# CONNECTIVE TISSUE 2

By

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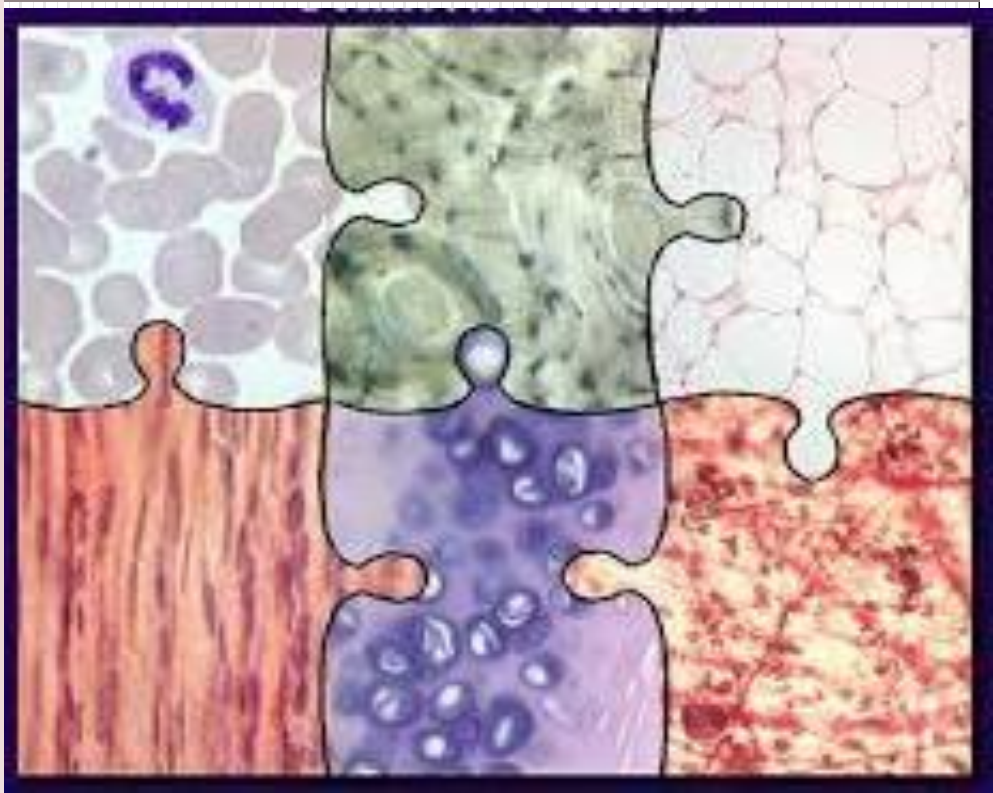
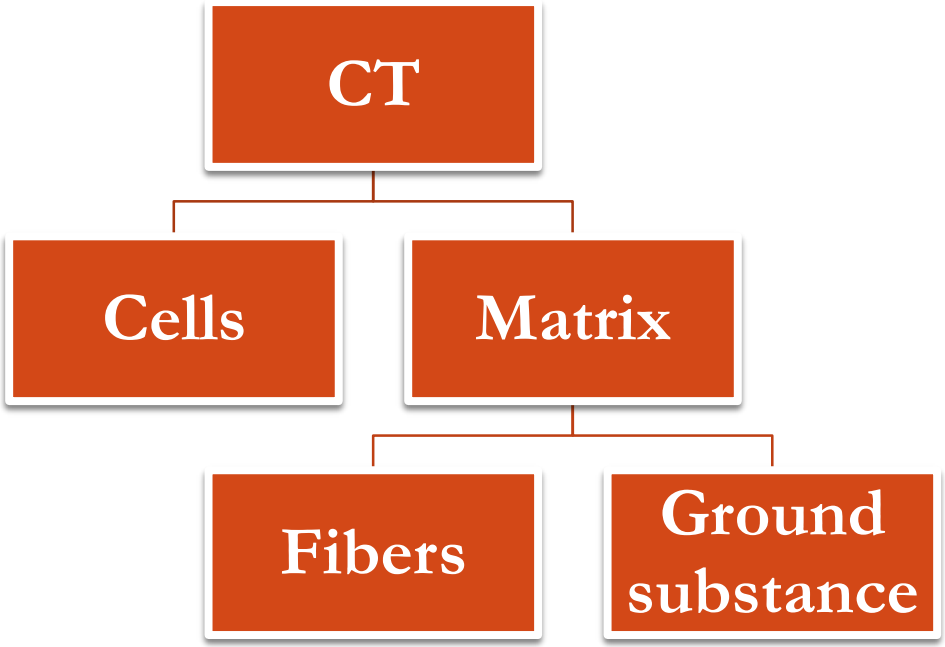


# Structure of C.T.

a - Connective tissue cells (less.)

b - Intercellular substance (Matrix) (More).




1. Collagen fibers
2. Elastic fibers
3. Reticular fibers

# I-Ground substance

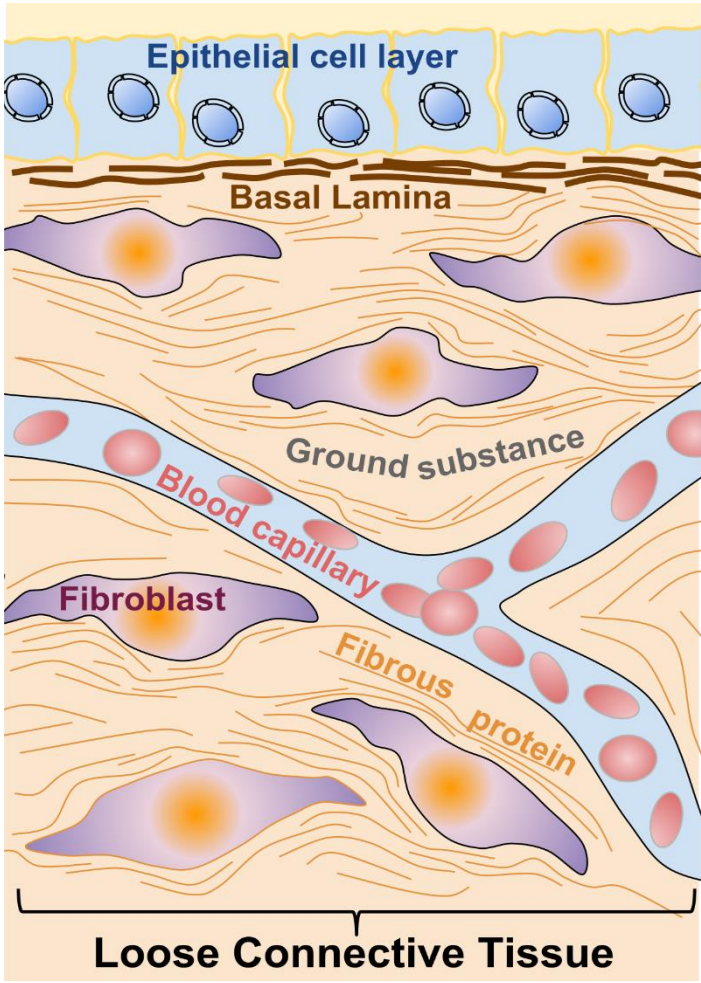
- Amorphous, colorless, transparent and homogenous material (Gel like).

- **Composed of :**

**1-** Glycosaminoglycans (GAGs)

**2-** Proteoglycans

**3-** Glycoproteins



# 1- **Glycosaminoglycans**(GAGs)

- Complex carbohydrate molecules. **or**
- Linear polysaccharide molecules (unbranched) formed of repeating disaccharide units (two-sugar units).

- **The disaccharide units are composed of:**

a- Uronic sugar

b- Amino sugar

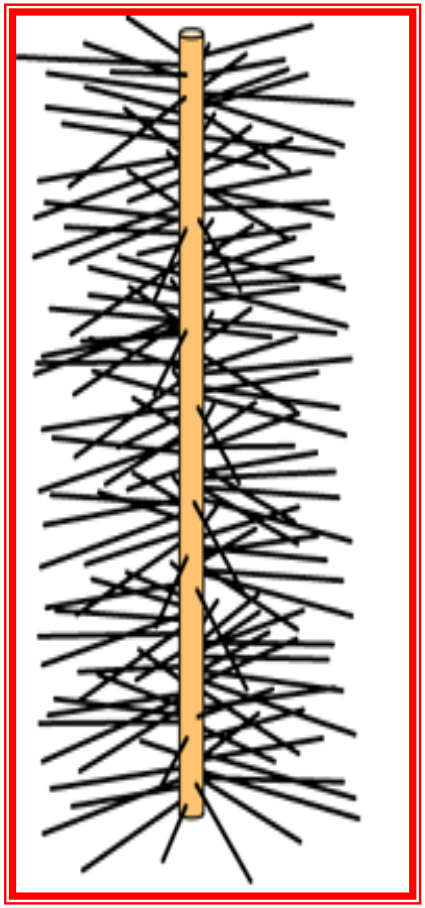
- **Glycosaminoglycans are of two types :**

**1- Sulfated: as chondroitin sulfate, heparin sulphate, keratin sulphate**

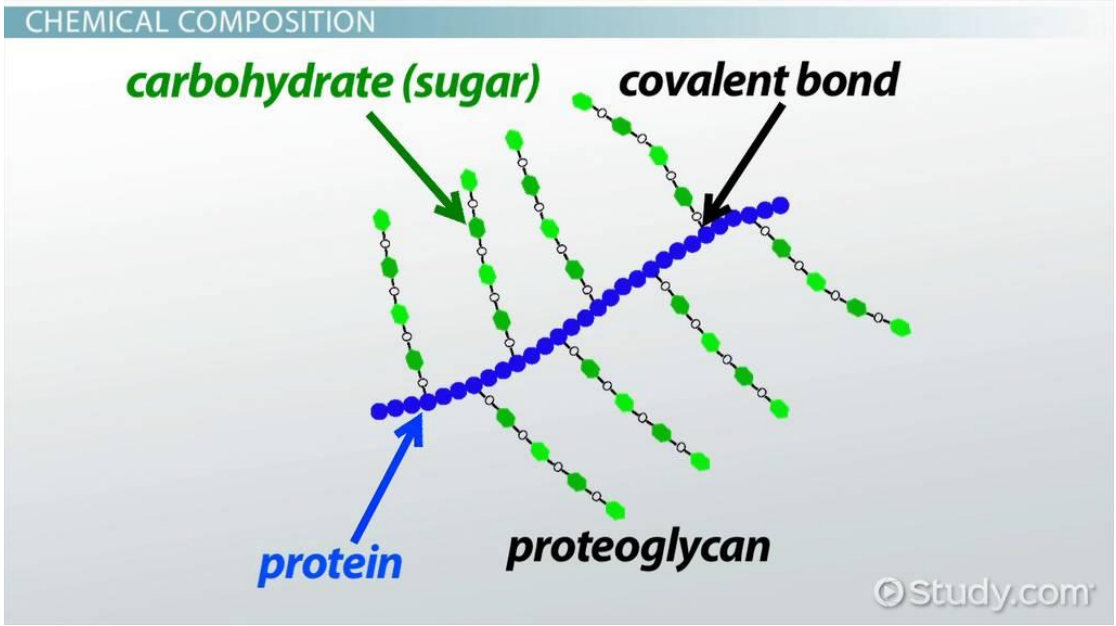
**2- Non sulfated: as hyaluronic acid**

# 2- Proteoglycans

## (Sulfated GAGs + a core protein)

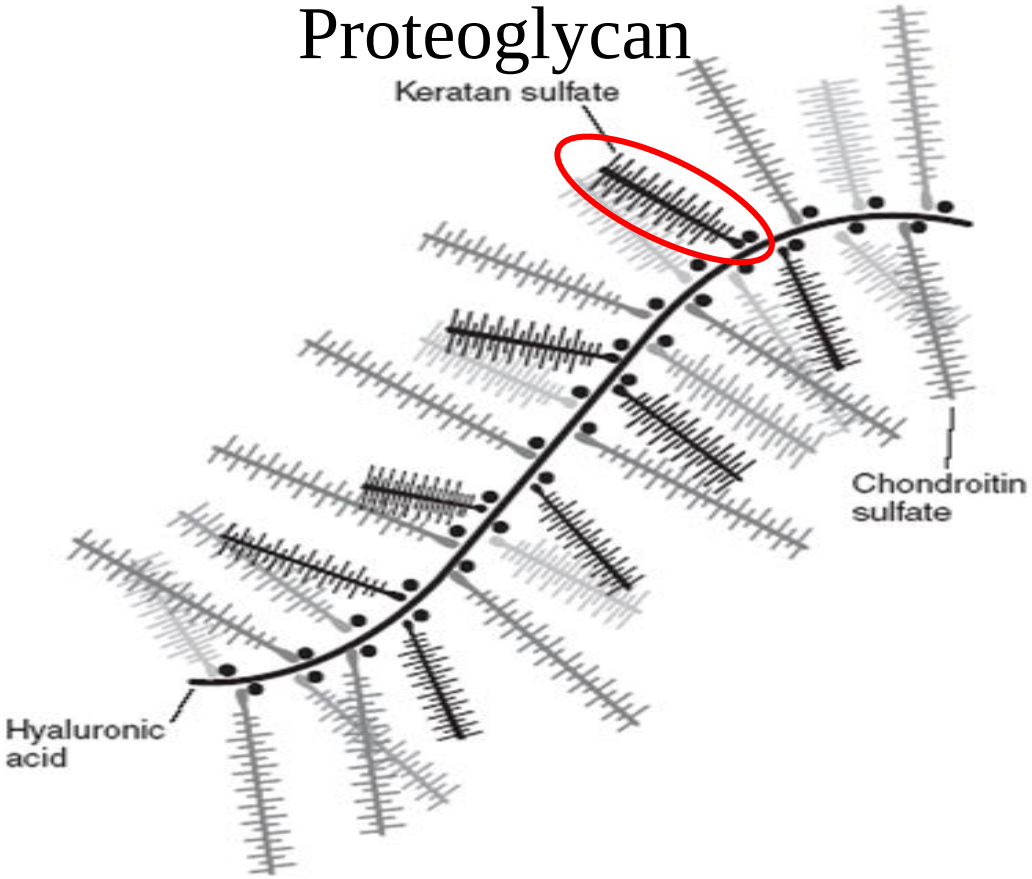


Proteoglycan molecule is similar to ***test tube brush***.



When several proteoglycans (aggrecans) are bound to hyaluronic acid, they form proteoglycan- hyaluronate complex as in cartilage

Proteoglycan

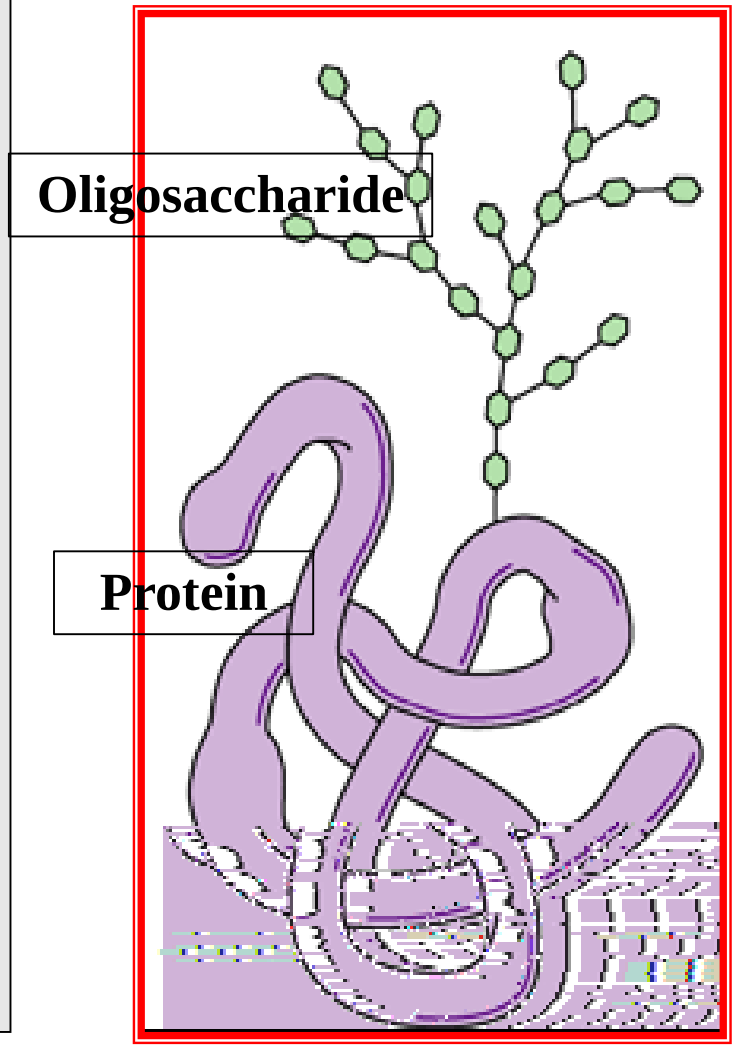


# 3- Adhesive glycoproteins

- Adhesive glycoproteins bind cells with the extracellular matrix components forming matrix network.

- It is formed of protein conjugated with branched oligosaccharides.
- Examples:

1- Fibronectin: present in CT.
2- Chondronectin: present in cartilage.
3- Laminin: present in basal laminae.



# CLASSIFICATION OF C.T.

## C.T. proper

-Loose C.T.
-Dense C.T

## Specialized C.T.

-Adipose
- Reticular
- Mucous
- Hemopoietic tissue

## Supporting C.T.

- Bone
- Cartilage

# I- Connective tissue proper

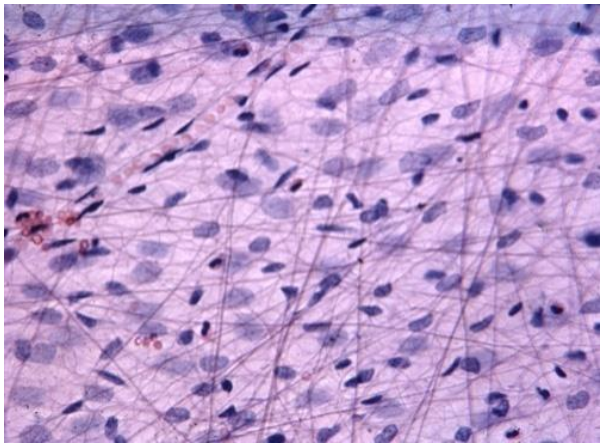
## 1-Loose (areolar) connective tissue

- contains spaces which may be filled with air or fluid.
- It connects and binds organs
- **Structure:**

**-Cells: All the cells *(fibroblasts and macrophages)* are the most numerous cells**

**-Fibers: All the fibers**

**-GS: Large amount of ground substance.**



- **Character:- It is flexible**
- **Sites**

**- It fills the spaces between muscle sheaths.**

**- It supports epithelial tissue.**

**- It ensheathes the blood and lymphatic vessels.**

# 2- Dense connective tissue

- **Structure:**

**Cells:**

- few cells

**Fibers:**

It is mainly formed of **collagenous fibers**

**GS:**

**Reduced** ground substance

- **Character:**

-Resist stretch

- **Types:**

**a) Dense regular connective tissue**

**b) Dense irregular connective tissue**

# Types of dense connective tissue

## *Dense irregular connective tissue:*

**Structure:**

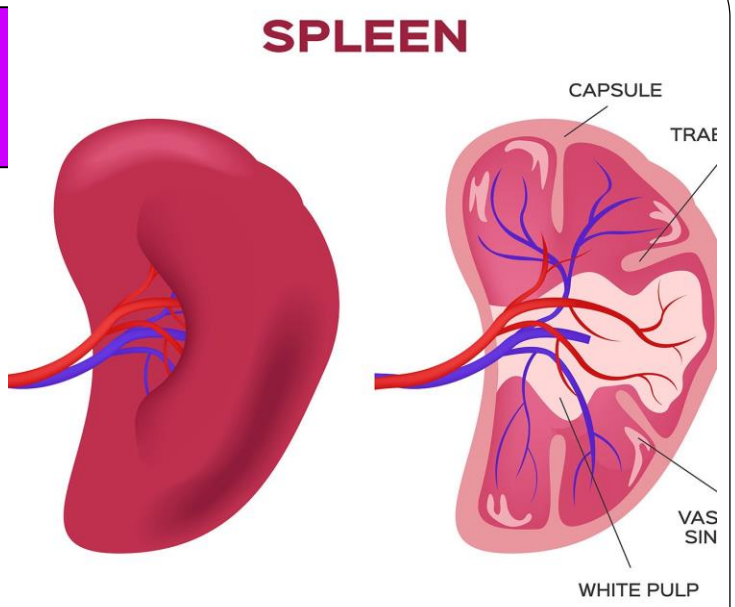
- The collagenous bundles are irregularly arranged without definite orientation and run in different directions.
- Few C.T cells
- little amount of ground substance.

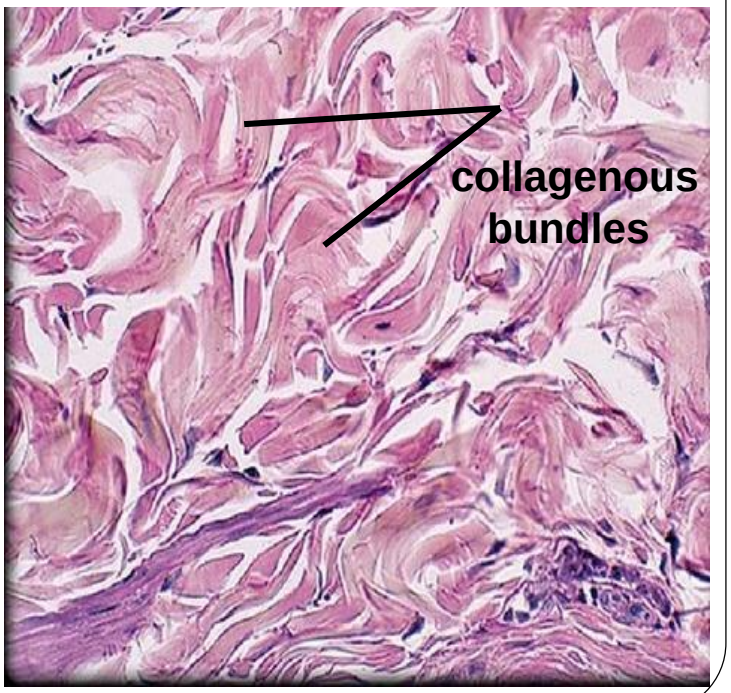
**Function:**

It withstands stretch from all directions.

**Sites:**

- Dermis of the skin.
- Capsules of spleen, lymph nodes and liver.
- perichondrium and periosteum.



## *2)Dense regular connective tissue:*

**Sturcture:**

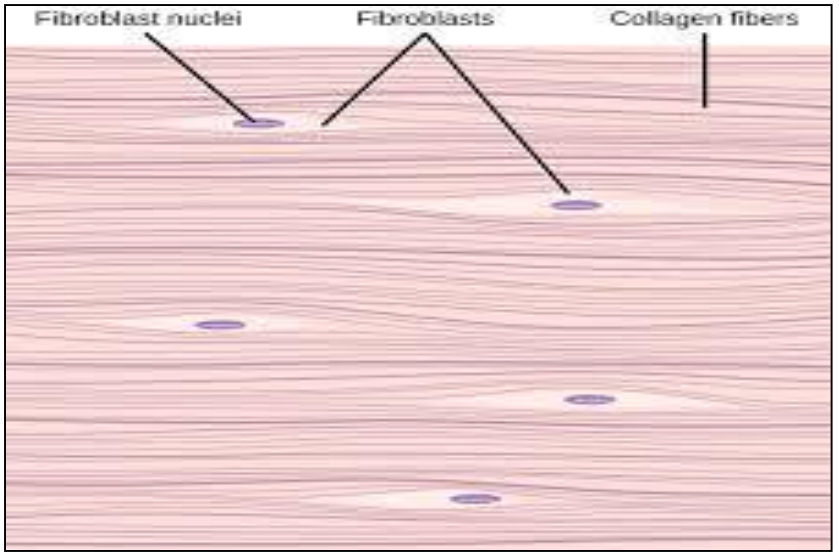
- The collagen bundles are arranged in regular pattern .
- Fibroblast are located between the collagen bundles with their long axis parallel to the bundles

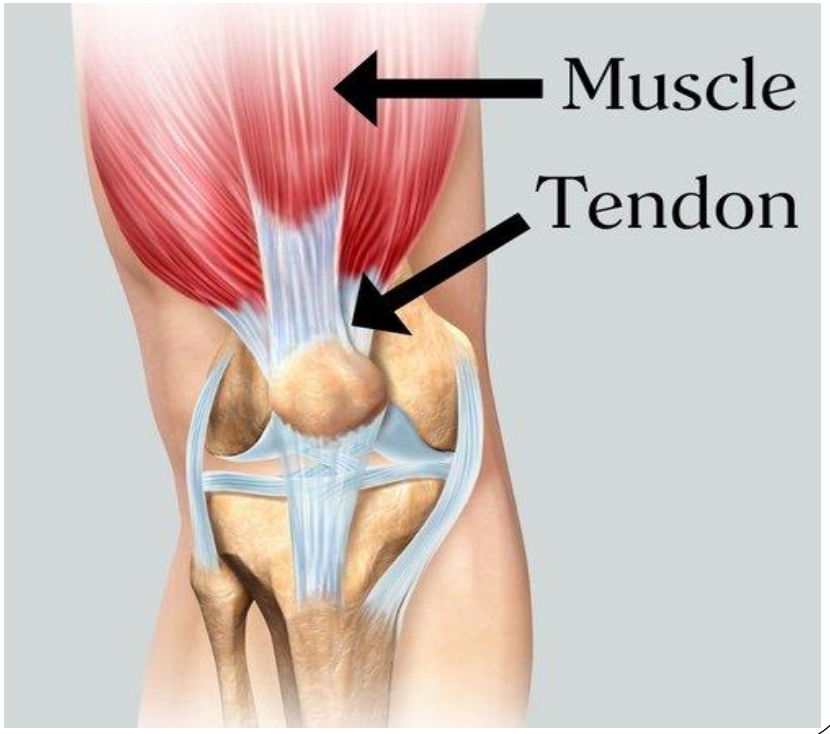
**Function:**

- It withstand prolonged stretch in one direction

**Site:**

- Tendons
- Ligments



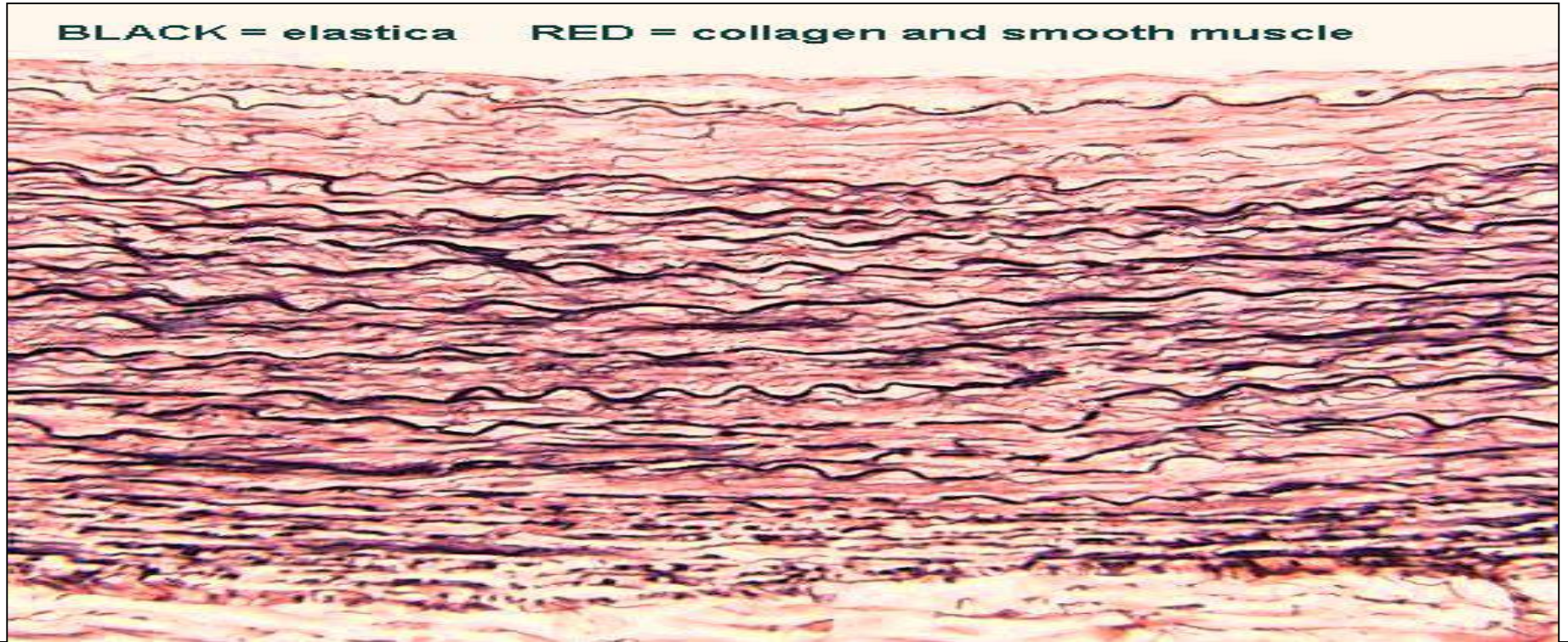



# Specialized connective tissue

# Yellow elastic tissue

- **Composition:**

**It is composed of bundles of thick parallel elastic fibers and thin collagenous fibers with flattened fibroblasts in-between.**



# Yellow elastic tissue

## Sites:

-Elastic lamina of arteries.

-Ligaments of vertebral column.

-True vocal cords.

## Characters:

The abundance of elastic fibers gives great elasticity to tissues & yellow color.

# Reticular connective tissue

- **Structure:**

1- **Reticular cells**

- They are fibroblasts with cytoplasmic processes.
- Specialized for the secretion of reticular fibers.
- Their nuclei are large with fine chromatin and one or more visible nucleoli.

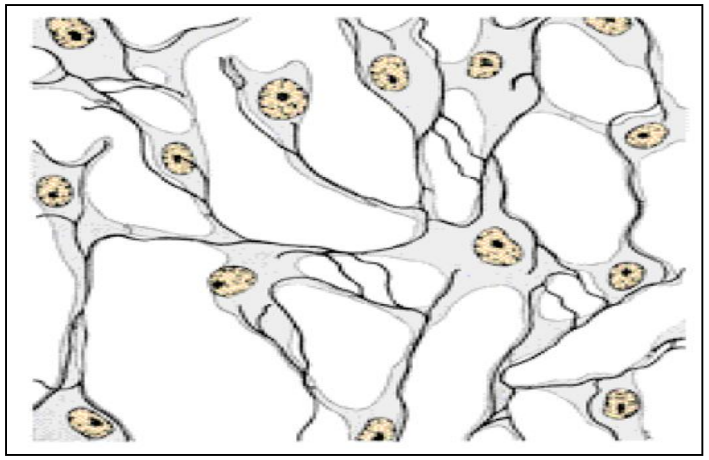
2- **Reticular fibers** (collagen III)

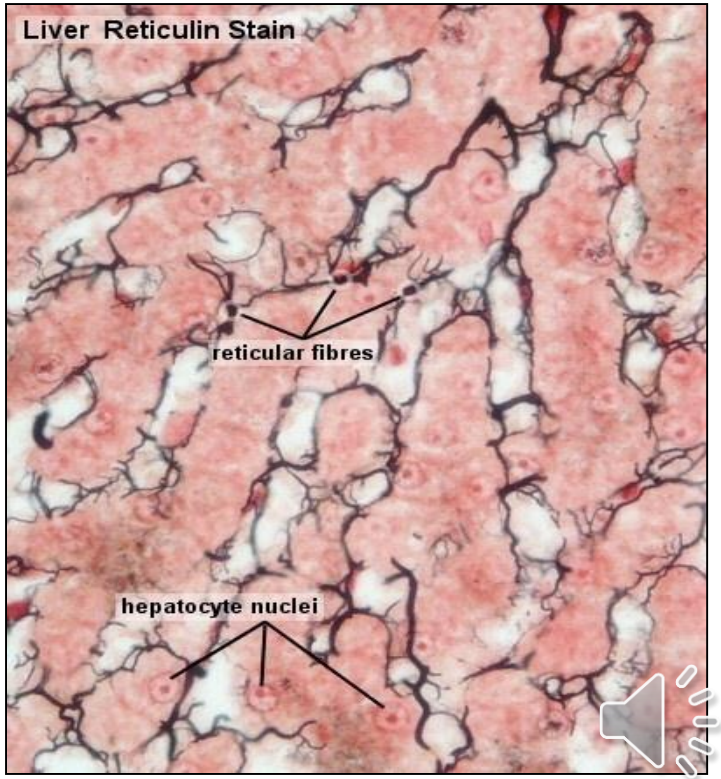
- - Reticular cells and fibers create **spongy like structure** within which cells and fluids are mobile.

3- **Ground substance.**

4- **Mononuclear macrophages**

- **Site: It forms the framework of all parenchymatous tissues (lymph node –spleen-Liver.) & bone marrow**





# Mucoid connective tissue

- **Structure:**

- **Cells:**

Mainly fibroblasts whose processes fuse with those of adjacent cells.

- **Fibers:**

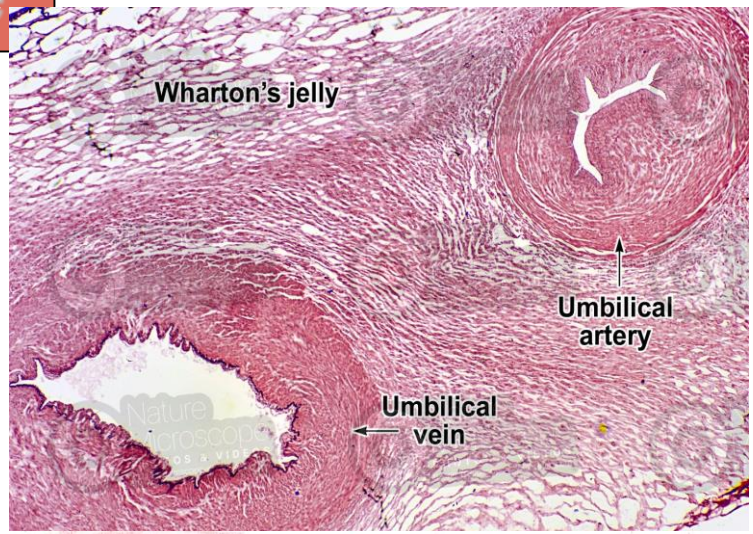
Few collagen, elastic and reticular fibers

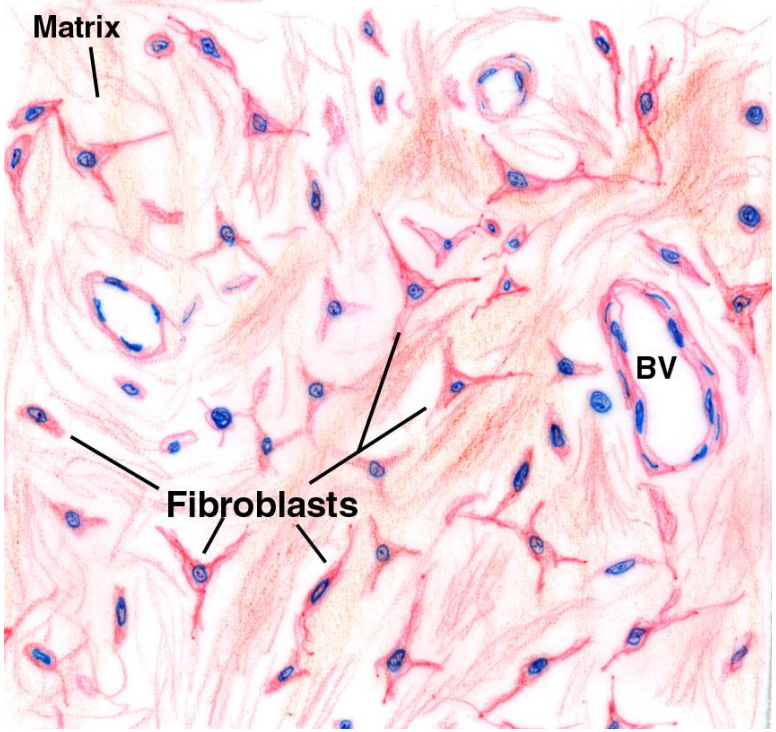
- **GS:**

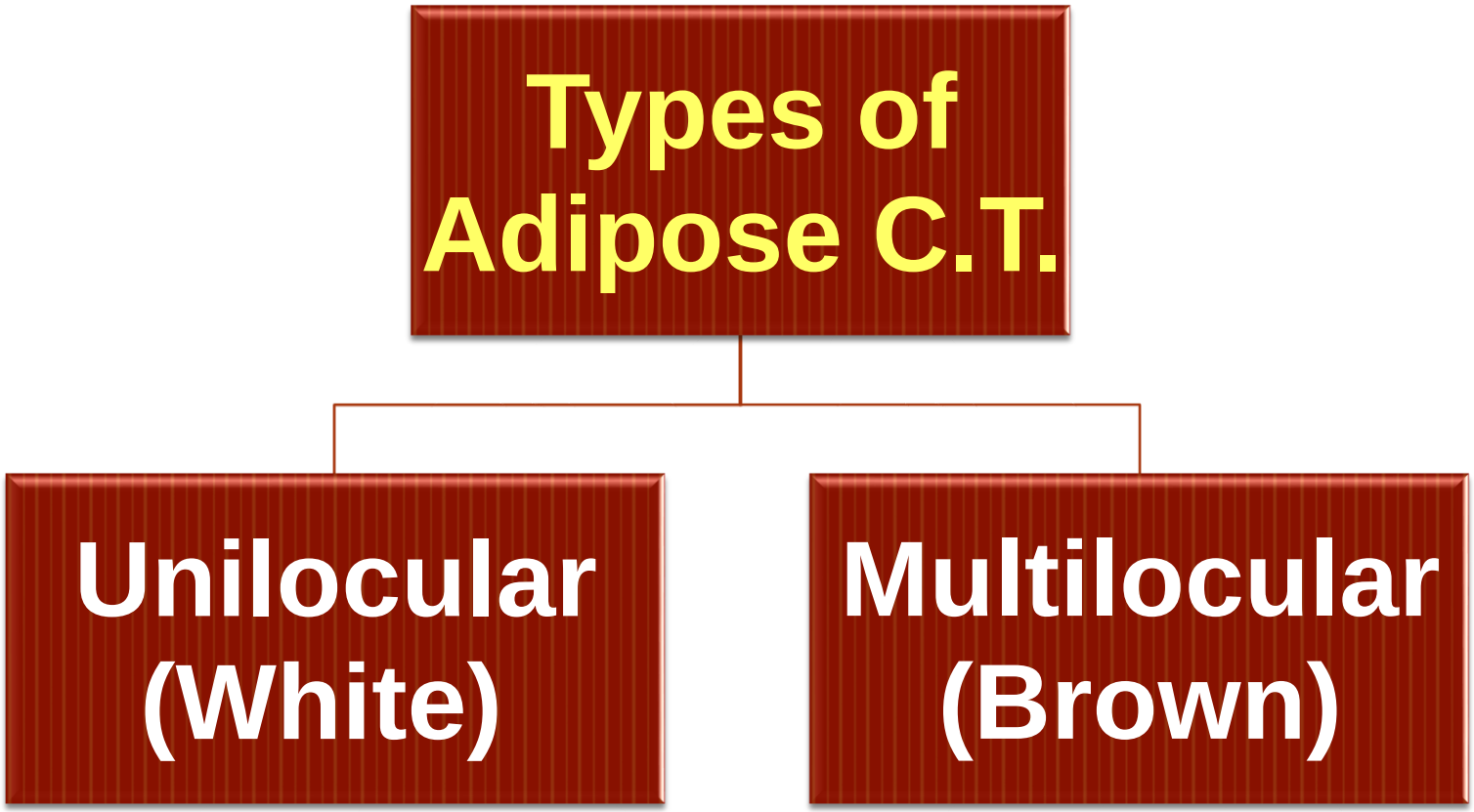
It has ***abundant jelly like matrix***

**Site:**

- Umbilical cord (Wharton's jelly).
- Pulp of young tooth.




Types of Adipose C.T.
Unilocular (White)
Multilocular (Brown)

# 1- White (Unilocular) adipose tissue

- It is the common type.
- it is the almost only type in adult.

- ***Sites:***

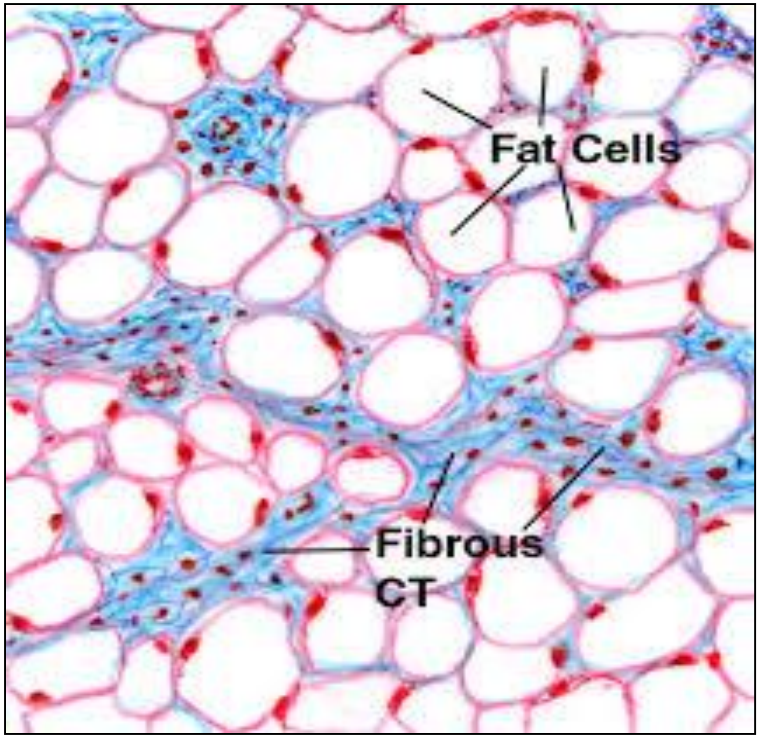
-It is present throughout the body (most common type in human) and is affected by sex and age.

-It is present throughout the human body except eyelids, penis, scrotum and auricle of external ear.

- ***Color:*** depends on diet, varies from white to yellow due to the dissolved carotenoid in fat droplets.

# Histological structure

- Fat cells( unilocular adipocytes) are arranged in groups surrounded by incomplete C.T. septa rich in blood vessels.



# Adipose (fat) cell

## *Unilocular Adipocytes*

## L.M:

- ***Shape :***

- Spherical when single
- Polyhedral in adipose C.T.(closely packed).

- ***Nucleus :***

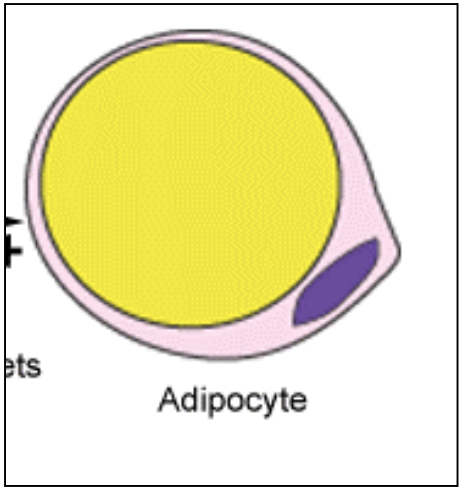
peripheral and flattened (signet ring appearance).

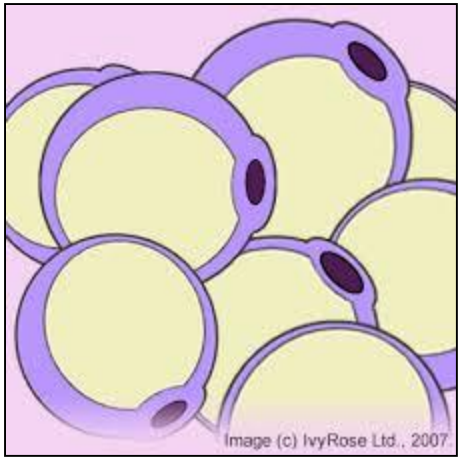
- ***Cytoplasm:***

- Hx & E staining.

Appears as thin ring surrounding a dissolved fat vacuole

- Sudan III: orange



## E/M:

- Each cell is surrounded by a basal lamina.
- The fat appears as :

minute droplets in addition to the single large one, the droplets are not surrounded by a membrane.

- *The thickest potion of the cytoplasm surrounding the nucleus contains:*

1-Golgi complex

2- Filamentous and ovoid mitochondria

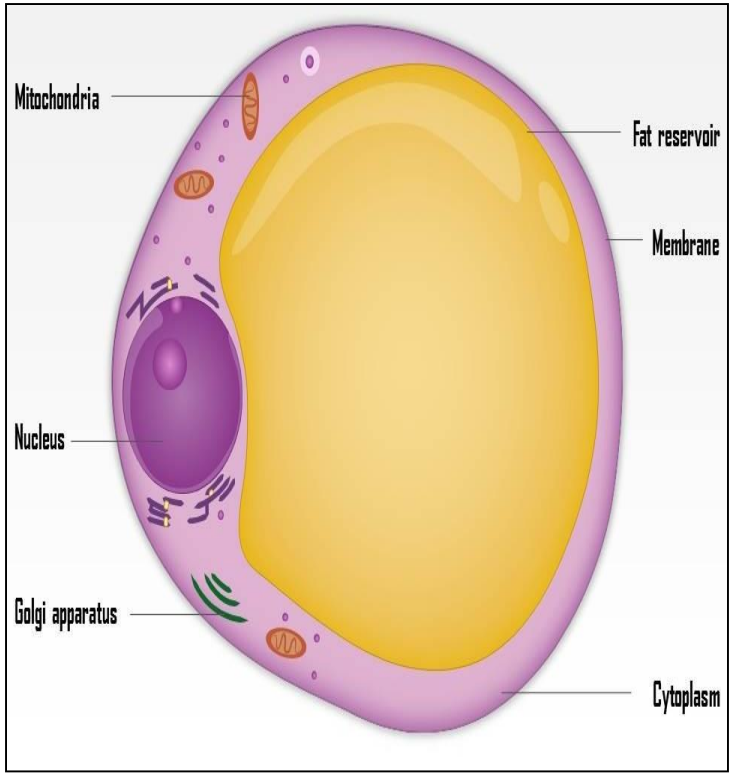
3- Few RER and free polyribosome.

- *The rim of cytoplasm surrounding the lipid droplet contains:*

1-Vesicles of SER

2- Occasional microtubules

3- Numerous pinocytic vesicles



# White adipose connective tissue

**Functions**

1-Store energy in the form of triglycerides.

2- Shape the surface of the body.

3- Shock absorbers chiefly in soles and palms.

4- Thermal insulators.

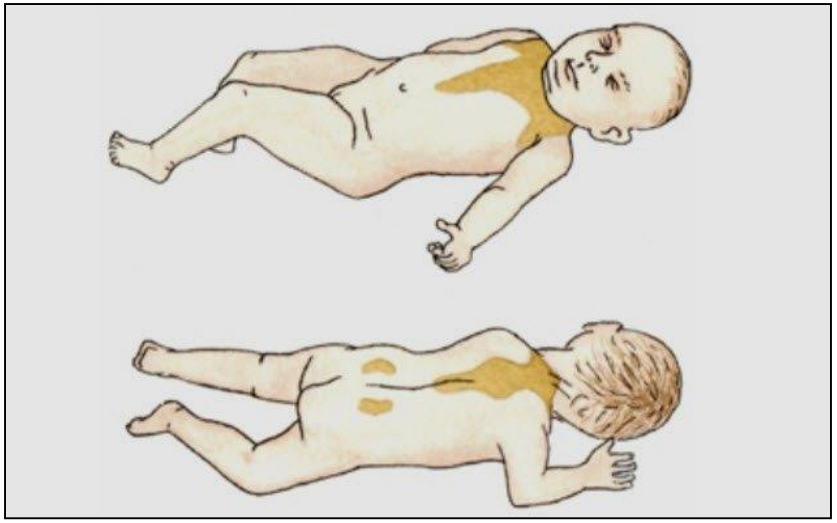
5- Fills the spaces between other tissues and keep some organs in position

# 2 - Multilocular adipose tissue (brown fat)

- It is greatly reduced in adult.
- ***Sites:*** - In hibernating animals.
  - In human newborn (e.g. neck, axilla, and mediastinum).
- ***Functions:***

-In animals It transforms the stored chemical energy to heat when stimulated.

-In human it is important in the first months of postnatal life as it produces heat that protects newborn against cold.



***Histological structure:***

**It is subdivided by connective tissue into prominent lobules.**

**Multilocular adipocytes**

**L/M:**

- ***Cell shape:***

- Polygonal.

- Diameter: smaller than those of unilocular adipose tissue.

- ***Cytoplasm:*** Several fat vacuoles in Hx & E staining.

- ***Nucleus:*** spherical and eccentric.

**E/M:**

- Numerous lipid droplets of different sizes.

- The mitochondria , sER are numerous

Its color is brown due to:

- Large number of blood capillaries.
- Numerous mitochondria that contain colored cytochrome.