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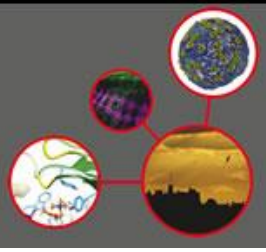

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# Controlling the activity pattern of the neuronal network by activation and silencing of specific neurons via light and temperature using the microelectrode array technology

Author(s): Dragicevic, E. (Munich)[1], Rascher-Eggstein, G. (Munich)[1], Millard, D. (Atlanta)[2], Clements, I. (Atlanta)[2], Nicolini, A. (Atlanta)[2], Chvatal, S. (Atlanta)[2], Clements, M. (Atlanta)[2], George, M. (Munich)[1], Ross, J. (Atlanta)[2], Fertig, N. (Munich)[1]

Institute(s): [1]Nanion Technologies GmbH, Munich, Germany, [2]Axion BioSystems, Inc., Atlanta, United States

Multiwell microelectrode array (MEA) systems provide simultaneous measurements of extracellular electrophysiological activity of excitable cells over long periods of time. Each electrode is capable of capturing extracellular action potentials of excitable cells in ultrahigh resolution (millisecond events with microvolt amplitudes), while multiple recording sites within each well allow population network activity measurements. The MEA technology has been used for neuronal network research for several years and offers unbiased, label free, non-invasive recordings of neuronal cell functions, in a regulated physiological environment. Using optogenetic stimulation and precise temperature control, we show that the activity of specific neuron populations can be controlled. With this, the novel solutions for specific cell stimulation (pacing) or silencing using multiwell light delivery add-ons for optogenetics further excels MEA-based disease modeling and drug discovery. Through even illumination of the wells and lack of induced artifacts, optogenetic stimulation exhibits improved reliability across wells, as compared to electrical stimulation.
Here, we demonstrate the control of neuronal activity by temperature, electrical and optogenetic stimulation, using different iPSC-derived neuronal cell types.
In summary, we present novel experimental possibilities by incorporating precise and fast temperature control and optogenetics approaches into already available and widely used technologies.