General Scope:
While the brain is one of the most famous systems, providing and controlling every function of the Body, it is barely understood in health and disease. New methods and new technology are required to interrogate neuronal cells by many means and at multi-scale in-vivo, and within model neural networks in-vitro. In particular, to understand how neural circuits operate, we need access to activity of large numbers of neurons at the same time, and record their activity at the single cell level and at the nanoscale regarding the lot of information which relies at the level of synapses and ion channels.

In that race, we have shown that graphene based nanoelectronics offers an ideal platform for recording and culturing neural networks, thanks to its flexibility, transparency and exceptional neural affinity (Veliev 2016). Also, the presence of readily accessible surface charges gives the unprecedented possibility to realize a direct coupling with cells, such the sensitivity reached in gapless graphene FET (G-FETs) is well beyond that of current silicon technology and allow to sense single neural spikes (Veliev et al. 2017) as well as nanoscale event such as ion channel currents (Veliev et al. 2018).

Research topic and facilities available:
We aim to implement novel graphene based nanosensors for both in-vitro and in-vivo recording of neuron assemblies, and combine them with several manipulation ports (optic, microfluidic and electrical). This unique combination would allow to interrogate neuronal systems by many means and to investigate neuronal processes within cultured and brain neuron networks.


Possible collaboration and networking: Such interdisciplinary project relies on strong collaborations with numerous Physicists (theorists, material sciences, nanoelectronics, signal processing…), Neurobiologists and Chemist at Néel and outside the lab (EPFL, IBS, IMEP, CERMAV…), as well as ‘HighTech’ plateforms for materials, nano/micro-fabrication in clean room, highly resolved microscopy and biotechnological platform (microfluidic, cells culture, microscopy, electrophysiological setup) that are gathered at the Néel Institut.

Possible extension as a PhD: oui (PhD funded)
Appreciated skills condensed matter physic, nanoelectronics, materials sciences, and electrophysiology
Starting date: March, 2019

Contact:
Name: Delacour Cécile
e-mail: cecile.delacour@neel.cnrs.fr