CONNECTIVE TISSUE 2

By

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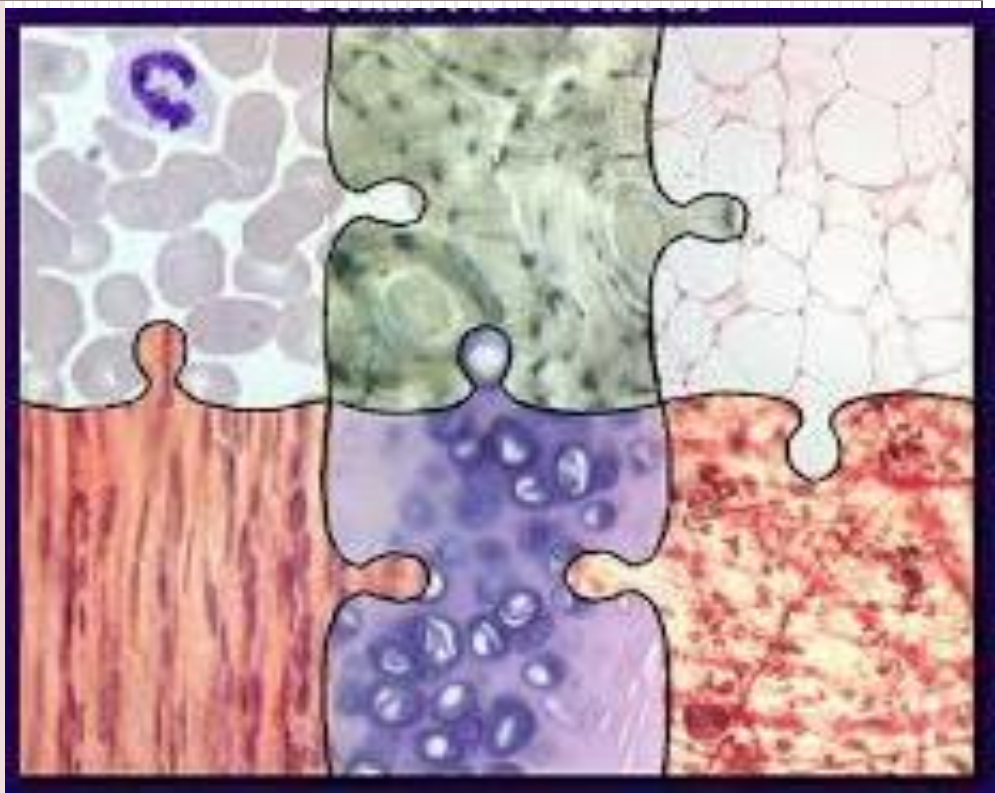
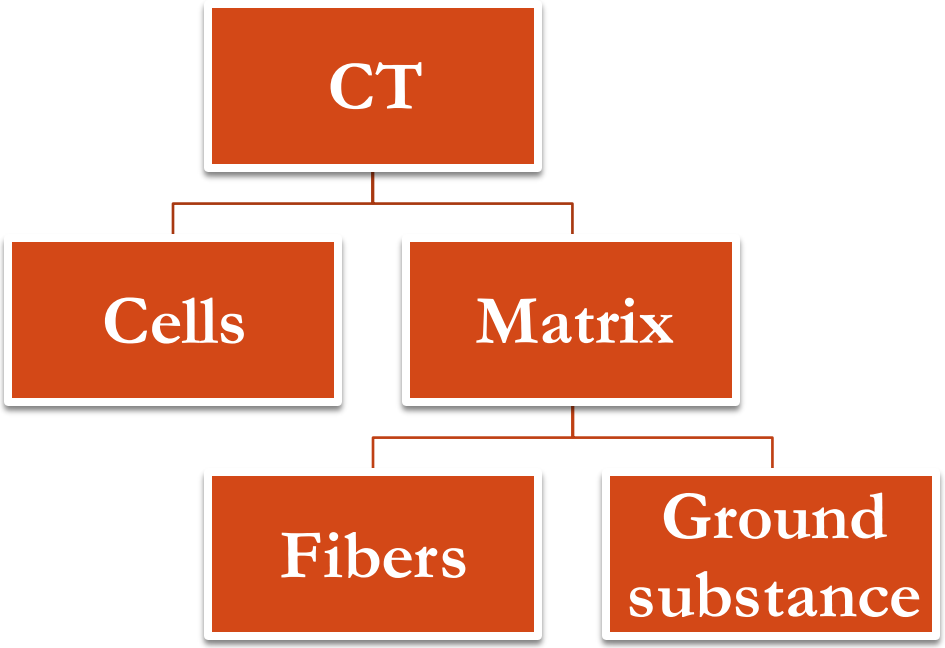
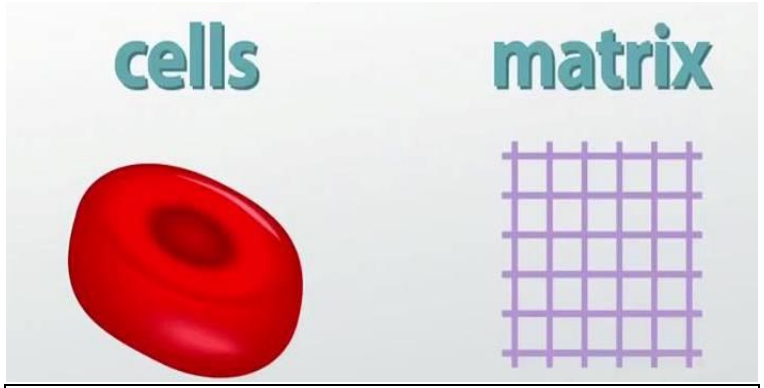


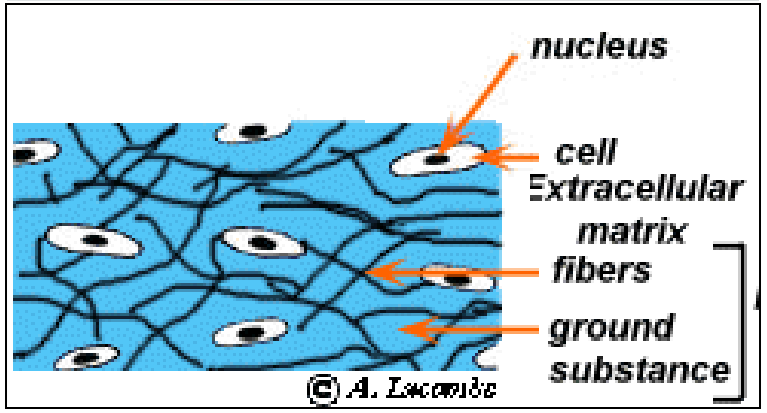
Structure of C.T.

a - Connective tissue cells (less.)

b - Intercellular substance (Matrix) (More).







I-Ground substance

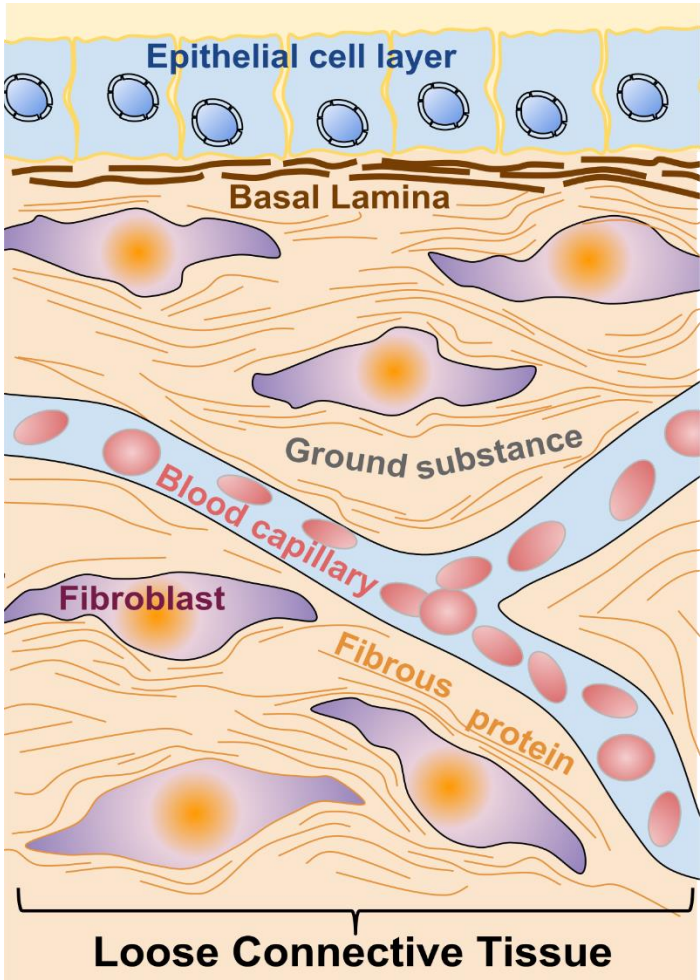
- Amorphous, colorless, transparent and homogenous material (Gel like).

- **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

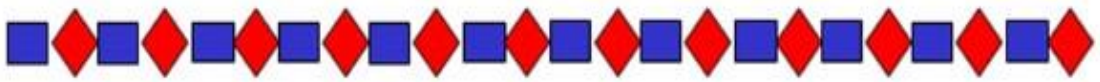
- **Glycosaminoglycans are of two types :**

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

2- Non sulfated: as hyaluronic acid

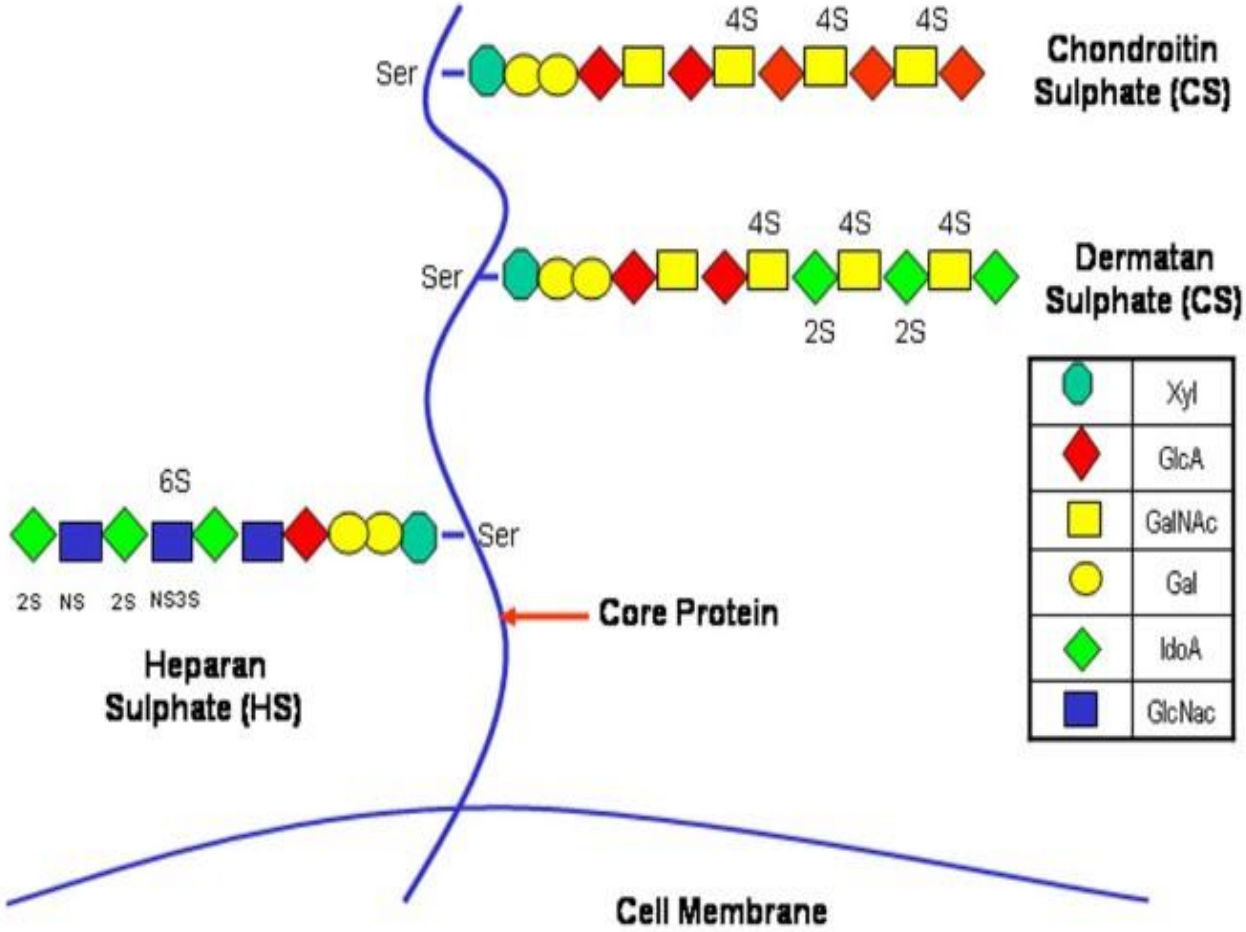
1- Glycosaminoglycans(GAGs)

Non sulphated



Hyaluronic acid

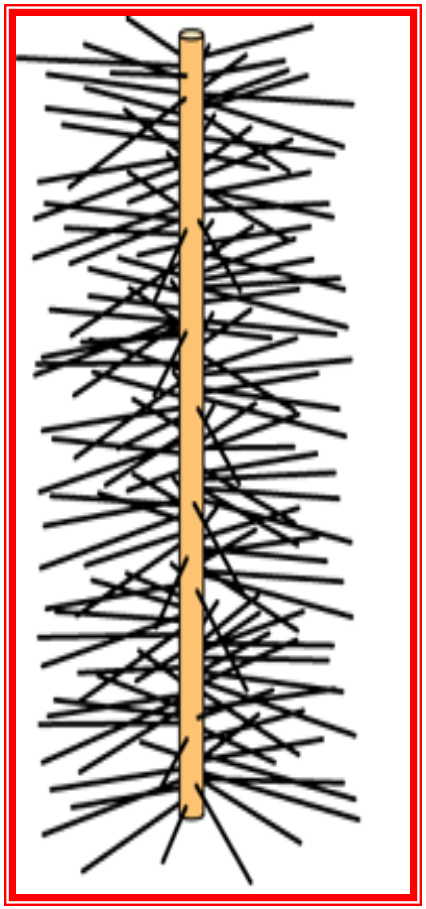
Sulfated

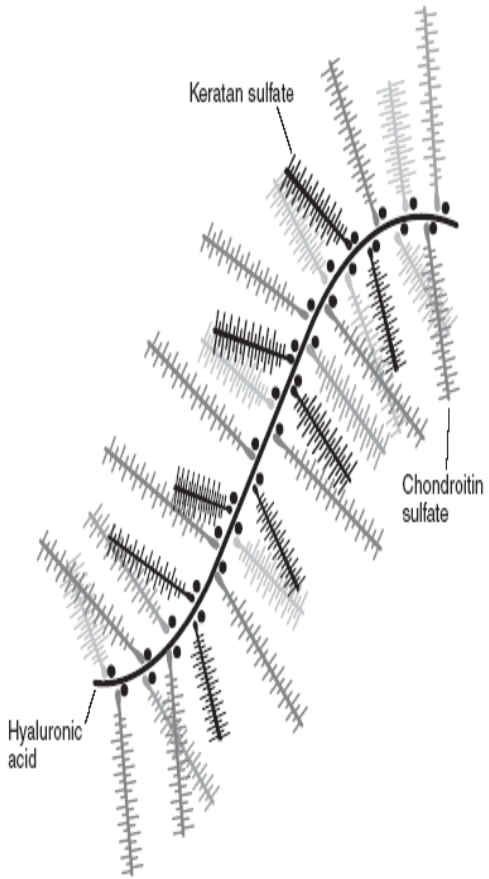


Proteoglycans

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 <u>proteoglycan- hyaluronate complex</u> as in cartilage

3- Adhesive glycoproteins

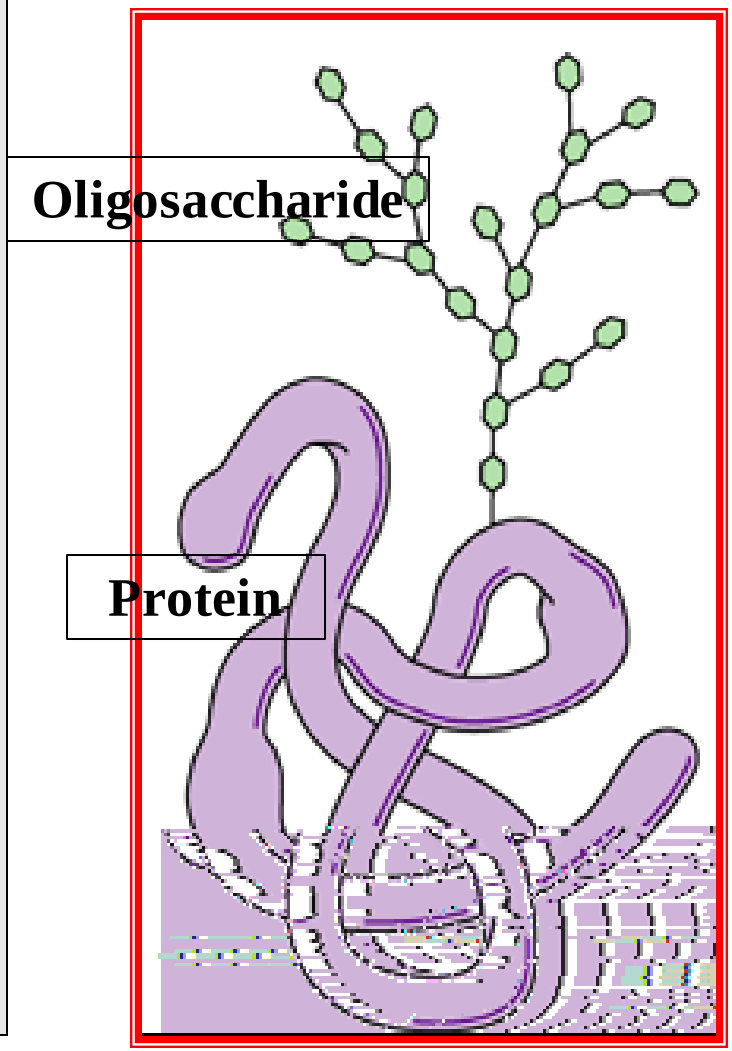
- Adhesive glycoproteins bind cells with the extracellular matrix components forming matrix network.

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

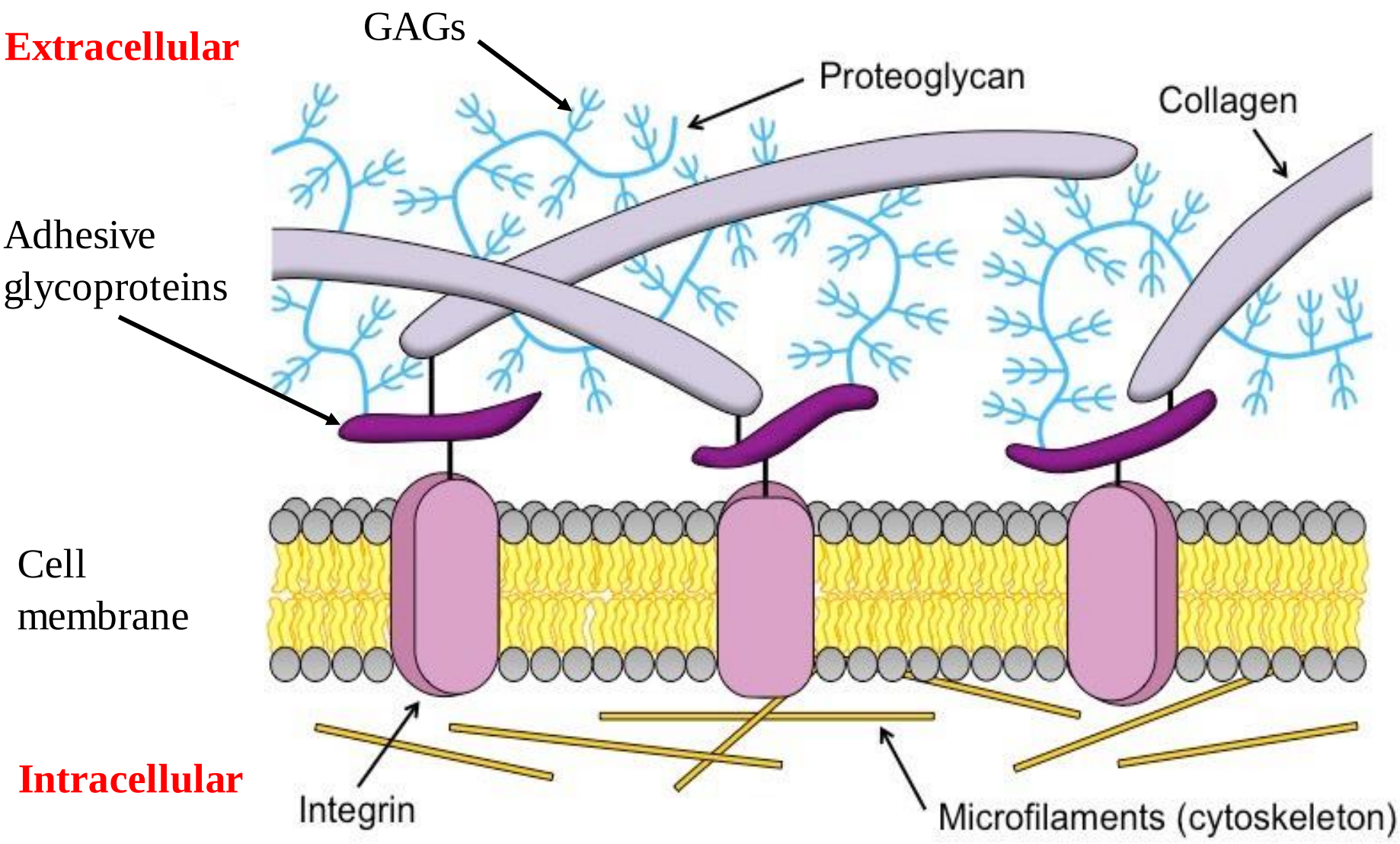
1- Fibronectin: present in CT.

2- Chondronectin: present in cartilage.

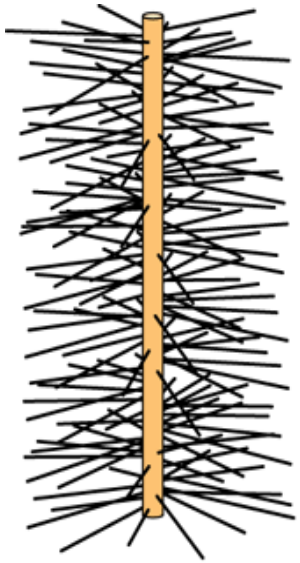
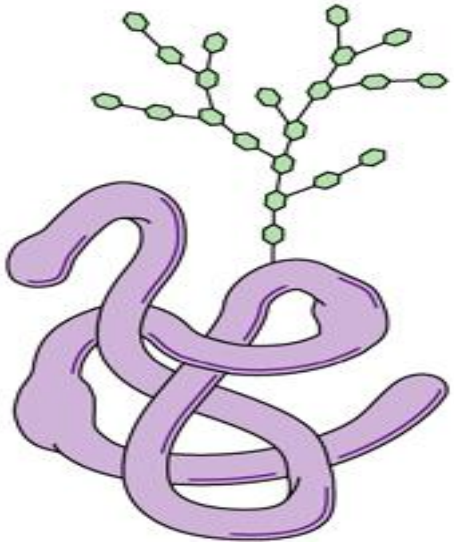
3- Laminin: present in basal laminae.



The adhesive glycoproteins bind the other components of the extracellular matrix with the C.T. cells.



Comparison between proteoglycans and glycoproteins

Proteoglycans	Glycoproteins
Carbohydrates moiety predominates	Proteins moiety predominates
Linear polysaccharides	Branched oligosaccharides
Repeated disaccharides	Monosaccharides
Heavily glycosylated proteins. Sulphated GAGS & have a protein core	Protein conjugated with branched oligosaccharides.
	

Functions of the ground substance

1- Supportive as in cartilage (viscous nature).

2- Protection: Act as barrier against invaders as bacteria by their jelly like structure (GAGS + many H2O and ions).

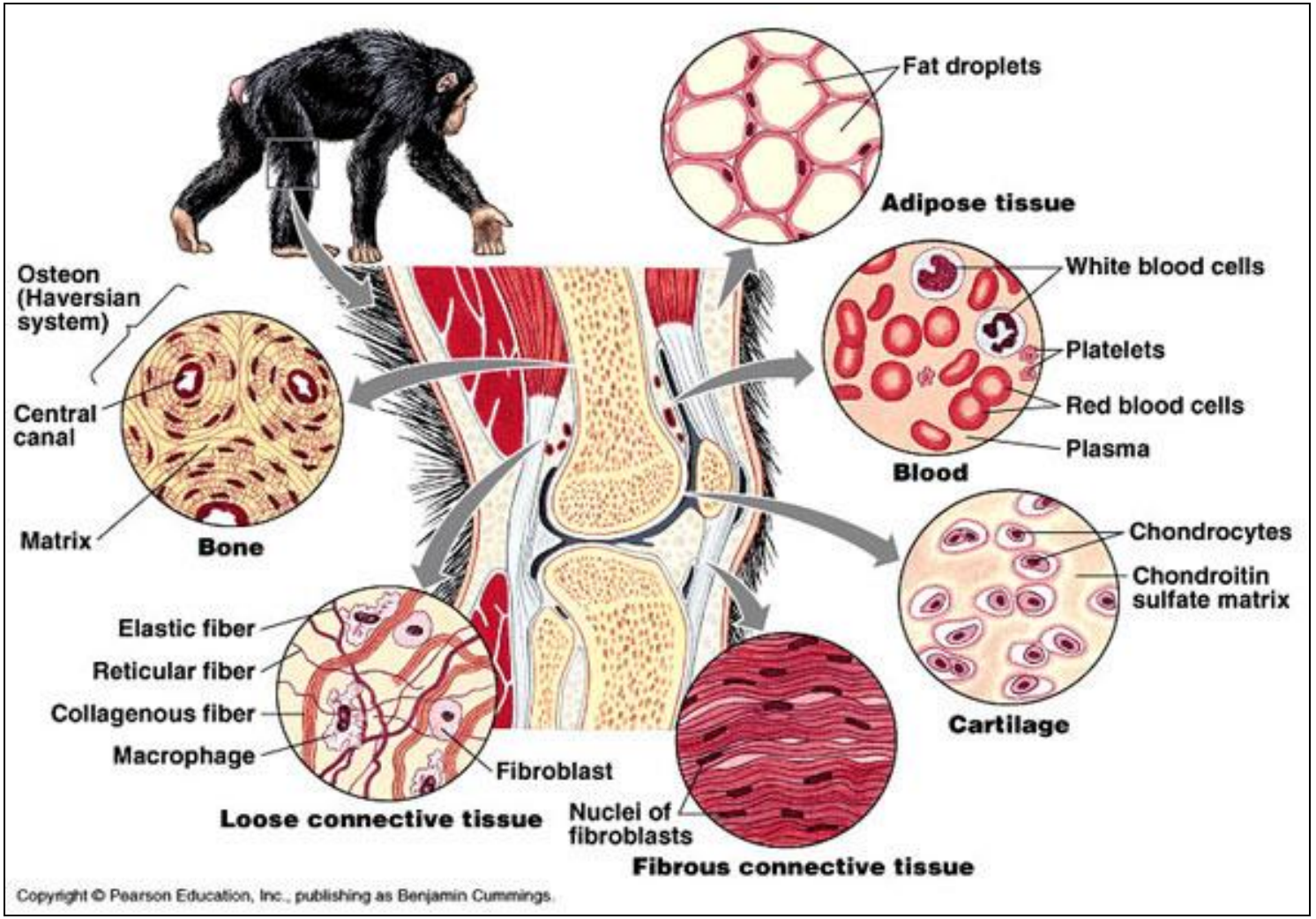
3- Bind growth factors and can inhibit and activate these factors.

4- Transport tissue fluid through their meshes.

5- Lubricant as in joints and synovial membranes.

6- Adhesion of cells to the surroundings

Types of C.T


Fat droplets
Adipose tissue
Osteon (Haversian system)
Central canal
Matrix
Bone
White blood cells
Platelets
Red blood cells
Plasma
Blood
Chondrocytes
Chondroitin sulfate matrix
Cartilage
Elastic fiber
Reticular fiber
Collagenous fiber
Macrophage
Fibroblast
Loose connective tissue
Nuclei of fibroblasts
Fibrous connective tissue
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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

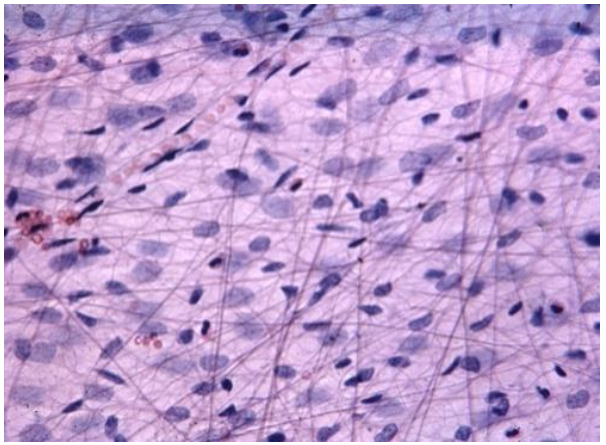
1-Loose (areolar) connective tissue

- 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.



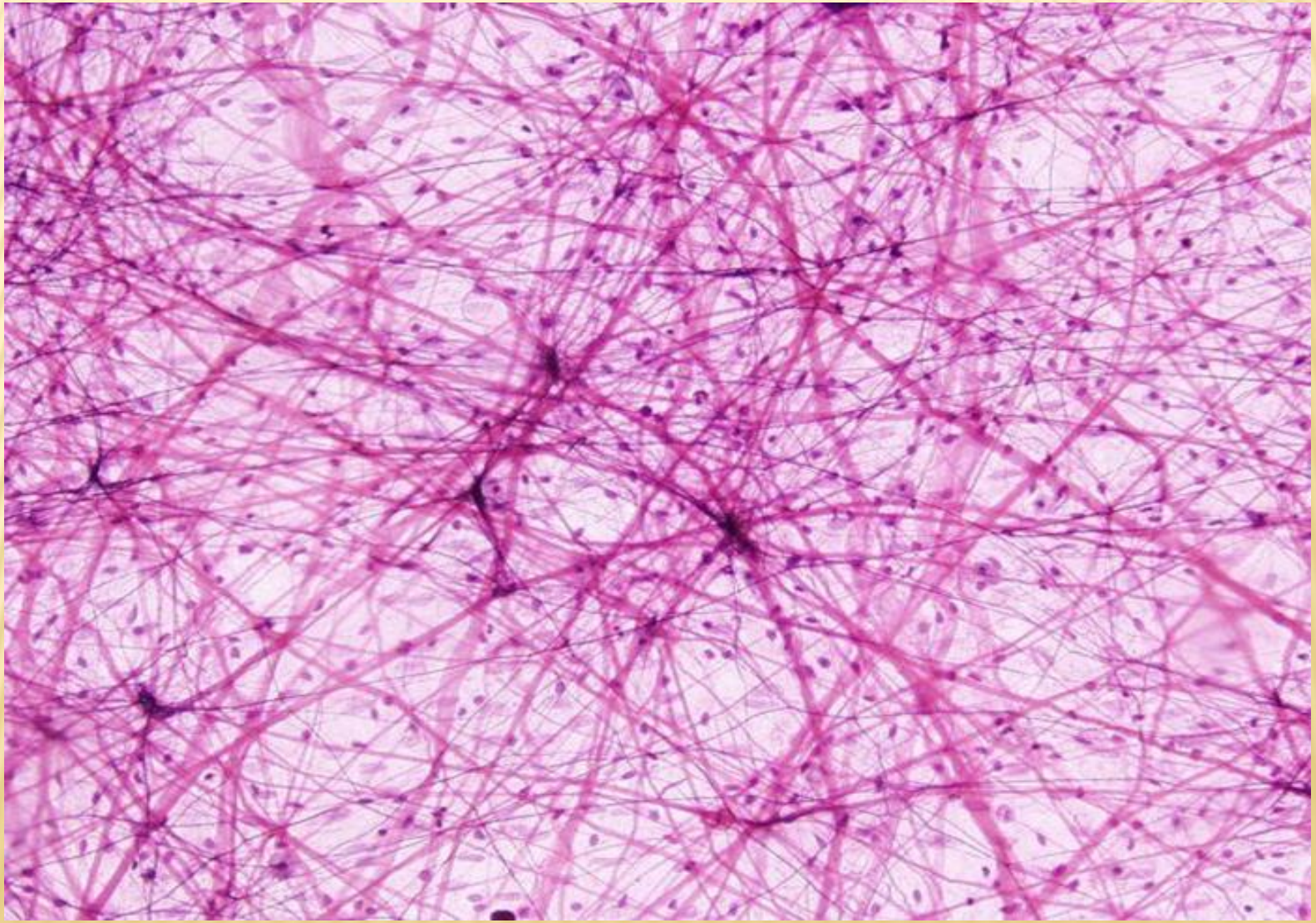
- **Character:- It is flexible**
- **Sites**

- It fills the spaces between muscle sheaths.

- It supports epithelial tissue.

- It ensheathes the blood and lymphatic vessels.

LOOSE C.T



2- Dense connective tissue

- **Structure:**

Cells:

- few cells

Fibers:

It is mainly formed of collagenous fibers

GS:

Reduced ground substance

- **Character:**

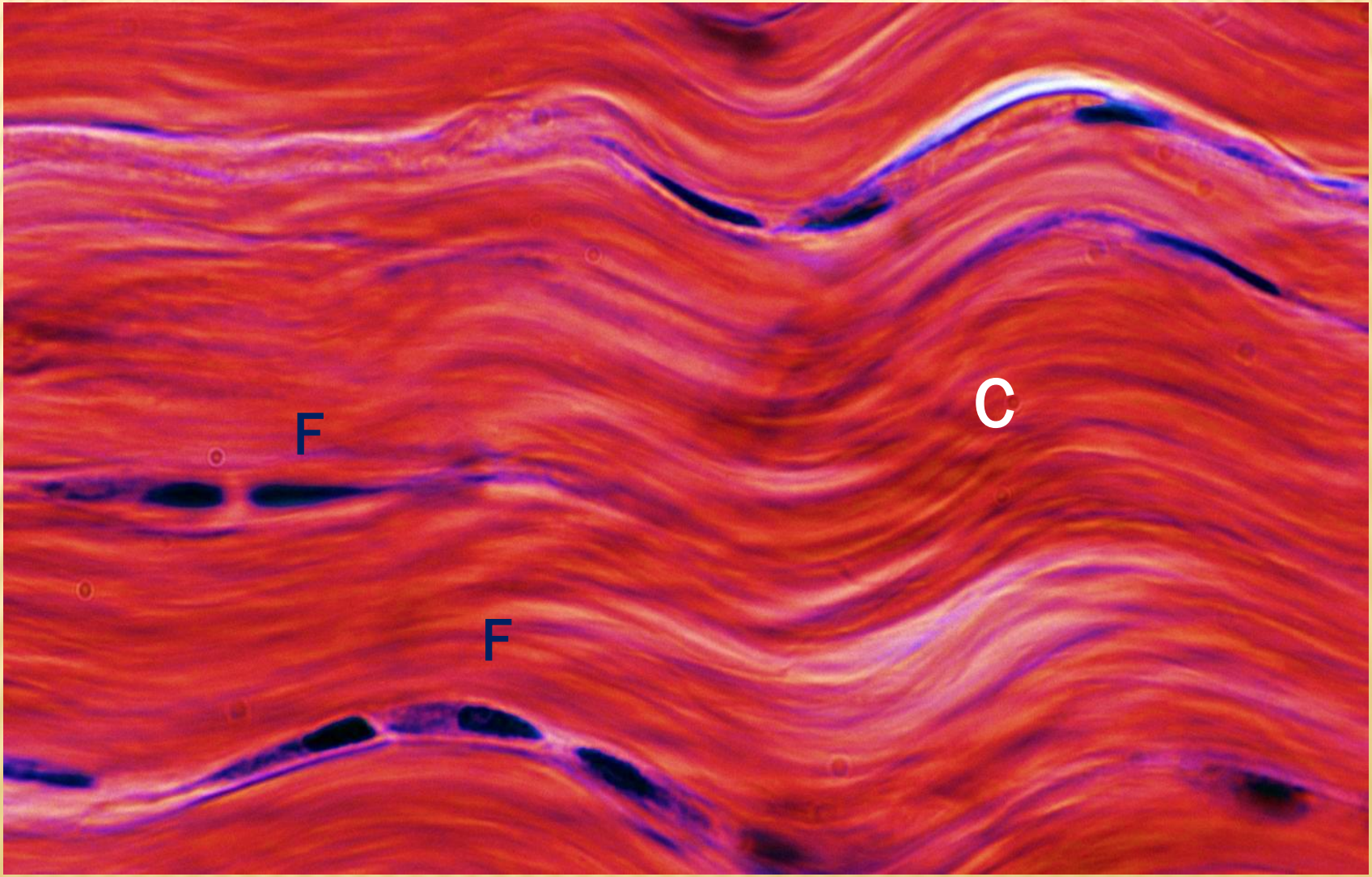
-Resist stretch

- **Types:**

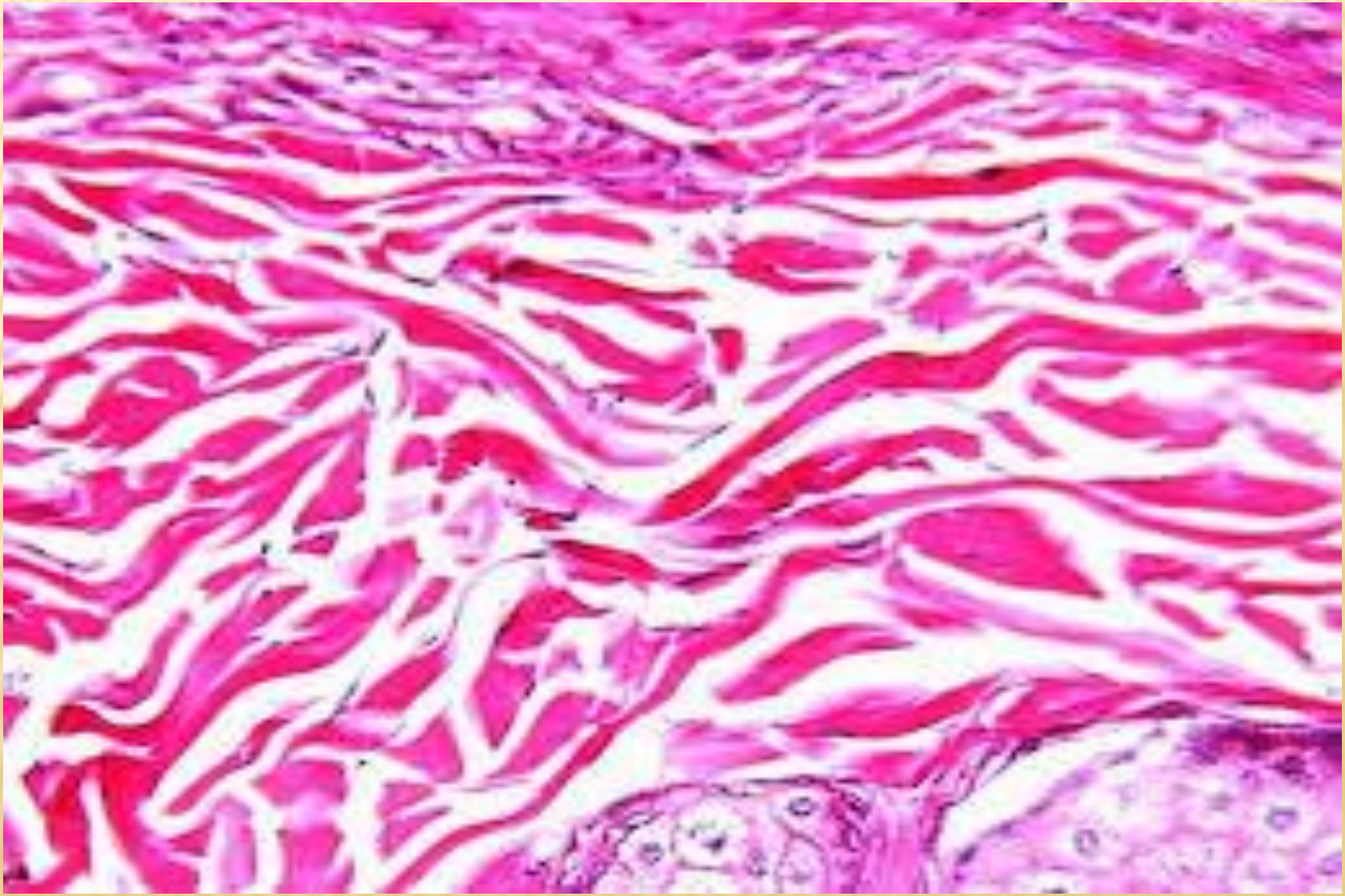
a) Dense regular connective tissue

b) Dense irregular connective tissue

DENSE REGULAR C.T



DENSE IRREGULAR C.T



Types of dense connective tissue

Dense irregular connective tissue:

Structure:

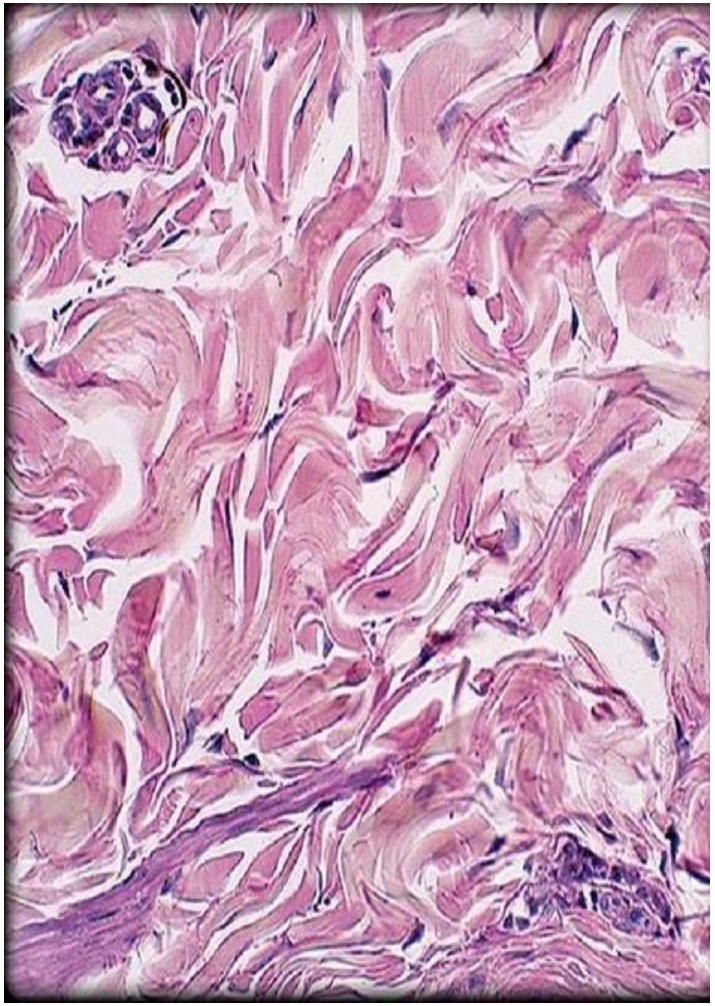
- The collagenous bundles are irregularly arranged without definite orientation and run in different directions.
- Few C.T cells
- little amount of ground substance.

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:

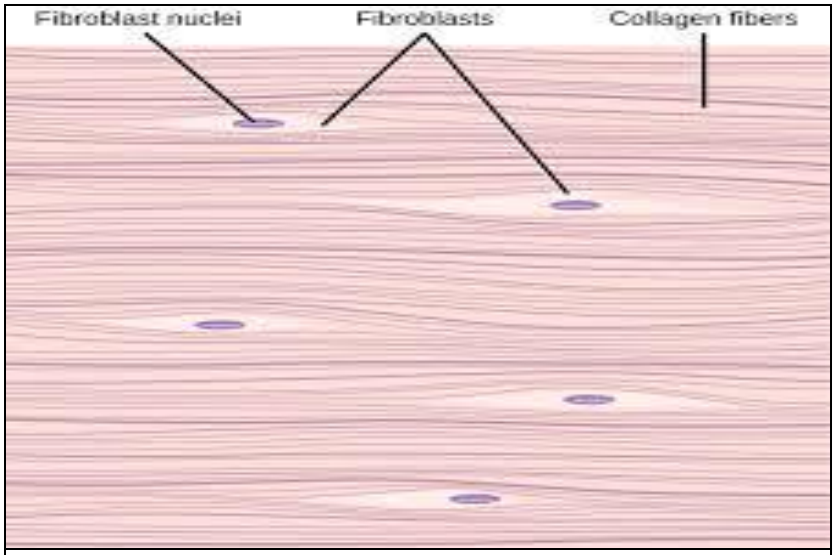
- The collagen bundles are arranged in regular pattern .
- Fibroblast are located between the collagen bundles with their long axis parallel to the bundles

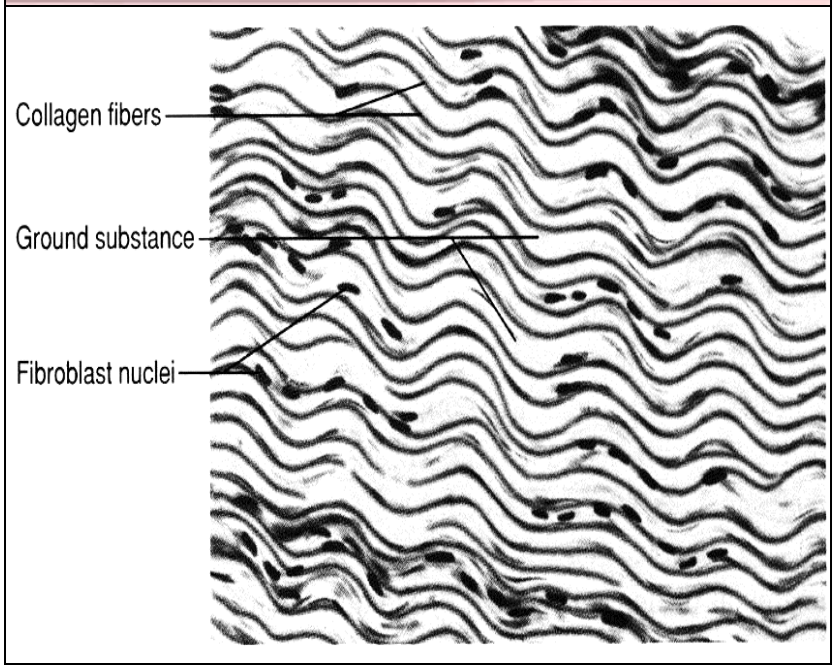
Function:

- It withstand prolonged stretch in one direction

Site:

- Tendons
- Ligments



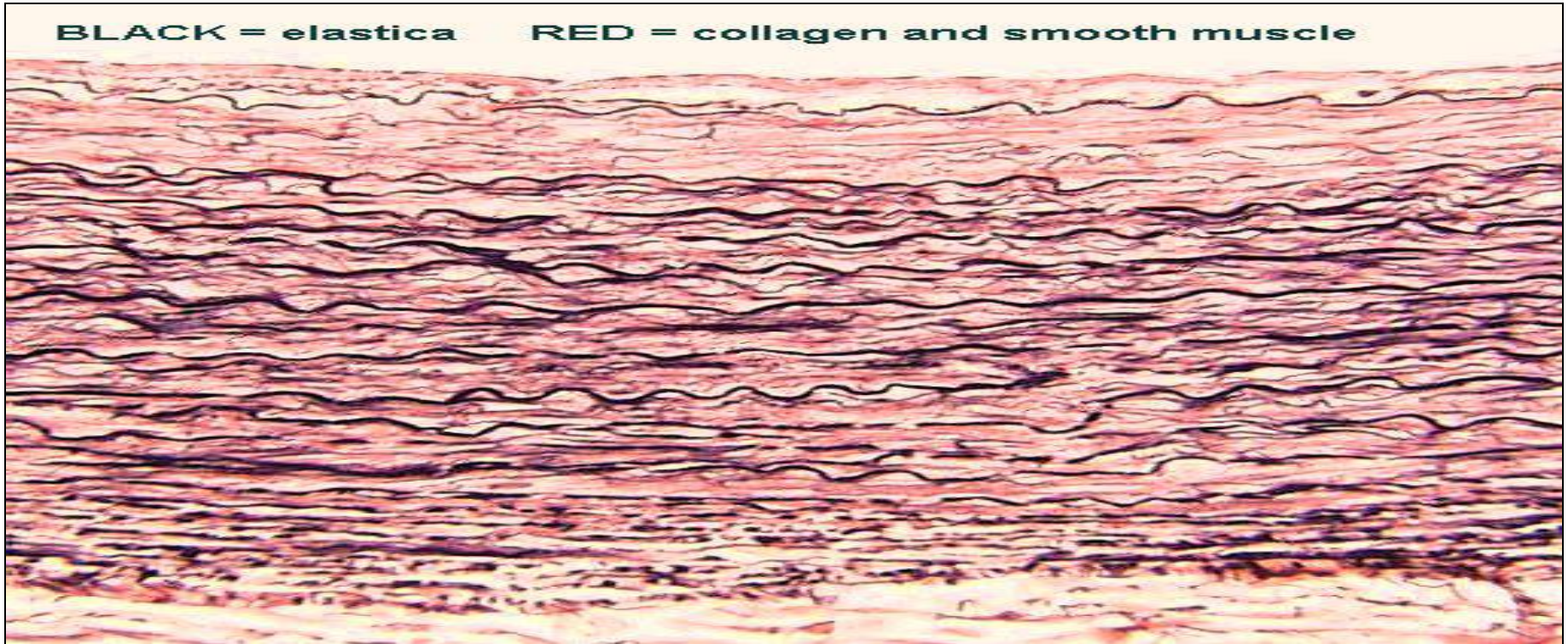


Specialized connective tissue

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.

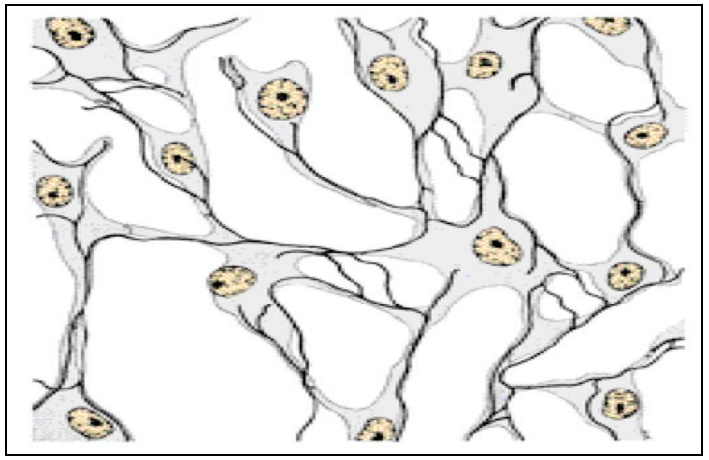
2- **Reticular fibers** (collagen III)

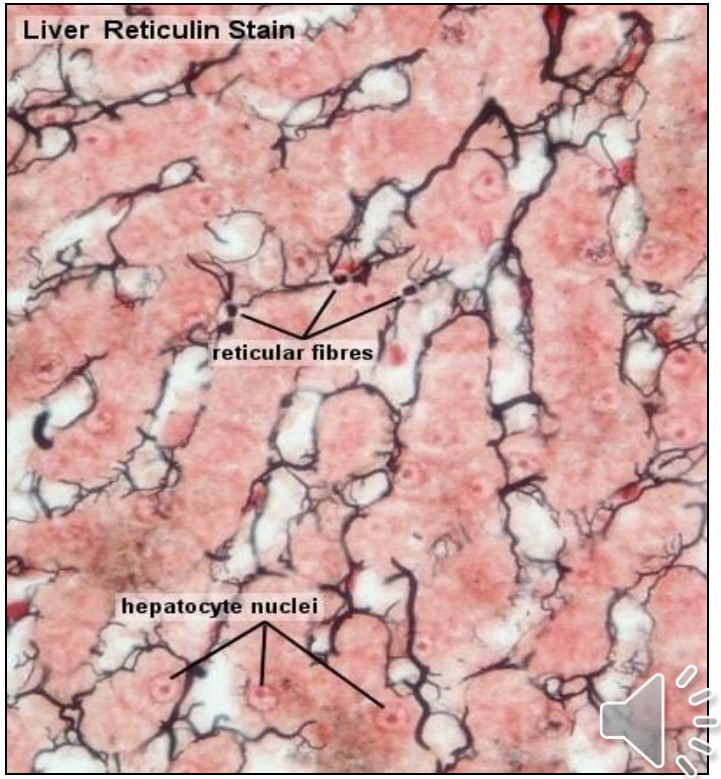
- - Reticular cells and fibers create **spongy like structure** within which cells and fluids are mobile.

3- **Ground substance.**

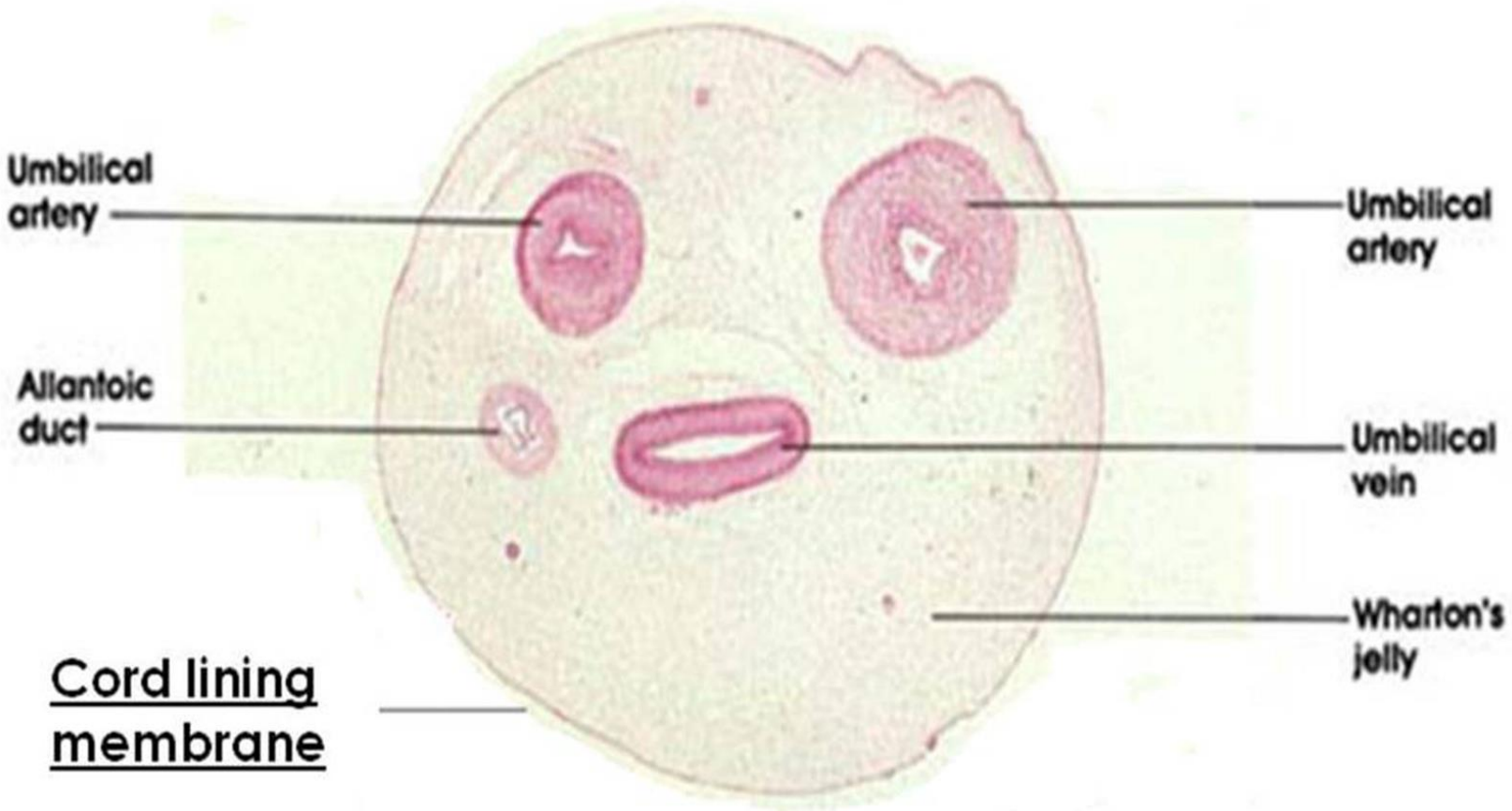
4- **Mononuclear macrophages**

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





Mucoid connective tissue



Mucoid connective tissue

- **Structure:**

- **Cells:**

Mainly fibroblasts whose processes fuse with those of adjacent cells.

- **Fibers:**

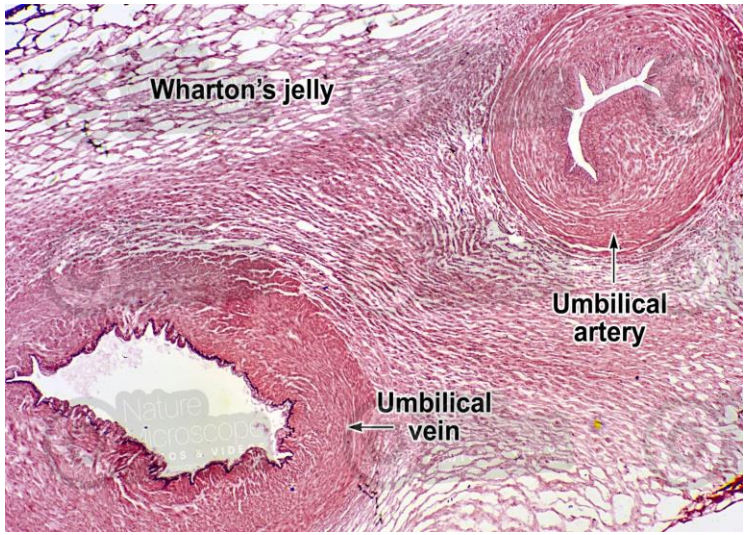
Few collagen, elastic and reticular fibers

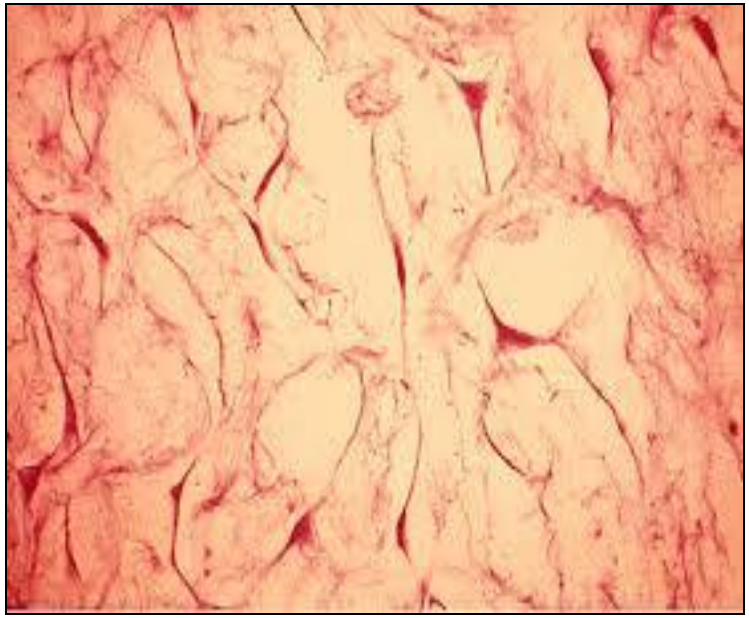
- **GS:**

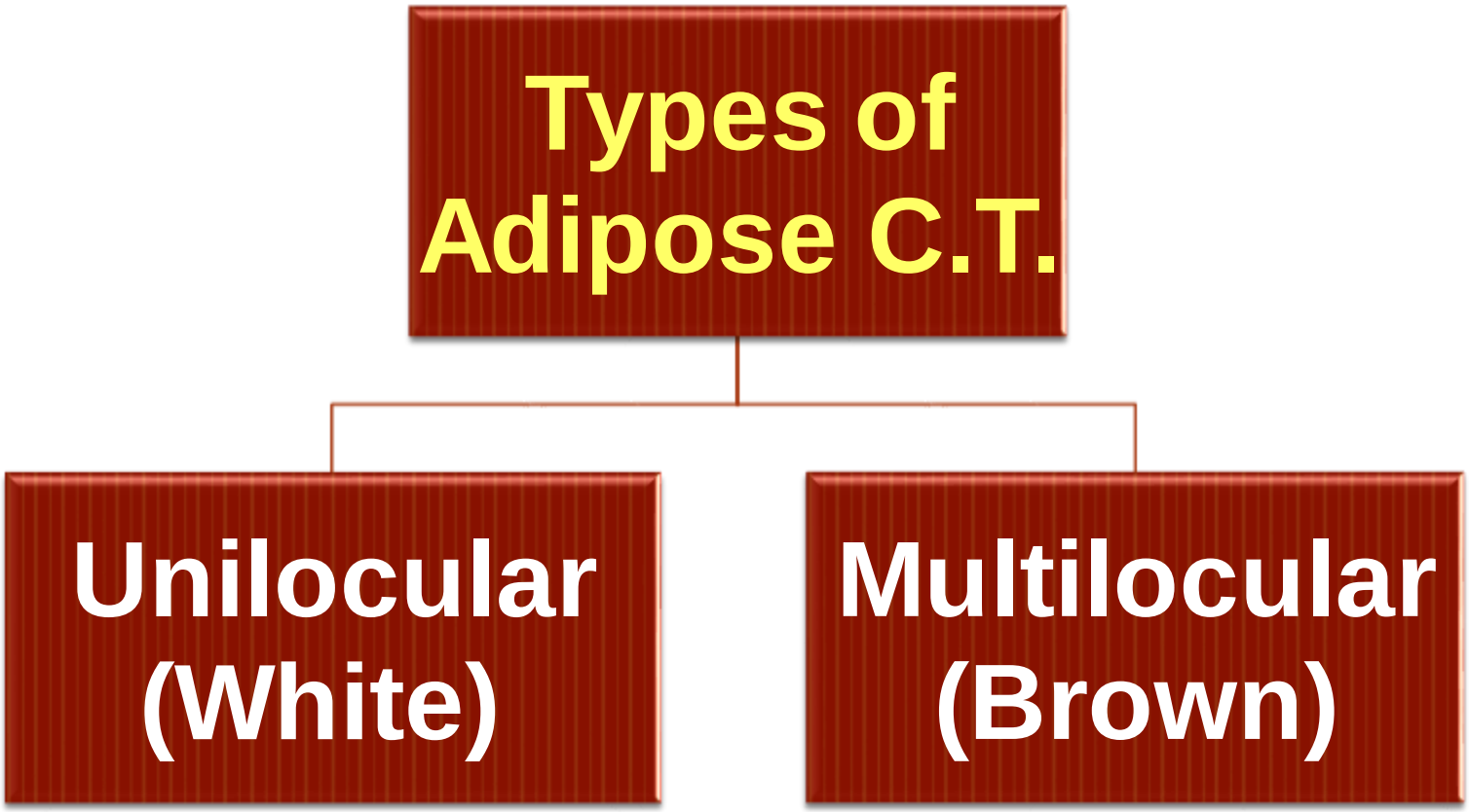
It has ***abundant jelly like matrix***

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:***

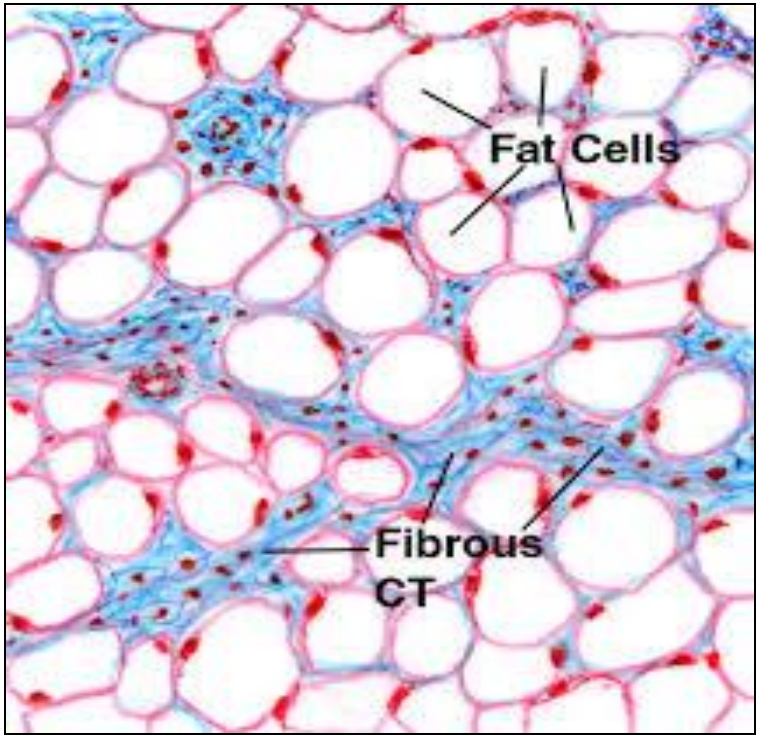
-It is present throughout the body (most common type in human) and is affected by sex and age.

-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 :***

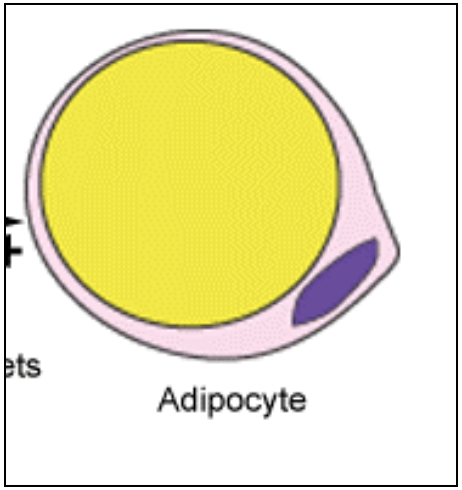
peripheral and flattened (signet ring appearance).

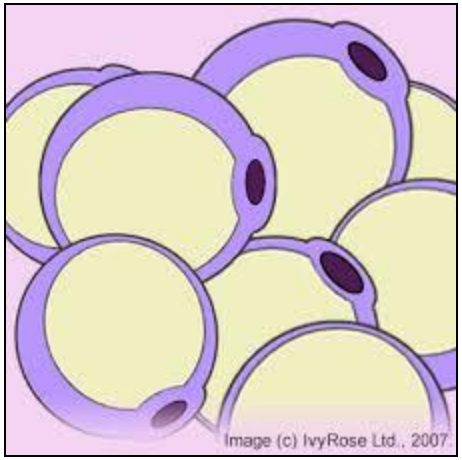
- ***Cytoplasm:***

- 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

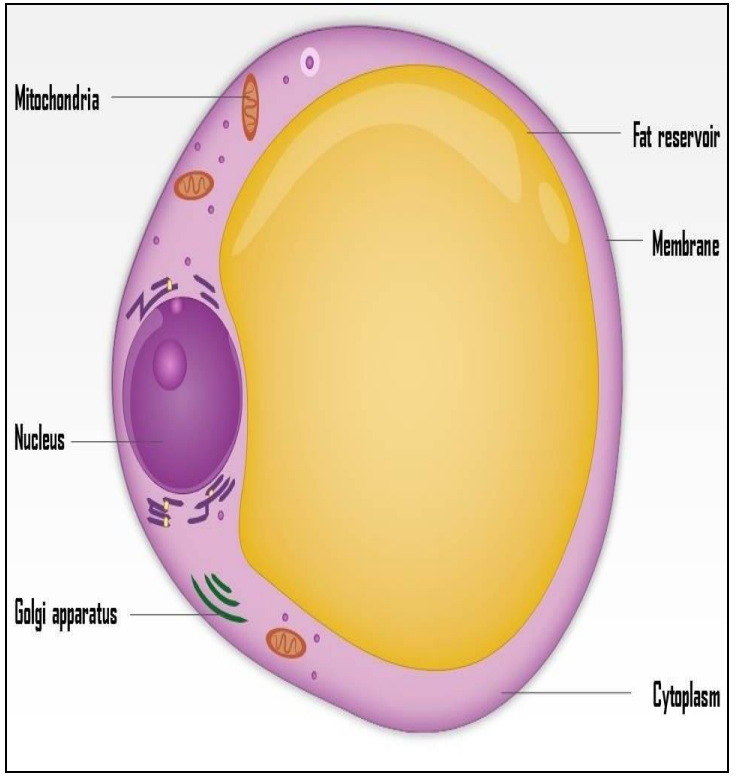
3- Few RER and free polyribosome.

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

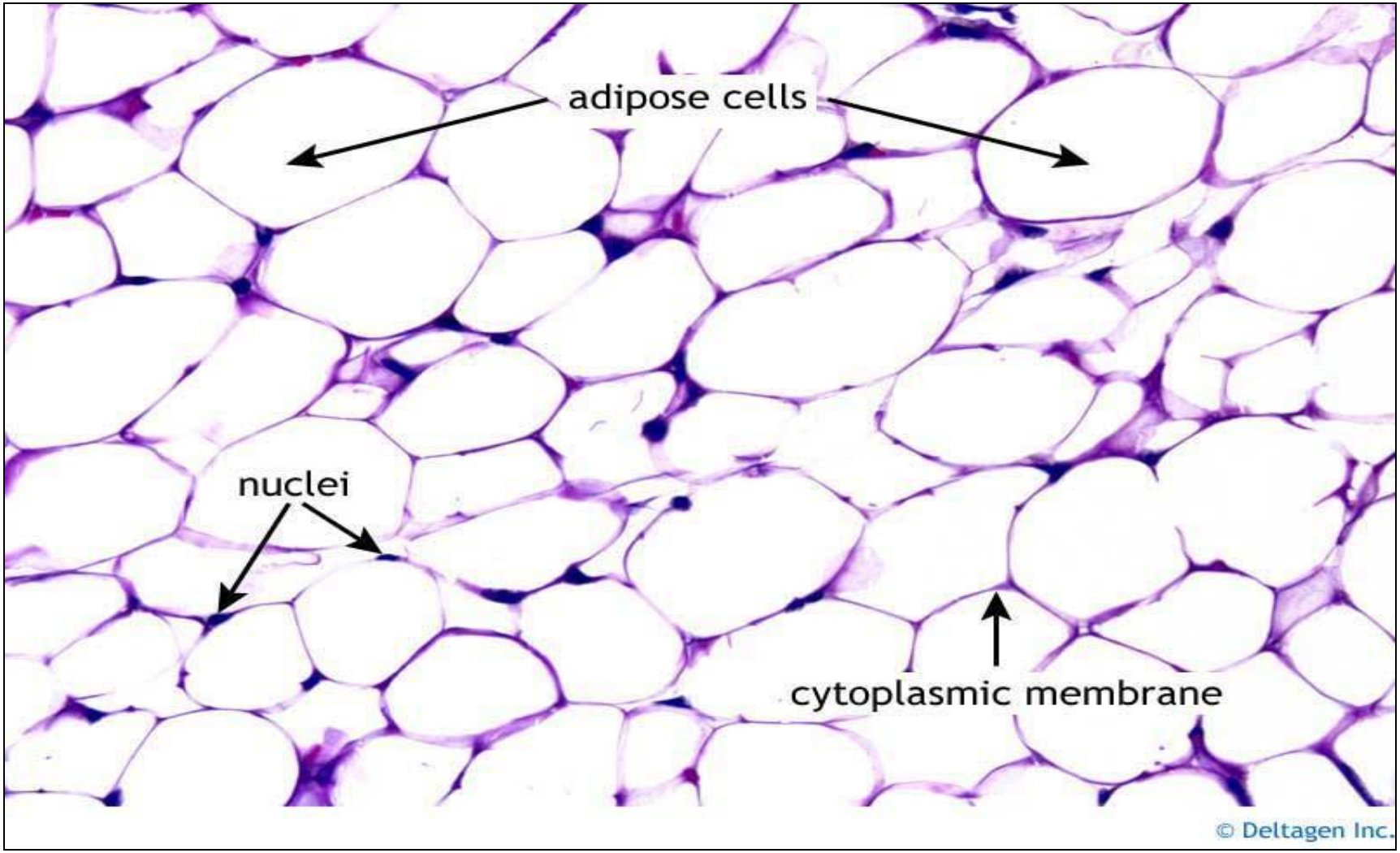
1-Vesicles of SER

2- Occasional microtubules

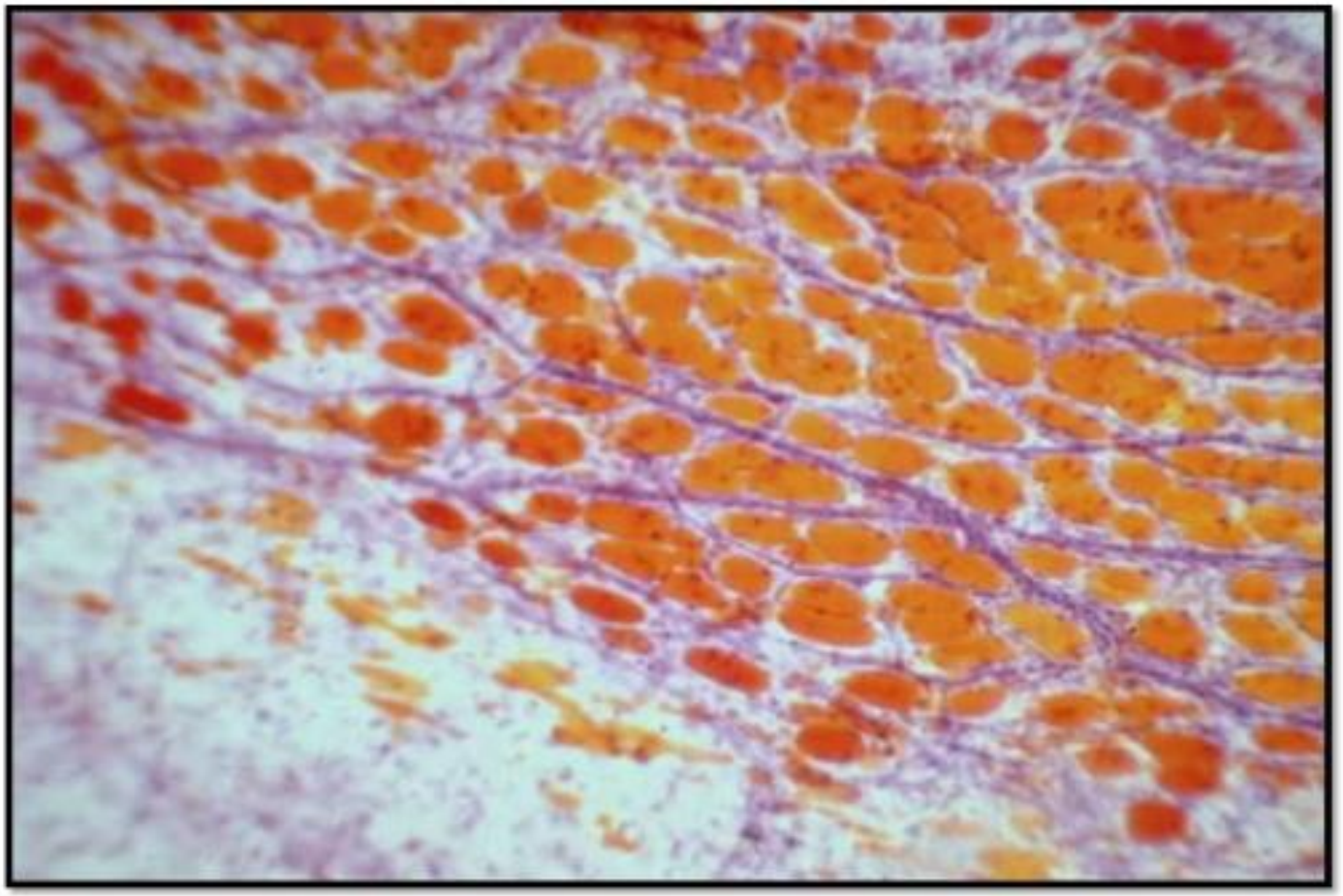
3- Numerous pinocytic vesicles



Unilocular (White) adipose C.T.



L.M. Adipocytes stained with Sudan III



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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.

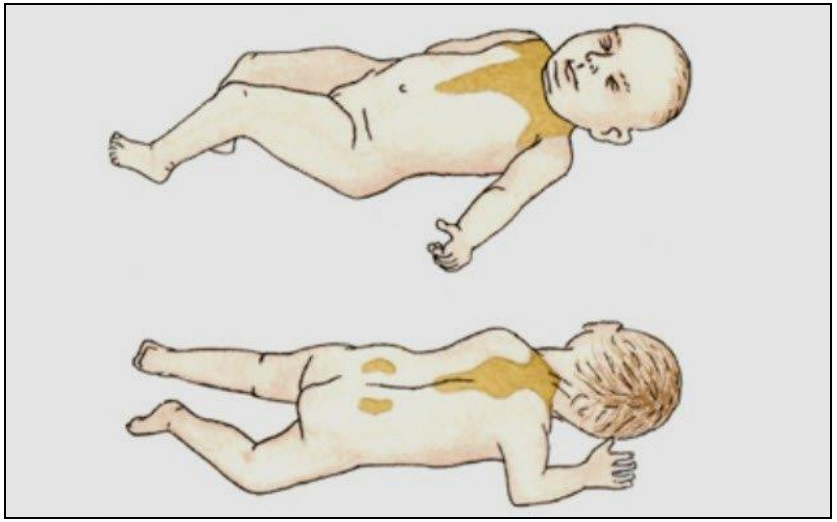
5- Fills the spaces between other tissues and keep some organs in position

2 - Multilocular adipose tissue (brown fat)

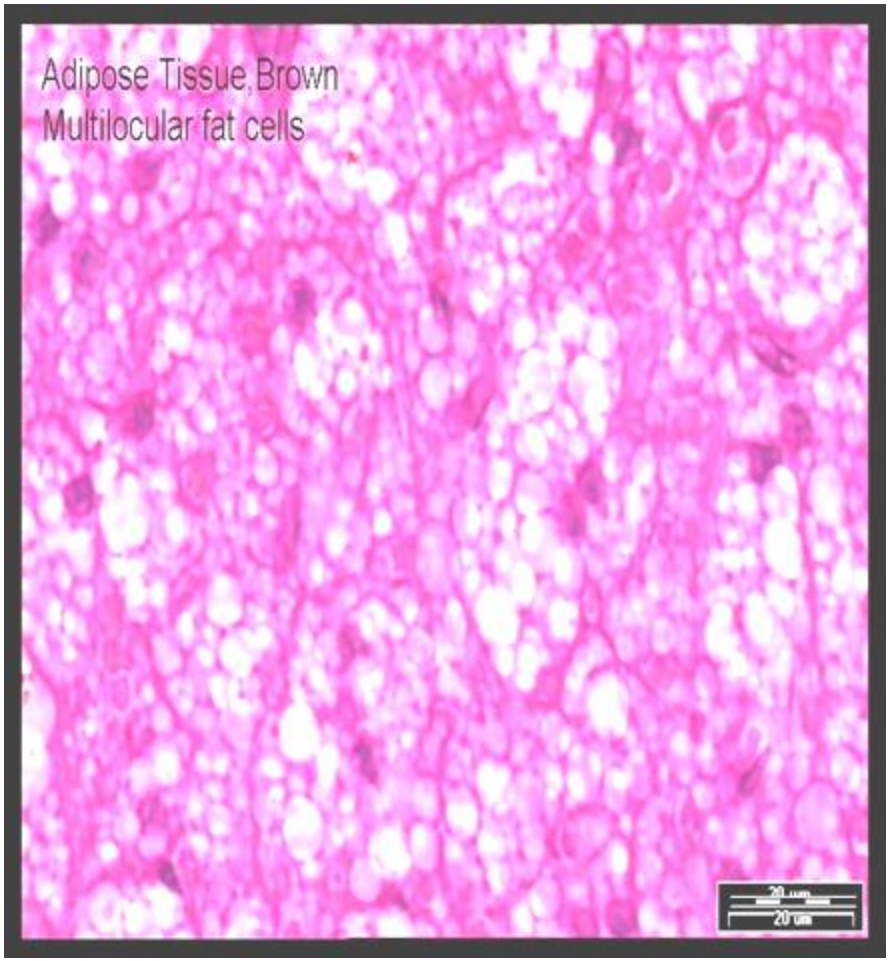
- It is greatly reduced in adult.
- ***Sites:*** - In hibernating animals.
  - In human newborn (e.g. neck, axilla, and mediastinum).
- ***Functions:***

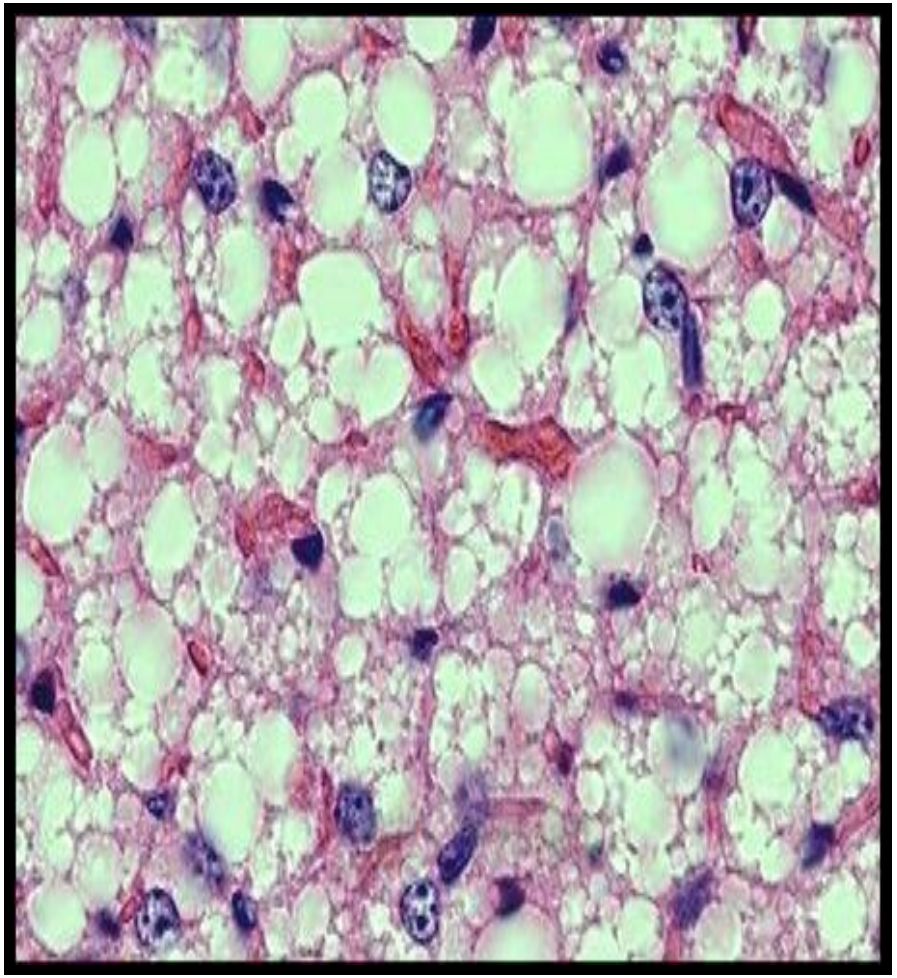
-In animals It transforms the stored chemical energy to heat when stimulated.

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



Brown (multilocular) adipose C.T.





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.

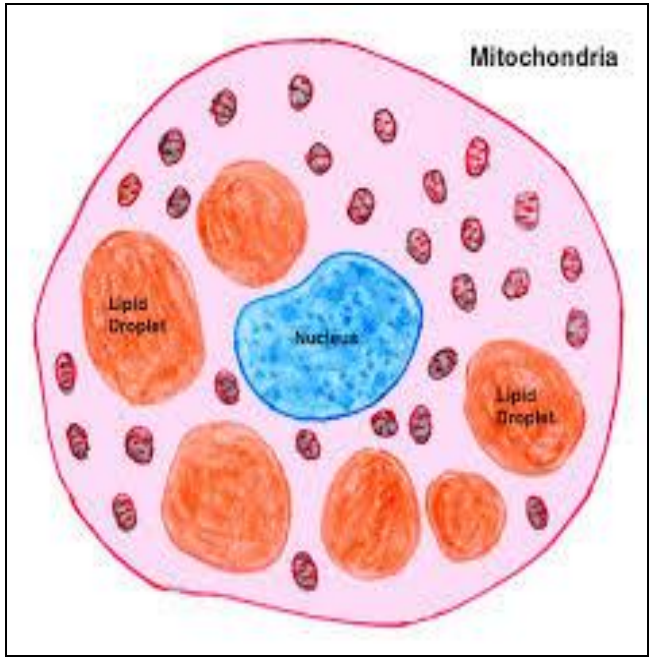
E/M:

- 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.




Thank
you!!