Title of Research:

17_PT01-02

Development of novel screening system to predict the effects of environmental factors in each organ by using cell-free circulating DNA in serum -- Advanced system for prediction of hazards from environmental factors in fetus using cell free fetal DAN in mother's blood

Principal Investigator:

Wataru Miyazaki, PhD (Professor, Department of Bioscience and Laboratory Medicine, Graduate School of Health Sciences, Hirosaki University)
66-1 Hon-cho, Hirosaki, Aomori 036-8564, Japan
(tel) +81-172-39-5955, (e-mail) miya@hirosaki-u.ac.jp

Collaborators:

Noriyuki Koibuchi (Professor, Department of Integrative Physiology, Graduate School of Medicine, Gunma University)
Izuki Amano (Assistant Professor, Department of Integrative Physiology, Graduate School of Medicine, Gunma University)
Takahiko Katoh (Professor, Department of Public health, Graduate School of Medicine, Kumamoto University))

Summary of Research:

  To prevent the adverse effects of several toxic chemicals at an early stage, it is important to develop a novel screening system for detecting organ injury. For such purpose, we have focused on the cell-free circulating DNA (cfDNA), whose origin may be identifiable if they harbor tissue-specific epigenetic modification. This system is simple and minimally invasive because we utilized cfDNA in serum to detect the injuries. Furthermore, our system may have the potential to detect fetal organ injury using cfDNA of fetal origin in maternal serum. Previously, we identified several candidate regions as the adult and fetal organ-specific markers (specific un-methylated regions). We performed bisulfite amplicon sequence assay with cfDNA derived from organ-specific injury mouse model, and detect the organ injuries. In this term, we have continued the assessment of the novel system using cfDNA from several chemical-exposure mouse models (nicotine, ethanol, high fat). The injuries in the liver and cerebellum were detected in ethanol and/or high fat exposed groups using our system. On the other hand, we could not detect the injuries of fetal organs from maternal cfDNA. To improve the labor, time, and cost of our system, we have attempted an improved method with Oligoribonucleotide Interference-PCR (ORNi-PCR). Both the cost and time of the improved method were smaller than the previous. These results indicate that our system may be useful to detect specific injured organs just by using serum, although further experiments are needed to detect the injuries of fetal organs using maternal blood.

Timeline:

March 1, 2019 – February 29, 2020

Topics:

Poster presentation at JCIA LRI Annual Workshop 2019 "Development of novel screening system to predict the effects of environmental factors in each organ by using cell-free circulating DNA in serum" (Tokyo, August 30th, 2019)

Publications:

1. Poster presentation at 9th Federation of Asian and Oceanian Physiological Societies Congress: FAOPS2019, title: A novel screening system to predict injured organs using cell-free DNA in serum