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MYELINATION

A not so even distribution

> these findings reveal that cortical pyramidal neurons exhibit diverse longitudinal profiles of myelination

Detailed maps of how myelin is distributed along axons are not available, although it is often presumed that myelin coverage is largely uniform. However, a new study in mice shows that the axons of cortical pyramidal neurons have diverse longitudinal profiles of myelination, thus challenging this presumption.

To investigate myelin distribution, Tomassy *et al.* used high-throughput electron microscopy serial reconstruction data sets relating to two volumes of mouse cortex — one from the primary somatosensory cortex and one from the primary visual cortex. From these data sets, the authors reconstructed single pyramidal neurons, including their myelin tracts, from various cortical layers.


ALAMY

They found that total myelin coverage of layer 5 (L5) and L6 axons was greater than that of L2/3 axons. Interestingly, L5 and L6 neurons had axons with long myelinated tracts that were broken up only by nodes of Ranvier and, in a few cases, short unmyelinated segments, whereas the majority of L2/3 axons exhibited myelinated tracts of variable lengths that were interspersed with lengthy regions that lacked myelination. The authors also found that the region between the axon hillock and the first internode was notably longer in L3 and L4 neurons than in L5 and L6 neurons, and was extremely long in some of the L2/3 neurons. Together, these findings reveal that cortical pyramidal neurons exhibit diverse longitudinal profiles of myelination, with neurons in deeper layers of the cortex showing greater myelin coverage.

Through *in situ* hybridization and immunohistochemical experiments, the authors next showed that oligodendrocyte precursor cells are evenly distributed throughout the cortical layers of the mouse brain, whereas oligodendrocytes, which myelinate axons, are more abundant in deeper cortical layers. They also found that in a transgenic mouse line in which deep-layer pyramidal neurons are found in upper cortical layers and upper cortical neurons are found in deep layers, all cortical layers exhibited similar levels of myelination. These data suggest that pyramidal neurons from different cortical layers have different capacities to influence the distribution of and myelination by oligodendrocytes.

This study reveals that the longitudinal coverage of axons by myelin varies considerably between classes of cortical pyramidal neurons. The functional importance of these differences is unclear; however, other structural features of myelin affect neural transmission — notably, myelin thickness influences nerve conduction velocity — suggesting that the distribution of myelin tracts may also have a profound impact on neuronal communication.

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ORIGINAL RESEARCH PAPER Tomassy, G. S. *et al.* Distinct profiles of myelin distribution along single axons of pyramidal neurons in the neocortex. *Science* **344**, 319–324 (2014)