

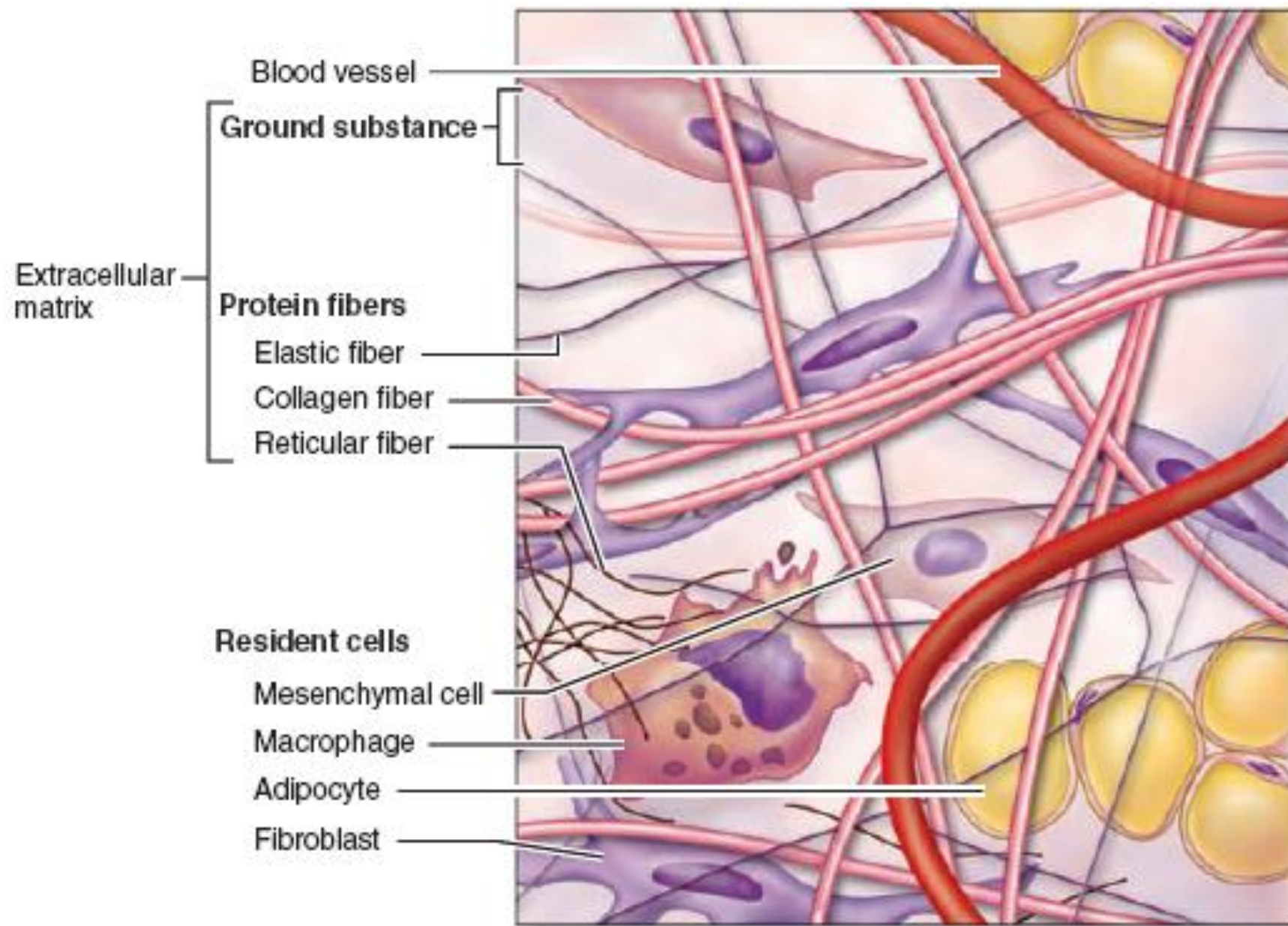
Connective Tissue Proper

By:

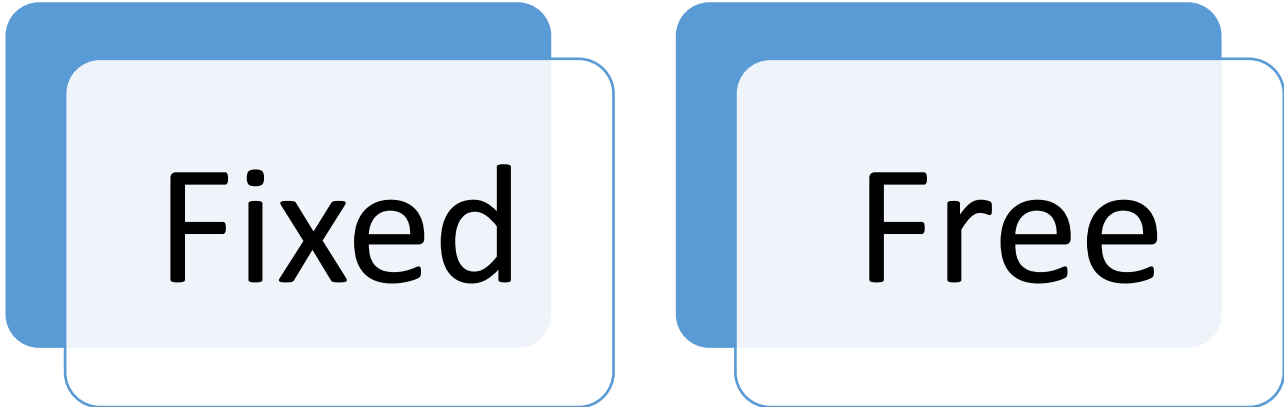
Dr. Musab Husein
MBChB, Msc

Definition

- It is a type of tissue specialized to physically support and connect other tissue and maintain the water required for metabolic diffusion to and from cells.
- Unlike the other tissue types which consist mainly of **cells**, the major constituent of connective tissue is the **extracellular matrix (ECM)**.
- Extracellular matrices consist of different combinations of **protein fibers** (such as collagens and elastic fibers) and **ground substance**.
- Ground substance is a complex of anionic, hydrophilic proteoglycans, glycosaminoglycans (GAGs), and multiadhesive glycoproteins (laminin, fibronectin, and others).



Types of C.T cells:



Fixed

Free

Fixed C.T cells:

- 1- Fibroblast and fibrocyte.
- 2- Adipose cells (Adipocytes)
- 3- Mesenchymal cells
- 4- Endothelial cells
- 5- Reticular cells.

1- Fibroblast :

Fibroblast develop from mesenchymal cell.

Fibroblast can divide and can change into myofibroblast.

Functions:

- 1- Form collagen elastin and reticulin substance in order to form C.T fibers.
- 2- Form mucoprotein of matrix.
- 3- Increase in number during healing of wounds.
- 4- Convert into myofibroblast which can close wounds during injury.



Fibroblast Cells

2- Adipose cells:

There are 2 types:

1- white cell (unilocular).

2- brown cell (multilocular)

Are present mainly in adipose tissue.

Function:

1- **brown**: reservoir energy and heat production.

2- **white**: release energy during starvation, they give body contour and heat production.



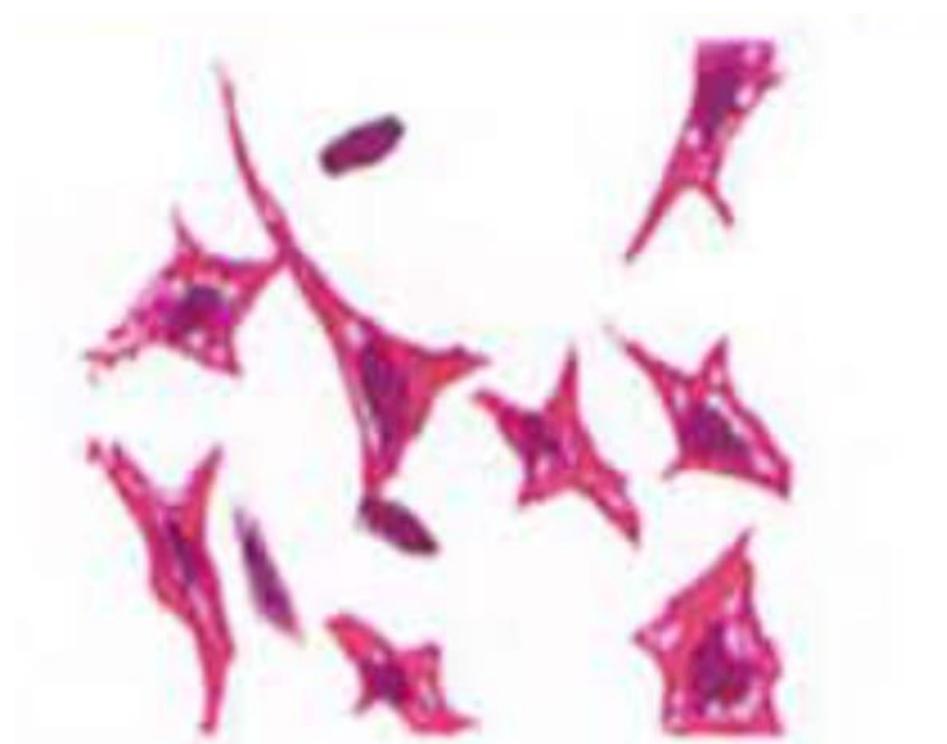
Two Fat Cells

3- Undifferentiated mesenchymal cells U.M.C:

Its embryonic mesenchymal branched cell.

Its present only in embryonic tissue.

Function: it can differentiate into other type of C.T cells.



Mesenchymal Cells

4-Endothelial cells :

Present in entire surface of capillaries and blood vessels.

Function:

1-Synthesis collagen type VI.

2-They can divided to form new capillaries in tissue injury

3-They can form basal lamina of endothelium.

Endothelial cells of lung capillaries secrete ACE.

5- Reticular cells:

- * They present mainly in reticular C.T.
- * They are modified fibroblast which are specialized to secrete fibers.
- * Reticular cells are found in stroma of bone marrow, lymph nodes, spleen, liver, pancreas and other organs.

Function:

- 1- they form stroma of bone marrow and glands.
- 2- They remove cellular debris from the lymphatic tissue.

Free C.T cells:

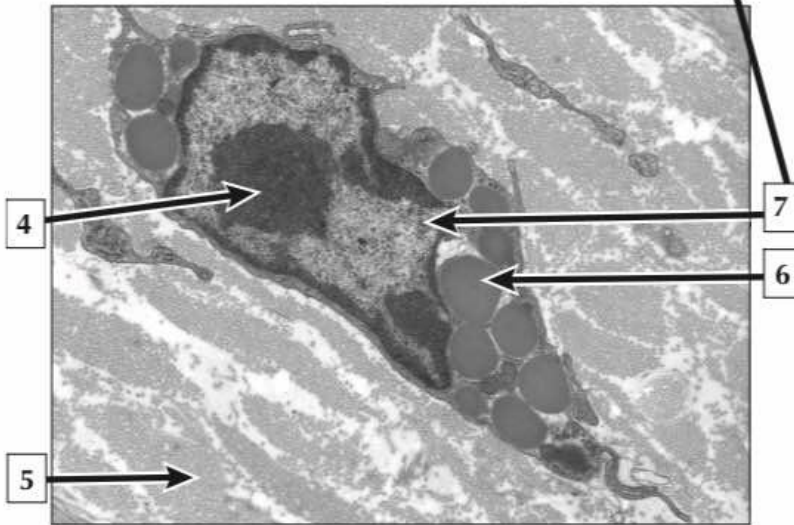
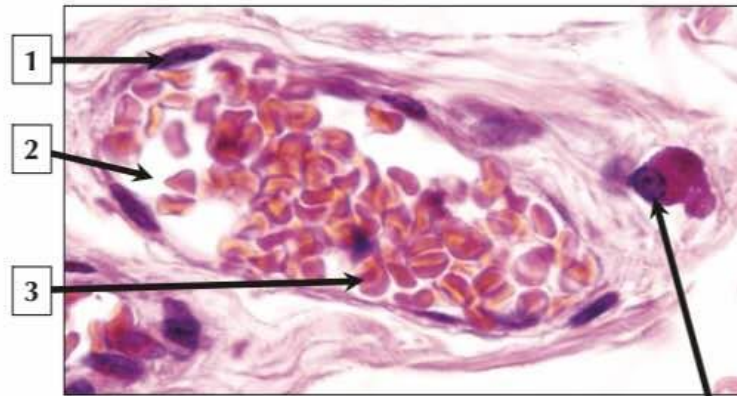
1- Mast cells:

They are small cells.

They are usually present in groups around B.V.

Types:

- 1- Heparin secretory: present in C.T of skin, they secrete heparin.
 - 2- Histamine secretory: found under the mucosa of respiratory and digestive tract they secrete histamine.
- The surface of both mast cells contains specific receptors for IgE.



Mast cell

Function:

- 1- They secrete heparin or histamine.
- 2- They release chemical mediators as immediate hypersensitivity factors which may cause anaphylactic shock.

2- Plasma cells:

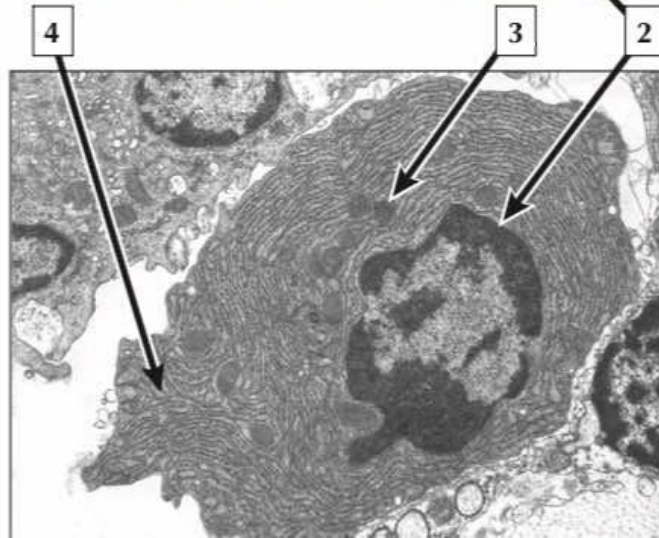
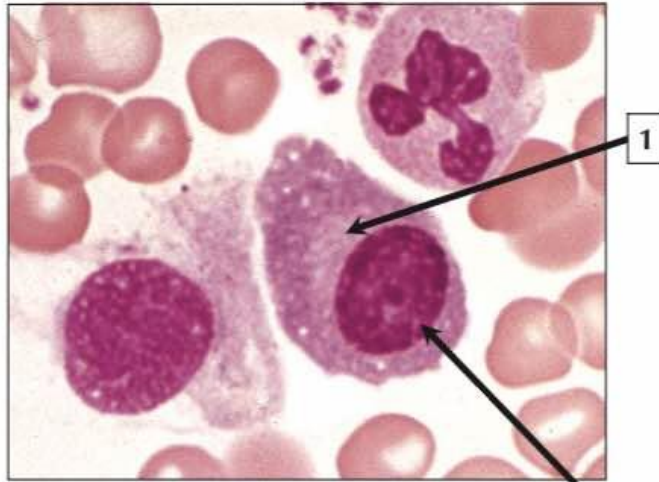
These cells are present in C.T of digestive, respiratory tract, lymph node and spleen.

They originate from plasma blast cells which develop from B-lymphocyte.

Function:

Secrete specific antibodies against organism and foreign bodies.

Increase in certain inflammatory condition to secrete specific antibodies.



Plasma cell

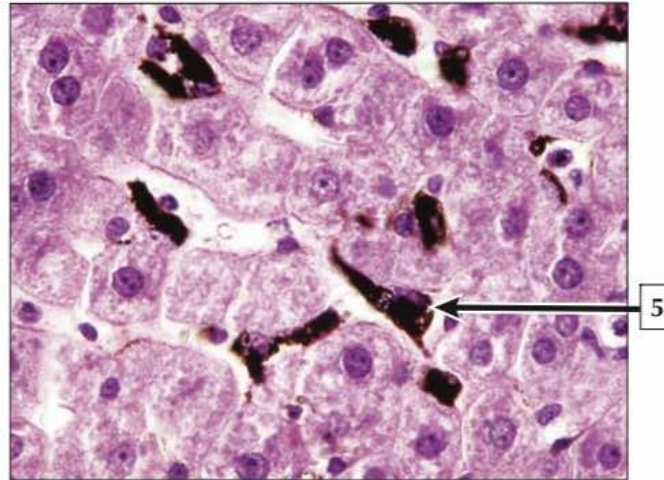
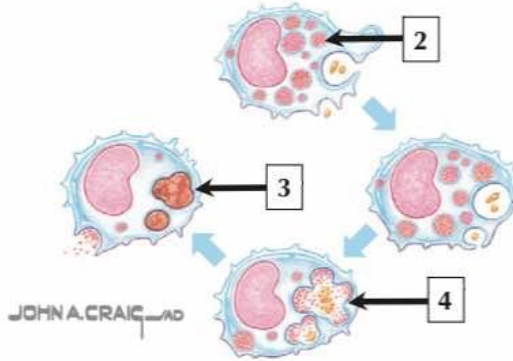
3- Free macrophages:

These cells are derived from blood monocytes after their migration to C.T.

Function:

- 1-They participate in the immune system.
- 2- they are highly phagocytic cells.
- 3- Secrete collagenase and elastase enzymes and lysozyme.
- 4- They can kill certain viruses through secretion of interferon.

1 Name the cellular process illustrated below.



Rat liver 1 hr after exposure to india ink

Macrophage

4- Blood leukocytes:

Its appear normaly in in the C.T of the following body organs:

Eosinophils and basophils: found in the C.T of respiratory, intestinal and female genital tracts . They increase in allergic condition.

Lymphocytes: increase in chronic infection.

Neutrophils: they migrate from B.V to C.T it increase in acute infection.

TABLE

**Functions of cells in connective tissue proper.**

Cell Type	Major Product or Activity
Fibroblasts (fibrocytes)	Extracellular fibers and ground substance
Plasma cells	Antibodies
Lymphocytes (several types)	Various immune/defense functions
Eosinophilic leukocytes	Modulate allergic/vasoactive reactions and defense against parasites
Neutrophilic leukocytes	Phagocytosis of bacteria
Macrophages	Phagocytosis of ECM components and debris; antigen processing and presentation to immune cells; secretion of growth factors, cytokines, and other agents
Mast cells and basophilic leukocytes	Pharmacologically active molecules (eg, histamine)
Adipocytes	Storage of neutral fats

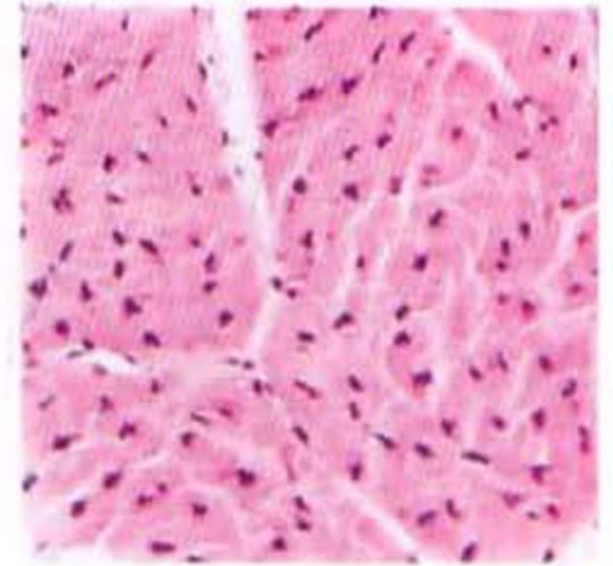
C.T. fibers:

Types of C.T fibers:

- 1- white collagenous fibers.
- 2- yellow elastic fibers.
- 3-Reticular fibers.

1-White collagenous fibers:

- *They are colorless wavy branching bundles.
- *Are soft, strong and flexible.
- *They are formed of protein called collagen.
- *Types of collagen according to the chain of amino acids:
 - 1- Type I.
 - 2- Type II.
 - 3- Type III.
 - 4- Type IV.
 - 5- Type V.



**White Collagenous C.T.
(T.S. In Tendon)**

2- Elastic fibers:

- *They are fine, straight branching in shape.
- *They are stretchable fibres and appear yellow in fresh state.
- *Formed from protein known as elastin.



**Elastic C.T. In Aorta
(Orcein Stain)**

3- Reticular fibers:

- * They are very thin fibers.
- * They branch to form a network or reticulum.
- * They are formed of collagen type III.



Reticular C.T.

TYPES OF C.T

	General Organization	Major Functions	Examples
Connective Tissue Proper			
Loose (areolar) connective tissue	Much ground substance; many cells and little collagen, randomly distributed	Supports microvasculature, nerves, and immune defense cells	Lamina propria beneath epithelial lining of digestive tract
Dense irregular connective tissue	Little ground substance; few cells (mostly fibroblasts); much collagen in randomly arranged fibers	Protects and supports organs; resists tearing	Dermis of skin, organ capsules, submucosa layer of digestive tract
Dense regular connective tissue	Almost completely filled with parallel bundles of collagen; few fibroblasts, aligned with collagen	Provide strong connections within musculoskeletal system; strong resistance to force	Ligaments, tendons, aponeuroses, corneal stroma
Embryonic Connective Tissues			
Mesenchyme	Sparse, undifferentiated cells, uniformly distributed in matrix with sparse collagen fibers	Contains stem/progenitor cells for all adult connective tissue cells	Mesodermal layer of early embryo
Mucoid (mucous) connective tissue	Random fibroblasts and collagen fibers in viscous matrix	Supports and cushions large blood vessels	Matrix of the fetal umbilical cord
Specialized Connective Tissues			
Reticular connective tissue	Delicate network of reticulin/ collagen III with attached fibroblasts (reticular cells)	Supports blood-forming cells, many secretory cells, and lymphocytes in most lymphoid organs	Bone marrow, liver, pancreas, adrenal glands, all lymphoid organs except the thymus
Adipose Tissue			
Cartilage			
Bone			
Blood			

Functions of C.T. proper:

- 1- Support and connect different organs and tissue together.
- 2- Through the C.T., B.V, nerve and lymph vessel reach the organs.
- 3- C.T plasma cells secrete antibodies, mast cells secrete histamine and heparin.
- 4- C.T. is important in regeneration and healing of wounds.
- 5- Some C.T cells are important for body defense and immune response.

Loose (areolar) C.T.:

- *Its common type of C.T in the human body.
- *It contains all types of cells and fibers.

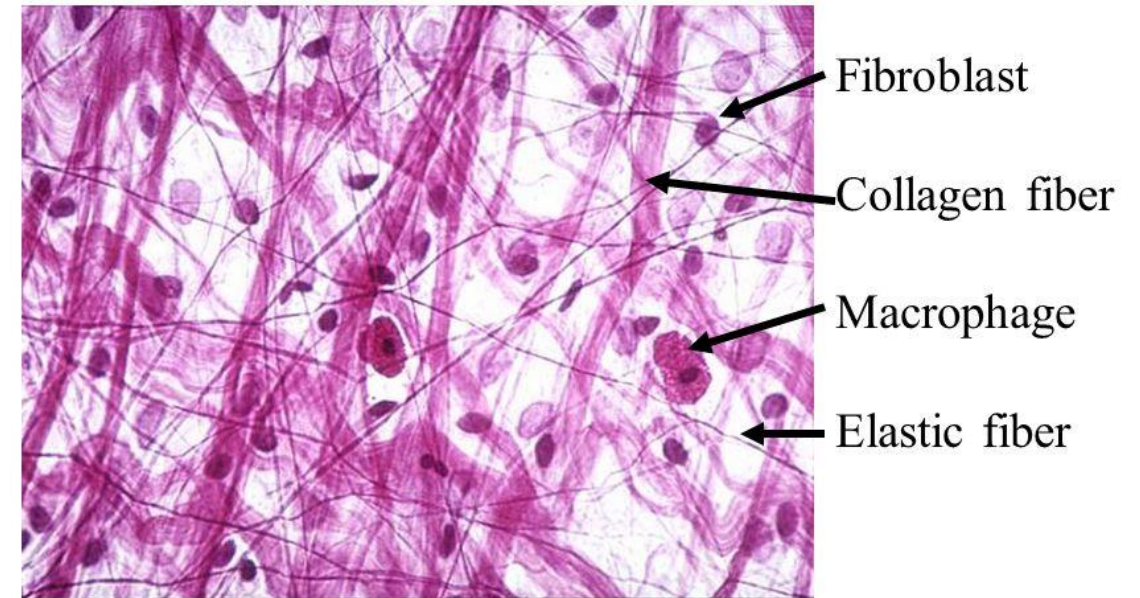
Function: it acts as packaging material for other tissues.

Structure:

- 1- loose matrix
- 2- C.T cells mainly fibroblast, macrophage, fat & mast cells.
- 3- C.T fibers mainly collagenous.

- *Site: present all over the body except the brain.

Areolar Connective Tissue (Loose)

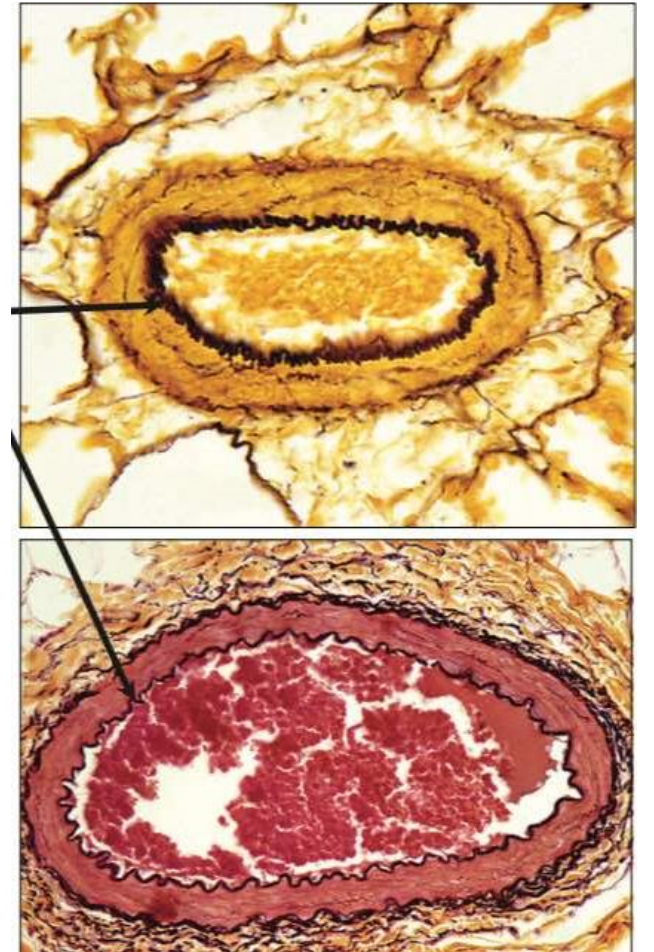


Elastic C.T.:

- *Its formed of condensed elastic fibers separated with areolar C.T.
- *Elastic tissue is present in the form of elastic membranes as in aorta or in the form of elastic ligaments as in vocal cords.

Site:

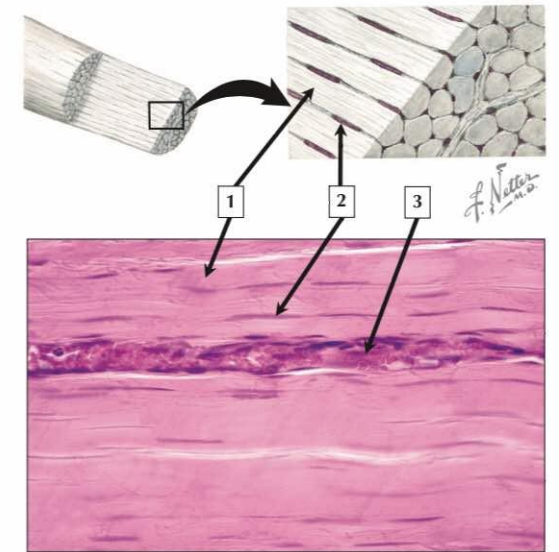
- 1- Aorta and large arteries.
- 2- Bronchia
- 3- Ligamentum flavum.
- 4- Suspensory ligament of penis.



White collagen(tendonous C.T.):

- *It's a very dense type of C.T.
- *Its formed mainly of collagen fibers.
- *It has small amount of matrix and its poor in blood supply.
- *The arrangement of collagen bundles in the white fibrous C.T. may be regular or irregular but usually pressing between them modified fibroblast cells which are known as tendon cells.

Site: sclera, capsule of gland and organ, dura mater and perichondrium.

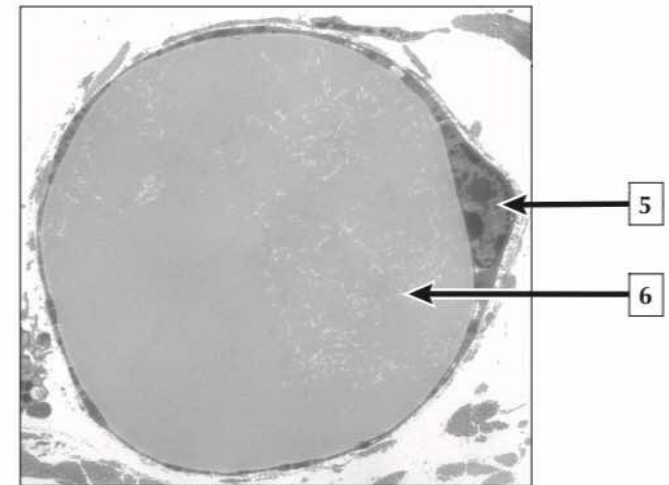
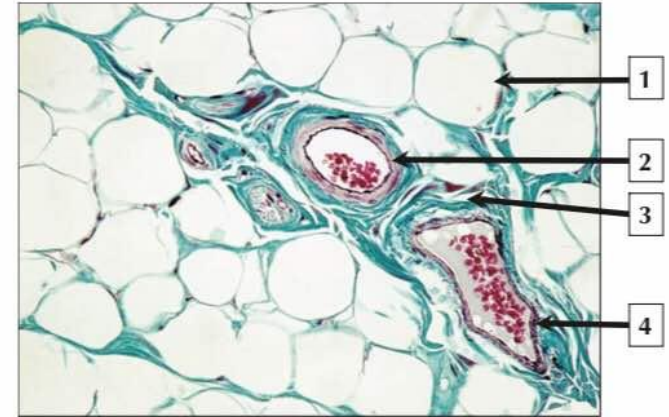


Adipose or fatty C.T:

- *It's the one of the largest tissue in the body.
- *Formed of loose matrix and few C.T cells but many fat cells.

There are 2 types:

- 1- white
- 2- brown.



1- white or yellow adipose tissue or unilocular adipose tissue:

*It composed of large fat cells. The bulk of each cell is occupied by a single large globule of non-pigmented fat.

Function :

- 1- It acts as heat insulator and as fat storage areas.
- 2- It gives the body its normal shape.

Sites:

Under the skin especially in females

Around the kidney and blood vessels.

In the mesentery, omentum and in the abdominal wall.

2- Brown adipose C.T. or multilocular adipose tissue:

*Its formed of small fat cells which are filled with many droplets of pigmented lipid.

Function:

It acts as heat generator, it gives heat to the different body organs

Site:

Interscapular region, axillary region .

Around the thoracic aorta.

Reticular C.T.:

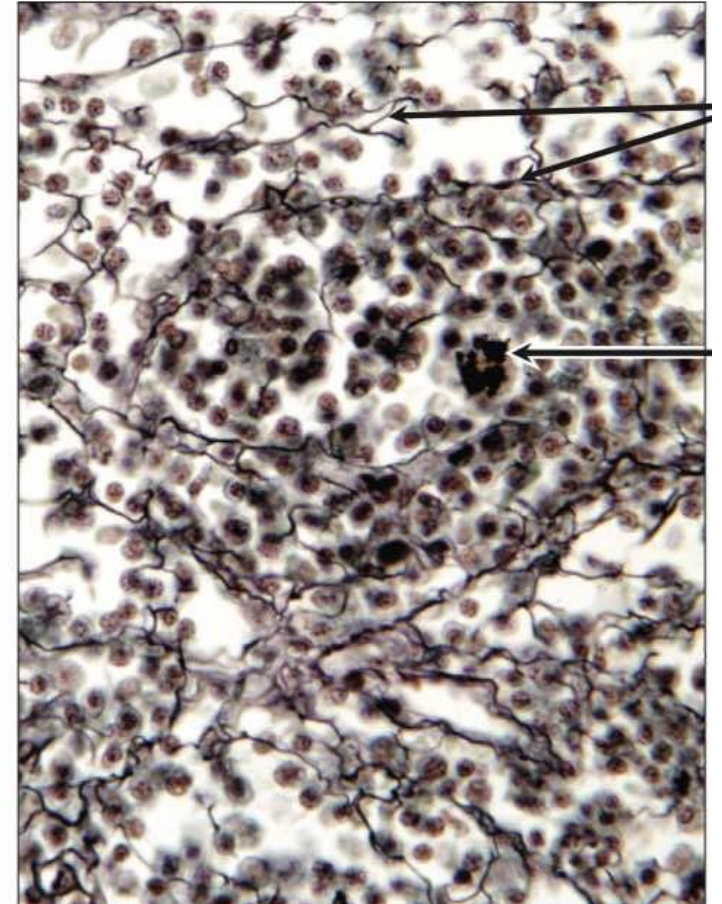
- *Its very fine type of adult C.T.
- *It forms the stroma or background of glands.

Formed of:

Reticular fibers, reticular cells and mononuclear phagocytic cells.

Site:

Present in stroma of bone marrow, stroma of spleen, lymph node, liver, testis, ovary and endocrine gland.



Mucoid C.T.:

*Its called also mucous C.T.

Formed of:

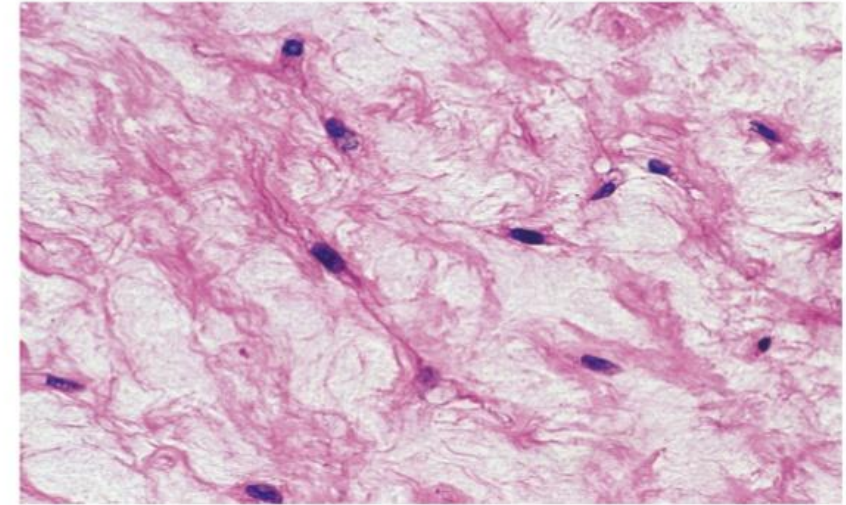
Mucoid cells , matrix and collagenous fibers.

Site:

In umbilical cord of the embryo.

In adult, its present in the vitreous humour of the eye ball and pulp of growing teeth.

MUCOUS TISSUE



Medical condition:

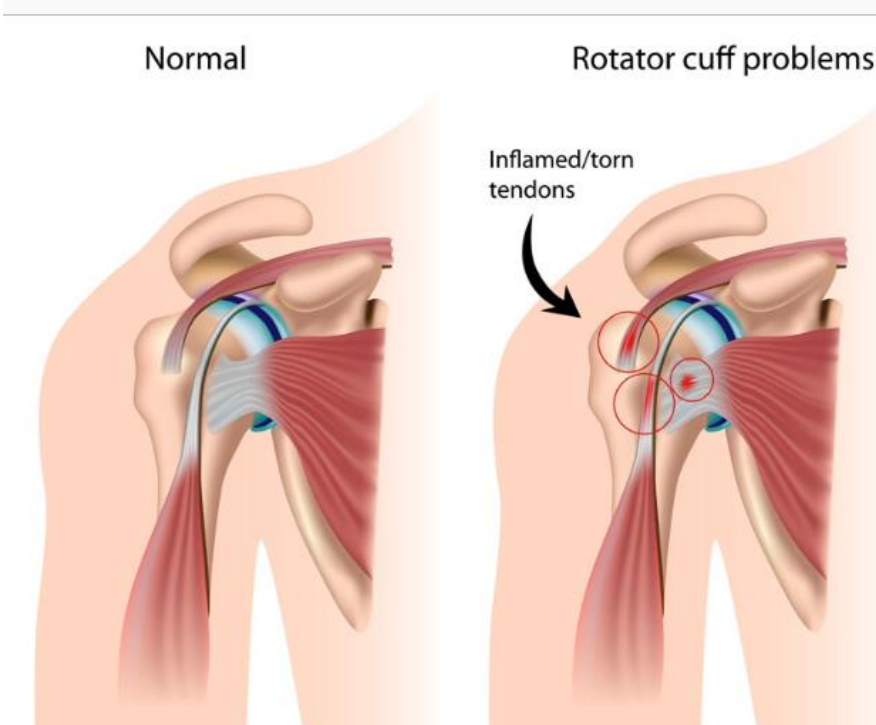
- Anaphylaxis:
- Its allergic reaction. It occurs when IgE antibodies bind with allergens and cause mast cells to release histamine.



Medical condition:

Tendinopathies:

Are commonly associated with rheumatoid arthritis. Tendons can become inflamed, weakened and (click) or even rupture.



Medical condition:

- **Obesity:**

- Is an increase in adipose tissue beyond the normal requirement of the body. It has a multifactorial etiology. Excess calories are stored as triglycerides in adipocytes.

THANK YOU