**Novel approaches to modulate neuronal network activity via multidimensional surface modifications**

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In the past decade, (nano)technology applications to the nervous system have often involved the study and the use of novel materials to modulate neuronal activity. The ability to govern neuronal excitability could have a significant impact not only on fundamental neurophysiology but in developing therapeutic approaches to treat neurological diseases. Surface modification via carbon-based nanomaterials (CBNs) demonstrated to have a pivotal role in the field of neuromodulation. In particular, we did show that both uncoated single-layer graphene1 and carbon nanotubes2,3 are not only fully biocompatible but, surprisingly, induces in cultured neurons an increased network synaptic activity via the combined effect of their physicochemical properties.

Interestingly, we demonstrated that neuronal network activity could be modulated not only through surface nanostructuration employing CBNs but changing the mechanical compliance of the substrates on which neuronal networks developed too. This surface modification proposes to mimic the different mechanical cues given by the extra-cellular matrix to neurons within the central nervous system. Measuring the synaptic activity of the neuronal network by patch-clamp recordings, we demonstrated how neuronal activity could be altered by different surface modifications opening to the possibility to orchestrate the firing activity of an entire neuronal network.

References:

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