



Category
winner

Yodai Takei

Category: Genomics, Proteomics and Systems Biology Approaches

Essay title: *Imaging nuclear architecture in single cells: Multiplexed imaging technologies uncover precise 3D maps of single nuclei*

Biography

Dr. Yodai Takei grew up in Yamanashi, Japan, and received his bachelor's and master's degrees in Pharmaceutical Sciences from The University of Tokyo. He earned his PhD in Biology from California Institute of Technology. He worked with Long Cai to develop imaging-based single-cell multi-omics technologies. Using these new technologies, he investigated the 3D organization of the nucleus in diverse cell types, revealing nuclear features emerging from the interplay of DNA, RNA, and protein molecules.

Yodai is currently a postdoctoral scholar in Michael Elowitz's lab at California Institute of Technology, studying spatiotemporal and combinatorial aspects of chromatin organization and gene regulation. Outside of the lab, he enjoys reading, running, and traveling.

Abstract

Various molecules such as DNA, RNA, and proteins are spatially organized within cells in our body. Inside each cell, the three-dimensional (3D) structure of the nucleus is particularly vital for comprehending different cell types and states. Nevertheless, our understanding of 3D nuclear organization has been limited by the lack of high-resolution spatial multiomics technologies. To overcome this, I have developed multiplexed imaging-based approaches, allowing transcriptome- and genome-scale imaging of individual molecules within single nuclei.

Utilizing these sequential fluorescence in situ hybridization (seqFISH) methods, I obtained precise 3D maps of the nucleus, incorporating nascent transcriptome, genome structures, and subnuclear structures in various cell types. Collectively, my thesis work establishes a crucial foundation for understanding diverse cell types and states through the principles of nuclear organization.