

Assay Development for Functional Analysis of iPSC-derived Neural Organoids

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Organoid Analysis

The Maestro MEA and Omni Product Family



Features	Maestro Pro	Maestro Edge	Maestro Volt*
Throughput (well format)	6, 24, 48, 96, 384**	6, 24, 96**	6
MEA Mode	✓	✓	✓
MEA Viability	✓	✓	✓
Impedance Mode	✓	✓	✓
Environmental Control	✓	✓	✓
Automation API	✓	✓	✓
Stimulation	Electrical & Optical	Electrical & Optical	Electrical
Omni Compatible	✓	✓	✓

*Maestro Volt only available in Europe and Asia

**Well format available in impedance only

- **Label-free, non-invasive tracking** extracellular voltage from cultured electro-active cells.
- **Integrated environmental control** provides a stable benchtop environment for short- and long-term toxicity studies
- **Sensitive voltage resolution** detects subtle extracellular action potential events
- **Scalable format (6-, 24-, 48- and 96-well plates)** meets all throughput needs on a single system
- **Industry-leading array density** provides high quality data from across the entire culture

- **Assay your cells in brightfield and fluorescence** – From label-free cell monitoring to fluorescence-based assays, the Omni adds dynamic visual results to any experiment.
- **Track every moment, straight from your incubator** – The Omni operates within an incubator, automatically capturing images as your cells grow in their optimal environment.
- **See every cell** – The Omni moves the camera, not the cells, capturing detailed brightfield images of the entire culture without disturbing the cells.
- **Monitor and analyze your cells remotely** – The software allows you to monitor your cells and perform data analysis from your desktop.



Features	Lux3	Omni Pro 12	Omni
Whole-well/Plate Brightfield		✓	✓
Automated Acquisition	✓	✓	✓
Fluorescence	✓	✓	✓
Plate Handling	Manual	Automated	Manual
Number of Plates	1	12	1
Incubator Compatible	✓	✓	✓
Dimensions & Weight	166 x 140 x 135 mm 1.3 kg	460 x 417 x 439 mm 40.2 kg	345 x 396 x 171 mm 9.7 kg

Functional Neuronal Phenotypes

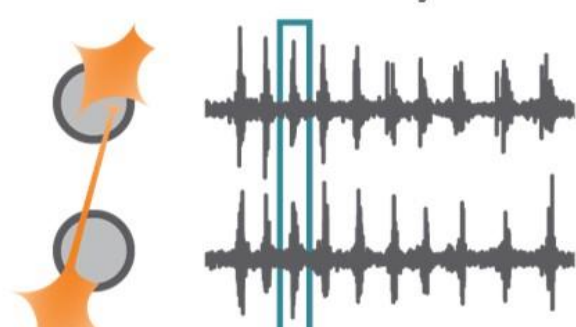
Mean Firing Rate = # of Spikes / Time



Activity

Are my neurons functional?
Action potentials are the defining feature of neuron function.

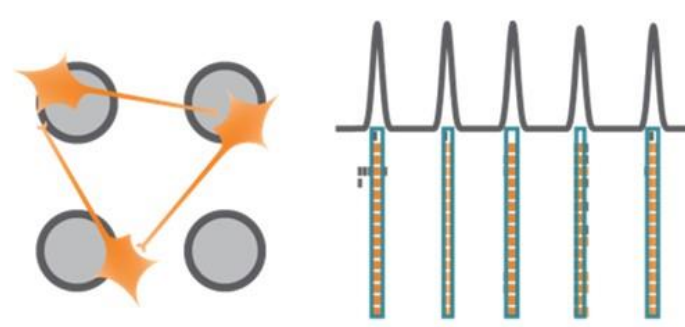
Connectivity



Synchrony

Are my synapses functional?
Synchrony reflects the strength of synaptic connections.

Burst of Action Potentials

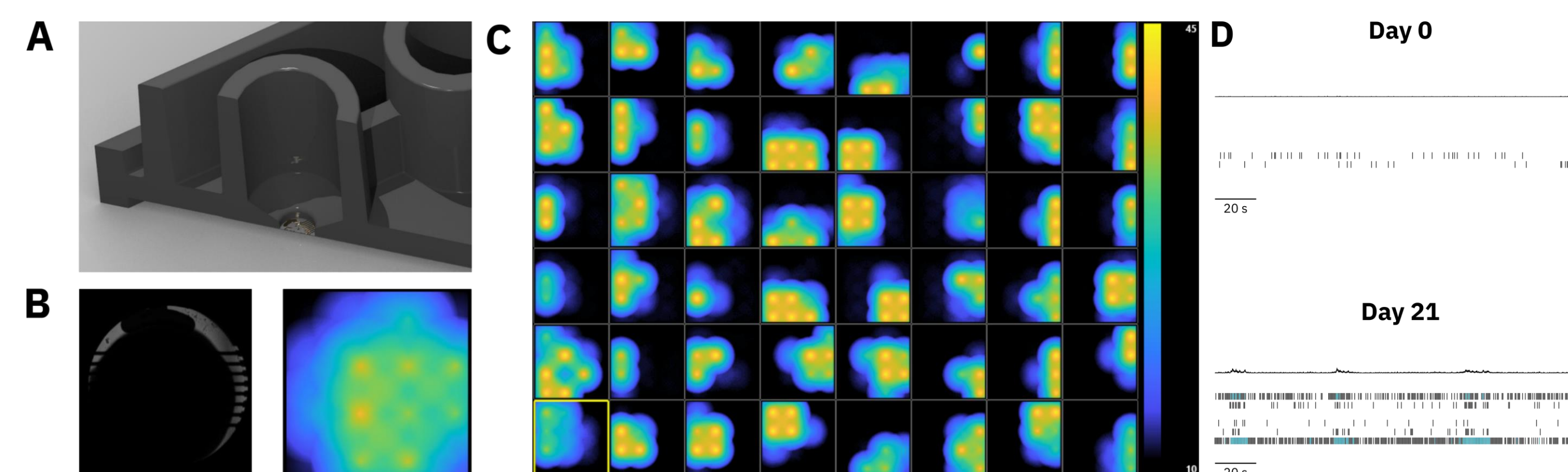


Oscillation

Is my network functional?
Oscillation is a measure of how the network activity is organized in time.

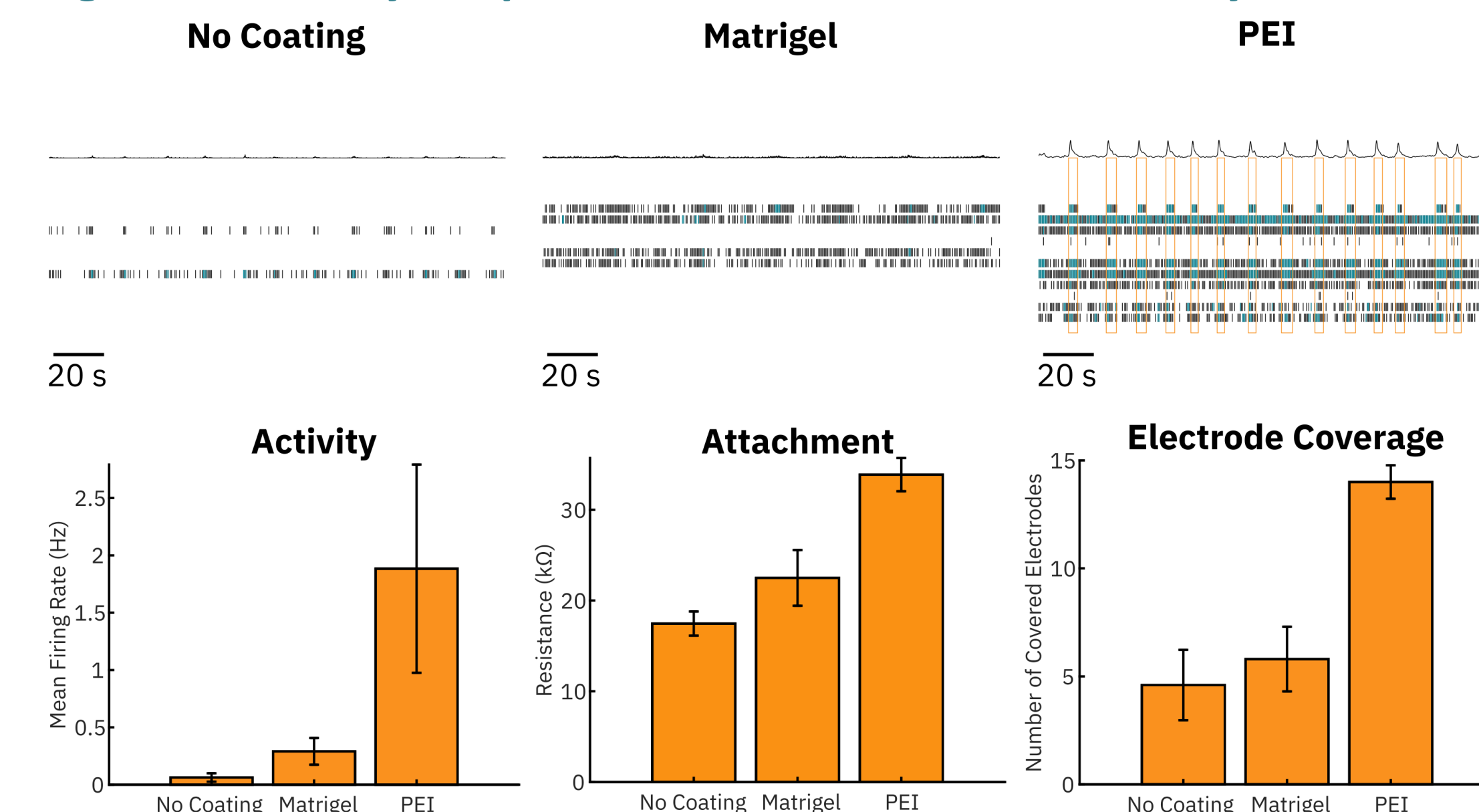
SpheroGuide

SpheroGuide MEA – A High Throughput Plate for Organoids



The SpheroGuide MEA plate from Axion BioSystems uses a specialty design to enhance the ability to record electrophysiological measurements from neural organoids. Each of the 48 wells has a funnel that guides organoids to the electrode array at the bottom of the well (above, A). After gentle centrifugation, the organoid is placed over the recording area as confirmed by imaging and the MEA Viability Module (above, B and C). Further, neural organoid activity matured over the course of culture in the SpheroGuide plate (above, D, Day 0 to Day 21 on MEA). With its organoid-specific design and optimized protocol, the SpheroGuide MEA plate allows for easy, high throughput MEA recordings of neural organoids.

Organoid Activity in SpheroGuide Plates Is Enhanced by PEI Coating



To facilitate electrophysiological measurement from neural organoids, midbrain organoids from STEMCell Technologies at ~Day 80 in their differentiation were plated into SpheroGuide plates on wells that were uncoated, coated with Matrigel, or coated with polyethylenimine (PEI). Organoids on uncoated wells had small amounts of spiking activity, attachment, and electrode coverage relative to coated wells, and these metrics improved only slightly with Matrigel coating. In contrast, with PEI coating, robust spiking activity, attachment to the surface, and electrode coverage were observed. Combined with the SpheroGuide MEA plate's high throughput capabilities, coating the substrate surface with PEI yielded consistent measurement from attached midbrain organoids for over 40 days in culture.