

Cartilage

VIVA VOCE

Q.1. What is cartilage?

- Cartilage is a specialized connective tissue that consists of two basic components: Cells (5%) and extracellular matrix (95%).

Q.2. Classify the cartilages.

- Based on composition and mechanical properties of matrix, cartilages are classified into three types:
 1. Hyaline cartilage
 2. Elastic cartilage
 3. Fibrocartilage.

Q.3. List the histological identification features of hyaline cartilage.

- Hyaline cartilage consists of matrix, cells, and covered by perichondrium.
- Matrix is basophilic and shows lacunae for chondrocytes.
- Matrix has intensely stained capsular (around each chondrocyte), less intensely stained territorial (around capsular matrix) and lightly stained interterritorial parts (surround territorial matrix).
- Chondrocytes lie in lacunae. They produce collagen and ground substance.
- Chondrocytes in developing stage divide to form group of cells that lie in form of cell clusters called isogenous group or cell nests.
- Perichondrium surrounds the cartilage and it has outer fibrous and inner cellular layers.

Q.4. Why is the hyaline cartilage called hyaline?

- Histologically, hyaline cartilage has glass-like (transparent) matrix and hyalos means glass in Greek. Hence, it is called hyaline cartilage.

Q.5. What are the locations of hyaline cartilage?

- Hyaline cartilage is present at the following locations: Fetal skeleton, articular cartilages, nose cartilage, costal cartilages, laryngeal cartilages (thyroid, cricoid and arytenoids cartilages), trachea and bronchi, and developing bones (epiphyses).

Q.6. How do chondrocytes receive nutrition?

- Cartilages are avascular. Chondrocytes receive their nutrition through diffusion.

Q.7. What is the composition of matrix of hyaline cartilage

- The hyaline cartilage matrix consists of 60–80% of intercellular water, 15% of collagen fibers, approximately 15% proteoglycans and glycoproteins, and 3–5% cells.

Q.8. Which type of collagen fibers are predominantly present in hyaline cartilage?

- Hyaline cartilage contains mainly type II collagen fibers (80%).

Q.9. Why does the hyaline cartilage have homogenous matrix?

- Collagen fibers cannot be seen in histological section because refractive indices of the collagen fibers and the ground substance are same. This gives a homogenous glassy-appearance to cartilage.

Q.10. Why does the matrix of hyaline cartilage I shows violet or blue on H&E staining?

- Ground substance has three types of proteoglycans, namely hyaluronan, chondroitin sulfate, and keratan sulfate. Acidic proteoglycans take hematoxylin (violet) color and hence, matrix of hyaline cartilage looks violet.

Q.11. What are three zones of matrix in hyaline cartilage?

- Based on this staining, matrix shows three zones as follows:
 1. Capsule/pericellular matrix—ring of densely staining matrix that surrounds the chondrocytes.
 2. Territorial matrix—surrounds capsular matrix. It stains less intensely than capsular matrix.
 3. Interterritorial matrix—surrounds territorial matrix. It stains lighter with hematoxylin (basic dyes) than territorial matrix.

Q.12. What are lacunae?

- Lacunae are spaces in matrix. They contain chondrocytes.

Q.13. What are cell nests or isogenous group?

- *Cell nests/isogenous group:* In developing cartilage, chondrocytes divide to form daughter cells. These newly formed cells lie in a group that is surrounded by territorial matrix. Such a group of daughter chondrocytes raised from a single mother chondrocyte is called isogenous group. These isogenous groups form a cell nest (group of cells).

Q.14. What is perichondrium?

- Free surface of hyaline cartilage is covered by irregular connective tissue (fibrovascular) layer called perichondrium.

Q.15. What are two layers of perichondrium?

- *Perichondrium has two layers:* Outer fibrous and inner cellular layer.
- Fibrous layer of perichondrium consists of dense irregular fibrous connective tissue whereas cellular layer has cells that divide and give rise to new chondrocytes.

Q.16. List the locations where perichondrium is absent in hyaline cartilages.

- Perichondrium is absent in articular cartilages and at the site of direct contact of cartilage with bone.

Q.17. List the functions of hyaline cartilages?

1. Hyaline cartilages maintain patency of trachea and the main bronchi because of its firmness.
2. Because of flexibility, costal cartilages provide support and protection to thoracic viscera.
3. Articular cartilages provide smooth surface for the movements.

Q.18. What is osteoarthritis?

- Osteoarthritis is one of the common joint diseases that occurs due to injury of articular cartilage. It mostly occurs by 65 years of age, specifically in weightbearing joints (hip joint, knee joint).

Q.19. Why elastic cartilage is called yellow cartilage?

- Freshly dissected elastic cartilage is yellowish in color due to presence of elastic fibers; hence, it is also called yellow elastic cartilage.

Q.20. List the locations of elastic cartilages?

- Elastic cartilage is present in pinna of external ear, walls of external acoustic meatus, auditory tube, epiglottis, tips of arytenoids, corniculate, and cuneiform cartilages of larynx.

Q.21. List the histological identification features of elastic cartilage.

- Elastic cartilage consists of matrix cells and covered by perichondrium.
- Matrix shows meshwork of branching anastomosing elastic fibers and ground substance that consists of proteoglycans.
- Large chondrocytes occupy lacunae in matrix. Chondrocytes lie singly or in group of two.
- Perichondrium surrounds cartilage and it has two layers: Outer fibrous and inner cellular.

Q.22. Name the special stains for elastic fibers.

- Elastic fibers cannot be differentiated with H&E staining. Elastic fibers are well demonstrated with orcein or resorcin-fuchsin staining.

Q.23. List the functions of elastic cartilages.

- Elastic cartilage provides elasticity, resilience, and firmness to the structure.

Q.24. List the histological identification features of fibrocartilage.

- Fibrocartilage consists of dense regular connective tissue (bundles of thick collagen fibers) with interspaced rows of chondrocytes. It does not have perichondrium.
- The chondrocytes lie singly or in rows within the lacunae in the matrix.

Q.25. Why is fibrocartilage called the white cartilage?

- Fibrocartilage contains bundles of thick collagen fibers that give white color to cartilage. Hence, this cartilage is also called white fibrocartilage.

Q.26. List the locations of fibrocartilages.

- Fibrocartilages are present at intervertebral discs, pubic symphysis, articular disc of sternoclavicular and temporomandibular joints, menisci, glenoidal labrum, acetabular labrum, and articular disc of wrist joint.

Q.27. Does the fibrocartilage show perichondrium?

- Fibrocartilage does not have periosteum.

Q.28. List the functions of fibrocartilage.

- Fibrocartilage helps in shock absorption. It helps to withstand compression and shearing forces.

Q.29. What is cellular cartilage?

- Cellular cartilage:* Cellular cartilage is seen during embryonic life. It consists of numerous cells and minimal matrix.

Q.30. What is achondroplasia/dwarfism?

- Achondroplasia is an autosomal dominant genetic disorder that is recognized by short legs and arms and normal torso. It is caused by mutation of fibroblast growth factor receptor 3 (FGFR3) gene.
- It has defective proteins that interfere with the conversion of cartilage to bone.

Q.31. List the differences between hyaline cartilage, elastic cartilage, and fibrocartilage.

- Refer Table 8.1.

**Multiple Choice Questions****Q.1. All of the following are true about cartilage EXCEPT:**

- A. Cartilage is a specialized connective tissue.
- B. Cells of cartilage are called chondrocytes.
- C. Cartilage is a vascular tissue.
- D. Cartilages are externally supported by a fibrocellular covering called perichondrium.

Q.2. Hyaline cartilage is present in all of the following structures EXCEPT:

- A. Fetal skeleton
- B. Costal cartilages
- C. Arytenoid cartilages
- D. Metaphysis

Q.3. All of the following are true about histology of hyaline cartilage EXCEPT:

- A. Matrix of hyaline cartilage has glassy appearance.
- B. Hyaline cartilage contains mainly type I collagen fibers (80%).
- C. Collagen fibers cannot be seen in histological section.
- D. Proteoglycans give firmness to cartilage.

Q.4. All of the following are true about perichondrium of hyaline cartilage EXCEPT:

- A. Free surface of hyaline cartilage is covered by perichondrium.
- B. Outer fibrous layer of perichondrium consists of dense irregular fibrous connective tissue.
- C. Inner cellular layer has cells that divide and give rise to new chondrocytes.
- D. Perichondrium is present in articular cartilages.

Q.5. All of the following are true about cartilage EXCEPT:

- A. Cartilage has limited capacity of regeneration.
- B. Hyaline cartilages may ossify with advancing age.
- C. Elastic cartilages do ossify.
- D. Cartilage shows limited and slow growth.

Q.6. All of the following are true about elastic cartilage EXCEPT:

- A. Elastic cartilage consists of matrix cells.
- B. Matrix shows meshwork of branching anastomosing elastic fibers.
- C. Chondrocytes lie in cell clusters.
- D. Perichondrium surrounds cartilage.

Q.7. Elastic cartilage is present in all of the following structures EXCEPT:

- A. Auditory tube
- B. Epiglottis
- C. External acoustic meatus
- D. Epiphysis

Q.8. All of the following about fibrocartilage are true EXCEPT:

- A. Fibrocartilage is combination of dense regular connective tissue and hyaline cartilage.
- B. It consists of type I and type II collagen fibers in varying proportions.
- C. Chondrocytes lie singly or in isogenous groups
- D. Fibrocartilage is surrounded by periosteum.

Q.9. All of the following are examples of fibrocartilage EXCEPT:

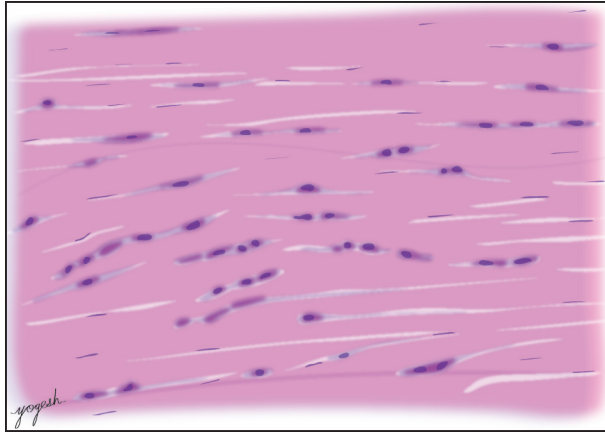
- A. Intervertebral discs
- B. Pubic symphysis
- C. Menisci of knee joint
- D. Epiphysis of bones

Table 8.1: Difference between hyaline, elastic, and fibrocartilages

Features	Hyaline cartilage	Elastic cartilage	Fibrocartilage
Cells	Chondroblasts and chondrocytes	Chondroblasts and chondrocytes	Few fibroblasts, few chondrocytes
Cell occurrence	Lies in groups (cell nests)	Lie single or in a group of two	Lie single or in a row
Fibers	Type II collagen fibers	Elastic fibers and few type II collagen fibers	Type I and type II collagen fibers
Perichondrium	Present	Present	Absent
Production of ground substance	By chondrocytes	By chondrocytes	By chondrocytes and by fibroblasts

Q.10. Which of the following is true about fibrocartilage?

- A. Chondrocytes are very few in number in fibrocartilage.
- B. Fibrocartilage contains bundles of thick collagen fibers that give white color to cartilage.
- C. Fibrocartilage is not covered by perichondrium.
- D. All of the above

Q.11. Identify the following structure.

- A. Hyaline cartilage
- B. Elastic cartilage
- C. Fibrocartilage
- D. Thyroid cartilage

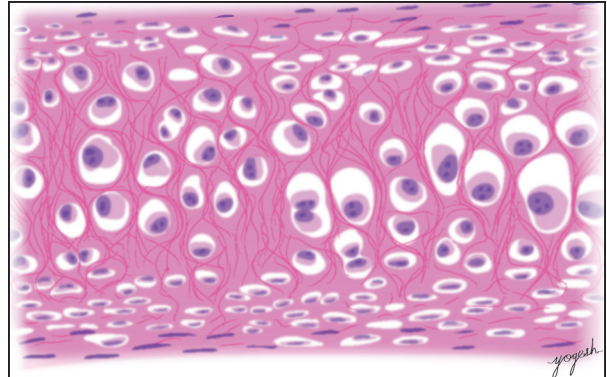
Q.12. Which of the following is true about elastic cartilage?

- A. Elastic cartilage consists of matrix cells and covered by perichondrium.
- B. Matrix shows meshwork of branching anastomosing elastic fibers.
- C. Large chondrocytes occupy lacunae in matrix.
- D. All of the above

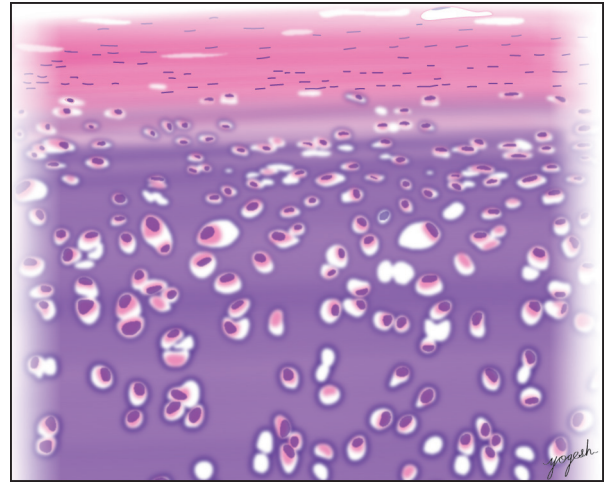
Q.13. Which of the following is true about hyaline cartilage?

- A. Matrix is basophilic and shows lacunae for chondrocytes.
- B. Matrix consists of type II collagen fibers.

- C. Chondrocytes in developing stage divide to form cell clusters called isogenous group or cell nests.
- D. All of the above

Q.14. Identify the following structure.

- A. Hyaline cartilage
- B. Elastic cartilage
- C. Fibrocartilage
- D. Thyroid cartilage

Q.15. Identify the following structure.

- A. Hyaline cartilage
- B. Elastic cartilage
- C. Fibrocartilage
- D. Thyroid cartilage

1. **C.** Cartilage is a vascular tissue (Ref: Page 74)
2. **D.** Metaphysis (Ref: Page 74)
3. **B.** Hyaline cartilage contains mainly type I collagen fibers (80%) (Ref: Page 75)
4. **D.** Perichondrium is present in articular cartilages (Ref: Page 74)
5. **C.** Elastic cartilages do ossify (Ref: Page 74)
6. **C.** Chondrocytes lie in cell clusters (Ref: Page 76)
7. **D.** Epiphysis (Ref: Page 74)
8. **D.** Fibrocartilage is surrounded by periosteum (Ref: Page 80)
9. **D.** Epiphysis of bones (Ref: Page 80)
10. **D.** All of the above (Ref: Page 80)
11. **C.** Fibrocartilage (Ref: Page 80)
12. **D.** All of the above (Ref: Page 78)
13. **D.** All of the above (Ref: Page 75)
14. **B.** Elastic cartilage (Ref: Page 79)
15. **A.** Hyaline cartilage (Ref: Page 77)

Reference: Textbook of Human Histology, 2/e, Yogesh Sontakke.

Chapter 8: [eSmartQuiz](#)

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