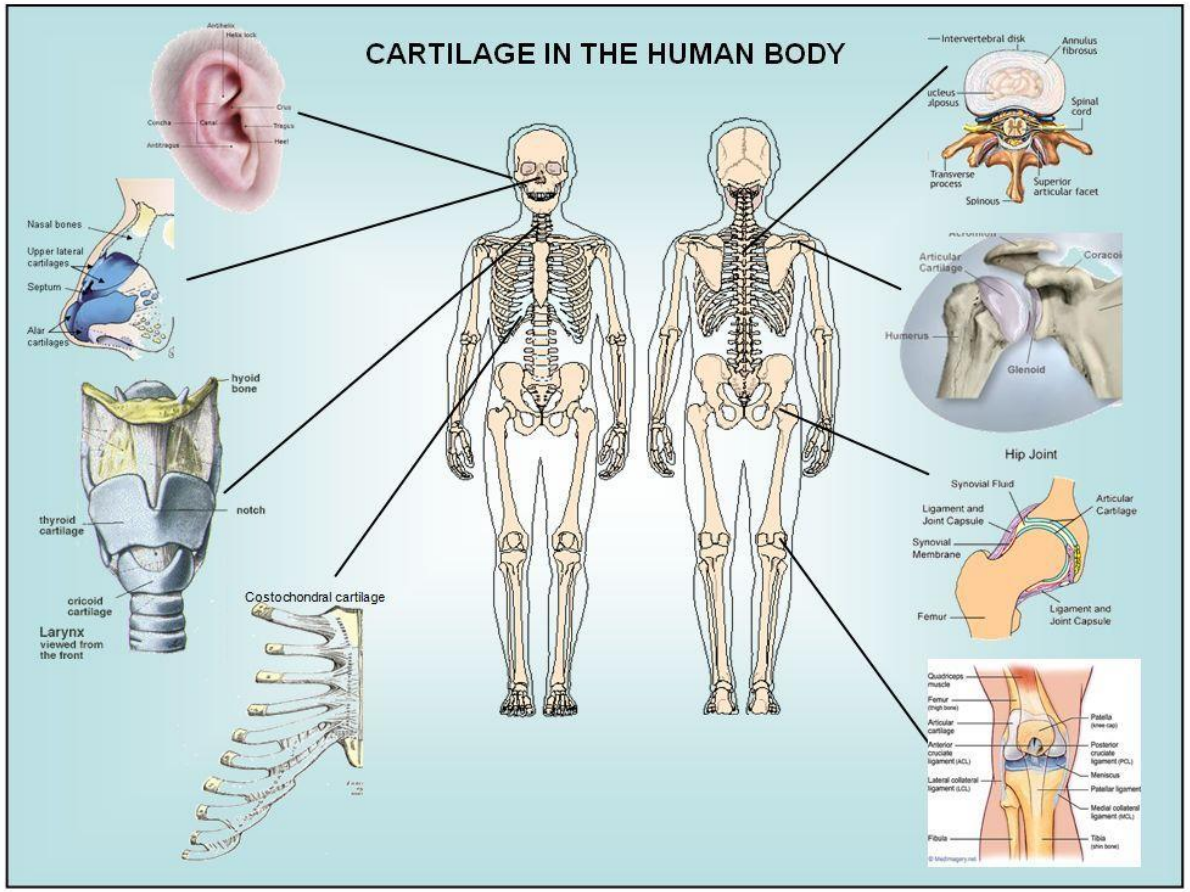
HISTOLOGY OF CARTILAGE

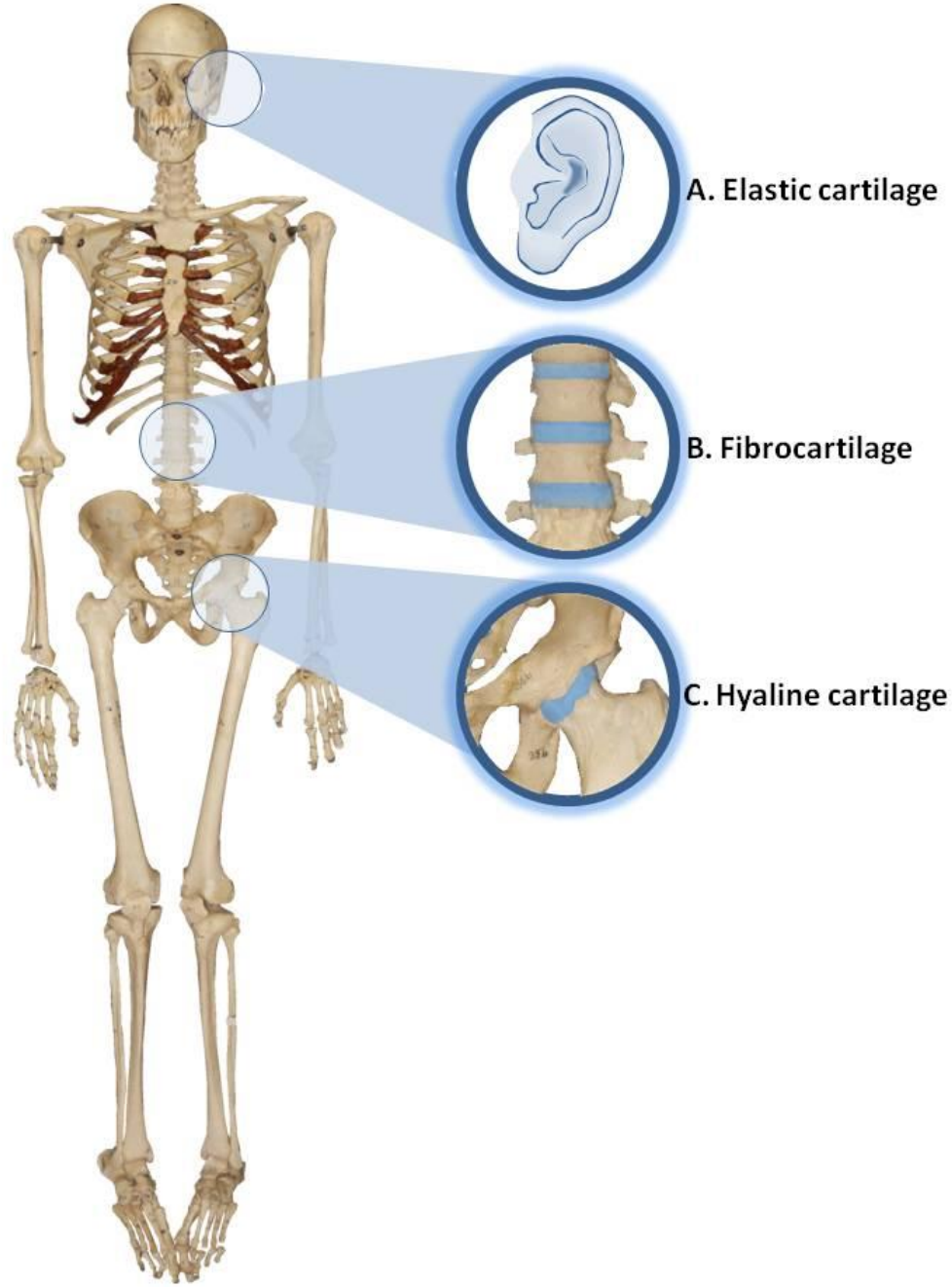
Dr AMAL ALBTOOSH

13/3/2022

Learning Objectives

1.Be able to recognize the three major know where each type is found in the body. cartilage types (hyaline, elastic and fibrocartilage).
2. Be able to identify cells and structures in sections of cartilage (e.g. chondroblast, chondrocyte, lacuna, Isogenous group, two types of matrix, the perichondrium, etc.).
3.Know the contents of cartilage matrix


CARTILAGE IN THE HUMAN BODY
Nasal bones
Upper lateral cartilages
Septum
Alar cartilages
hyoid bone
notch
thyroid cartilage
cricoid cartilage
Larynx viewed from the front
Costochondral cartilage
Intervertebral disk
Annulus fibrosus
Nucleus pulposus
Spinal cord
Transverse process
Superior articular facet
Spinous
Articular Cartilage
Coracoid
Humerus
Glenoid
Hip Joint
Synovial Fluid
Articular Cartilage
Ligament and Joint Capsule
Synovial Membrane
Femur
Ligament and Joint Capsule
Quadriceps muscle
Femur
Articular cartilage
Anterior cruciate ligament (ACL)
Lateral collateral ligament (LCL)
Fibula
Patella
Posterior cruciate ligament (PCL)
Meniscus
Patellar ligament
Medial collateral ligament (MCL)
Tibia


A. Elastic cartilage
B. Fibrocartilage
C. Hyaline cartilage

CARTILAGE

A tough, elastic, fibrous connective tissue that is a major constituent of embryonic and young vertebrate skeletons, is converted largely to bone with maturation, and is found in various parts of the adult body, such as the joints, outer ear, and larynx.

Characteristic features

- Modified connective tissue
- Forms skeletal basis of some parts of body
- Matrix is firm giving it the characteristic consistency
- Resists compression
- Avascular: lacking blood and lymphatic vessels, and without nerve terminals.

✓ (nutrients diffuse through matrix)

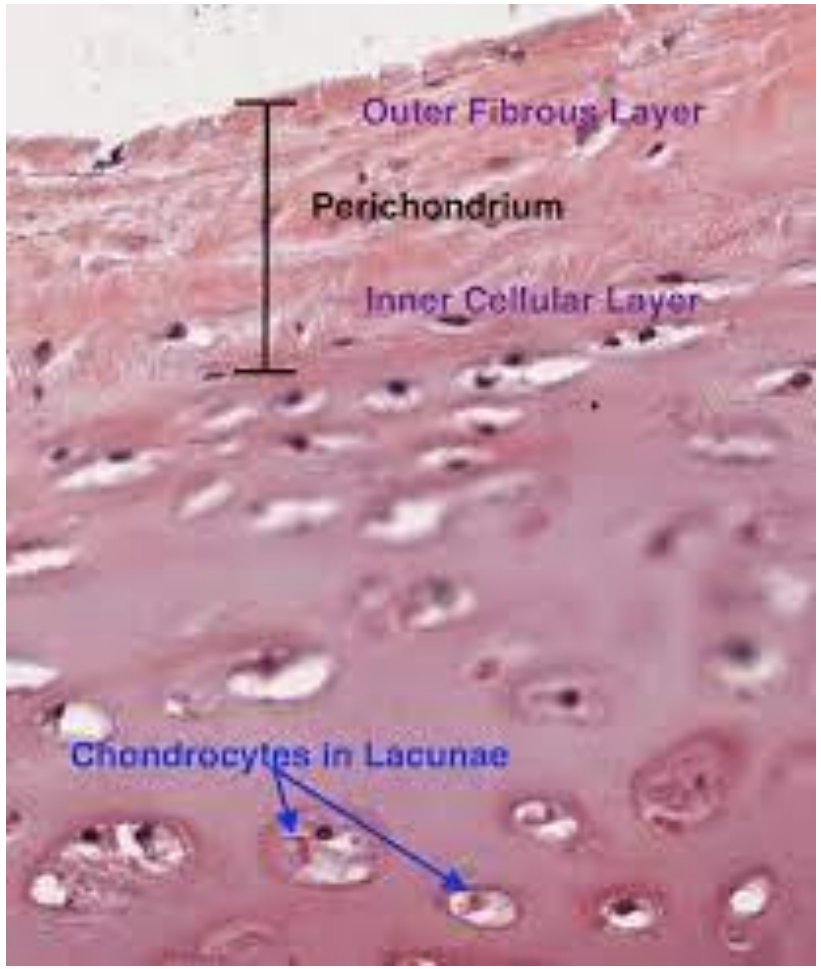
- Perichondrium is rich in blood vessels

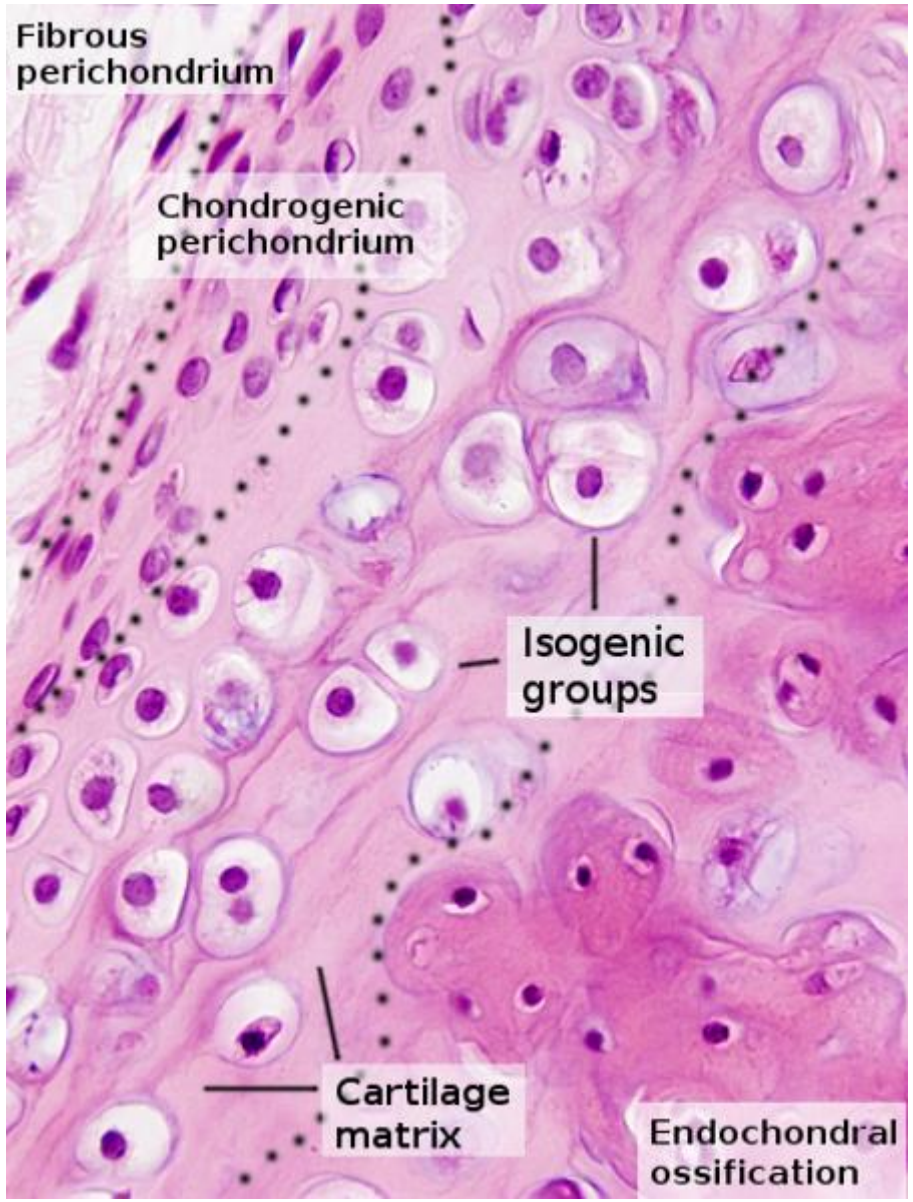
PERICHONDRIUM

- perichondrium, which is a layer of connective tissue that surrounds developing bone and also helps protect cartilage,
- It has an external layer, called fibrous perichondrium, composed of fibrous connective tissue containing collagen fibers and fibroblasts.
- and internal layer called chondrogenic perichondrium, where chondrogenic cells and chondroblasts are found.

❖Present in **most** of the hyaline & elastic cartilage

- Absent in fibrocartilage




Fibrous perichondrium
Chondrogenic perichondrium
Isogenic groups
Cartilage matrix
Endochondral ossification

MATRIX

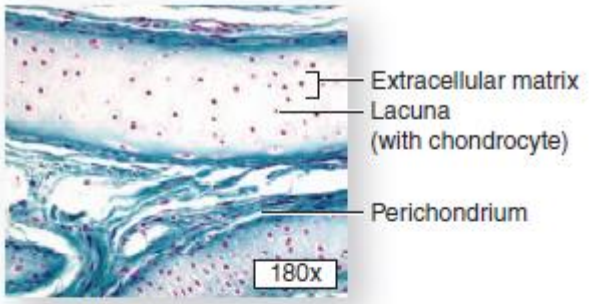
- The mechanical and biochemical features of cartilage depend on the extracellular matrix.
- which is mainly composed of:

1. water (65-80%).
2. collagen (15-20 %; type II collagen being the most abundant)
3. proteoglycans (mainly aggrecan) and glycoproteins (10 %).
4. and Long molecules of hyaluronan are also present in the cartilage extracellular matrix.

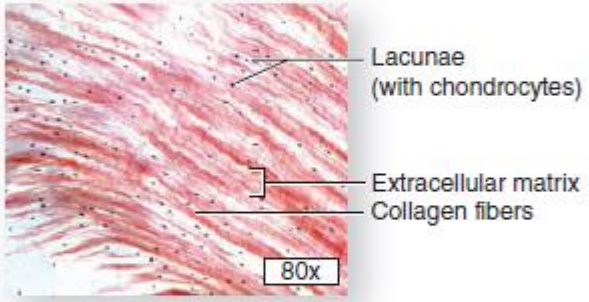
✓ Staining differences are apparent between the matrix immediately around each lacuna, called the **TERRITORIAL MATRIX.**

✓ and that more distant from lacunae, the **INTERTERRITORIAL MATRIX.** Collagen is more abundant in the interterritorial parts

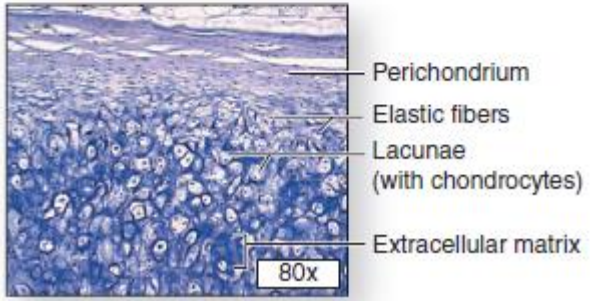
- of the matrix



b Hyaline cartilage

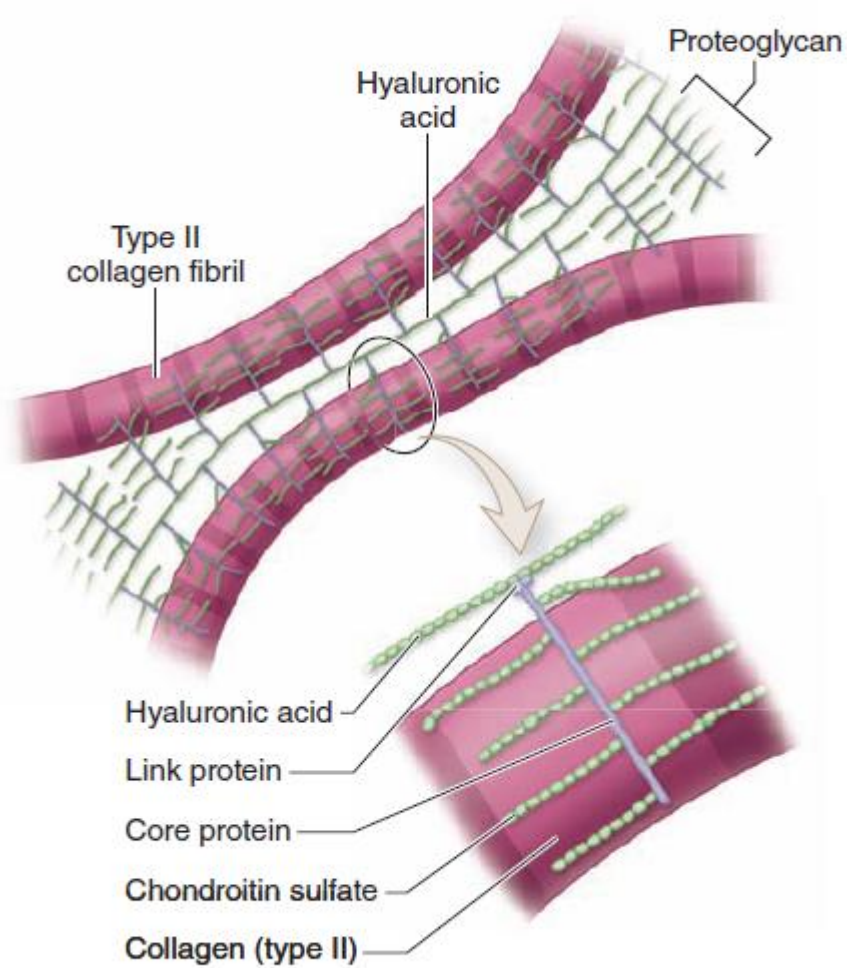


c Fibrocartilage

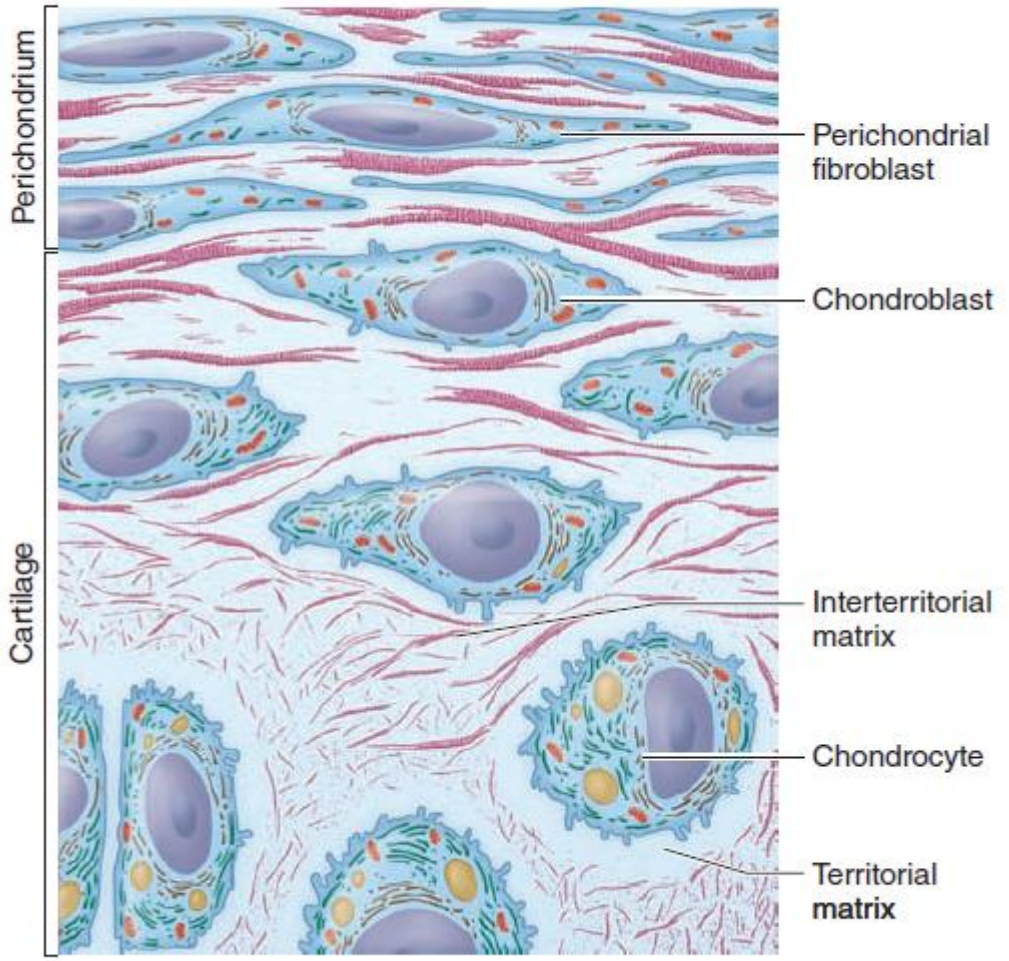


d Elastic cartilage

FIGURE **7–2** **The structure of cartilage matrix and cells.**



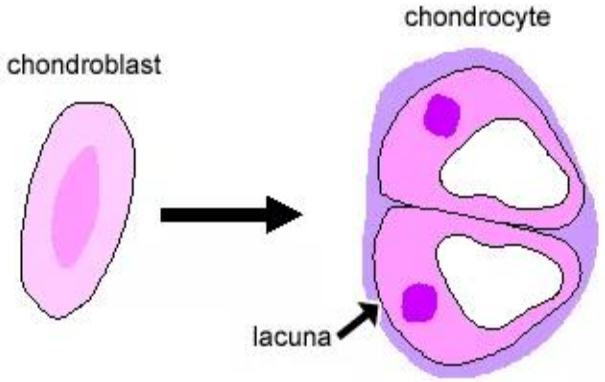
a



b

CHONDROBLAST

- Chondroblasts (AKA* perichondrial cells) are **cells that play an important role in the formation of cartilage** (AKA chondrogenesis).
- They are located in the perichondrium.
- Mesenchymal (embryologically)
- Progenitor of chondrocytes
- Lines border between perichondrium and matrix
- Produce the intercellular matrix and collagen fibres
- Cells which become imprisoned within this matrix become chondrocytes.

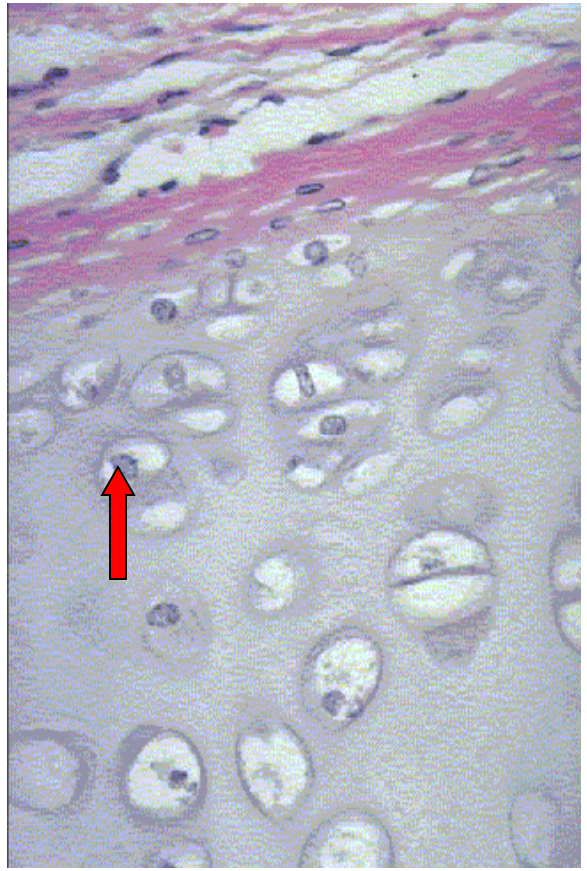


*AKA: Also Know As

CHONDROCYTE

Chondrocytes: from Greek chondros = cartilage+ kytos = cell) are **the only cells found in healthy cartilage**. They produce and maintain the cartilaginous matrix

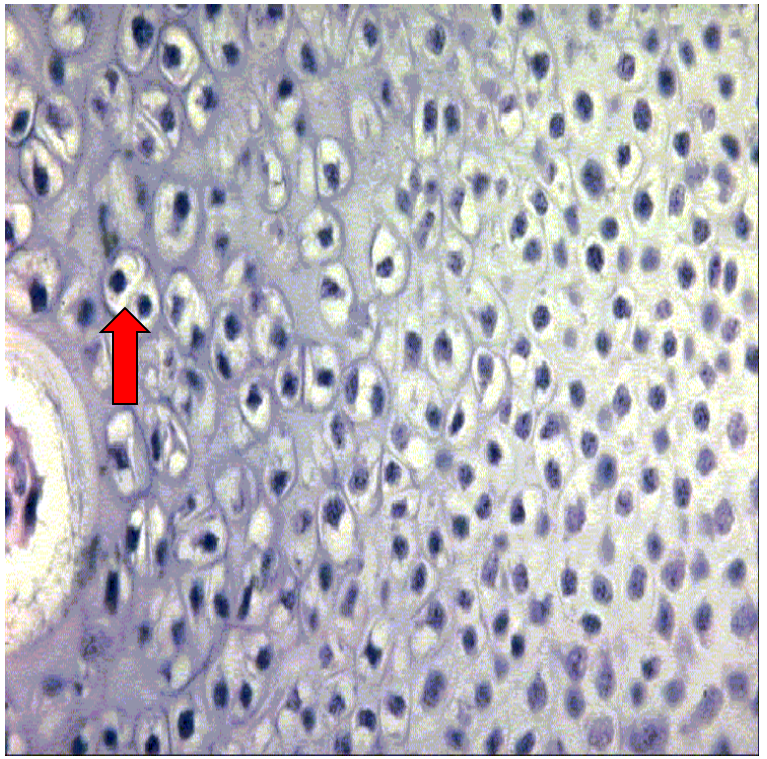
- Mature cartilage cell
- Resides in a space called the **lacuna**
- Isogenous cell group
- Basophilic
- Clear areas = Golgi and lipid droplets



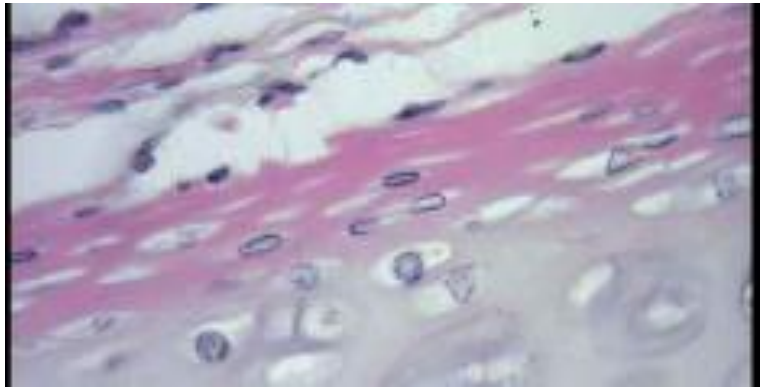
Cartilage Growth

Now, cartilage has two patterns of growth, appositional growth and interstitial growth.

- **Appositional growth** occurs when chondroblast secrete new matrix along existing surfaces and this causes the cartilage to expand and widen.

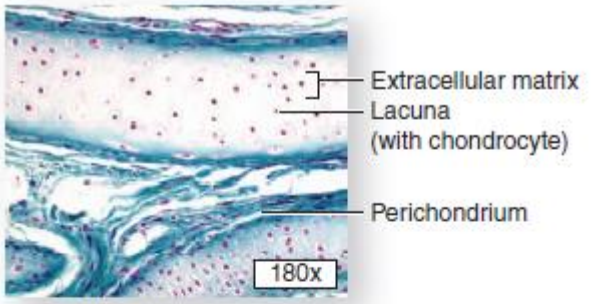


- In **Interstitial growth**, chondrocytes secrete new matrix within the cartilage and this causes it to grow in length.

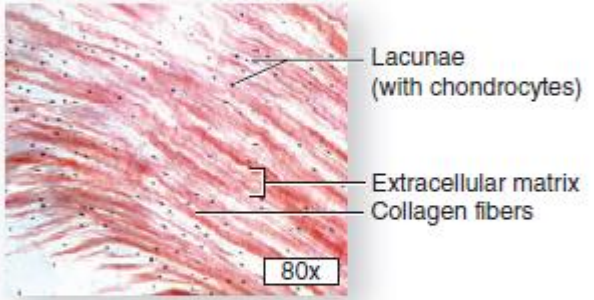


TYPES OF CARTILAGE

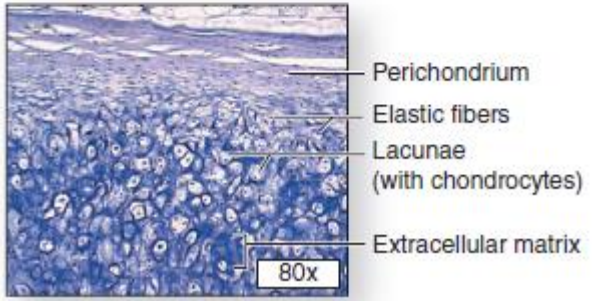
- **HYALINE**
- **ELASTIC**
- **FIBROUS**



b Hyaline cartilage

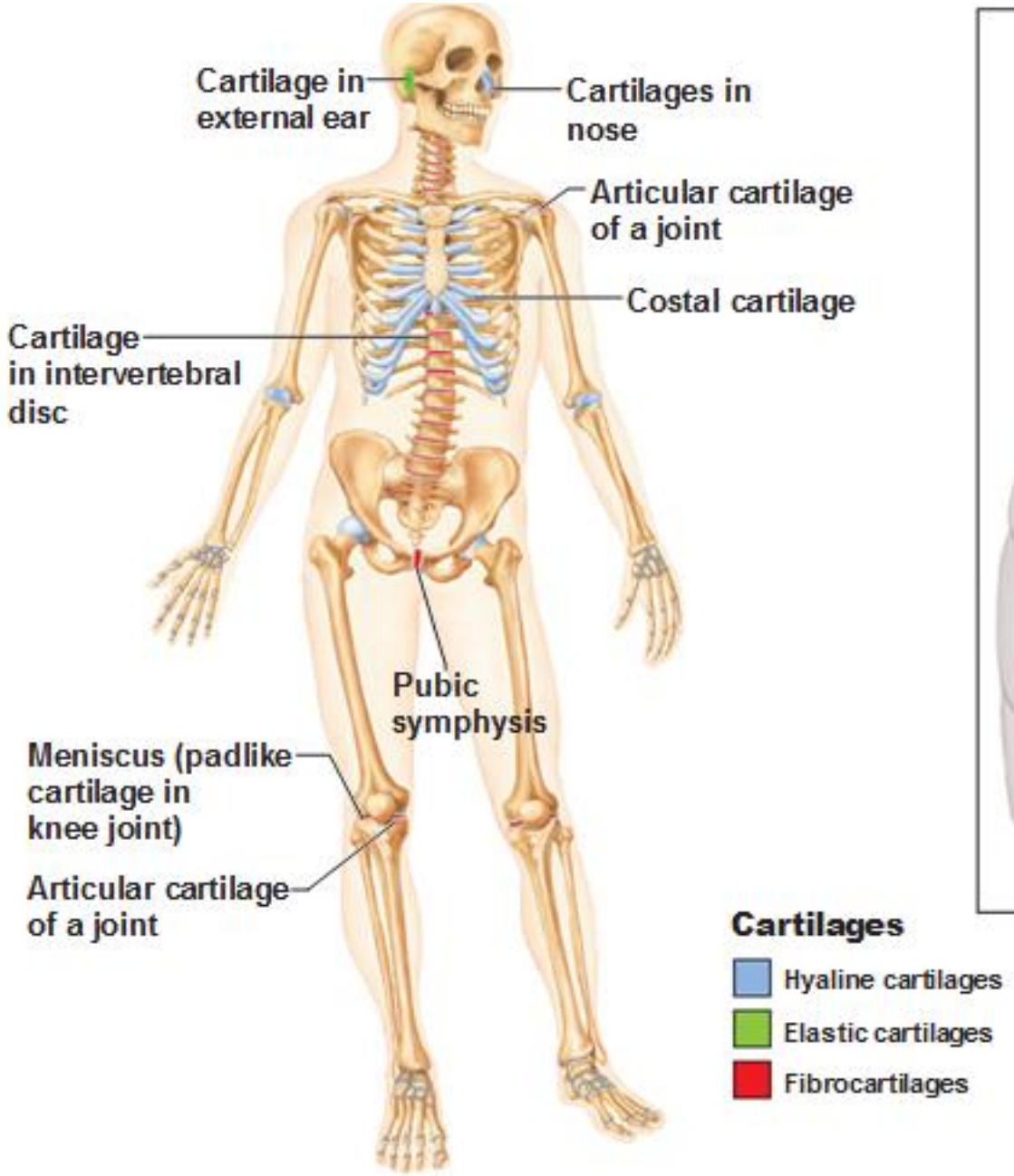


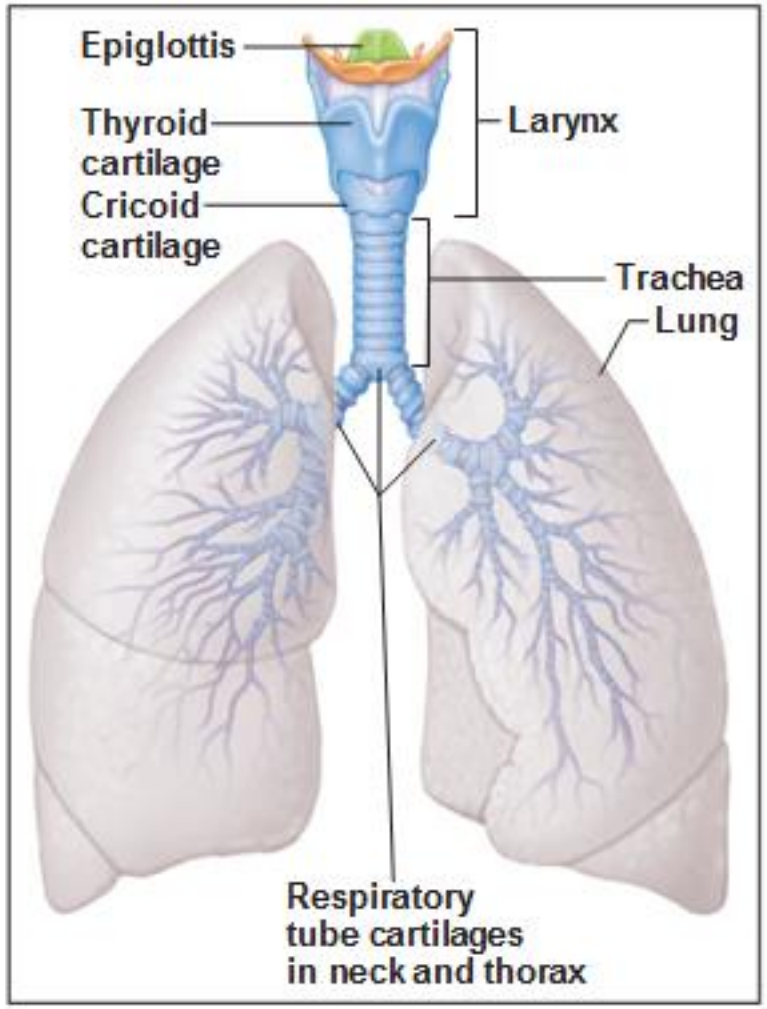
c Fibrocartilage



d Elastic cartilage

CARTILAGE: LOCATIONS





Cartilages

- Hyaline cartilages
- Elastic cartilages
- Fibrocartilages

HYALINE CARTILAGE

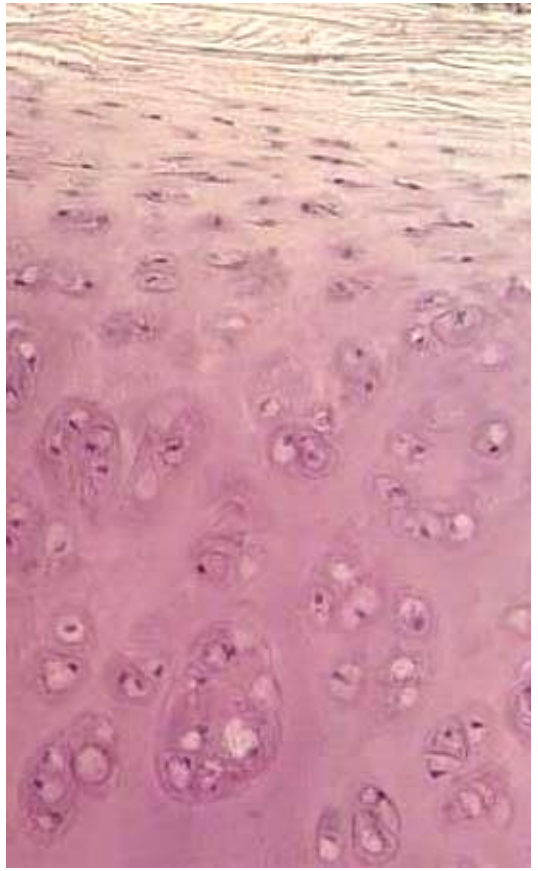
- **Sites:** Tracheal rings, nasal septum, larynx, costal cartilage & articular surfaces of joints

- **Cartilage cells:** Present singly or in groups of 2 or 4 cells inside lacunae

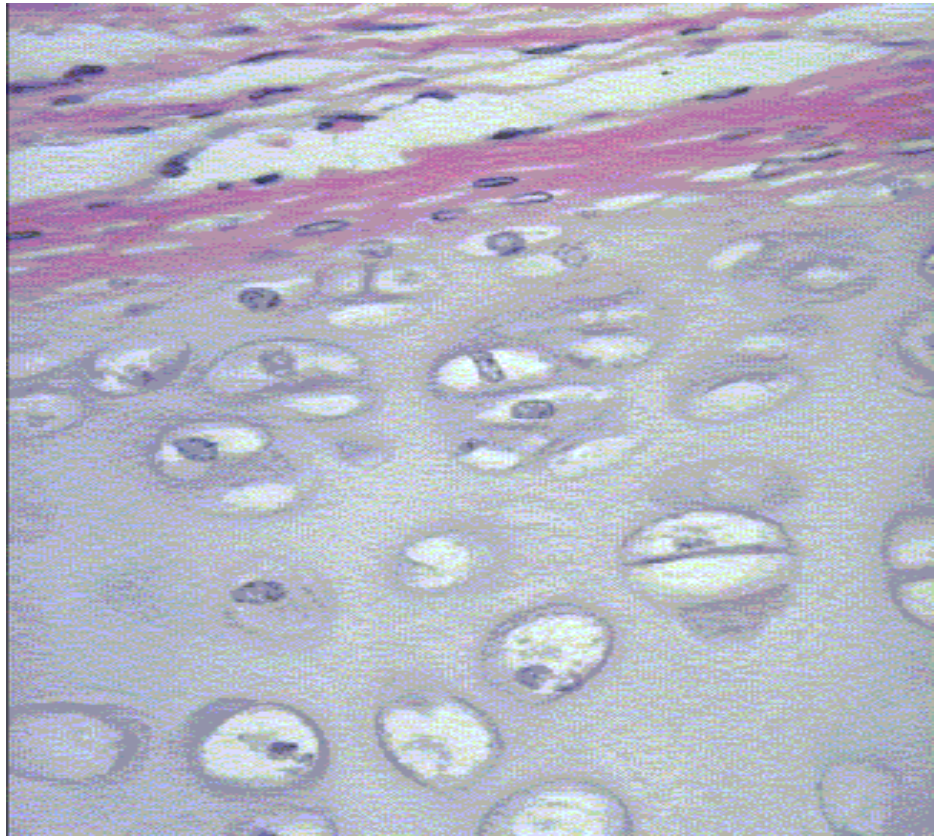
- **Cartilage Matrix:** Collagen type II

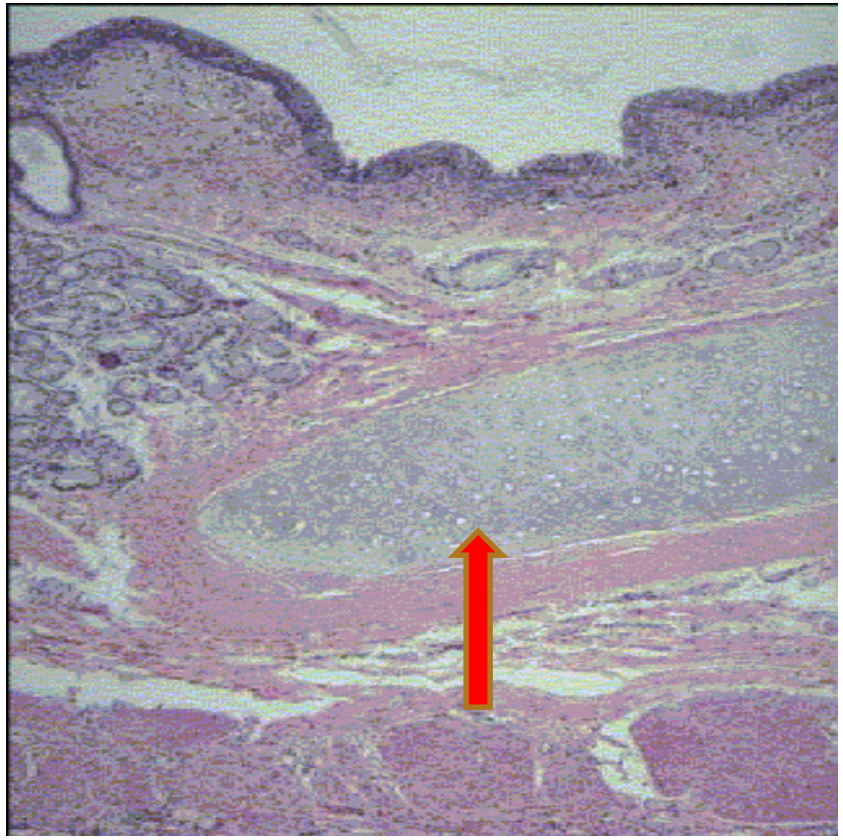
- **Ground substance:** Homogenous, clearly basophilic

- **Functions:** supportive



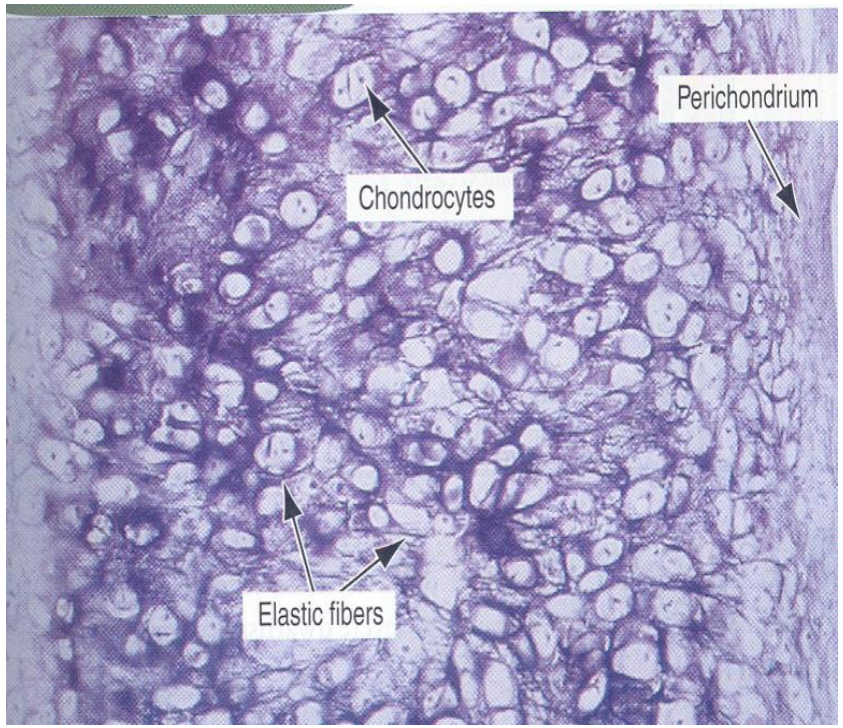
Hundreds of eyes staring back at you (hyaline cartilage)





ELASTIC CARTILAGE

- **Sites:** Auricle, ext. auditory meatus, auditory tube, epiglottis, apices of arytenoid cartilage
- **Cartilage cells:** larger, more numerous, packed more closely
- **Cartilage Matrix:** elastic fibres, Collagen type II
- **Ground substance:** Rich in elastic fibres
- **Functions:** supportive with resilience



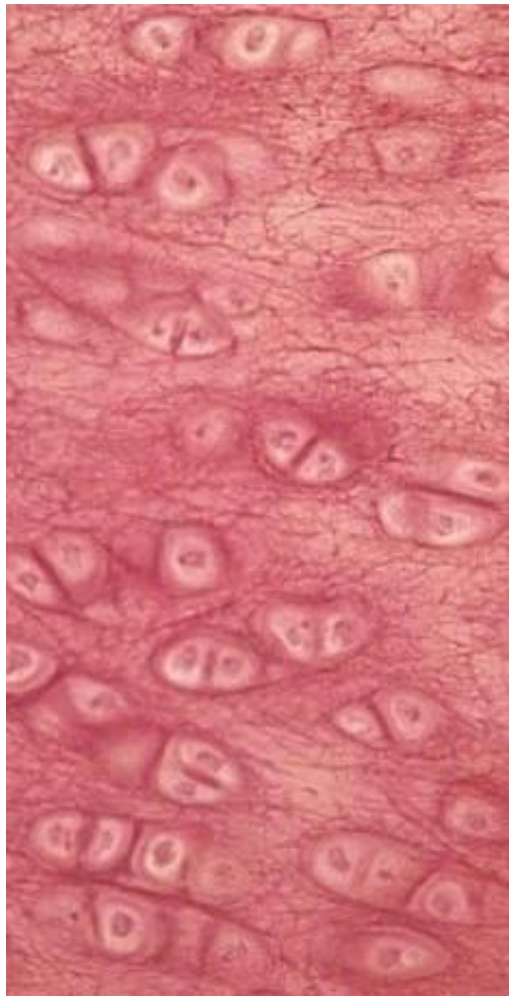
FIBROCARTILAGE

- **Sites:** intervertebral discs, arytenoid cartilage (except apices), pubic symphysis, manubriosternal joint, articular disc of TM joint.
- **Cartilage cells:** fewer, smaller, scattered singly or in rows

- **Cartilage Matrix:** collagen type I & II
- **Ground substance:** acidophilic
- **Functions:** supportive with tensile strength

Intervertebral disc

TYPES OF CARTILAGE



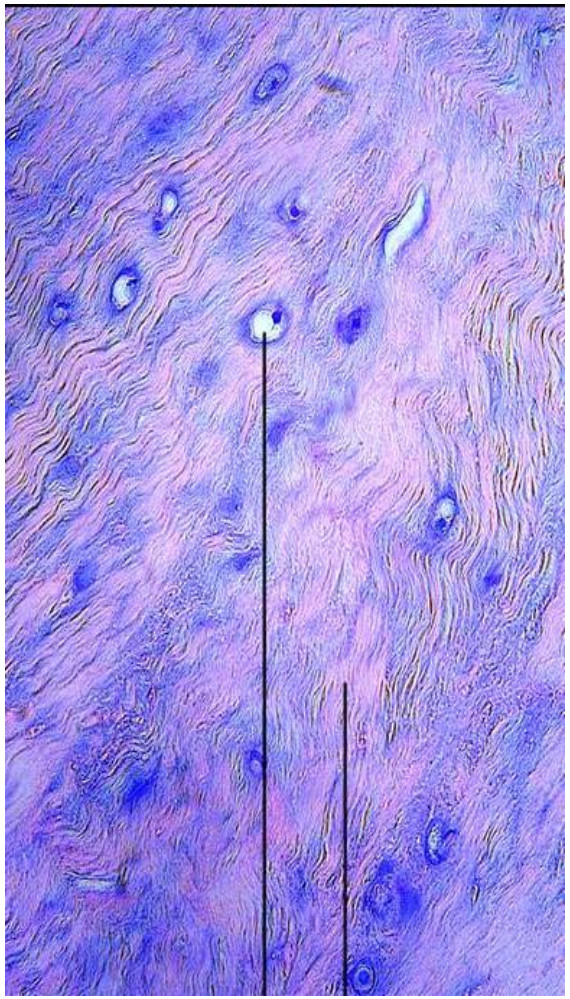


table 6.1 Cartilage Types, Characteristics, and Locations

Type of Cartilage	Identifying Characteristics	Perichondrium	Location
Hyaline	Type II collagen, basophilic matrix, chondrocytes usually arranged in groups (isogenous groups)	Perichondrium usually present except on articular surfaces	Articular ends of long bones, nose, larynx, trachea, bronchi, ventral ends of ribs, template for endochondral bone formation
Elastic	Type II collagen; elastic fibers	Perichondrium present	Pinna of ear, auditory canal and tube, epiglottis, some laryngeal cartilages
Fibrocartilage	Type I collagen, acidophilic matrix, chondrocytes arranged in parallel rows between bundles of collagen, always associated with dense collagenous connective tissue and/or hyaline cartilage	Perichondrium absent	Intervertebral disks, articular disks, pubic symphysis, insertion of tendons, meniscus of knee

Adapted with permission from Gartner LP, Hiatt JL. *Color Textbook of Histology*. Philadelphia, PA: Saunders; 1997:132.

https://histology.medicine.umich.edu/resources/cartilage


www.ihearthisto.com