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Synaptic architecture and function in *C. elegans*

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Chemical synapses are highly specialized cell-cell contacts containing molecular machineries allowing remarkable signaling precision exemplified by the precise timing and reliability of synaptic transmission. Synaptic fine-architecture is an important organizational basis enabling these properties. Despite the importance of synaptic organization our knowledge of synaptic fine-architecture is still largely enigmatic, due to various technical limitations such as preparation techniques and the necessity of high 3D resolution to resolve structural components.

The combination of high pressure freezing, freeze substitution and electron tomography opens a window to systematically study synaptic fine-architecture in a close-to-native state with high spatial precision. We take advantage of *C. elegans* neuromuscular junctions as highly tractable model synapses to study synaptic architecture and protein function in 3D. Excellent preservation of the tissues is a necessity for high 3D resolution studies. High pressure freezing allows vitrification of intact *C. elegans* adults and therefore provides a snapshot of a living nervous system. By applying these techniques we could resolve and quantify a dense network of filaments interconnecting synaptic vesicles reminiscent of the filament network originally described at mammalian synapses. We are using the advantages of *C. elegans* as model where mutants of many candidate genes are available or can be readily generated. Importantly, many of the synaptic mutants are viable in *C. elegans* and can therefore be easily maintained and manipulated. We are using these advantages to dissect the components and regulators of the filamentous network interconnecting synaptic vesicles and to shed light on the functional role of these architectural