Medical School Histology Basics: Connective Tissue

VIBS 243

Mast cell

Macrophage

Fibroblasts

Plasma cell

Fat cells

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Function of Connective Tissue

The histological glue which binds the other tissues together to form organs
Mechanical support - stroma below epithelium, skeleton
Metabolite exchange - vascular beds
Energy storage - adipose tissue
Inflammation - site of action for blood borne immune cells
Distinguishing features and histological identification

- **Loose connective tissue** – sparse collagen and elastic fibers, plentiful cells including fibroblasts, leukocytes
- **Dense connective tissue** – concentrated collagen, few cells
- **Cartilage** – avascular homogeneous matrix of collagen and protein-polysaccharides with few cells
- **Bone** – calcified collagen matrix with few cells trapped in the caves of bone
SKIN

Dense irregular connective tissue (few cells and lots of fibers)

Loose connective tissue (lots of cells and few fibers)
Slide 109: Skin, hand, monkey

- Irregular connective tissue, dense surface region and loose subdermal region
  
  Adipose cells,

  Location of a high density of collagen fibers

Dense irregular connective tissue

Loose connective tissue
Slide 109: Skin, hand, monkey

- Epidermis
- Dermis
- Dense Irregular connective tissue
- Fibroblasts
- Adipose cells
- Collagen fibers in bundles
- Loose connective tissue
Dense irregular connective tissue

Dense surface region of dermis

Subdermal region

Loose connective tissue

Skin, hand, monkey

Epithelium of the epidermis

Endothelium

Bundles of collagen fibers

Nerve

Fibroblasts

Dense irregular connective tissue
Spleen (reticulum stain)- capsule and reticulum fibers
Slide 118: Liver & spleen with colloidal carbon, rat

- Dense irregular connective tissue capsule
- Macrophages
Kidney Capsule, urinary vascular poles
slide #19713

Dense irregular
connective tissue
of capsule

fibroblasts

Bundles
of collagen

nephrons
Penis – transitional epithelium and surrounding slide 277 spongy cavernous of penile urethra

- Skin
- Dense irregular connective tissue creating the tunica albuginea
- Erectile vascular tissue
- Urethra
Small intestinal villi

Epithelium

Lamina propria

Smooth muscle
Slide 32409: Rat intestine (toluidine blue)

- Loose connective tissue (e.g., lamina propria)

- Fibroblasts

- Blood vessels
Dense **irregular** connective tissue

Dense **regular** connective tissue
Slide 202: Tendon

- Dense **regular** connective tissue
- High density of collagen fibers
- Fibroblasts
CELLS OF CT

FIBROBLASTS
MESENCHYMAL CELLS and RBC
ADIPose CELLS
MACROPHAGE
PLASMA CELLS
MAST CELLS and WBC

CHONDROBLASTS
CHONDROCYTES

OSTEOBLASTS
OSTEOCYTES
OSTEOCLASTS
Cells of connective tissue

Fig. 2-1  Loose Connective Tissue (spread). Supravital staining with neutral red. Upper: high magnification.

I. Fibroblast
II. Fixed macrophage
III. Mast cell

Mast cell  Macrophage  Fibroblasts  Fibroblasts  Plasma cell  Fat cells
Cells of connective tissue

Fig. 2-1  Loose Connective Tissue (spread). Supravital staining with neutral red. Upper: high magnification immersion.
Blood cells are connective tissue cells

Blood cells

- Erythrocyte
- Neutrophil
- Eosinophil
- Basophil
- Monocyte

Bone marrow cells

https://www.youtube.com/watch?v=UTo4LnXonTk&list=PLQltfhuKr1sgtel3O9lpDsbgEWfMY3JaX5&index=19
Slide 109: Skin, hand, monkey

- Fibroblasts
- Bundles of collagen fibers
- Smooth muscle
- Smooth cells
- Muscular artery
- Venule
- Endothelial cells
Slide 196: Spermatic cord

- Loose connective tissue
- Fat cells
- Fibroblasts
- Nerve
- Bundles of collagen fibers
- Valve in vein
- Smooth muscle
- Endothelial cells
- Fibroblasts
Slide 196  Vein of Spermatic cord

- Large vein
- Fat cells
- Smooth muscle
- Valve in a large vein
- Fibroblasts
Vein of Spermatic cord

- Arteriole
- Smooth muscle cells
- Fibroblasts
Slide 19716: Tail of epididymis

- Fibroblasts,
- Collagen fiber bundles
- Fat cells
EM 8e: Fibroblasts

Fibroblasts

Collagen fibers
Slide 126: Bile duct with portal vein, monkey

- Loose connective tissue (many cells and few fibers),
- Adipose cells,
- Fibroblasts

Plasma cells
White fat cell cytoplasm can be seen surrounding the single fat droplet.

Brown fat cell cytoplasm can be seen surrounding multiple fat droplets.
Slide HISTO42: Lung Mast cell
– Light blue granules
Cardiac stomach w/chronic infection

- Plasma cells
- Mast cells
- Loose connect tissue
- Epithelium

140
EM 8d: Mast cell

Granules,
Mitochondria,
Golgi region

rough endoplasmic reticulum
432 lung macrophages
Macrophage in lamina propria of rat intestine
EM 8h: Macrophage in aged testis; 30,000x

Enlarged basal lamina
Heterophagic vacuoles
Leydig cell cytoplasm
Myoid cell

Note varied densities in vacuoles.
Blood bathing of the hepatocytes travels through portal sinuses.

Slide 118 carbon deposits in the macrophages in the spleen.
Slide 126: Bile duct with portal vein, monkey

- Loose connective tissue,
- plasma cells
Cardiac stomach w/chronic infection

- Plasma cells
- Neutrophils
- Eosinophils
- Fibroblasts in loose connect tissue
- Endothelium
- Parietal cells of stomach
111 Skin

Large bundles of collagen fibers running in different directions (irregular) and of high density (dense) = dense irregular connective tissue in the dermis of skin

Epithelium

Nuclei of fibroblasts
With flexibility, high tensile strength, and impressive resistance to stretch, concentrations of these fibers are found where these attributes are crucially important.
Slide HISTO039: Larynx

- Loose connective tissue of the lamina propria
- Fibroblasts
- Dense irregular connective tissue in capsule
- cartilage
- perichondrium
- Bundles of collagen fibers
- Epithelium
EM 10d: 
Schwann cell

Collagen fibers

Fibroblast
EM 8e: Fibroblasts

Fibroblasts

Bundles of collagen fibers

type I collagen

Skin
Slide 218 spleen with dark, branched reticular fibers
Fig. 2-4  Loose Connective Tissue. Stain: hematoxylin-eosin. High magnification.
Slide 427: Aorta

- Elastin lamina

Smooth muscle cell nuclei

Lumen

Muscle and elastic fibers
Slide 426: Renal artery and vein with nerves

- Elastin fibers
- Elastin lamina
- Smooth muscle
EM 9: Smooth muscle cells

Elastic lamina
EM 10f: Arteriolar Wall

- Elastic fibers
- Endothelium
- Smooth muscle
Intestine: Connective Cells

- Mast cell
- Macrophage
- Fibroblasts
- Plasma cell
- Fat cells
In summary

Function of Connective Tissue

The histological glue which binds the other tissues together to form organs
Mechanical support - stroma below epithelium, skeleton
Metabolite exchange - vascular beds
Energy storage - adipose tissue
Inflammation - site of action for blood borne immune cells
Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

Questions on Connective Tissue

Connective tissue:
   a. provides mechanical support and metabolic exchange for epithelia
   b. provides site of battle for blood borne immune cells
   c. stores energy in striated muscle cells
   d. a and b
   e. a, b, and c

Classification of connective tissue proper is based on:
   a. ratio of cells to extracellular matrix
   b. arrangement of fibers
   c. the density of fibers in the extracellular matrix
   d. a and b
   e. a, b, and c

Cells of connective tissue that are progenitor (stem) cells are:
   a. adipose cells
   b. macrophages
   c. plasma cells
   d. fibroblasts
   e. mast cells
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脂肪细胞

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