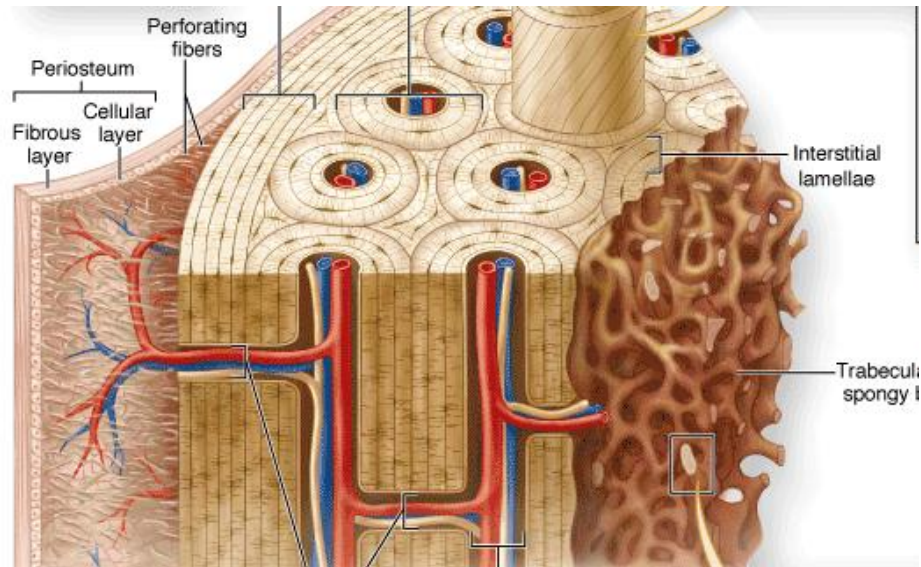
Bone is a specialized connective tissue composed of calcified intercellular material the **bone matrix** and three cell types:

- 1- **Osteocytes** which are found in cavities (**lacunae**) between layers (lamellae) of bone matrix.
- 2- **Osteoblasts** which synthesize the organic components of the matrix, are located at the surfaces of bone matrix, usually side by side in a layer somewhat resembling a simple epithelium
- 3- **Osteoclasts** which are multi-nucleated giant cells involved in the resorption and remodeling of bone tissue.



Because metabolites are unable to diffuse through the calcified matrix of bone, the exchanges between osteocytes and blood capillaries depend on communication through the **canaliculi** , which are very thin, cylindrical spaces that perforate the matrix.

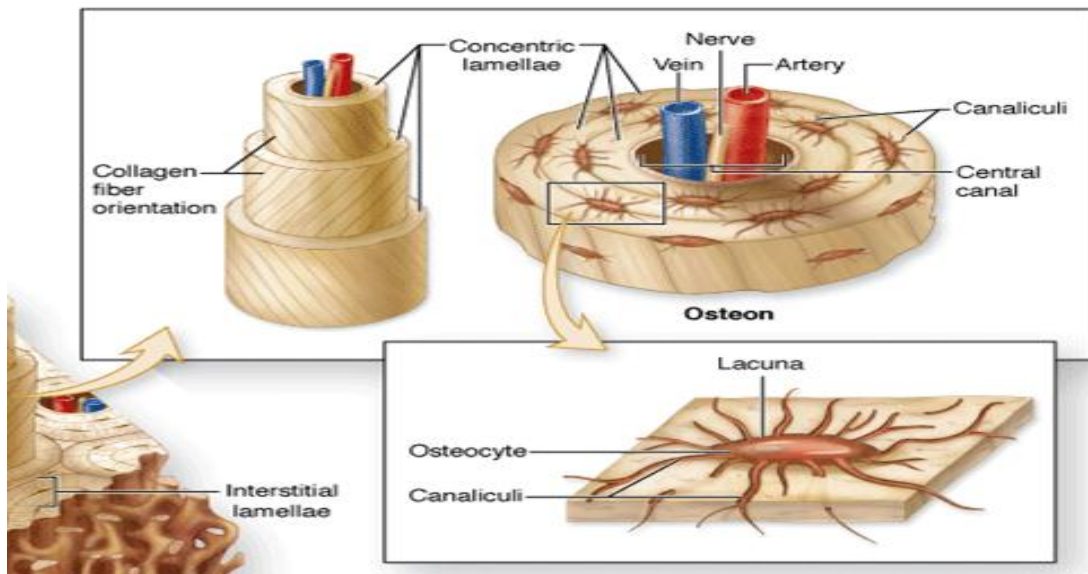
The whole bone surface is covered by a layer of connective tissue called **periosteum** consists of a dense fibrous outer layer of collagen bundles and fibroblasts covering a more cellular layer.



There are two types of bone tissue:

- **Spongy bone**, also called **cancellous** bone, gets its name because of its spongy appearance. The large spaces, or vascular cavities, in this type of bone tissue contain blood vessels and **bone marrow**. Spongy bone is the first bone type formed during bone formation and is surrounded by compact bone. Both compact bone and the trabeculae separating the cavities of spongy bone have the same basic histologic structure.
- **Compact bone**, or **cortical bone**, is strong, dense, and forms the hard outer bone surface. It characteristically shows multiple layers of calcified matrix and is referred to as **lamellar bone**. The lamellae are quite organized, either parallel to each other or concentrically around a vascular canal. Each complex of concentric bony lamellae surrounding a small canal containing

blood vessels, nerves, and loose connective tissue is called an **osteon** (haversian system).

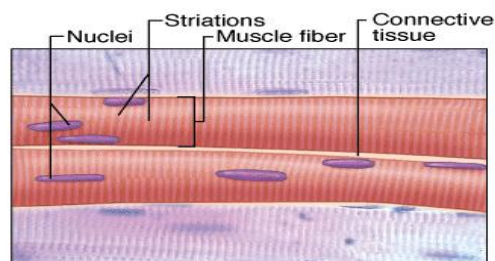


## Muscle Tissue

These are contractile tissues which contract and shorten their length when stimulated by nerve action. They return to their original length after they have done their job. Microfilaments and associated proteins together generate the forces necessary for cellular contraction.

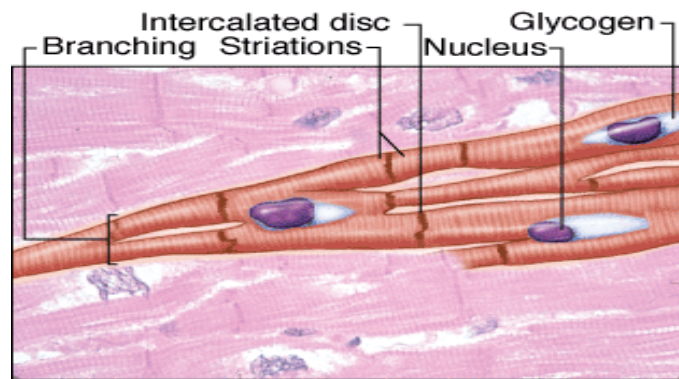
Three types of muscle tissue can be distinguished on the basis of morphologic and functional characteristics.

**1- Skeletal muscle** is composed of bundles of very long, cylindrical, multinucleated cells that show cross-striations. Their contraction is quick, forceful, and usually under voluntary control.



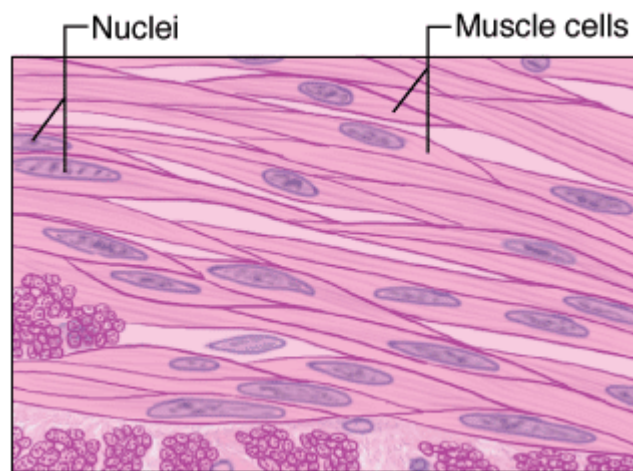
a Skeletal muscle

**2- Cardiac muscle** also has cross-striations and is composed of elongated, branched individual cells that lie parallel to each other. At sites of end-to-end contact are the **intercalated disks**, structures found only in cardiac muscle. Contraction of cardiac muscle is involuntary, vigorous, and rhythmic.



**b Cardiac muscle**

**3- Smooth muscle** consists of collections of fusiform cells that do not show striations. Their contraction process is slow and not subject to voluntary control.



**c Smooth muscle**