Connective Tissues

Connective tissue forms a framework upon which epithelial tissue rests and within which nerve tissue and muscle tissue are embedded. Blood vessels and nerves travel through connective tissue.

Characteristics features

1. All types of connective tissues arise from the mesoderm.
2. Variable degrees of vascularity (number of blood vessels):
    a. Highly vascular – bone, adipose (fat) …
    b. Poorly vascular – cartilage, tendons …

Functions of connective tissue

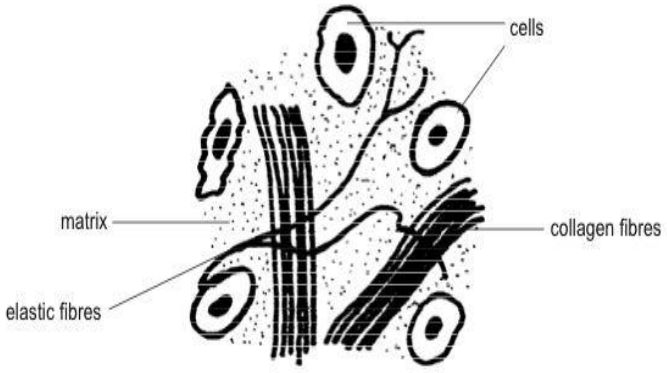
1- Wound repair / inflammatory response

2- Mechanical support for other tissue

3- Transport, immunological defense, energy reserve.

Structure

1. Cells
2. Extracellular matrices (Ground substance & Fibers).



Cells

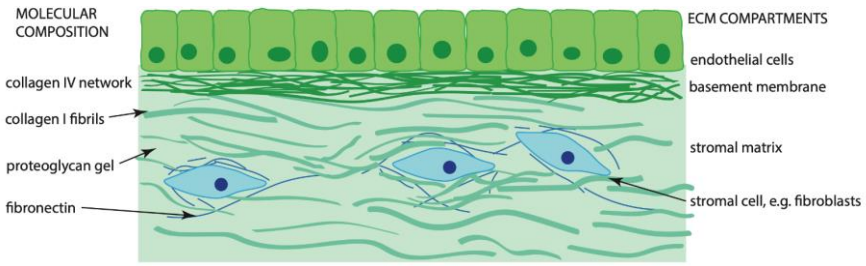
1. Fibroblasts
2. Macrophages
3. Mast Cells
4. Adipose cell
5. Plasma cells
6. White blood cell (leukocytes)
7. Reticular cells
8. Pigment cells
9. Mesenchymal cells

Extracellular matrix

Between the cells is an extracellular substance called the **extracellular matrix (ECM)**.

Extracellular matrix refers to the fluid, macromolecules, and minerals that surround the cells. The matrix is made up of protein fibers, polysaccharides, extracellular fluid, and minerals.

The major structural macromolecule type found in the ECM are proteins, like collagen and elastin. Because these are fibrous proteins, it is called **fibers**.



Fibers

Produced by fibroblasts, give the tissue different functions depending on the fiber type

Types of Fibers

Tissue	Purpose	Location
Collagen fibers	Bind bones and other tissues to each other	tendon, ligament, skin, cornea, cartilage, bone, blood vessels, gut, and intervertebral disc.
Elastic fibers	Allow organs like arteries and lungs to recoil	extracellular matrix
Reticular fibers	Form a scaffolding for other cells	liver, bone marrow, and lymphatic organs

Classification of connective tissues

I.Proper connective tissues: include loose and dense connective tissues.

A. Loose connective tissues include: biological packing material; supports epithelia lining gut, respiratory & urinary tracts, etc.

Types

1- Areolar con. T. hypodermis
2- Reticular con T. (lymph node)
3- Adipose con. T. (under the skin)

B. Dense connective tissue also called dense fibrous tissue

1- Dense Irregular con. T. (dermis)
2- Dense Regular con. T.
3- Elastic con. T.

Types

a- White fibrous con. T. (tendon)
b- Elastic con. T. (ligament of the vertebral column).

II. Specialized connective tissue includes: tendons and ligaments, Bone and Cartilage, haemopoetic tissue, blood and adipose tissue.

III. Embryonic connective tissue includes: mesenchyme and mucous connective tissue.

Adipose tissue

Adipose tissue is a specialized connective tissue consisting of lipid-rich cells called adipocytes.

As it comprises about 20-25% of total body weight in healthy individuals.

Function

1. Store energy in the form of lipids (fat).

2. In case of food deprivation, its an essential source of energy and water.

3. Thermal isolation
4. Cushioning the organs
5. Endocrine role
6. Production of numerous bioactive factors

Based on its location, fat tissue is divided into:

1. Parietal or subcutaneous fat: embedded in the connective tissue under the skin.
2. Visceral fat: surrounds the internal organs, such as eyeballs or kidneys .

Depending on adipocyte morphology, there are two types of adipose tissue:

A- white adipose connective tissue:

- o It is formed by large fat cells; each cell. Contains a large droplet of fat.
- o It appears yellow because contains carotene pigments.

Locations

1- under the skin, mammary glands.

2- around the kidney and blood vessels.

3- in the abdominal wall.

Functions

o Acts as a heat insulator and as a fat storage area in the body.

o It supports the kidney and other organs.

B- Brown adipose connective tissue.

o It is formed by fat cells; each fat cell is filled with multiple fat droplets.

o It appears brown because it is rich in blood vessels and pigments.

Locations

1- mainly in fetuses and newborn infants.

2- in the scapular, axillary and mediastinal regions.

Functions

It provides heat for newborns.

Muscular tissue

Muscular tissue Is composed of cells that have the special ability to shorten or contract in order to produce movement of the body parts.

Muscle occurs in three distinct types:

1- Skeletal muscle.
2- Smooth muscle.
3- Cardiac muscle.

Muscle type	Structural elements	Function	Location
Skeletal	1-Long cylindrical fiber 2-Striated 3-Many peripherally nuclei	1- Voluntary movement 2- Produces heat 3- Protects organs	Attached to bones
Cardiac	1-Short 2-Branched 3-Striated 4-Single central nucleus	Contracts to pump blood	Heart
Smooth	1-Short 2-Spindle-shaped 3-No striation 4-Single nucleus in each fiber	1- Involuntary movement 2- Moves food 3- involuntary control of respiration 4- Moves secretions 5- Regulates flow of blood in arteries by contraction	Walls of major organs and passageways