

## **Glial engineering and glial interfaces: new path towards neuromodulation**

Neuromodulation achieved by electrical stimuli targeting generation/inhibition of neuronal action potential have been widely applied in both neuroscience and clinical practice for neuroprosthetics. However, growing evidence indicate that conventional neurocentric view of neuromodulation is too narrow and that mechanistic insight beyond neuromodulation need to consider the effects of the response of glial cells. Among glial cells, astrocytes have an active function as regulator and modulator of synapses, and play a critical role in decision making, memory and learning, sensory and motor function. A causal role of glial dysfunction is assessed in human pathologies such as Epilepsy, Depression, Glioma as well as Chronic Pain. Astrocytes are equipped with ion channels and water channels that can respond to a variety of environmental chemo-physical stimuli and thus can be a target for neuromodulation approaches. Furthermore, the biomechanical signaling pathways of glial cells themselves function as excitable systems and may thus be controlled in novel ways. Finally, permissive interaction of glial cells with materials interface can drive engineering of safe and long-term stable materials interface for neuroprosthetics. Thus, glial cells can no longer been neglected by neural engineering and deserve to become biological and biophysical target of neuromodulation approaches. In this presentation, the most recent advances are reported of our work about validation of biomaterial interfaces and devices that interact with glial cells. It will be shown that nanostructured devices and photonic probes enabled to reach unprecedented insights into the mechanism beyond the function of astroglial cells in brain physiology and to define novel targets for neuromodulation as therapy for brain dysfunction. Moreover, Glial interfaces and glial engineering are proposed as multidisciplinary fields that have the potential to enable significant advancement of knowledge surrounding cognitive function and in tecvhnologies for glial-mediated neuromodulation.