

Introduction

- Derived from Mesoderm
- Acts as supportive tissues:
 - + Structural framework
 - + Organ protection
 - + Stores energy
 - + Nutrient transportation
 - + Protection against pathogens
- Consists of CELLS and MATRIX
 - Matrix: fibers + ground substance (from fibroblast) --> surrounds cells and make up majority of volume

Categories

- **Connective tissue proper:**
 - + Cells: mainly fibroblast
 - + Matrix: Semi fluid
- **Supportive connective tissue:**
 - + *Cartilage*: chondrocytes, gel-like fluid
 - + *Bones*: osteocytes, calcified matrix
- **Fluid connective tissue:**
 - + *Blood*: blood cells, fluid matrix

Connective Tissue Proper

Constituents:

- Scattered cells that are either **fixed** or **migratory**
- Fibres
- Viscous ground substance

Fixed cells:

- Fibroblasts
- Adipocytes
- Mesenchymal cells
- Macrophages

Migratory cells:

- Lymphocytes
- Mast cells
- Plasma cells
- Macrophages

Fibroblast

- **Most abundant**
- **Always present**
- **Secretes components of ground substance**
- **Secretes protein sub-units --> form fibres**
- **Involved in wound healing**
- **Elongated along fibres, elliptical nucleus, moderately dense**

Mesenchymal cells

- **Smaller, less differentiated than fibroblasts**
- Differentiated into other connective tissue cells when injured/infected
- **Star (stellar)/spindle (fusiform) shape**
- **Oval nucleus, can be seen clearly**
- **Lie along capillaries**
- Present in many types of connective tissues

Adipocytes

- **Lipid synthesis and storage**
- **Contain 1 or more lipid droplets**
- **Displaced nucleus; narrow cytoplasm's rim**
- **Main cell of adipose tissue**
- Also present in loose connective tissue (clumps or single)
- **Non - dividing**

Macrophages (ALSO Histiocytes)

- **Derived from Monocytes**
- **Phagocytosis of: dead tissue; foreign materials**
- **If stimulated --> Release chemicals triggering immune system**
- **Store antigenic materials to present to antibody-producing cells**
- **Stellate/Fusiform shape, lie along fibres**
- **Large, irregular nucleus**
- **Difficult to distinguish these and fibroblasts**

Migratory cells

Besides **Mast cells**, all migratory cells immigrated from blood

Amoeboid:

- Neutrophils
- Eosinophils
- Monocytes
- Lymphocytes --> Plasma cells (differentiated)

Mast cells

- From immune system
- **Large cells, shape varied amongst species**
- **Small, maybe binucleus**
- **Basophilic granules, contains heparin and histamine --> Released in response to injury/infection**
- **Similar to basophils**

Plasma cells

- **Ovoid, basophilic cytoplasm**
- **Eccentric "cart wheel" nucleus**
- **A lot in lymph nodes and connective tissues of G.I Tract**
- **Produce antibodies**

Classification of CT Proper

Based on physical and histological characteristics

- Loose (areolar) connective tissue
- Dense CTissue (Regular, Irregular)
- Elastic CT
- Reticular CT
- Adipose tissue (White, Brown)

Ground substance

- **Surrounds cells and fibres**
- **Clear and viscous**
- **--> Slow pathogens --> Facilitates phagocytosis**
- **Contains proteoglycans and glycoproteins**

Elastic Fibres

- **Composed of protein elastin**
- **branches and wavy**
- **Stretch and recoil to relaxed state**
- **Yellowish when fresh**
- **Difficult to see with H&E, use specialised stain**
- **Forms Elastic fibres ligaments (in continuous vertebrae) or discontinuous sheets (skin, lung, blood vessels)**



Reticular Fibres

- Composed of same protein as collagen
- thinner than collagen
- tough, flexible, branching, interweave network
- stabilise position of cells, blood vessels, nerves
- difficult to see histologically(need silver chain)
- Found in: parenchyma of spleen, liver, lymph nodes, glands and bone marrows.

Collagen fibres

- Long, straight
- Flexible, strong
- Polypeptide chains twisted into a rope
- white/clear when fresh
- Stained pink with eosin
- Most common in CT proper
- Form almost entirely Tendons and Ligaments

Loose CT (areolar)

- Volume mostly made of ground substance --> inhibits passage of microorganisms
- Loosely arranged fibres
- Fixed/migratory cells are common
- Cells resist infection and assist wound healing
- Very vascular
- Packing around organs, support epithelial tissue

Dense CT

- Collagen fibres dominate --> fewer cells --> Sometimes called *Collagenous* tissue
- Less physiologically active (less nerves and blood vessels)
- High strength, low to moderate elasticity

Dense CT (cont)

- Collagen fibres either **PARALLEL**: --> Regular Dense CT (ligaments, tendons, joint capsules)
- Or **RANDOMLY ARRANGED**: --> Irregular dense CT (dermis, organ capsules)

Elastic CT

- Elastic fibres dominate (irregular or regular dense)
- Moderate mechanical strength and high elasticity
- Found in: Airways of Respiratory tree, arteries, ligaments of abdominal cavity and vertebral column.

Reticular CT

- Forms framework of softer tissues: spleen, liver, lymph nodes and bone marrows.

Adipose tissue

Mostly fat cells
Reserve energy and water

White adipocytes

- Bulk of body fat

Brown

adipocytes:

- Smaller, multilocular cells

- Large, unilocular

- Round, central nuclei

- Signet ring: peripheral nucleus, lipid removed during processing --> leaving a vacuole

- Involved in heat production

- Many blood vessels and nerves

- Many in young animals and hibernators