

The roles of microglia-synapse interactions in neuronal circuit remodeling and degeneration

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A series of discoveries spanning the last few years have challenged the classic view of microglia, the brain immune cells, showing unexpected roles in the active maintenance and remodeling of neuronal circuits during normal physiological conditions. During my presentation, I will first discuss my work and other pioneer studies showing that microglial morphology, dynamic sampling of the brain parenchyma and functional interactions with synaptic elements (axon terminals, dendritic spines, synaptic clefts, perisynaptic astrocytic processes) are regulated by neuronal activity and sensory experience throughout the lifespan. I will further show that surveillant microglia continuously eliminate particular subsets of non-degenerating synaptic elements, in relation with neuronal activity and sensory experience, by using specialized mechanisms that include the phagocytic engulfment of axon terminals, dendritic spines and excitatory synapses between them, much as the proteolytic remodeling of the perisynaptic extracellular space. Lastly, I will present new observations showing that microglial interactions with axon terminals and dendritic spines, both degenerating and non-degenerating, become dysregulated in two neurodegenerative diseases: HIV-associated neurocognitive disorder (HAND) and Alzheimer's disease (AD), thus including microglia as a novel, potentially important player in the complex mechanisms underlying the pathogenesis of HAND and AD.

Biography

Marie-Ève Tremblay obtained her Ph.D. at Université de Montréal in 2009. Her postdoctoral work with Dr. Ania Majewska in Rochester NY (2009-2011) contributed to discovering a previously unexpected role for microglia in the remodeling of neuronal circuits. As a pioneer in the field, at 31 years of age she chaired a highly attended minisymposium on the *Roles of microglia in the healthy brain* during the 2011 Society for Neuroscience meeting. Last year she was appointed Assistant Professor at Université Laval in Québec. Research in her laboratory aims at elucidating the mechanisms of learning and memory from the standpoint of interactions between all CNS cell types.

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