Connective tissues

Connective tissue is the term applied to a basic type of tissue of mesodermal origin, while in the head region it is originating from both the mesoderm (mesenchymal cells) and neural crest (ectomesenchymal cells). It is one of the four basic types of tissue in the body.

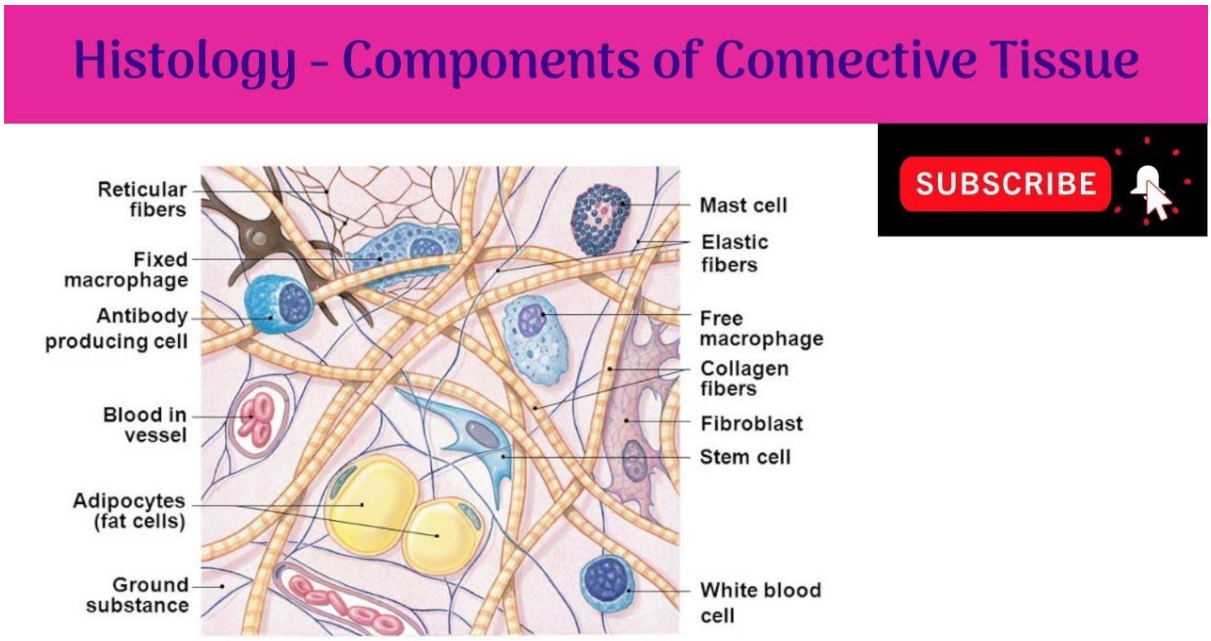
The connective tissue maintains the form of the body and its organs and provides internal support for the organs and muscles.

All connective tissue consists of three main components:

•Fibers

•Ground substance (extracellular substance).

• Cells.



Connective tissues functions include:

1. Support the body and to bind or connect together all types of tissue.

2. Provides a mechanical support.

3. Defensive against the microorganism because it is containing all types of defensive cells.

4. Storage of energy because it is containing adipose tissue (fat).

5. Mediate the exchange of nutrients, metabolites and waste products between tissues and the circulatory system.

Connective tissue is separated from the epithelium by basement membrane.

Embryonic origin:

Mesodermal in origin. Mesoderm gives rise to mesenchymal cells

Mesenchymal cells are undifferentiated cells and they are the source of all types of connective tissue cells.

In the head region the C. T is derived from neural crest cells.

The term mucosa is indicating the:

i. **Epithelium.**

ii. **Underlying connective tissue which is called lamina propria.**

All supporting/connective tissues are composed of:

1. Cells:

I. Main cell type is fibroblasts which produce the fibers and ground substance.

- **Forms of fibroblast:**
  a. As fibroblast

b. Myofibroblast: Fibroblast with a feature of both the fibroblast and smooth muscle. It is observed during wound healing. Their activity is responsible for wound closure after tissue injury.

II. Immune cells also present in connective tissue

- **Macrophages**
- **Plasma cells**
- **Mast cells**
- **Neutrophils, Lymphocytes**

Cells of the immune system enter support tissues where they assist in defence against pathogenic microorganisms.

Macrophages

They are the phagocytic cells of C.T.

They are part of mononuclear phagocytic system (MNPS).

Cell of the MNPS are present in many types of tissues in the body and have special names:

***Macrophage (histocyte) in loose connective tissue .**

***Kupffer cells in liver**

***Osteoclasts in bone**

***Microglial cells in central nervous system**

***Alveolar macrophage in lung**

Cells of MNPS arise from precursor cells called monocytes,which are one kind of white blood cells.

Functions of macrophage:

- **Removal of microorganism**
- **Removal of cellular debris(as scavenger cells) resulting from acute inflammation.**
- **In the spleen it removes worn-out(old) RBCS .**

Mast cells

Large rounded or ovoid cells, 20-30 um, with spherical nucleus and cytoplasm filled with basophilic granules .The granules are liberated from the cell by exocytosis when stimulated during an inflammatory or allergic response.

The granules are containing:

- **Histamine: which act as vasodilator and increase the permeability of small blood vessels, causing edema and redness in surrounding tissue.**
- **Heparin: Sulfated GAGS, which is an anticoagulant.**
- **Eosinophilic chemotactic factor (ECF) and neutrophil chemotactic factor (ECF) which attracts eosinophils and neutrophil to the site of inflammation.**

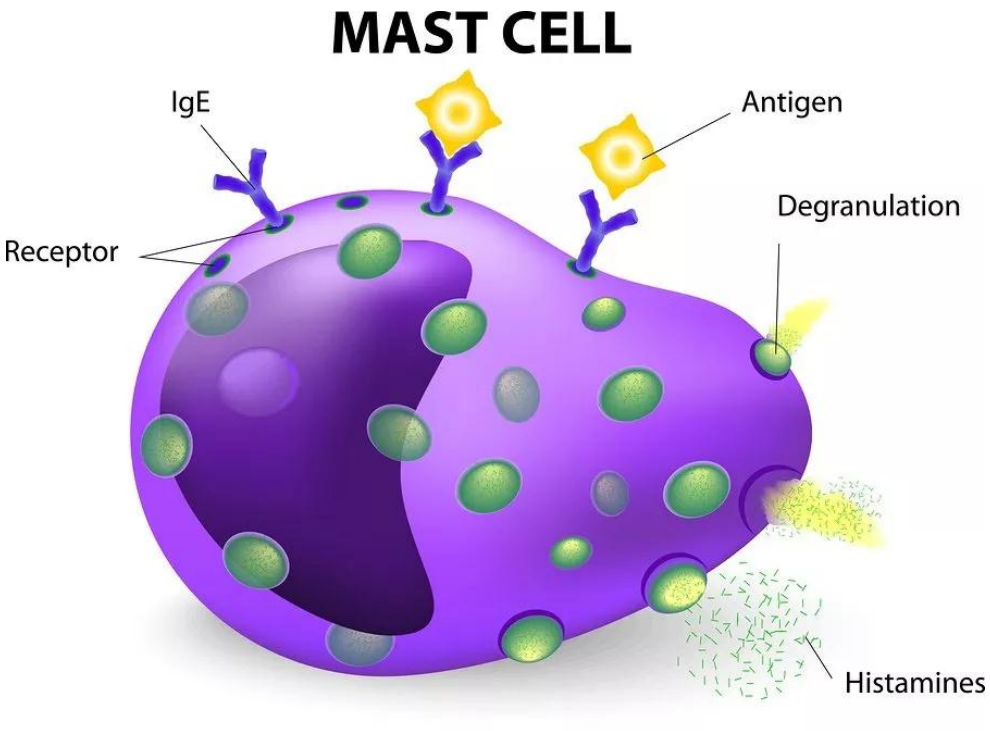
Mast cells are originated from bone marrow. The surface of mast cells contains receptors for IgE (a type of immunoglobulin (antibodies) produced by plasma cells.

The major constituents and functions of mast cells; are very similar to those of basophils to which they are probably related and which are described in detail with blood cells.

The mast cell has a receptor for the immunoglobulin E(IgE).

***Plasma cells* are cells of the immune system that secrete large amounts of antibodies.They are derived from B lymphocytes.**

There are five types of antibodies (immunoglobulins):IgA;IgM;;IgE; IgD; and IgG .



2. Fibers: Collagen, elastic and reticular

Fibers

Loose connective tissue is named based on the "weave" and type of its constituent fibers. There are three main types:

i. Collagen fibers: Collagen is the main fiber type found in most supporting tissues and is the most abundant protein in the human body.

Collagen fibers are consisting of bundles of fibrils.

Collagen fibers are the dominant fiber type in most connective tissues. The primary function of collagen fibers is to add strength to the connective tissue.

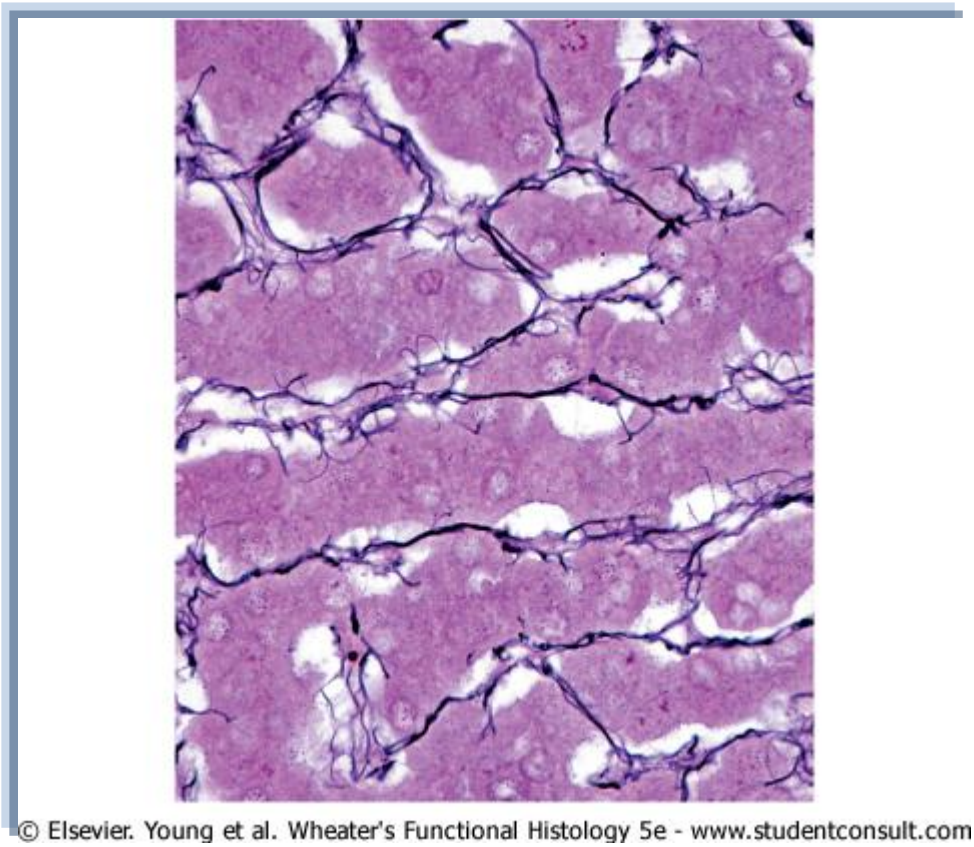
Collagen fibers usually occur as a bundle. They are protein in nature representing 30% of the body dry weight.

Types of collagen fibers:

- **Type I collagen is found in fibrous supporting tissue, the dermis of the skin, tendons, pulp of tooth, and periodontal ligament.**
- **Type II collagen is found in hyaline cartilage and consists of fine fibrils**

ii.Elastic fibers: elastic fibers are made of elastin and are "stretchable".

iii.Reticular fibers: reticular fibers consist of one or more types of very thin collagen fibers. They join connective tissues to other tissues.

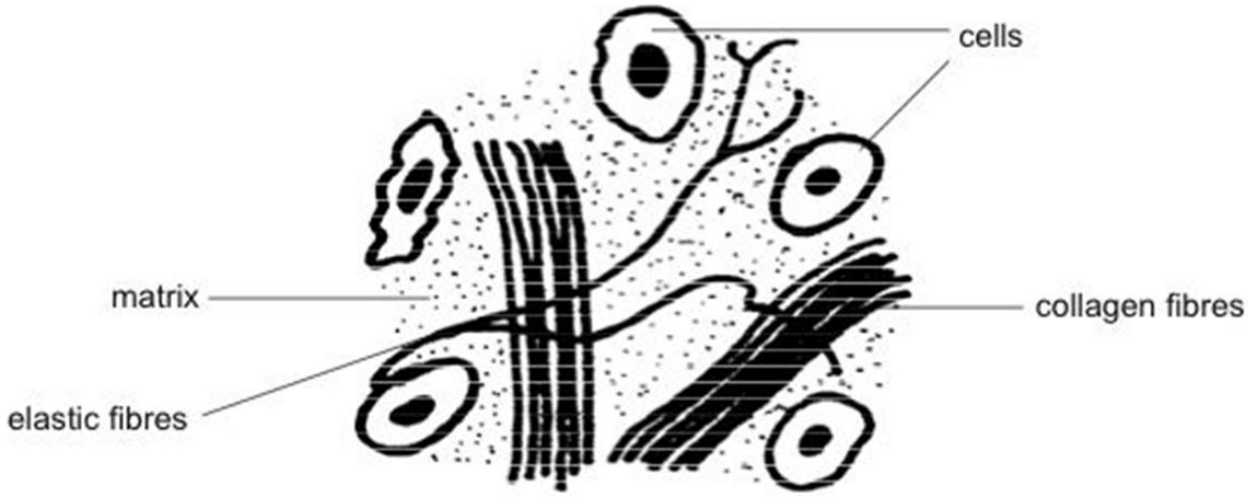


3. Ground substance: Present between cells and fibers. Ground substance is a clear, colorless, and viscous fluid containing glycosaminoglycans and proteoglycans to fix the collagen fibers in the intercellular spaces.The fibroblast which is responsible for secreting the extracellular matrix in most tissues.

Types of connective tissue:

A. The loose (areolar) tissue: It is so-named because its fibers are far enough apart.

It is found beneath the dermis layer of skin and is also underneath the epithelial tissue of all the body systems that have external openings. It makes the skin elastic and helps it to withstand pulling pain.



Function

1.Areolar connective tissue holds organs in place

2. and attaches epithelial tissue to other underlying tissues.

3.It also serves as a reservoir of water and salts for surrounding tissues.

4. Almost all cells obtain their nutrients from and release their wastes into areolar connective tissue.

B. Dense connective tissue. It is either dense regular or dense irregular.

i. Dense regular connective tissue .Dense connective tissue is characterized by:

• an abundance of fibers. The fibers are organized in a regular, parallel pattern. The example is the tendon of the muscles.

ii. Dense irregular connective tissue: The collagen fibers are arranged in irregular manner. It is seen in the dermis of skin and lamina propria of oral mucosa.

Adipose Tissue:

It is a special type of tissue in which adipose (fat or adipocytes) cells predominate .

There are two types of adipose tissue:

1.White (yellow or unilocullar) adipose tissue :

2. Brown (multilocular) adipose tissue: It is composed of cells that contain numerous lipid droplets and large number of mitochondria and highly vascular. Brown fat is brown because,

1. It has rich blood supply in between fat cells.

2. Large number of mitochondria inside the fat cell.

Ground substance:

It is amorphous transparent substance filling the spaces between the cells and fibers of connective tissue. One substance in ground substance called glycosaminoglycan is important for attraction water to the connective tissue.

Another substance in connective tissue called glycoproteins (fibronectin, laminin). It is important in connecting the cells with fibers of connective tissue.