Simultaneous Multipoint Measurement of Cellular Network by Isolated Micro Channel Array with Pt-Black Electrodes

Abstract

We present a new type of MCA (Micro Channel Array) for simultaneous multipoint measurement of cellular network. Presented MCA is designed for advanced neuronal network analysis which has been studied by MEA (Micro Electrode Arrays) system. First of all, sucking and clamping of cells through channels of developed MCA is expected to improve electrophysiological signal detections. Electrophysiological sensing electrodes integrated around individual channels of MCA are electrically isolated for simultaneous multipoint measurement.

Objective

- Pt-Black Electrode for Lower Electrode Impedance
- Parylene-C as Insulator for High-Biocompatibility

Advancements from Previous MCA

- Drawback of Microelectrode Array (MEA):
  - Simultaneous Observation of Single-cell and Cellular Network

Fabrication and Results

(a) The 1st Deep - RIE
(b) The 2nd Deep - RIE
(c) Parylene Patterning
(d) Ti/Pt Patterning
(e) Thermal Oxidation
(f) Pt Electroplating

Target of Electrode Impedance: Around 100 kΩ @ 1 kHz

Target: Non-Cultured Rat’s Cortical Slice

Achievement: Simultaneous Multipoint Measurement of Spontaneous Spike Potential by 64ch MCA

Summary

We presented 64ch isolated MCA for cellular network analysis. Spontaneous action potential of cortical slice in suction could be observed at multiple points simultaneously by developed MCA. As the next step, we could culture the hippocampal neurons on developed MCA for cellular network analysis. Therefore, we can analyze the behavior of individual single cells and cellular networks simultaneously.