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Neuronal activity modulates myelin plasticity and regeneration

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The CNS is responsive to an ever-changing environment. Until recently, studies of neural plasticity focused almost exclusively on functional and structural changes of neuronal synapses. In recent years, myelin plasticity has emerged as a potential modulator of neural networks. Myelination of previously unmyelinated axons, and changes in the structure on already-myelinated axons, can have large effects on network function. The heterogeneity of the extent of how axons in the CNS are myelinated offers diverse scope for dynamic myelin changes to fine-tune neural circuits. The traditionally held view of myelin as a passive insulator of axons is now changing to one of lifelong changes in myelin, modulated by neuronal activity and experience.

Myelin, produced by oligodendrocytes (OLs), is essential for normal brain function, as it provides fast signal transmission, promotes synchronization of neuronal signals and helps to maintain neuronal function. OLs differentiate from oligodendrocyte precursor cells (OPCs), which are distributed throughout the adult brain, and myelination continues into late adulthood. OPCs can sense neuronal activity as they receive synaptic inputs from neurons and express voltage-gated ion channels and neurotransmitter receptors, and differentiate into myelinating OLs in response to changes in neuronal activity.

This lecture will review myelin plasticity in adult animal, whether myelin changes occur in non-motor learning tasks, and questions whether myelin plasticity and myelin regeneration are two sides of the same coin.

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