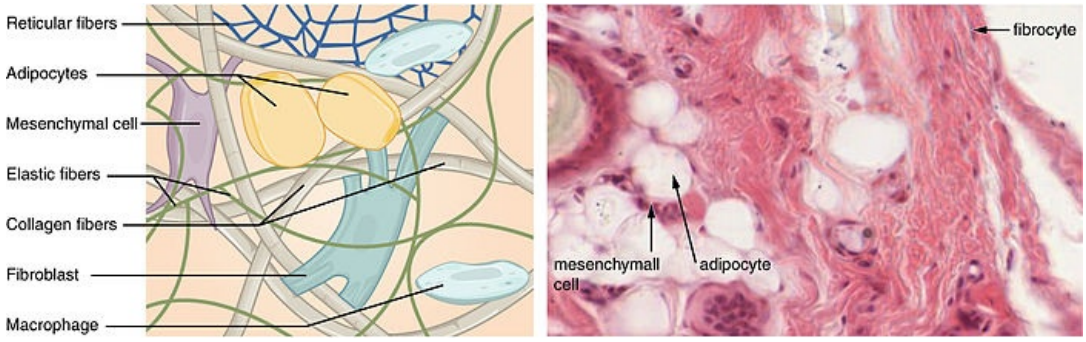
Binders

Connective tissue consists of cells and the intercellular mass in which these cells are embedded.
All connective tissues have a mesenchymal origin, from which the following tissue types are differentiated:

- **Ligament** (different types)
- **Cartilage** (3 types, chondrocytes, chondroblasts)
- **Bone** (osteocytes, osteoblasts)
- **Dentin** (tooth, odontoblasts)
- **Cement** (tooth, cementoblasts, cementocytes)

Connective cells

Connective cells form different types of cells depending on the type of connective tissue. These include fibroblasts, fibrocytes, odontoblasts, osteoblasts and chondroblasts.



Extracellular matrix (ECM)

ECM is produced by the cells of a given tissue type. It consists of macromolecules that form a complexly organized network. Cells have binding sites, receptors for ECM used to attach cells to ECM and to regulate their activity. The ECM is a colorless, transparent, gel-like substance in which cells and fibers are embedded. We divide the matrix into **fibrous component** and **component amorphous**.

The fibrous component of the ECM

Collagen fibers

Collagen fibers are 1–20 µm long. The properties of the collagen fiber include strength and flexibility. They tend to form bundles.They are produced by tissue cells, but also by smooth muscle cells, glial cells, adipocytes and epithelia. About 21 types are known collagen, which differ in sequence and type of amino acid in the chain.


Collagen fibers

The most well-known types of collagen include:

- collagen I (75 nm fibrils, bundles of fibers, we can see with the eye, most widespread in the body, occurrence in fibrocartilage)
- collagen II (thin fibrils 20 nm, separate, without bundles, hyaline and elastic cartilage)
- collagen III (45 nm fibrils, reticular fibers)
- collagen IV (in lamina basalis)

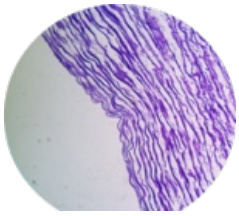
Collagen fibers are eosinophilic (acidophilic) and can be stained with eosin, light green, aniline blue, saffron, or picrofuchsin. Collagen synthesis takes place on GER ribosomes. The protein follows a route to the Golgi complex where it is hydroxylated and glycosylated. Here it is also packed in pouches without a membrane, the so-called vesicles and by exocytosis it is then sent out of the cell in the form of a protocolagen molecule (3 polypeptide chains with registration peptides at the ends of the chain that prevent polymerization). It produces protocologen-peptidases and cleaves the registration peptides. A tropocollagen molecule is formed, which can now polymerize and form *collagen myofibrils*. *Collagen fibrils* can then form and polymerize into the final *collagen fiber*.

Reticular fibers

They are made of type III collagen. The fibers are 0.2–2 µm long and are made up of 45 nm fibrils. They form networks in bodies. They are colored by silver impregnation (argyrophilic), PAS reaction (they have a lot of glycoproteins and proteoglycans),Gomori's impregnation.

Elastic fibers

Elastic fibers are thinner than collagen fibers. They are 0.5–4 µm in length. The central protein forms elastin and surrounding microfibrils. They are elastic, form networks, anastomosing and branching. Elasticity is ensured thanks to the hydrophobic property. They are produced by fibroblasts. Stains with special staining methods such as orcein, resorcin-fuchsin and aldehyde-fuchsin.



Elastic fibers

The amorphous component of the ECM

Made up mainly of water and ions. We also find here glycosaminoglycans (GAGs), which form large unbranched polysaccharide chains. These chains are composed of disaccharide units and have a negative charge. These are amino sugars *N-acetylglucosamine, N-acetylgalactosamine*, which are often sulfonated. In many GAGs, a second sugar, uronic acid with a carboxyl group, is part of the molecule. GAGs are highly hydrophilic and maintain the ECM architecture. They prevent its deformation by compressive forces thanks to: hyaluronic acid, chondroitin sulfate, dermatan sulfate, heparan sulfate and heparin, keratan sulfate and proteoglycans. With the exception of hyaluronic acid, GAGs bind covalently to protein and form proteoglycans − large molecules capable of maintaining high ECM hydration. Another part of the amorphous component consists of adhesion proteins. As an example, we can cite fibronectin, which is a multifunctional glycoprotein and binds to receptors (integrins) on the surface of cells or laminin, which is a sulfonated glycoprotein in the basal lamina.

References

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