Medical Biology

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.

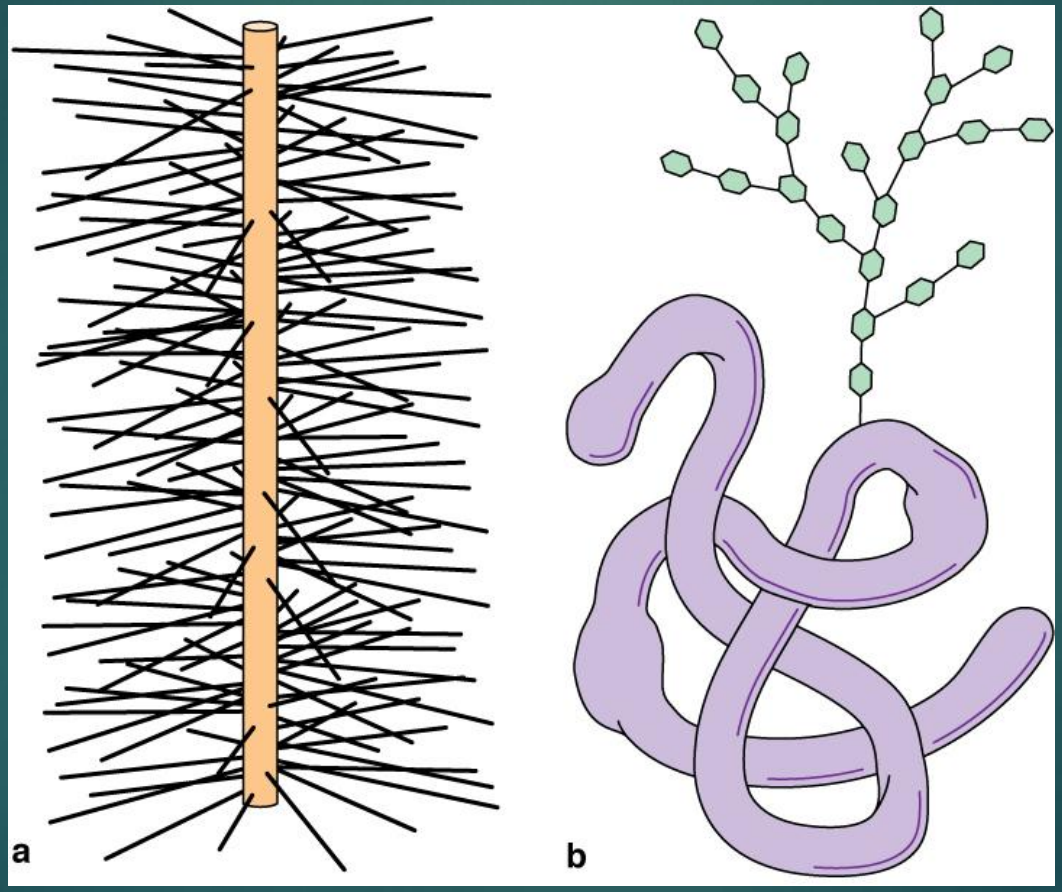
Ground substance composed of:

- **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.

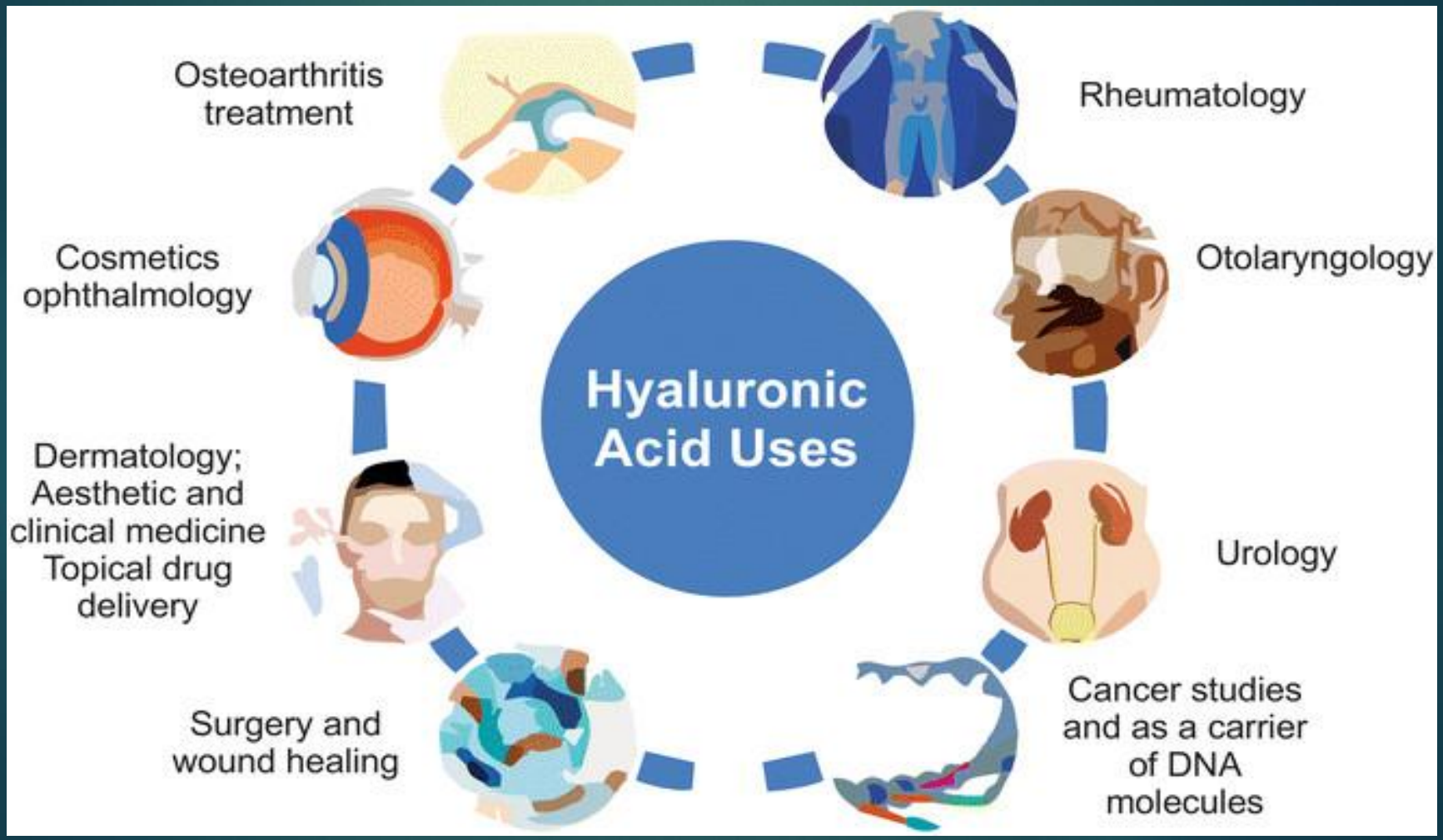
a proteoglycan
b glycoprotein



- 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.

Angioedema is a condition where small blood vessels leak fluid into the tissues under the skin, causing swelling in different parts of the body. It can develop because of an allergic reaction

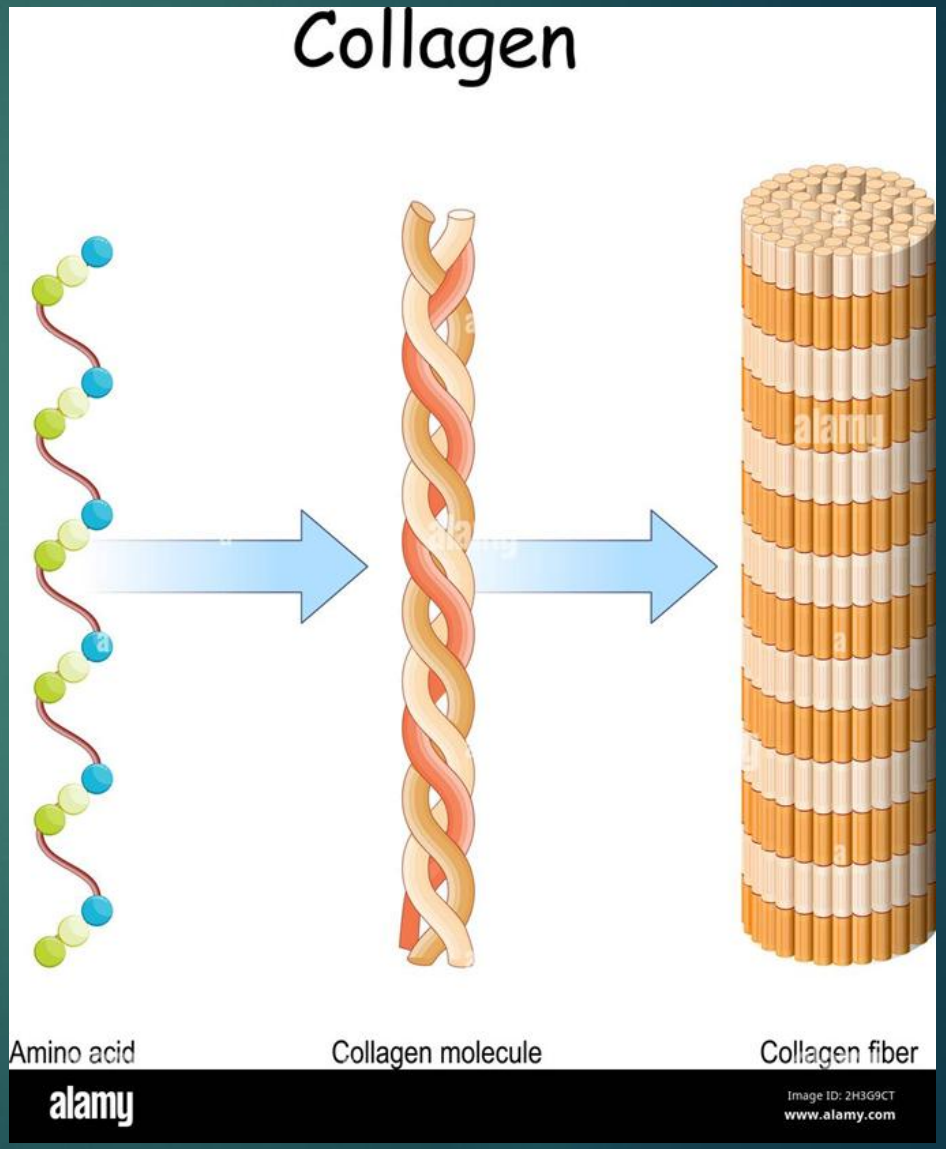
Biomedical applications of hyaluronic acid



II-Fibers:

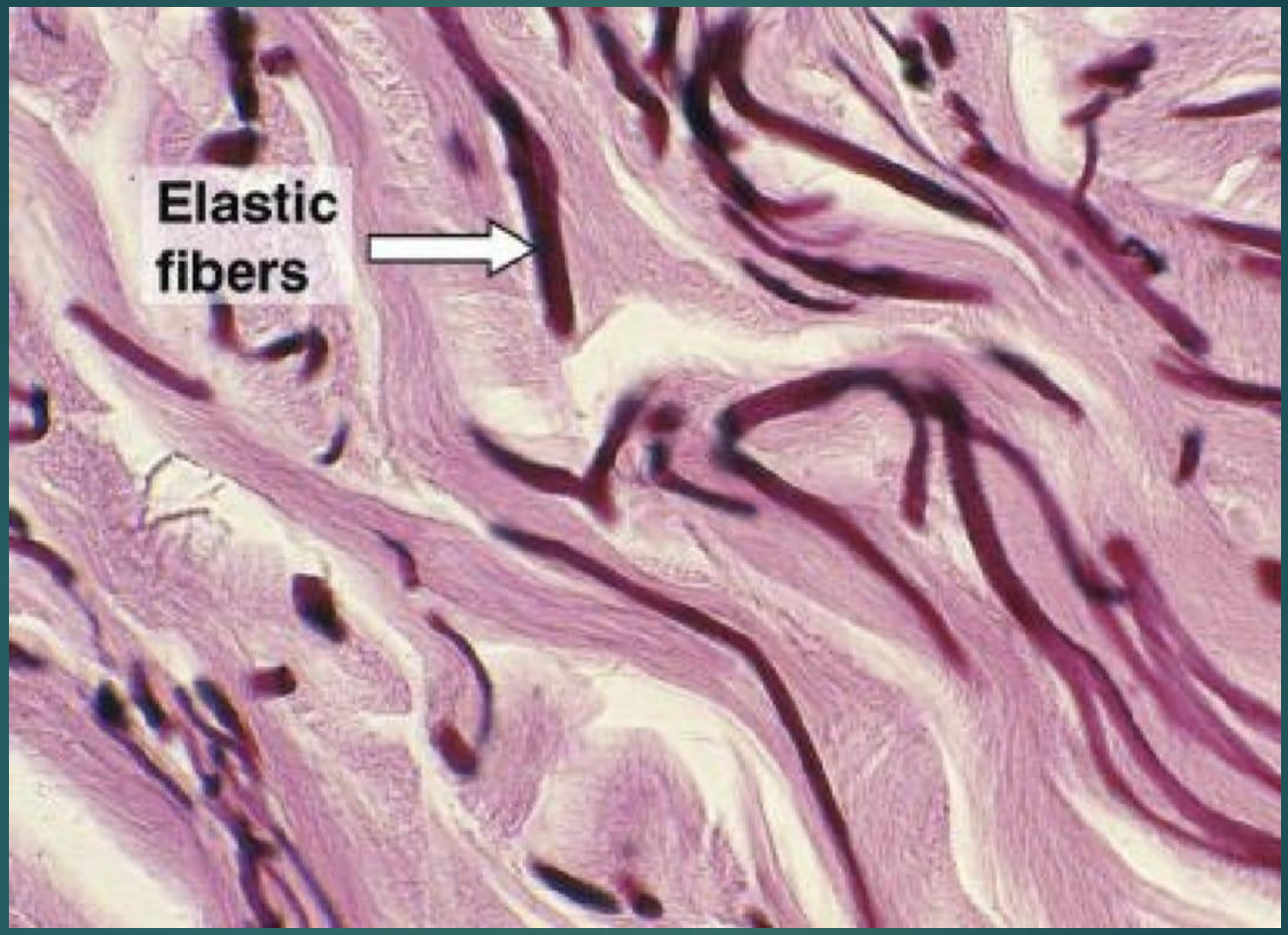
- **Collagen fibers (white fibers):**

there are several types of collagen fibers (currently named type I to XXI)



MEDICAL APPLICATION
Keloid

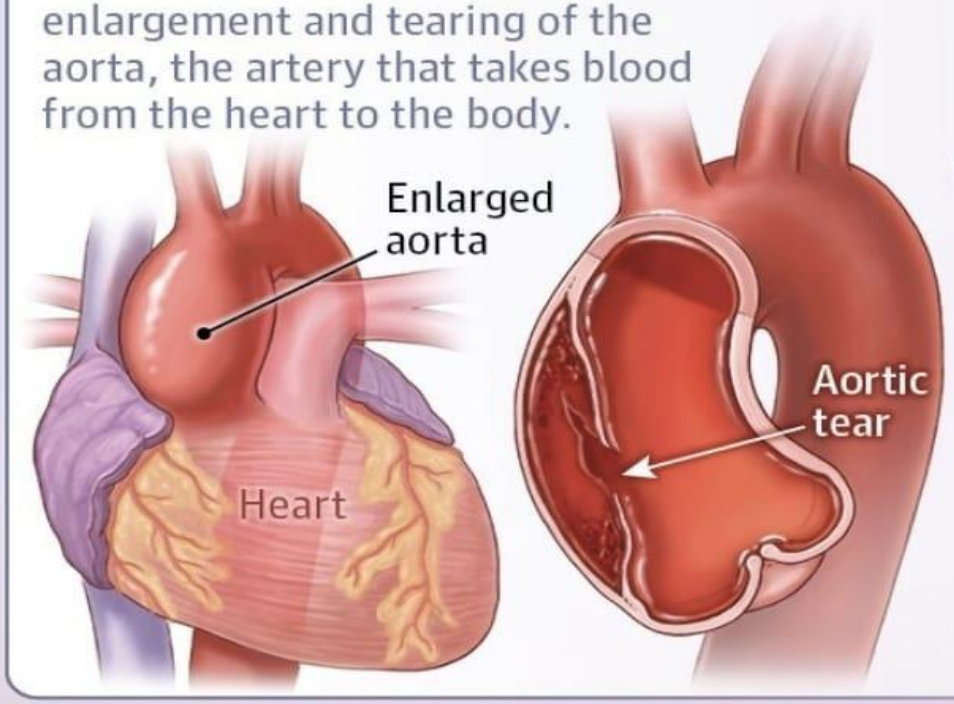
Elastic fibers (yellow fibers):



Marfan syndrome is a genetic disorder affecting connective tissue that provides structural support in the body.

Effects of Marfan syndrome

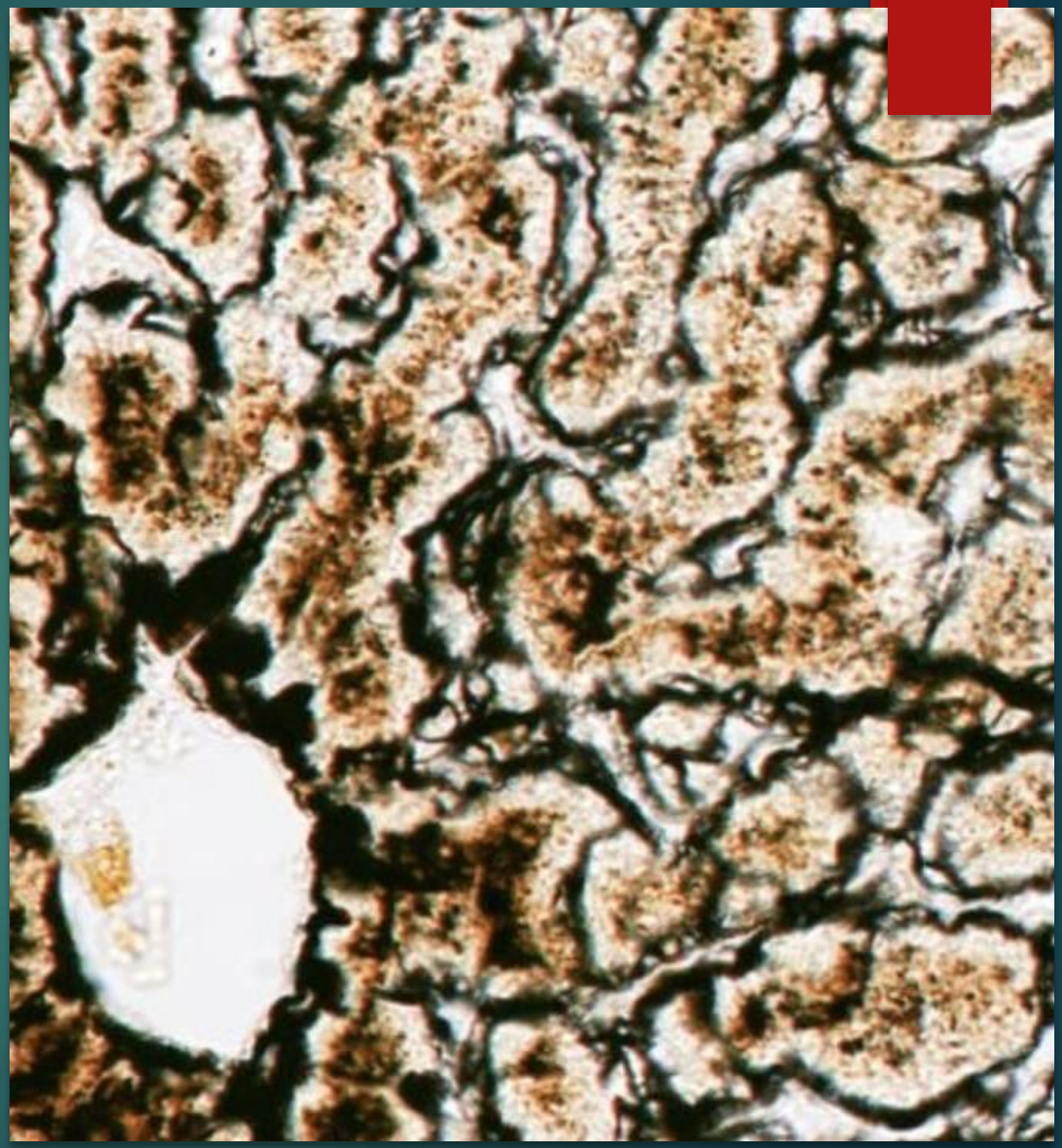
Weak connective tissue can cause enlargement and tearing of the aorta, the artery that takes blood from the heart to the body.



Treatment for Marfan syndrome includes

- Monitoring of the aorta, medications to limit aortic enlargement, and, in many patients, aortic repair to prevent aortic complications
- Counseling about exercise and family planning
- Specialty care for chronic pain, mental health, orthopedic, and eye problems

- **Reticular fibers:**



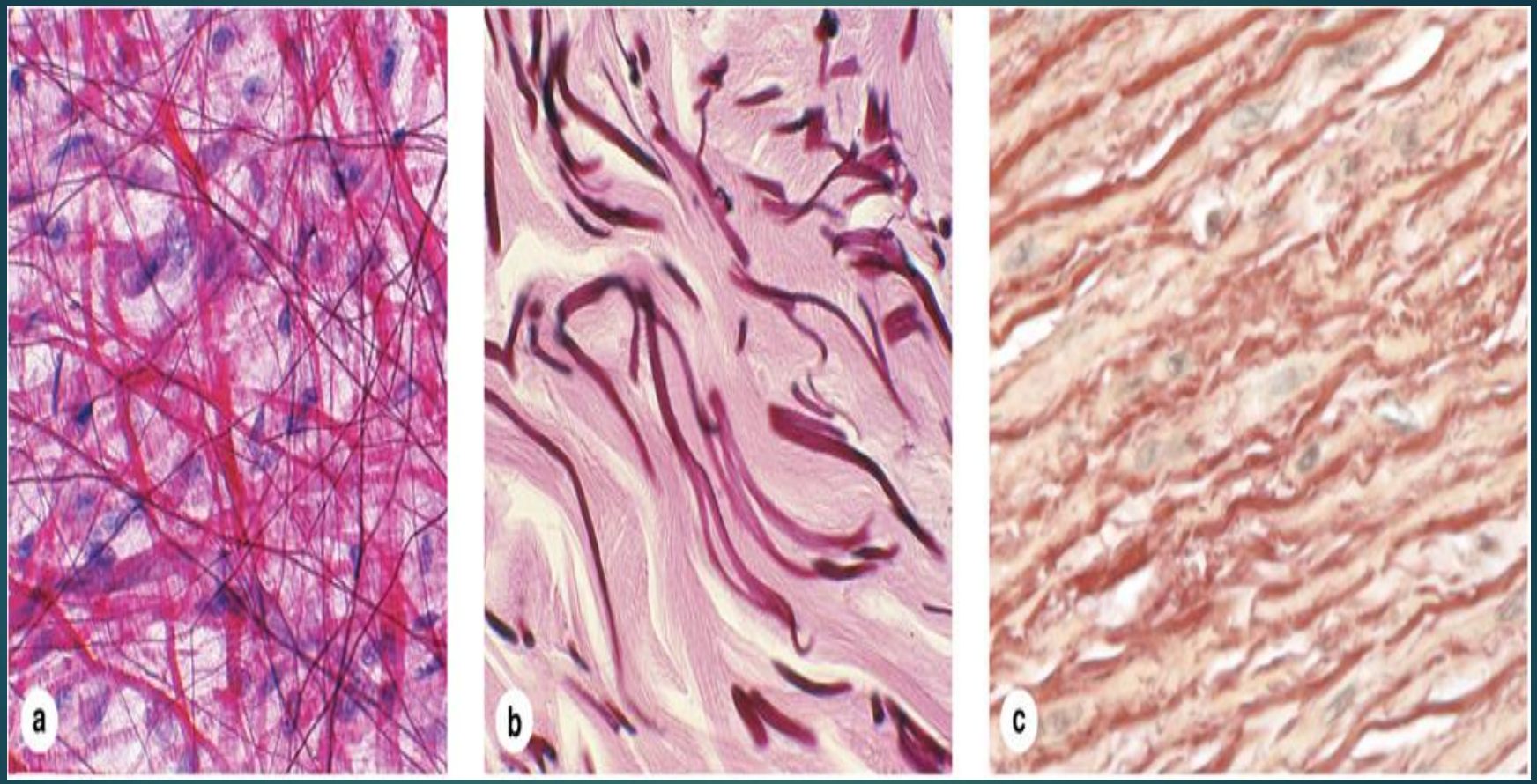
Ehlers-Danlos Syndrome

Rare **connective tissue disorder**

Due to inherited alterations in genes affecting **collagen**

1. Skin hyperextensibility
2. Joint hypermobility
3. Tissue fragility, poor wound healing, easy bruising

Most types have normal life expectancy


a
b
c

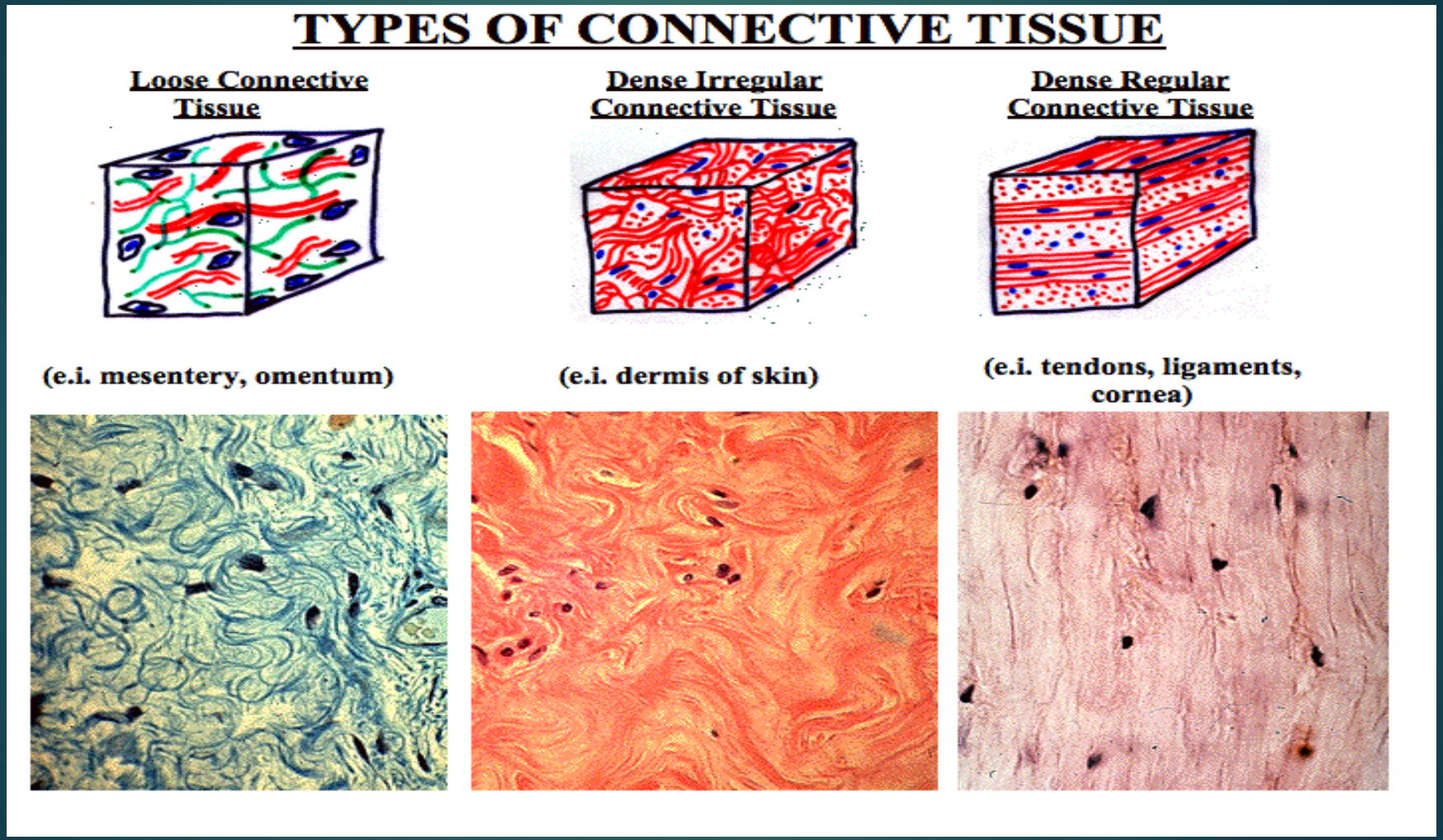
- Clinical Correlation:
- Sun Exposure and Molecular Changes in Photoaged Skin
- Chronological aging of the skin
- photoaging.

Connective tissue classification

- Connective tissue proper
1. Dense
   - Regular
   - Irregular
2. Loose
- Connective tissue with special properties
1. Adipose tissue
2. Hematopoietic (lymphatic and myeloid)
3. Elastic tissue
4. Reticular tissue
- Supporting connective tissues
1. Cartilage
2. Bone
- Embryonic connective tissues
1. Mucous tissue
2. Mesenchymal tissue

Connective Tissue Proper:

- a-Loose Connective Tissue:



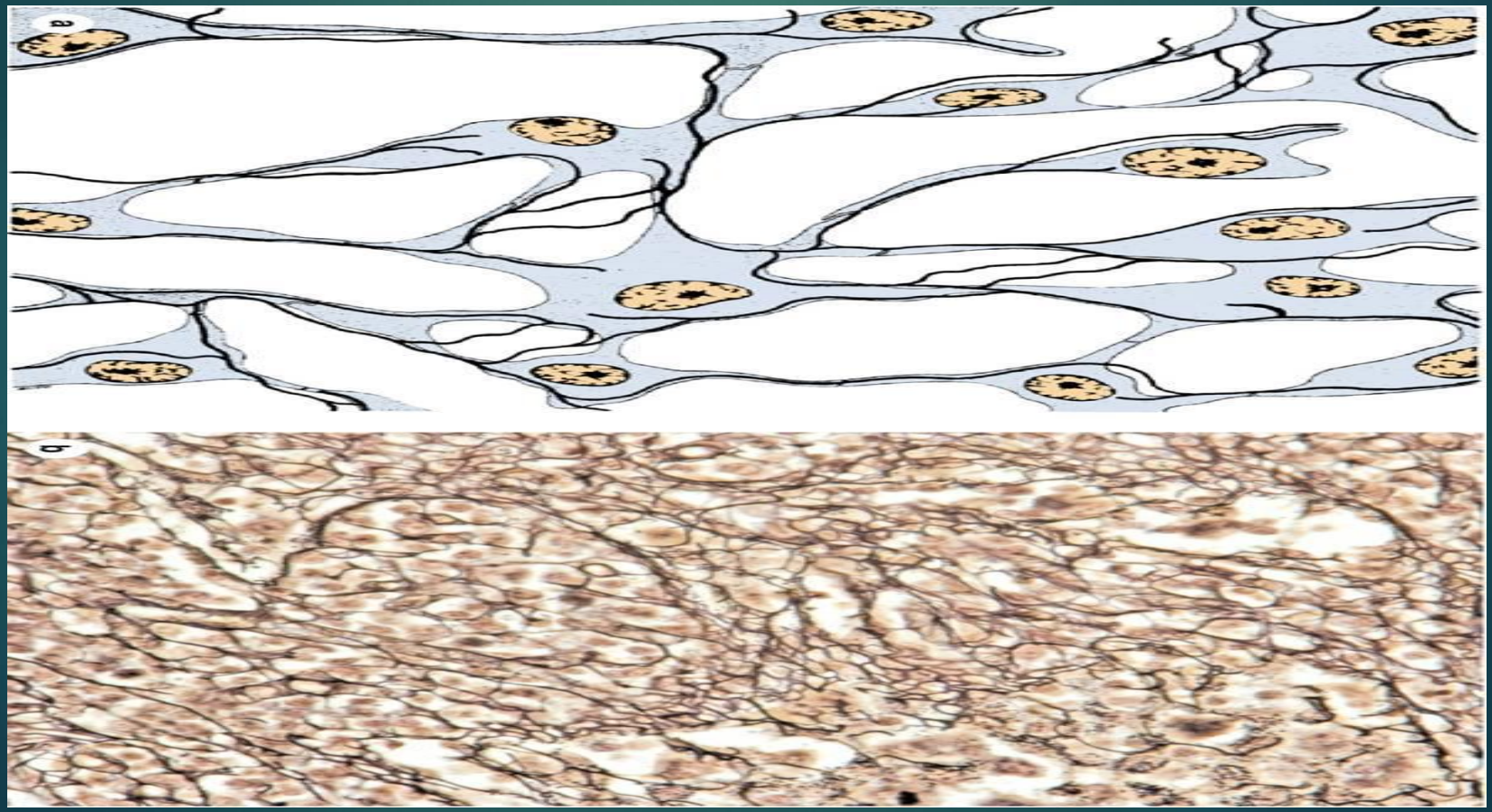
Connective Tissue With Special Properties:

- **Elastic tissue:**

  Elastic tissue is composed of thick, parallel elastic fibers. The space between these fibers is occupied by thin collagen fibers and flattened fibroblasts.

Reticular tissue:

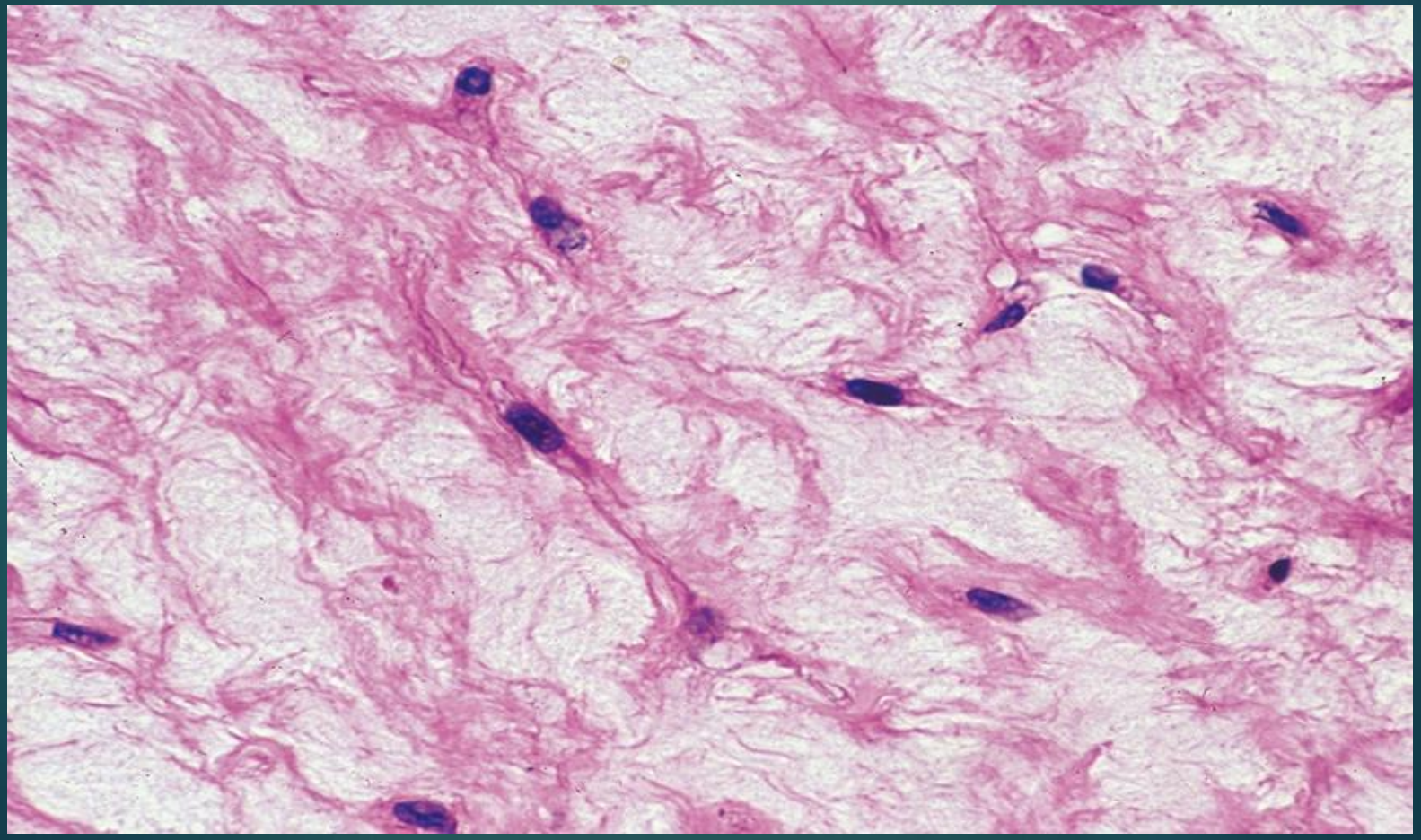
Reticular tissue provides the architectural framework that creates a special microenvironment for hematopoietic and lymphoid organs (bone marrow, lymph nodules, nodes and spleen).



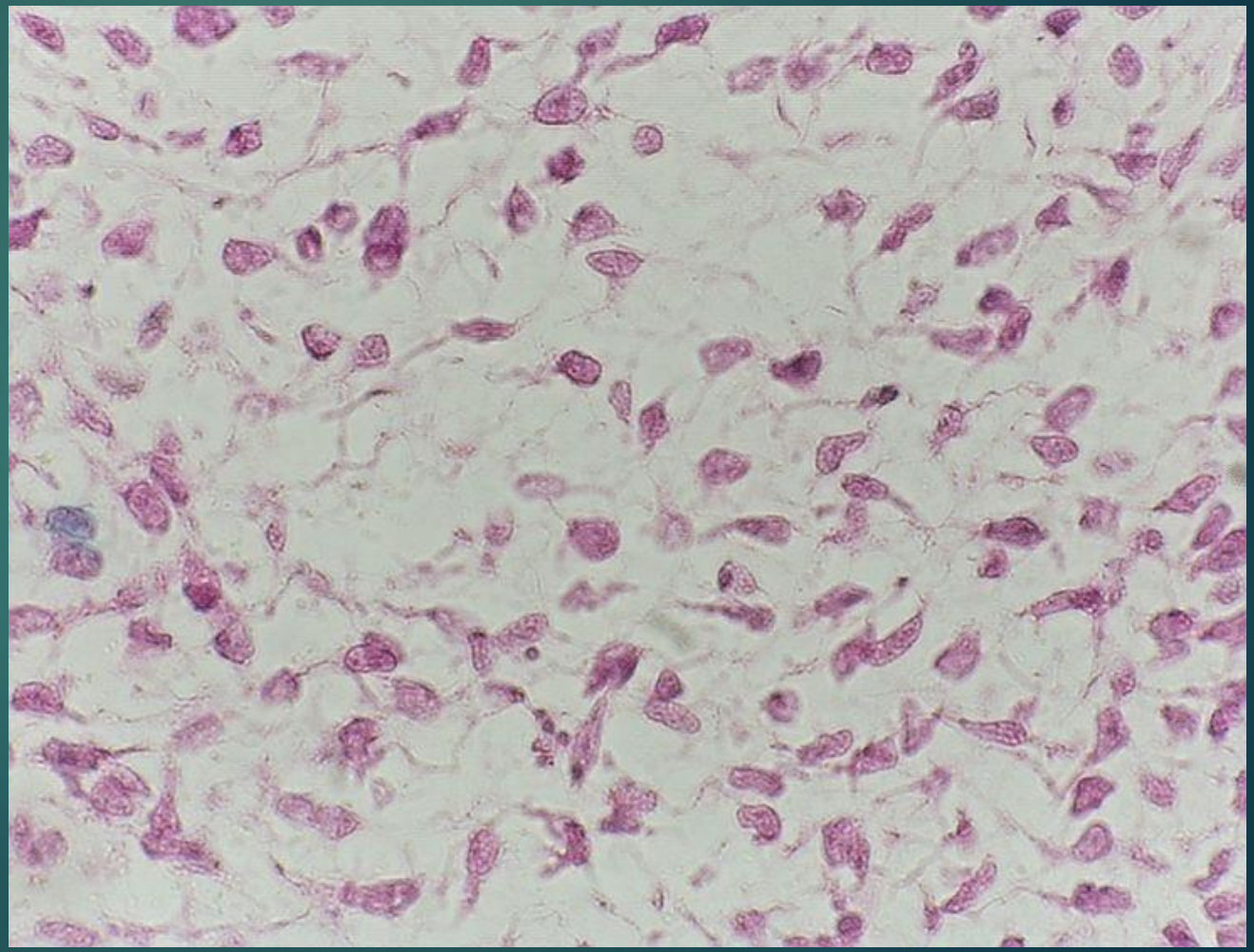
Embryonic Connective Tissue:

- **Mucous tissue:**

  This is found in the umbilical cord (Wharton's jelly). It is a loose connective tissue composed of fibroblasts



- **Mesenchymal tissue:**
- Is the connective tissue of embryo, consists of mesenchymal cells in a gel like amorphous ground substance containing scattered reticular fibers.



Thank you