LiMe
Institute for Life and Medical Sciences
Kyoto University

# 19th nanobiofluids seminar

2025 Oct 31st, 14:00-15:00
Conference Room (Room 134), 1st Floor, Bldg. No.1
https://www.infront.kyoto-u.ac.jp/en/access/
Zoom link

## Mechanosensitive ion channels as biophysical sensors in muscle stem cells

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**Abstract**
The ability of adult tissues to regenerate relies on how stem cells precisely sense their environment and respond with the correct fate. Mechanical forces generated by routine tissue activity and injury are emerging as potent regulators of stem-cell activation. Yet, the molecular mechanisms by which stem cells decode these physical cues remain poorly understood. Skeletal muscle exhibits a strong regenerative capacity supported by muscle stem (satellite) cells, which reside between the myofiber and basal lamina. In response to muscle damage, satellite cells exit dormancy, expand, and commit to myogenic differentiation to rebuild functional tissue. However, the sensors that convert mechanical input into specific intracellular programs have not been fully defined.
To address this, mechanosensitive ion channels enriched in satellite cells were investigated using satellite cell–specific genetic approaches. These analyses revealed that multiple channels, including PIEZO1, cooperatively regulate sequential transitions of satellite cell behavior through distinct mechanisms. In this seminar, recent findings on metal-ion–dependent mechanosensing and a previously unrecognized mechanosignaling axis in muscle stem cells will be introduced, along with their physiological significance during muscle regeneration.

**Biography**
Kotaro Hirano is an Assistant Professor in the School of Pharmaceutical Sciences at the University of Shizuoka, Japan. He received his B.S., M.S., and Ph.D. in Engineering from Kyoto University, where he uncovered distinct functions of mechanosensitive ion channels in orchestrating transitions from quiescence to commitment in muscle stem cells. During his graduate training, he conducted research as a Visiting Scholar at the Wistar Institute Cancer Center (Philadelphia, USA), supported by the Ministry of Foreign Affairs of Japan.
Dr. Hirano held a JSPS Research Fellowship (DC1) and has been recognized with several national honors, including the Young Investigator Award from the Japanese Muscle Society (2025), the Young Researcher Award from the Joint Meeting of the Japanese Societies of Muscle, Bone & Rheumatism (2024), the Best Presentation Award at the Pharma-Bio Forum for Next-Generation Scientists (2022), and early-career distinctions from the Japanese Biochemical Society and other scientific organizations since 2018.

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