Regulation of local protein synthesis in regenerating axons

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Recent studies have begun to focus on the signals that regulate axonal protein synthesis and the functional significance of localized protein synthesis. However, knowledge of what proteins are actually synthesized in mammalian axons has been based mainly on predictions. Consequently, the catalog of locally synthesized proteins is very limited. We have used axons purified from cultures of injury-conditioned adult dorsal root gantlion and proteomics methodology to identify the cytoskeletal proteins b-actin, peripherin, vimentin and a tropomyosin isoform as being axonally synthesized. In addition to the cytoskeletal elements, several heat shock proteins (HSP27, HSP60, HSP70, and grp75), resident ER proteins (calreticulin and grp78/BiP) and proteins that potentially affect protein degradation (Uch-L1 and g-synuclein) are synthesized in the DRG axons. Local treatment of the DRG axons with NGF or BDNF selectively increased transport of cytoskeletal mRNAs into the axonal compartment but had little effect upon transport of HSP and resident ER protein mRNAs. This indicates that axonal mRNAs can be segrated based on the extracellular signals that regulate their subcellular localization.

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