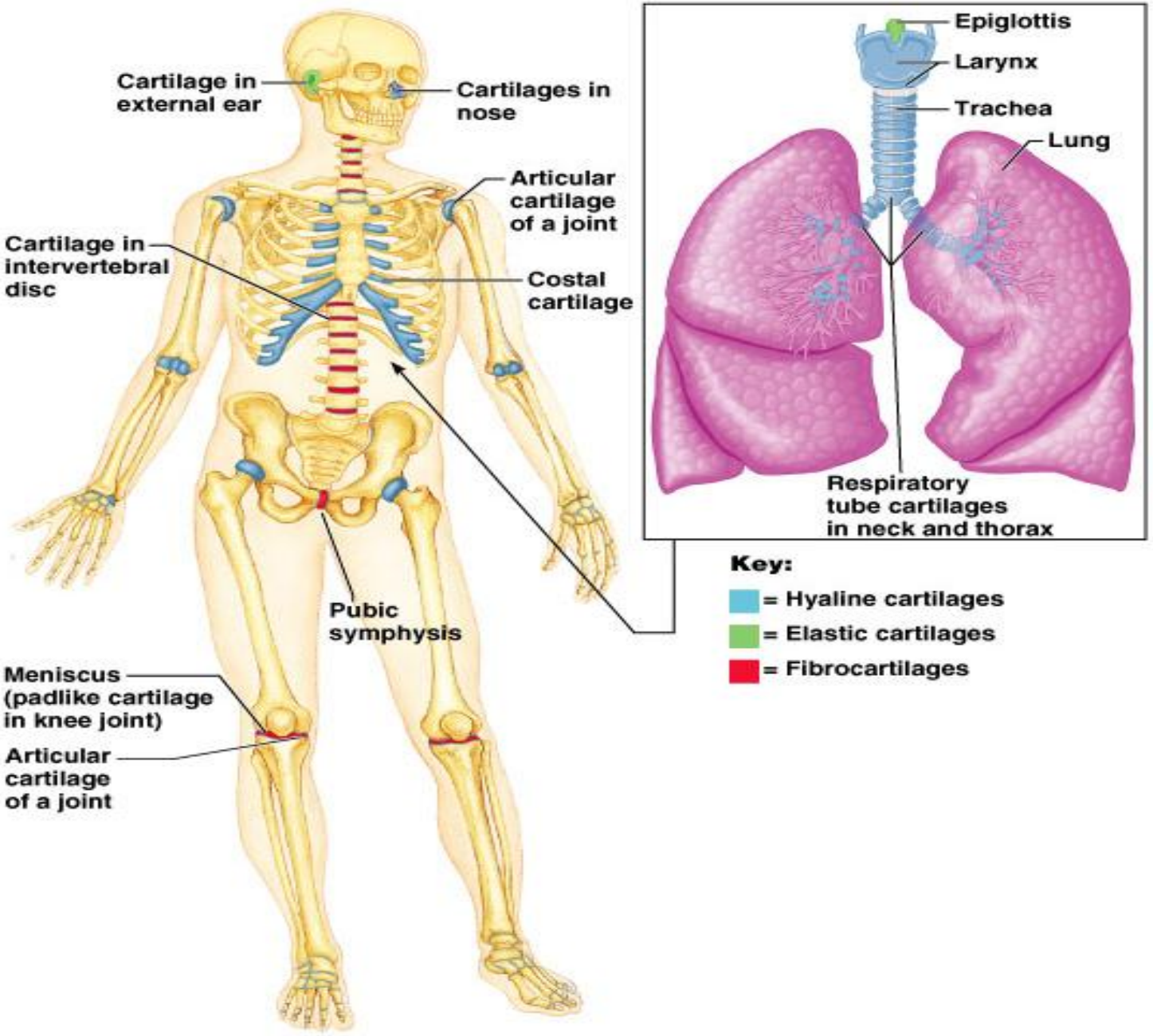
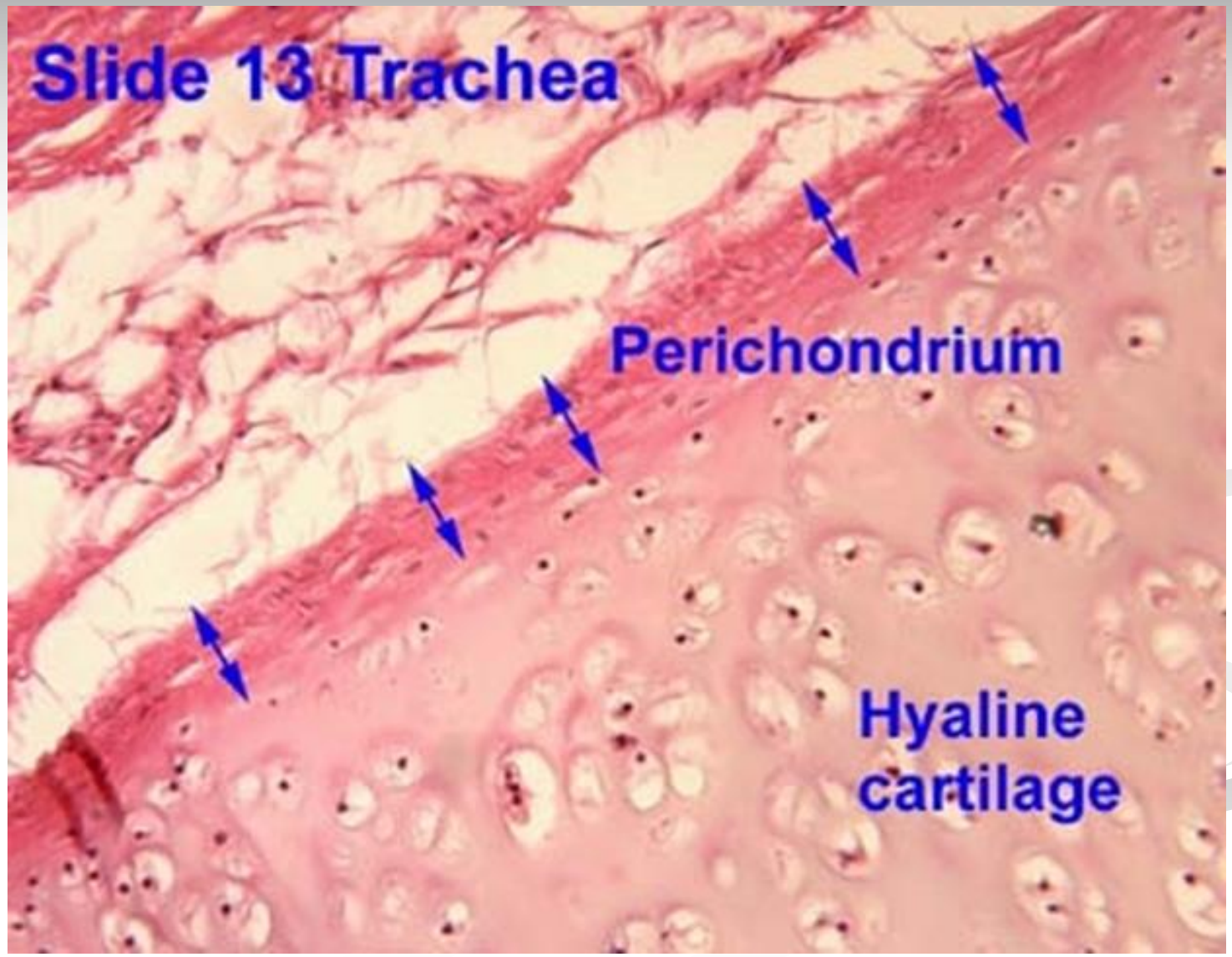
Medical Biology

The cartilage

- Cartilage is a type of supporting connective tissue.
- Consists of cells and extracellular matrix composed of connective tissue fibers and ground substance.
- not contain vessels or nerves.
- Cartilage consists mainly of cells called chondrocytes and chondroblasts that synthesize the extracellular matrix.
- No other cells than chondrocytes.
- perichondrium.
- very important during development, most of the bones of the skeleton are preceded by a temporary cartilage.


Cartilage in external ear
Cartilages in nose
Articular cartilage of a joint
Cartilage in intervertebral disc
Costal cartilage
Pubic symphysis
Meniscus (padlike cartilage in knee joint)
Articular cartilage of a joint
Epiglottis
Larynx
Trachea
Lung
Respiratory tube cartilages in neck and thorax
Key:
= Hyaline cartilages
= Elastic cartilages
= Fibrocartilages

Perichondrium

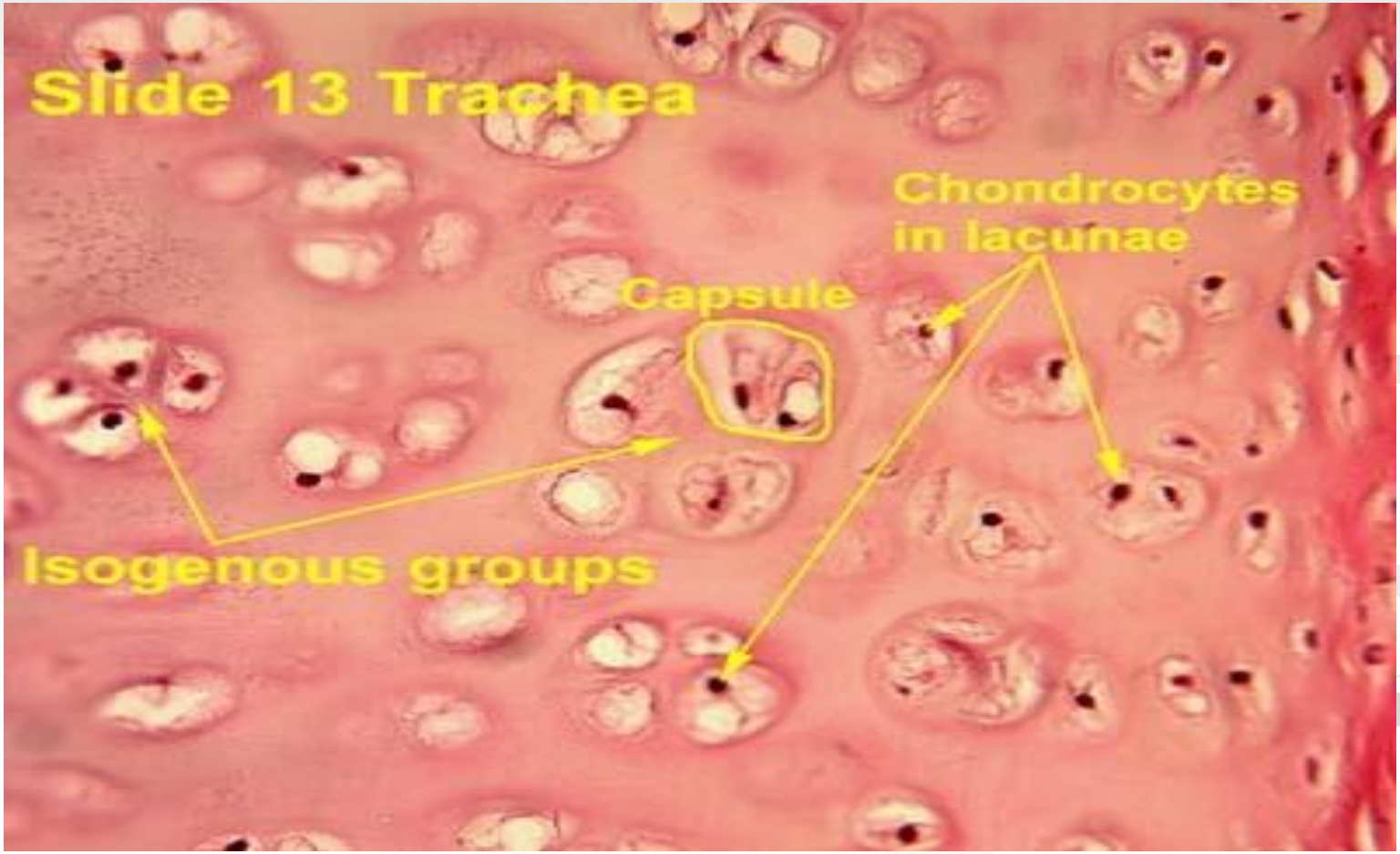


Functions of the perichondrium:

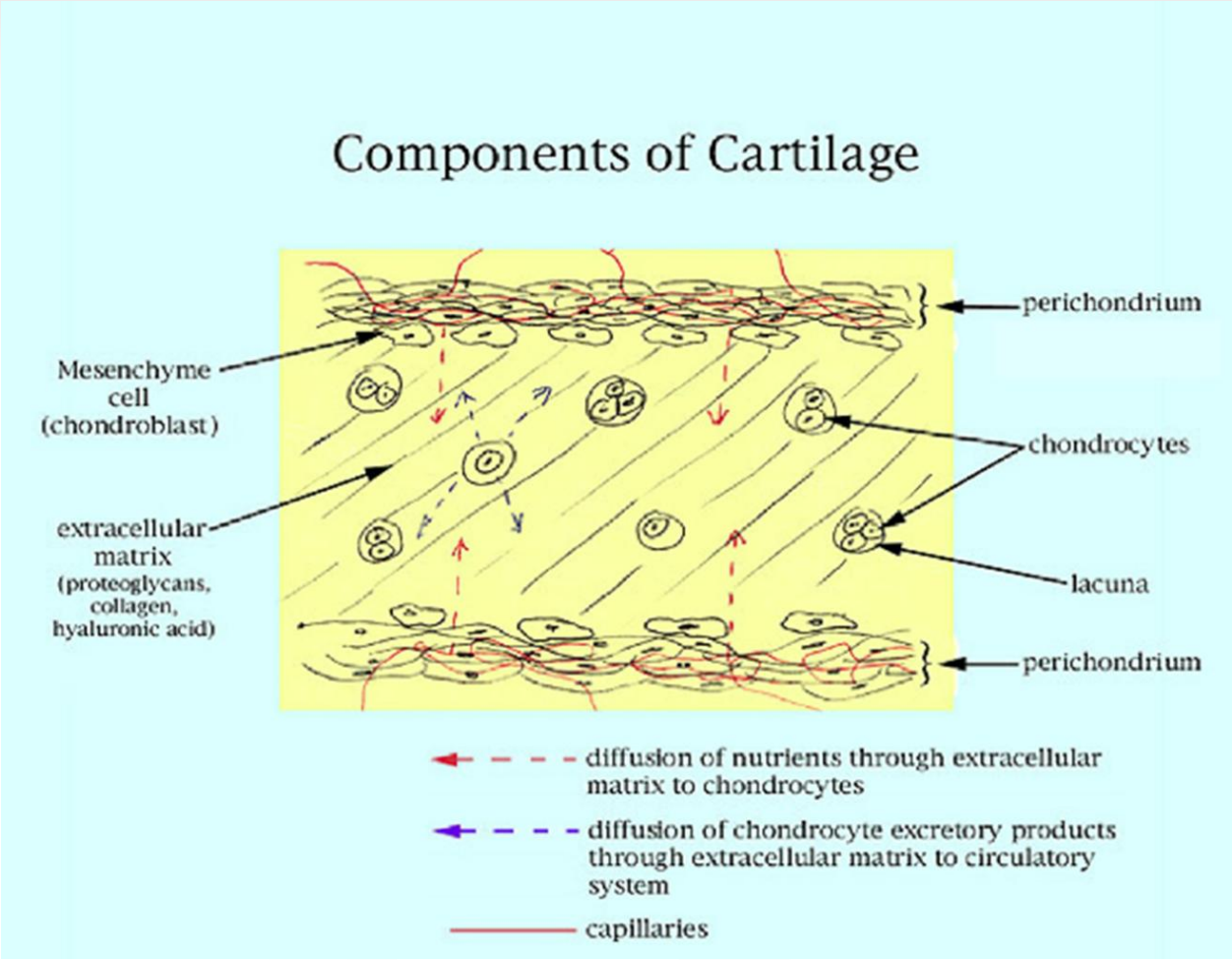
- **growth of cartilage.**
- **nutrition**

Cartilage cells

- mesenchyme cells ⟶ chondroblasts ⟶ chondrocytes ⟶ isogenous groups.



- chondrogenic cells ⟶ chondroblasts ⟶ chondrocytes.



- Chondrocyte function is hormone dependent. Synthesis of sulfated GAGs is accelerated by growth hormone.

Cartilage matrix

- It is produced and maintained by chondrocytes and chondroblasts. It consists of:
- 1. Fibers: collagen or elastic fibers
- 2. Ground substance: contains sulfated glycosaminoglycans and hyaluronic acid
- Cartilage matrix is highly hydrated because of its high water content (60%-80%).
- Cartilage is a semirigid tissue and can act as shock absorber.

- Hyaline cartilage consists of only type II collagen fibers
- proteoglycans (aggregan of chondroitin sulfate and keratan sulfate)
- adhesive glycoprotein called chondronectin.
- Type I collagen fibers is the dominant fiber in fibrocartilage.
- While plenty of elastic fibers with few collagen fibers are present in elastic cartilage.

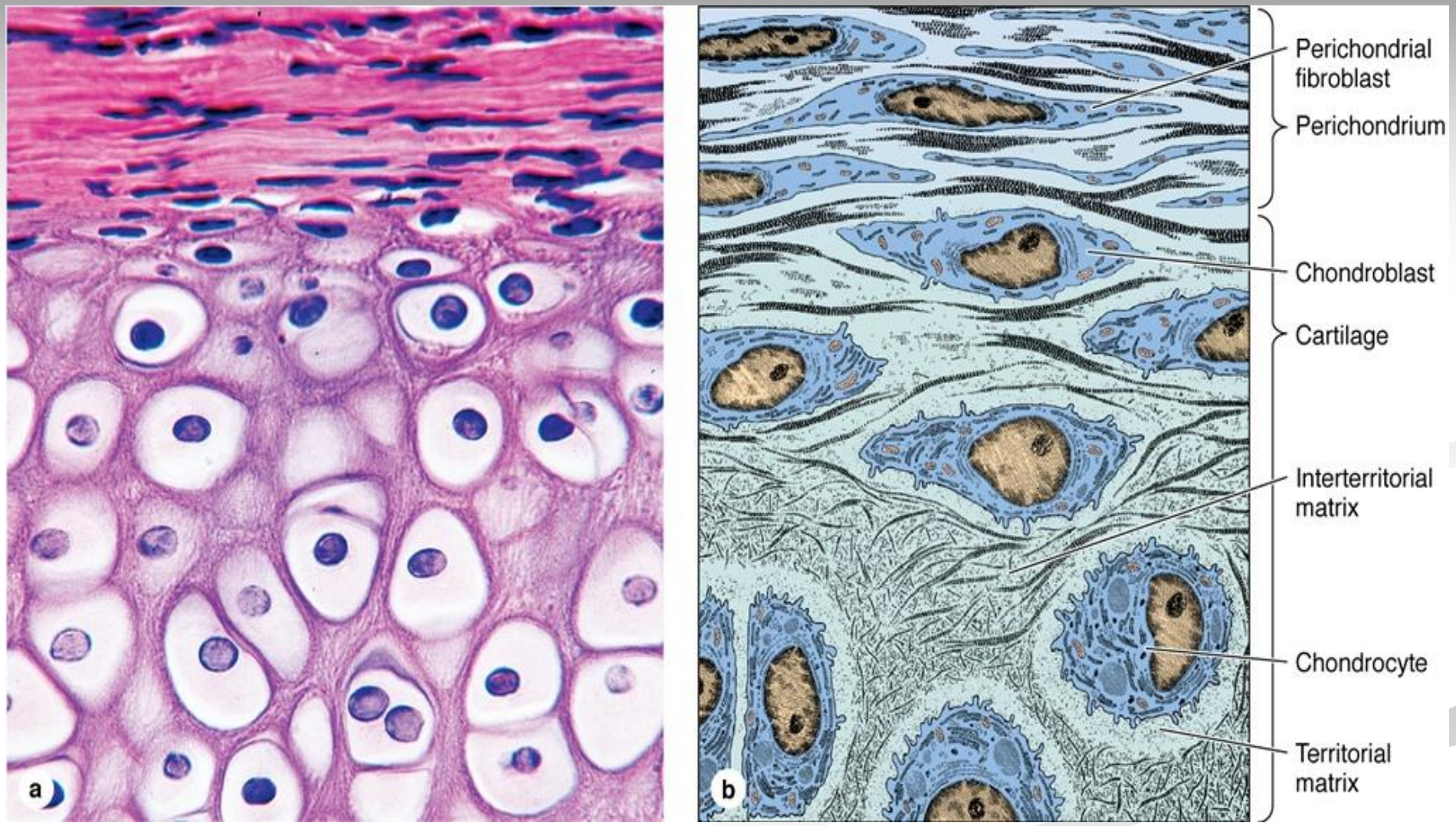
Types of cartilage

Classified into 3 types depending on the amount and types of connective tissue fibers :

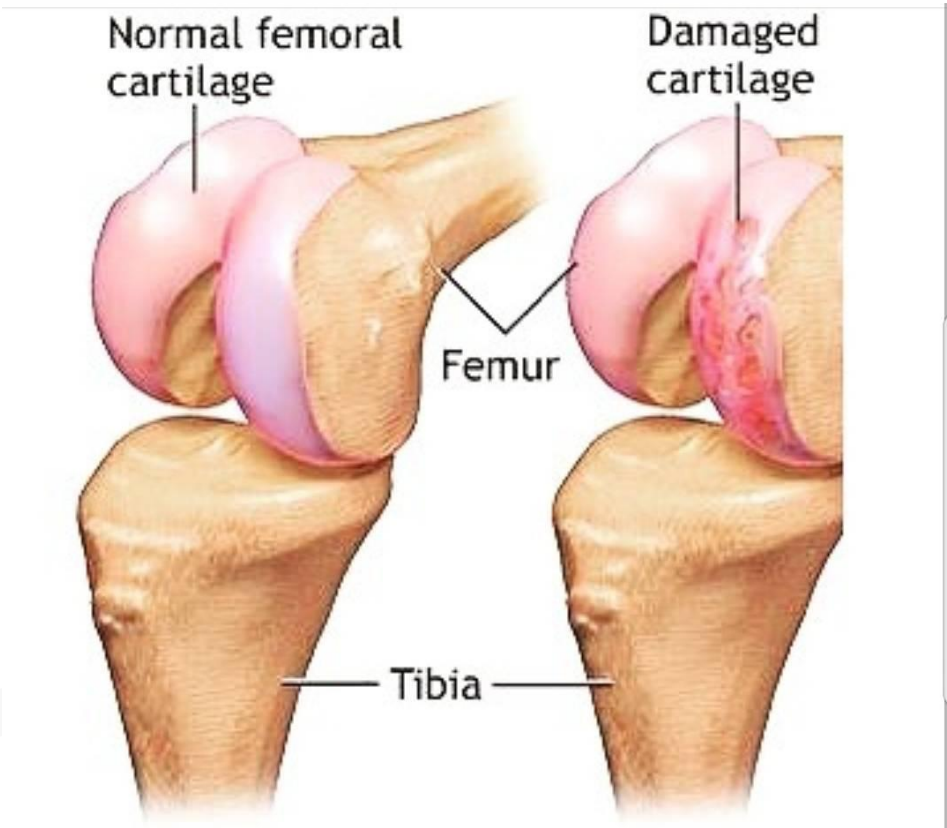
- **Hyaline cartilage: flexible and resilient.**
- **Elastic cartilage: highly bendable.**
- **Fibrocartilage: resists compression and tension.**

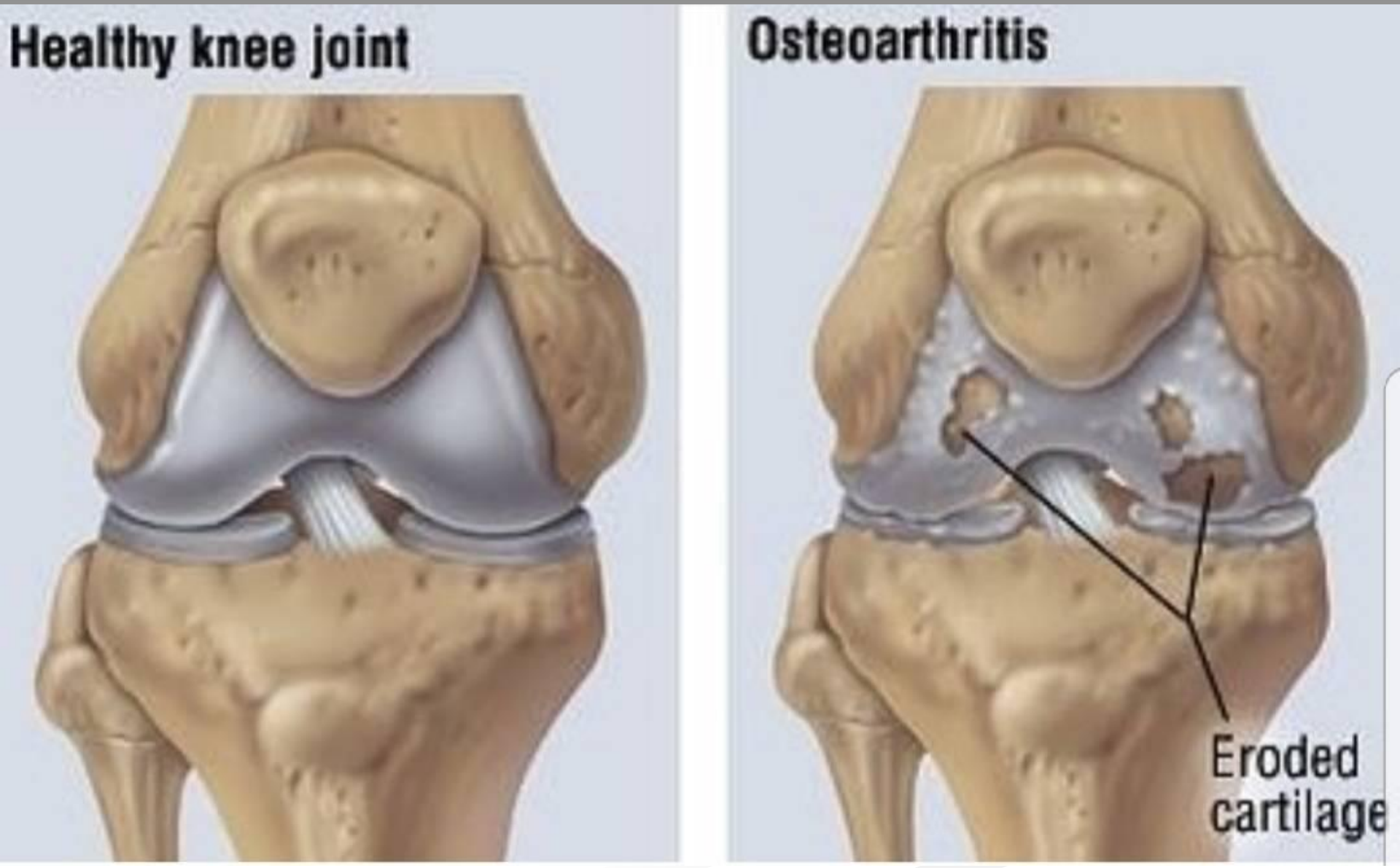
hyaline cartilage:

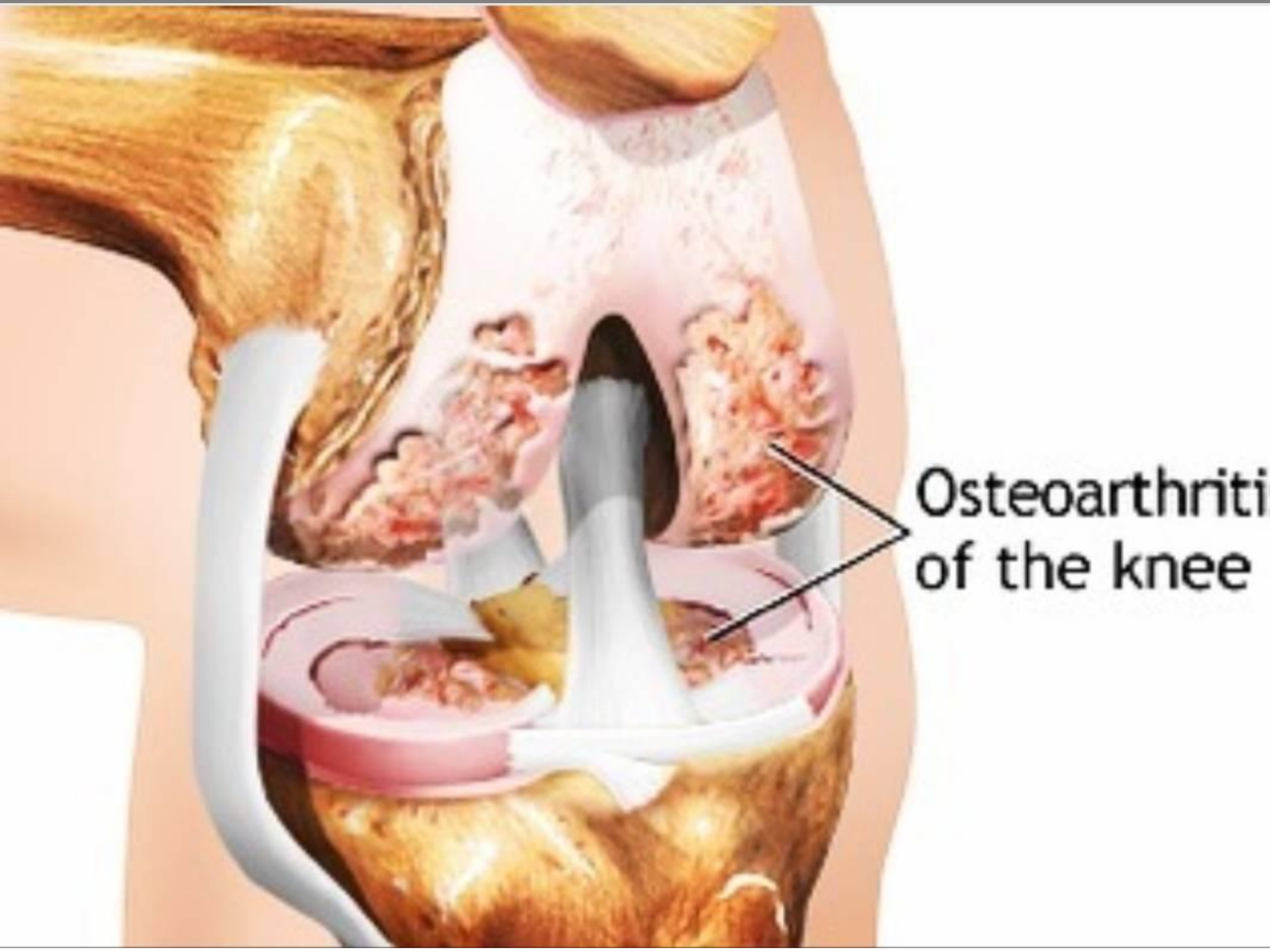
- Fresh hyaline cartilage, is a bluish-gray, semi translucent, in the embryo, it serves as a temporary skeleton.
- hyaline cartilage is located in the articulating surfaces of the movable joints, in the walls of larger respiratory passages (nose, larynx, trachea, bronchi), in the ventral ends of the ribs (costal cartilage) and in the epiphyseal plate, where it is responsible for the longitudinal growth of bone.


a
b
Perichondrial fibroblast
Perichondrium
Chondroblast
Cartilage
Interterritorial matrix
Chondrocyte
Territorial matrix

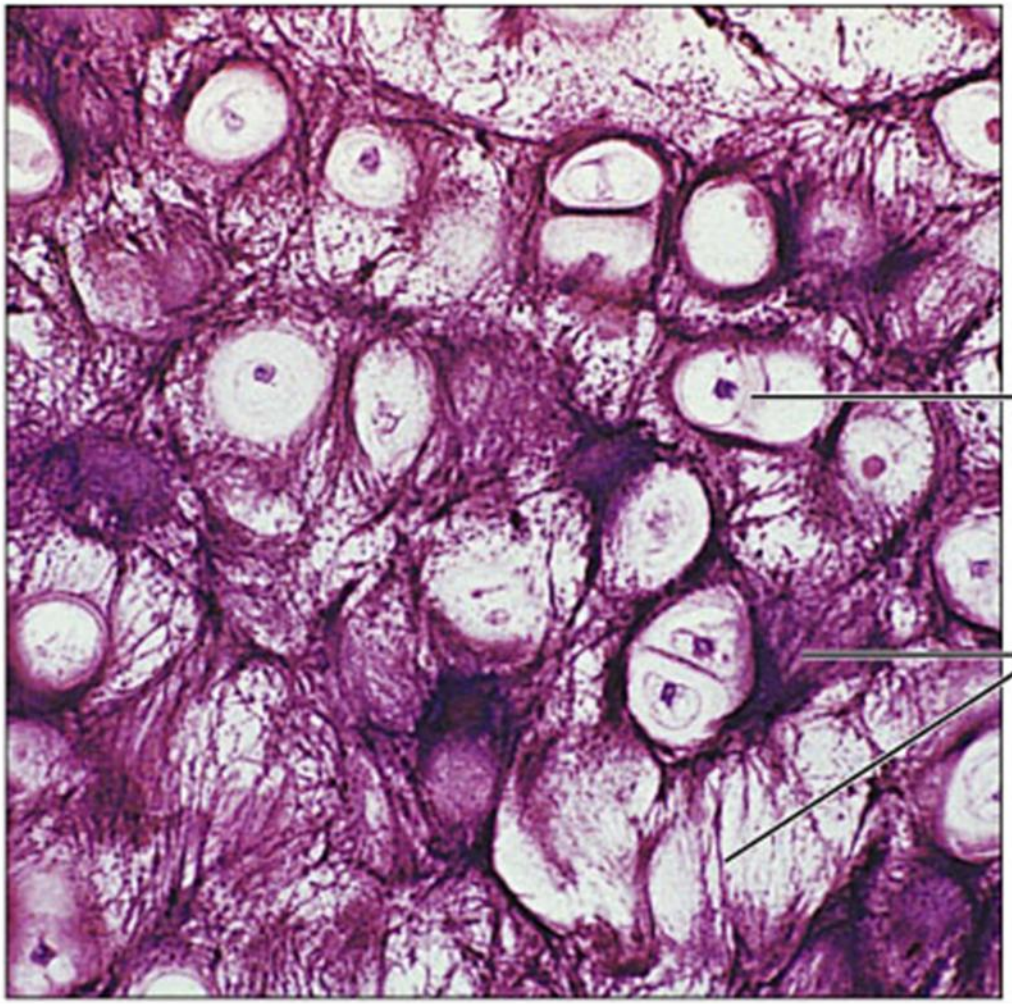
Clinical notes: Osteoarthritis



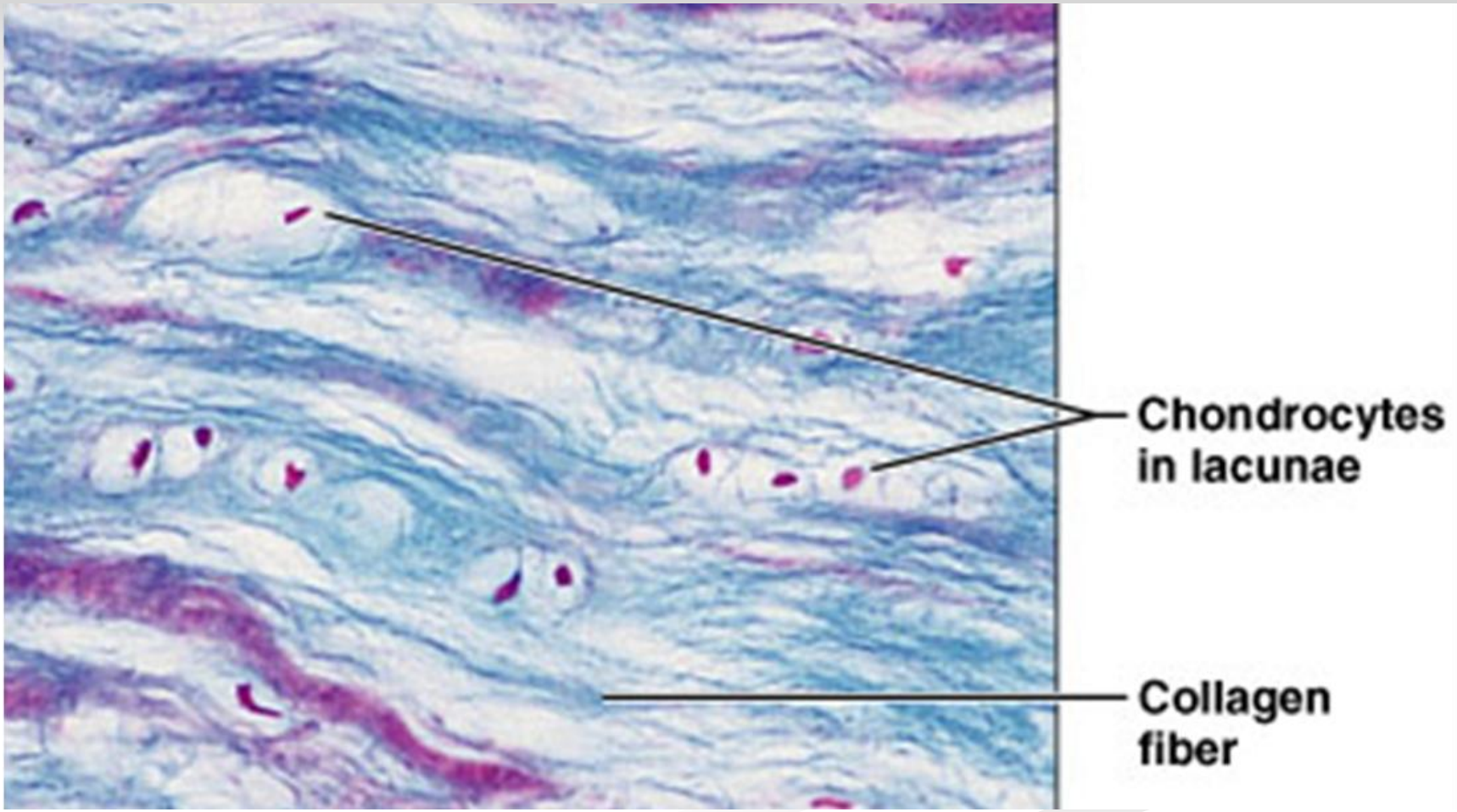

Healthy knee joint
Osteoarthritis
Eroded cartilage


Osteoarthriti
of the knee

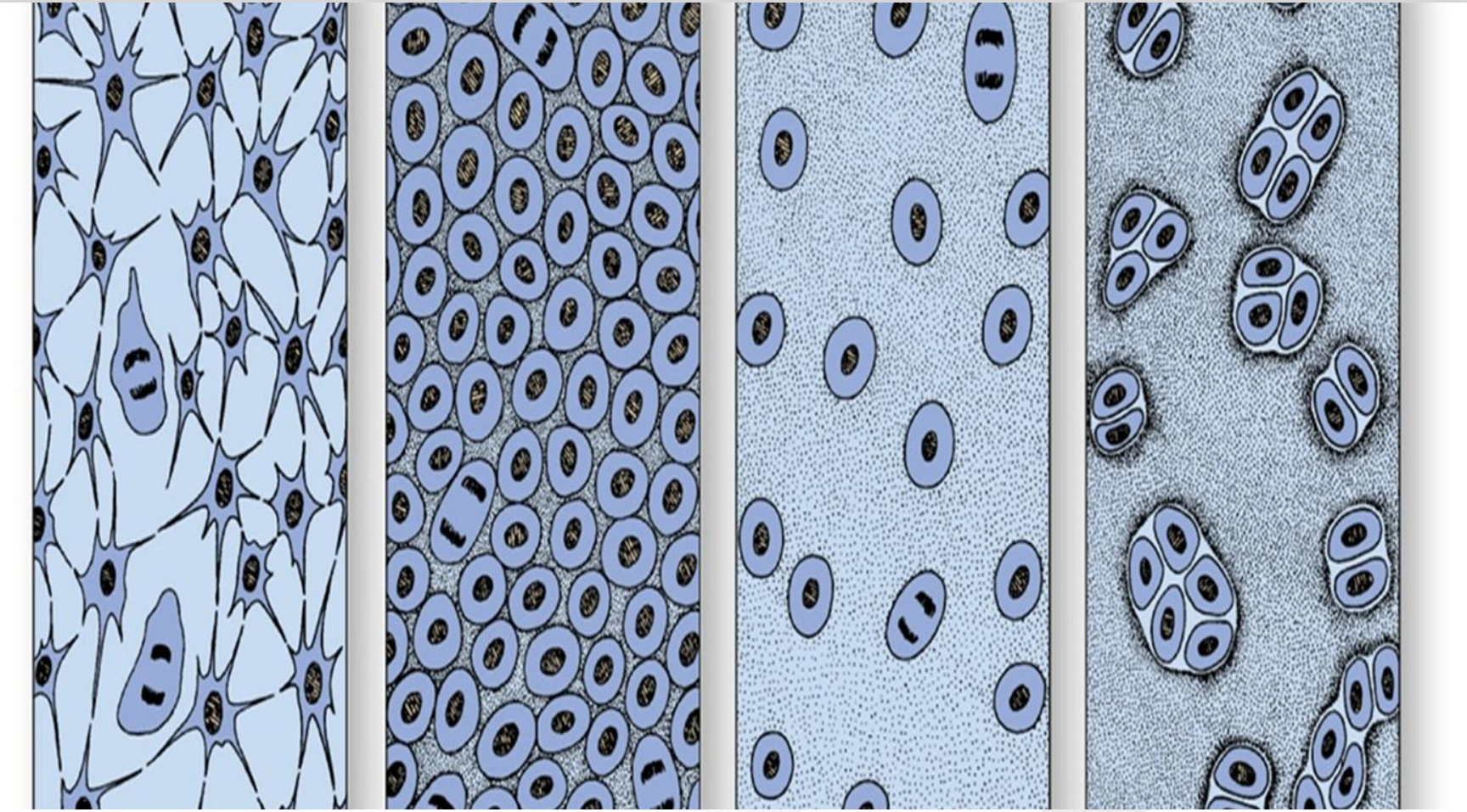
elastic cartilage:



fibro cartilage:

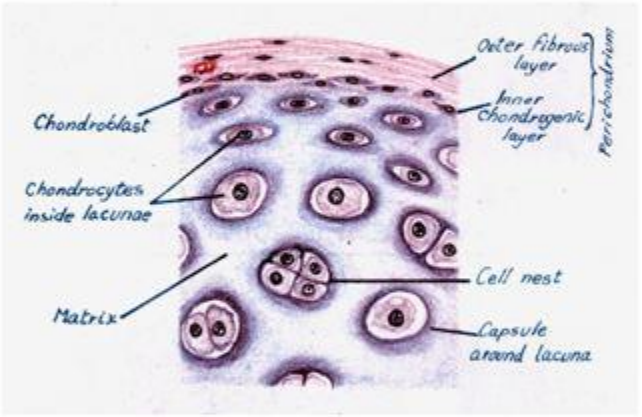


Cartilage histogenesis



1. Appositional growth:

- Is produced by the activity of Chondroblasts in the inner chondrogenic layer.
- It leads to increase in width.

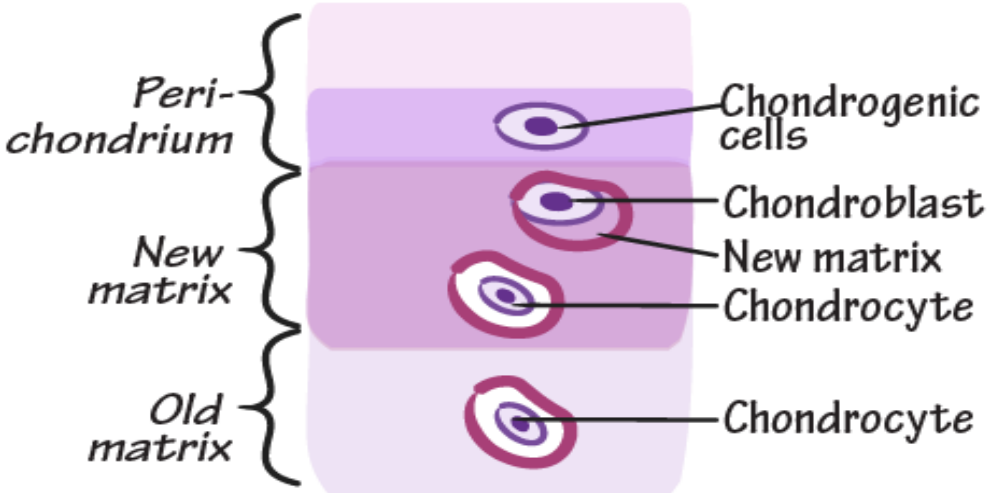


2. Interstitial growth:

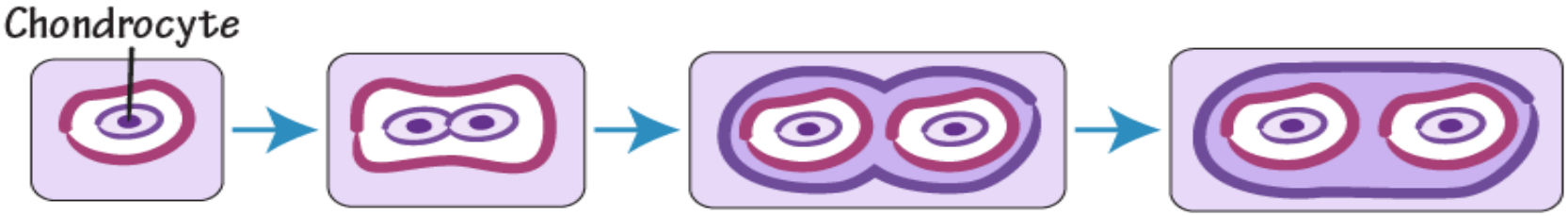
- Is produced by division and activity of mature chondrocytes.
- It leads to increase in length.

CARTILAGE

APPOSITIONAL GROWTH



INTERSTITIAL GROWTH



Chondrocyte secretes new matrix

Degenerative changes in cartilage

- Due to the poor access of nutrients to the chondrocytes they may atrophied in deep parts of thick cartilage. Water content decreases and small cavities arise in the matrix, which often leads to the calcification of the cartilage. The chondrocytes may eventually die, and the cartilage is gradually transformed to bone.
- In contrast to hyaline cartilage, which can calcify with aging, the matrix of elastic cartilage does not calcify.

Regeneration of cartilage tissue

- Except in young children, damaged cartilage undergoes slow and often incomplete **regeneration**, by activity of cells in the perichondrium which invade the injured area and generate new cartilage. In extensively damaged areas—and occasionally in small areas—the perichondrium produces a scar of dense
- connective tissue instead of forming new cartilage. The poor regenerative capacity of cartilage is due in part to the avascularity of this tissue.

Medical Applications

- Cells of cartilage can give rise to either benign chondroma or slow growing malignant chondrosarcoma tumors in which cells produce normal matrix components. Chondrosarcomas will metastasize and are generally removed surgically.

THANK YOU