CLASSIFICATION OF CONNECTIVE TISSUE AND DESCRIPTION OF EACH TYPE

LEARNING OBJECTIVES

At the end of the lecture student should be able to:

1. Classify the different types of connective tissue.
2. Identify the different types of connective tissue under the microscope.
3. State the distribution of each type.

CLASSIFICATION OF CT

2 MAIN GROUPS.

A. Embryonal connective tissue.

B. Adult connective tissue.

A. EMBRYONIC CONNECTIVE TISSUE:

1. Mesenchymal tissue.
2. Mucous (Mucoid) tissue.

CLASSIFICATION OF CT (CONT)

B). **ADULT CONNECTIVE TISSUE:**

1. CONNECTIVE TISSUE PROPER.
2. CARTILAGE
3. BONE.

CLASSIFICATION OF CT (CONT)

1. CONNECTIVE TISSUE PROPER.

A. LOOSE:

a) RETICULAR
b) AREOLAR
c) ADIPOSE

B. DENSE:

a) REGULARLY ARRANGED
b) IRREGULARLY ARRANGED

CLASSIFICATION OF CT (CONT)

2. CARTILAGE:

a) HYALINE CARTILAGE
b) FIBROCARTILAGE.
c) ELASTIC CARTILAGE.

3. BONE.

EMBRYONIC CONNECTIVE TISSUE

MESENCHYMAL TISSUE

- Immature connective tissue of embryo derived from mesoderm is known as mesenchyme.
- It is composed of mesenchymal cells, lie in a viscous homogeneous ground substance.
- Each mesenchymal cell is characterized by an oval nucleus with prominent nucleoli & fine chromatin, and relatively little cytoplasm.
- Each cell is roughly star-shaped with multiple thin processes.

EMBRYONIC CONNECTIVE TISSUE

MUCOUS (MUCOID) TISSUE

- It is an advance stage of mesenchymal tissue.
- Some mesenchymal cells are differentiate into fibroblasts, which in turn synthesized collagen fibers. Thus the intercellular substance becomes more viscous.
- Now it is a jelly like tissue, containing mainly fibroblasts, collagen fibers and abundance amorphous ground substance, composed mainly of hyaluronic acid.
- It is widely distributed in the body of the fetus.
- It is a principal component of the umbilical cord, where it is known as “Wharton’s jelly.”

ADULT CONNECTIVE TISSUE

1. C.T. PROPER

(a) LOOSE CT

(i) Areolar

(ii) Reticular

(iii) Adipose

(b) DENSE CT

(i) Regularly arranged

(ii) Irregularly arranged

2. SUPPORTIVE CONNECTIVE TISSUE

(a) CARTILAGE

(i) Hyaline

(ii) Elastic

(iii) Fibrocartilage

(b) BONE

(i) Compact

(ii) Spongy

C.T. PROPER

According to the arrangement of its fibers --- 2 main types:

A. Loose

B. Dense

LOOSE C.T. (Sub-classified into:)

1. **Loose areolar C.T.**
2. **Reticular C.T.**
3. **Adipose C.T**

LOOSE AREOLAR C.T.

- Widely distributed
- Packing & anchoring material of body and acts as embedding medium for many structures including blood vessels & nerves.
- Binds tissues & organs together but also allow a considerable degree of mobility.
- Forms supporting framework (stroma) of most organs.
- Structurally all 3 basic components of C.T. are best represented in this type.

EXAMPLES:

1.Subcutaneous tissues (superficial and deep fascia).
2. Mesentery
3. Omentum.

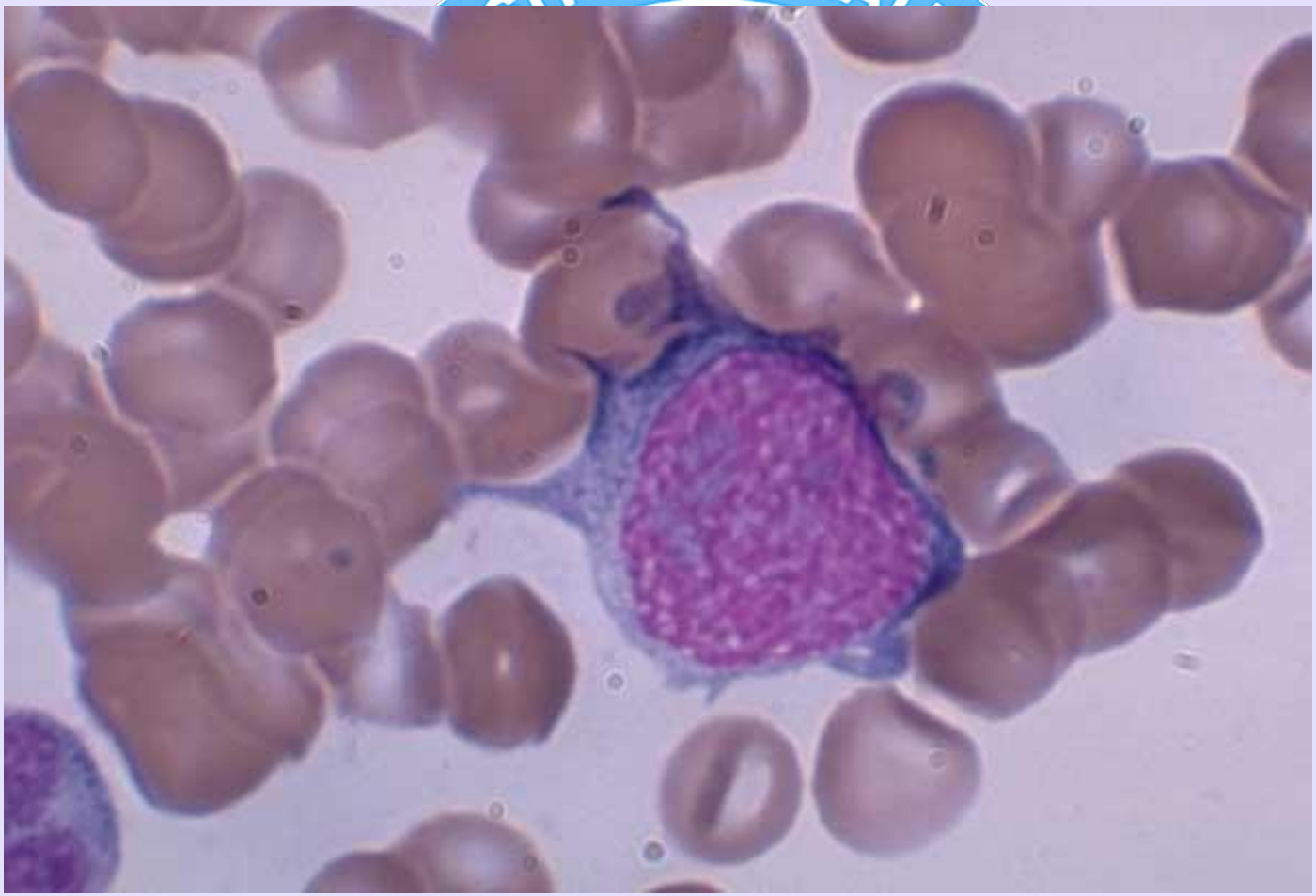
RETICULAR C.T.

It consists of reticular cells & reticular fibers.

RETICULAR CELL: It is simply a fibroblast, which only synthesizing the reticular fibers.
They have stellate shape and possess long process, which pass in different directions to make contact with those of the neighboring cells. These processes are wrapped around with the reticular fibers.

EXAMPLES: It forms supporting framework of liver, spleen, bone marrow & lymphoid organs.

Reticular Cell.



ADIPOSE C.T.

- It consists entirely of fat cells, organized into lobules, which are separated from each other by fibrous septa.
- Within a lobule, individual fat cell is supported by a meshwork of delicate reticular fibers, containing abundant blood capillaries.
- According to the colour, location & morphology of the component cells, adipose tissue is subdivided into 2 varieties:

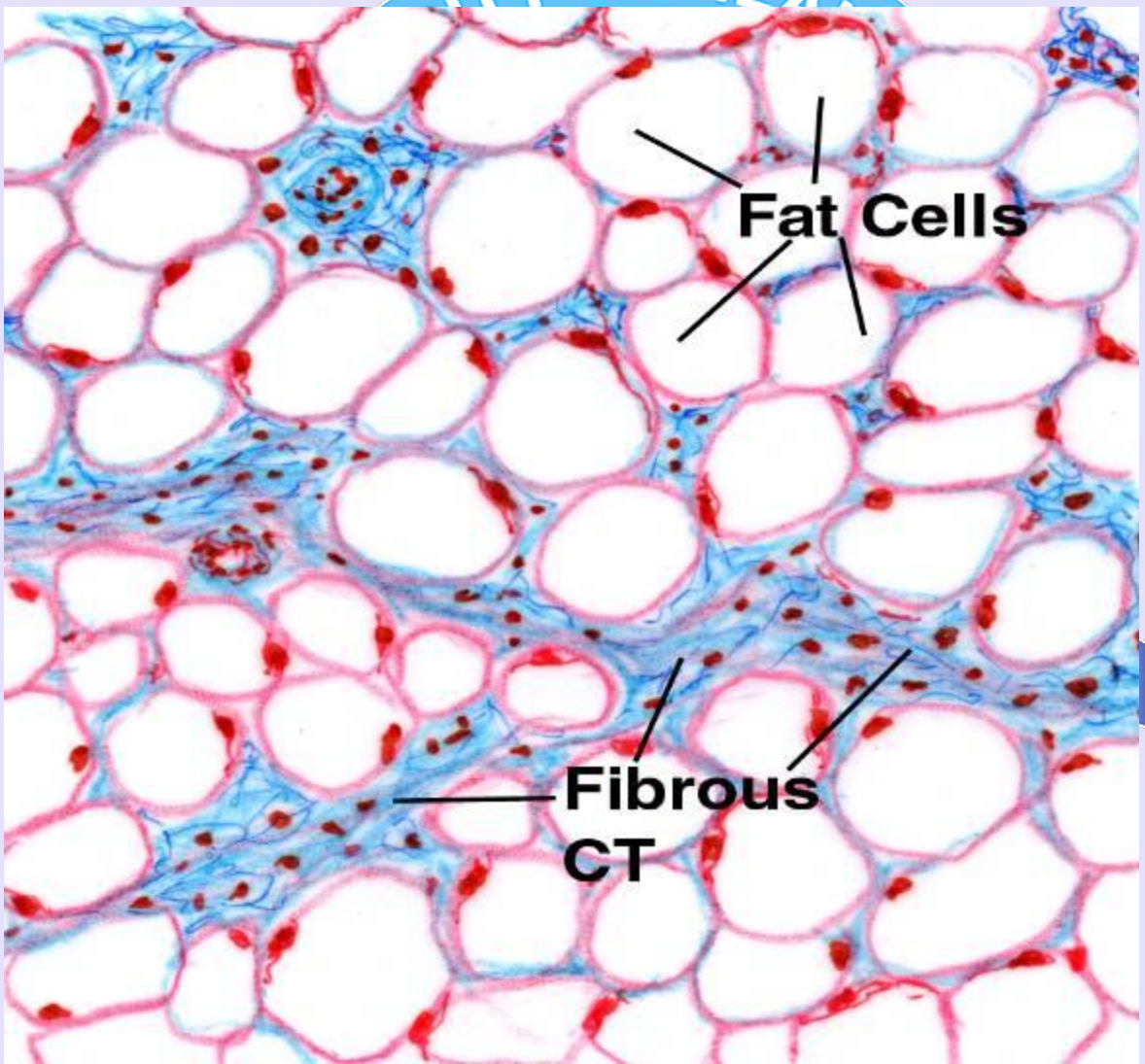
1. **WHITE ADIPOSE TISSUE**: (unilocular adipose tissue). widely distributed and most of the adipose tissue of the adult man.
2. **BROWN ADIPOSE TISSUE**: (multilocular adipose tissue). In human being, it is relatively common in fetus & child, but in adult it is absent or restricted in distribution.

ADIPOSE C.T.

WHITE ADIPOSE TISSUE (unilocular adipose tissue).

- Widely distributed and most of the adipose tissue of the adult man.
- On naked eye examination, it appears whitish or yellow in colour.
- Under L/M :- a single large fat droplet (without membrane) in each cell, displaced the nucleus (surrounded by a small quantity of cytoplasm) to the peripheral region. In ordinary histological preparation, the fat cell gives a characteristic "signet ring appearance".
- Under E/M :- a fat cell contains a small Golgi apparatus, few mitochondria, small amount of smooth endoplasmic reticulum and some free ribosomes.

WHITE ADIPOSE TISSUE (unilocular adipose tissue)



ADIPOSE C.T.

BROWN ADIPOSE TISSUE

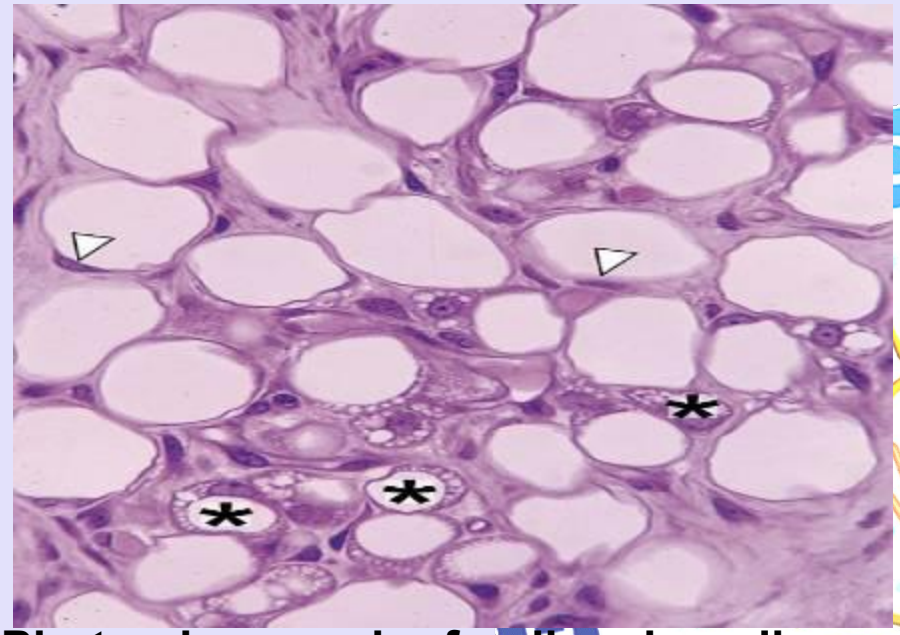
(multilocular adipose tissue)

- In human being, it is relatively common in fetus & child, but in adult it is absent or restricted in distribution.
- On naked eye examination, it appears brown in colour.
- **Under L/M** :- In each cell, the fat is present in many small droplets (hence the name multilocular).
- **Under E/M** :- Brownish appearance is due to 2 reasons:

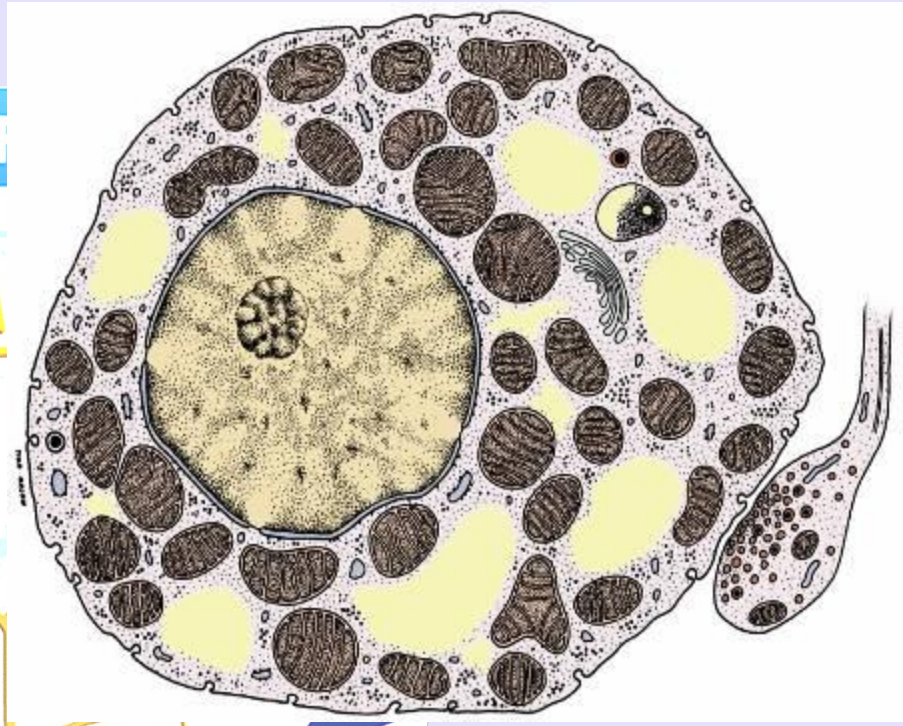
1. Very rich capillary blood supply.
2. Cells contain numerous mitochondria with rich cytochrome enzymes.

- Its only function in man to production of heat in first few months of postnatal life, to protect the new born against cold.

FAT CELLS (Adipocytes)



Photomicrograph of <u>unilocular adipose tissue</u> of a young mammal. Arrows show nuclei of adipocytes (fat cells) compressed against the cell membrane. Note that, although most cells are unilocular, there are several cells (asterisks) with small lipid droplets in their cytoplasm, <u>an indication that their differentiation is not yet complete</u>.



<u>Multilocular adipose tissue</u>. Note the central nucleus, multiple fat droplets, and abundant mitochondria. A sympathetic nerve ending is shown at the lower right.

DENSE C. T.

- It is characterized by closely packed of its fibers.
- As compare to loose C.T., it contains fewer fibers and lesser amount of ground substance.
- It is less flexible but more resistant to stress.
- It is divided into 2 categories, according to the arrangement of its component fibers.

1. **REGULARLY ARRANGED** : Fibers are arranged parallel to each other.
   EXAMPLES: Tendons, Aponeurosis & Ligaments.

2. **IRREGULARLY ARRANGED** : Fibers interlace to form a dense network.
   EXAMPLES: Dermis, Fibrous capsule of organs (Liver, Testis & Lymph nodes) and Fibrous perichondrium & Fibrous periosteum.

SUPPORTIVE CONNECTIVE TISSUE (CARTILAGE & BONE)

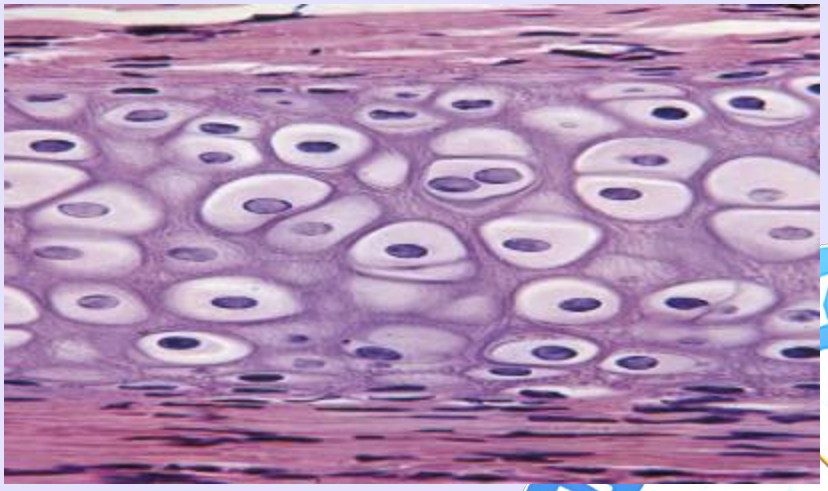
- They are special type of CT, characterized by rigid nature of their intercellular substance.
- In CARTILAGE, the ground substance is composed chiefly of proteoglycan, which is rich in Chondroitin sulfate.
- In BONE, ground substance is impregnated with certain inorganic salts, principally calcium phosphate

CARTILAGE

- consists of cells (chondrocytes) and an extensive extracellular matrix, composed of fibers & ground substance.
- Chondrocytes synthesize and secrete extracellular matrix, and the cells themselves are located in matrix cavities called "lacunae".
- Extracellular matrix is enriched with fibers and proteoglycan & glycosaminoglycan.
- Variation in the composition of matrix components produce 3 types of cartilage.

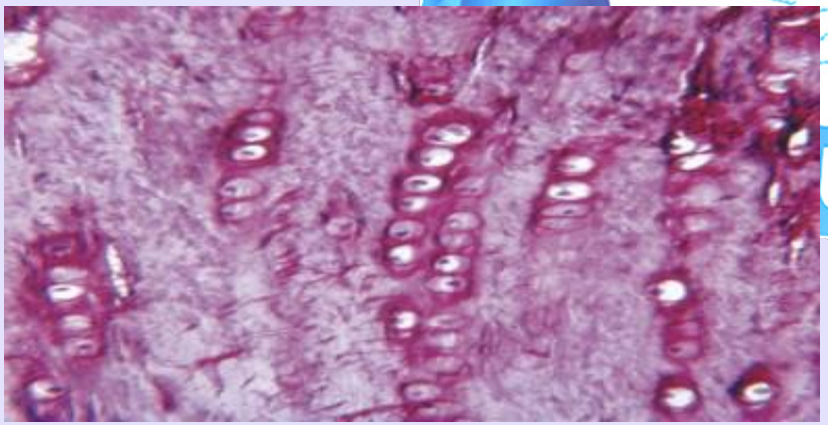
1. Hyaline cartilage.
2. Elastic cartilage.
3. Fibro cartilage.

CARTILAGES



Hyaline cartilage

Elastic cartilage



Fibrocartilage

BONE (Osseous Tissue)

- Like cartilage, it is characterized by rigid nature of intercellular matrix, but differ from cartilage in that, its matrix is impregnated with inorganic mineral salts, mainly calcium-phosphate.
- It is the toughest & hardest tissue of the body, second to Enamel of tooth.

 BONE CELLS :- 3 types:

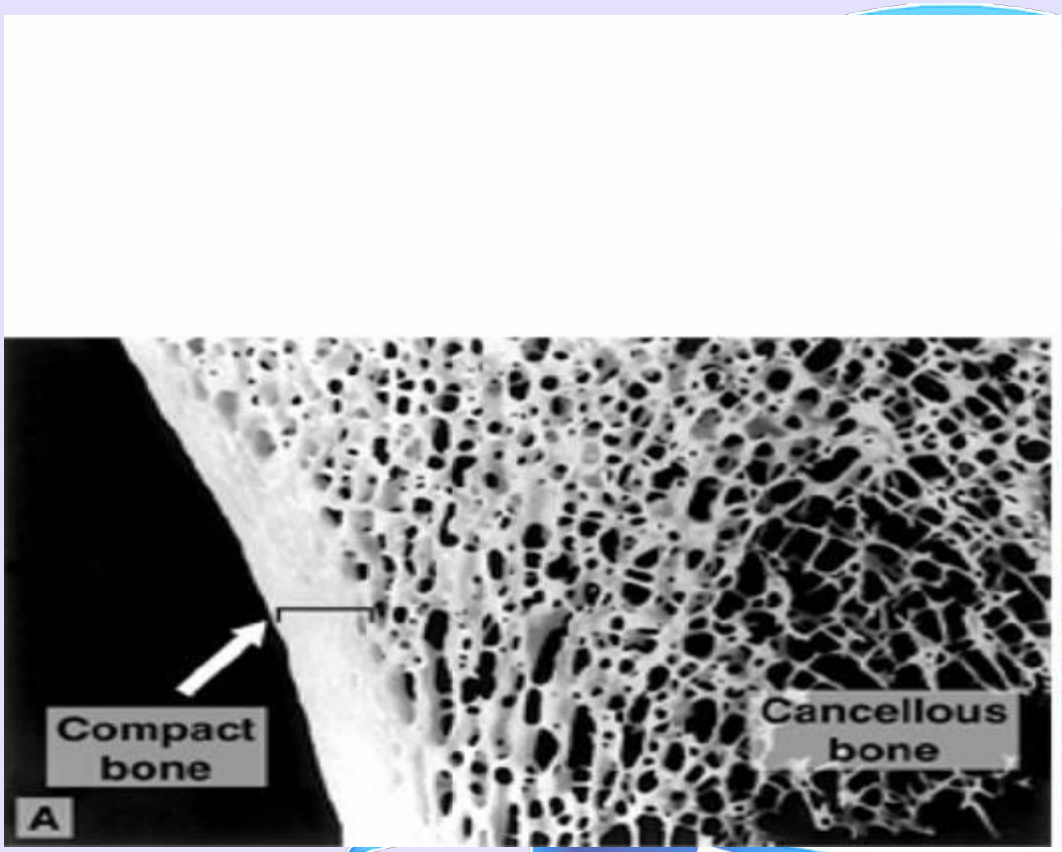
1.Osteoblasts. 2. Osteocytes. 3.Osteoclasts

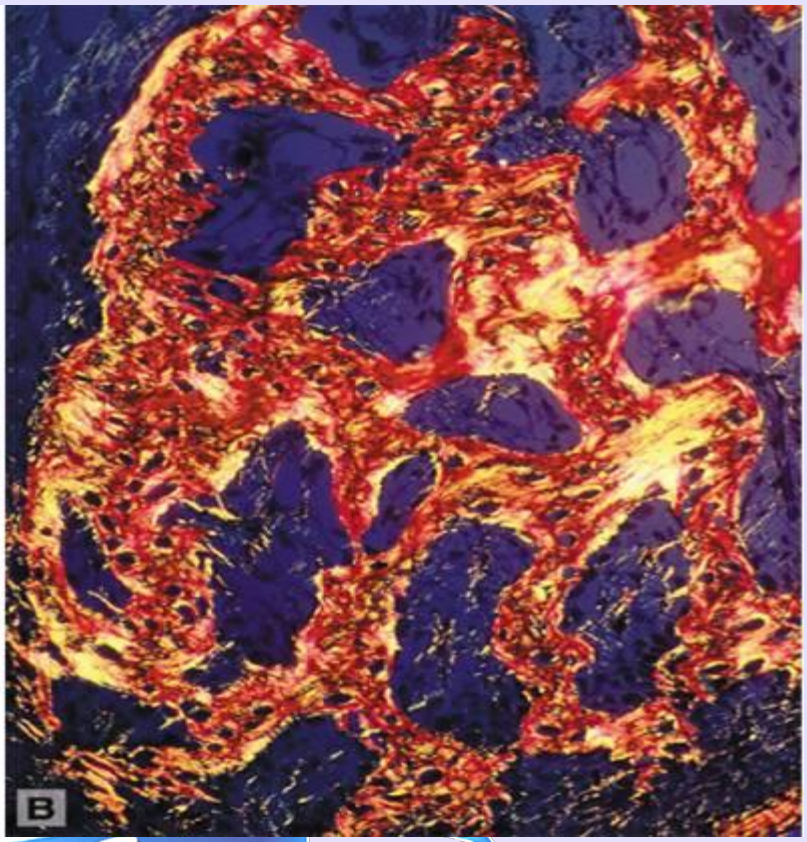
Under microscope, it is sub-divided into 2 types

 COMPACT:- Appear as dense areas without cavities.

 SPONGY:- In which bone substance is in the form of trabeculae, separated from each other by numerous inter-connecting cavities.

COMPACT AND SPONGY BONES





A: Thick section of bone illustrating the cortical compact bone and the lattice of trabeculae of cancellous bone.

B: Section of cancellous (spongy) bone with its characteristic random disposition of collagen fibers.

REFERENCES

Basic Histology by **JUNQUEIRA**

page no 121 -127