Smooth muscle

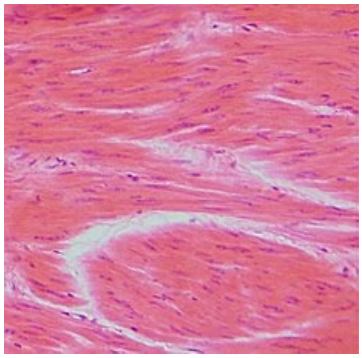
Smooth muscle is one of the three types of muscle found in the body of mammals, including the human body. It is found mainly in the muscle layers of the walls of organs of the digestive, respiratory, genitourinary systems or in blood vessels, and is also scattered in the skin, in the iris or ciliary body of the eye. It is uncontrollable by will. Its contraction affects the vegetative nervous system or hormonal stimuli (oxytocin, adrenaline, noradrenaline, serotonin).

Development of smooth muscle

Smooth muscle develops from the splanchnopleura around the alimentary canal and its derivatives. In this way, the *tunica muscularis* of the alimentary canal, trachea or bronchi is formed. The muscle of the vascular wall is formed from mesenchymal cells . These cells are a potential source of smooth muscle throughout the body.

Structure of smooth muscle cells

Smooth muscle is composed of individual spindle-shaped cells. Each cell contains a single elongated nucleus located centrally in the wider part of the cell. The size of the cells varies from about 20 µm to 500 µm in the uterine wall during pregnancy. The cells are surrounded by a network of reticular fibers and a basal lamina. These structures serve to evenly distribute the forces and thus enable the contraction to be harmonized.



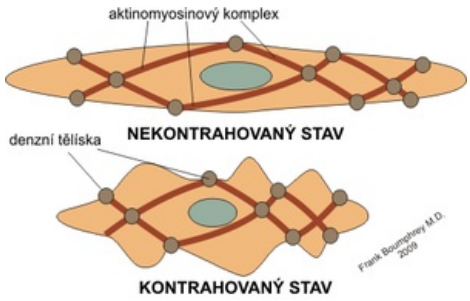
Smooth muscle cells; stained with hematoxylin-eosin.

The plasma membrane is called the sarcolemma, on its inner surface there are plates, the so-called dense bodies. Dense bodies have the function of attachment of thin and intermediate filaments, they are formed by the protein α-actinin, so they are similar to the Z-discs of striated muscle. The sarcolemma creates numerous pinocytic invaginations, individual cells are connected by nexuses. Intermediate filaments mainly contain desmin and vimentin.

Furthermore, the smooth muscle cell contains numerous mitochondria (the energy supply is provided mainly by glycolysis). The Golgi apparatus is located near the nucleus, the granular endoplasmic reticulum is abundantly represented , but also free ribosomes. Sarcoplasmic reticulum is reduced, T-tubules are absent. We also find here, for example, glycogen inclusions. The cell produces type III collagen, proteoglycans or elastin (similar to a fibroblast).

Contraction of smooth muscle

The contraction of smooth muscle, like skeletal muscle , is based on the reaction of actin with myosin , but the course of contraction is different. Myofilaments cross each other to form a lattice-like structure, rather than the transverse striations characteristic of skeletal or cardiac muscle. Thin filaments are made of actin and tropomyosin (unlike striated muscles, troponin is missing), thick filaments are made of myosin. Contraction is initiated by the release of Ca 2+ , which forms a complex with calmodulin. This complex subsequently activates the myosin light chain kinase and its phosphorylation occurs, which enables the formation of the actinomyosin complex. Myosin filaments in smooth muscle differ from myosin filaments in striated muscle in that the ends of the molecule are bare and the heads are in the center of the filament.



Mechanism of contraction

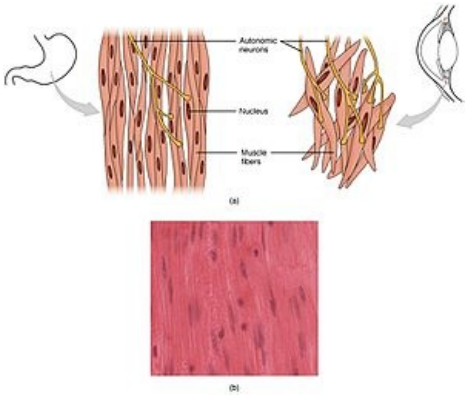
Links

Related articles

- Striated cardiac muscle tissue
- Skeletal muscle structure

Used literature

- KLIKA, Eduard. *Histologie pro stomatology.* 1. edition. Praha : Avicenum, 1988. pp. 448.
- JUNQUIERA, L. Carlos – CARNEIRO, José – KELLEY, Robert O. *Základy histologie.* 1. edition. Jinočany : H & H, 1997. pp. 502. ISBN 80-85787-37-7.



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