

Neuroscience Seminar Series

Friday, March 7th, 2014 at 11:30 am

Salle des Conférences (R229)
Centre Universitaire des Saints-Pères
45 rue des Saints-Pères, 75006 Paris

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The Synapse Nanomap

The mechanisms behind many cellular pathways are well understood, and their molecular players are becoming increasingly clear. However, it is still unclear how cellular pathways are organized in quantitative terms. How many molecules are involved in a given pathway? Do their numbers correlate in any fashion? We have addressed these issues by studying the organization of synaptic vesicle recycling, a pathway that has long served as a model for the general mechanisms of cellular trafficking. We used quantitative Western Blotting to measure the absolute copy numbers of 62 proteins totalling more than 40% of the synaptic protein weight, and we estimated their locations by super-resolution fluorescence imaging. We used mass spectrometry to estimate the abundance of a further ~1100 proteins. Together with electron microscopy measurements of synaptic morphology, these data allowed us to generate a model of the synapse showing both protein numbers and structures. We found that protein copy numbers varied over more than three orders of magnitude, from around 150 copies for the endosomal fusion proteins to more than 20,000 for the exocytotic ones. The copy numbers of proteins involved in the same step of the vesicle recycling pathway correlated closely. This finding points to a hitherto unknown mechanism of regulation in cellular pathways.