Organization and maintenance of the motor nerve terminal: Roles for presynaptic actin and perisynaptic Schwann cells

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Abstract

At the adult frog neuromuscular junctions (*Rana pipien* and *Rana catesbiana*), F-actin microfilaments are enriched in the nonrelease domains of nerve terminals, outside the vesicle-rich release sites. The development of this defined F-actin cytoskeleton may be critical for nerve terminal function as microfilaments may play a role in synaptic vesicle release and recycling and/or synaptic maintenance. I used cutaneous pectoris muscles of adult frogs (*Rana pipiens*) and bullfrog larvae (*Rana catesbiana*) stained with markers of synaptic and cytoskeletal components to ask how elements of the neuronal cytoskeleton, microfilaments, microtubules, and neurofilaments, are organized at the frog neuromuscular junction and how they organize during development of presynaptic motor nerve terminals.^ The presynaptic actin cytoskeleton stained by β-actin antibody extended the length of the nerve terminal in a series of interconnected rings that surrounded clusters of synaptic vesicles. At developing neuromuscular junctions β-actin stain is initially concentrated at growth cones and intermittently along the lateral surfaces of the nerve terminal. The assembly of the β-actin cytoskeleton appeared secondary to clustering of synaptic vesicles. I compared the stability of the presynaptic actin cytoskeleton of developing and adult neuromuscular junctions after treatment with latrunculin A. The β-actin cytoskeleton was noticeably less stable at larval neuromuscular junctions than at adult synapses. These data support a role for the actin cytoskeleton in presynaptic maturation and stability.^ I tested whether the perisynaptic Schwann cells (PSCs) have a role in maintaining the actin cytoskeleton of the nerve terminal using complement-mediated cell lysis to selectively ablate PSCs *in vivo.* At various time points after ablation, I examined the actin organization at denuded motor nerve terminals. I report here that the stability and long-

term maintenance of the nerve terminal actin cytoskeleton is dependent at least in part on the presence of PSCs. Following ablation of PSCs, a significant decrease in the intensity of presynaptic actin stain was observed and remained altered for several weeks. After PSC ablation, terminals also displayed reduced staining for synaptic vesicles.^

Subject Area

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