14th nanobiofluids seminar

2025 May 9th, 13:30-14:30

Conference Room (Room 134) 1st floor, Bldg. No.1

https://www.infront.kyoto-u.ac.jp/en/access/

Zoom registration

Prediction of hematopoietic stem cell diversity using quantitative phase imaging

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Abstract

Cells undergo continual transformations, never retaining their original state. Hematopoietic stem cells (HSCs), at the apex of the hematopoietic hierarchy, are not exempt from this dynamic process. Foundational research on HSCs has progressed in tandem with the development of innovative identification technologies. Given that the functional quality of HSCs is critically linked to the safety and efficacy of stem cell therapies, there is a pressing need to accurately identify high-quality HSCs. However, conventional approaches predominantly relied on snapshot evaluations at single time points, thereby overlooking the inherent temporal variability of these dynamic cells. In this study, we integrated an ex vivo HSC expansion system with quantitative phase imaging (QPI) and machine learning to noninvasively predict the functional quality of murine HSCs. Single-cell QPI tracking during culture revealed diverse HSC dynamics that were undetectable using conventional snapshot analysis. By performing multidimensional analyses of cellular features extracted from QPI data, we achieved accurate prediction of HSC functional quality. Moreover, incorporating time information from continuous QPI datasets into machine learning models significantly enhanced predictive accuracy. Observations of similar dynamic behavior in human HSCs further support the potential of this new framework for functionally predicting HSC quality based on temporal dynamics.

Biography

Takao Yogo received his M.D. from the Faculty of Medicine at The University of Tokyo and worked as a hematologist at the Japanese Red Cross Medical Center. He earned his Ph.D. in the Division of Stem Cell

Biology at the Institute of Medical Science, The University of Tokyo, under the mentorship of Dr. Satoshi Yamazaki, where he visualized the spatiotemporal dynamics of transplanted HSCs and identified a unique cell population driving early post-transplant hematopoiesis, termed “Hematopoietic Inflation”. He continued his research as a postdoctoral fellow in the same lab, where he initiated studies integrating HSC ex vivo expansion with label-free QPI to analyze the kinetics of HSC behavior during culture. His recent work focuses on single-cell expansion systems to predict the functional quality of both murine and human HSCs, aiming to contribute to the development of clinically applicable stem cell therapies.

Host: Hirofumi Shintaku, shintaku@infront.kyoto-u.ac.jp