



Faculty of Biological Science and Technology
Zoology and Botanical Department
Practical Histology

Connective Tissue

Cells, Fibers, Types

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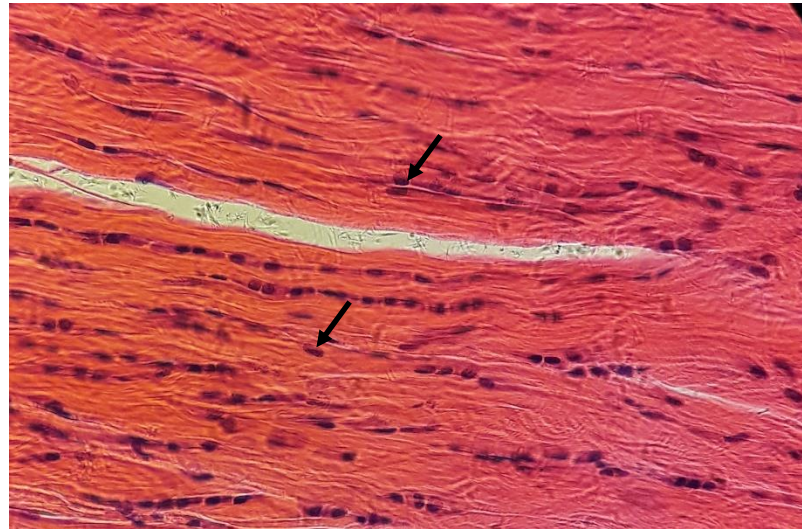
Introduction

- ▶ Connective tissue is the most abundant tissue in the body. This tissue fills the gaps between other tissues and connects different parts of body to each other such as muscle to bone or epithelial tissues to underlying tissues
- ▶ Each connective tissue consists of following components:
 - ▶ 1) Extracellular matrix (ECM) that is a non-living substance made by cells. ECM made up of two parts:
 - ▶ Protein fibers such as collagen or elastic fibers
 - ▶ Ground substance which is a collection of Glycoproteins, Glycoseaminoglycan and proteoglycan
 - ▶ 2) cells which are different depending on the type of connective tissue
- ▶ Despite epithelial, nervous or muscle tissues, the main component of connective tissue is ECM and the cells are scattered in it



Fibroblasts

- ▶ Fibroblasts are the most abundant cells in connective tissues
- ▶ They involve in ECM synthesis
- ▶ Their morphology are variable depending on their level of activity and the type of tissue in which they are located
- ▶ Generally, fibroblast is elongated or star-shaped cell with numerous process and a large, elongated and euchromatin nucleus
- ▶ Fibrocytes are spindle-shaped with heterochromatin nuclei and eosinophilic cytoplasm

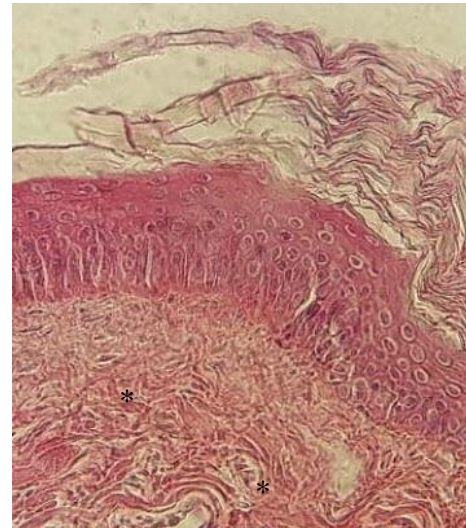
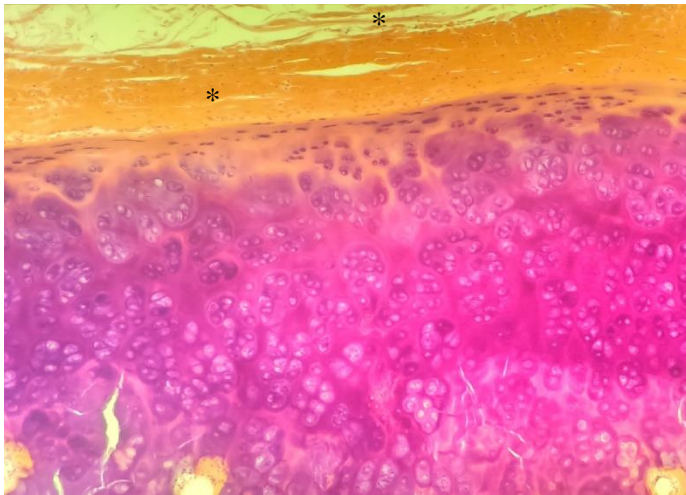


Longitudinal section of tendon. Numerous fibroblasts nuclei can be seen. Black arrows depict two of them. Fibroblast cytoplasm is not clear, due to the same color as the collagen fibers. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



Collagen fibers

- ▶ Collagen is the most abundant and tough protein in human body
- ▶ It provides support, structure or strength to connective tissue, skin, bone, tendon and etc.
- ▶ There are different kind of collagen
- ▶ It has eosinophilic properties so it is stained with eosin

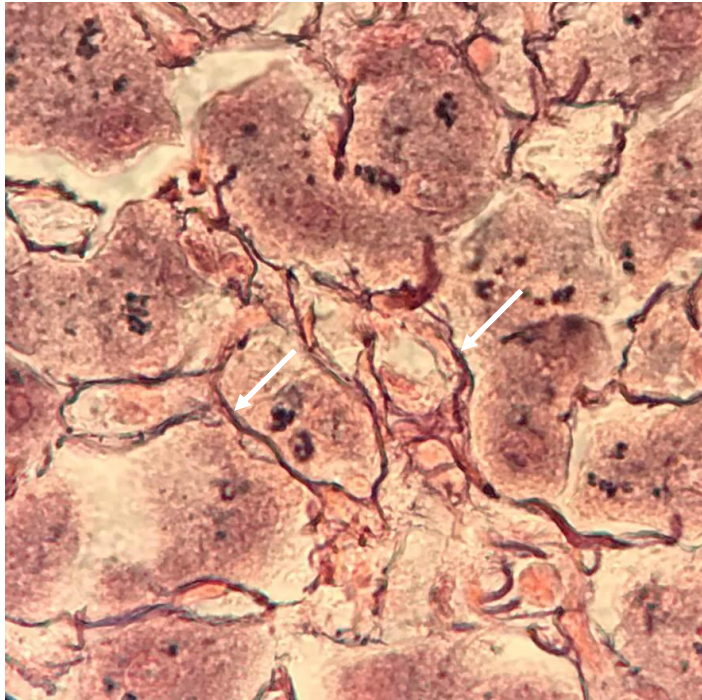


Left: asterisks depicts collage fibers in perichondrium. H&E, 4X. Right: asterisks depicts collage fibers in skin dermis. These pictures are taken from histological slide in histology laboratory of Isfahan University



Reticular fibers

- ▶ It is composed of collagen fiber type III which able to form a network. Cells in many organs such as liver, bone marrow, or lymphatic organs rely on this network and support
- ▶ They are very thin, about 0.5 to 2 μm
- ▶ Duo to presence of sugar connected to collagen type III, these fibers turn black with silver salts

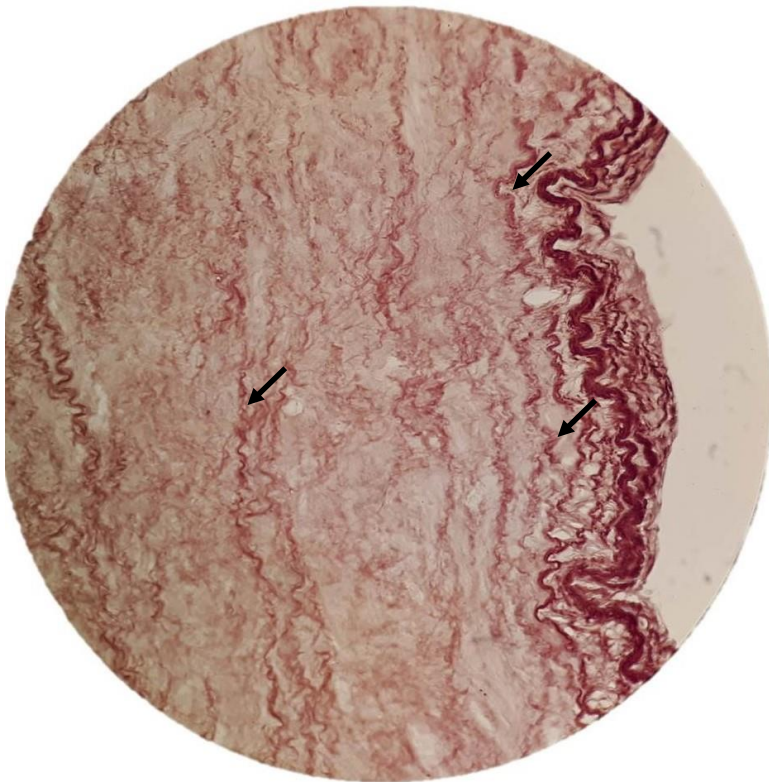


Liver. Reticular fibers (white arrows) form a network in this organ. Reticulin staining, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University



Elastic fibers

- ▶ Elastic fibers made up of fibrillin and elastin proteins and has elasticity
- ▶ It is more thinner than collagen fibers type I
- ▶ Because they do not have any eosinophilic properties, they can not be seen by H&E staining



Elastic fibers (arrows) in cross section of an artery. Orsein staining, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



Classification of connective tissues

- ▶ Due to difference in the composition of ground substances, fibers and the amount and type of cells, there are different types of connective tissues in the body such as bone , cartilage, adipose tissue, tendon and skin dermis

Types of connective tissues

Connective tissue proper

- Loose (alveolar)
- Dense
 - regular
 - irregular

Connective tissue with special properties

- Reticular tissue
- Adipose tissue
- Bone
- Cartilage

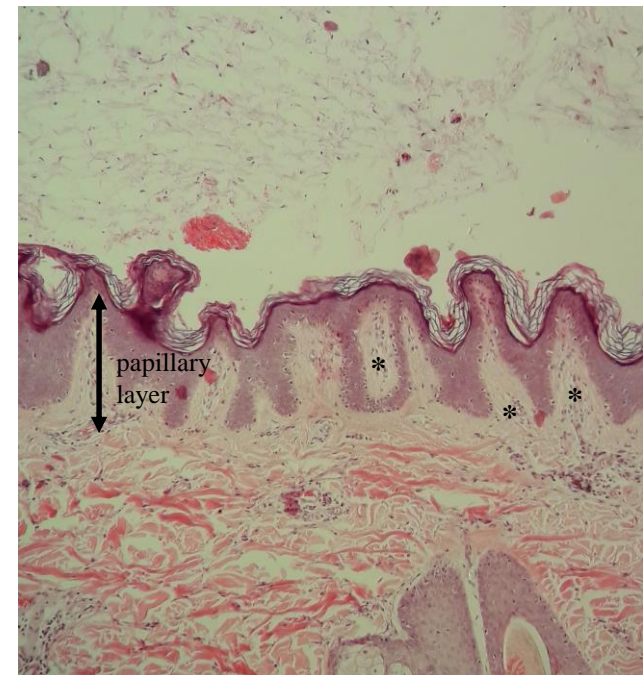
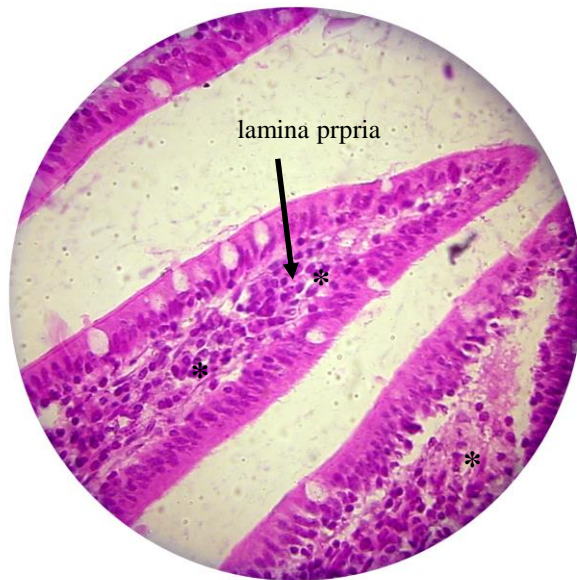
Embryonic connective tissue

- Mesenchyme
- Muroid connective tissue



Loose (areolar) connective tissue

- ▶ This kind of connective tissue more ground substance than fibers and relatively more cells
- ▶ Fibroblasts is the most abundant cells in loose connective tissue; However, there are other cells
- ▶ Lamina propria and papillary layer in dermis is made up of loose connective tissue

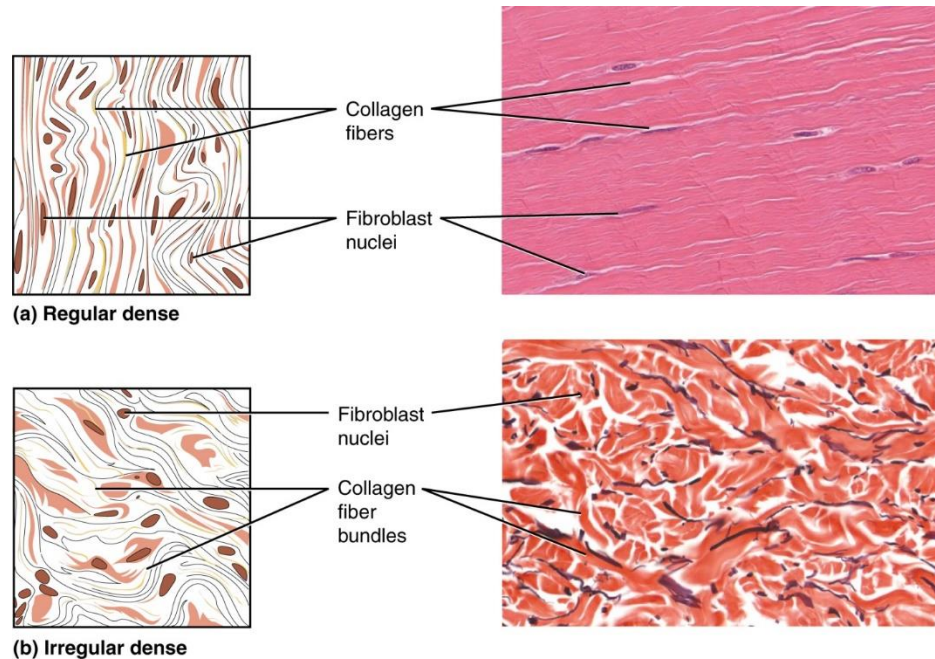


Left: lamina propria in small intestine. Right: papillary layer (asterisks) in skin dermis. H&E, 4X. These pictures are taken from histological slide in histology laboratory of Isfahan University



Regular and irregular dense connective tissue

- ▶ Generally, dense connective tissue has more collagen fibers than cells
- ▶ Collagen fibers are arranged parallel to each other in regular dense connective tissue; for example, in tendon
- ▶ Collagen fibers do not have specific pattern and are arranged in different directions in irregular dense connective tissue; for example, in skin dermis

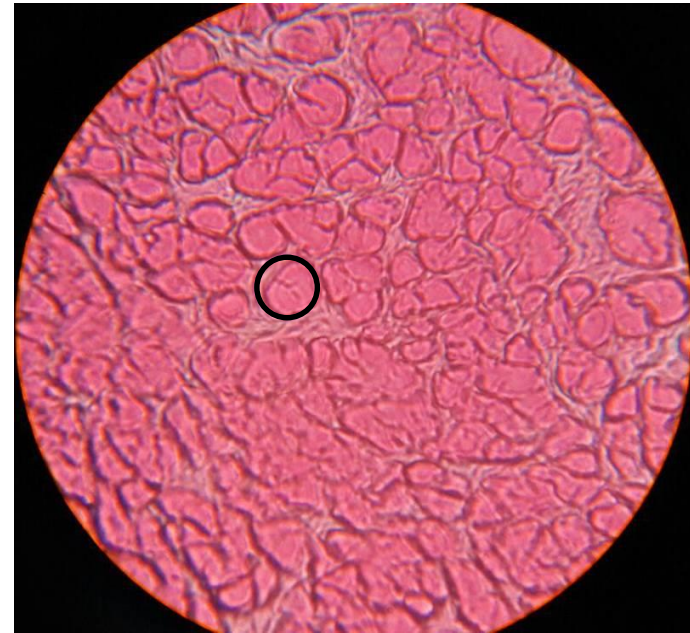
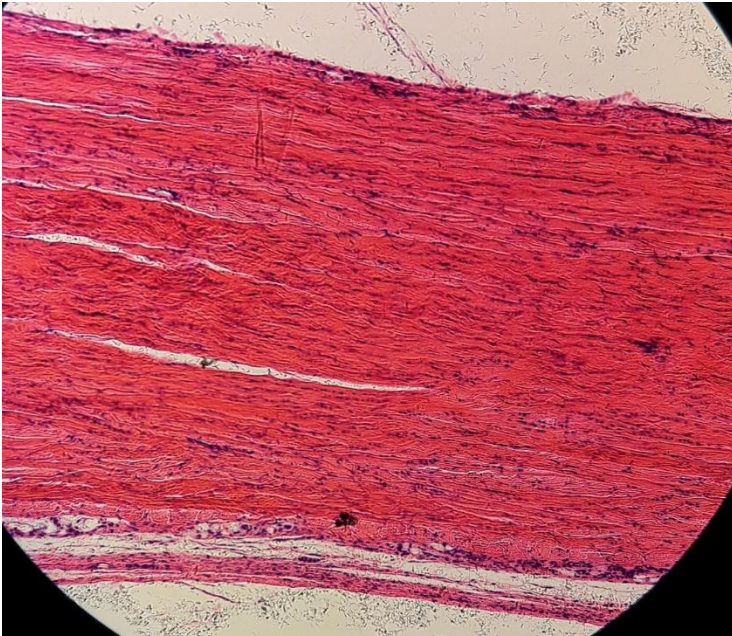


From: <https://www.biologyonline.com/dictionary/dense-regular-connective-tissue>



Tendon

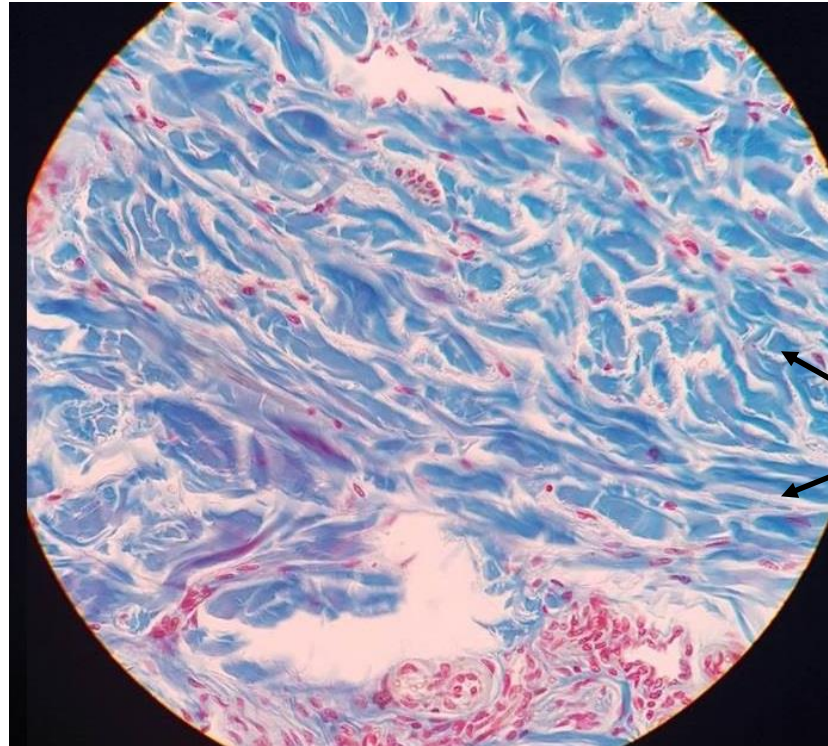
- ▶ A tendon is a band of fibrous, regular dense connective tissue that connects muscle to bone
- ▶ Fibroblasts in tendon is called tendinocytes
- ▶ Collagen fibers are surrounded by layers of connective tissue



Left: longitudinal section of tendon. 10X, H&E. Right: cross section of tendon. Black circle depicts a collagen fiber. 40X, H&E. All collagen fibers are arranged parallel to long axes of tendon. These pictures are taken from histological slide in histology laboratory of Isfahan University



Irregular dense connective tissue



collagen fibers

Reticular layer of dermis is a thick layer of irregular dense connective tissue. Collagen fibers arranged in different directions. 40X. This picture is taken from histological slide in histology laboratory of Isfahan University