Lectures of Histology

(1st Stage)
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Anatomy and Histology Department

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* Classification of Connective Tissue

Different combinations and densities of the cells, fibers, and other extracellular matrix (ECM) components produce graded variations in histological structure within connective tissue. Descriptive names or classifications used for the various types of connective tissue typically denote either a structural characteristic or a major component, so there are 3 major types of connective tissue (with their subdivisions) (Fig.1):

1. Proper connective tissues
- Loose (areolar)
- Dense regular
- Dense irregular

2. Embryonic connective tissues
- Mesenchyme
- Mucoid (mucous)

3. Specialized connective tissues
- Reticular
- Elastic
- Adipose
- Cartilage (hyaline, elastic, fibrous)
- Bone (cancellous, compact)
- Blood

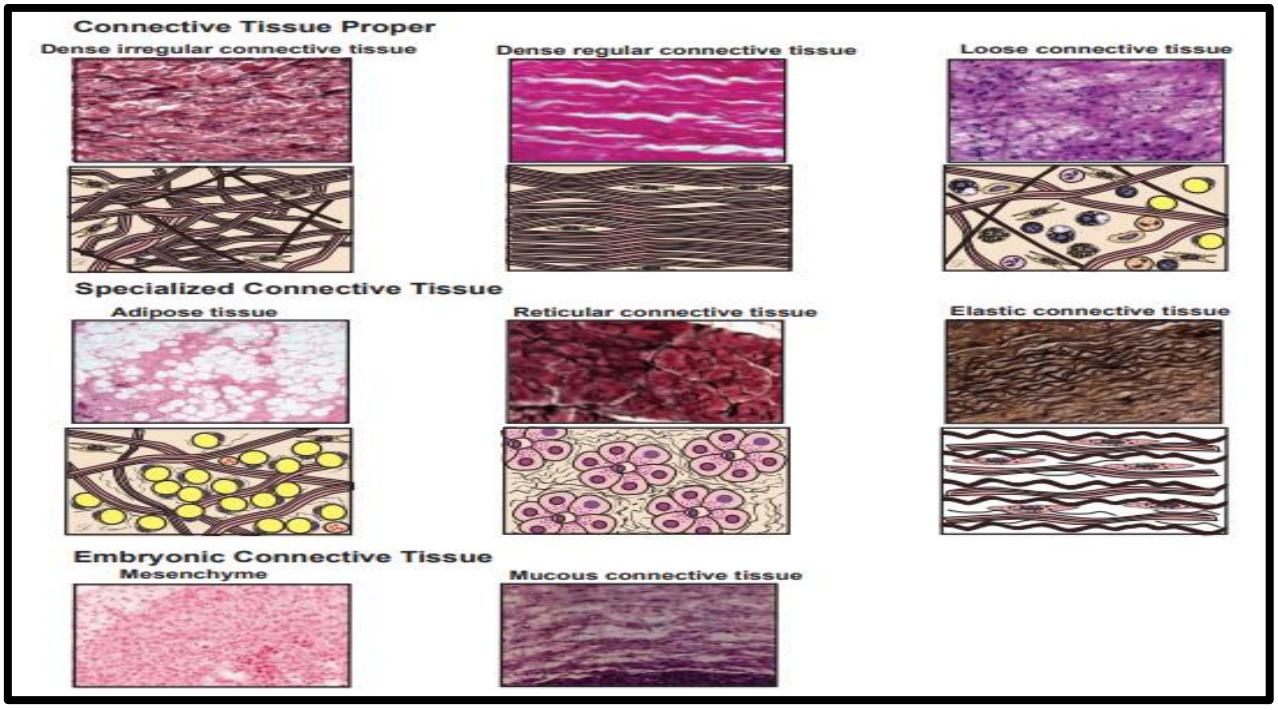
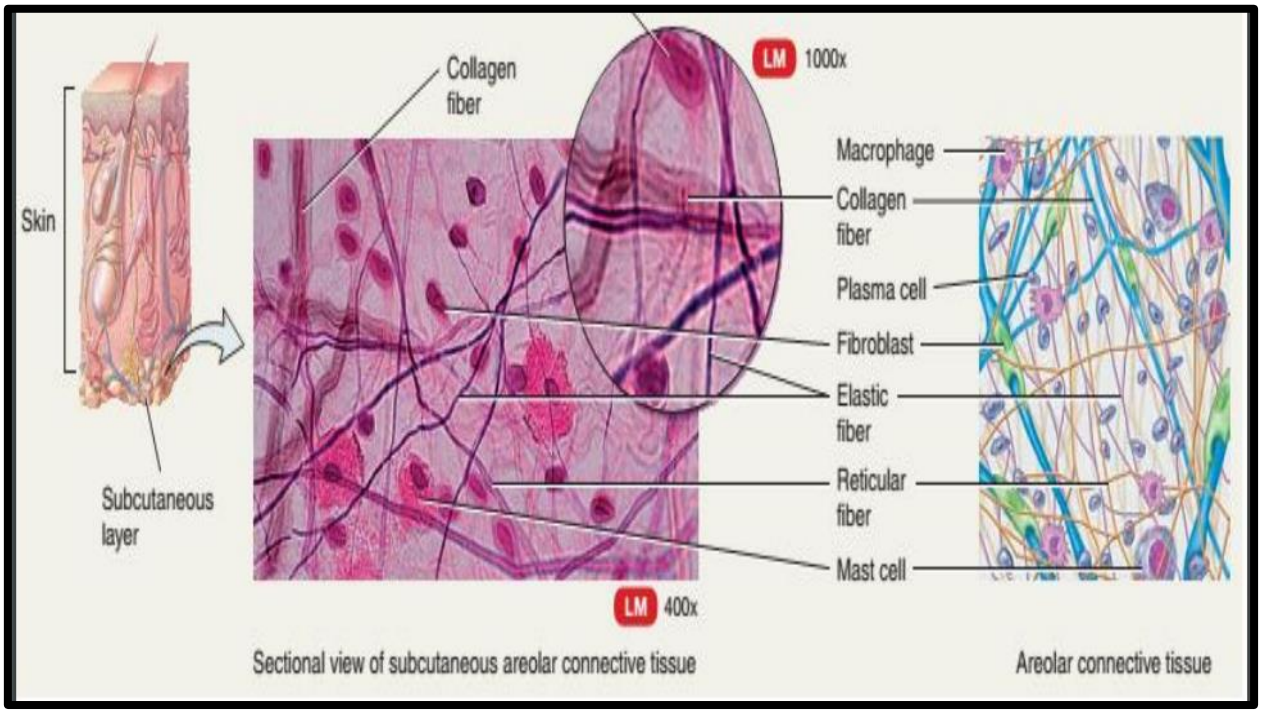


Fig. 1: Types of Connective Tissue.

Proper connective tissue is usually classified as **loose** or **dense** according to the **amount** of fibers and ground substance present.

Loose also called **areolar** connective tissue (Fig.2), more prevalent in the body than dense connective tissue, and exhibits loose, irregular arrangement of cells and fibers. It's characterized by **abundant** ground substance, with **numerous** cells and **fewer** fibers (collagen fibers predominate, and fibroblasts being the most common cell types, in addition to adipose cells, mast cells, and macrophages) compared to dense connective tissue. It is richly vascularized, flexible, and not highly resistant to stress. It provides protection, and support for the tissue that are not subjected to strong forces. Lamina propria of the digestive tract and the mesentery are good examples of loose connective tissue.



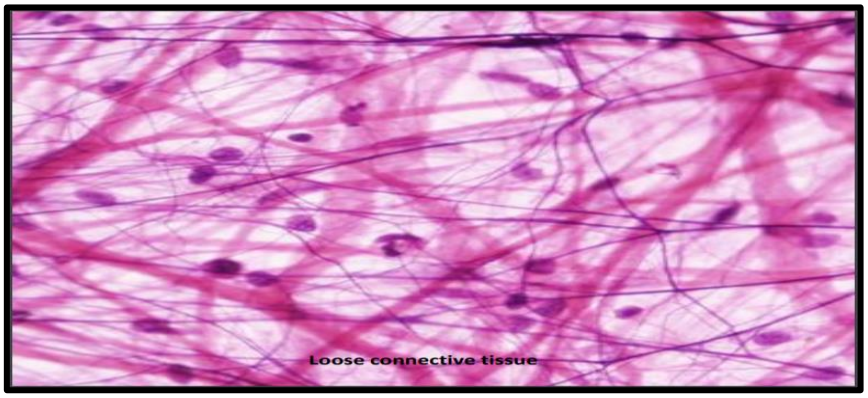
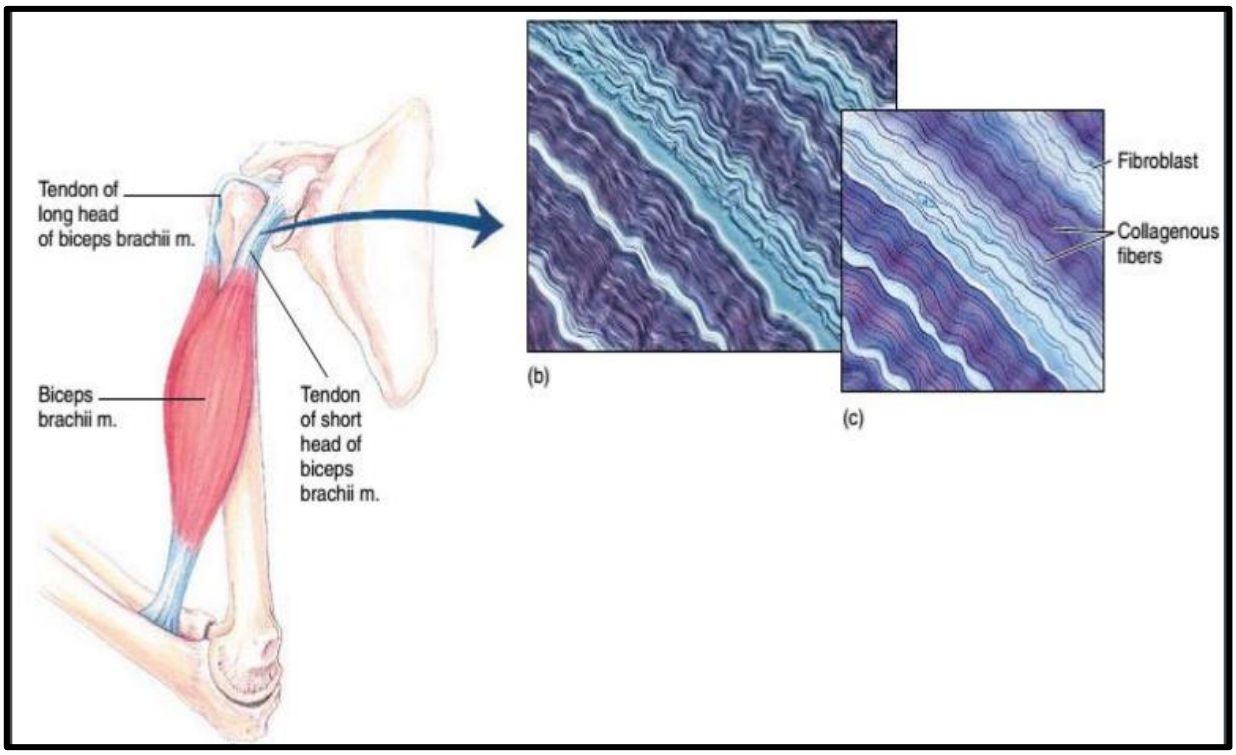


Fig. 2: Loose Connective Tissue.

Dense connective tissue contains thicker and **more** densely packed collagen fibers, with **fewer** cell types and **less** ground substance. In both types (**regular and irregular**), fibroblasts are the most abundant cells, which are located between the dense collagen bundles.

Dense regular provides resistance to traction forces in a single specific direction (but little stretch), contains densely packed collagen fibers that exhibit a regular and parallel arrangement. This type of tissue is found in the tendons and ligaments (Fig.3).



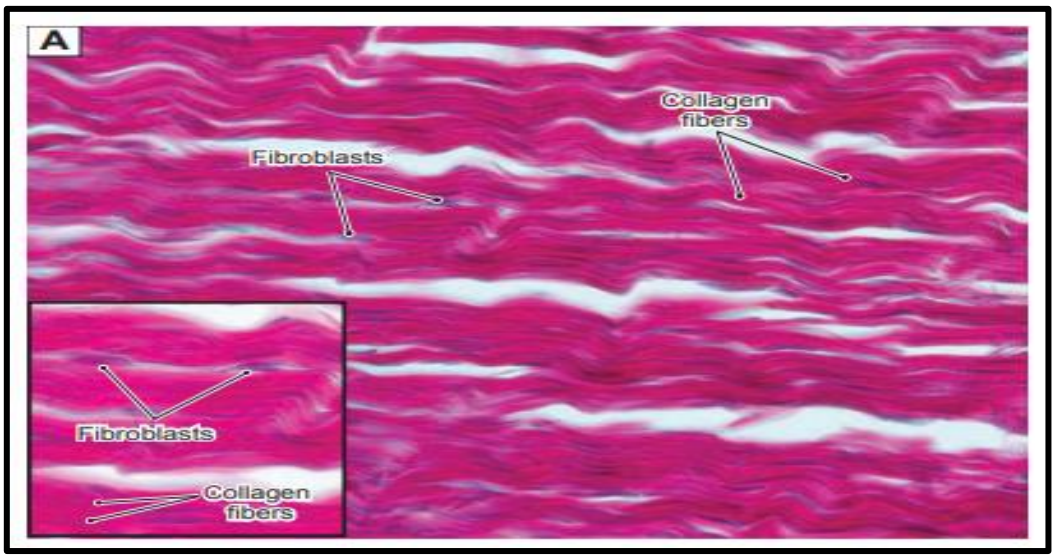
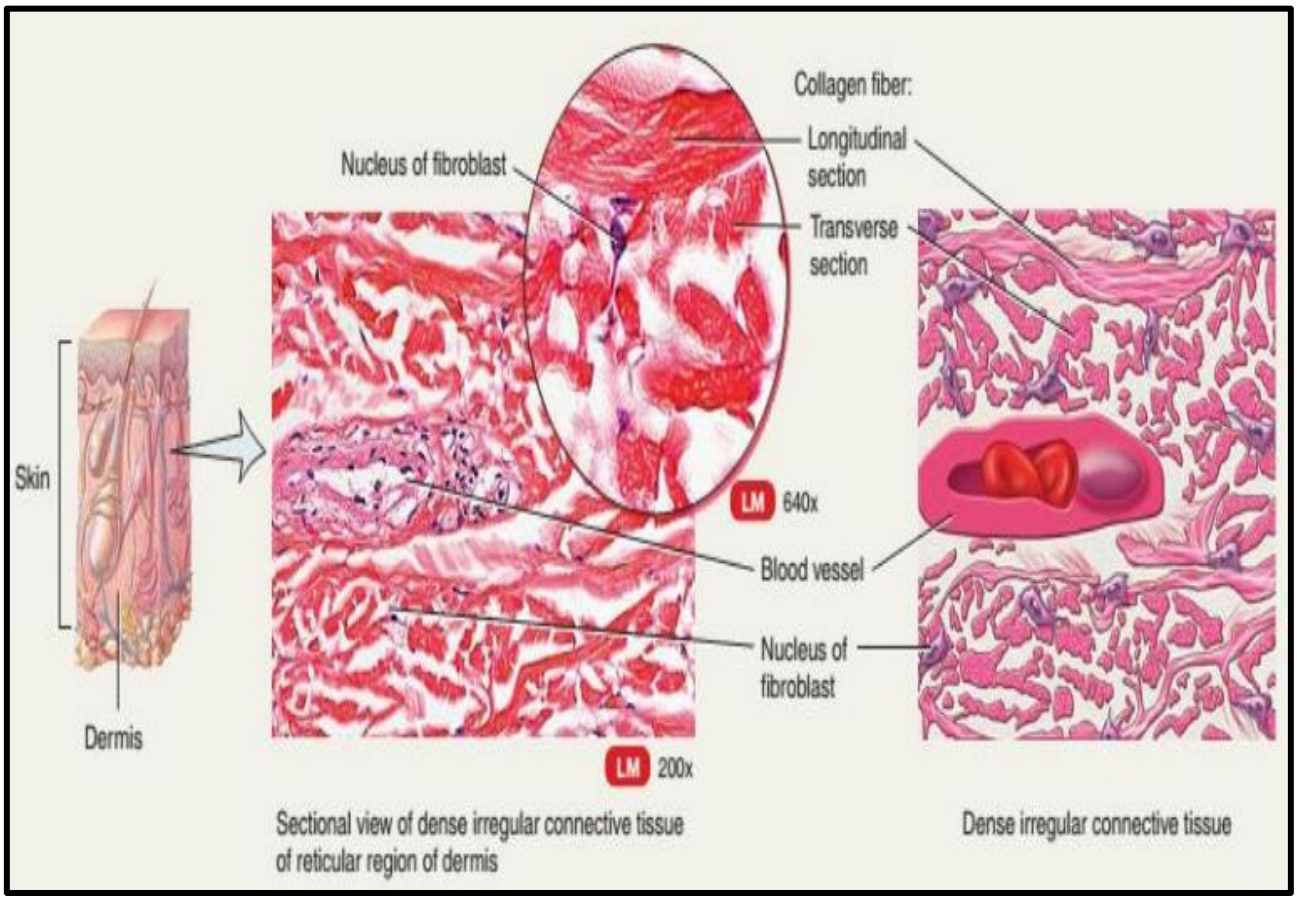


Fig. 3: Dense Regular Connective Tissue.

Dense irregular provides strong fiber meshwork to resist stress from all directions (collagen fibers exhibit a random and irregular orientation, with some elastic fibers). This type of tissue is present in the dermis of skin, in capsules of different organs, and in areas that need strong support, as well as some elasticity (Fig.4).



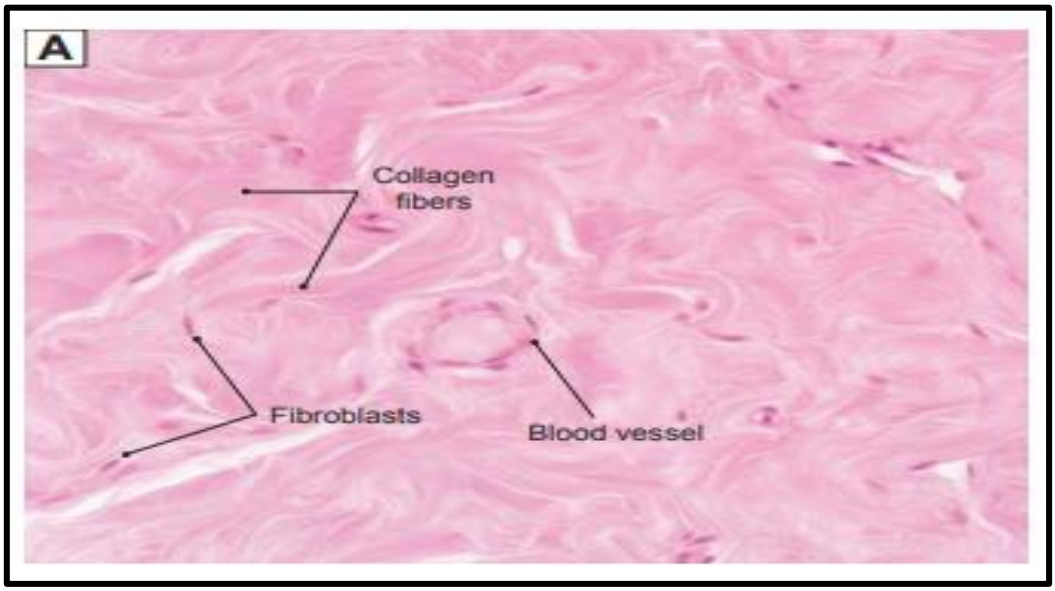


Fig. 4: Dense Irregular Connective Tissue.

Embryonic connective tissue is a type of loose tissue formed in early embryonic development.

Mesenchyme contains considerable ground substance, scattered reticular fibers and star-shaped mesenchymal cells that have pale-staining cytoplasm with small processes (Fig.5). Mesenchymal connective tissue can differentiate into different types of C.T.

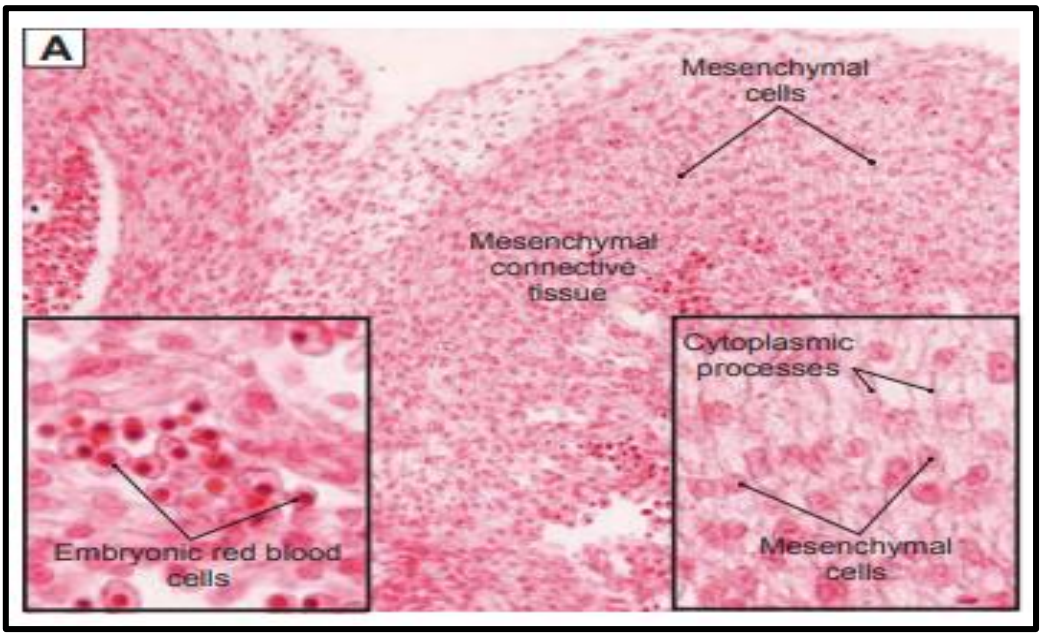
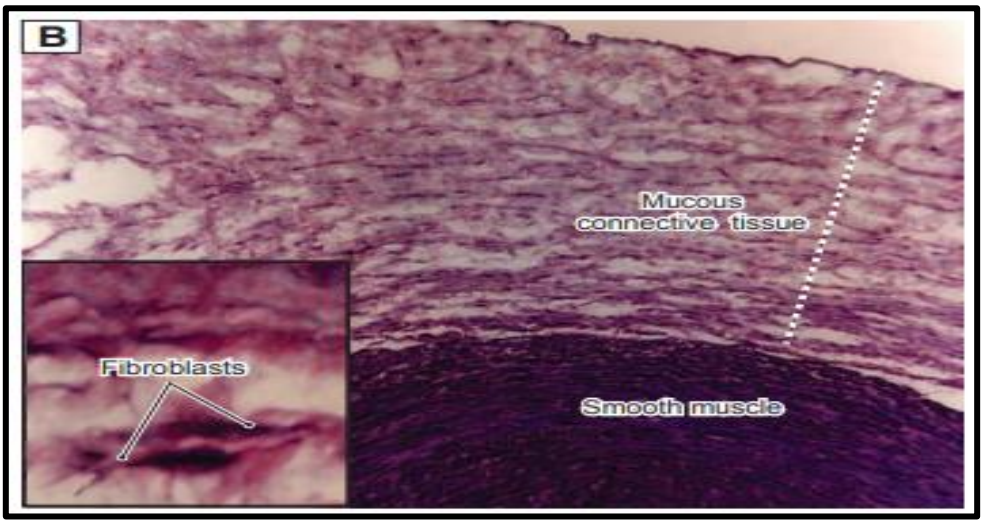


Fig. 5: Mesenchyme Connective Tissue.

Mucoid/mucous exhibits jelly-like matrix (abundant and composed chiefly of hyaluronan) with some sparse collagen fibers and scattered fibroblasts (Fig.6). It's mainly found in the umbilical cord (as a principal component, where it's referred to as Wharton's jelly), subdermal C.T. of the fetus, dental pulp of the developing teeth, also found in the nucleus pulposus of the intervertebral disk in adult tissue.



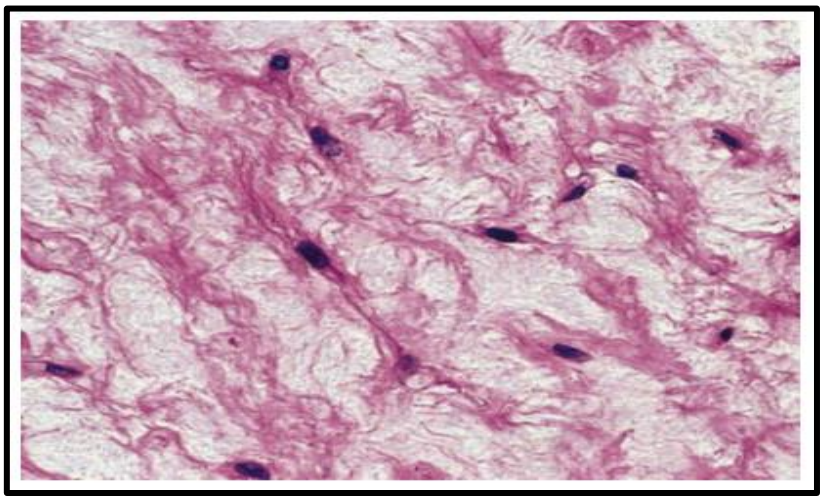
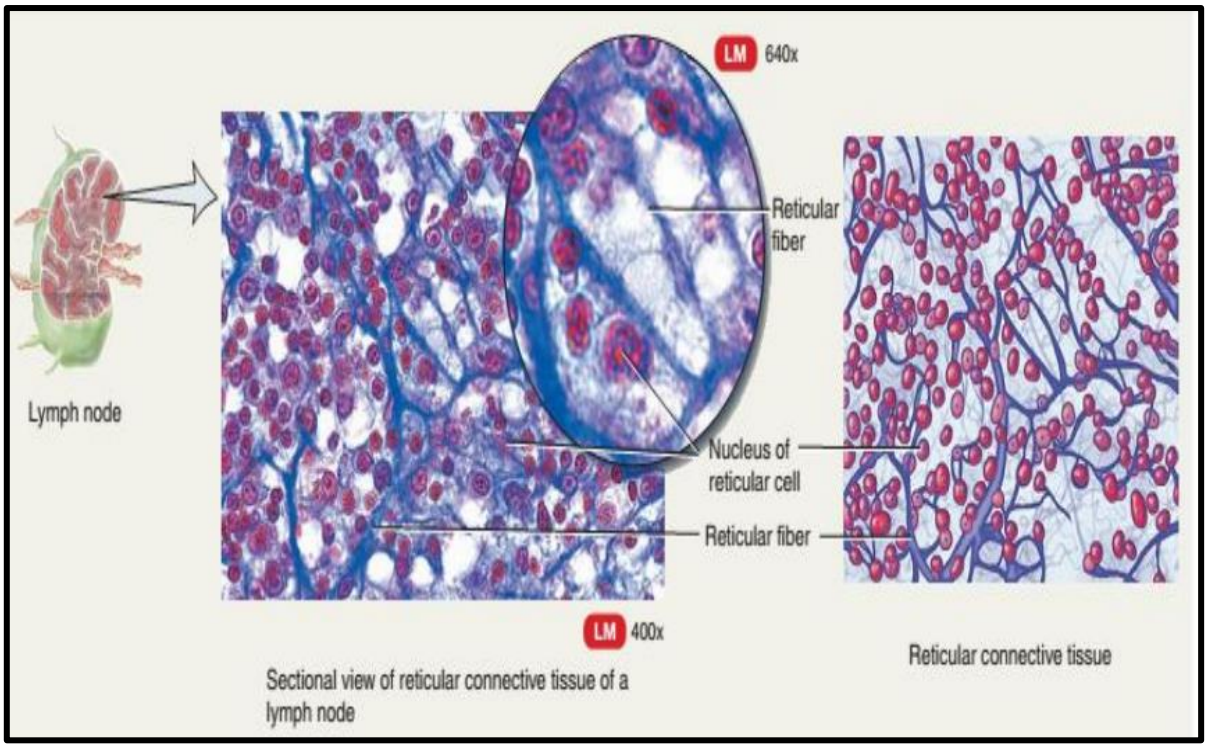


Fig. 6: Mucoid (Mucous) Connective Tissue.

Specialized connective tissue contains various types of tissues: **Reticular** tissue which is type of special loose. **Adipose** tissue that is found in two types (white and brown). **Bone** and **Cartilage** which represent supportive (skeletal) tissue, and **Blood** the fluid tissue.

Reticular is a specialized loose connective tissue that contains a network of branched reticular fibers, reticulocytes (specialized fibroblasts), and macrophages. This tissue provides the architectural framework for parenchymal organs, such as pancreas, liver, lymphoid nodes, spleen, bone marrow, and endocrine glands (Fig.7).



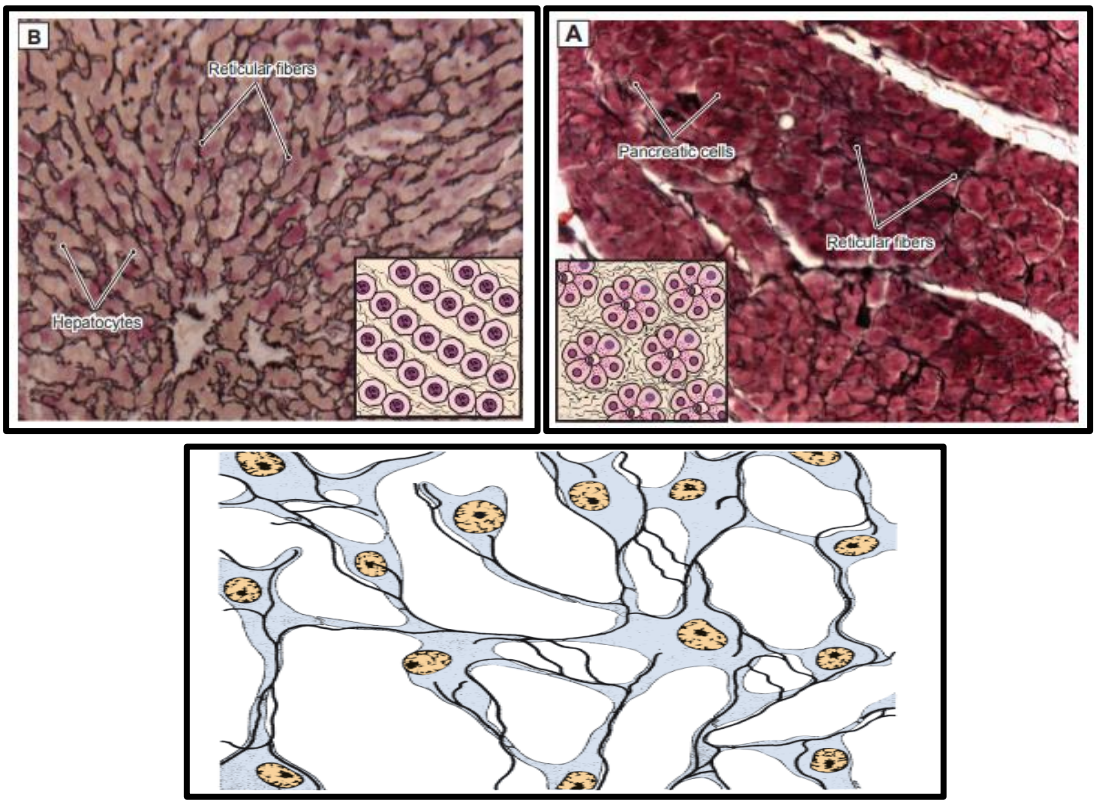
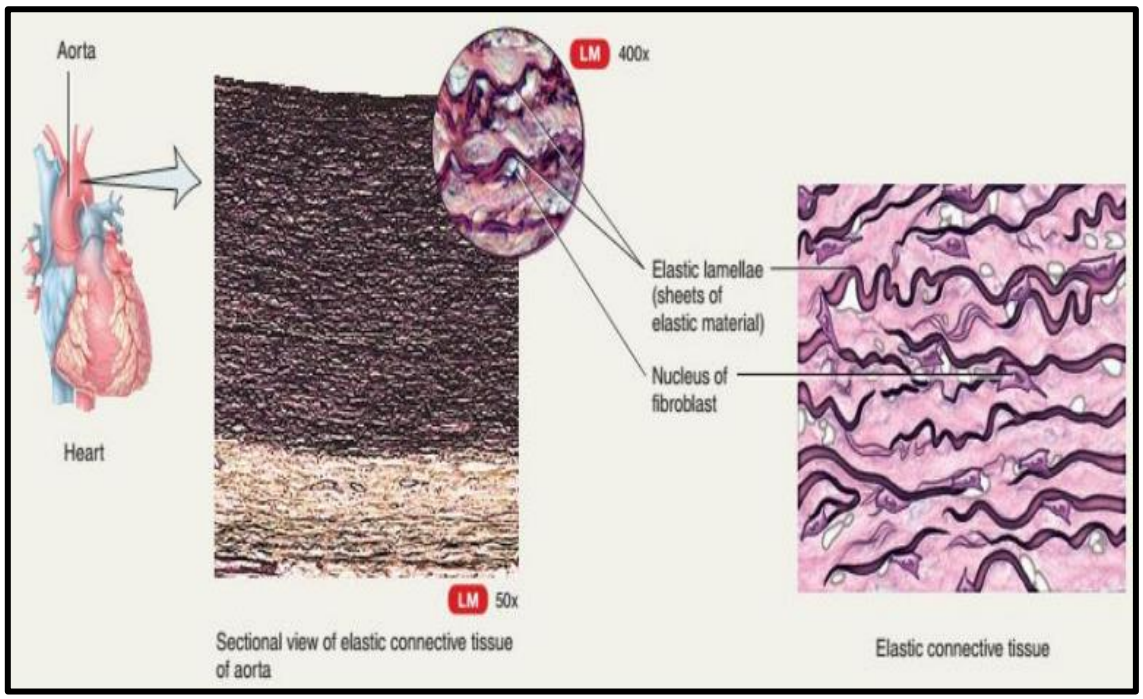


Fig. 7: Reticular Connective Tissue.

Elastic is composed of thick elastic fibers (abundance of elastic fibers in this tissue is the cause of its typical yellow color and great elasticity) with a sparse network of collagen fibers and fibroblasts filling the interstitial space. This tissue provides flexible support for other tissues and can recoil after stretching (Fig.8). Elastic tissue is usually found in vertebral ligaments, lungs, large arteries, and dermis of skin.



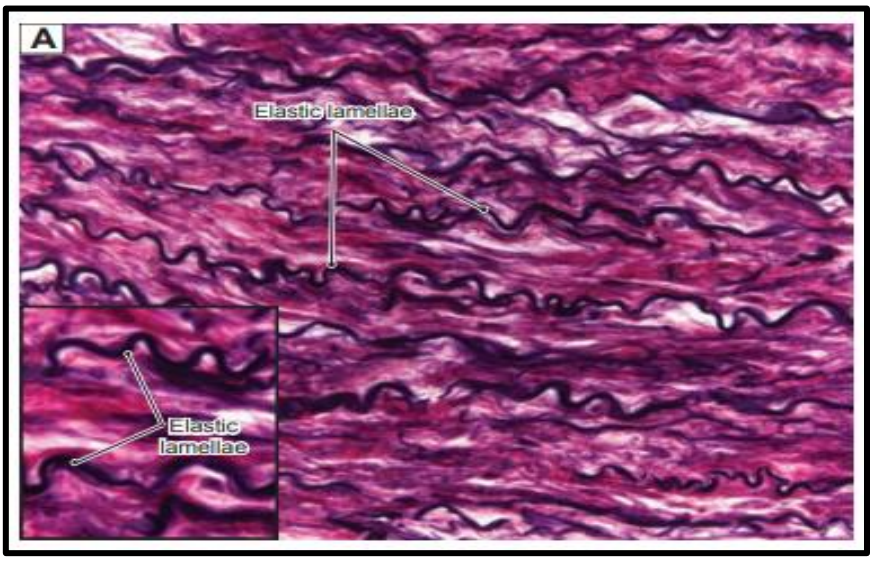
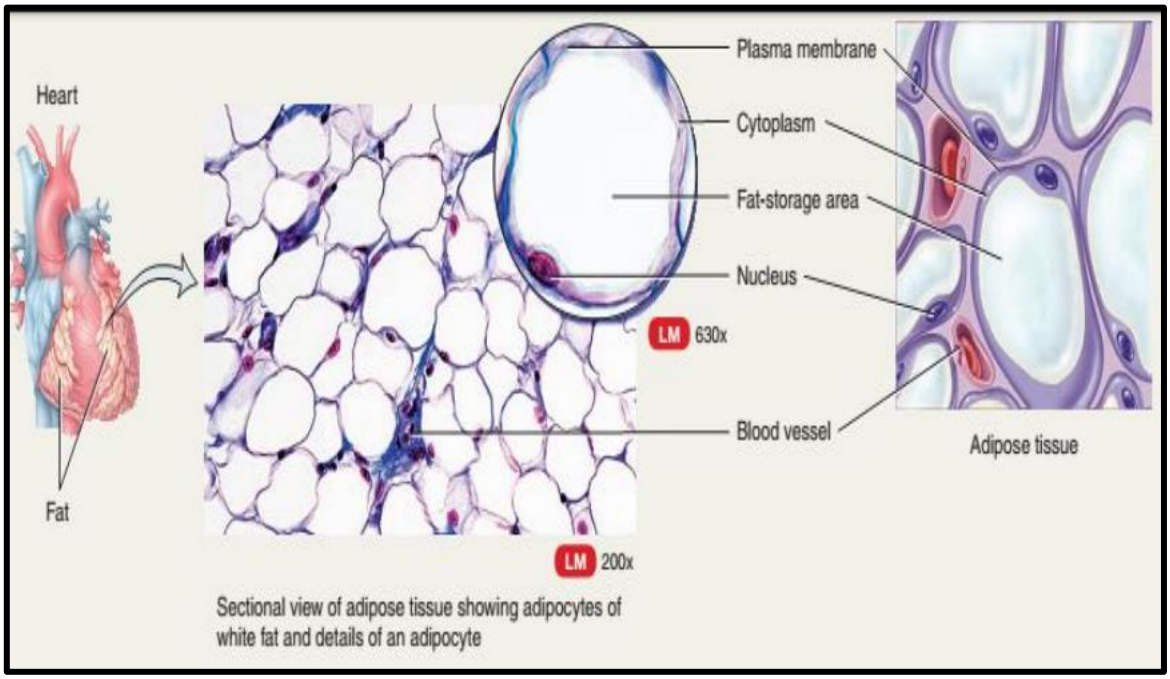


Fig. 8: Elastic Connective Tissue.

Adipose is a special form of connective tissue, provides both cushioning for organs and energy storage, consisting predominantly of adipocytes that are the primary site for fat storage and are specialized for heat production. It has a rich neurovascular supply. Adipose tissue can be divided into white adipose tissue and brown adipose tissue.

- **White adipose tissue** is composed of unilocular adipose cells, the typical appearance of cells in white adipose tissue is lipid stored in form of a single, large droplet in the cytoplasm. The flattened nucleus of each adipocyte is displaced to the periphery of the cell. This type of tissue is found throughout the adult human body (Fig.9).



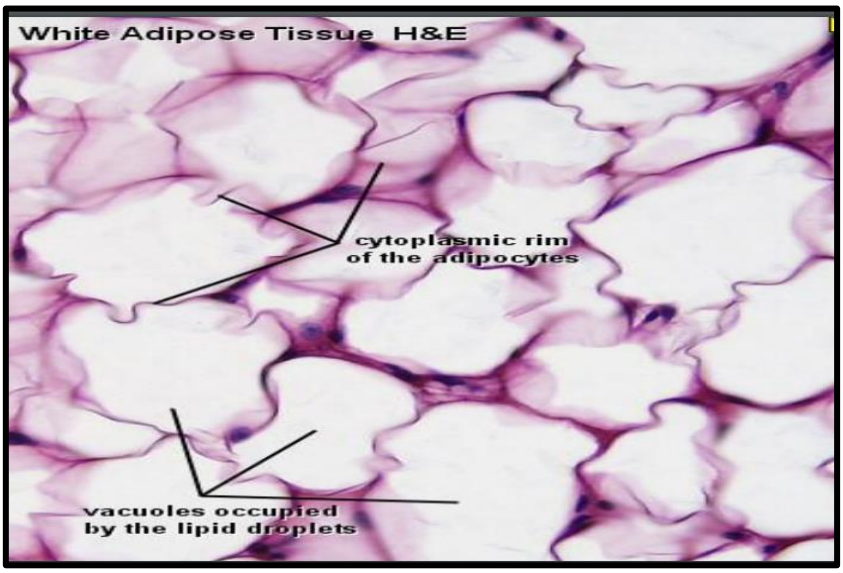


Fig. 9: White Adipose Connective Tissue.

- **Brown adipose tissue**, is composed of multilocular adipose cells. Lipid is stored as multiple droplets in cytoplasm. Cells have a central nucleus and a relatively large amount of cytoplasm. Brown adipose tissue is more abundant in hibernating animals and is also found in human embryo, in infants, and in perirenal region of adults (Fig.10).

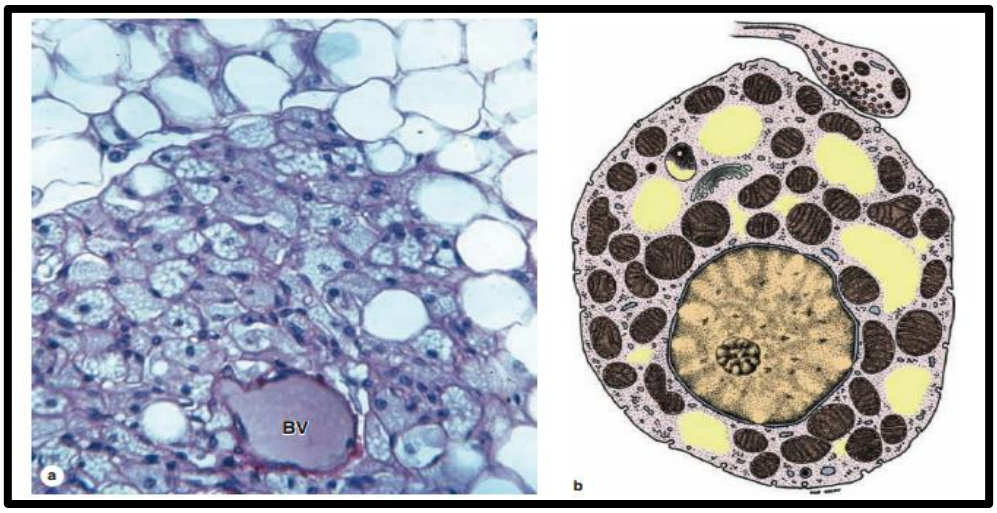


Fig. 10: Brown Adipose Connective Tissue.

Cartilage is a type of supportive (skeletal) tissue, found in three forms (hyaline, elastic, fibrous). Cartilage is composed of chondrocytes and extracellular matrix.

Bone is a type of supportive (skeletal) tissue, found in two forms (cancellous, compact), contains osteoblasts, osteocytes, osteoclasts, and bone matrix.

Blood is fluid tissue, in which cells are suspended. Composed of RBCs, WBC, platelets, and plasma.