

Myelination

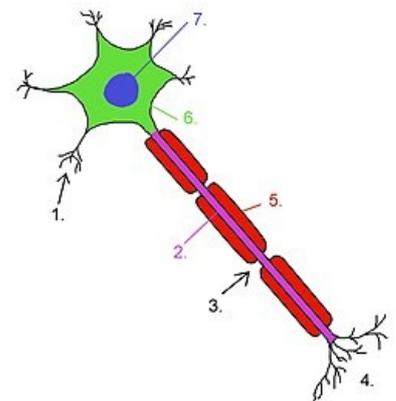
The axons of nerve cells do not exist freely, but are embedded or enveloped by glial cells. In the peripheral nervous system, the axon sheaths are formed by Schwann cells, in the central nervous system are formed by oligodendrocytes. On the surface of glial cells (Schwann cells or oligodendrocytes) is a glycoprotein that binds to the membrane of the adjacent axon. Small-diameter axons are usually free or only embedded in the cytoplasm of glial cells - **unmyelinated axons**, while other axons are surrounded by a layer of modified glial cell membranes - **myelinated axons**.

Formation of the myelin sheath

First, the axon is placed in the folds of the cytoplasm of Schwann cells. The protrusions of these cells surround the axon, their cell membranes adhere to each other to form a **mesaxon**, which then wraps around the axon several times (forming an outer and inner mesaxon). The myelin sheath is made up of **myelin**, which is a lipoprotein complex composed of lipids (mainly galactocerebroside) and proteins. The proteins provide a tight connection between the cell membranes. There is a small amount of Schwann cell cytoplasm somewhere between the coiled membranes. This cytoplasm, together with the cell membrane, is called the inner (between the axon and the myelin sheath) and outer (on the surface of the myelin sheath) mesaxon. The **Schmidt-Lantermann incisures** are the parts of the cytoplasm of Schwann cells that have been embedded in the myelin sheath. It is for the nourishment of the axon. The **node of Ranvier** is a gap in the myelin sheath where two Schwann cells meet.

Differences in myelination between the central and the peripheral nervous system

In the **peripheral nervous system**, the myelin sheath is formed by **Schwann cells** and is interrupted by the nodes of Ranvier. The **internode** is the distance between two nodes of Ranvier, so it is the section of the axon that is myelinated by a one Schwann cell. The thicker the axon, the longer the internodes. In the region of the node of Ranvier, the axon is usually thickened, and there are ion channels in the axolemma. In the **central nervous system**, the myelin sheath is formed by oligodendrocytes. One oligodendrocyte myelinates more than one axon, the Schmidt-Lantermann incisures are absent, and the axons are only incompletely covered



Neuron

Unmyelinated axons

In the **peripheral nervous system**, all unmyelinated axons are embedded in the cytoplasm of Schwann cells. One Schwann cell forms a sheath for many unmyelinated axons. Schwann cells are longitudinally connected and form a continuous sheath around unmyelinated axons.

In the **central nervous system**, unmyelinated axons lie freely between other processes of neurons and glial cells. The neuropil is a place where processes of neurons connect with each other

Myelinated axons

Myelinated axons conduct action potentials much faster than unmyelinated axons. The axolemma is exposed to the external environment in the region of the Nodes of Ranvier. There are also located ion channels and the ionic changes necessary for the generation of the action potential take place here. The action potential is propagated in jumps (saltatory conduction). So the action potential is conducted very rapidly from one node of Ranvier to another. The speed of conduction for a myelinated axon is 1-100 m/s, while for a non-myelinated axon it is about 0.6-2 m/s.

Links

Related articles

- Neuron
- Axon

External sources

- Myelin(english wikipedia)

Literature

- KONRÁDOVÁ, Václava – UHLÍK, Jiří – VAJNER, Luděk. *Funkční histologie*. 2. edition. H&H, 2000. ISBN 978-80-86022-80-2.
- JUNQUEIRA, L. Carlos – CARNEIRO, José – KELLEY, Robert O. *Základy histologie*. 1. v ČR edition. H & H, 1997. 502 pp. ISBN 80-85787-37-7.