DOMINO: Development of cortical multisensory integration mechanisms at micro- and macro- scales during normal and pathophysiological conditions

Main area: Development and maturation of cognitive processes and multisensory integration at micro- and macro-scales
Keywords: multisensory integration; neurodevelopment; experience-dependent plasticity; autism spectrum disorders; multiscale; neuronal modeling
Duration: 36 months
Total project funding: € 570.429

Abstract

The ability to seamlessly integrate multiple sensory modalities into unified percepts is one of the key faculties of our brains. Impairments in sensory integration are thought to lie at the basis of many intellectual disabilities, including autism spectrum disorders (ASD). Yet, our understanding of how cortical multisensory integration develops is limited. To address this, we will combine experiments in animals and humans (both healthy and in the autistic spectrum) to understand how multisensory integration develops. Experiments in mice will reveal the microcircuit-level correlates of multisensory, experience-dependent plasticity in primary and association cortices. To this aim, we will combine high-channel count electrophysiology and optogenetics with sensory manipulations in head fixed mice (wild-type and a transgenic model for ASD). Human experiments will reveal the psychophysics and physiology of multisensory integration across development. This will be tested by combining behavioral assays and techniques made possible by 7T MRI equipment (high-resolution fMRI). These experiments will be used to validate animal experiments in the context of human ASD, and provide insights in how multisensory integration develops in the human brain. These experimental components will then be integrated into a computational model of spike-based experience-dependent plasticity for multisensory integration. This component will provide a reference frame to understand how multisensory integration develops in the neocortex, and will provide a key contribution to ongoing efforts in the Human Brain Project aimed at modelling the human brain and at developing ICT tools to address brain disorders. Ultimately, by investigating how cortical multisensory integration develops, and what may go wrong in ASD, we will provide a crucial missing element not only to understand disorders such as ASD, but to eventually address them, by developing strategies to treat impaired developments of key functions such as multisensory integration.

Consortium

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