

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.

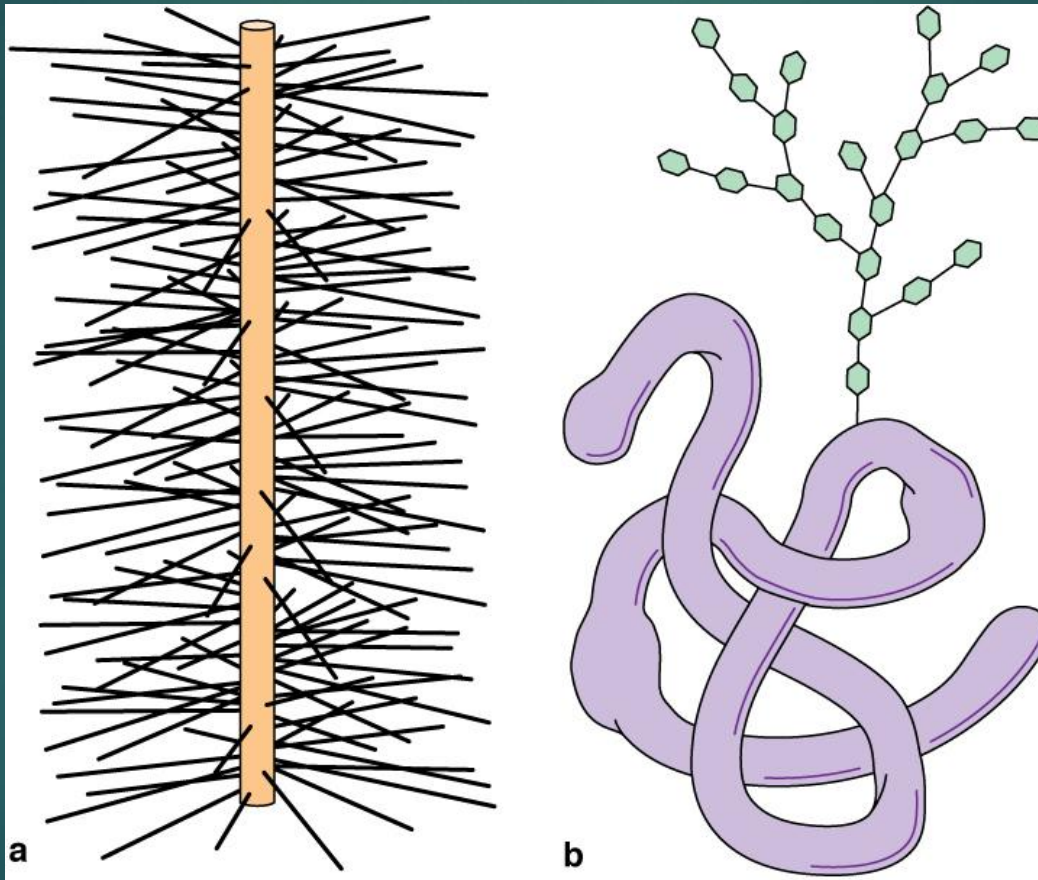
Ground substance composed of:


- ▶ **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



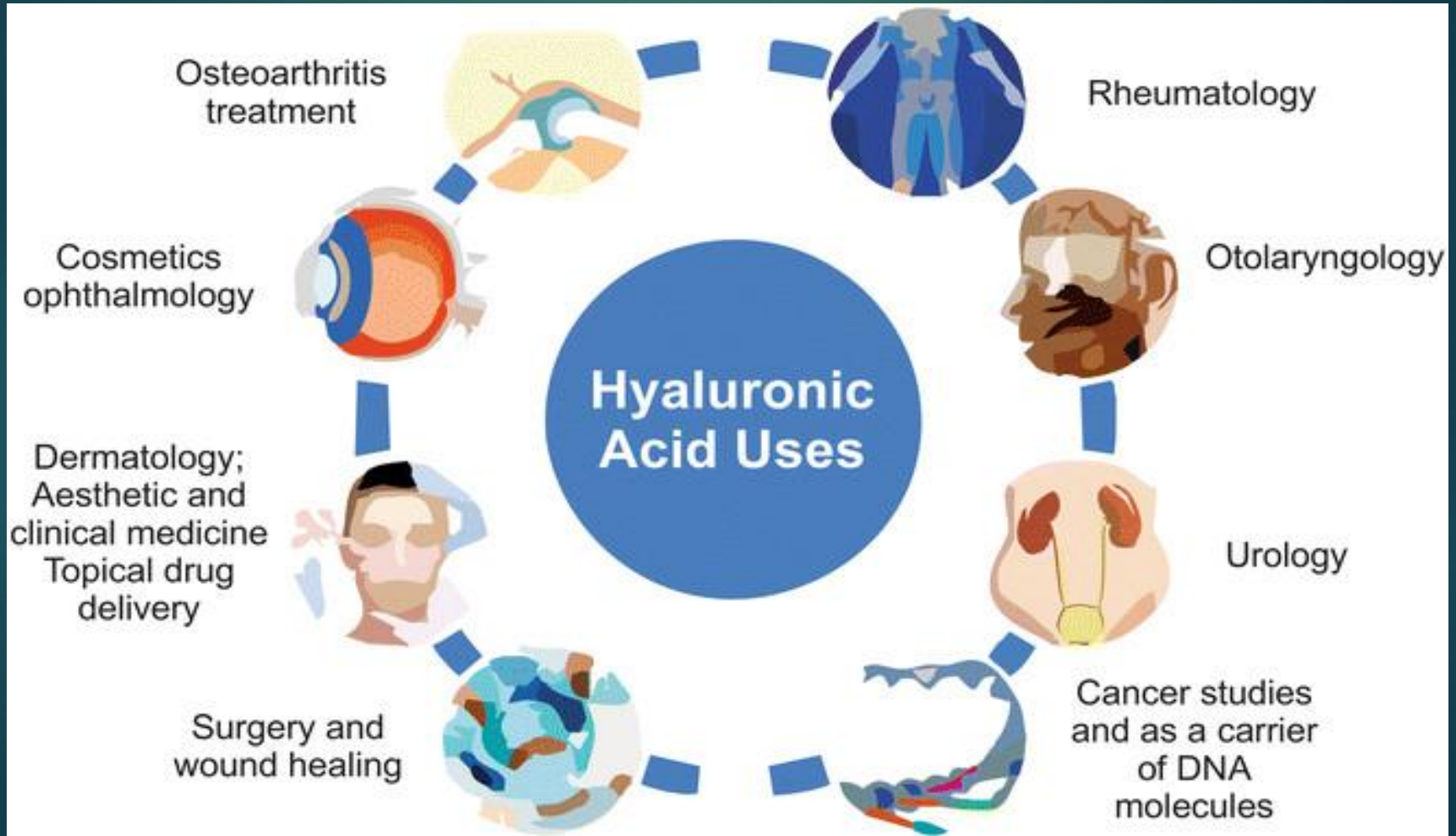
- 
- ▶ interstitial or tissue fluid
 - ▶ tissue fluid contain small percentage of plasma proteins that pass through the capillary walls as a result of the hydrostatic pressure of the blood.
 - ▶ **Edema** result from accumulation of water in the extracellular space in many pathological conditions e.g. 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



Types of collagen fibers:

About 20 different types of collagen fibers, differ by their composition, morphology, distribution in tissues and functions.

- ▶ Type I: in connective tissue proper, fibrocartilage and bone.
- ▶ Type II: in cartilage (hyaline and elastic).
- ▶ Type III: reticular fibers.
- ▶ Type IV: in basement membrane.

MEDICAL APPLICATION

Keloid



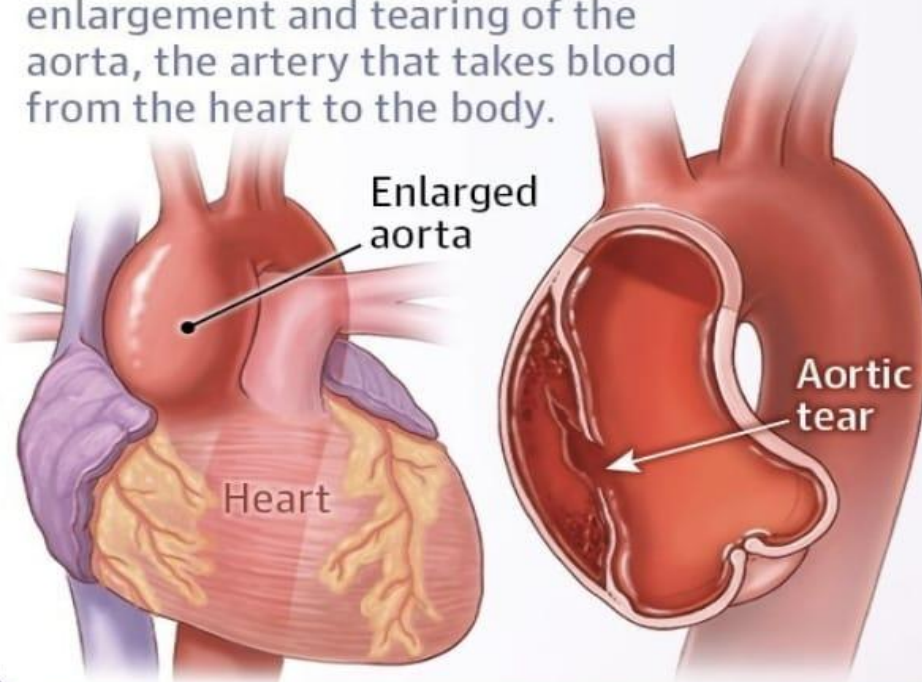
Elastic fibers (yellow fibers):



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.



Eye problems

Tall stature

Breastbone deformities

Curved spine

Long fingers

Abnormal joint mobility

Chronic pain

Long toes

Flat feet

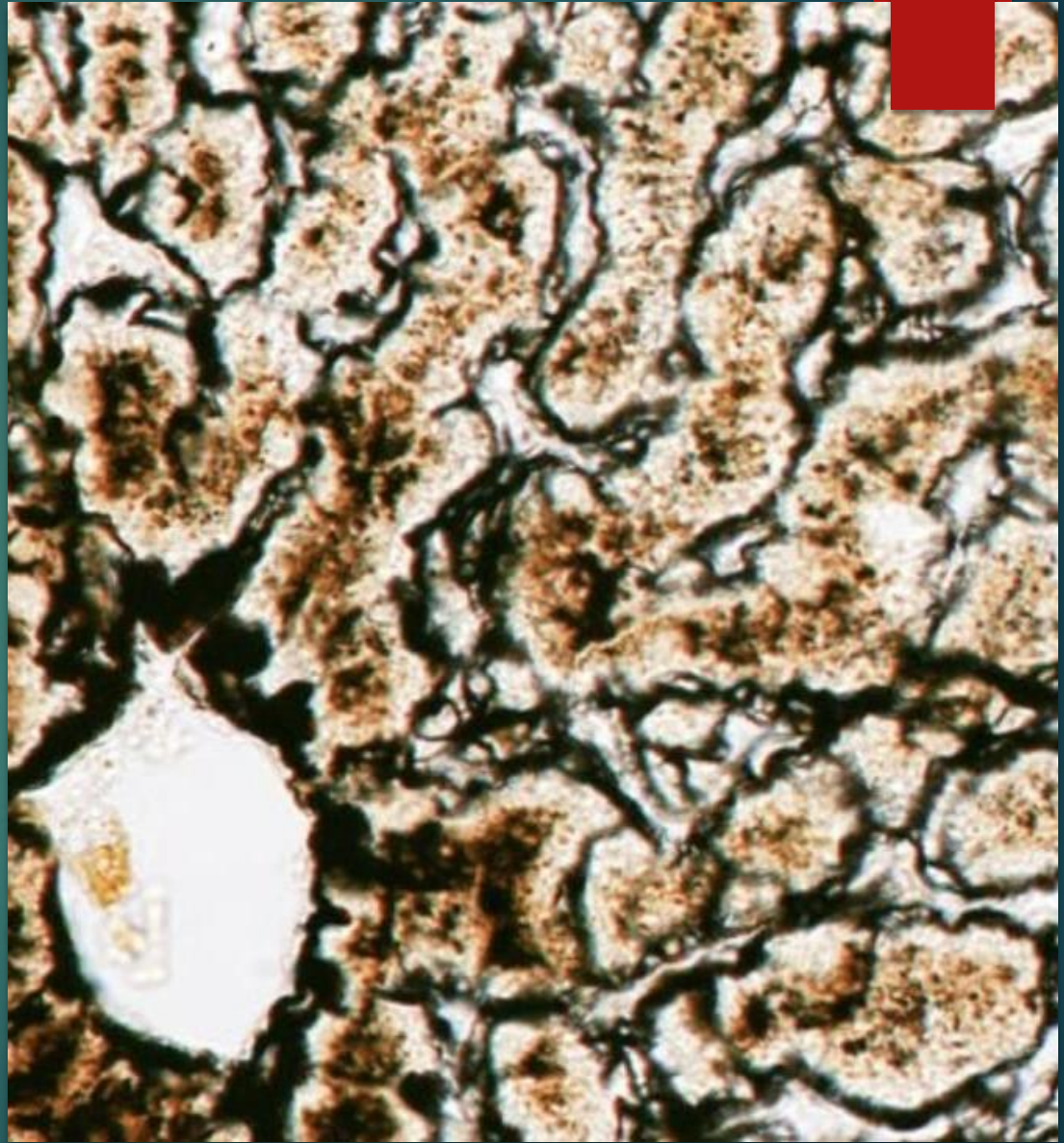


Treatment for Marfan syndrome includes

- 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

Handwritten signature

▶ Reticular fibers:



Ehlers-Danlos Syndrome

Rare **connective tissue disorder**

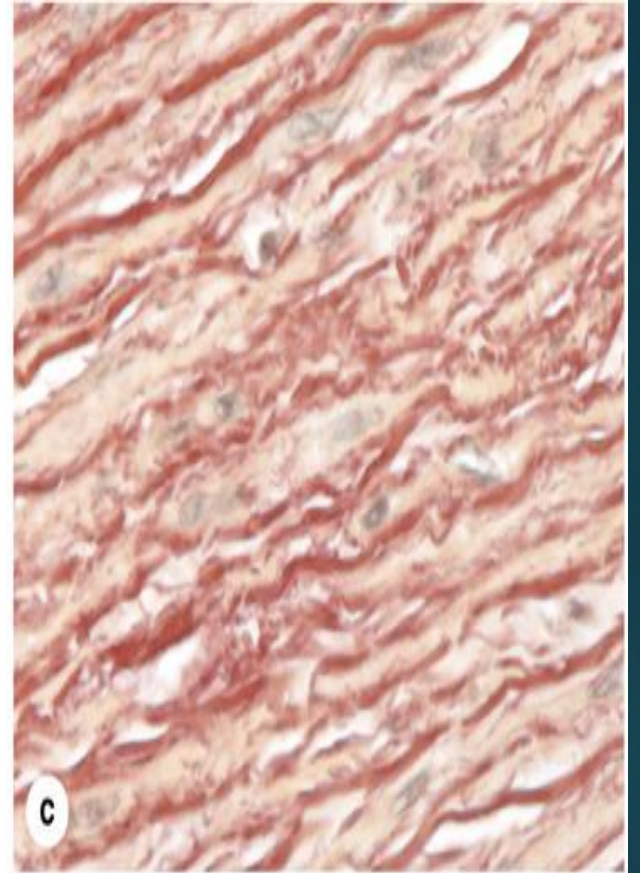
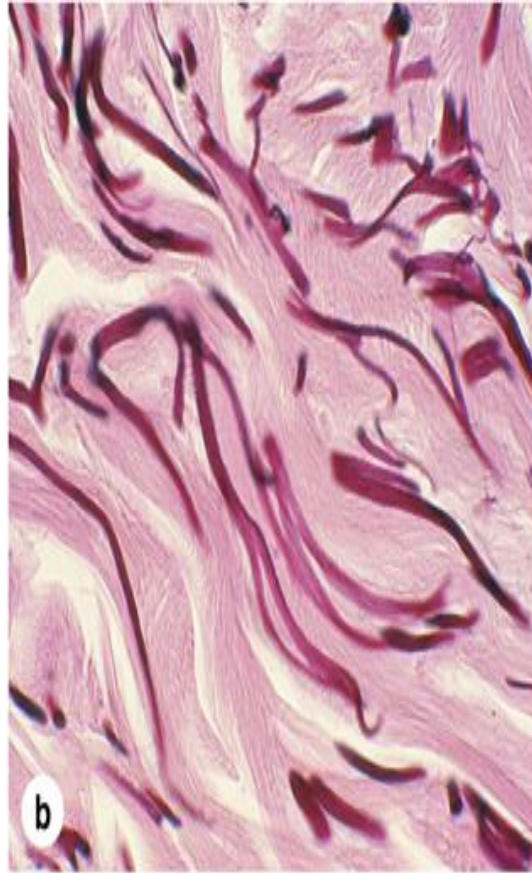
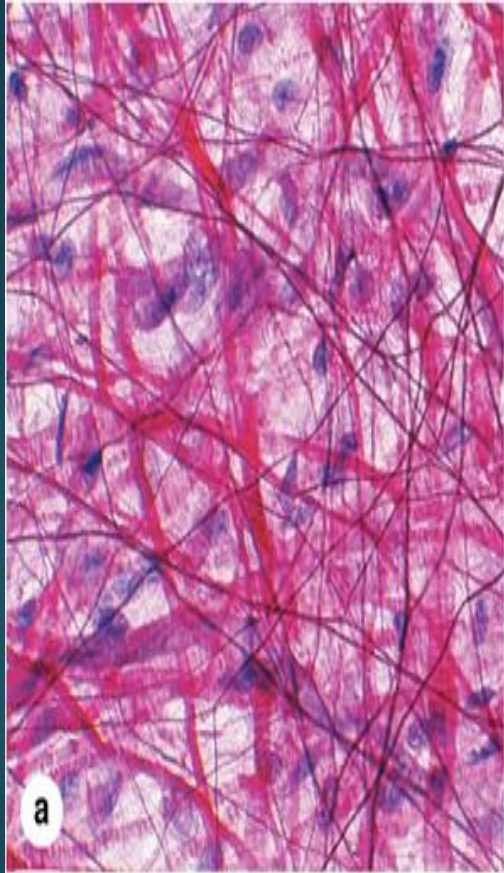
Due to inherited alterations in genes affecting **collagen**



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

Most types have normal life expectancy





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



Connective tissue classification

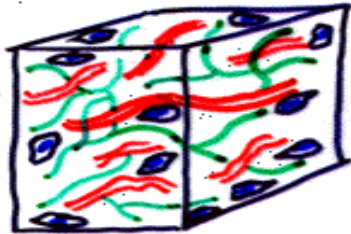
- ▶ Connective tissue proper
 1. Dense
 - ▶ Regular
 - ▶ Irregular
 2. Loose
- ▶ Connective tissue with special properties
 1. Adipose tissue
 2. Hematopoietic (lymphatic and myeloid)
 3. Reticular tissue
- ▶ Supporting connective tissues
 1. Cartilage
 2. Bone
- ▶ Embryonic connective tissues
 1. Muroid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

Connective Tissue Proper:

▶ a-Loose Connective Tissue:

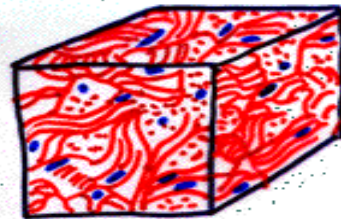
TYPES OF CONNECTIVE TISSUE

Loose Connective Tissue



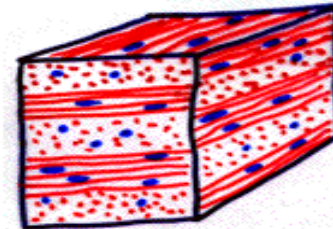
(e.i. mesentery, omentum)

Dense Irregular Connective Tissue

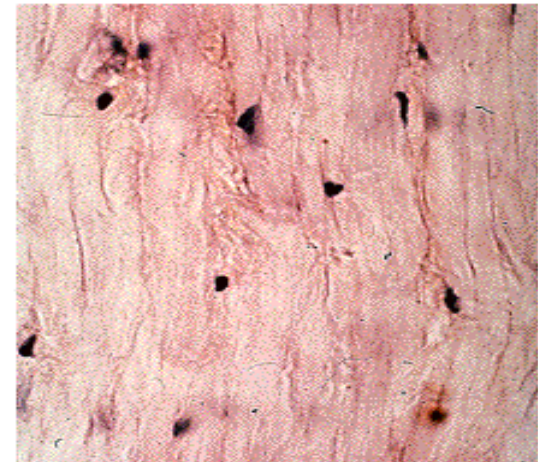
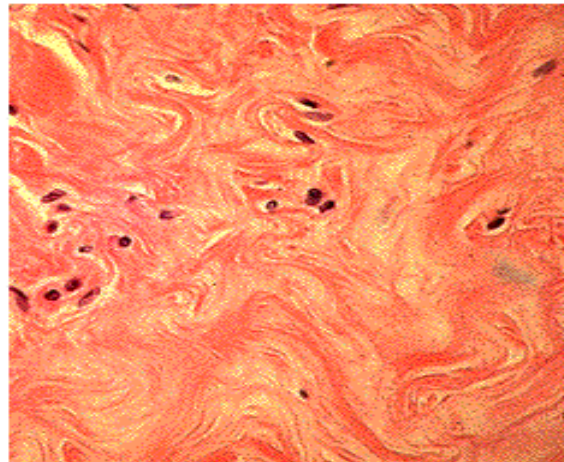
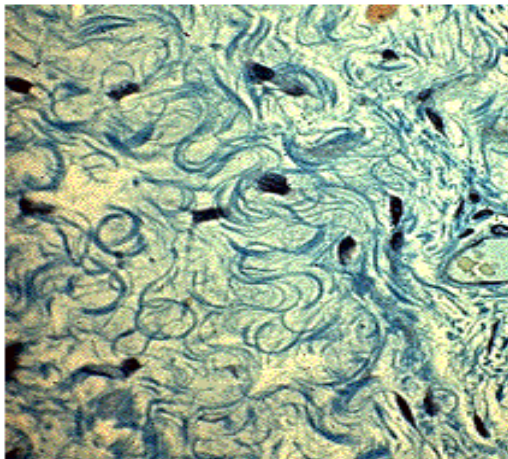


(e.i. dermis of skin)

Dense Regular Connective Tissue

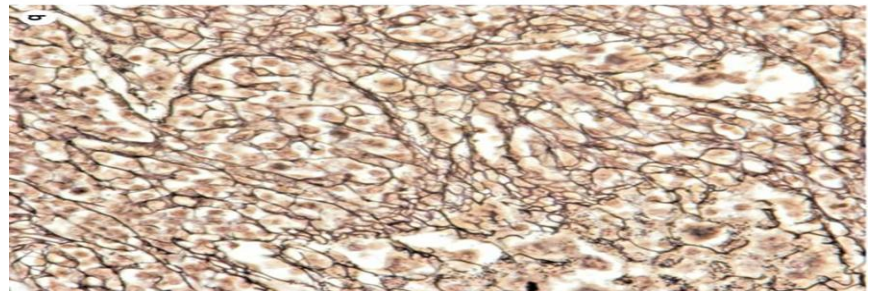
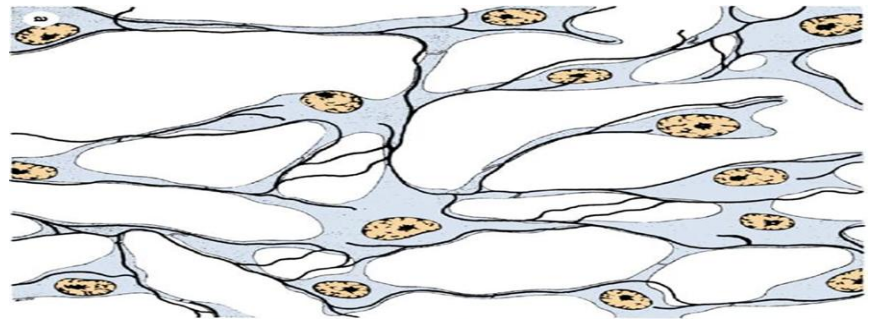


(e.i. tendons, ligaments, cornea)



Connective Tissue With Special Properties:

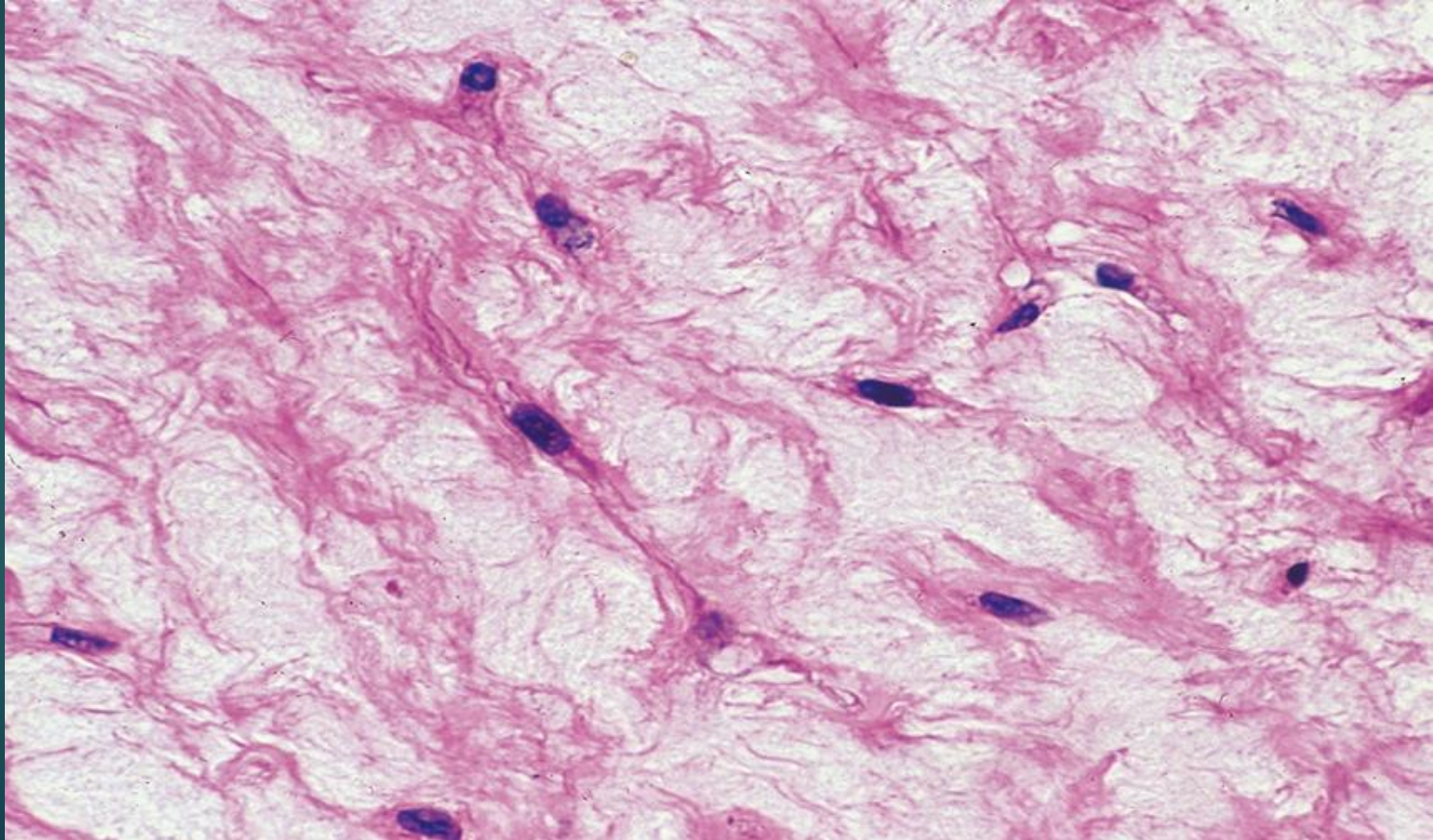
- ▶ Reticular tissue:
 - Consists of delicate networks of type III collagen and is most abundant in certain lymphoid organs where the fibers form attachment sites for lymphocytes and other immune cells.



Embryonic Connective Tissue:

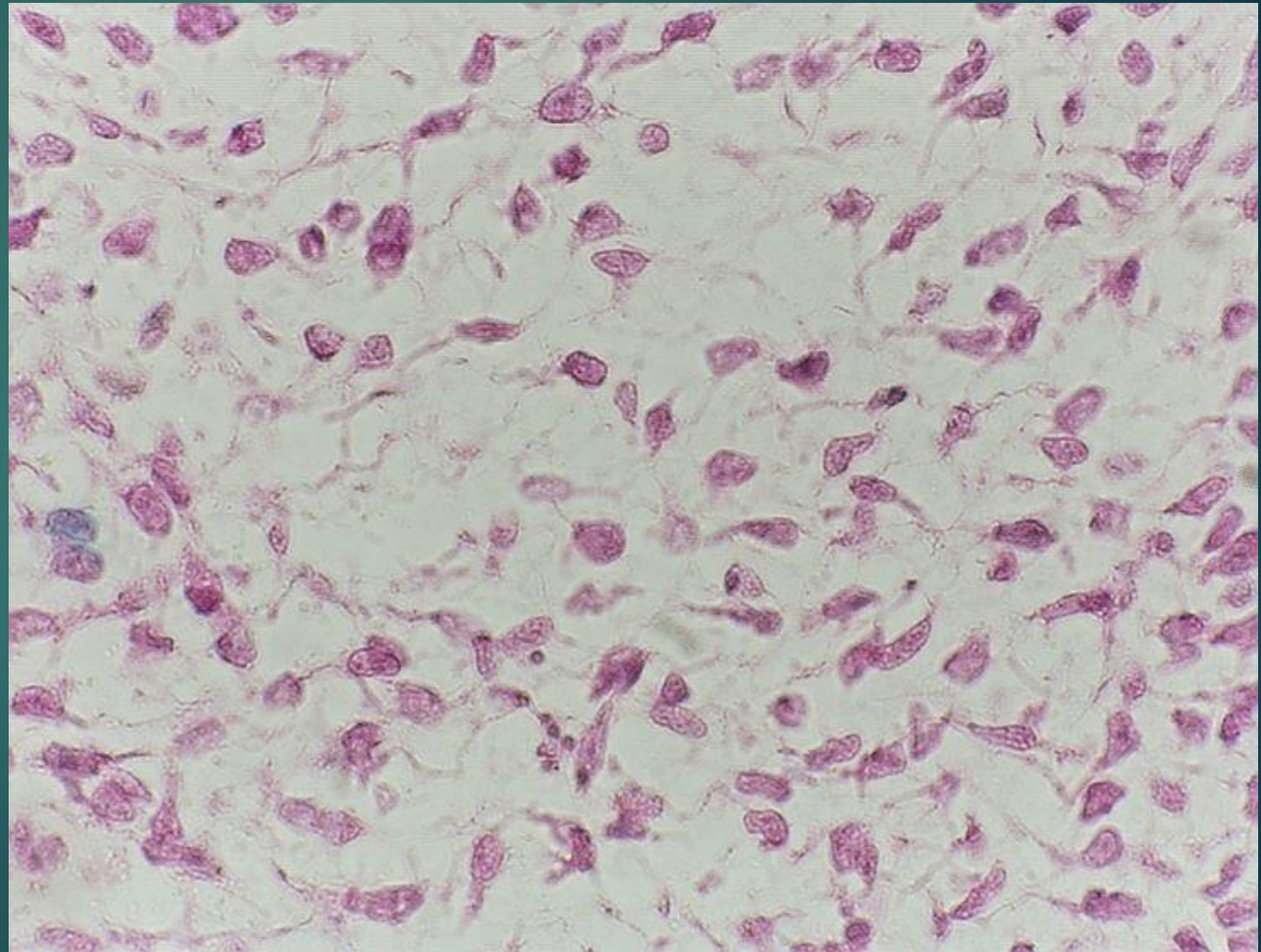
▶ Mucoid tissue:

It is referred to as (Wharton's jelly), it is a gel-like connective tissue with few cells found most abundantly around blood vessels in the umbilical cord.



▶ Mesenchymal tissue:

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



	Collage fibers	Reticular fibers	Elastic fibers
1. Fresh state	White.	-----	Yellow.
2. Stain	H&E : pink.	Silver: brown.	H&E: faint. Orcein: brick red.
3. Types	20 types, most common is type I.	Collagen type III.	-----
4. Description	<ul style="list-style-type: none"> ▪ Cylindrical. ▪ Run in bundles. ▪ Fibers are not branched but bundles do. 	Short branching fibers that form a network.	Either long & thin branching fibers or parallel sheets.
5. Function	Tensile strength.	Support.	Flexibility & elastic recoil (due to elastin protein).

Thank you

