Quantification of Seizureogenic Activity with Multiwell Microelectrode Array Technology for Proconvulsant Risk Assessment and Disease-in-a-Dish Epilepsy Models

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Multiwell MEA Technology

Why use the Maestro?
- Maestro experiments involve seeding cells onto the MEA plate and allowing the neural network to mature over a period of days to weeks.
- MEA technology is label-free and non-invasive, such that the maturation process can be monitored through repeated recordings over that time frame.
- The network electrophysiology phenotype provides a functional measure in response to perturbations of key biological variables, such as pharmacology or gene expression.

Why use multi-electrode arrays?
- Thorough evaluation of electrically active cells such as neurons requires both single-cell activity analysis and assessment of network function. Historically, electrophysiological examination of neurons has been performed with patch clamps, providing limited information regarding the dynamic behavior of individual cells within a tissue that is not representative of the in vivo or in vitro population.
- Microelectrode array (MEA) provides a high-throughput, screening method for the evaluation of network activity and connectivity in cultured neurons. It collects data simultaneously from up to 64 microelectrodes in a cultured neuronal population, providing insights into how that cell behaves in a population.
- A planar grid of microelectrodes (c) interfaces with cultured neurons (b), monitoring in vivo neural behavior in a dish. Electrodes detect changes in raw voltage (a) through recording of extracellular field potential.

MEA Assay for ProC Risk Assessment

Activity with Firing rate 150

Environmental control

AxIS software and AEDs, – multiwell

Network Activity

Advanced Applications

Disease-in-a-Dish Models – Dravet Syndrome

In vitro measurements of network activity may also be used to study in vitro-induced disorders of genetic origin, such as Dravet syndrome. In an iPSC–derived model of Dravet syndrome, the cultured neurons exhibit an enhanced network phenotype, characterized by significantly longer bursts in mature cultures.

Control

Maestro allow simultaneous use of live, benchtop system.

Axion’s Maestro multiwell microelectrode array (MEA) platform enables functional cellular analysis in 384-well plates with an industry-leading 762 electrodes across all plate formats.

Typical Assay Workflow

Plate Preparation

Maintenance and Maturation

Experiment

Network Bursting Measures Excitability

The magnitude of the network burst phenotype is modulated by neuroactive compounds of various types and is highly reliable across replicates.

While MFR did not differentiate the excitability to alter the “state” of the cultured networks using the Maestro™ multiwell microelectrode array (MEA) platform for the comprehensive evaluation of network function. Historically, electrophysiological examination

Optogenetics is the integration of fast, light-activated channels (opsins) that allow targeted, precise manipulation of cellular activity. Optogenetics involves the expression in neurons of recombinant light-gated ion channels (opsins) that directly hyperpolarize or depolarize the cell. The luminescent optical stimulator pairs directly with the Maestro™ multiwell microelectrode array to provide rapid, non-invasive control of network activity in a dish.

Maestro™ MEA platform enables functional characterization of neural cell culture activity and connectivity with a flexible, easy-to-use, benchtop system.

Axion’s Maestro multiwell microelectrode array (MEA) platform enables functional cellular analysis in 384-well plates with an industry-leading 762 electrodes across all plate formats.

In vitro measurements of network activity may also be used to study in vitro-induced disorders of genetic origin, such as Dravet syndrome. In an iPSC–derived model of Dravet syndrome, the cultured neurons exhibit an enhanced network phenotype, characterized by significantly longer bursts in mature cultures.

Conclusions
- The Maestro™ MEA platform enables functional characterization of neural cell culture activity and connectivity with a flexible, easy-to-use, benchtop system.
- Axion software and advanced analysis tools make evaluation and reporting of functional data simple and hassle-free with an array of automatically generated reports.
- Maestro™ MEA delivers accurate and predictive results on functional neural network biology in a convenient benchtop platform furthering safety and toxicology, disease-in-a-dish modeling, and drug discovery research.

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