Dynamic Modulation of Axonal Trafficking of Synaptic Vesicles in Activity Dependent Presynaptic Function

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Neurons use neurotransmitter carrying synaptic vesicles to transmit information at specialized locations called presynapses. Synaptic vesicle release of neurotransmitter becomes less efficient over time due to presynaptic communication. Older vesicles must then be replaced with newer vesicles to maintain efficient communication. We have recently shown how vesicle turnover is mediated during homeostasis, but it is less clear if/how vesicle turnover is modulated due to activity. Here we will present our recent work investigating whether vesicle turnover is modulated due to presynaptic activity. Specifically, we study dynamic changes in vesicle axonal trafficking using cultured hippocampal neurons and high-resolution fluorescence microscopy. We use this approach to distinguish the rate of vesicle turnover as a function of time after presynaptic activity. We show that turnover is dynamically modulated commensurate with activity level and supports changes in synaptic vesicle use. Our findings, therefore, shed light on the intricate processes that determine vesicle turnover.

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