Development of carbon nanotube MEA system enabling simultaneous measurement of neurotransmitter release and field potential

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Multi-electrode (MEA) assays using human induced pluripotent stem cell (hiPSC)-derived neurons are expected to predict the toxicity and the pharmacological effects. If we can measure the release of neurotransmitter using this MEA, it is possible to evaluate the drug related to release of neurotransmitters, and it is expected to improve the accuracy of medicinal effects. In this study, we aimed to develop the carbon nanotube (CNT) MEA chip, which enables in both electrochemical measurement of DA release and conventional field potential measurement.
The CNT-MEA chip was fabricated by electro-plating method. Detection sensitivity to dopamine (DA) in the fabricated CNT-MEA chip was examined by electrochemical measurement method. The change of DA release to methamphetamine (MTH) were measured using cultured human iPSC-derived dopamine neurons on CNT-MEA.
As a result of the electrochemical measurement, an oxidation peak current was observed at 0.25 V, and the detection limit and linearity of DA was less than 5 nM. We have succeeded in real time detection of DA release using human iPS cell derived DA neurons, and detected the changes in the amount of DA release depending on MTH dose. Furthermore, in the human iPSC-derived DA neuron, a change of spike pattern at MTH administration was detected by conventional field potential measurement. CNT-MEA is expected as a new MEA measurement method that improves the accuracy of toxicity prediction and the pharmacological effects.