Development of drug assessment in central and peripheral neuronal networks using oriented nanofiber devices.

Takahashi Sayuri[1], Aoi Odawara[1], Naoki Matsuda[1], Yuto Ishibashi[1], Masaki Sudo[2], Ikuro Suzuki[1]

[1]1) *Tohoku Institute of Technology,* [2]2) *Stem Cell & Device Laboratory, Inc.*

In vitro Microelectrode array (MEA) assay systems using human iPSC-derived neurons and rodent primary cultured cells are expected to be useful for drug discovery and pre-clinical studies for toxicity and efficacy. However, as experimental problems, there are problems that the sample is likely to aggregate, it takes time until functional maturation, and dispersion culture has random structure and does not reflect the tissue structure. This is particularly remarkable for iPSC-derived neurons. In addition, since the actual state of nerve function is not yet elucidated, the fact that evaluation parameters are not established also contributes to difficulty.

As one of the methods to solve these problems, we are working on the construction of an evaluation method in which neurons are cultured on an oriented nanofiber device (NFD). When human iPSC-derived central neurons were cultured on NFD, it was found that aggregation was suppressed and synchronous burst firing, which is an indicator of maturation, was detected early. Since this NFD forms a neural network along the fiber, it can give direction to activity propagation in the network. When excitatory drugs acting on synapses were administered, the propagation speed in the network changed. The change in propagation speed reflects synaptic function, suggesting that it is useful as a drug efficacy evaluation parameter. In addition, rat DRG neurons, which are peripheral nerves, were cultured on NFD and measured by CMOS-MEA. As a result, we succeeded in measuring the axonal conduction of one cell along the fiber in multiple points. A change in conduction speed due to drug administration was detected, suggesting that it is also effective in evaluating peripheral neurotoxicity such as axon disorder.