Connective Tissue

- These tissues connect and support other tissues of the body

- connective tissue is formed by three classes of components: **cells, fibers**, and **ground substa**nce. Unlike the other tissue types (epithelium, muscle,and nerve), which consist mainly of cells, the major constituent of connective tissue is the extracellular matrix (ECM). Extracellular matrices consist of different combinations of protein fibers (collagen, reticular, and elastic fibers) and ground substance. *Ground substance is a highly hydrophilic, viscous complex of anionic macromolecules (glycosaminoglycans and proteoglycans) and multiadhesive glycoproteins* (laminin, fibronectin, and others) that stabilizes the ECM by binding to receptor proteins (integrins) on the surface of cells and to the other matrix components.

- The connective tissues originate from the mesenchyme, an embryonic tissue formed by elongated undifferentiated cells, the mesenchymal cells. These cells are characterized by oval nuclei with prominent nucleoli and fine chromatin. They possess many thin cytoplasmic processes and are immersed in an abundant and viscous extracellular substance containing few fibers. The mesenchyme develops mainly from the middle layer of the embryo, the mesoderm.

Structure of connective tissue

- Cells
- Intercellular substance or matrix

Matrix

- Amorphous ground substance
- Thread like formed elements called fibers (collagen fibers, reticular fibers, elastic fibers)
- Tissue fluid

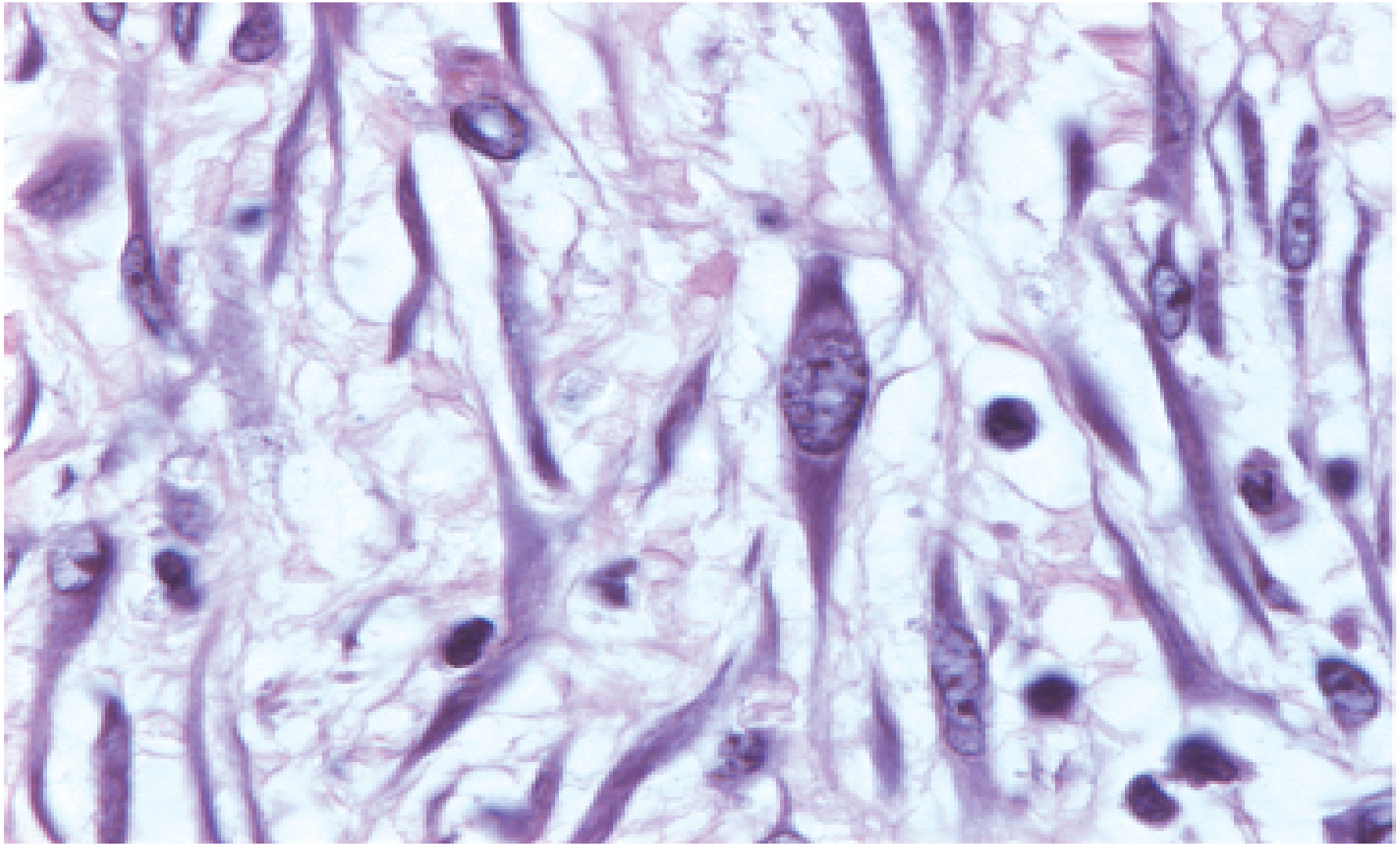
CELLS OF CONNECTIVE TISSUE

- A variety of cells with different origins and functions are present in connective tissue. **Fibroblasts** originate locally from **undifferentiated mesenchymal cells** (osteosit,adiposit,condrosit) and spend all their life in connective tissue; other cells such as **mast cells**, **macrophages**, and **plasma cells** originate from hematopoietic stem cells in bone marrow, circulate in the blood, and then move into connective tissue where they remain and execute their functions. White blood cells (leukocytes) are transient cells of most connective tissues; they also originate in the bone marrow and move to the connective tissue where they reside for a few days, then usually die by apoptosis.

Fibroblasts

- Fibroblasts synthesize collagen, elastin, glycosaminoglycans, proteoglycans and multiadhesive glycoproteins. **Fibroblasts** *are the most common cells in connective tissue and are responsible for the synthesis of extracellular matrix components*. Two stages of activity—active and quiescent—are often observed in these cells .Cells with intense synthetic activity are morphologically distinct from the quiescent fibroblasts that are scattered within the matrix they have already synthesized. Some histologists reserve the term fibroblast to denote the active cell and **fibrocyte** to denote the quiescent cell

Section of rat skin. A connective tissue layer (dermis) shows several fibroblasts (F), which are the elongated cells. Hematoxylin and eosin (H&E) stain. Medium magnification. (Courtesy of TMT Zorn.)



Macrophages

- *Macrophages were discovered and initially characterized by their phagocytic ability*. They have a wide spectrum of morphologic features that correspond to their state of functional activity and to the tissue they inhabit. In the electron microscope, *macrophages are characterized by an irregular surface with pleats, protrusions, and indentations, a morphologic expression of their active pinocytotic and phagocytic activities*. They generally have a well-developed Golgi apparatus, many lysosomes, and rough ER

- Monocyte Blood Precursor of macrophages
- Macrophage Connective tissue, lymphoid organs, lungs, bone marrow Production of cytokines, chemotactic factors, and several other molecules that participate in inflammation (defense), antigen processing and presentation
- Kupffer cell Liver Same as macrophages
- Microglia cell Nerve tissue of the central nervous system Same as macrophages
- Langerhans cell Skin Antigen processing and presentation
- Dendritic cell Lymph nodes Antigen processing and presentation
- Osteoclast Bone (fusion of several macrophages) Digestion of bone

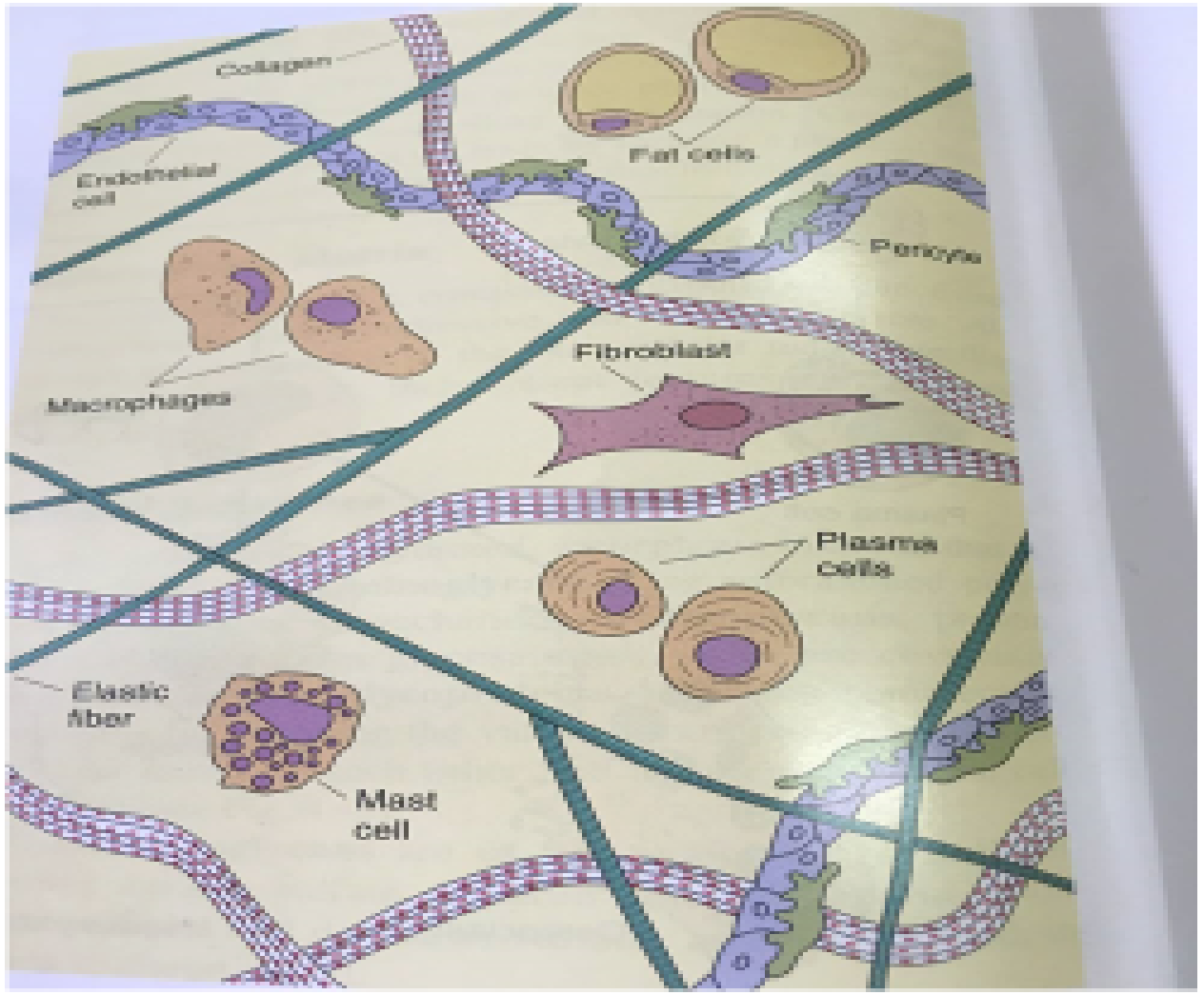
Plasma Cells

- Plasma cells are large, ovoid cells that have a basophilic cytoplasm due to their richness in rough ER. The juxtanuclear Golgi apparatus and the centrioles occupy a region that appears pale in regular histologic preparations . The nucleus of the plasma cell is generally spherical but eccentrically placed. Many of these nuclei contain compact, peripheral regions of heterochromatin alternating with lighter areas of euchromatin, a configuration that can give the nucleus of a plasma cell the appearance of a clock-face. There are few plasma cells in most connective tissues. Their average lifespan is short, 10–20 days. ***Plasma cells are derived from B lymphocytes and are responsible for the synthesis of antibodies. Antibodies are immunoglobulins produced in response to penetration by antigens***

Mast Cells

- Mast cells are large, oval or round connective tissue cells, 20–30 m in diameter, whose cytoplasm is filled with basophilic secretory granules. The rather small, spherical nucleus is centrally situated and may be obscured by the cytoplasmic granules
- The secretory granules are 0.3–2.0 m in diameter. Their interior is electron-dense and heterogeneous. **Mast cells function in the localized release of many bioactive substances with roles in the inflammatory response, innate immunity, and tissue repair**. Because of their high content of acidic radicals in their sulfated glycosaminoglycans, mast cell granules display metachromasia, which means that they can change the color of some basic dyes (eg, toluidine blue) from blue to purple or red. The granules are poorly preserved by common fixatives, so that mast cells are frequently difficult to identify. :

Adipocyt or fat cell



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