Synaptopodin, an activity-dependent, actin-associated protein

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Long-term potentiation (LTP) is an attractive electrophysiological model for learning and memory. Similar to the formation of long-term memory, the later stages of LTP (L-LTP) depend on new mRNA and protein synthesis. This dependency on de novo RNA synthesis has led to the identification of several genes that are upregulated after LTP induction. These LTP-associated proteins are thought to support the increase in synaptic efficacy during the maintenance phase of LTP. One of the identified LTP-associated transcripts is synaptopodin, an actin-associated protein expressed in neurons and renal podocytes. (Yamazaki et al, J Neurochem 2001). In neurons, synaptopodin is located within the neck of mature spines (i.e. spines that contain a spine apparatus). Since synaptopodin is an activity-dependent actin-associated protein and is localized to the spine-neck, it can be hypothesized that synaptopodin is involved in the morphological changes of dendritic spines following the induction of LTP. Indeed, our results demonstrate that synaptopodin, by modifying the actin-cytoskeleton, can induce morphological changes in transiently transfected Cos7 cells. We further provide evidence that synaptopodin associates with α-actinin, an actin bundling protein. Our current research focuses on examining the role of the synaptopodin/α-actinin association by mutation analysis in Cos7 cells and in primary cultured hippocampal neurons.

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