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CV

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HOW MIND EMERGES FROM BRAIN: A VIEW INTO THE FUTURE

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Elly Nedivi is a Professor in the Department of Brain and Cognitive Sciences at MIT, with a joint appointment in the Department of Biology. She is also a member of the Picower Institute for Learning and Memory. Dr. Nedivi received her Ph.D. in Neuroscience from Stanford University Medical School and completed her postdoctoral training at The Weizmann Institute in Israel. In 1998, after two years at Cold Spring Harbor Laboratory in New York, she joined the faculty of the Department of Brain and Cognitive Sciences and the Picower Institute for Learning and Memory at MIT.The Nedivi lab studies the cellular mechanisms that underlie activity-dependent plasticity in the developing and adult brain through studies of neuronal structural dynamics, identification of the participating genes, and characterization of the proteins they encode. Following a screen for activity-regulated genes and isolation of a large number of candidate-plasticity genes (CPGs), part of the lab is devoted to elucidating the neuronal and synaptic function of two previously unknown CPGs, CPG15 and CPG2, and characterized their very different activities. CPG15 is a novel growth factor that plays a dual role in the nervous system, acting as a survival factor for cortical progenitors and later as a growth and differentiation factor. CPG2 is a large intracellular adaptor protein localized to the postsynaptic endocytic zone of excitatory synapses, and a critical component of the endocytic pathway mediating glutamate receptor internalization. Recently, we have returned to the CPG pool for identification of additional genes of interest.

Motivated by the large number of CPGs that affect neuronal structure, in collaboration with Peter So's lab in the Department of Mechanical Engineering at MIT we have developed multi-photon microscopy for large volume, high resolution imaging of dendritic arbor and synaptic structural dynamics in vivo. We were the first to show unambiguous evidence of dendritic growth and retraction and of branch tip additions in the adult brain. Surprisingly, our data singled out GABAergic interneurons as those capable of structural dynamics, suggesting that circuit rearrangement is restricted by cell type-specific rules. A large part of the lab is now devoted to imaging-related projects, some associated with characterization of CPG function in vivo, others asking more general questions related to structural plasticity of cortical circuitry. Recently, we have also developed methods for labeling and chronic monitoring of excitatory and inhibitory synapses across entire neuronal arbors in the mouse visual cortex in vivo.

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