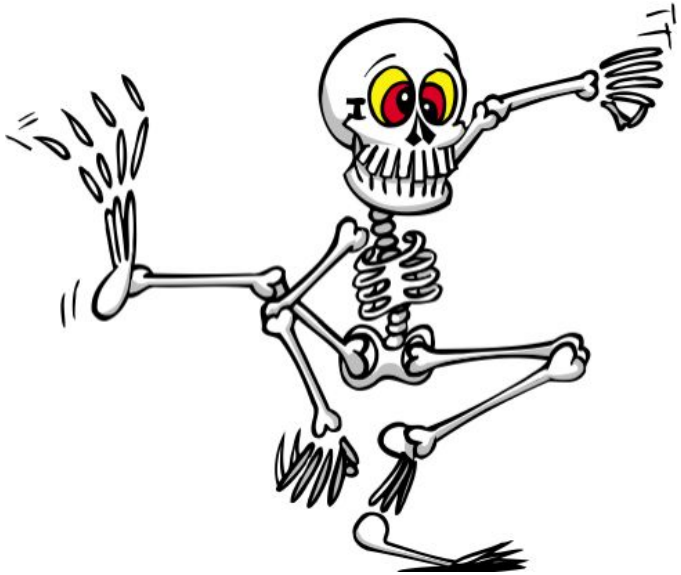
Cartilage & Bone

Histology Lecture 1 – Musculoskeletal Block

Objectives:

By the end of this lecture, the student should describe the microscopic structure, distribution and growth of the different types of:

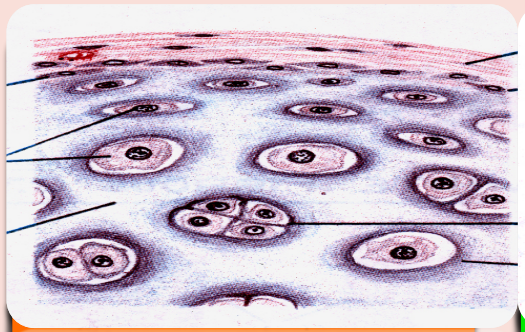
(1) Cartilage.
(2) Bone.



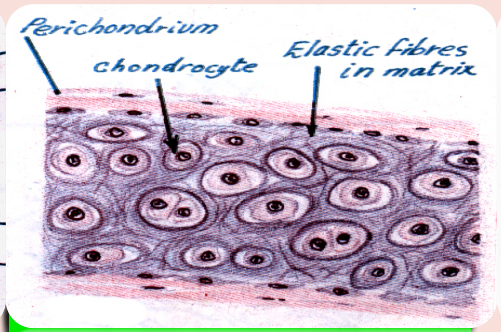
Cartilage

- It is a specialized type of Connective Tissue with rigid matrix. Differs than other types of CT that it is Avascular "no blood vessels"

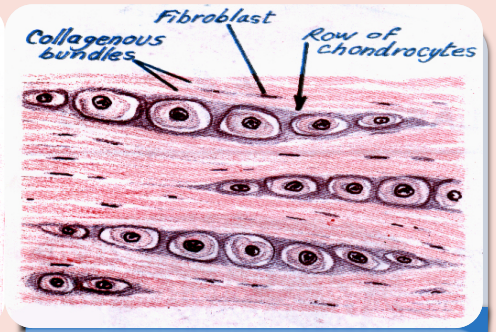
Types of Cartilage



Hyaline Cartilage



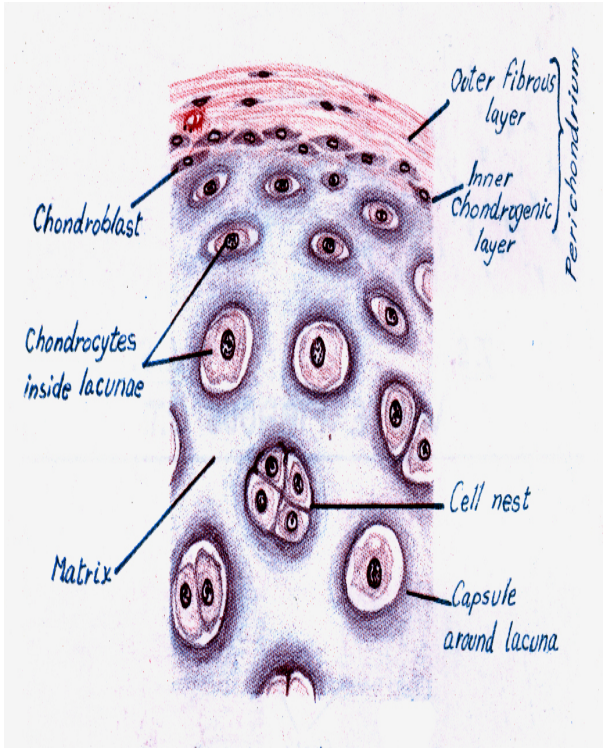
Elastic Cartilage



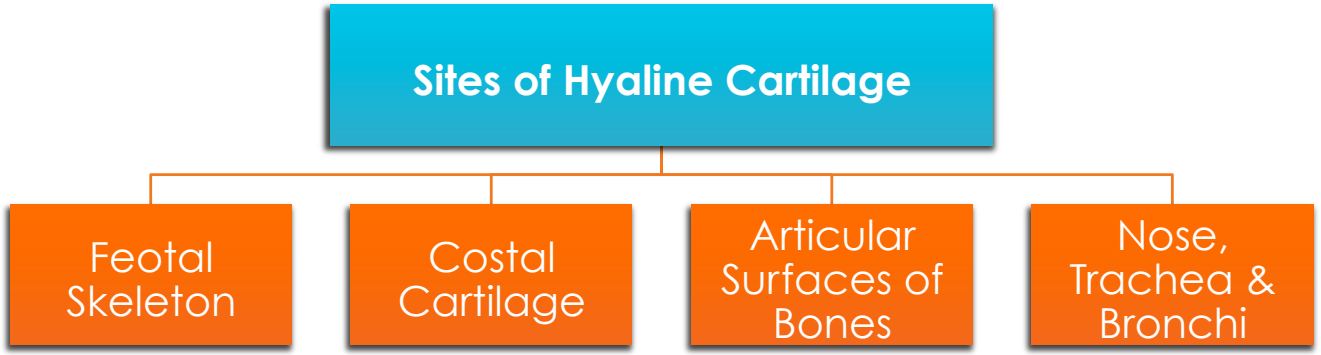
Fibrocartilage

Hyaline Cartilage

Component	Description	
1- Perichondrium Vascular C.T. compsosed of 2 layers	Outer Fibrous layer	Dense Fibrous C.T.
	Inner Chondrogenic layer	Contains Chondroblasts "no lacunae" they secrete cartilage Extracellular Matrix and rise to Chondrocyte
2- Cells "Chondrocytes" Found in cell space called **Lacunae**	Young Chondrocytes	Small & present singly in their lacunae.
	Mature Chondrocytes	Large, and are found singly or in groups of 2, 4 or 6 cells in their lacunae (cell nests)
3- Matrix	Homogeneous and basophilic, contains collagen type II	



Hyaline Cartilage



Types of Collagen
This table is not required but better to go through

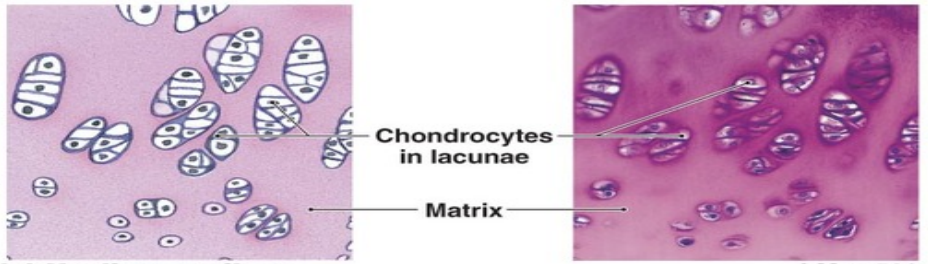
Collagen Type	Principle Tissue Distribution	Cells of Origin
I	Loose and dense ordinary connective tissue; collagen fibers	Fibroblasts and reticular cells; smooth muscle cells
	Fibrocartilage	
	Bone	Osteoblast
	Dentin	Odontoblasts
II	Hyaline and elastic cartilage	Chondrocytes
	Vitreous body of the eye	Retinal cells
III	Loose connective tissue; reticular fibers	Fibroblasts and reticular cells
	Papillary layer of dermis	
	Blood vessels	Smooth muscle cells; endothelial cells
IV	Basement membranes	Epithelial and endothelial cells

Comparison

HYALINE CARTILAGE

LOCATIONS: Between tips of ribs and bones of sternum; covering bone surfaces at synovial joints; supporting larynx (voice box), trachea, and bronchi; forming part of nasal septum

FUNCTIONS: Provides stiff but somewhat flexible support; reduces friction between bony surfaces



ELASTIC CARTILAGE

LOCATIONS: Auricle of external ear; epiglottis; auditory tube; cuneiform cartilages of larynx

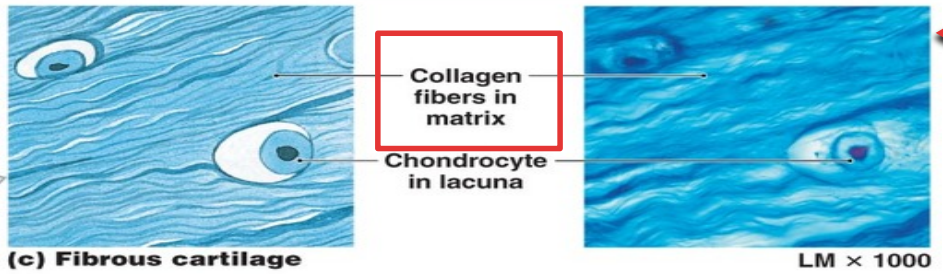
FUNCTIONS: Provides support, but tolerates distortion without damage and returns to original shape

Similar to Hyaline Cartilage In addition to **Elastic Fibers**

FIBROUS CARTILAGE

LOCATIONS: Pads within knee joint; between pubic bones of pelvis; intervertebral discs

FUNCTIONS: Resists compression; prevents bone-to-bone contact; limits relative movement



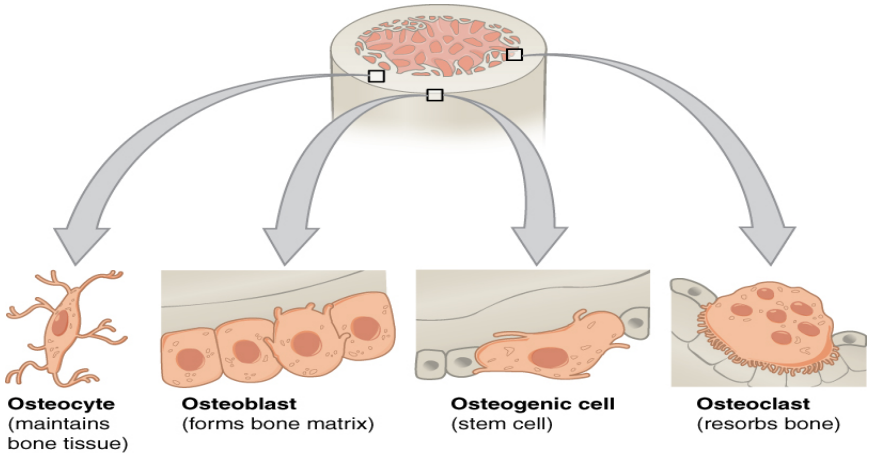
Has **no Perichondrium**, Composed of rows of chondrocytes in lacunae separated by parallel bundles of **collagen fibers (type I)**

Red boxes are **IMPORTANT**, other informations are **ADDITONAL**

Bone

- It is a specialized type of Connective Tissue with **hard "Calcified"** matrix.
- **Types of Bones**: 1- Compact Bone. 2- Spong "Cancellous" Bone.
- **Functions:** Body support, Calcium store and protection for vital organs as brain & Marrow.
- **Components**

1- Cells



2- Matrix : hard because it is calcified (Calcium salt).

Contains **type I collagen** fibers, It forms bone **lamellae and trabeculae**

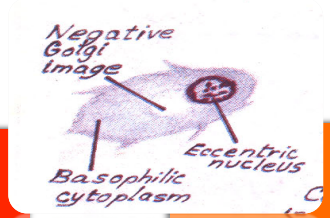
3- Periosteum

4- Endosteum

Bone Cells

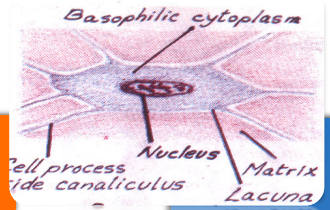
Osteogenic Cell

- in periosteum & endosteum.
- **Fate:** give rise to **osteoblasts**



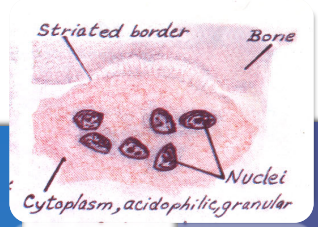
Osteoblast

- in periosteum & endosteum.
- **Origin:** osteogenic cells.
- **Function:** They secrete the bone matrix & deposit Ca salts in it.
- **Fate:** change to **osteocytes**



Osteocyte

- Branched cells. Present singly in lacunae. Their branches run in the Canaliculi.
- **Origin:** osteoblasts.
- **Function:** They maintain the bone matrix.

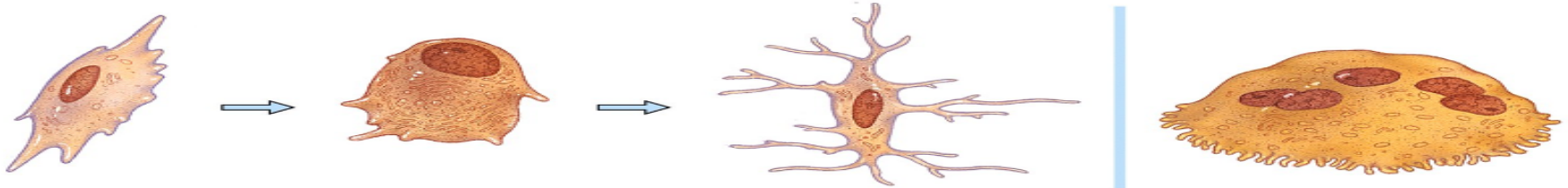


Osteoclast

- Large multinucleated cells on bony surfaces, in Howship's lacunae. They have striated or ruffled border. Cytoplasm is rich in lysosomes.

Origin: blood monocytes.

Function: bone resorption



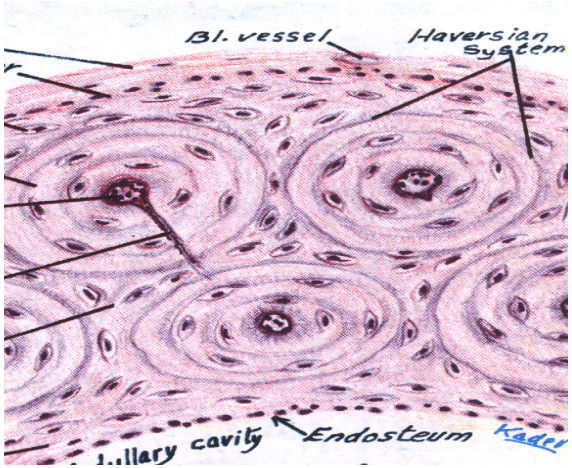
Osteogenic cell (develops into an osteoblast) → Osteoblast (forms bone matrix) → Osteocyte (maintains bone tissue)

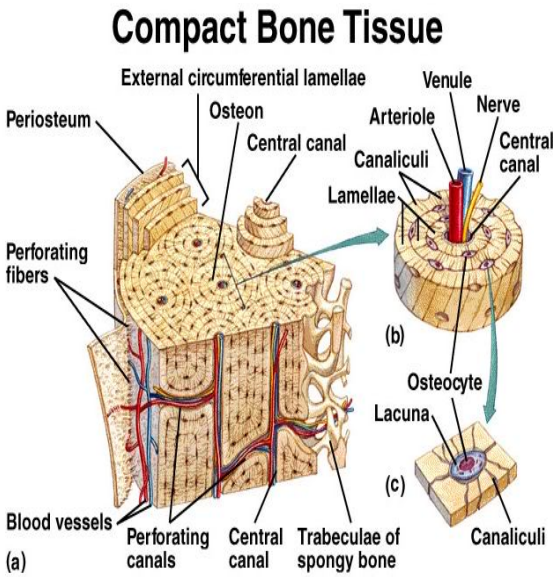
Osteoclast (functions in resorption, the breakdown of bone matrix)

Compact Bone

- **Distribution:** Diaphysis of Long Bones.
- **Components**

1- Periosteum	Outer Fibrous Layer
	Inner Osteogenic Layer
2- Endosteum	
3- Bone Cells	
4- Bone Lamellae	**Havarsian System "Osteon"**: Longitudinal cylinders, each formed of bone lamellae + Havarsian canal running in the center **<u>Volkmann's canals:</u>** connect the Haversian canals together. They run obliquely or transversely.
	External Circumferential Lamellae
	Internal Circumferential Lamellae
	Interstitial Lamellae



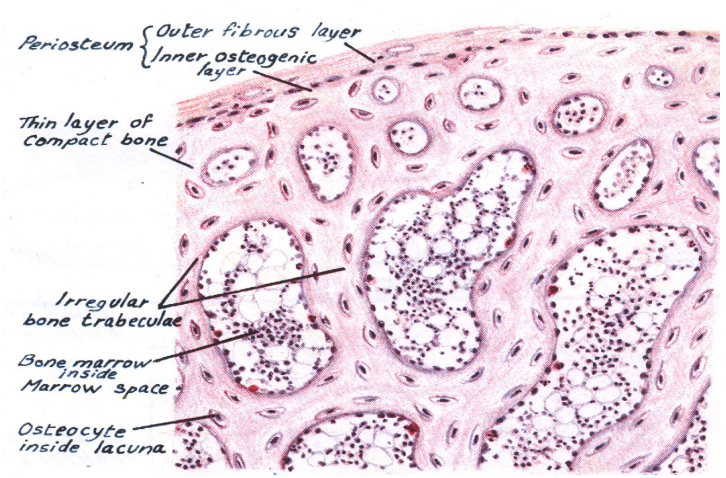


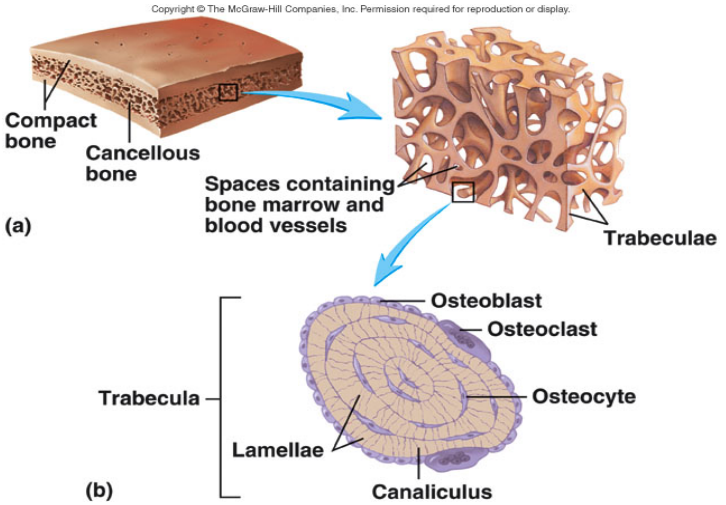
Spongy Bone

- **Distribution:** In flat bones & epiphysis of of long bones.
- **Components:**

1- Periosteum
2- Endosteum
3- Irregular Bone Marrow Trabeculae
4- Irregular Bone Marrow Spaces
5- Bone Cells

- **NO Havarsian System "Osteon"**





Growth

Growth of Cartilage

- **Appositional Growth**

It's the growth in width, caused by the activity of **Chondroblast** in the inner chondrogenic layer

- **Interstitial Growth**

It's the increase in length, caused by the activity of Mature **Chondrocytes**

Growth of Bone

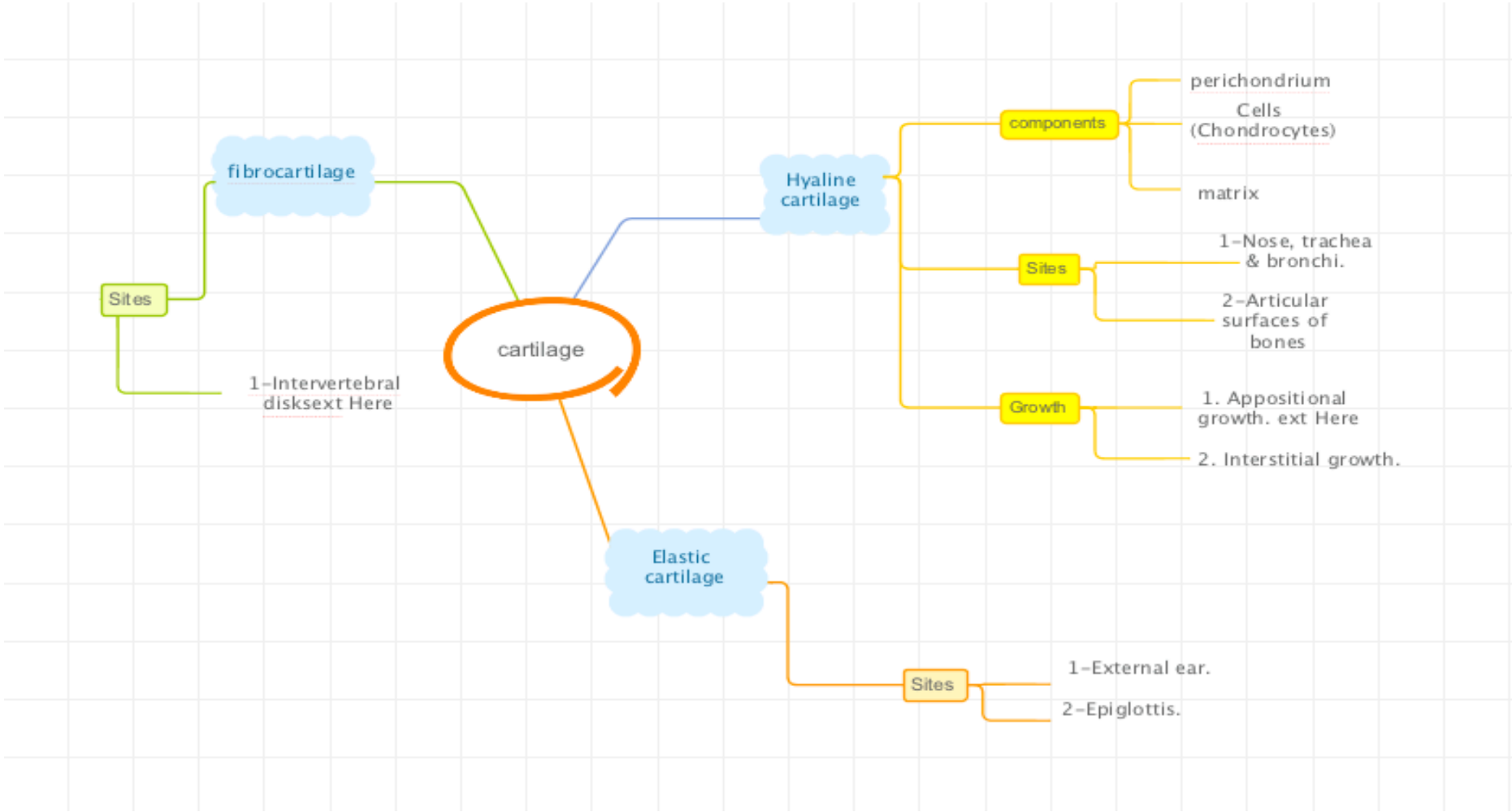
- **Appositional Growth**

It's the growth in width, caused by the activity of **Osteoblast**

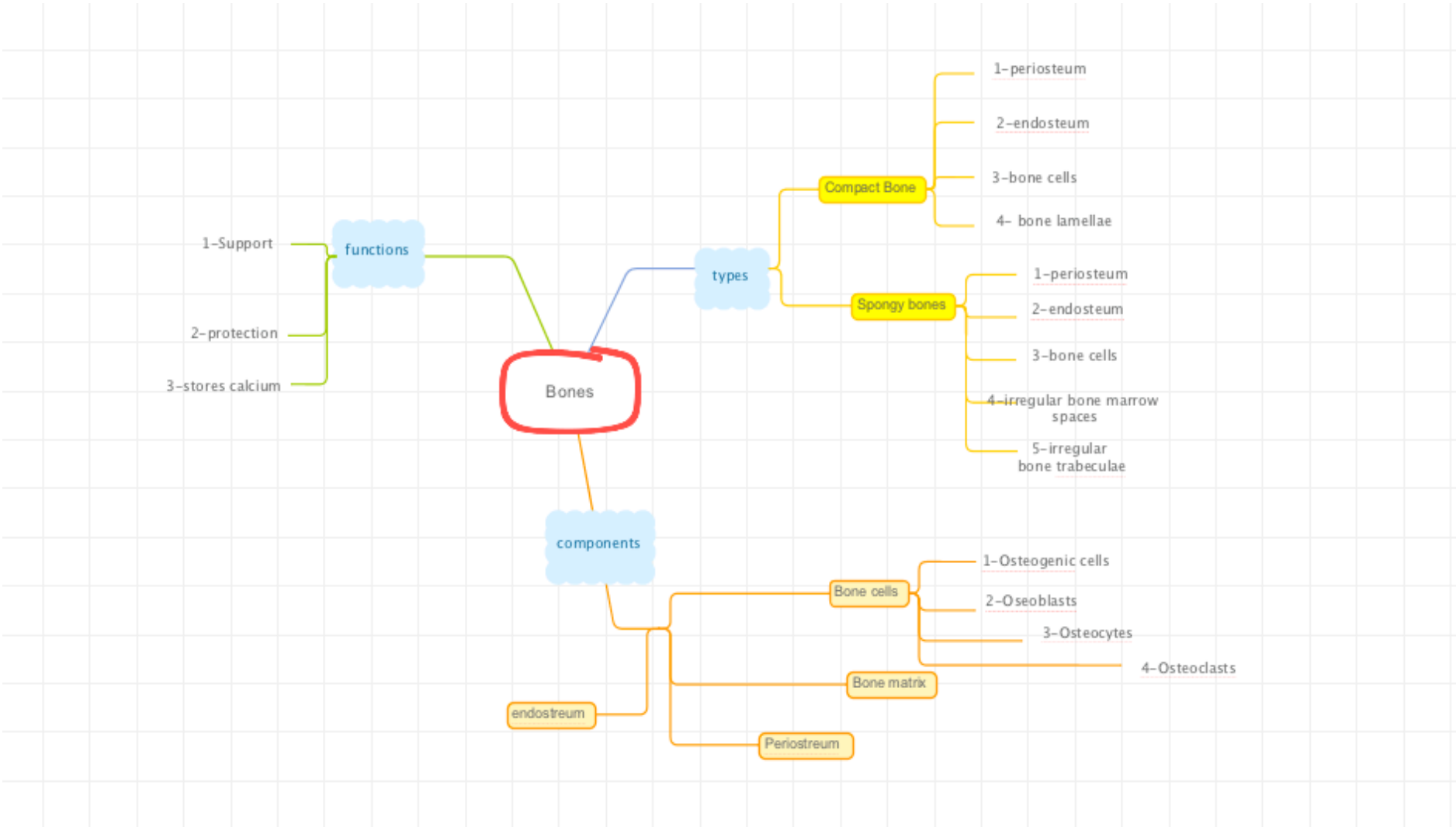
- **Intersitial Growth**

It's produced by the activity of **epiphyseal plate of cartilage**

Mind Map
Cartilage



Mind Map
Bone



MCQ's

Q1) which one of the following is NOT a site of hyaline cartilage:

A-Nose, trachea & bronchi.

B-Foetal skeleton.

C-Intervertebral disks.

D-Articular surfaces of bones.

Q2) which one of the following cells activity produce Appositional growth of bones:

A-Osteoclasts.

B-osteoblasts.

C-Osteocytes.

D-Oestrogenic Cells.

Q3) which one of the following is a site of elastic cartilage:

A-Nose, trachea & bronchi.

B- Intervertebral disks.

C-Costal cartilages.

D-Epiglottis.

Q4) one of the major differences between compact bones and Cancellous (spongy) is :

A- Periosteum.

B- Endosteum.

C- Haversian systems.

D-bone cells.

Q5) which one of the 3 cartilage types has NO Perichondrium

A- Fibrocartilage

B- Elastic cartilage

C- Hyaline cartilage

Q6) Longitudinal growth of bone is caused by the activity of Epiphyseal Plate of cartilage :

A-True. B-False.

Q7) which one of the following is the function of Osteoclasts:

A- Bone formation

B- Maintaining bone matrix.

C- calcium storage

D- Bone resorption

1- C
2- B
3- D
4- C
5- A
6- A
7- D

Motivation Corner

Some people want it to happen, some wish it would happen, others **make** it happen.
- Michael Jordan

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Thank you for checking our work

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