Kinesin-dependent, rapid, bi-directional transport of ER sub-compartment in dendrites of hippocampal neurons

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Although spatially restricted Ca^{2+} release from the endoplasmic reticulum (ER) through intracellular Ca^{2+} channels plays important roles in various neuronal activities, the accurate distribution and dynamics of ER in the dendrite of living neurons still remain unknown. To elucidate these, we expressed fluorescent protein-tagged ER proteins in cultured mouse hippocampal neurons, and monitored their movements using time-lapse microscopy. We report here that a sub-compartment of ER forms in relatively large vesicles that are capable, similarly to the reticular ER, of taking up and releasing Ca^{2+}. The vesicular sub-compartment of ER moved rapidly along the dendrites in both anterograde and retrograde directions at a velocity of 0.2-0.3 μm/s. Depletion of microtubules, overexpression of dominant-negative kinesin, and kinesin depletion by antisense DNA reduced the number and velocity of the moving vesicles, suggesting that kinesin may drive the transport of vesicular sub-compartment of ER along microtubules in the dendrite. Rapid transport of the Ca^{2+}-releasable sub-compartment of ER might contribute to rapid supply of fresh ER proteins to the distal part of the dendrite, or to the spatial regulation of intracellular Ca^{2+} signaling.

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