267. Electrode Arrays I

Location: Hall A

Time: Sunday, October 18, 2015, 1:00 PM - 5:00 PM

Program#/Poster#: 267.13/BB56

Topic: G.04. Physiological Methods

Title: A neuroelectronic device based on nanocoax arrays

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Abstract: We report on the development of a nanocoax-based neuroelectronic array. A nanocoax consists of concentric conductor core, a dielectric annulus and an outer conductor shield. Computer simulations with this architecture indicate that a nanocoax array can pixelate local field potentials (LFPs) at a spatial pitch far smaller than bare wire sensors of equal size. Moreover, the shielded nature of the nanocoax provides improved signal-to-noise ratio at any pitch. We have developed fabrication techniques in which nanocoax arrays, consisting of individual coaxes as small as 300 nm diameter, can be deployed as multielectrode arrays for neural LFP recordings. First, we made extracellular LFP recordings from leech Hirudo medicinalis ganglion sacs. Biphasic waveforms with amplitude and duration akin to published leech action potentials were evident. Next, we cultured HEK293-Channelrhodopsin2 cells (HEK-ChR2) on 5×6 arrays of 2 um coaxes. Brief application of blue light (0 to 30 mW/mm^2) evoked negative LFPs with a linear optical dose-response relationship. Importantly, optically-evoked LFPs were only observed on nanocoax sensors found to be in direct contact with HEK-ChR2 as determined after recording with fluorescent microscopy. These results encourage future development of nanocoax electrode arrays for optogenetic neural recordings with high spatial and electronic resolution.

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