

Specialized Connective Tissues

Lec 1

1-Cartilage

2- Bone

3-Blood

1- Cartilage Is a special form of connective tissue in which the extracellular matrix has a firm consistency. The main functions of cartilage are to **1- support soft tissues**. Being smooth surfaced and resilient, **2- it provides a shock-absorbing** and **3- sliding area for joints**.



Cartilage is also **4- essential for the development and growth of long bones both before and after birth**. Cartilage consists of cells called (**chondrocytes**) and an extensive extracellular matrix composed of **fibers** and **ground substance**.

Chondrocytes synthesize and secrete **the extracellular matrix**. The cells themselves are located in matrix cavities called **lacunae**. **Collagen, hyaluronic acid, proteoglycans, and small amounts of several glycoproteins** are the **principal macromolecules present in all types of cartilage matrix**.

As a consequence of different function requirement, three forms of cartilage have evolved, each exhibiting variations in matrix composition, **hyaline cartilage, elastic cartilage, and fibrocartilage**.

In all three types cartilage is **avascular** and is **nourished by diffusion of nutrients from capillaries in adjacent c.t. (perichondrium) or by means of synovial fluid** from joint cavities. In some instances, blood vessels traverse a cartilage to nourish other tissues, but these vessels do not supply nutrients to the cartilage. **Cartilages have no lymphatic vessels or nerves.**

The perichondrium: is a **capsule-like sheath that surrounds cartilage** in most places forming an interface between the **cartilage and the tissue**. Articular cartilage which covers the surface of the bones of movable joints is devoid of perichondrium and is sustained by the diffusion of oxygen and nutrients from the **synovial fluid**.

1- Hyaline cartilage: is the most common and best-studied of the three types. Fresh hyaline cartilage is **bluish-white** and **translucent**. **In the embryo, it serves as a temporary skeleton until it is replaced gradually by bone. Between the diaphysis and the epiphysis of growing long bones the epiphyseal plate, composed of hyaline cartilage, is responsible for the longitudinal growth of bone.** In adults, hyaline cartilage is present mainly in the walls of the respiratory passages (nose, through bronchi), on the ventral ends of the ribs, and on bone surfaces within joints (articular cartilages).

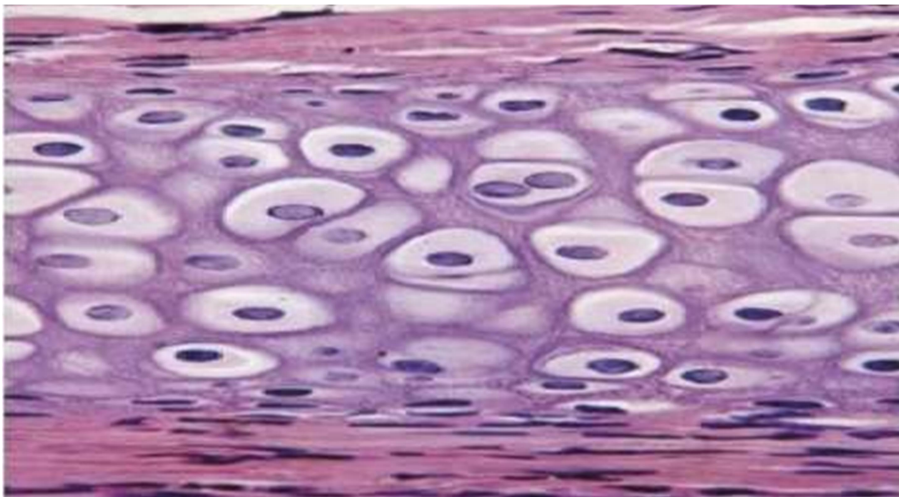


Figure 1: Hyaline cartilage

- Matrix: forty percent (40%) of the dry weight of hyaline cartilage consists of **collagen embedded in an amorphous intercellular substance.**

The high content of solvation water acts as **an elastic shock absorption** that functions as a **biomechanical spring of great importance, especially in articular cartilage**. Within the cartilage matrix, immediately surrounding each **chondrocyte, is a zone of glycosaminoglycan-rich, collagen-poor matrix**. This peripheral zone, called the capsule, histochemically exhibits intense basophilia.

- **Perichondrium:** except in articular cartilage of joints, all hyaline cartilage is covered by a layer of dense connective tissue, **the perichondrium which is essential for the growth and maintenance of cartilage. It is rich in collagen fibers and contains cells that resemble fibroblasts.**

- **Nutrition:** in general cartilage is **devoid of vessels, lymphatics, and nerves.**

The fluid of the matrix permits nutrients, dissolved gases, and waste products to diffuse readily between the perichondrium and the more deeply placed chondrocytes.

- **Retrogressive changes:** with old age, cartilage loses its translucency and becomes less cellular, and the matrix shows less basophilia **owing to a loss of proteoglycans and an increase in non-collagenous proteins.** The most important retrogressive change within cartilage is **calcification.**

*Regeneration: the ability to regenerate an area of cartilage that has been lost or damaged **is low.**

2- Elastic cartilage: Occurs in locations where support with flexibility is required as in the **external ear, auditory tube, and epiglottis.** In fresh condition, it is **yellow in color.** The matrix contains extensive networks of elastic fibers. The cartilage is surrounded by a perichondrium elastic cartilage and is less likely to undergo retrogressive changes.

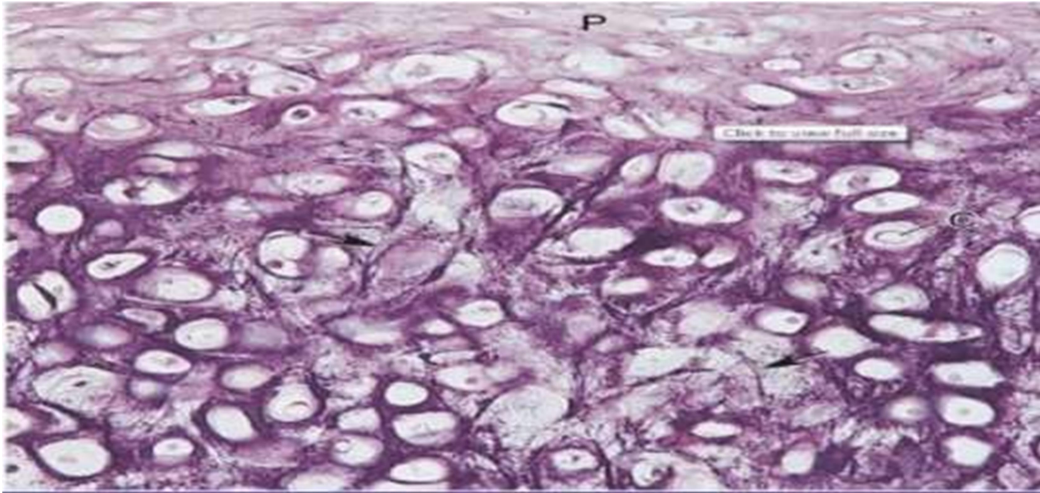


Figure2: Elastic cartilage

3-Fibrocartilage: Occurs where tough support or tensile strength is required, e.g. **intervertebral discs, in the symphysis pubis, and where some tendons and ligaments are attached to the bone.** It never occurs alone but merges gradually into neighboring hyaline cartilage or with dense fibrous tissue. It is composed of dense collagenous c.t. between bundles of which there are small regions of hyaline cartilaginous matrix containing lacunae with enclosed cells. This cartilage is devoid of perichondrium.

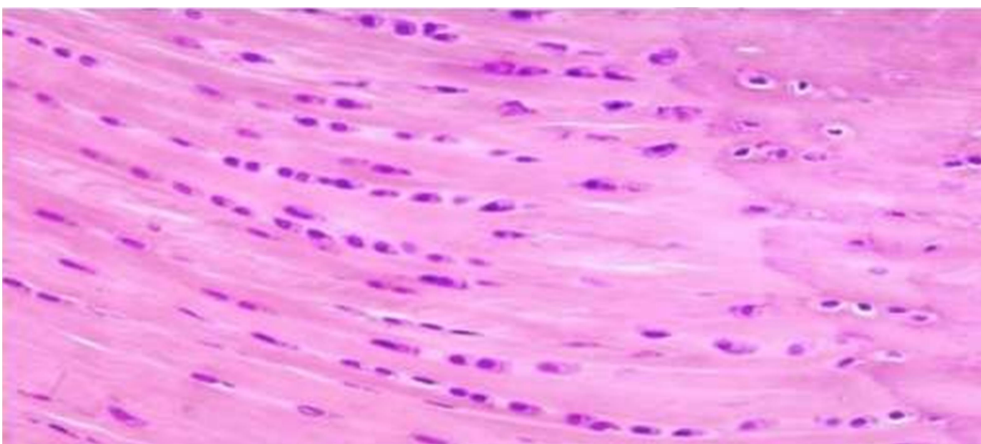


Figure 3: Fibrocartilage.