

Free cells

1. Mast Cells

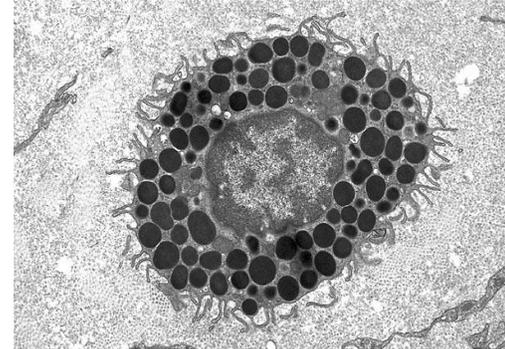
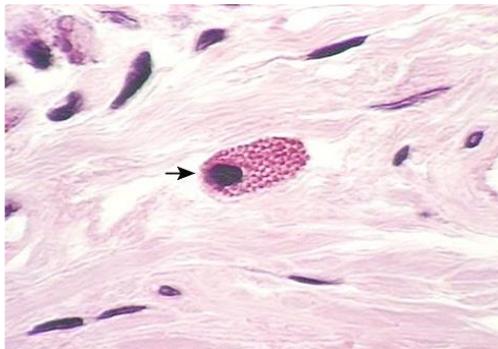
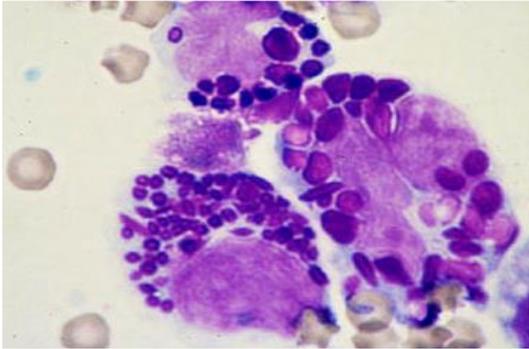
Origin: from haemopoetic stem cell in B. M

Two types:

- Connective tissue mast cells** are found in skin (dermis) and peritoneal cavity
- mucosal mast cells** are in the mucosa of the digestive and respiratory tracts.
- Contain basophilic granules
 - (**Metachromatic** staining)
 - when stained with **toluidine blue**, the granules bind the dye and change its color to **red**.

Histological features:

- By LM, mast cell is a large CT cell. Its cytoplasm is full of basophilic granules that may obscure the nucleus. Its nucleus is rounded and central in position.
- A distinctive staining feature of mast cells is "**metachromasia**" which means that certain basic stains give to their granules a color other than that of the dye itself e.g. toluidine blue stain gives a purple color instead of blue, due to the chemical composition of the secretory granules.
- By EM, their cytoplasm contains numerous secretory granules.



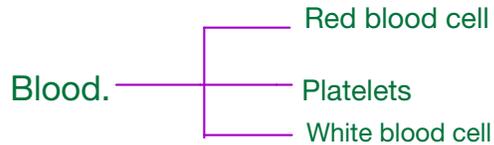
Function:

- they initiate allergic and local inflammatory responses by release (degranulation) of their granules which contain; the anticoagulant **heparin** and **histamine** which promotes increased vascular permeability and smooth muscles contraction.

2. Macrophages: they are derived from the monocytes that migrate from bloodstream into CT.

Microphages in brain

3. White blood cells (leukocytes): they include neutrophils, eosinophils, basophils, monocytes and lymphocytes.



Macrophages= Histiocytes

Origin : From **blood monocytes** (Type of WBC)

- **Macrophages:** they are derived from the monocytes that migrate from bloodstream into CT.

Histological features:

large, irregular cells with eccentric kidney-shaped nucleus.

The cytoplasm shows numerous lysosomes.

Three types:

No stimulate (EX. No infection & injury)

- **Resident** :resting
- **Elicited**: moving to a stimulus
- **Activated**: active in phagocytosis:

Infection =immigrated to site that degenerated

- -pseudopodea (Larg in size & numerous of lysosomes)

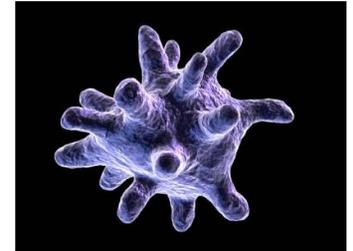
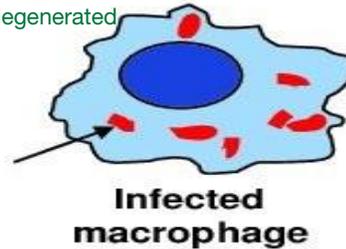
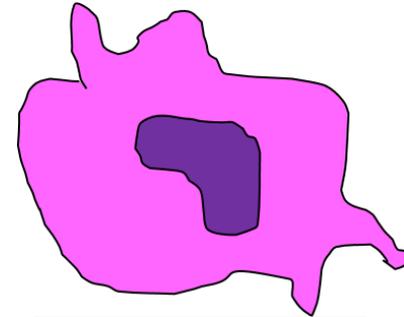
- Kidney shaped eccentric nucleus- (Like a shape of monocytes)

- large number of **lysosomes**

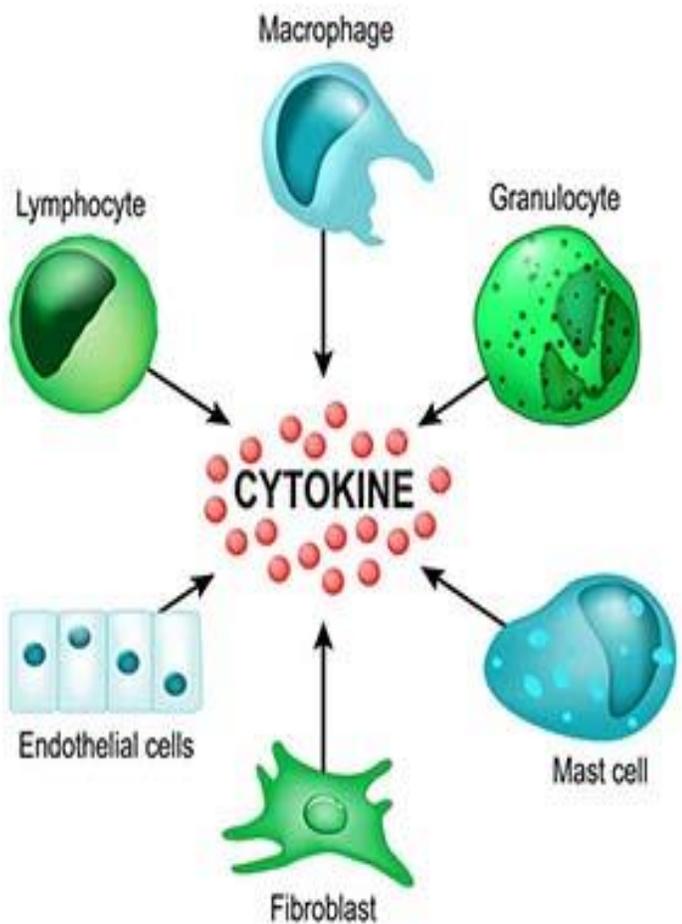
Function : Phagocytosis

They are phagocytic cells; macrophages engulf a broad variety of foreign materials including bacteria, dead cells and dust particles.

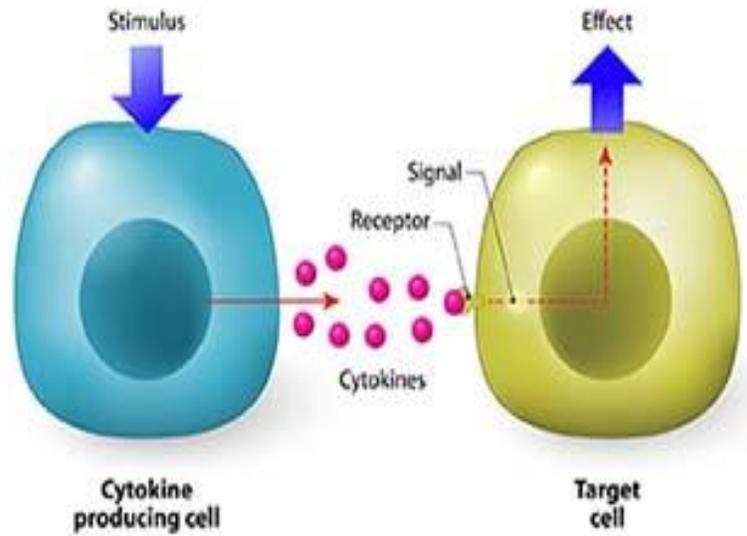
*protein secreting cells. —> Organelles is ribosome + RER (rough)



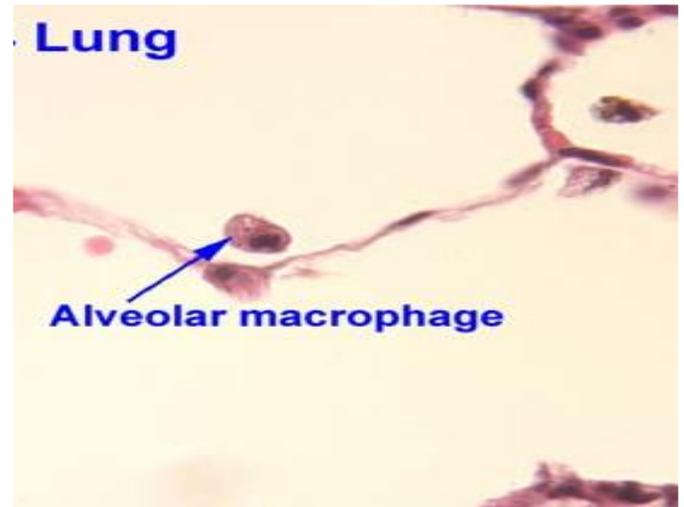
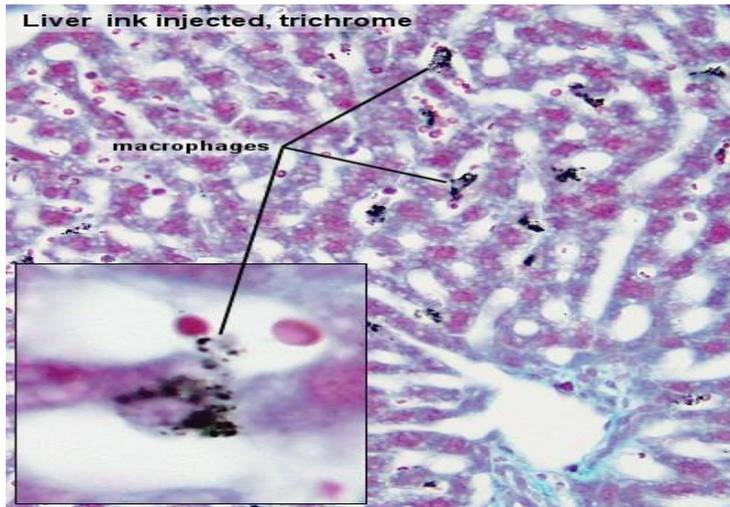
*fat secreting cell. —> Organelles is ER
*phagocytic cell. —> Organelles is lysosomes



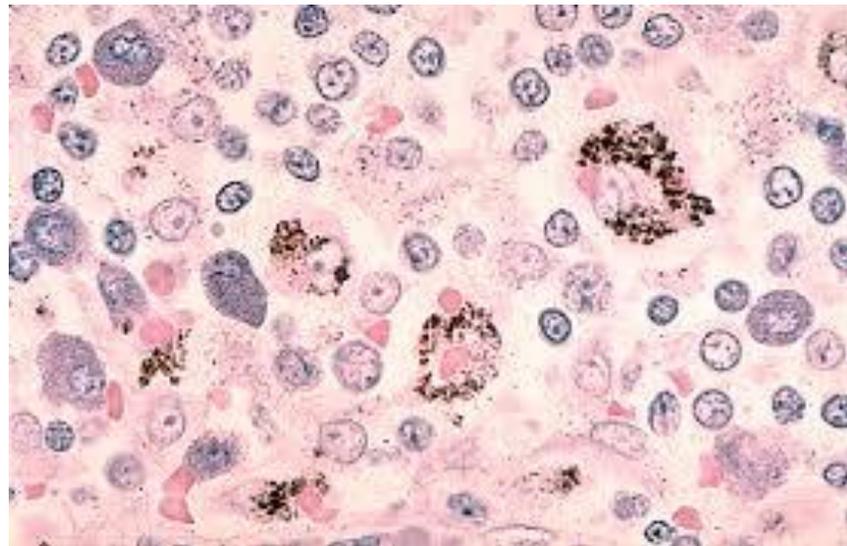
Cytokines



Types of White blood cells
(All of them have immune function+producing cytokines)



Kupffer cell in liver



Plasma Cells

Origin : they are derived from B lymphocytes that enter the CT.

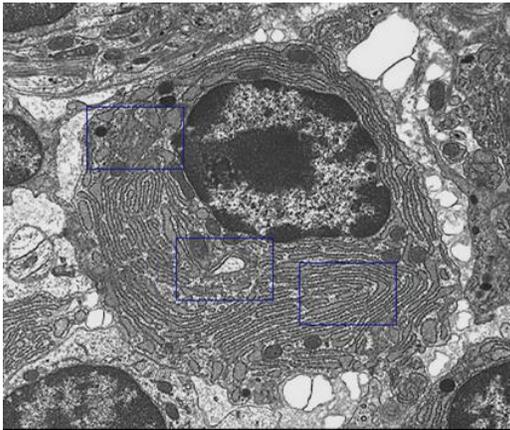
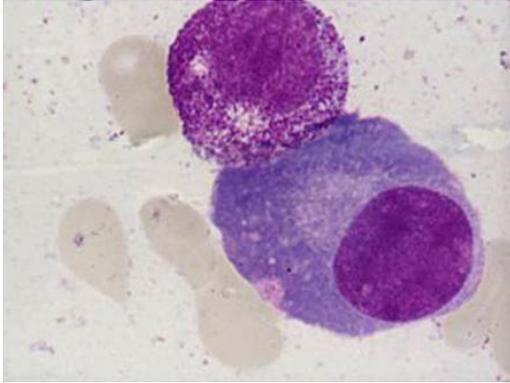
Histological features:

- By LM, they are large oval cells, with basophilic cytoplasm. The nucleus is spherical and eccentrically-placed. The chromatin of the nucleus is arranged giving the nucleus a **cart-wheel appearance**.
- The prominent juxtannuclear Golgi apparatus appears unstained "**negative Golgi image**" against the deeply-basophilic cytoplasm. (Contain large amount of amino acid)
- By EM, the cytoplasm shows closely-packed cisternae of rER together with large juxtannuclear Golgi complex.

Function:

Humoral immunity

they are responsible for synthesis of antibodies against bacteria and foreign proteins penetrating into the CT.

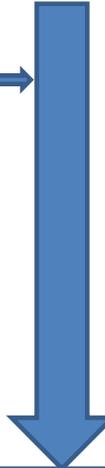


Classification of C.T.

Depend on ground substance



Jelly like



- Embryonic C.T
- Muroid C.T.

- C.T. Proper**
- Loose C.T.
 - Dense C.T.

- Modified types**
- ❖ Blood = fluid
 - ❖ Cartilage = firm
 - ❖ Bone = hard

CLASSIFICATION OF CONNECTIVE TISSUE

Classification depends on the proportion of **cells to fibers**, and on the **arrangement**, and the **types of fibers**.

Three categories can be defined:

Connective tissue proper:

it includes: (Jelly like)

- Loose areolar connective tissue.
- Dense irregular connective tissue
- Dense regular connective tissue.
- Elastic connective tissue.
- Reticular connective tissue.
- Adipose connection tissue.

Embryonic connective tissue

it includes: (Jelly like)

- Mesenchymal CT.
- Muroid CT.

Specialized connective tissue:

it includes: (Modified type)

- Cartilage.
- Bone.
- Blood.

Embryonic connective tissue

Mesenchymal CT

Site: it is found in embryo.

Histological structure:

it consists of:

- Undifferentiated (**Type of cells**) mesenchymal cells (UMCs) with their processes come in contact with each other forming a network.
- A gel-like ^{Abundant amount} amorphous ground substance. (**Type of ground substance**)
- Scattered reticular fibers. (**Type of fibres**)

Mucoid CT

Site: it is found in the umbilical cord and pulp of growing teeth.

Histological structure:

It consists of:

- Abundant ground substance (Wharton's jelly)
- Spindle-shaped UDMCs that are widely separated and fibroblasts.
- Unapparent fine collagen fibers that have the same refractive index as the matrix. (**Type II collagen**)

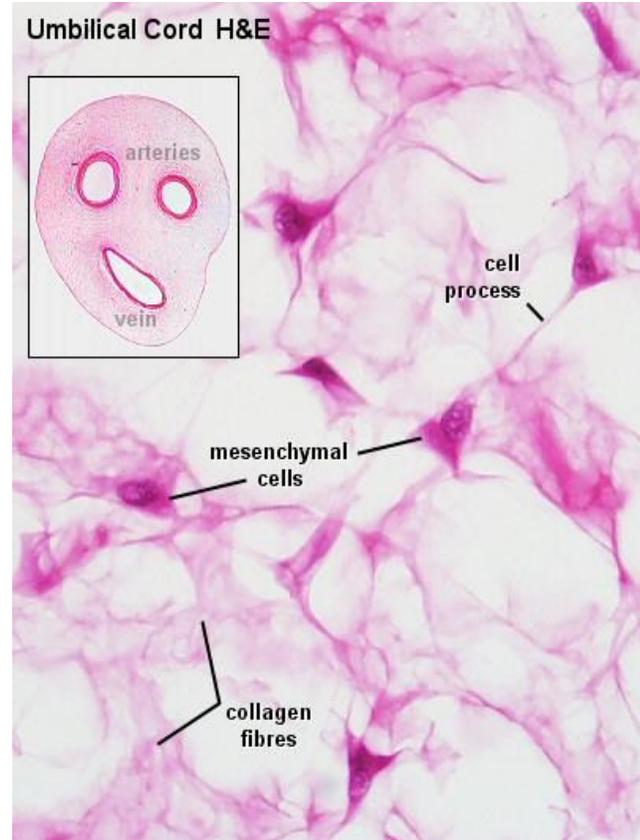
Mucoid C.T. = Embryonic C.T

↳ Help maintain the round shape of the eye → vitreous of the eyeball. الهدف من وجودها في.

- **Mucoid connective tissue** (or **mucous tissue**) is a type of **connective tissue** found during **fetal** development.
- It is composed mainly of **ground substance** with few cells & fibers
- It is most easily found as a component of **Wharton's jelly**.
- **Cells : UDMC, Fibroblasts**
- **Fibers : present but not apparent collagen type II**
- **Ground substance : Abundant**

Sites:

- Mucous connective tissue forms the **umbilical cord**.
- The **vitreous of the eyeball** is a similar tissue. ↳ (Located in the posterior chamber of the eye)



Connective tissue proper

Loose connective tissue:

relatively cell rich, soft .

It is also rich in vessels and nerves.

→ This type contains abundant amount of ground substance

Loose connective tissue may occur in some special variants:

- **LACT:** connective tissue
- **Reticular:** connective tissue
- **Adipose:** tissue.

Cell ↑
Fibres ↓

Dense CT:

- connective tissues are completely dominated by fibres.
- They are subdivided according to the arrangement of the fibres in the tissue.

Dense irregular:

connective tissue the fibres do not show a clear orientation within the tissue but instead form a densely woven three-dimensional network (dermis).

Dense Regular

1. White fibrous C.T.
2. Elastic C.T.

Cell ↓
Fibres ↑

Connective tissue proper

Loose areolar CT:

it is the most widely distributed connective tissue in the body.

It binds body parts together while allowing them to move freely over one another.

Histological structure

- ❑ All types of fibers; collagen, elastic and a small proportion of the reticular fibers.
- ❑ All types of connective tissue cells with predominance of fibroblasts and macrophages.
- ❑ Good amount of ground substance.
- ❑ Highly vascular

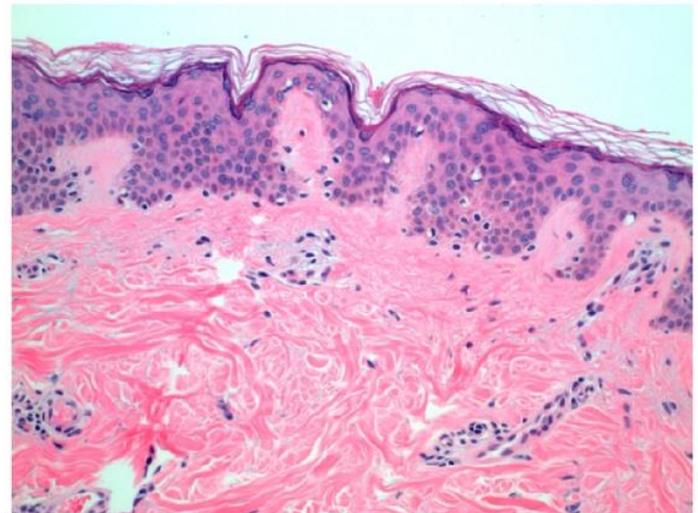
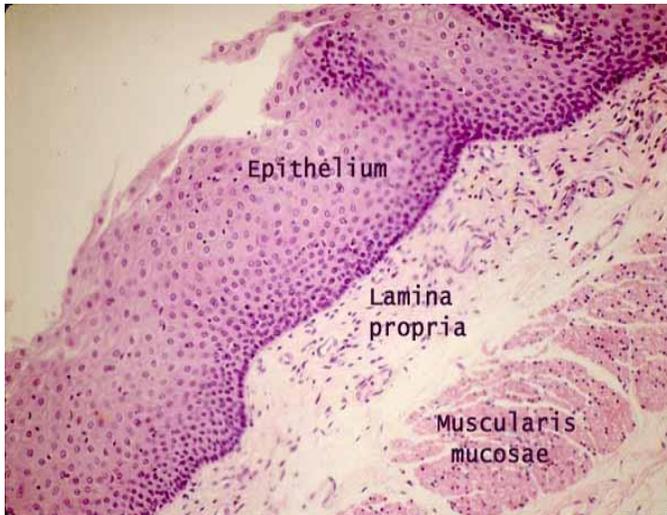
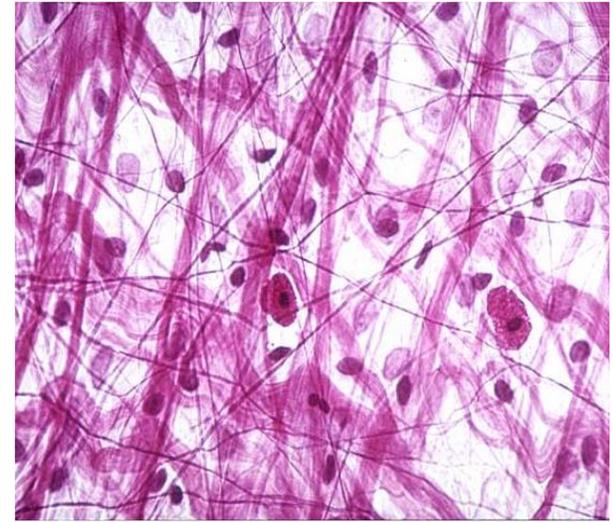
sites:

- It is present beneath the epithelium in all mucous membranes forming the lamina propria.
- It forms the papillary layer of dermis which attaches the skin epidermis to underlying structures.
- It surrounds glands, small blood vessels, and nerves.

Loose Areolar C.T.

Function:

- Supports and binds other tissues (by its fibers).
- Holds body fluids and provide nutrition (by its ground substance).
- Defends against infection (by its white blood cells, plasma cells, mast cells and macrophages).



Stratified squamous keratinized found in skin

Reticular CT: Don't show up in routine H&E stain

Histological structure:

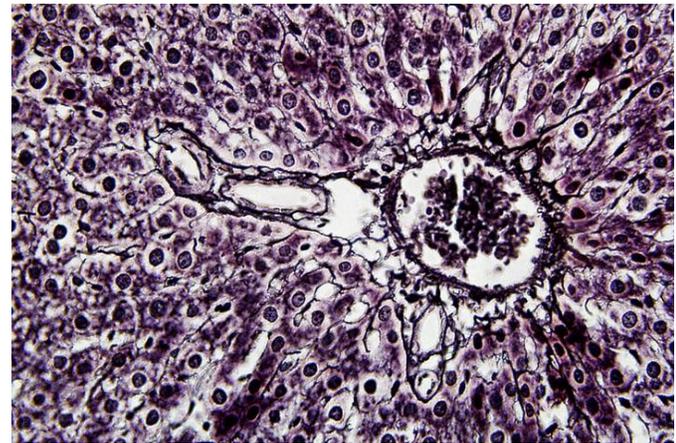
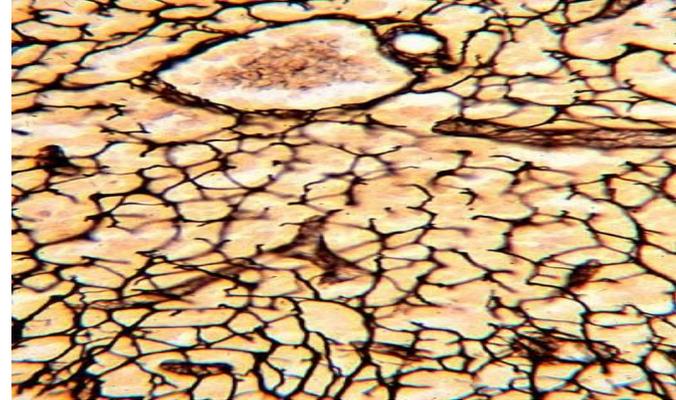
- Reticular fibers, forming a network.
- **Reticular cells**, these are the fibroblasts of reticular connective tissue, that synthesize the reticular fibers.

Site : reticular tissue is limited to certain sites

- Hemopoietic tissue in the bone marrow.
- Lymphoid tissue in lymph nodes and spleen.
- In the **liver**.

Function

- It forms the supporting



Liver (silver stain)

Adipose C.T.

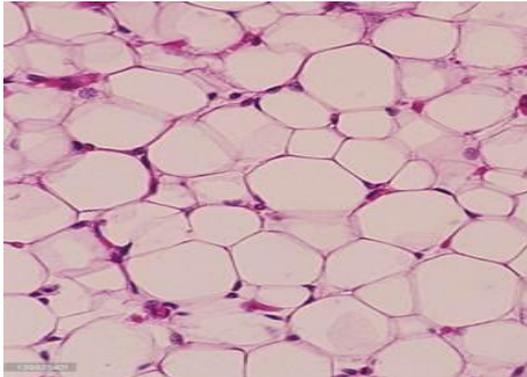
Unilocular adipose C.T.

Yellow fat → Protect & insulate organ

- Unilocular fat cells
- C.T. fibers: collagenous F.
- rich in blood supply
- Carotenoids

Sites:

- Subcutaneous tissue
- Around vital organs



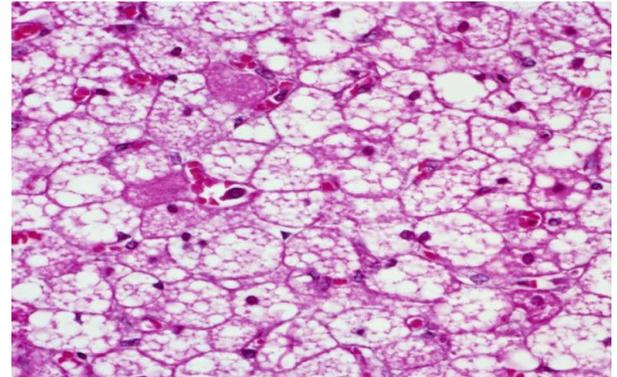
Multilocular adipose C.T.

Brown fat

- Multilocular fat cells
- C.T. fibers – collagenous F.
- rich in blood supply
- Many blood vessels, numerous mitochondria, cytochrome pigment

Sites:

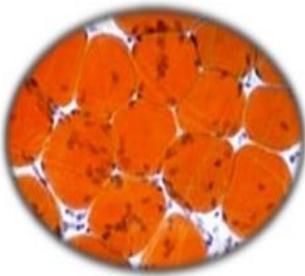
- Back & neck of newborn



Adipose C.T.

2. Lipid

- **Frozen sections are used**
- **Sudan III** → **orange colour**
- **Sudan black** → **black colour**
- **Osmic acid** → **black colour**



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Function:

- Storage of energy in the form of triglycerides.
- Subcutaneous adipose tissue shapes the body.
- Pads of fatty tissue in palms and soles act as shock absorber.
- Thermal insulation of the body; due to the poor heat conduction of adipose tissue.
- Fixation of the vital organs as heart and kidney, thus keeping them in position.

Dense regular C.T.

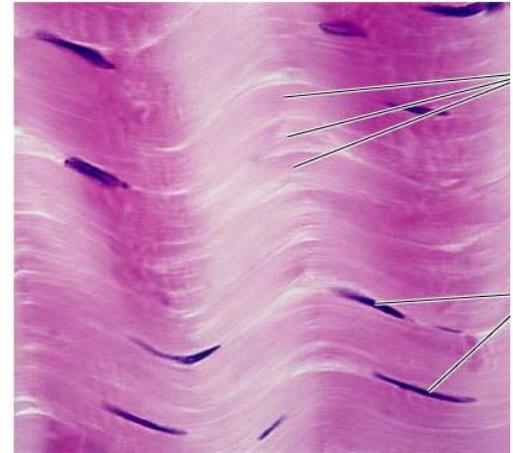
White Fibrous C.T.

Histological structure

- Closely-packed wavy bundles of collagen fibers running in the same direction and parallel to the direction of pull.
- Rows of fibroblasts (**tendon cells**) with flattened nuclei aligned between the collagen bundles.
- Little amount of ground substance.
- Unlike areolar CT this tissue is poorly vascularized.

Sites

- It is found in:
- Tendons, which attach muscles to bones.
- Ligaments, which bind bones together at joints.
- **sclera of the eye**



Function:

forms white flexible structures with great resistance to pulling forces wherever it is exerted in a single direction.

Dense Irregular CT:

Histological structure:

- Thick bundles of collagen fibers arranged irregularly (running in more than one plane).
- Little amount of ground substance with few fibroblasts.

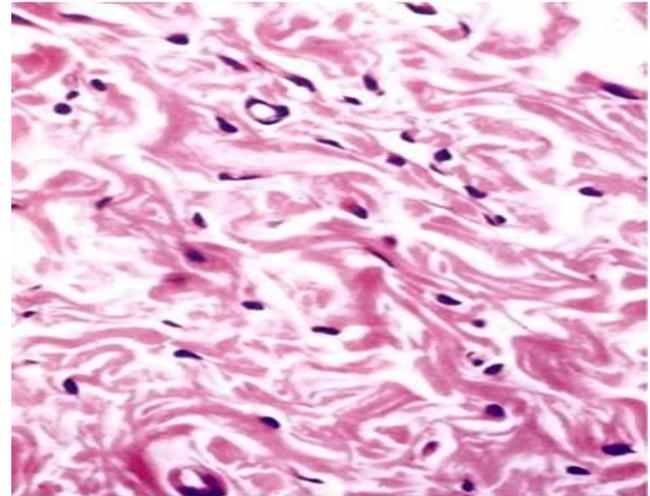
Sites :

It is found in :

- reticular layer of dermis** of the skin.
- It forms the capsules of fibrous joints.
- It forms the capsules of body organs e.g. kidney, spleen, lymph nodes and liver.

Function

forms sheets in body areas where tension is exerted from many different directions.



Elastic C.T.

Histological structure:

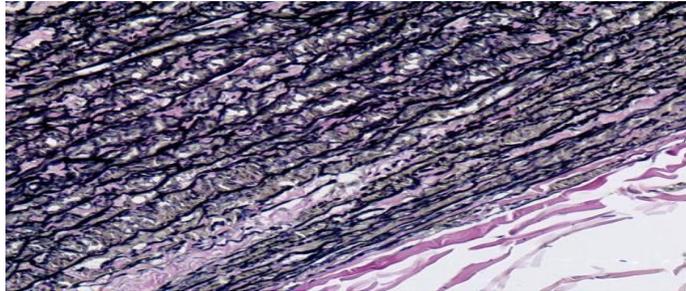
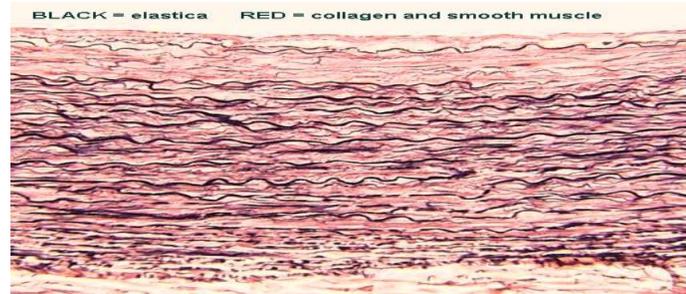
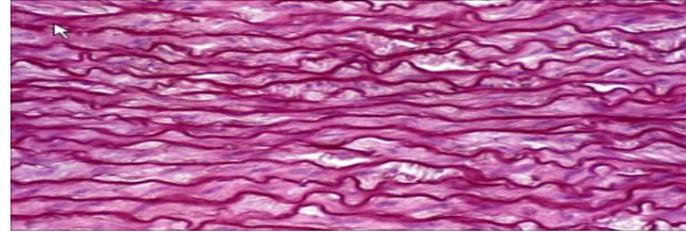
elastic fibers predominate; they run in all directions, also they may form fenestrated membranes.

Site :

it is found in:

- Elastic laminae of arteries.
- True vocal cords.
- Few ligaments in the body are very elastic such as ligamenta flava and ligamenta nuchae connecting adjacent vertebrae.

Function: this tissue is present where flexibility and elastic recoil are needed



CONNECTIVE TISSUE

- Connective tissues are the most abundant of the primary tissues.
- The cells of the connective tissues are far apart, separated by an abundant amount of extracellular material, also called extracellular matrix

Function :

1. **Bind** together and provide **mechanical support** for other tissue (metabolic, defense, transport, storage)
2. Architectural **framework** of the body
3. Insulation:
Fat cells or adipose tissue, is a connective tissue which not only cushions body organs but also insulates them and provides reserve energy fuel.
4. Nutrition
5. **Protection:** inflammatory response
6. Wound repair
7. Transportation:
Blood is a connective tissue and it carries and delivers oxygen and nutrient to tissues.

Thank You