Understanding Ribosomal Protein Distribution and Expression in Neurons and Their Compartments using Single-Cell RNA Sequencing and Single Molecule Microscopy.

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J. Garat[I], A. Di Paolo[I], P. Smircich[I], **J. Sotelo**[II]

[I]145755, Montevideo, Uruguay, [II]Dept. Genomica, Instituto de Investigaciones Biologicas Clemente Estable, Montevideo, Uruguay

Given neurons' diversity and polarization, understanding local translation mechanisms and ribosomal regulation in different neuronal subtypes and their compartments is crucial for unraveling novel functions. Interestingly, recent studies have challenged the traditional view of the ribosome as a uniform translation molecular machine, revealing evidence of ribosomal heterogeneity and extra-ribosomal roles for ribosomal proteins (RPs) in translation regulation. We investigate RP gene expression and distribution in neuronal subtypes and axons using single-cell RNAseq data re-analysis and RP proteins in the axon compartment. Several RP genes exhibit differential expression among 13 neuronal subtypes in mouse cortex, notably with Rpl21 and Rps27 overexpressed in GABAergic Lamp5 and Vip neurons, respectively, compared to Glutamatergic neurons. Preliminary results suggest Rps27 overexpression conservation in Vip GABAergic neurons across species. Moreover, we examine RP mRNA and protein localization in axons using advanced and super resolution microscopy, revealing their presence and neosynthesis in axons. We also find evidence of ribosome-RNA associations in axon wholemounts and study ribosome organization in mature myelinated axons with super resolution microscopy. These findings underscore variability in RP gene expression among neuronal somas and shed light on local synthesis processes in axons, raising questions about regulatory functionality and potential protein abundance differences as properties of the translational machinery.