

304th LBB Seminar

Engineering approaches to capture dynamic cancer cell–microenvironment interactions



講師 : **Dr. Misa Minegishi, Ph.D.**

Assistant Professor

Institute for Life and Medical Sciences, Kyoto University

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会場 : 東京科学大学 総合研究院 生体材料工学研究所
第二会議室 22 号館 (1 階)

Abstract: Cancer cells continuously interact with surrounding cells and physicochemical factors in their microenvironment, and these interactions shape cell behavior and fate. During metastasis, cancer cells encounter unfamiliar tissue environments and must dynamically respond and adapt to survive and proliferate. However, conventional approaches often capture only snapshots of these interactions, limiting our ability to follow how cancer cells and their surrounding microenvironment change over time. To overcome this limitation, we develop engineering approaches to quantitatively analyze cancer cell–microenvironment interactions across spatial and temporal scales.

In this seminar, I will first introduce MECH-seq, an experimental platform that combines controlled mechanical confinement with molecular profiling to investigate how cancer cells respond and adapt to their physical microenvironment. Using this platform, we are investigating how prolonged mechanical confinement progressively shifts the balance among distinct cancer cell fates, including proliferation, dormancy, and cell death, as well as the molecular changes associated with these shifts.

I will then present sGRAPHIC, a proximity-labeling approach that enables fluorescent labeling and isolation of cells neighboring cancer cells in living tissues. By combining sGRAPHIC with single-cell RNA sequencing, we identified a galectin-3-mediated interaction between metastatic cancer cells and hepatocytes that promotes cancer cell proliferation in the liver (Nat. Commun., 2023).

Together, these engineering approaches provide complementary perspectives on how cancer cells interact with, respond to, and adapt to their surrounding microenvironment. Through the development and application of these technologies, we aim to understand the dynamic processes that support cancer cell survival and metastatic progression.

お問い合わせ: 総合研究院 生体材料工学研究所 診断治療シ
ステム医工学分野 梨本(内線 8119)