Microfluidic Technologies toward Pharmacology on a ChipHiroshi Kimura¹, Teruo Fujii²¹*Tokai University, Japan*, ²*The University of Tokyo, Japan*

Although animal experiments are indispensable for preclinical screening in the drug discovery process, various issues such as ethical considerations and species differences remain. To solve these issues, cell-based assays using human-derived cells have been actively pursued. However, it remains difficult to accurately predict drug efficacy, toxicity, and organ interactions, because cultivated cells often do not retain their original organ functions and morphologies in conventional in vitro cell culture systems. In the TAS research field, which is a part of biochemical engineering, the technologies of organ-on-a-chip, based on microfluidic devices built using microfabrication, have been widely studied recently as a novel in vitro organ model. Since it is possible to physically and chemically mimic the in vitro environment by using microfluidic device technology, maintenance of cellular function and morphology, and replication of organ interactions can be realized using organ-on-a-chip devices. So far, functions of various organs and tissues, such as the lung, liver, kidney, and gut have been reproduced as in vitro models. Furthermore, a body-on-a-chip, integrating multi organ functions on a microfluidic device, has also been proposed for prediction of organ interactions. In this presentation, we introduce integrated microfluidic platforms, which allow precise control of the cell culture environment on organ/body-on-chips. Functional components, such as sensors, valves and pump, can be integrated into the devices by microfabrication methods. We performed cell-based assays and tissue culture to evaluate the function of these devices. Because cells cultured in vitro could be maintained and measured, these devices may be applied to medical, pharmaceutical and biological sciences.