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Axonal Transport and Morphology: How Myelination gets Nerves into Shape[1] PETER JUNG, PENG ZHAO, Ohio University, PAULA MONSMA, TONY BROWN, Ohio State University — The local caliber of mature axons is largely determined by neurofilament (NF) content. The axoskeleton, mainly consisting of NFs, however, is dynamic. NFs are assembled in the cell body and are transported by molecular motors on microtubule tracks along the axon at a slow rate of fractions of mm per day. We combine live cell fluorescent imaging techniques to access NF transport in myelinated and non-myelinated segments of axons with computational modeling of the active NF flow to show that a), myelination locally slows NF transport rates by regulating duty ratios and b), that the predicted increase in axon caliber agrees well with experiments. This study, for the first time, links NF kinetics directly to axonal morphology, providing a novel conceptual framework for the physical understanding of processes leading to the formation of axonal structures such as the "Nodes of Ranvier" as well as abnormal axonal swellings associated with neurodegenerative diseases like Amyotrophic lateral sclerosis (ALS).

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