Connective Tissue (CT):

Is one of the four types of biological tissue that support, connect, or separate different types of tissues and organs in the body. Connective tissue is found in between other tissues everywhere in the body, including the nervous system. In the central nervous system, the three outer membranes (the meninges) that envelop the brain and spinal cord are composed of connective tissue .

Functions of Connective Tissue

1-forms capsules that surround the organs of the body .

2-Makes up tendons ,ligaments .

3-Bone ,cartilage and adipose tissue are specialized types of c.t that support the soft tissue of the body and store fat .

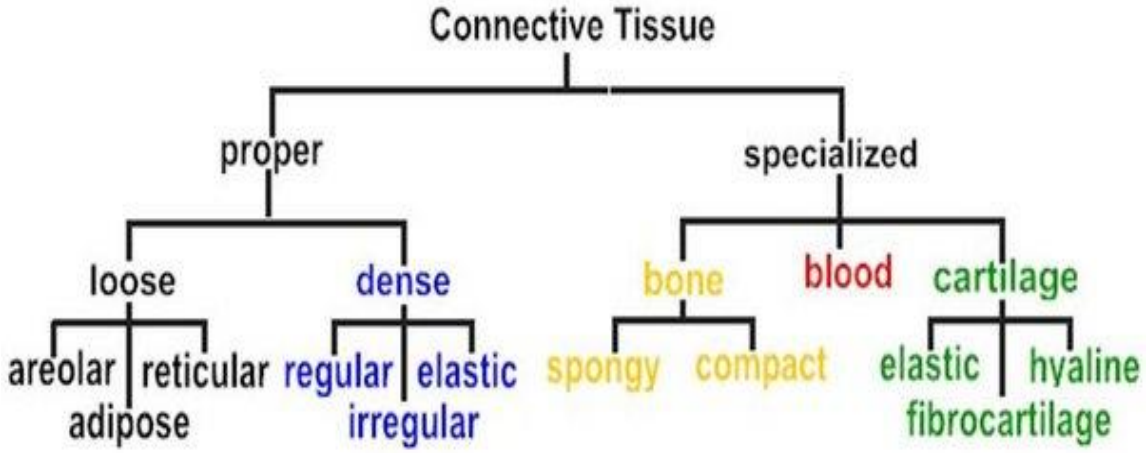
4-Role in defending the organism due to the phagocytosis & immune competent cells .

5-Play role in cell nutrition .

6-Provide physical barriers .

7- Specific protein called antibodies are produced by plasma cells in the c.t.

Classification of Connective tissue :



A-Connective tissue Proper

1-Loose Connective Tissue:

a- Loose Connective Tissue Areolar:

the most widespread type of connective tissue proper, supported epithelium and have cells called fibroblasts.

Functions : Support and binding of other tissues, holding body fluids, defending the body against infection, storing nutrients as fat. It contain a 2 types of fibers :

- White or collagenous fibers .

- Yellow or elastic fibers .

b- Loos Connective Tissue Adipose

Loose adipose tissue is crowded with fat cells, which account for 90% of its mass. Adipose tissue is richly vascularized. It removes lipids from the bloodstream after meals and later releases them into the blood, as needed.

Function : Reserve food fuel, insulates against heat loss, supports and protects organs.

Location : is found in the hypodermis, but it is also abundant in the mesenteries and forms cushioning pads around the kidneys and behind he eyeballs.

c- Loose Connective Tissue Reticula:

is similar to areolar tissue but the only fibers in its matrix are reticular fibers. Bone marrow, spleen and lymph nodes consist largely of reticular connective tissue.

Function : Form a soft internal skeleton that supports other cell types like white blood cells, mast cells, macrophages.

Location: Lymphoid organs (lymph nodes, bone marrow, and spleen).

2-Dense Connective Tissue:-

In this type of tissue, the collagen fibers are densely packed, and arranged in parallel. This type of tissue is found in ligaments (which link bone to bone at joints) and tendons (connections between bones or cartilage and muscle).

a- Dense Regular.

contains many collagen fibers that are packed together Primarily parallel collagen fibers; a few elastic fibers major cell type is the fibroblast.

Function: Attaches muscles to bones or to muscles; attaches bones to bones; withstands great tensile stress when pulling force is applied in one direction.

Location: Tendons, Ligaments.

b-: Dense Irregular:

Primarily irregularly arranged collagen ,fibers; some elastic fibers major cell type is the fibroblast .

Location : Fibrous capsules of organs and joints, dermis of the skin, submucosa of the digestive tract.

Function: support tissues in multiple directions. This is because the fibers run in multiple directions.

c-Dense Connective Tissue, Elastic

Has the ability to receive a relatively large amount of blood all at once with a lot of pressure. The aorta for example has to expand and recoil RIGHT AWAY because the next heart beat is on the way. with a high proportion of elastic fibers instead.

Location : Between vertebrae of the spinal column and in the blood vessel walls .

Function: Stabilizes of vertebrae and penis cushions shocks, permits expansion and contraction of organ.

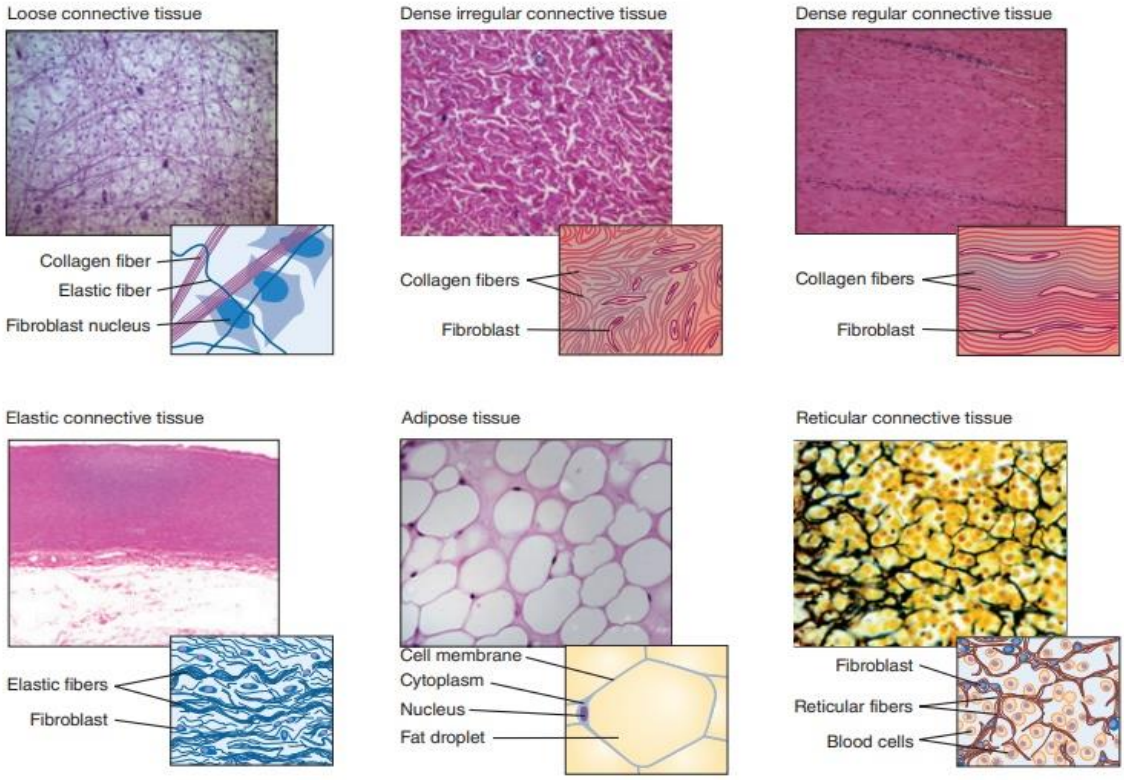


FIGURE 5-6 Types of typical connective tissues.

Photos: © Donna Beer Stolz, PhD, Center for Biologic Imaging, University of Pittsburgh Medical School; bottom right: © Dr. John D. Cunningham/Visuals Unlimited.

2- Specialized Connective Tissue :

Include :

a-Cartilage:

b-bone:

c-blood:

d-lymph:

2-a- Special C.T. Cartilage :

Cartilage is a flexible connective tissue , including the joints between bones, the rib cage, the ear, the nose, the bronchial tubes and the intervertebral discs. It is not as hard and rigid as bone, but it is stiffer and less flexible than muscle. this tissue lacks a direct blood supply ,it heals very slowly.

There are three types of cartilage:

1- Hyaline Cartilage:

This type of cartilage has a glassy appearance when fresh. Hyaline cartilage has widely dispersed fine collagen fibers which strengthen it , and it is the weakest of the three types of cartilage

Function : Supports and reinforces

Location : found in the ribs, nose, larynx, trachea. Is a precursor of bone.

2- Elastic cartilage: Similar to hyaline cartilage, but more elastic fibers in matrix for this reason it's more flexible . Maintains the shape of a structure while allowing Supports the external ear (pinna); epiglottis

3- Fibrocartilage: :Matrix similar to but less firm than that in hyaline cartilage; strong , thick collagen fibers predominate. Tensile strength with the ability to absorb compressive shock Intervertebral discs; and the wedges in knee joint .

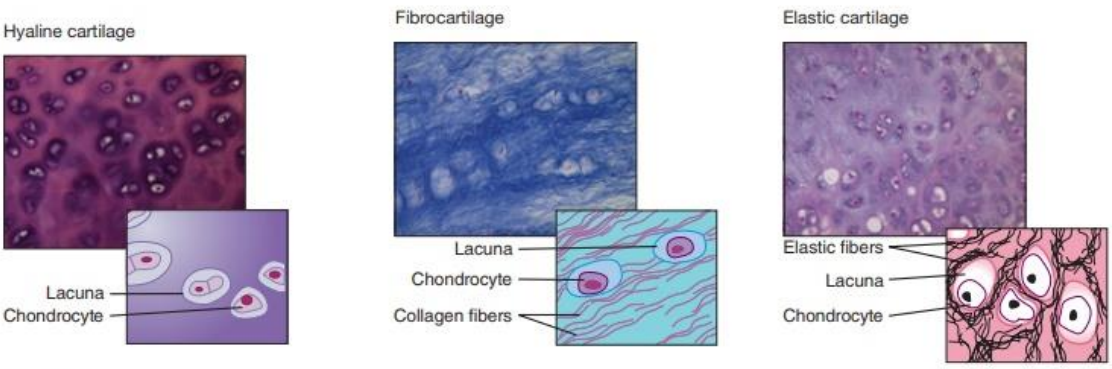


FIGURE 5-7 Types of cartilage.

Photos: © Donna Beer Stolz, PhD, Center for Biologic Imaging, University of Pittsburgh Medical School.

2-b-Bone tissue:

Bone tissue is a type of connective tissue that contains lots of calcium and phosphorous salts. About 25% of bone tissue is water, another 25% is made up of protein fibers like collagen. The other 50% of bone tissue is a mixture of mineral salts, primarily calcium and phosphorous.

Bone cells :

1-Osteoblasts :- These are the bone forming cells (osteogenic). These are cuboidal or trapezoid in shape with the nuclei lying at one or the other. They have many processes. The cytoplasm is rich with RNA .

2-Osteocytes :- They flattened , ovoid shaped lying in the lacunae and each consists of darkly staining nucleus with small amount of cytoplasm and numerous branching processes. The processes of an osteocytes joined with the other osteocyte

(adjacent cells) , there function generator osteoblasts when the bone has been laid down .

3-Osteoclasts:- These are large cells found on the surface bone where resorption are taken place. They are multinucleated with a vacuolated cytoplasm. They have important role in remodeling of bone.

Function :

1- **Support**
2- **Protection**
3- **Movement**
4- **Mineral storage**
5- **Blood cell production**
6- **Energy storage**

Bone marrow :

It is present in the cavity of compact and spongy bone , consist of reticular connective tissue , fibers ,RBC,WBC ,platelets, fat cells and blood vessels . They are two types of bone marrow :

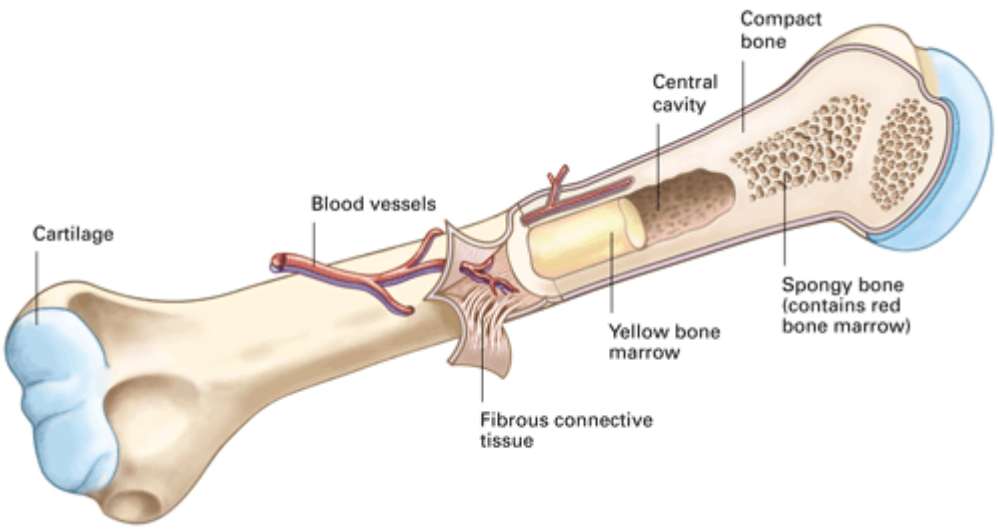
1- Compact bone :

Compact bone : makes up the shaft of along bone .It contains cylindrical structural units called osteons (haversian system) the central canal of each osteon surrounded by rings of hard matrix Bone cells (osteocyte) are located in spaces called lacunae

between the ring of matrix .blood vessels in the central canal carry nutrients that allow bone to renew itself

2- Spongy bone :
contains numerous bony bars and plates ,separated by irregular spaces although lighter than compact bone, spongy bone is still designed for strength . Spongy bone is also the site of red bone marrow which is critical to produce of blood cells .

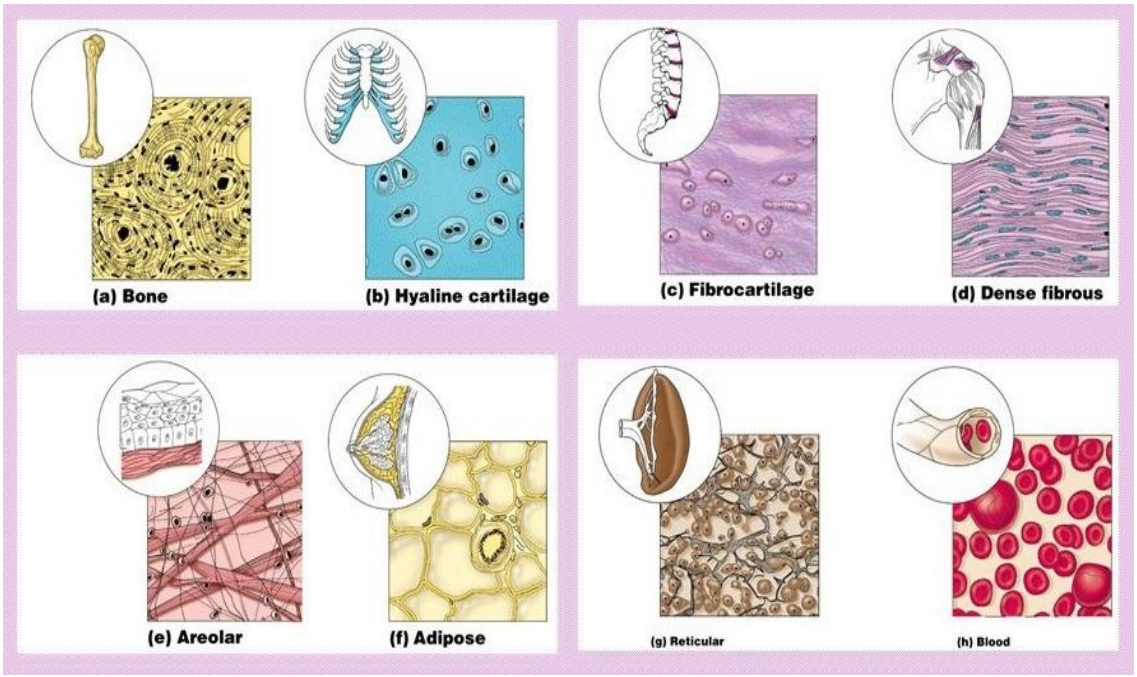
Function : Supports and protects, stores calcium and other minerals and fat. Marrow inside bones is site of blood cell formation.



c-Blood :
Is the most atypical connective tissue. It does not bind things together or give mechanical support. It is classified as connective tissue because it develops from mesenchyme and consists of blood cells surrounded by a nonliving matrix. Blood tissues are found inside the blood vessels. (arteries, arterioles, capillaries, venules and veins) .

Some white blood cells are also found in other types of body tissues, for example lymphocytes are also found in the lymphatic system .
Even though it has a different function in comparison to other connective tissues it does have an extracellular matrix. The matrix consists of the plasma, while red blood cells, white blood cells, and platelets are suspended in the plasma .

Function : Transport of respiratory gases, nutrients and wastes .

Location : Within the blood vessels .

d-Lymph :
is another type of fluid connective tissue. This clear fluid originates from blood plasma that exits blood vessels at capillary beds. A component of the lymphatic system, lymph contains immune system cells that protect the body against pathogens .