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REPEATED STIMULATION AND INDUCTION OF LONG TERM POTENTIATION WITH STRETCHABLE MICROELECTRODE ARRAYS

Mary Kate Dwyer[1], Nevin Varghese[1], Ruben Wong[2], Cami Rowan[2], Oliver Graudejus[2], Barclay Morrison, III[1]
[1] *Columbia University, Biomedical Engineering, New York, USA*
[2] *BMSEED LLC, Phoenix, USA*

Stretchable microelectrode arrays (sMEAs) have previously been used to record field potentials from organotypic hippocampal slice cultures (OHSCs). sMEAs allow mechanical injury and electrophysiological recordings to take place on the same device to collect data before and after injury. Recently, improvements have been made to reduce artifact when stimulating through any of the 28 electrodes. Long term potentiation (LTP), a cellular correlate of learning and memory, can now be studied after mechanical injury with our sMEAs. Similar to previous work, hippocampi were removed from P8-10 Sprague-Dawley rats, sliced into 400µm sections, and placed onto either the sMEAs or Millipore inserts. After 10-13 days, neuronal activity in the OHSCs was recorded with the sMEAs in artificial cerebrospinal fluid. Two electrodes were chosen to stimulate the Schaffer collateral (SC) pathway from 0-40µA to create a stimulus response (SR) curve and determine the current necessary for half maximal response (I50). Two SC SR recordings were taken 24 hours apart and the electrodes within the CA1 were averaged. The maximum response only changed by 2.5% (893µV vs. 915µV, N=4) over 24 hours. The I50 varied by 4.3µA (11.3µA vs. 15.6µA, N=4). After the final SR recording, LTP was induced by three rounds of 100 pulses at 100Hz at I50. LTP was calculated as the average magnitude of the response 50-60 minutes after LTP induction divided by the last 10 minutes of baseline. Response in the CA1 increased to 124±9% (AVERAGE±SD, N=5) of baseline. Performing multiple recordings on the sMEA can decrease the number of samples and animals needed and prevent damage to the OHSC during transfer between stretch well and recording electrodes. These promising results will allow future studies of LTP to include a pre-injury control. Analysis of the electrical activity before injury could better define the mechanisms of LTP alteration after injury, providing insight for more targeted treatments after brain trauma.

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