THE NANOPROBE TOOLBOX FOR NANOSCALE EXPLORATION OF LIVE BRAIN TISSUE

A. G. Godin[1], N. Danné[1], J. Varela[2], M. Piponnier[1], E. S. Shibu[1], J. Dupuis[2], A. Bianco[3], L. Groc[2], B. Lounis[1] and L. Cognet[1]

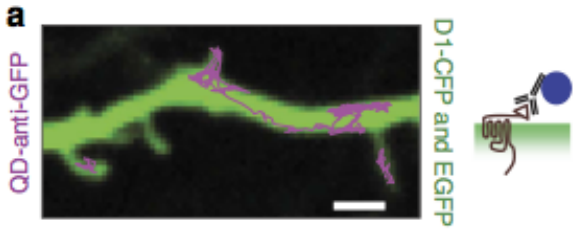
[1]University Bordeaux, CNRS, Institut d'Optique – LP2N, Talence, 33400, France

[2]University Bordeaux, CNRS, Interdisciplinary Institute for Neuroscience, Bordeaux, 33000, France

[3]University of Strasbourg, CNRS, Immunopathology and therapeutic chemistry, 67000 Strasbourg, France

The optical microscopy of single molecules is at the origin of many discoveries in biological science, in particular in neurosciences. It allows sub-wavelength localization of isolated nano-objects and subtle probing of their spatio-temporal nano-environment including in living neurons. I will present several recent strategies based on single nano-object microscopy aiming at imaging the nanoscale complexity of brain tissue.

These include the development of a new probe delivery method in the live animal to perform the first single quantum dot tracking study in acute brain slices revealing the movement properties of dopamine receptors at the surface of neurons in acute slices [1] and the demonstration that luminescent carbon nanotubes constitute a novel class of nanoprobes to map the nanoscale dimensions of the brain extracellular space and its local viscosity [2]. I will also present the preparation of ultra-small near-infrared absorbing nanoparticles based on tiny gold nanorods [3] or ultra-short carbon nanotubes [4-5] that can be efficiently imaged at the single particle level in cells and tissues using photothermal microscopy.



Single quantum dot tracking in live brain tissue

References

[1] J.A. Varela et al, "Targeting neurotransmitter receptors with nanoparticles in vivo allows single molecule tracking in acute brain slices", *Nat. Commun.* 7 (**2016**) 10947

[2] A.G. Godin et al. "Single-nanotube tracking reveals the nanoscale organization of the extracellular space in the live brain" *Nat. Nanotechnol.* (**2016**), advanced publication. doi:10.1038/nnano.2016.248

[3] E. S. Shibu et al "Small gold nanorods with tunable absorption for photothermal microscopy in cells" *Adv. Sci.*, (**2016**) early view. DOI: 10.1002/advs.201600280

[4] Z. Gao, et al "Optical detection of individual ultra-short carbon nanotubes enables their length characterization down to 10 nm" *Sci. Rep.* 5 (**2015**) 17093

[5] J. Russier et al *Submitted*.

corresponding author: laurent.cognet@u-bordeaux.fr