Laboratory of Radiation Chemical Biology

Graduate School of Science

Professor Kazuya KABAYAMA kaba@irs.osaka-u.ac.jp

URL: https://kaba612.wixsite.com/radiation-chembio

Targeted Alpha Therapy (TAT) is a type of radiopharmaceutical treatment that delivers high-energy alpha-emitting radionuclides to cancer cells, selectively eliminating them. This therapy is particularly promising as a new treatment for refractory cancers. Our laboratory is developing candidate drug compounds labeled with the short-lived alpha-emitting radionuclide astatine-211 (^{211}At) and advancing research with a focus on First-in-Human (FIH) trials.

Additionally, in collaboration with organic chemists, we design and synthesize fluorescently labeled bioactive molecules. These molecules enable molecular-level analysis of carbohydrate and lipid-related compounds involved in diseases such as infections, cancer, and diabetes. Our specific research themes include the following:

Drug Development for Targeted Alpha Therapy

Targeted Alpha Therapy (TAT) utilizes radioactive isotopes (RIs) that emit high-energy alpha particles to treat cancer. Alpha particles have a short range and a high cell-killing effect, while minimizing damage to normal tissues. In our research, we develop drug delivery systems (DDS) using antibodies and peptides that bind to target molecules. By analyzing the stability and pharmacokinetics of RI-labeled compounds, we aim to establish safer and more effective treatments.

Functional Analysis of Lipid-Related Molecules in Innate Immunity

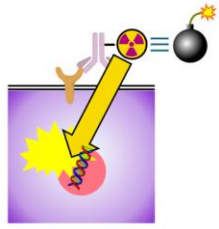
Innate immunity serves as the body's defense mechanism against pathogens, and lipid-related molecules play a crucial role in its regulation. Pathogen-derived and endogenous lipids, such as lipopolysaccharides (LPS) and sphingolipids, are involved in inflammatory responses and immune cell activation. This research aims to elucidate the molecular functions of these lipid-related molecules and the regulatory mechanisms of immune responses, contributing to a better understanding of disease mechanisms and potential therapeutic strategies.

Molecular Chemical Validation of Glycan-Mediated Interactions

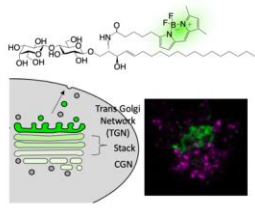
Glycans are biomolecules present on cell surfaces that play essential roles in intercellular communication and recognition. Specifically, interactions between lectins and glycan-modified proteins are deeply involved in pathological processes such as cancer metastasis and viral infections. This study utilizes fluorescence labeling techniques and high-sensitivity mass spectrometry to analyze the structure and function of glycan-protein interactions. Additionally, we aim to develop novel glycan probes to visualize glycan functions at the cellular and tissue levels, facilitating advancements in disease diagnosis and therapeutic development.

Live-Cell Imaging-Based Analysis of Biomolecular Dynamics

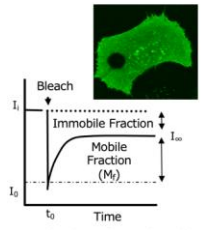
Real-time analysis of biomolecular dynamics is crucial for understanding cellular functions and disease mechanisms. Live-cell imaging is a technique that visualizes the movement of biomolecules using fluorescent proteins and fluorescent probes, allowing for spatiotemporal analysis of their behavior. In this study, we analyze the dynamics of proteins and lipids within cell membranes and organelles to elucidate intracellular signaling and membrane transport mechanisms. Our goal is to contribute to research on cancer and neurodegenerative diseases by providing deeper insights into these fundamental biological processes.



Drug development for Targeted Alpha Therapy



Chemical biology of glycans- and lipids-related molecules



Analysis of molecular dynamics using live cell imaging

We are developing an innovative drug that can treat cancer with a single injection. If you're interested, please let us know!

Department of Biological Sciences
Graduate School of Science, Osaka University
1-1, Machikaneyama-cho, Toyonaka
560-0043, Japan

Tel: +81-6-6850-5192

Scan here for the lab's website >>