Laboratory title : 

Supervisor

Name :  Thesis title :

In vivo calcium dynamics of dendritic activity of defined neocortical neuronal populations during sensory information processing in Fmr1KO mice

Keywords :  Calcium imaging in vivo, autism, neocortex, behavior, dendrites

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Abstract

We aim to examine the functional neocortical circuits determining sensory information processing in Fragile X Syndrome (FXS). FXS is the most common form of inherited intellectual disability disorder and the best-characterized causes of autism spectrum disorders (ASD) with one third of FXS patients fulfilling the diagnostic criteria for autism and the majority of FXS patients exhibiting autistic features.

We recently reported that the primary somatosensory cortex of Fmr1KO mice (the mouse model for FXS) is hyperexcited in response to tactile sensory stimulation. Moreover, we described an overall defect in dendritic function encompassing changes in dendritic information processing that would likely explain the aforementioned sensory hypersensitivity phenotype. We found that a dysfunction of specific ion channels (i.e. channelopathies) contribute to the cellular and behavioral symptoms of this disorder. Finally, we were able to correct these defects in dendritic and sensory information processing by pharmacologically targeting one of these ion channels, namely the BKCa channel (Zhang et al., 2014, Nature Neuroscience).

We now aim to investigate the precise subcellular nature of this phenomenon within functional neocortical neuron assemblies in living animals during sensory information processing using high-resolution imaging approaches. In addition, the use of innovative cell targeting approaches will enable us to determine at the cell-type specific level whether all neurons are similarly affected or whether only certain types of neurons exhibit these changes in sensory information processing. Knowledge from this study will enhance our mechanistic understanding of neocortex defects in FXS (and other ASDs), and guide future targeted rescue approaches.

Qualification required

Background in neuroscience, biology, physics, medicine or a related field are required. Candidates should be highly motivated, talented, and good team players.