87th RAP Seminar

The 87th Seminar on RIKEN Center for Advanced Photonics

Language: Japanese

Date: **June 28 (Fri), 16:20 - 17:20, 2024**

Location: **W319, 3F, Cooperation Center, Wako Campus, RIKEN**

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Title: **Cell-omics technology: dive into the three-dimensional cell cloud**

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Speaker: **Prof. Etsuo A. SUSAKI**

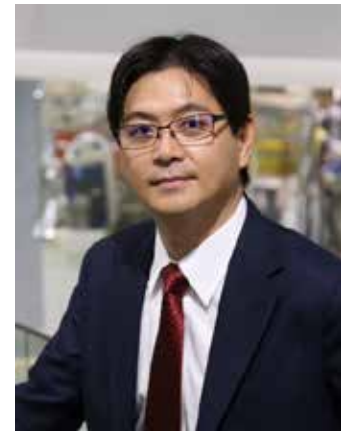**Juntendo University Graduate School of Medicine**

Pre-registration

State-of-the-art tissue clearing and three-dimensional (3D) imaging have opened up cellomics, a framework for observing and analyzing whole organs and organisms at the single-cell level. This talk aims to provide an overview of the cellomics approach, with particular emphasis on workflow ideas and elemental technologies including tissue clearing, 3D tissue staining, light-sheet 3D imaging, and image informatics.

The speaker's research team began developing tissue clearing and whole organ 3D imaging techniques with light-sheet microscopy around 2010, with the goal of analyzing the whole set of cells in an organ (the cellome). The first CUBIC clearing reagents were published in 2014 (Susaki et al. Cell 2014; Tainaka et al., Cell 2014), and updated to the second generation reagents in 2018 (Tainaka et al., Cell Rep. 2018). In parallel, we built several light-sheet microscopes, with examples taken with a custom-made light-sheet microscope in 2020 (Susaki et al., Nat Commun 2020) and a simplified open-source light-sheet microscope released this year (Otomo et al., bioRxiv 2023). The 3D tissue staining required for cell labeling has been extremely difficult in the past, but after 6 years of trial and error, we succeeded in designing a new protocol in a bottom-up manner by applying the gel-like properties of biological tissue (Susaki et al. Nat Commun 2020). Furthermore, the whole-cell cellome reference developed by the team allows for reference annotation and multi-sample comparisons similar to other established omics (Murakami et al., Nat Neurosci 2018; Mano et al, Cell Rep Methods 2021).

Therefore, cellomics enables organ-scale 3D imaging with single-cell resolution and the analysis of biological information based on 3D spatial context, paving the way for new approaches to analyzing multicellular systems collectively. CUBICStars, Inc., was launched in 2019 for the social implementation of CUBIC technology. Cellomics technology is now providing an advanced basis for the systematic analysis of multicellular systems in various biomedical fields.