New project

Microarray of Planar Bilayer Lipid Membranes for Electrophysiological Study of Transmembrane Proteins

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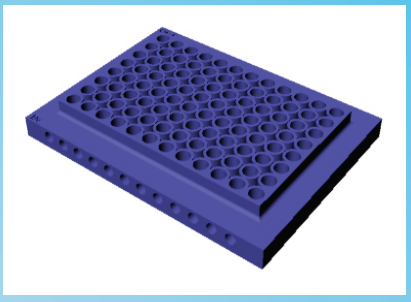
Context

A membrane protein is a protein attached to or incorporated into a biological membrane such as cell membranes or organelles, accounting for thirty to fifty percents of all proteins. Especially transmembrane proteins, spanning the entire membrane, play very important roles for signal transduction and neurotransmitter transport, and are considered as the target of more than half of drugs. In spite of the fundamental and industrial importance as well as the longtime efforts of researchers, our knowledge on the transmembrane proteins has not advanced satisfactorily since the proteins keep their original structures and activities only at the membranes. To overcome those problems, parallelized and automated platforms for the membrane protein screening have been recently launched, using planar patch-clamping technology with arrayed cells expressed target membrane proteins, although they sometimes suffer from unstable electrical sealing at recording sites and expensive cost [1].



Schematic design of 96-well array for planar bilayer lipid membranes.

Objectives

We, therefore, propose an alternative microarray system taking advantages of BioMEMS technology. The former project successfully developed simultaneous monitoring of ion channel reconstituted in planar bilayer lipid membranes at a nine-well biochip (See the project by Le Pioufle) [2]. In this project, we focus on expansion of the original model of the chip to a massively parallel, more practical platform for a high throughput screening purpose.

Methods

Hybrid stereolithography will be used for the microarray fabrication, where micrometer-sized apertures for the formation of bilayer membranes are able to form with a standard photolithography process at a thin polymer film [3]. Multi-channel electrophysiological recordings of transmembrane proteins with optical observation will describe the characteristics of the proteins, protein-ligand interaction and other physiological phenomena.

References and Publications

[1] C. Ionescu-Zanetti, R. M. Shaw, J. Seo, Y.-N. Jan, L. Y. Jan, L. P. Lee, Proc. Natl. Acad. Sci. U. S. A. 102, p.9112, 2005.

[2] B Le Pioufle, H. Suzuki, K. V. Tabata, H. Noji, S. Takeuchi, Anal. Chem. 2007 (in press).

[3] H. Suzuki, S. Takeuchi, μTAS 2007 p.1276, 2007.