

## Organic Neuroelectronics: a cross-fertilisation story

Successful translation of electronic devices, operated as sensors and/or transducers, to clinical settings demands precise knowledge of their working principles as well as of the peculiar needs arising from the targeted application scenarios. This demands a tight mutual exchange between the scientific fields of device engineering and neurosciences, which metaphorically mirrors the most ambitious goal of Neuroelectronics: namely the bidirectional communication of electronic devices with the living matter, and, in particular, with the central nervous system.

The technological and scientific platform of organic electronics provides materials, tools and procedures to effectively tackle this goal, giving rise to the field of Organic Neuroelectronics.

Typically, operation of Organic Neuroelectronic devices demands driving voltages across the biotic/abiotic interface, which may result in undesired electrochemical reactions that are harmful both for the patient and for the device.

This talk reports on a novel device architecture which bypasses these drawbacks: the common-drain/grounded-source electrolyte-gated organic transistor. When implanted, this architecture allows one to maximize brain-signal amplification while applying null net bias, and consequently eliciting no parasitic currents, across the tissue. We demonstrate the viability of the proposed configuration by recording *in vivo* the somatosensory evoked activity from the barrel cortex of rats, achieving a superior signal-to-noise ratio which enables the detection of evoked activity at the single-trial level.

Additionally, future developments of Organic Neuroelectronic devices are discussed, referring to the capability of such devices to mimic neural signal processing and learning features, as well as on strategies to implement their speed, spatial resolution and mechanical performance.