Connective Tissue

Lec. 4

Histology

Structural Elements of Connective Tissue

- **Consist of**

1- Extracellular Substance

a. Amorphous matrix Ground substance – unstructured material that fills the space between cells

b. Fibers Collagen, Elastic, or Reticular.

2- Cells:

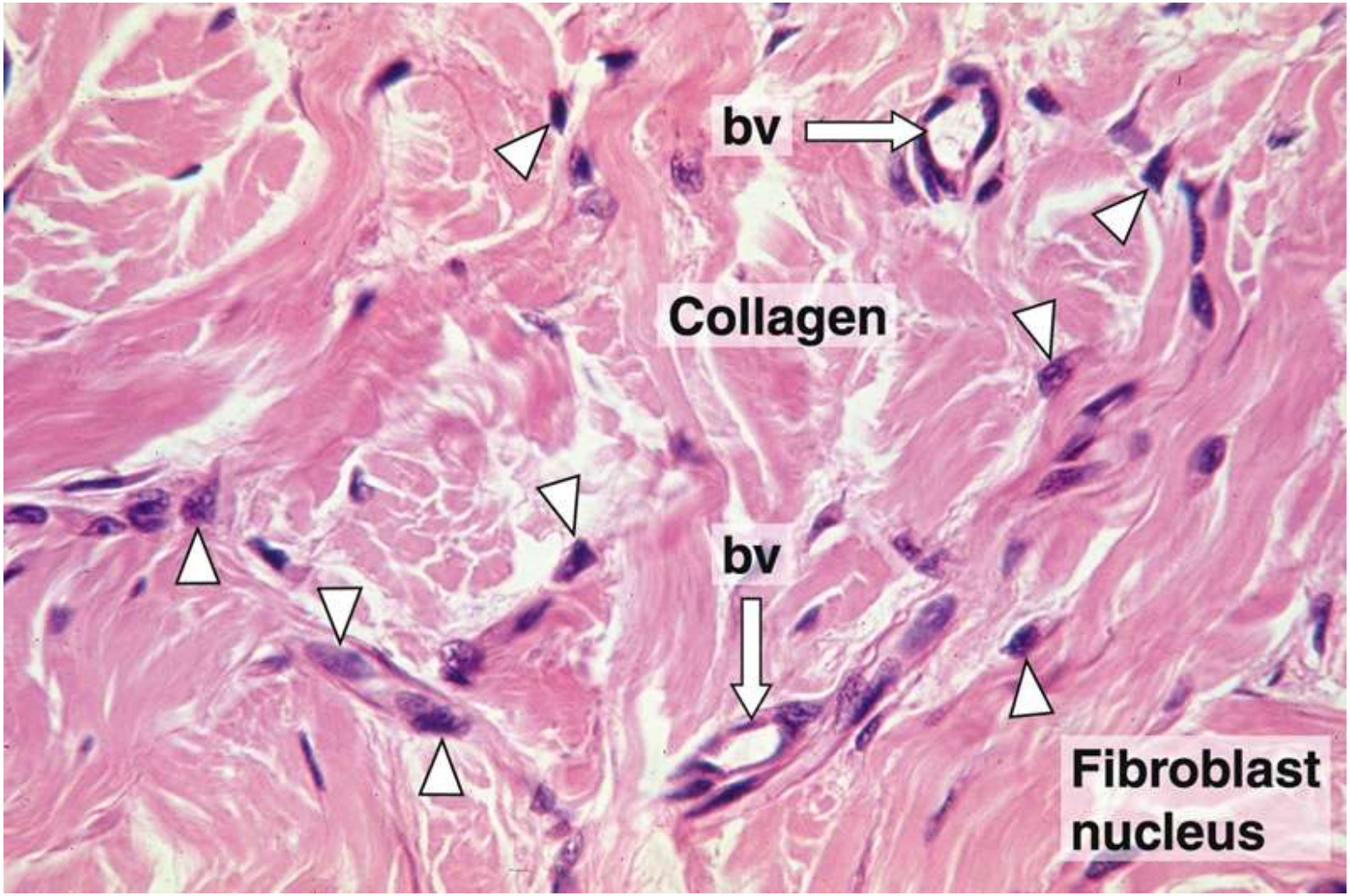
Fibroblasts, Chondroblasts, Osteoblasts, Hematopoietic stem cells, and others

Extracellular Substance

B\ Fibers

1-Collagen fibers (White fibers)

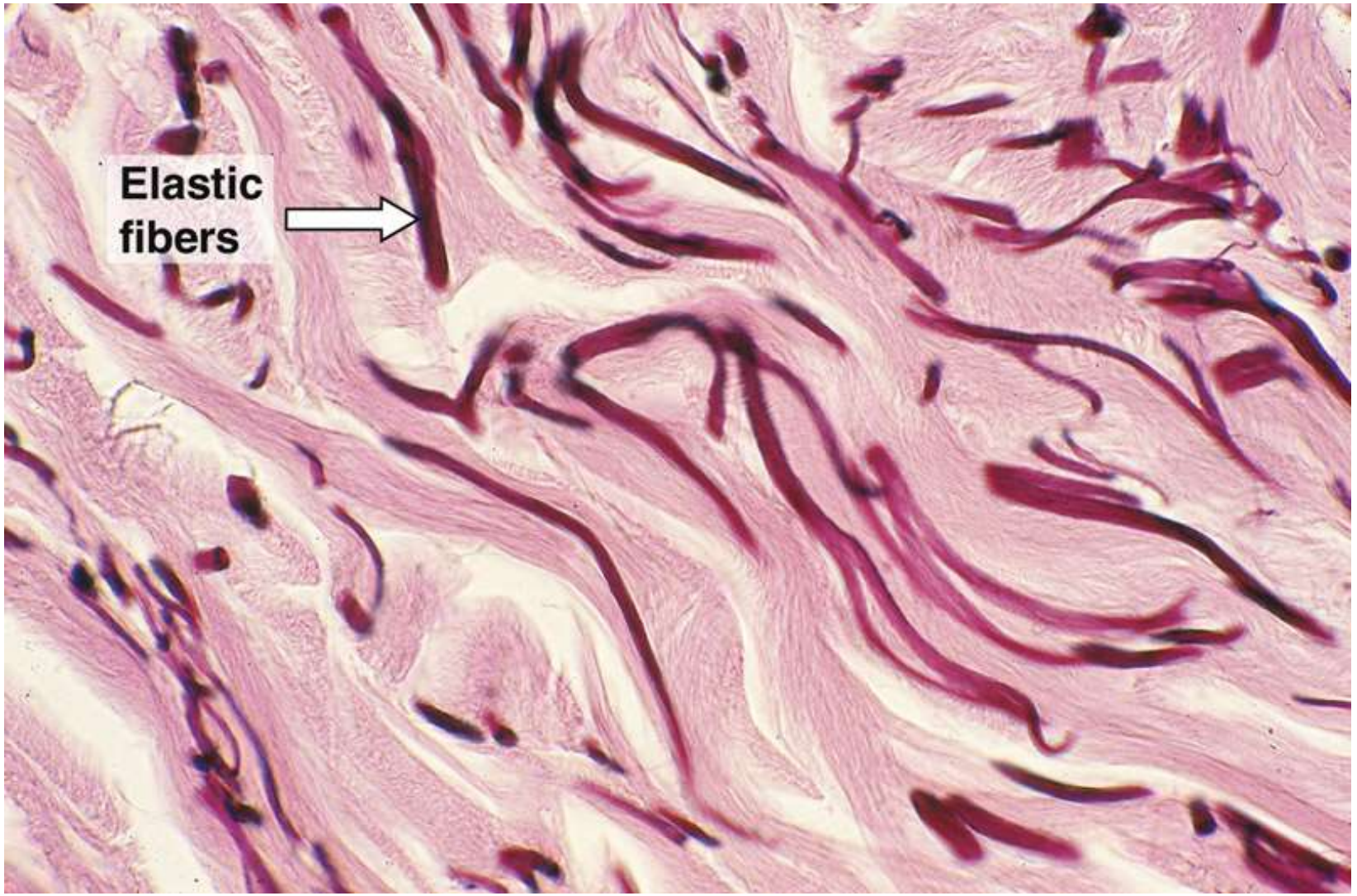
- **Composed of the protein collagen**
- **The collagen fiber is the dominant fiber type in most connective tissues and Collagen is the most abundant protein in the animal body Lots of , these collagen fibrils are bound together to form collagen fibers so they are found in bundles parallel to each other.**
- **They do not branch.**
- **The primary function of collagen fibers is to add strength to the connective tissue. Collagen fibers composed of the protein collagen. Strong, flexible, inelastic; great tensile strength (i.e. resist stretch). Perfect for tendons, ligaments**



Dense irregular connective tissue from human dermis contains thick bundles of collagen fibers, fibroblast nuclei (arrowheads), and a few small blood vessels (bv).

2-Elastic fibers (yellow fibers)

- Elastic fibers. Contain molecules of protein elastin that resemble coiled springs. Returns to its original shape after stretching or compression. Perfect for lungs, large blood vessels
- Elastic fibers are colored in fresh tissues with a light yellow color - but this coloration is only visible if large amounts of elastic fibers are present in the tissue, for example, in the elastic ligaments of the vertebral column.

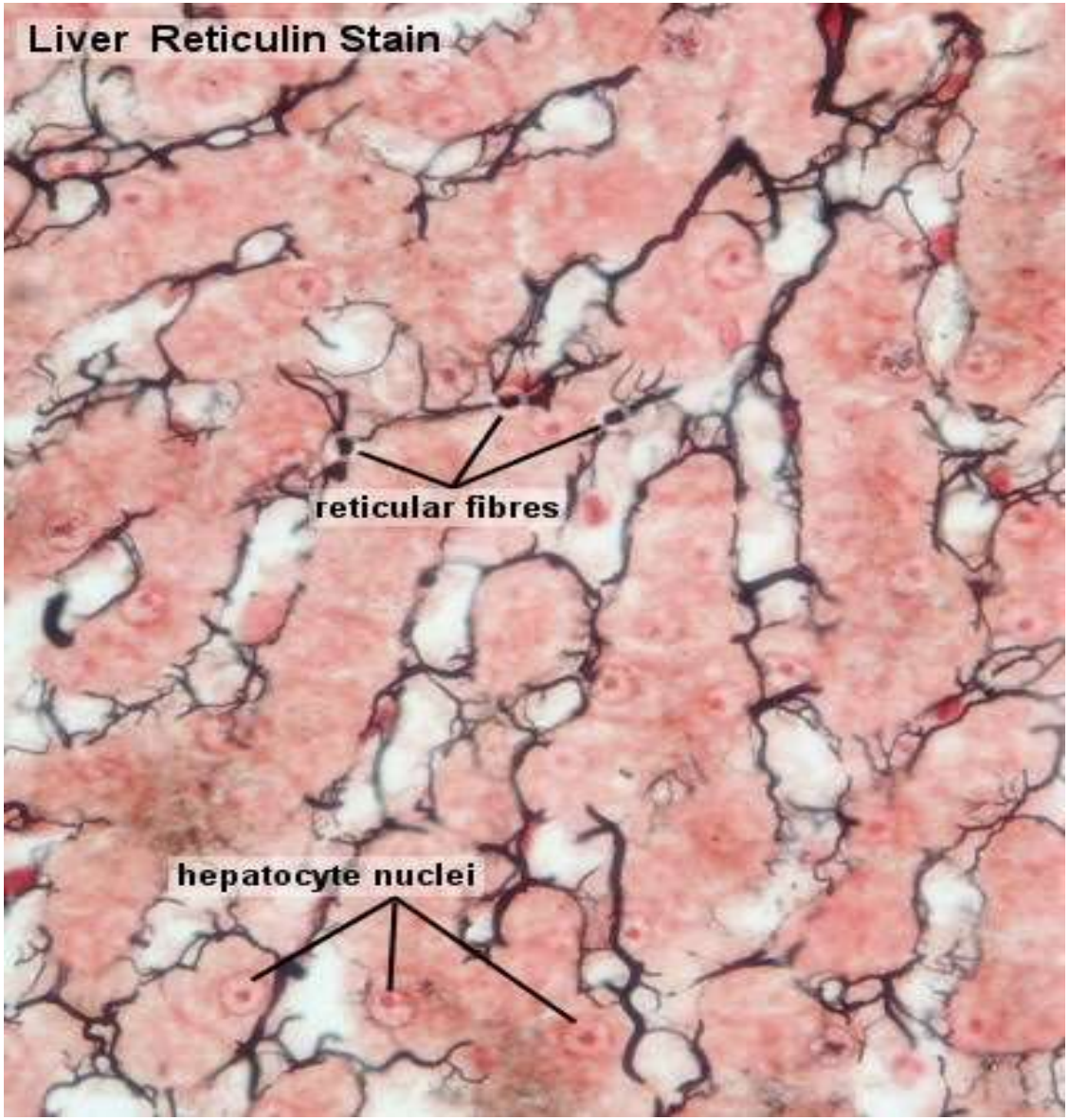


Skin dermis, selectively stained for elastic fibers. Dark elastic fibers are interspersed with pale red collagen fibers. The elastic fibers are responsible for skin's elasticity.

3-Reticular fibers

- Reticular fibers are very delicate and form fine networks instead of thick bundles.

- They are usually not visible in histological sections but can be demonstrated by using special stains. For example, in silver stained sections reticular fibers look like fine, black threads .



The liver is one of the organs in which the cells are supported by a network of reticular fibers. They appear as fine black lines in this silver stained preparation.

Connective Tissue Cells

Connective tissue cells are usually divided into two groups based on their ability to move within the connective tissue.

A. Fixed cells:

- **Fibrocytes (or fibroblasts) .**
- **Adipocytes [Fat cells] are fixed cells.**

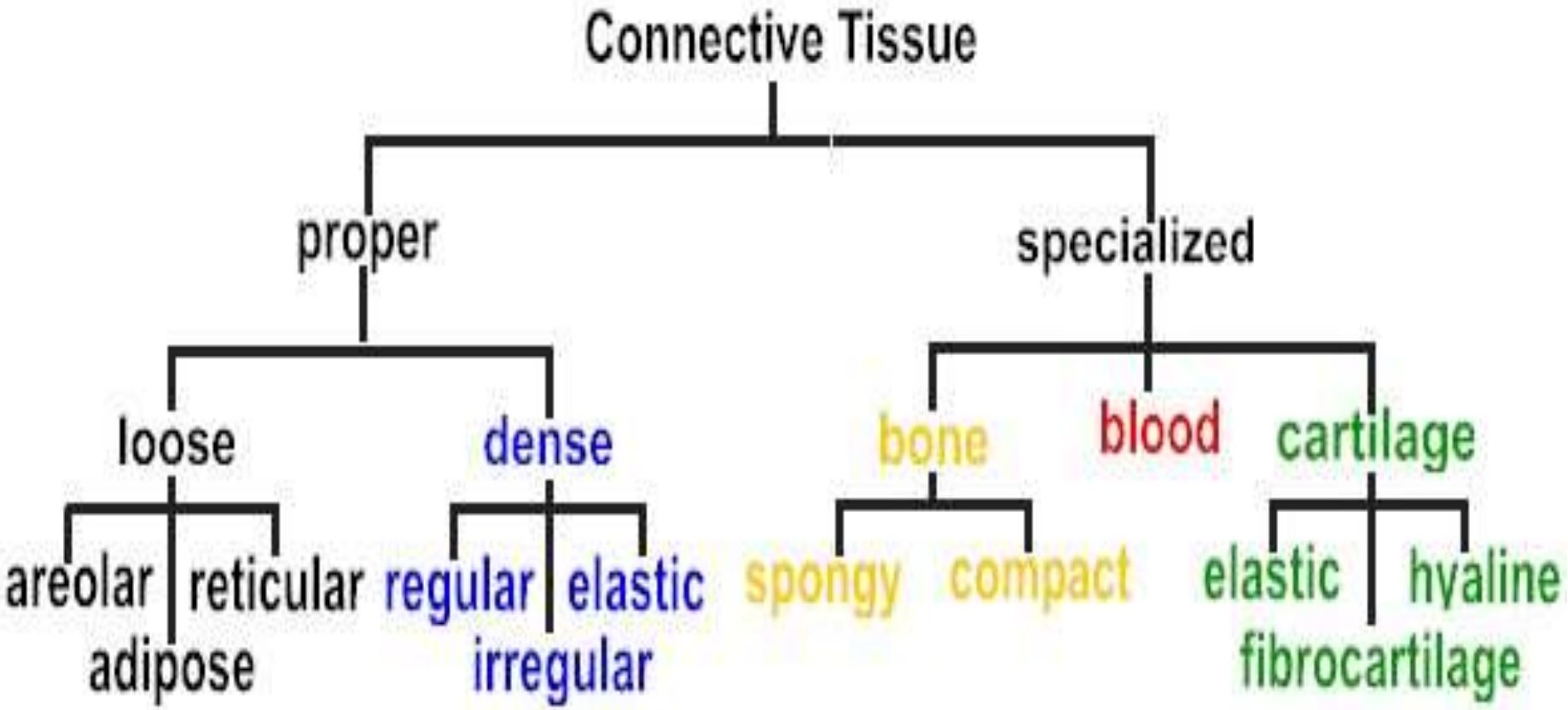
B.Wandering cells:

- **Macrophages, monocytes.**
- **Lymphocytes, plasma cells.**
- **Eosinophils and mast cells. wandering cells.**

Connective Tissue Cells

1. **Fibroblasts -** secrete the proteins needed for fiber synthesis and components of the extracellular matrix
2. **Adipose** or **fat cells** (**adipocytes**). Common in some tissues (dermis of skin); rare in some (cartilage)
3. **Mast cells**. Common beneath membranes; along small blood vessels. Can release heparin, histamine, and proteolytic enzymes in response to injury.
4. **Leukocytes (WBC's)**. Respond to injury or infection
5. **Macrophages**. Derived from monocytes (a WBC). Phagocytic; provide protection
6. **Chondroblasts -** form cartilage
7. **Osteoblasts -** form bone
8. **Hematopoietic stem cells** - form blood cells
9. **Undifferentiated mesenchyme** (stem cells). Have potential to differentiate into adult cell types.

Classification of Connective tissue



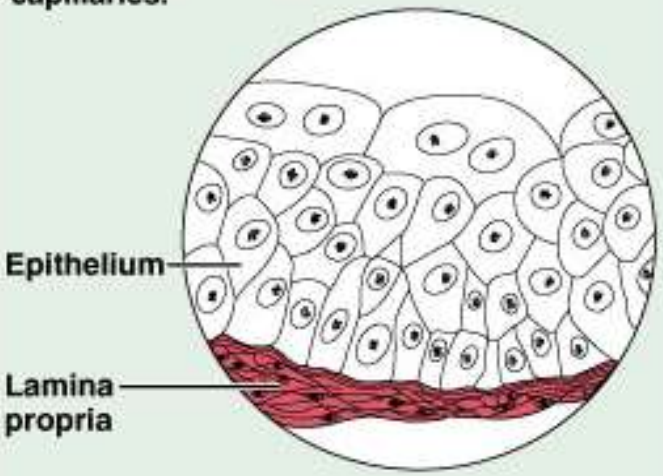
Areolar Connective Tissue

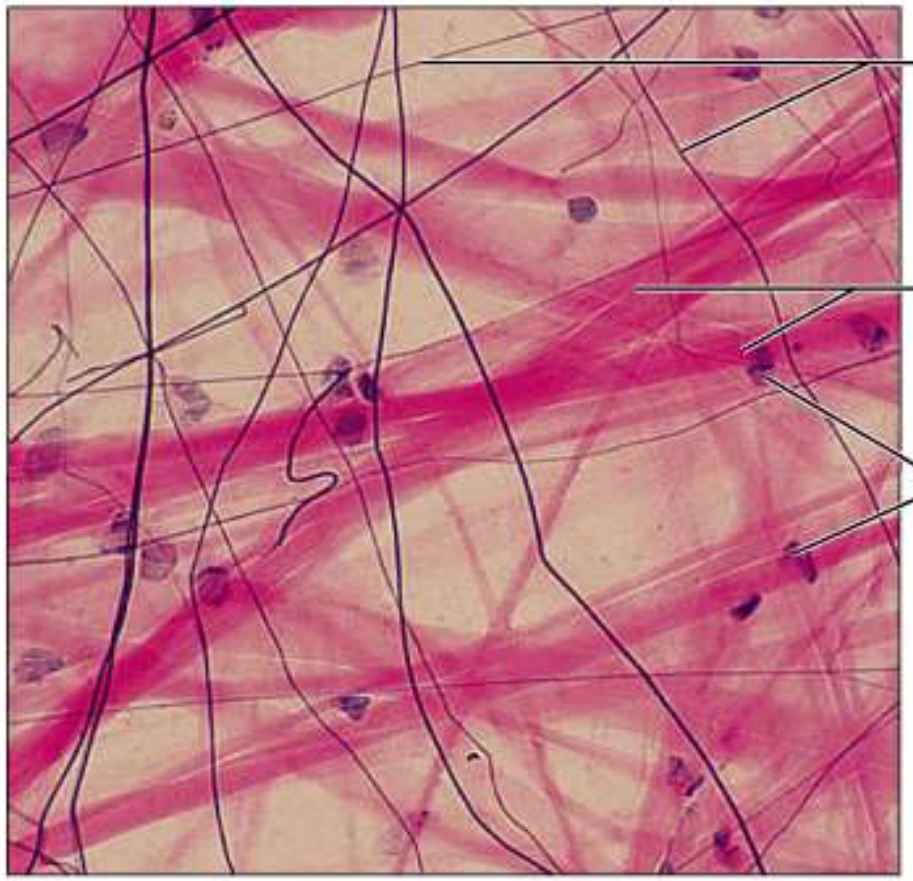
(b) Connective tissue proper: loose connective tissue, areolar

Description: Gel-like matrix with all three fiber types; cells: fibroblasts, macrophages, mast cells, and some white blood cells.

Function: Wraps and cushions organs; its macrophages phagocytize bacteria; plays important role in inflammation; holds and conveys tissue fluid.

Location: Widely distributed under epithelia of body, e.g. forms lamina propria of mucous membranes; packages organs; surrounds capillaries.





Photomicrograph: Areolar connective tissue, a soft packaging tissue of the body (400×).

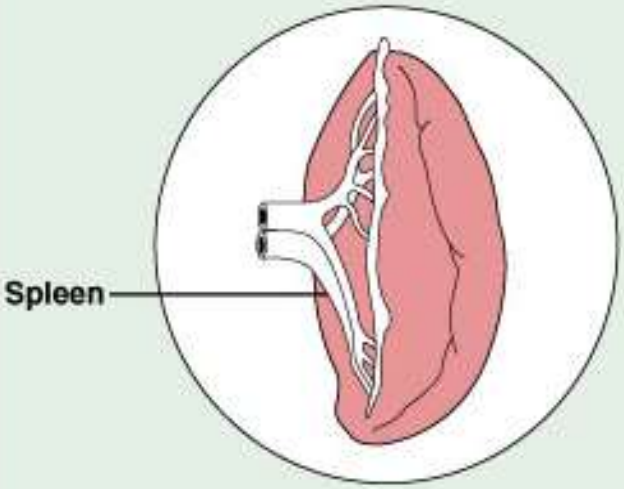
Reticular Connective Tissue

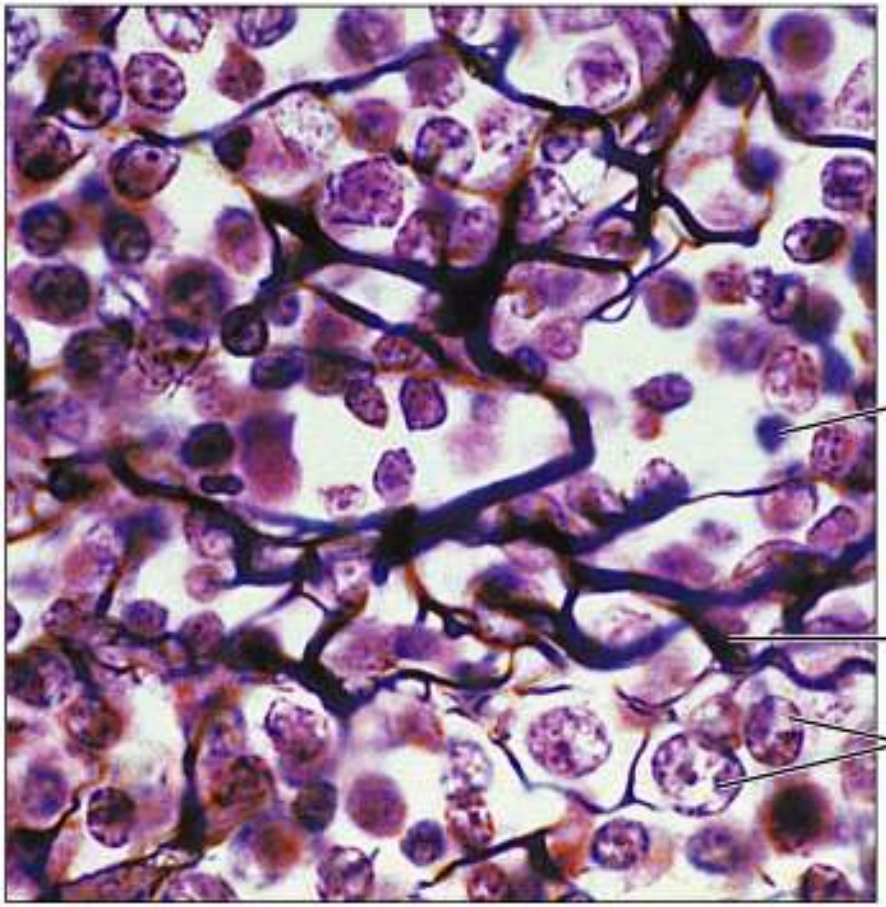
(d) Connective tissue proper: loose connective tissue, reticular

Description: Network of reticular fibers in a typical loose ground substance; reticular cells lie on the network.

Function: Fibers form a soft internal skeleton (stroma) that supports other cell types including white blood cells, mast cells, and macrophages.

Location: Lymphoid organs (lymph nodes, bone marrow, and spleen).





Photomicrograph: Dark-staining network of reticular connective tissue fibers forming the internal skeleton of the spleen (350×).

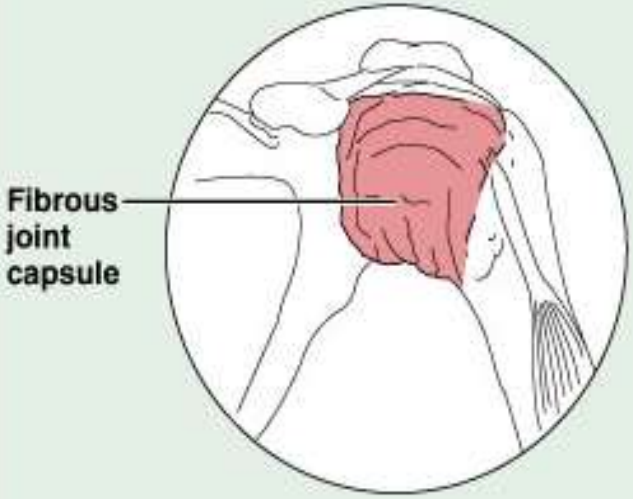
Dense irregular connective tissue

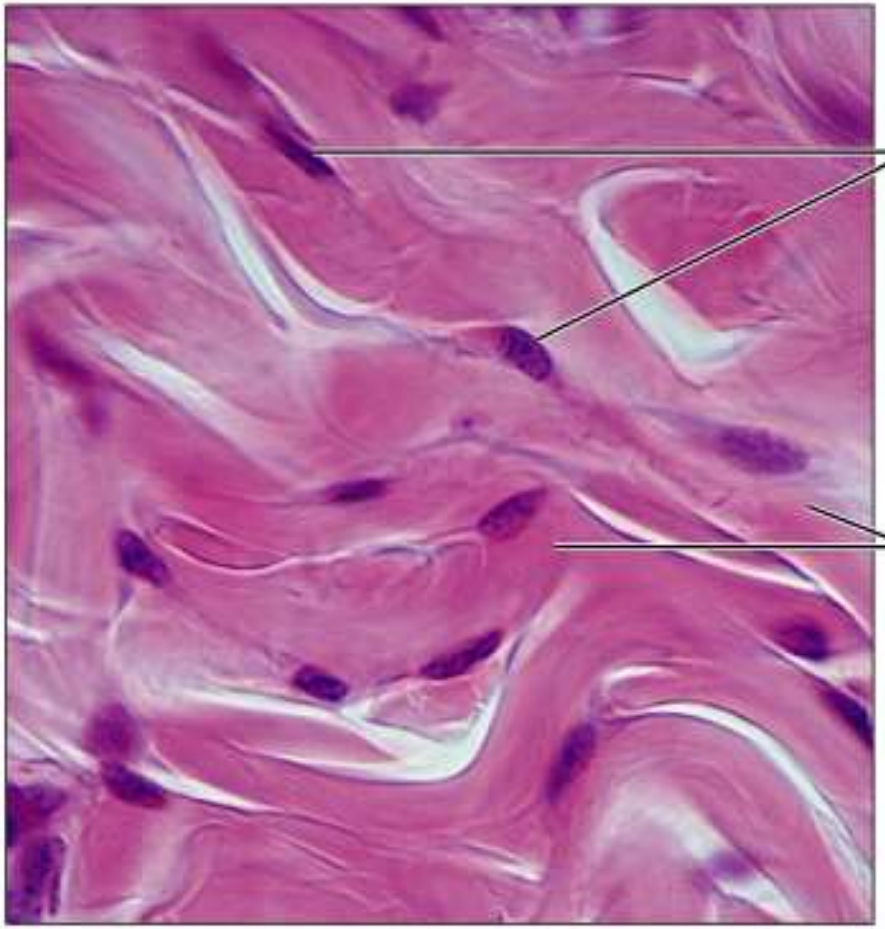
(e) Connective tissue proper: dense connective tissue, dense irregular

Description: Primarily irregularly arranged collagen fibers; some elastic fibers; major cell type is the fibroblast.

Function: Able to withstand tension exerted in many directions; provides structural strength.

Location: Dermis of the skin; submucosa of digestive tract; fibrous capsules of organs and of joints.





Photomicrograph: Dense irregular connective tissue from the dermis of the skin (400×).

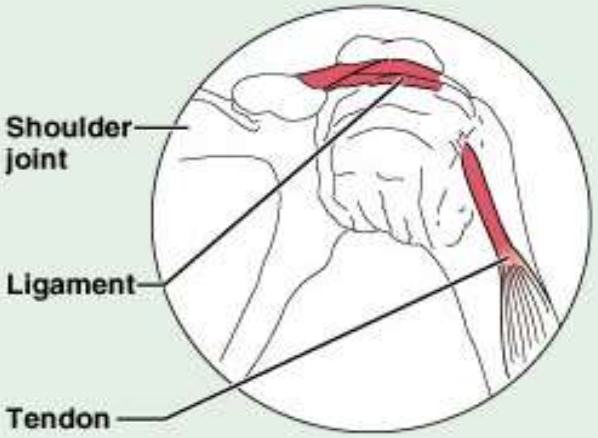
Dense Regular Connective Tissue

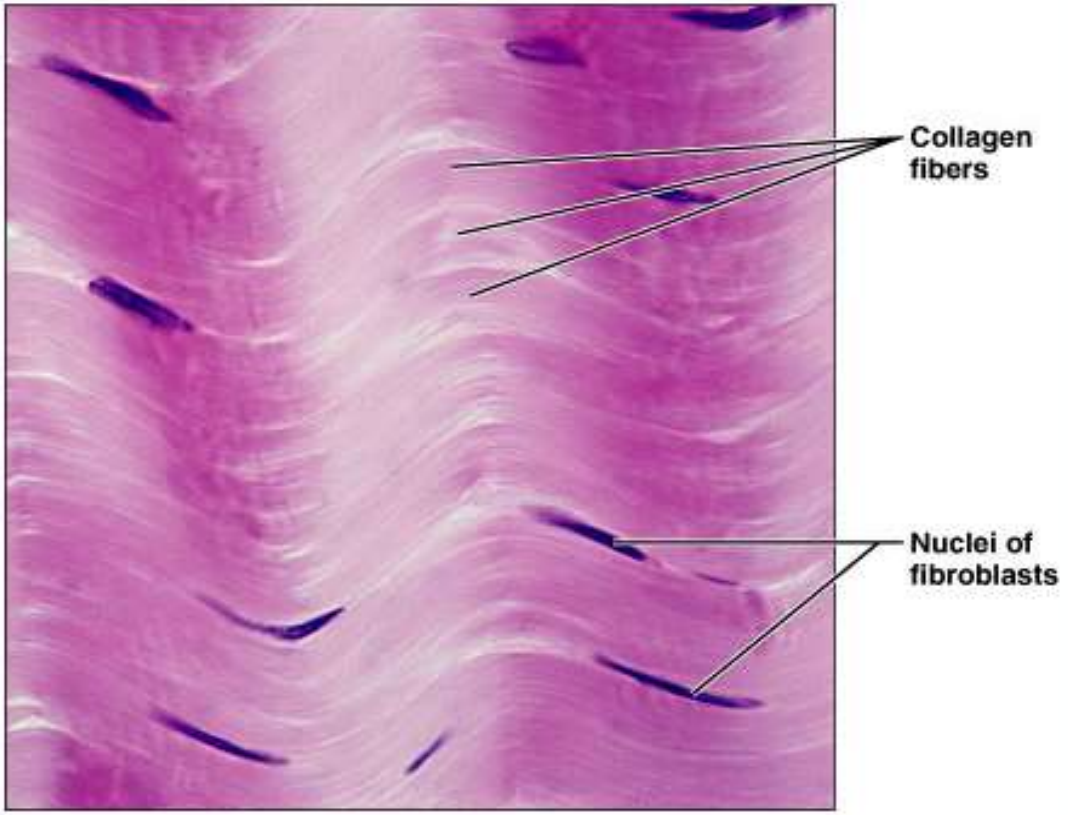
(f) Connective tissue proper: dense connective tissue, dense regular

Description: Primarily parallel collagen fibers; a few elastin fibers; major cell type is the fibroblast.

Function: Attaches muscles to bones or to muscles; attaches bones to bones; withstands great tensile stress when pulling force is applied in one direction.

Location: Tendons, most ligaments, aponeuroses.





Photomicrograph: Dense regular connective tissue from a tendon (1000×).