Golgi-independent secretory trafficking through recycling endosomes in neuronal dendrites and spines

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Abstract

Neurons face the challenge of regulating the abundance, distribution and repertoire of integral membrane proteins within their immense, architecturally complex dendritic arbors. While the endoplasmic reticulum (ER) supports dendritic translation, most dendrites lack the Golgi apparatus (GA), an essential organelle for conventional secretory trafficking. Thus, whether secretory cargo is locally trafficked in dendrites through a non-canonical pathway remains a fundamental question. Here we define the dendritic trafficking itinerary for key synaptic molecules in rat cortical neurons. Following ER exit, the AMPA-type glutamate receptor GluA1 and neuroligin 1 undergo spatially restricted entry into the dendritic secretory pathway and accumulate in recycling endosomes (REs) located in dendrites and spines before reaching the plasma membrane. Surprisingly, GluA1 surface delivery occurred even when GA function was disrupted. Thus, in addition to their canonical role in protein recycling, REs also mediate forward secretory trafficking in neuronal dendrites and spines through a specialized GA-independent trafficking network.

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