

Joint Studies Programs

As one of the important functions of an inter-university research institute, IMS facilitates joint studies programs for which funds are available to cover the costs of research expenses as well as the travel and accommodation expenses of individuals. Proposals from domestic scientists are reviewed and selected by an interuniversity committee.

(1) Special Projects

A. Developments of New Methodology for the Research of Biomolecular Sensing System

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Investigation of signal transduction in the *in vitro* 2D neural networks using dissociated cultured neurons is valuable for understanding the cell biology of neurons and synapses and also important for development of treatment methods with intractable diseases such as neurodegenerative diseases and muscular dystrophy and related drug developments. In the previous reports, the action potential, the long-term synaptic potentiation (LTP) was induced by the stimulation using pipette patchclamp, and the corresponding excitatory post synaptic currents (EPSCs) were measured by another pipette with a whole cell arrangement. Although pipette patch clamp is an established highly reliable method of electrophysiology, it has such weak points as simultaneous multi-point measurements and long term monitoring are difficult. To overcome these weak points of pipette patch clamp, planer patch clamp has been recently proposed. Furthermore, to apply planer patch clamp method to neural cells, we have proposed and been developing incubation type planer patch clamp method. Concerning the stimulation of electrically excitable cells, photo-stimulation provides a versatile alternative to electrode stimulation, which has several challenges, such as difficult simultaneous multi-point measurements in intracellular electrodes and limited spatial resolution in extracellular electrodes. Laser beam stimulation has several advantages such as high spatial and time resolutions, not so strong requirement for the mechanical stability and easy simultaneous multi-point stimulations.

In this project, we have successfully developed the incubation type planer patch clamp biosensor (Figure 1) and observed the light gated ion channel current of ChR2 expressed C2C12 cells (Figure 2) using this biosensor. Furthermore, we are now developing the multi channel devices using plastic substrates. The unique structure of this device is that microfluidics are formed upper side of the substrate and the electrode structures, which correspond to the pipette of the pipette patch

clamp, are formed at the lower side, and these structures are formed by the both side embossing technique. Recently we have succeeded in the cell positioning at the micropore region by the single cell manipulations (Figure 3).

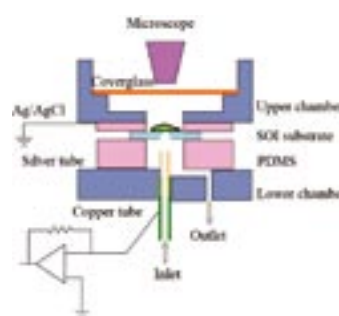


Figure 1. Schematic structure of the incubation type planer patch clamp biosensor.

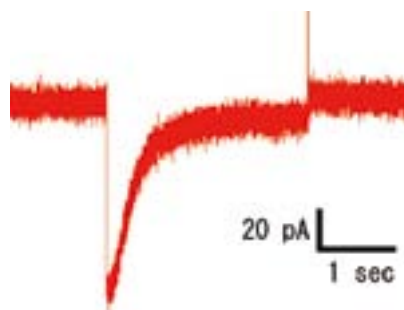


Figure 2. Observed light gated ion channel current of ChR2 expressed C2C12 cell using incubation type planer patch clamp biosensor.



Figure 3. Single cell manipulations on the microfluidic circuits. Single cell is positioned on the microfluidic area.

(2) Research Symposia

(From Oct. 2009 to Sep. 2010)

Dates	Theme	Chair
Nov. 6, 2009	Molecular Imaging for System Biology	OZAWA, Takeaki URISU, Tsuneo
Oct. 30–31, 2009	Progressive Research on Unconventional Dielectrics —Electron and Ferroelectricity—	IKEDA, Naoshi ISHIHARA, Sumio YAKUSHI, Kyuya YAMAMOTO, Kaoru
Mar. 23–24, 2010	What Can We “Learn” or “Get” from a Growing Rhodopsin Family?	SUDO, Yuki FURUTANI, Yuji
Feb. 19–20, 2010	Control of Potential Spaces in Molecular Assemblies —Approaches from Coordination Chemistry—	CHANG, Ho-Chol TANAKA, Koji
Feb. 19–20, 2010	Status and Prospects of Synchrotron Light Source Technologies	KATOH, Masahiro
Jun. 18–19, 2010	Plasmon-Enhanced Optical Field and Its Development into Molecular Science	IMURA, Kohei OKAMOTO, Hiromi
Jul. 2, 2010	Preparatory Meeting for Molecular Science Summer School	OTAKI, Hiroki FURUTANI, Yuji

(3) Numbers of Joint Studies Programs

Categories		Oct. 2009–Mar. 2010	Apr. 2010–Sep. 2010	Total
Special Projects		1	0	1
Research Symposia		5	1	6
Research Symposia for Young Researchers		0	1	1
Cooperative Research		59	59	118
Use of Facility	Instrument Center	34	27	61
	Equipment Development Center	4	1	5
Use of UVSOR Facility		77	63	140
Use of Facility Program of the Computer Center				171*

* from April 2009 to March 2010