جامعة المستقبل
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قسم الادلة الجنائية

المحاضرة السابعة

Cartilage, Histogenesis, Growth and repair of cartilage

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1. Introduction to Cartilage

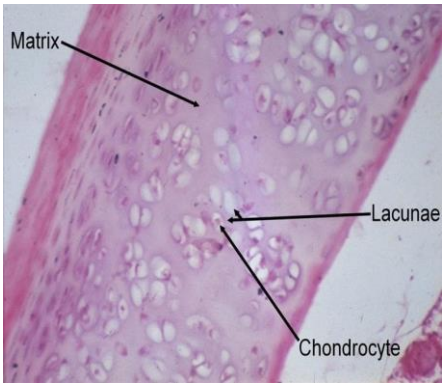
Cartilage is a type of **connective tissue** found in many parts of the human body. It is **strong but flexible**, which helps support body structures and allows smooth movement between bones.

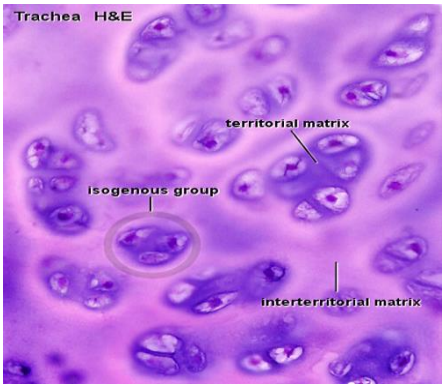
Cartilage can be found in several places such as:

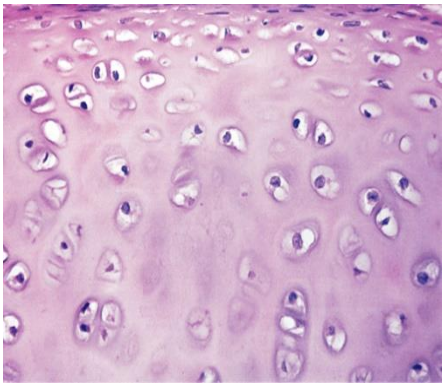
- Nose
- Ear
- Joints
- Trachea (windpipe)
- Between vertebrae of the spine

The main function of cartilage is to **support tissues and reduce friction between bones** during movement.

Unlike many other tissues, cartilage **does not contain blood vessels or nerves**, so nutrients reach it by **diffusion from surrounding tissues**.







2. General Characteristics of Cartilage

Cartilage has several important characteristics:

- It is **firm and flexible**
- It **does not contain blood vessels**
- It **does not contain nerves**
- It has a large amount of **extracellular matrix**
- It grows slowly
- Its ability to repair itself is limited

Because cartilage lacks blood vessels, **healing and repair occur very slowly** compared to bone tissue.

3. Components of Cartilage

Cartilage consists of two main components:

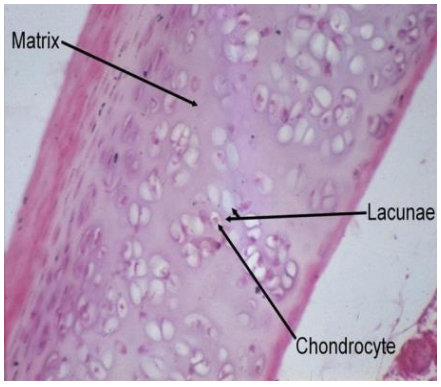
1. Chondrocytes

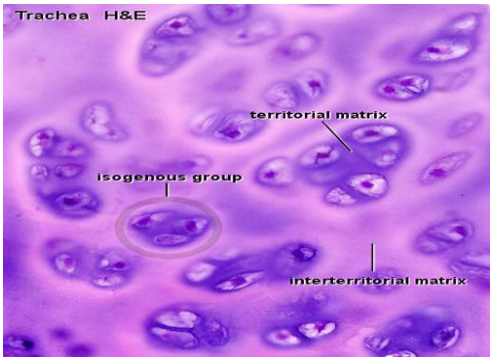
Chondrocytes are the **main cells of cartilage**.

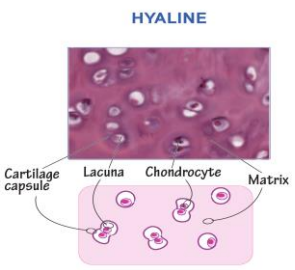
Functions:

- Produce cartilage matrix
- Maintain cartilage tissue
- Control cartilage growth

These cells are located inside small spaces called **lacunae**.







2. Extracellular Matrix

The extracellular matrix is the **material surrounding the cells**.

It contains:

- Collagen fibers
- Proteoglycans
- Water

Functions of the matrix:

- Provides **strength and support**
- Gives cartilage **elasticity**
- Helps absorb **mechanical pressure**

Water forms about **60–80% of cartilage structure**, which helps it resist compression.

4. Perichondrium

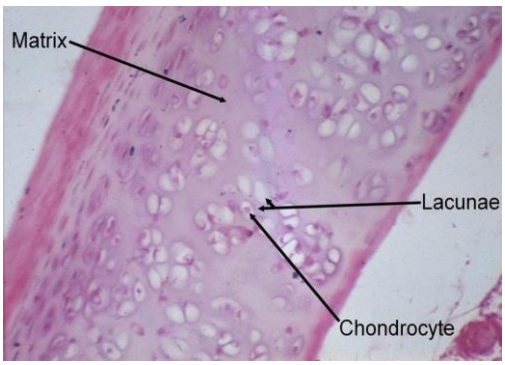
Most cartilage is surrounded by a connective tissue layer called the **Perichondrium**.

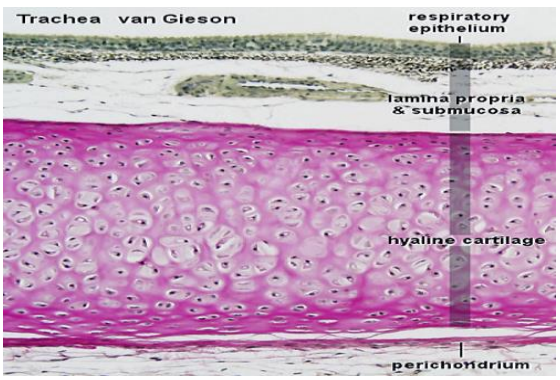
Functions of the perichondrium:

- Protects cartilage
- Provides nutrients to cartilage
- Helps cartilage grow
- Participates in cartilage repair

However, some cartilage **does not have a perichondrium**, such as:

- Articular cartilage (in joints)
- Fibrocartilage





5. Types of Cartilage

There are **three main types of cartilage** in the human body.

5.1 Hyaline Cartilage

Hyaline cartilage is the **most common type of cartilage** in the body.

Characteristics:

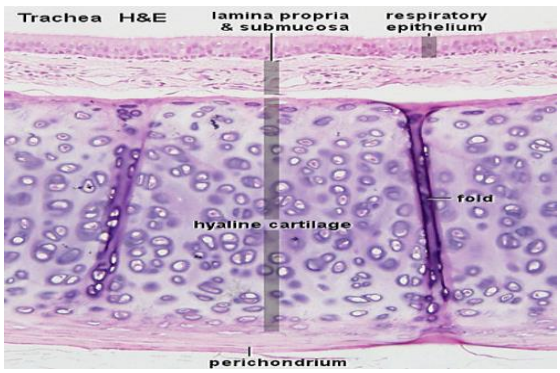
- Smooth and glass-like appearance
- Contains fine collagen fibers
- Semi-transparent structure

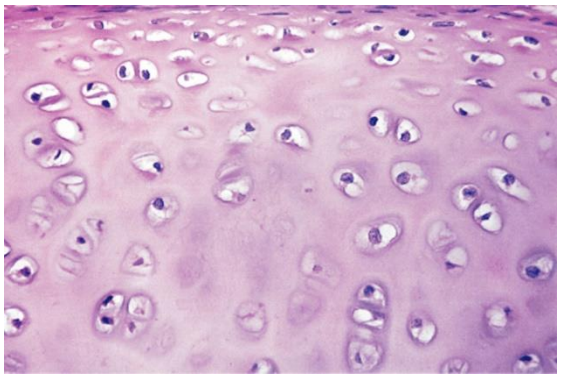
Locations:

- Joints
- Nose
- Trachea
- Larynx
- Costal cartilage (ribs)

Functions:

- Reduces friction in joints
- Supports respiratory structures
- Maintains shape of some organs





5.2 Elastic Cartilage

Elastic cartilage contains **elastic fibers** in addition to collagen.

Characteristics:

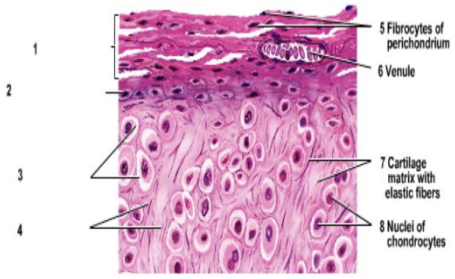
- Very flexible
- Returns to its original shape after bending

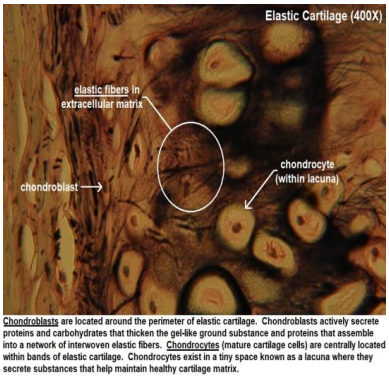
Locations:

- External ear (auricle)
- Ear canal
- Epiglottis

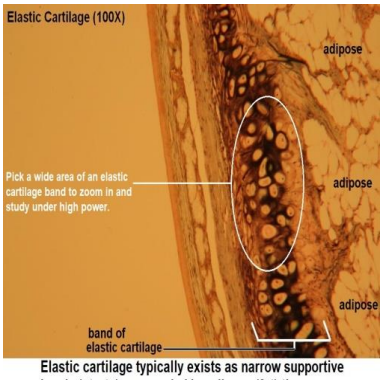
Function:

- Maintains shape while allowing flexibility.





Chondroblasts are located around the perimeter of elastic cartilage. Chondroblasts actively secrete proteins and carbohydrates that thicken the gel-like ground substance and proteins that assemble into a network of interwoven elastic fibers. Chondrocytes (mature cartilage cells) are centrally located within bands of elastic cartilage. Chondrocytes exist in a tiny space known as a lacuna where they secrete substances that help maintain healthy cartilage matrix.



Elastic cartilage typically exists as narrow supportive bands (struts) surrounded by adipose (fat) tissue.

5.3 Fibrocartilage

Fibrocartilage is the **strongest type of cartilage**.

Characteristics:

- Large amount of collagen fibers
- Very strong and resistant to pressure
- Less flexible than other types

Locations:

- Intervertebral discs
- Knee meniscus
- Some tendon attachments

Function:

- Absorbs shock
- Resists mechanical stress

6. Histogenesis of Cartilage

Histogenesis means **the formation of tissues during embryonic development**.

Cartilage develops through several steps:

Step 1

Mesenchymal cells group together and differentiate into **chondroblasts**.

Step 2

Chondroblasts begin to **produce extracellular matrix**.

Step 3

When the matrix surrounds the cells, they become **mature cartilage cells called chondrocytes**.

This process forms the basic structure of cartilage tissue.

7. Growth of Cartilage

Cartilage grows in **two different ways**.

1. Interstitial Growth

This growth occurs **within the cartilage itself**.

Process:

1. Chondrocytes divide
2. New cells form
3. These cells produce matrix

Result:

Cartilage increases **in length and internal size**.

This type of growth occurs mainly in **early development and articular cartilage**.

2. Appositional Growth

This growth occurs **from the surface of cartilage**.

Process:

1. Cells in the perichondrium become chondroblasts
2. They produce new cartilage matrix
3. New cartilage forms on the outer surface

Result:

Cartilage becomes **thicker**.

8. Repair of Cartilage

Cartilage has **limited ability to repair itself**.

Reasons include:

- Lack of blood vessels
- Low number of cells
- Slow cell division

When cartilage is damaged, repair may occur in different ways:

1. Minor Repair

Small injuries may heal slowly using nearby cells.

2. Fibrous Tissue Formation

Sometimes damaged cartilage is replaced by **fibrous connective tissue** instead of real cartilage.

3. Medical Treatment

Modern medicine may repair cartilage using:

- Cartilage transplantation
- Stem cell therapy
- Tissue engineering

9. Importance of Cartilage

Cartilage plays several important roles in the body:

- Allows **smooth joint movement**
- Reduces friction between bones
- Absorbs shocks during movement
- Supports structures like the nose and ear
- Helps bone growth in children

10. Diseases of Cartilage

Some common cartilage disorders include:

Osteoarthritis

A condition where cartilage in joints **degenerates and wears away**.

Cartilage Injuries

Common in athletes or after accidents.

Developmental Disorders

Sometimes cartilage does not form correctly during development.

Conclusion

Cartilage is an essential connective tissue that provides **support, flexibility, and protection** in the body.

It consists of **chondrocytes and extracellular matrix**, and it exists in three main types:

- Hyaline cartilage
- Elastic cartilage
- Fibrocartilage

Cartilage grows by **interstitial growth and appositional growth**, but its ability to repair is limited due to the lack of blood vessels.

Understanding cartilage structure and development is important in **histology, anatomy, and medical science**.