INT Symposium on “Advanced Photonic Imaging in Neuroscience”

11th and 12th July 2019 Marseille, France

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Christophe Leterrier has been working on the organization of the axon since his PhD, where he studied the axonal targeting of the CB1 cannabinoid receptor. For his postdoc, he worked on revealing new cytoskeletal components of the axon initial segment, as well as their nanoscale organization. He started the NeuroCyto lab in 2017, with the aim of deciphering the axonal cytoskeleton architecture using advanced microscopy techniques. The team currently focuses the organization of axonal actin and its partners in order to understand the function of newly discovered axonal actin structures: rings, hotspots and trails.

S2-L1 ‘*Actin-based structures in the axon: a nanoscale view.*’

The intricate morphology and molecular identity of axons is maintained for decades, but also continuously adapts to changes in the environment and activity of neurons. Axons fulfill these paradoxical demands thanks to a unique cytoskeletal organization that ensures the coordinated transport, anchoring and mobility of axonal components. While axonal microtubules are readily seen by electron microscopy, a number of axonal actin structures have been recently discovered, thanks to the development of optical super-resolution microscopy techniques. We use Single Molecule Localization Microscopy (SMLM) to map the nanoscale architecture of actin-based structures within the axon. In the axon initial segment, a key compartment for the maintenance of neuronal polarity, we resolved a highly organized assembly encompassing the periodic actin/spectrin scaffold and its partners: ankyrin, myosin. We have also visualized new actin structures along the axon shaft: rings, hotspots and trails, and are now resolving their molecular organization and functions. For this, we develop a combination of versatile labeling, correlative acquisition and quantitative analysis strategies that allow for high-content, nanoscale interrogation of the axonal architecture.