MINI-SYMPOSIUM: MATERIALS FOR THE DIGITAL ENVIRONMENT

Talk 2 – Wednesday, June 17, 2020, 5 p.m.

TAPERED OPTICAL FIBERS TECHNOLOGY FOR MULTIFUNCTIONAL NEURAL INTERFACES

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Last decade has seen the development of a set of technologies to access subcortical regions of the mouse brain, with the main goal to obtain fully-integrated implantable devices enabling optical control and monitor neural activity, extracellular readout and localized drug delivery. These approaches include the use of integrated optoelectronic elements on both flexible or stiff substrates, multifunctional polymeric optical fibers, micro and nanophotonic circuits, as well as tapered optical fibers [1-11]. After a review of the state-of-the-art in this field, this presentation will focus on the engineering and use of multifuntional tapered optical fibers to control and monitor neural activity using only one optical waveguide with reduced invasiveness. The technology exploits mode-division demultiplexing operated by a millimeters-long taper that allows to redirect and/or collect light over different brain regions and subregions [11]. Exploiting micro and nanotechnologies to structure the highly curve surface of the fiber taper, it is possible to engineer the stimulation and the collection volume, as well as to realize multiple electrodes for extracellular electrophysiology along the taper. The simplicity of this technique, together with its versatility and reduced invasiveness, indicate this approach can greatly complement the set of existing methods for multifunctional neural interfaces with deep brain regions.

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