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Sharing is Caring: The Role of Actin/Myosin-V in Synaptic Vesicle Transport between Synapses in vivo

MICHAEL GRAMLICH, Washington University in St. Louis

Inter-synaptic vesicle sharing is an important but not well understood process of pre-synaptic function. Further, the molecular mechanisms that underlie this inter-synaptic exchange are not well known, and whether this inter-synaptic vesicle sharing is regulated by neural activity remains largely unexplored. I address these questions by studying CA1/CA3 Hippocampal neurons at the single synaptic vesicle level. Using high-resolution tracking of individual vesicles that have recently undergone endocytosis, I observe long-distance axonal transport of synaptic vesicles is partly mediated by the actin network. Further, the actin-dependent transport is predominantly carried out by Myosin-V. I develop a correlated-motion analysis to characterize the mechanics of how actin and Myosin-V affect vesicle transport. Lastly, I also observe that vesicle exit rates from the synapse to the axon and long-distance vesicle transport are both regulated by activity, but Myosin-V does not appear to mediate the activity dependence. These observations highlight the roles of the axonal actin network, and Myosin-V in particular, in regulating inter-synaptic vesicle exchange.