

# Nerve fiber

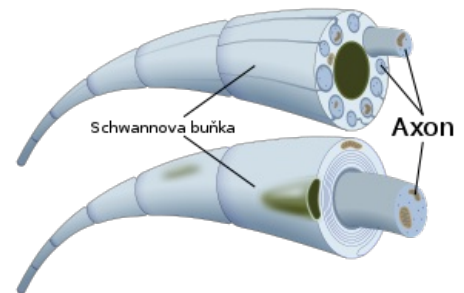
**Nerve fibers** are made up of axons and glial cells. Their structure is different in the central and peripheral nervous system. However, in both systems they can be either myelinated or unmyelinated. The **myelin sheath** consists of lipoproteins, in which *galactocerebroside* predominates. More strongly myelinated fibers conduct impulses saltatory (from Latin *salto, are* – to jump) between individual Ranvier notches on the axon. This makes the impulse transmission faster than in unmyelinated or weakly myelinated fibers.

## Nerve fibers in the central nervous system

In the CNS, nerve fibers are arranged in *tracts*. They consist mainly of myelinated fibers. Myelin sheaths form oligodendrocytes, and a single sheath can envelop multiple axons. In addition to these, there are numerous unmyelinated junctions in the CNS that run freely between neurons.

## Nerve fibers in the peripheral nervous system

In the PNS, nerve fibers are organized into **nerves**. They are surrounded by Schwann cells. The myelin sheath is formed by the insertion of the axon into the fold of the Schwann cell. The internal membranes fuse to form a mesaxon. By its rotation around the axon, it forms a multi-layered membrane. Its layers then merge. Remains of Schwann cell cytoplasm remain inside the sheath – Schmidt-Lantermann clefts. The myelin sheath of one axon consists of one Schwann cell. Between the individual Schwann cells are Ranvier's notches. **Unmyelinated fibers** are enveloped by a Schwann cell that does not form myelin. Multiple axons may be involved in a Schwann cell. Schwann cells are tightly packed together so they do not form Ranvier's incisions.



Unmyelinated nerve fiber above, myelinated nerve fiber below

## Classification of nerve fibers according to conduction velocity

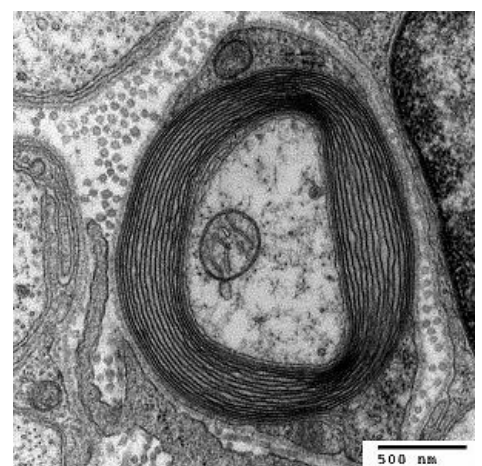
**Conduction velocity** is approximately directly proportional to axon thickness. We classify nerve fibers in the PNS into three types according to the conduction velocity. This classification also includes the peripheral branches of the projections of pseudounipolar neurons.

- **A-fibers** are myelinated: (radius, conduction velocity)
  - A $\alpha$ -fibers, Ia, Ib (12–20  $\mu\text{m}$ , 70–120  $\text{ms}^{-1}$ ) ensure proprioception and somatic momentum
  - A $\beta$ -fibers, II (5–12  $\mu\text{m}$ , 30–70  $\text{ms}^{-1}$ ) conduct touch and pressure information
  - A $\gamma$ -fibers (3–6  $\mu\text{m}$ , 15–30  $\text{ms}^{-1}$ ) ensure the momentum of intrafusal muscle fibers
  - A $\delta$ -fibers, III (2–5  $\mu\text{m}$ , 12–30  $\text{ms}^{-1}$ ) transmit pain and temperature messages
- **B-fibers** (3  $\mu\text{m}$ , 3–15  $\text{ms}^{-1}$ ) are also myelinated and represent preganglionic autonomic fibers.
- **IV C-fibers** are unmyelinated and are both sympathetic postganglionic fibers (0.3–1.3  $\mu\text{m}$ , 0.3–1.3  $\text{ms}^{-1}$ ) and are also involved in the conduction of pain information (0.4–1, 2  $\mu\text{m}$ , 0.5–2  $\text{ms}^{-1}$ ).

## Links

## References

- JUNQUEIRA, L. Carlos – CARNEIRO, José – KELLEY, Robert O.. *Základy histologie*. a LANGE medical book edition. Jinočany : H & H, 1997. 502 pp. ISBN 80-85787-37-7.



Myelinated neuron - electron microscope