

# Connective tissues

## Article to be checked

Check of this article is requested.

Suggested reviewer: Carmeljcaruana

LITTLE BIOPHYSICS OF CONNECTIVE TISSUE. GOOGLE IT!

## This article was checked by pedagogue



This article was checked by pedagogue, but more than year ago.

Signature: Carmeljcaruana (talk)



## CONNECTIVE TISSUE Biophysical point of view

### General Features

Tissue is a part of an organism consisting of a large number of cells having a similar structure and function. Connective tissue is one group of the four tissues in the body. It maintains the form of the body and its organs and provides cohesion and internal support.

### Origin

All connective tissue types derive from Mesenchyme, an embryonic form of connective tissue.

Indented line

### Function

Connective Tissue provides mechanical support to tissues and organs allowing them to resist tension and compression. Furthermore it provides metabolic support in the form of growth factors, hormones, and high energy lipids through blood vessels. It contains also different cells that generate immune responses to foreign cells.

## Main components

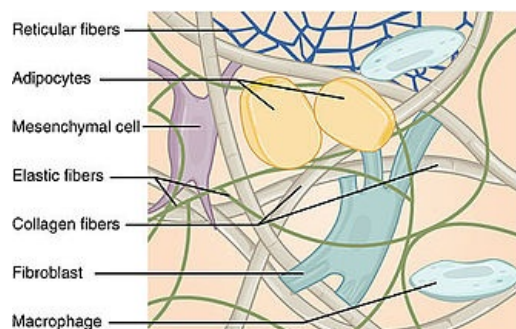
Connective tissue is composed of two main components

### Cells

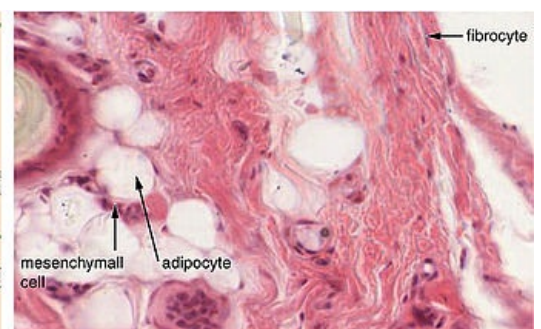
Depending of the type of connective tissue, different cells can be found. Generally connective tissue cells can be divided into fixed and wandering cells.

Fixed Cells:

Mesenchymal Cells, Fibroblasts, Reticular Cells, Adipose Cells  
Wandering Cells: Mast cell, Macrophage, Plasma Cell, White blood cells



Connective tissue and its main components



### Extracellular Matrix (Fibers + Ground Substance)

Usually the extracellular matrix consists of large protein fibers and nonfibrous areas of ground substance rich in various glycosaminoglycans and water.

### Fibers

There are two types of fibers, Collagen and Elastic.

## **Grundsubstance**

Ground substance is a complex of anionic, hydrophilic proteoglycans, glycosaminoglycans (GAGs), and multiadhesive glycoproteins.

Tissue must not only accommodate tensile or pulling forces but they must also resist compression. The primary component in connective tissue that responds to compression are glycosaminoglycans. GAGs resist compression by occupying a large volume and retaining water. The base component of GAGs is a disaccharide of two different sugars. These disaccharides are joined into polymers that can contain 1000s of disaccharides. The sugars that make up the disaccharides differ between GAGs, but the main feature is that they are negatively charged. The largest GAG is Hyaluronic Acid, a long polymer of the disaccharide glucosamine-glucuronate. It forms a dense, viscous network of polymers, which binds a high amount of water, giving it an important role in allowing diffusion of molecules in connective tissue.

Proteoglycans contain a core of protein with one or many side chains of sulphated GAGs as well as branched oligosaccharides.

## **Types of connective tissue**

Depending on the proportion of the cells, fibers and intercellular substance, there are different types of connective tissue. A strong connective tissue for example needs a greater proportion of the collagen fibers and fewer cells, like dense connective tissue in tendons. Connective tissue composed of mostly cells isn't very strong, like adipose connective tissue.

### **Connective tissue proper**

#### **Loose connective tissue**

This type has many cells, Fibroblasts, a loose arrangement of fibers, and moderately viscous fluid matrix.

#### **Dense irregular connective tissue**

It has randomly distributed bundles of Collagen I and is for example in joint capsules or the layer of skin underneath the epidermis.

#### **Dense regular connective tissue**

Here the collagen fibres are densely packed, and arranged in a parallel way. It is typically found in ligaments or tendon. These are resistant to loaded tension forces, but allow some stretch.

### **Adipose Tissue**

#### **White Adipose Tissue**

Found in many organs throughout the body. Contains Adipocytes, with one large lipid droplet, which store fat in form of triglycerides, which can be broken down for energy by the organism.

#### **Brown Adipose Tissue**

This tissue type is found mainly in newborn. Adipocytes contain many small lipid droplets. The main function of the brown adipocyte is to produce heat by nonshivering thermogenesis.

### **Cartilage Tissue**

#### **Hyaline Cartilage**

Is the most common type of Cartilage tissue. Its cells, Chondrocytes are mostly arranged in isogenous groups. It is located in the outer surface of movable joints for example.

#### **Elastic Cartilage**

It generally resembles hyaline cartilage in its chondrocytes and major ECM components, but its matrix includes abundant elastic fibers, which increase tissue flexibility.

#### **Fibrocartilage**

Contains varying combinations of Hyaline cartilage in small amount of dense connective tissue. It provides very tough, strong support at tendon insertions and in intervertebral discs.

### **Bone tissue**

Bone is a type of connective tissue with a calcified extracellular matrix, specialized to support the body, protect many internal organs, and act as the body's  $Ca^{2+}$  reservoir. Bone tissue contains three types of cells: osteoblasts, which deposit bone, osteocytes, which maintain the bone, and osteoclasts which resorb bone.

## References

- Junqueira's Basic Histology Text & Atlas, Anthony L. Mescher 13th Edition ISBN 978-1-259-07232-1
- Histology & Cell Biology, Douglas F. Paulsen 4th edition ISBN 978-0-8385-0593-9
- [http://en.wikipedia.org/wiki/Connective\\_tissue](http://en.wikipedia.org/wiki/Connective_tissue)
- <http://www.britannica.com/EBchecked/topic/132995/connective-tissue>
- [http://www.histology.leeds.ac.uk/tissue\\_types/connective/connective\\_tissue\\_types.php](http://www.histology.leeds.ac.uk/tissue_types/connective/connective_tissue_types.php)

**Picture:** [http://commons.wikimedia.org/wiki/File:408\\_Connective\\_Tissue.jpg?uselang=ang](http://commons.wikimedia.org/wiki/File:408_Connective_Tissue.jpg?uselang=ang)