

Title of Research:

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Chip device for *in vitro* systemic toxicology

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Summary of Research:

Body-on-a-chip has emerged as a novel approach for Alternatives to Animal Testing. The aim of this study is to develop a body-on-a-chip for *in vitro* drug testing to evaluate systemic toxicity of chemicals. In our chip devices, several tissues including the liver, the cardiac tissue, and the small intestine were fabricated as either cell layer tissues or spherical tissues to replicate *in vivo* kinetics and interactions. One of our results showed that improved oxygen supply and a selection of energy metabolisms significantly matured human iPS-derived cardiomyocyte spheroids. Changes in beating of these spheroids were characterized using cell motion imaging on the chip device, indicating that this can be an important toxicity testing. In addition, human iPS cell-based signaling reporter system was also developed for prediction of chemical teratogenicity.

Timeline:

March 1, 2019 - February 29, 2020

Topics:

Poster presentation at JCIA LRI Annual Workshop 2019 "Chip devices for *in vitro* systemic toxicology" (Tokyo, August 30th, 2019)

Publications:

1. Y. Sawada, Y. Miura, E. Kobayashi, K. Iijima, J. Fukuda, H. Itagaki, "Evaluating immunotoxicity in co-culture system of THP-1 and undifferentiated / keratinized NHEK", The 46th Annual Meeting of The Japanese Society of Toxicology, Tokushima, Japan, June 2019
2. T. Shinagawa, J. Fukuda, S. Toyama, J. Fujita, K. Fukuda, Y. Kanda, A. Satsuka, "Maturation of human iPS-derived cardiomyocytes on oxygen-permeable spheroid culture device", Yokohama Branch Meeting of Society for Chemical Engineers, Yokohama, Japan, August 2019
3. T. Usui, D. Qin, J. Fukuda, "Co-culture of CACO-2 cell sheets and E. coli-encapsulated microbeads for *in vitro* intestine model", APCCHE2019, Sapporo, September 2019
4. Y. Yamamura, J. Fukuda, "Drug evaluation chip device using multiple 3D tissue models", The 32nd Annual Meeting of the Japanese Society for Alternatives to Animal Experiments, Tsukuba, Japan, November 2019
5. D. Qin, T. Usui, J. Fukuda, "Co-culture of intestinal epithelial cells and bacteria-embedded beads for *in vitro* small intestine model", The 32nd Annual Meeting of the Japanese Society for Alternatives to Animal Experiments, Tsukuba, Japan, November 2019