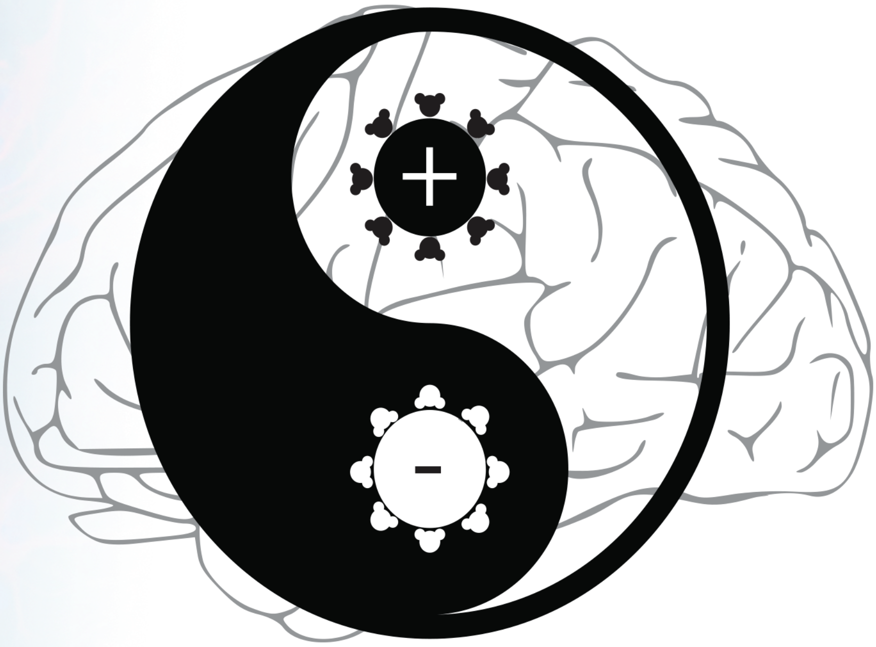
IN-FET

> Applying Nanotechnologies and Nanoelectronics for innovative breakthroughs in neuromodulation



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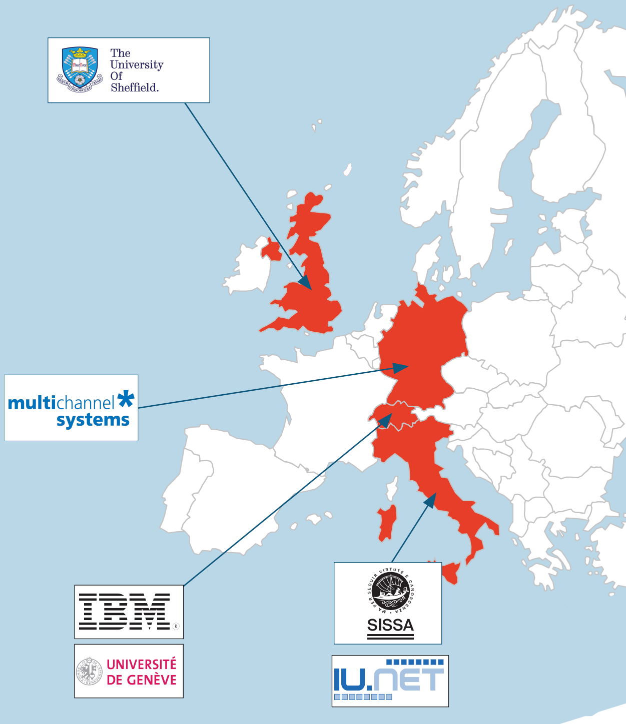
A project supported through the Horizon 2020 Framework Programme
of the European Union for Research and Innovation.

CHALLENGE & CONSORTIUM

There is a need for a paradigm shift in the treatment of drug-resistant epilepsy. Several routes have been explored to modulate or silence dysfunctional neural circuits, through genetic, electrical, magnetic or optical means. All have serious limitations due to the unphysiological mechanisms used to regulate neuronal activity.
In IN-FET, we address this issue by manipulating the elementary building blocks of cell excitability: the ions. IN-FET tackles the visionary idea of altering neuronal firing and synaptic transmission by direct ionic actuation at the microscopic scale, while monitoring cell responses by arrays of nanoscale transistors. We develop and test, in vitro, the use of active polymers to trap or release electrochemically specific ions in the extracellular milieu surrounding neurons. These polymers are integrated with ion sensors and ultra-sensitive nanowire arrays, offering closed-loop regulation of cellular electrical activity.

IN-FET will deliver for the first time a device that can physiologically modulate the neuronal membrane potential, the synaptic release probability, and glutamatergic NMDA receptors activation by altering potassium, calcium, and magnesium ionic concentrations in a controlled and spatially-confined manner. High-resolution simultaneous probing of cell activity will be performed by Si-nanowire vertical transistors, penetrating the membranes and detecting the cell electrical activity at unprecedented spatial and temporal resolutions.
IN-FET's multidisciplinary consortium brings together state-of-the-art electrochemistry, 3-d nanofabrication, nanoelectronics, and numerical simulations, and combines neuronal biophysics to device modeling. IN-FET will thus establish the proof-of-principle for a breakthrough biocompatible neuromodulation technology, with a clear impact for future brain implants for epilepsy treatment, advancing neuroscience, biomedical microsystems engineering, and nano-neurotechnology.



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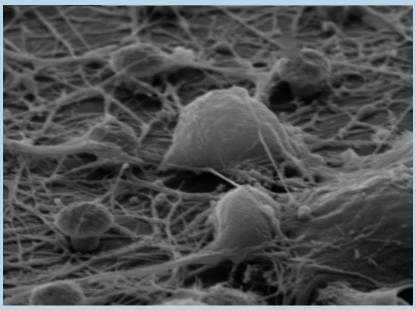

The IN-FET project is supported by the European Commission through the Horizon 2020 Framework Programme (H2020, 2015-2020). The IN-FET project addresses the thematic areas of the Future and Emerging Technologies Open Scheme, targeting transformative frontier research and innovation with a high potential impact on technology, to benefit our economy and society.

The project started on 1 January 2020 and will last 42 months.

Nanotechnologies and Nanoelectronics for innovative breakthrough neuromodulation.

Collaborative project

EU contribution: 3 370 000 €

42 months

IN-FET

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