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Connective tissue

Connective tissue forms a framework upon which epithelial tissue rests and within which nerve tissue and muscle tissue are embedded. Blood vessels and nerves travel through connective tissue.

Connective tissue functions not only as a mechanical support for other tissues but also as an avenue for communication and transport among other tissues. Connective tissue is derived from embryonic **mesenchyme(mesoderm)**

Connective tissue consists of individual **cells** scattered within an extracellular **matrix**.

Unlike cells of epithelial tissue, connective tissue cells are not directly attached to one another.

Component of Connective Tissue

Connective tissue consists of cells embedded in an extracellular matrix. The matrix, in turn, consists of fibers and ground substance.Characteristic connective tissue cell types include both resident cells and immigrant or wandering cells.

1-Cells

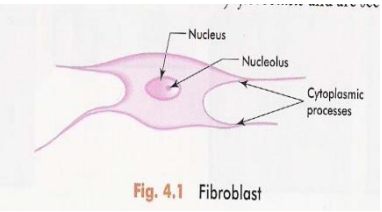


Fig. 4.1 Fibroblast

Resident cells reside in the place where they are found:

• **Fibroblasts** (which secrete the fibers and ground substance of the extracellular matrix).Fibroblasts are normally quiescent in mature tissues but become activated during tissue repair following injury. (Fibroblasts may also become activated during adaptive responses to mechanical stresses.)

When active, fibroblasts are manufacturing and secreting collagen and other components of extracellular matrix at the site of growth or tissue damage. some texts refer to active fibroblasts as fibro*cytes*.in active form of fibroblast are **fibrocyte**

Contractile Cells are **myofibroblast** (actin,myosin,fibres)

Fibroblast that produce reticular fibers called **reticular cell**

• **Mesenchymal cells.** Undifferentiated cells • Stellate in shape, Cytoplasmic process, • Pluripotenant cell • Near blood vessels • Involving in wound healing

• **Adipocytes** (which store fat). are large connective tissue cells which contain a substantial amount of lipid stored in the form of conspicuous round droplets. Adipocytes function primarily for reserve energy,they also assist in thermoregulation (maintaining body temperature) and in a few sites offer some cushioning capacity (e.g., around kidneys, behind eyeballs).

The most common type of adipocyte is called the *unilocular* adipocyte or *white fat*. Each cell contains one single fat droplet (hence, *uni*locular) surrounded by a thin rim of cytoplasm.

A more specialized and localized type of adipocyte is called the *multilocular adipocyte* or brown fat. These cells function in thermogeneration, essentially burning fat to produce heat.

Individual brown fat cells contain numerous small lipid droplets (hence the name multilocular) and numerous mitochondria (whose cytochromes confer a brownish color to unstained brown fat). In these cells, the metabolic reactions of the mitochondria are uncoupled from ATP synthesis so that energy produced is simply released as heat.

• **Mast cells** (which trigger inflammation). are secretory cells. Upon the slightest disturbance, they release chemical signals which diffuse through the surrounding ground substance and trigger the process of inflammation.

Mast cells occur as small individual cells, scattered rather widely in ordinary connective tissue. The cytoplasm of mast cells is packed with secretory vesicles, contain chemicals such as histamine, heparin, cytokines, and growth factors. They release these chemicals during allergic reactions and certain immune responses. These chemicals have many effects, including the widening of blood vessels and angiogenesis. During an allergic response, they can cause flushing (a hot, red face) and itching. Mast cells are part of the body's immune system.

• **Macrophages** (which ingest and remove foreign material or damaged cells).ther are two type of macrophage: **Free and Fixed type**

Fixed Cells- Irregular Shape ,filopodia process, production and maintannce of extracellular matrix, Derived from mesenchyme ,fibroblast, mesenchymal cell ,adipocyte

Free cell -rounded, no filopodia,tissue reaction to injury or invasion of micro organisms(involve in fagocytosis),macrophage (histocyte),derived from monocytes,in liver (Kupffer cells) , in CNS(microglia) , in skin (Langerhans) and of lung (dust cells) which are all involved in immune defense and inflammation.

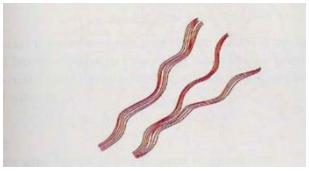
Another types of free cell are **plasma cell**(Antibody producing -derived from B lymphocytes , oval in shape ,basophilic cytoplasm) and **Leukocyte**

2- Fibers : classified into three types

Collagen fibers is the most common protein in the body. As an essential structural element in the extracellular matrix of most connective tissues, including bone and cartilage, **collagen** confers toughness and tensile strength. Scars are made of collagen. White colour when fresh,Do not branch,wavy,present in bundle

Collagen protein forms Fibres,Fibres composed of fibril

made of microfibrils,Micro fibrils made up tropocollagen-striations

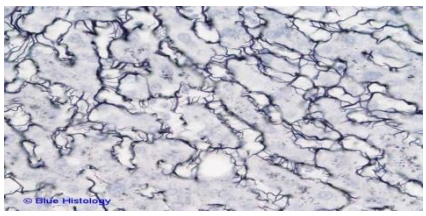


Synthesized by **fibroblast**

More than a dozen different varieties of collagen exist in the body

- **Type I** collagen (e.g., dermis, tendon, organ sheath, fascia).
- **Type II** collagen reinforces cartilage.
- **Type III** collagen forms reticular fibers and also occurs in basement membranes and bone.
- **Type IV** collagen occurs in the basal lamina around smooth and skeletal muscle fibers.
- **Type VII** collagen is an interlinking collagen important for formation of basement membranes , Blood vessels.

Reticular fibers made from type III collagen, provide a



very delicate network supporting individual cells in certain

organs (lymph nodes, spleen, liver). Reticular fibers do not

show up in routine H&E stained specimens, but they can be

demonstrated with silver salts. The collagen which reinforces cartilage, bone, basement

membranes, basal lamina, and assorted other structures

is not organized into microscopically visible fibers.

Elastic fibre Yellow in color when fresh,Composed of elastin protein,Singly present,Branched and anastomose forming network,Can be stretched (one and a half times)Synthesized by fibroblast and smooth muscle cells in blood vessels,elastic fibers help restore normal shape after distortion. Like rubber bands, elastic fibers can deteriorate with age and exposure to sun.

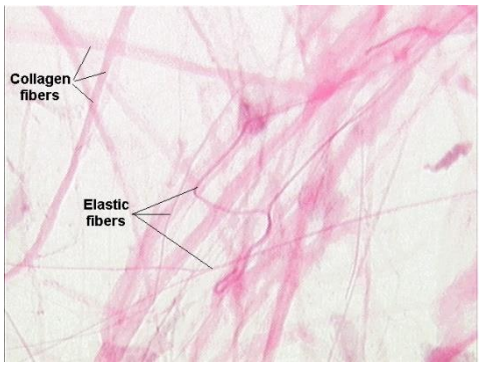
in addition to its occurrence as a minor constituent in

most ordinary connective tissue, elastin is also

characteristic of arterial walls (especially *elastic arteries*

such as the aorta) and of elastic cartilage

(found in ear and epiglottis).



3-Extracellular matrix

The extracellular matrix of connective tissue is composed of ground substance and fibers. ground substance consists mainly of water. The principal fiber type is collagen (the most abundant protein in the body), with elastic fibers as a minor element. The extracellular materials which comprise the matrix are produced by fibroblasts.