Imaging of neural reactive plasticity through correlative two photon and electron microscopy

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Abstract:
The repairing potential of the central nervous system (CNS) in response to injury is highly variable depending on the neuronal population involved. Although previous works showed that cerebellar climbing fibers (CFs) are capable of structural remodeling as a response to injury, no time-lapse description of their dynamics following injury has been reported yet. Here we defined the temporal evolution of the degenerative event and followed the structural rearrangement after injury by coupling time lapse two-photon imaging with laser nanosurgery. To characterize the damage and to elucidate the possible formation of new synaptic contacts on the sprouted branches of the lesioned CF, we combined two-photon imaging with block face scanning electron microscopy (FIB-SEM). Here we describe the approach followed to characterize the reactive plasticity after injury by tracking back a single fluorescent axon previously imaged in vivo, and seeing its ultrastructure within significant volumes of brain tissue.