Neuronal protein trafficking: Emerging consequences of endoplasmic reticulum dynamics

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The highly polarized morphology and complex geometry of neurons is determined to a great extent by the structural and functional organization of the secretory pathway. It is intuitive to propose that the spatial arrangement of secretory organelles and their dynamic behavior impinge on protein trafficking and neuronal function, but these phenomena and their consequences are not well delineated. Here we analyze the architecture and motility of the archetypal endoplasmic reticulum (ER), and their relationship to the microtubule cytoskeleton and post-translational modifications of tubulin. We also review the dynamics of the ER in axons, dendrites and spines, and discuss the role of ER dynamics on protein mobility and trafficking in neurons.