

Recent Advances in Network Electrophysiology Using Multi-Electrode Arrays

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Accelerating Electrophysiology Using Higher-Throughput Multielectrode Arrays.

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At Tensor Biosciences we are leveraging the unique properties of planar multi-electrode arrays to create new and improved methods for evaluating CNS compounds in vitro. We are pursuing three technologies that each takes advantage of a different aspect of the arrays. The first technology primarily concerns increasing throughput by parallelizing the slice testing process. The use of multi-electrode arrays avoids the need to place glass electrodes individually by hand as is required by conventional methods. Building upon this speed advantage, we have created a system that incorporates custom hardware, software, and incubation technologies to enable a single operator to run four experiments simultaneously. Data gathered using this system to perform both our rhythmic oscillation and long-term potentiation assays is presented. These assays are intended for use in studying compounds that affect cognition. Our second technology combines multi-electrode arrays and cultured slices. Multi-day testing of cultured slices typically involves the implantation and removal of stimulating and recording electrodes each day. Therefore it is impossible to guarantee that across successive days the same pathways are being stimulated and the same neurons recorded. Using planar multi-electrode arrays, we developed a method for growing cultured slices directly on the electrodes. This enables us to stimulate and record from the same slice areas for the lifetime of the slices, which can be days or even weeks. Results gathered using our four-day neurotoxicity assay demonstrates the use of this technology to test compounds that block NMDA- and AMPA-mediated excitotoxicity. Our third technology takes advantage of the two-dimensional nature of a planar array. With the proper spacing between electrodes, one can simultaneously study multiple subregions in a single slice revealing differential responses to a given compound. As a proof-of concept, we chose hypothalamic slices containing several nuclei with different types of neurons. This preparation enables us to study single units across multiple subregions. Though still under development, we hope that this assay will prove useful to the study of neuro-endocrinological disorders such as obesity. The four assays presented in this talk represent just a few of the many potential commercial applications for multi-electrode arrays, and Tensor remains dedicated to their further development.