

Nanoscale imaging of live brain tissue by single molecule microscopy

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Single molecule microscopy allows nanometer localization of the detected emitters and subtle probing of their spatio-temporal nano-environment including in living cells and tissues [1]. I will present several single molecule strategies using different types of nano-emitters to probe complex and confined bio-environments.

These include the development of a new probe delivery method in the live animal to perform the first single quantum dot tracking in acute brain slices [2] and an original strategy based on phase imaging aiming at performing 3D single particle tracking and 3D super-resolution microscopy in thick environments [3].

For deep tissue imaging, single walled carbon nanotubes, which bear optical resonances in the near infrared and nanoscale dimensions, are particularly promising [4]. I will show that, long trajectories (>10 min) of nanotubes diffusing in the brain extracellular space can be recorded at the single nanotube level. Analysis their movements provides super-resolved maps of tissue structuration which can be modulated upon biochemical digestion of the brain extracellular matrix in live animals [5].

[1] A. G. Godin, et al *Biophys. J.* 107 (2014) 1777

[2] Varela et al, *Nat. Comm.* 7 (2016) 10947

[3] Bon et al *submitted*

[4] N. Fakhri, et al *Science* 330, (2010) 1804.

[5] A. G. Godin, et al *Nat. Nanotechnol.* 12 (2017) 238