



Biology

Connective Tissue

It is the most numerous tissues in the body, which connects the structures with each other.

characterized by:

- binding and supporting the organs.
- it is vascular except the cartilage.
- it is derived from mesoderm layer.

Structure of Connective Tissue

3 classes of components

1- Cells

- 1-Fibroblast.
- 2-Macrophage.
- 3-Mast cell.
- 4-Plasma cell.
- 5-Lymphocytes.
- 6-Leukocytes.
- 7-Adipose cell.

2- Fibers

Reticular

Elastic

Collagen

Extracellular matrix

3- Ground substance

macromolecules

multiadhesive glycoproteins

Functions of connective tissue

**1-Establishing a structural framework and
Protecting delicate organs:**

2-Transporting fluids and dissolved materials:

3-Storing energy reserves:

**4-Defending the body from
microorganisms:**

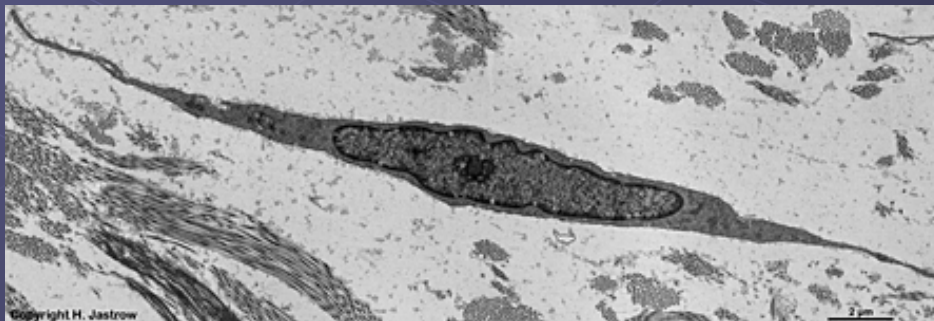
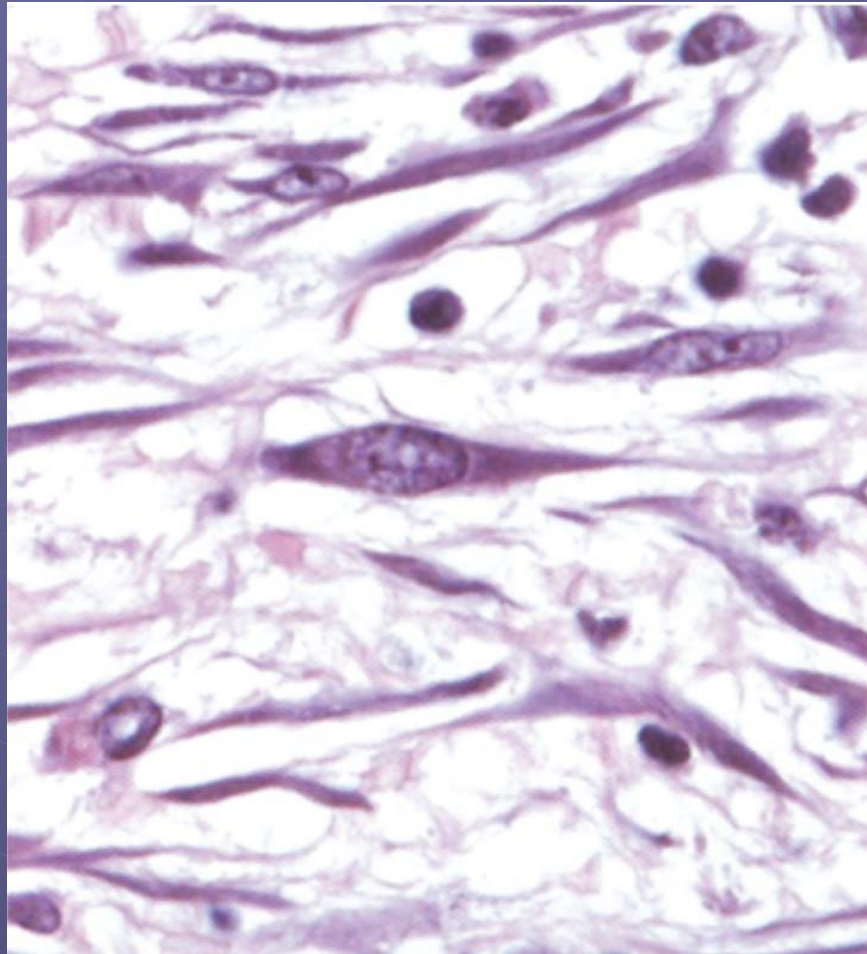
Connective tissue component

- **Cells:**

- **Fibroblasts:**

Fibroblasts are the most common cell type found in connective tissue.

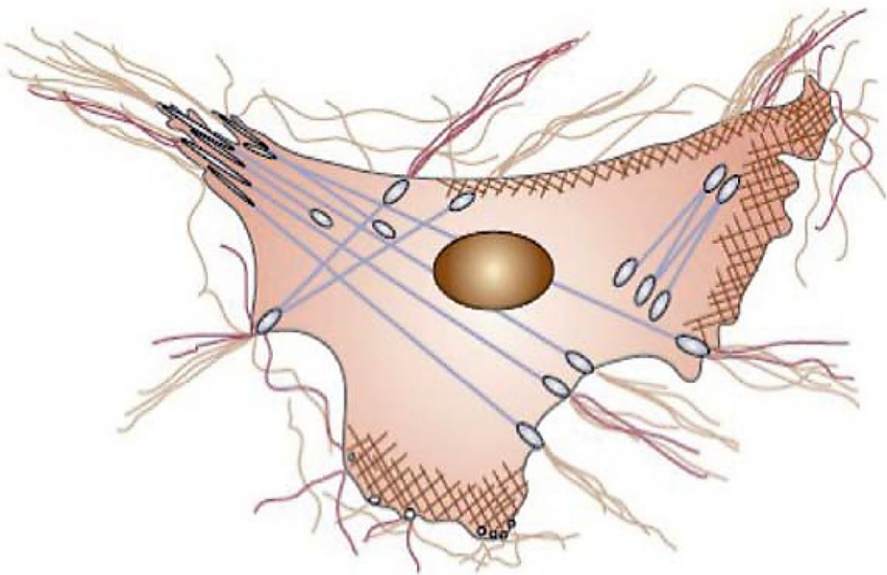
They are derived from undifferentiated mesenchymal cells.



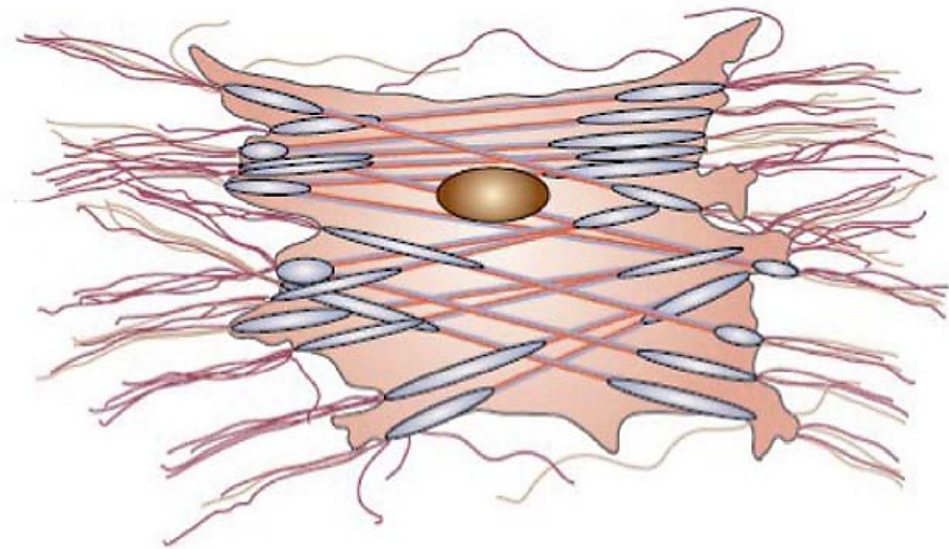
MEDICAL APPLICATION

- Myofibroblast
- wound contraction.

Fibroblast



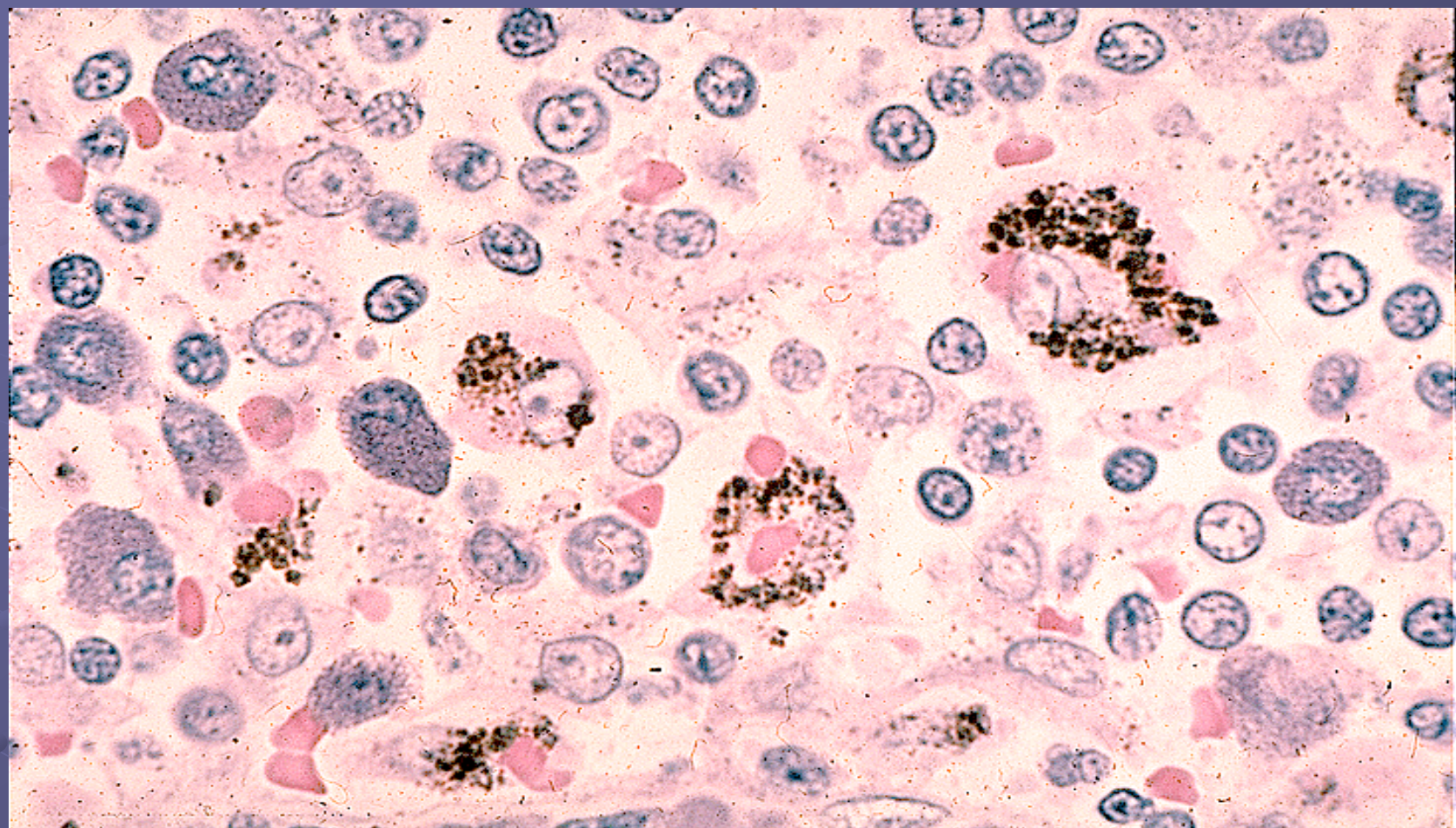
Myofibroblast



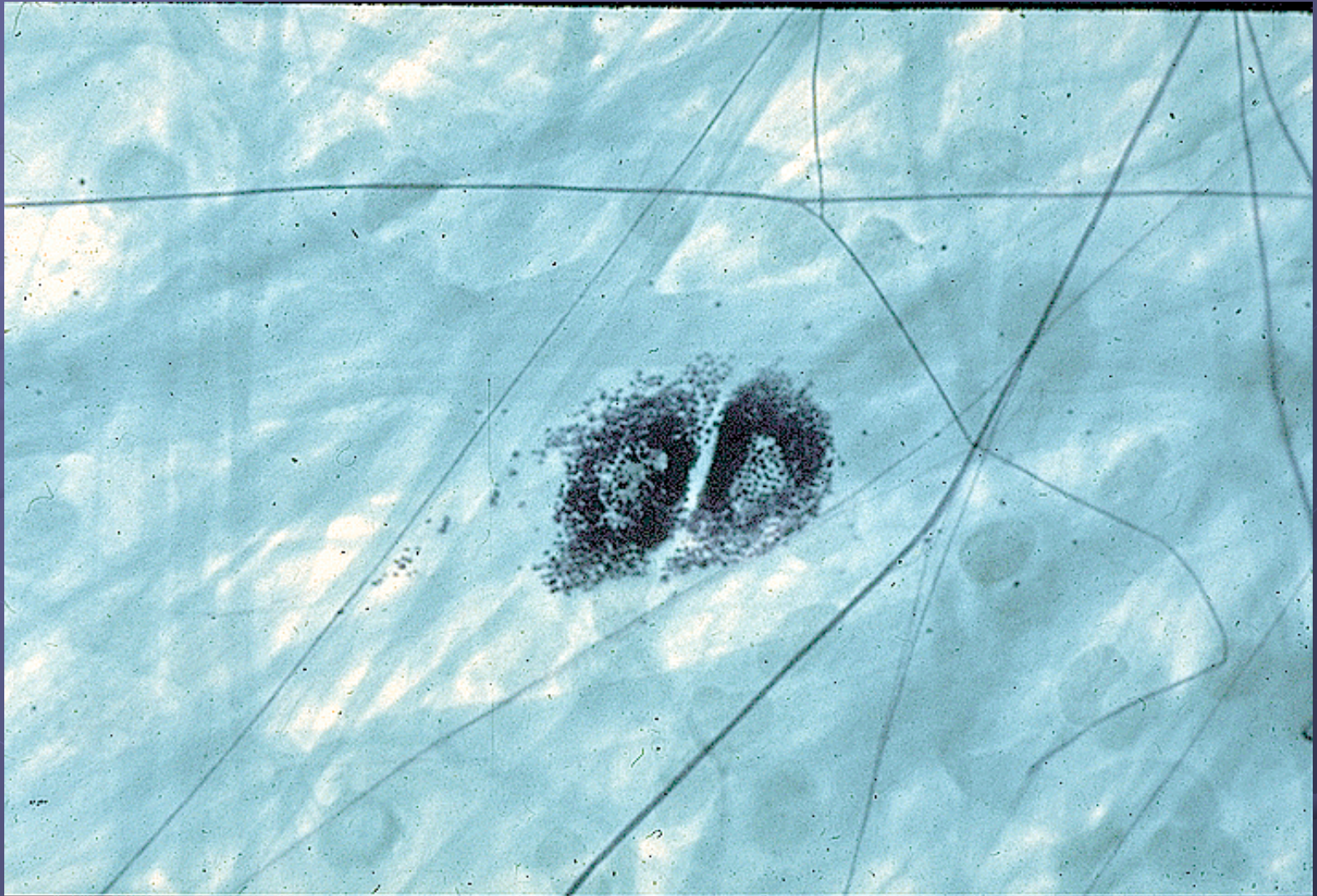
- | | | | | | |
|--|-------------------------------|---|----------------------|---|--------------|
|  | Focal Adhesion |  | F-actin stress fibre |  | Fibronectins |
|  | α -smooth muscle actin |  | Cortical actin | | |

● **Macrophages:**

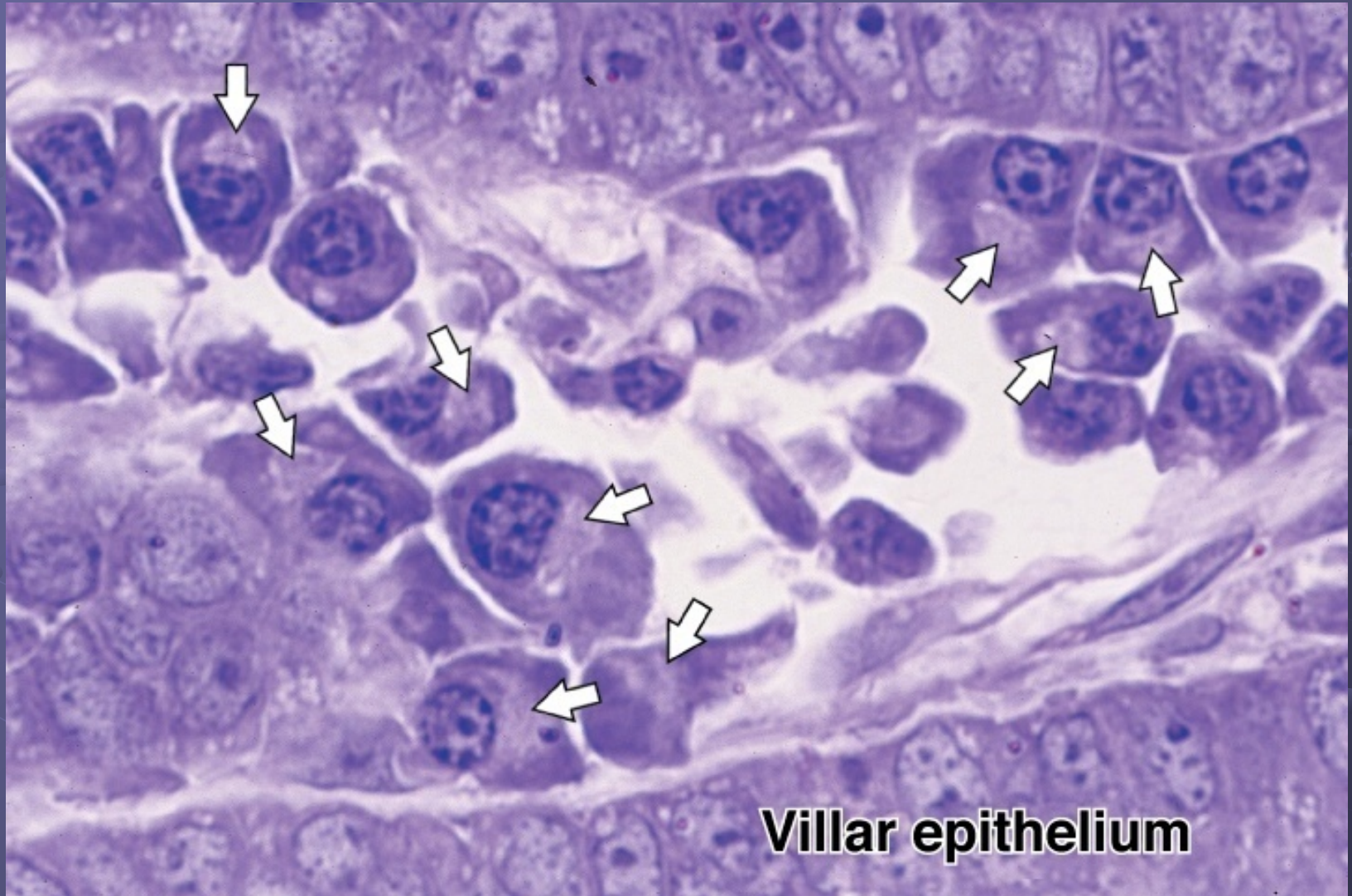
- Macrophages originate from monocytes.
- alveolar macrophages in the lung, peritoneal macrophages in the peritoneal cavity, synovial macrophages in the synovial cavity, Kupffer cells in the liver, histiocytes in the connective tissue proper, osteoclasts in bone, and microglia in nervous system.
- **The main functions of macrophages are ingestion by phagocytosis of microorganisms**
- Other functions:
- antigen presentation, removing cell debris e.g. during pregnancy, the increased uterus size is involuted immediately after delivery by action of macrophages. Macrophages also are secretory cells that secrete enzymes and cytokines have defensive functions.

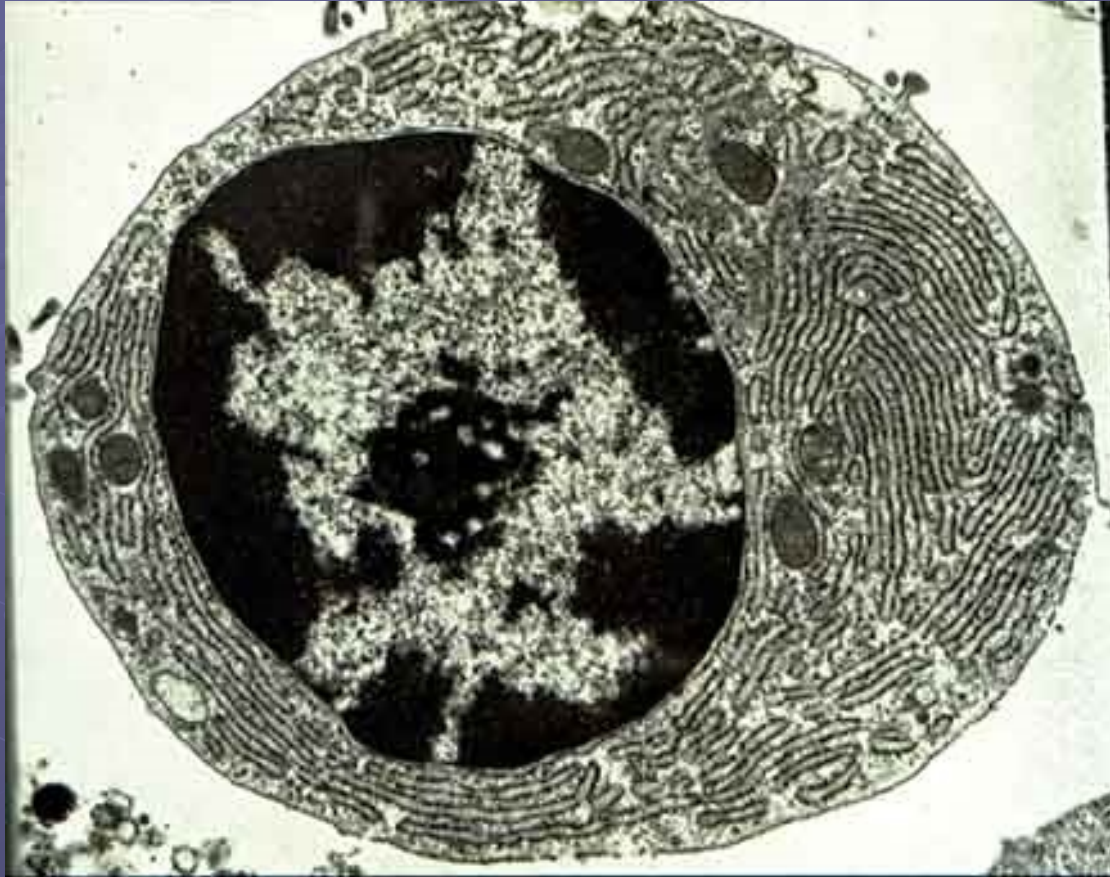


● Mast cells:



● Plasma cells:

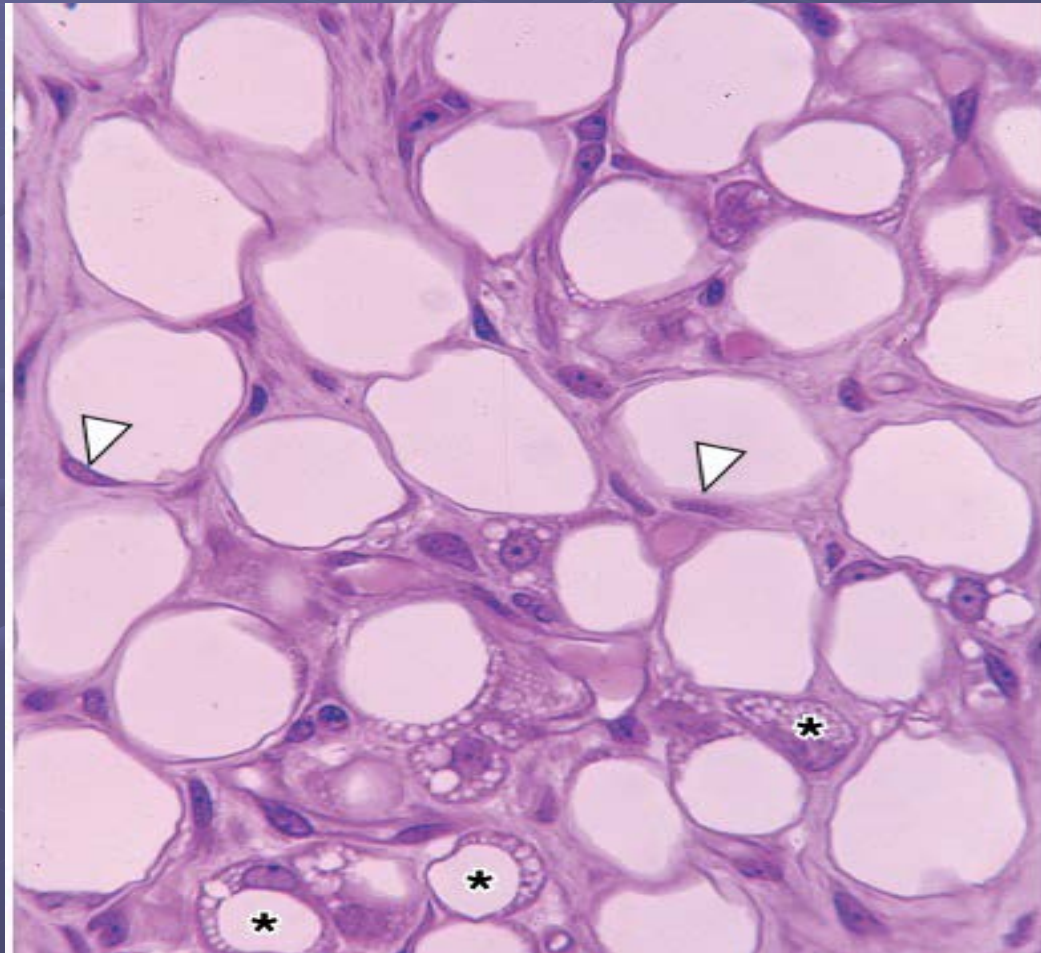




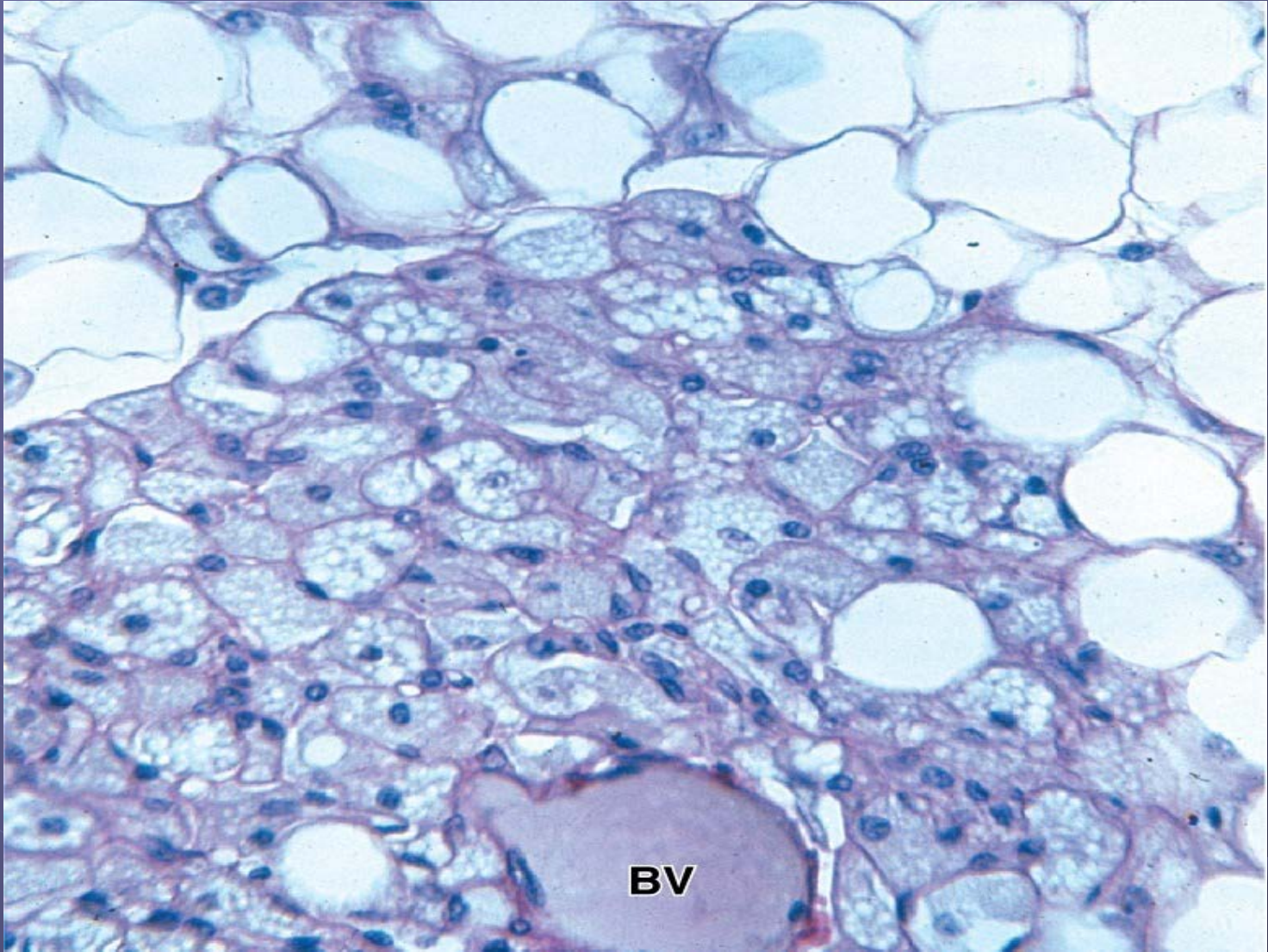
● **Adipose cells:**

- storing energy as fat, also act as an endocrine organ to secrete leptin hormone which regulate the appetite under normal condition and so regulate the amount of adipose tissue, defect in its secretion result in obesity.

White fat cells (unilocular cells):



- **Brown fat cells(multilocular cells):**
- It is especially abundant in newborns and in hibernating mammals. Its primary function is to generate body heat in animals or newborns that do not shiver .Brown adipocytes contain numerous smaller droplets and a much higher number of mitochondria (rich in iron) and make it brown. Brown fat also contains more capillaries than white fat, since it has a greater need for oxygen than most tissues.



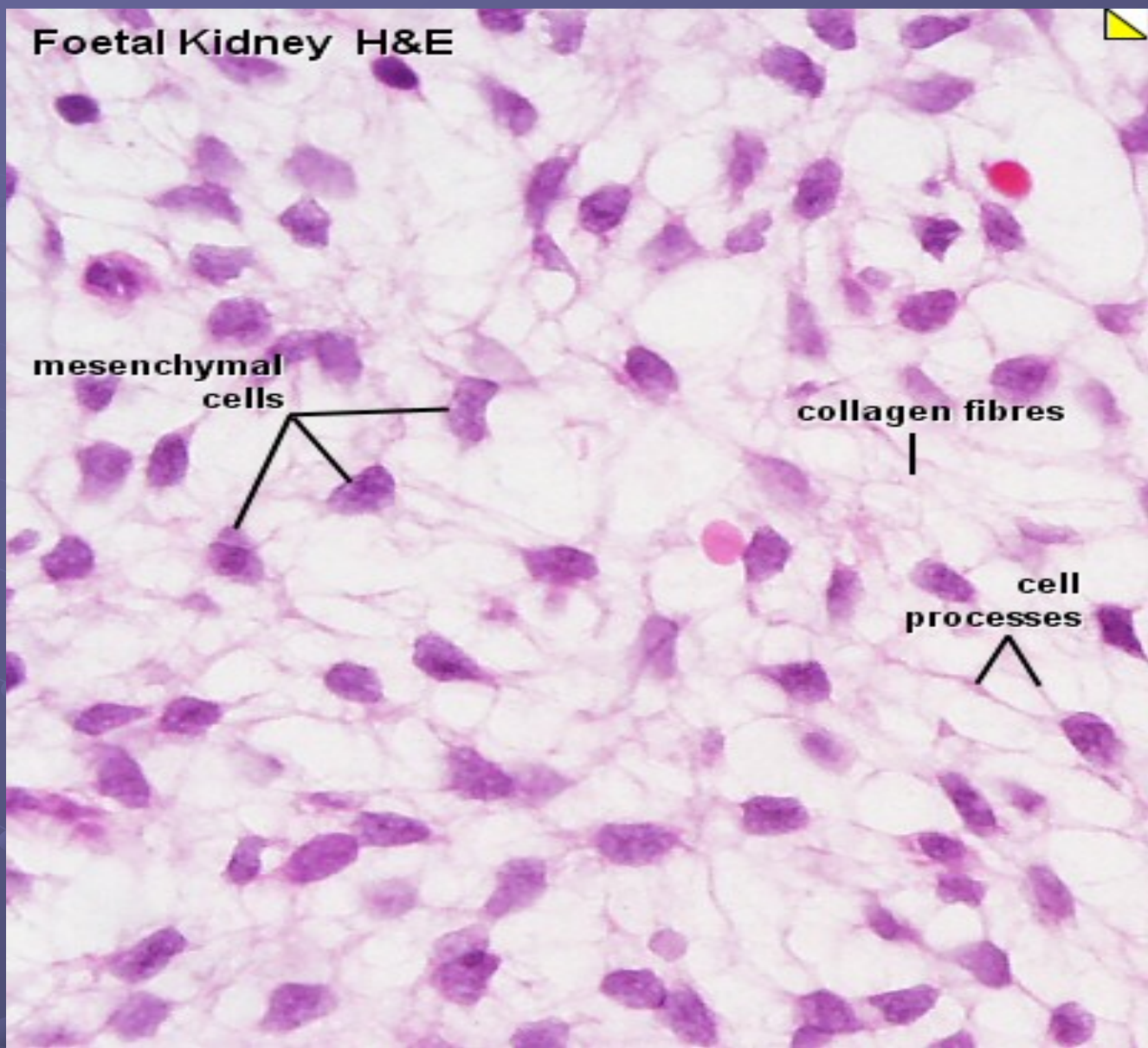
● **Leukocytes:**

- The white blood cells (lymphocytes, eosinophils, and basophils) are commonly found in connective tissue.

● **Undifferentiated mesenchymal cells (cells of regeneration):**

- These cells have ability to give rise any kind of cells, it form osteoblasts, chondrocytes, adipocytes.

Foetal Kidney H&E



mesenchymal cells

collagen fibres

cell processes

Extracellular matrix

I-Ground Substance:

- amorphous, transparent and colorless extracellular matrix, a semifluid gel and a high water content. It is binding cells to the fibers of connective tissue.

Ground substance composed of:

- **glycosaminoglycans.**
- **proteoglycans.**
- **adhesive glycoproteins.**
- The **glycosaminoglycan** are unbranched polysaccharide molecules of 5 types:
 - 1. Hyaluronan (or hyaluronic acid) is the dominant
 - 2. The remaining 4 are **chondroitin sulfate, dermatan sulfate, keratan sulfate and heparan sulfate.**

- Except for hyaluronic acid, the other 4 glycosaminoglycans are bound to a core protein to form much larger molecules called **proteoglycan aggregates**. These proteoglycans attract large amounts of water, which forms the **hydrated gel** of the ground substance.

● The third class of ground substance constituents is **adhesive glycoproteins** responsible for linking the components of the matrix both to one another and to the surfaces of cells. These includes:

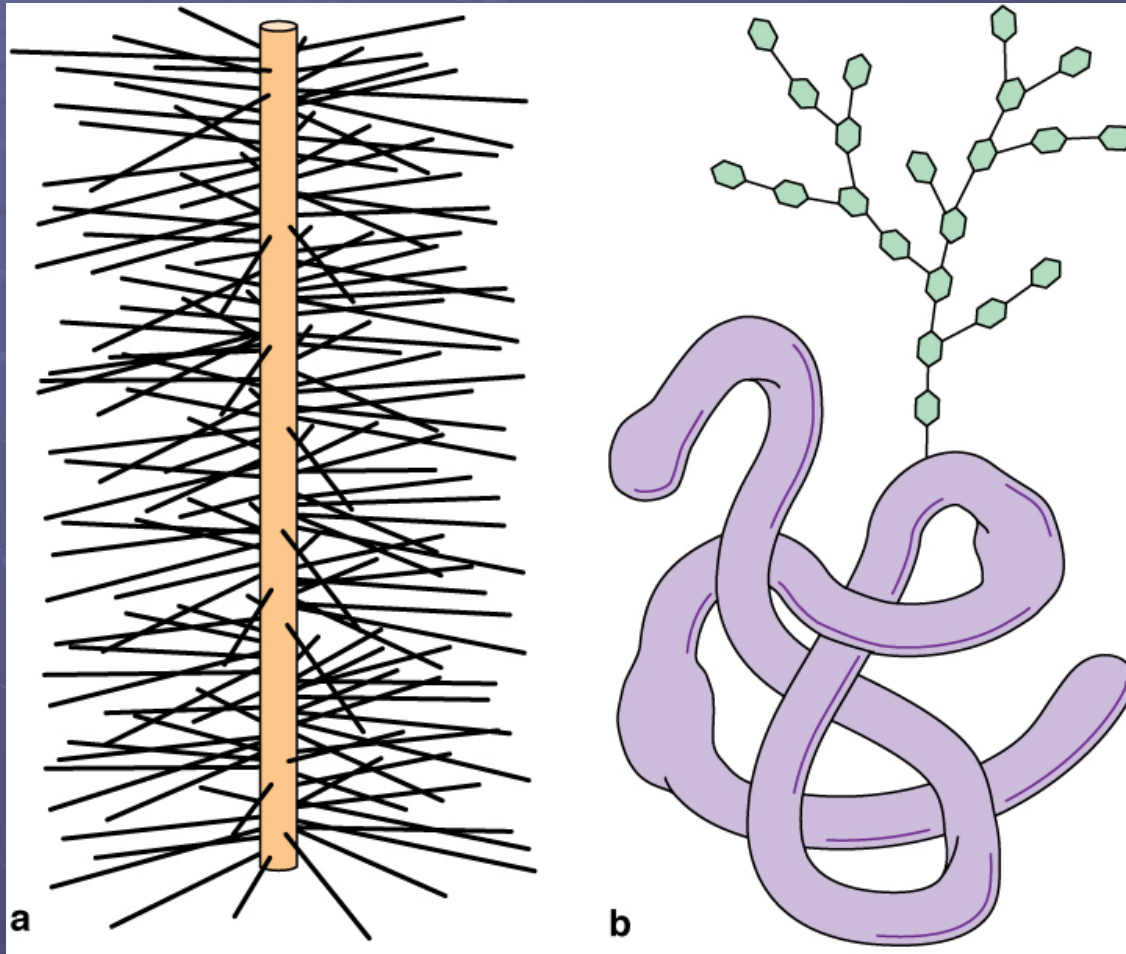
● Fibronectin

● Laminin

● Such laminin glycoprotein are the major structural components of the cell basement membrane. This protein binds epithelial cells to the basal lamina.

a proteoglycan

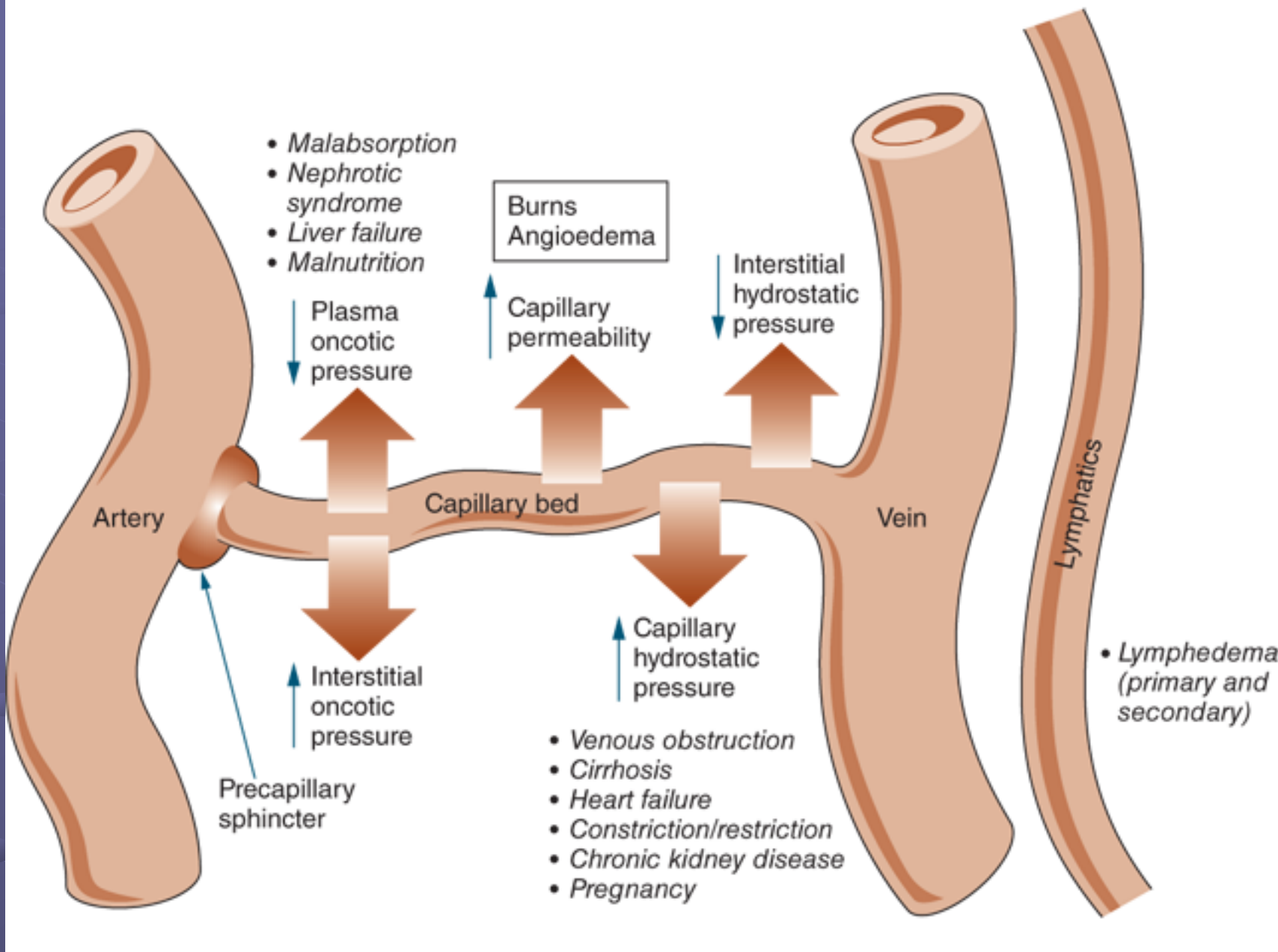
b glycoprotein



● **interstitial or tissue fluid**

● tissue fluid contain small percentage of **plasma proteins** that pass through the capillary walls as a result of the hydrostatic pressure of the blood .

● **Edema** result from accumulation of water in the extracellular space in many pathological conditions e.g. congestive heart failure.





Causes of Edema:

- obstruction of lymphatic vessels due to parasitic plugs or tumor cells and chronic starvation;
- protein deficiency results in a lack of plasma proteins and a decrease in colloid osmotic pressure.
- increased permeability of the blood capillary endothelium resulting from chemical or mechanical injury or the release of certain substances produced in the body (e.g, histamine).



Thank you