Quantative visualization of living cell adhesion

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Considering the size of the cells inside our body, they are extremely small at approximately 10 μm. This is one-tenth of the diameter of a human hair (0.1 mm or 100 μm) and they are no longer visible to the naked eye. I have developed microscopy techniques to visualise these cells. My particular interest lies in the phenomenon of cell adhesion. Individual cells adhere to their surroundings and neighbouring cells, forming tissues that develop into the organs that support our bodies. From this perspective, cell adhesion is the foundational step in sustaining our bodies. Technologies that visualise this process and enable quantitative evaluation are critically important. In this presentation, I will share how researchers visualise phenomena that are invisible to the naked eye, with providing an overview of my work, ranging from cell adhesion studies to organ tissue research. Below is an abstract for researchers.

Developing technologies to measure the “structure and physical properties” of living cell tissues is a major challenge in life sciences. I have pioneered nanoimaging technology that breaks the diffraction limit by utilizing interference light, which is typically considered noise (xy ~100 nm, z ~2 nm) (J. Phys. Chem. Lett. 2022 †*(cover), 2024 †*, PNAS 2024 †*). Furthermore, through collaborative research with the medical school, we are successively elucidating the role of stiffness governing diverse organ regeneration and disease states (Cell Stem Cell 2015 (cover, Best of Cell Stem Cell), iScience 2022 †*, Mucosal Immunology 2023, Smooth Muscle Society Award 2023, Osaka University Award 2024, Japan Society for Molecular Biology Poster Award 2025). We have pioneered a new interdisciplinary field of organ regeneration based on stiffness, continuously providing foundational technologies spanning from life sciences to regenerative medicine industries (19 papers published since 2022 as first author †/Principal Investigator*). Balancing my roles as a researcher and as a public relations committee member for applied physics, I operate a physical chemistry laboratory that contributes to the local community by spreading the joy of interdisciplinary collaboration among high school students, university students, and researchers.

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