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神経細胞ネットワークハイスループットスクリーニング 素子基板上への細胞播種と培養

New Seeding and Culturing Cell Technique for Neural Network Formation of High Throughput Screening Device

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The iPS cell technology has made possible to investigate the living neural cells of patients with brain intractable diseases. To investigate the origin of the diseases and develop new drags using this technique, we think that developing a suitable neural network formation technique and the high throughput screening apparatus is essentially necessary.

We have developed the first incubation type planar patch clamp, by which high throughput measurements of ion channel current with neural network is realized. The performance of the device have been tested using HEK293 cells on which a chimera molecule of channel-rhodopsin-wide-receiver (ChR-WR) was expressed[1]. Recently we have also investigated the spontaneous ion channel current for the neuron primary culture. It was the first success of ion channel current recording for nerve cells using incubation type planar patch clamp. However, in this experiment, significant aggregation of nerve cells was induced due to the surface migration of the cell and this significantly hinder the analysis of the observed channel current data. Thus it has been an important target for us also to form a well defined aggregation-controlled neural network which makes it possible to simulate the real neural network of the brain and understand the mechanisms of neural connection and communication. Using a new seeding cell apparatus (which we name Joro), neuron cells can be seeded in the cell cage pattern in a well controlled way more easily and efficiently. Joro is specially designed suitable to seeding a small number of precious cells area-selectively on the chip. After about 13 days incubation, an aggregational-controlled neural network was formed as show in Fig. 1. We are going to carry out the Ca^{2+} imaging along with the ion channel current measurement by planar patch clamp.

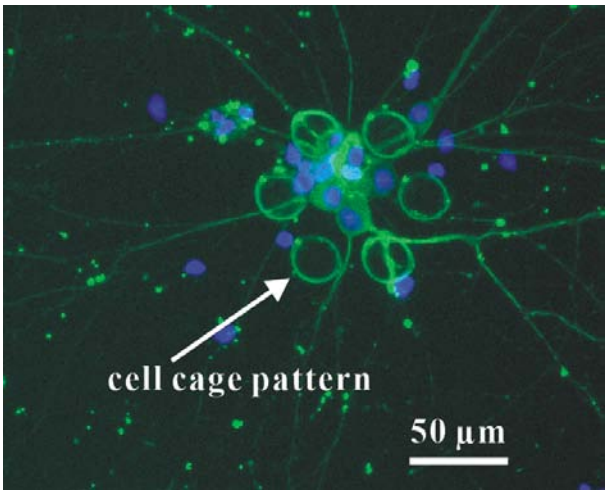

Fig.1 Neural network formation after 13 days incubation using Joro substrate seeding apparatus. Green: tubline, Blue: DAPI. Scale bar: 50 µm. 6 rings indicate the cell cage pattern.

[1] Z-H. Wang, N. Takada, H. Uno, T. Ishizuka, H. Yawo and T. Urisu ***Coll. Surf. B***96 (2012) 44