UNIVERSITY OF TOYAMA

Department of Biointerface Chemistry, Graduate School of Medicine and Pharmaceutical Sciences, University of Toyama

Our research group aims to elucidate biological phenomena, especially those occurring on biomembranes, using biophysical approaches based on physical chemistry and surface chemistry, and to utilize the knowledge obtained from the above basic research for developing pharmaceutical formulations.

Master's Thesis Project: Development of Amphipathic Peptide–Phospholipid Nanodiscs as Novel Drug Carriers for Intracellular Delivery

High-density lipoprotein (HDL) is a colloidal particle in the blood responsible for the reverse cholesterol transport system carrying peripheral cholesterol to the liver. HDL is initially in discoidal form when produced. These discoidal particles can also be created artificially (which are called nanodiscs) using phospholipids and apolipoprotein A-I (apoA-I), the major protein component of HDL, or amphiphilic polypeptides with an alpha-helix structure similar to apoA-I. The use of peptides allows the nanodiscs to be prepared more easily but the particles become less thermally stable than nanodiscs with apoA-I. However, this instability may be exploited to enhance the interaction of the particles with cell membranes. In this project, the student will modify the lipids and peptides used to prepare nanodiscs to control their thermal stability and establish methods to efficiently transport drugs loaded on nanodiscs into cells.

For further reading/references see:

C. Anada, K. Ikeda, A. Egawa, T. Fujiwara, H. Nakao, M. Nakano. "Temperature- and Composition-Dependent Conformational Transitions of Amphipathic Peptide-Phospholipid Nanodiscs." J. Colloid Interface Sci. 588, 522-530 (2021). doi:10.1016/j.jcis.2020.12.090

C. Anada, K. Ikeda, H. Nakao, M. Nakano. "Improvement of Thermal Stability of Amphipathic Peptide–Phospholipid Nanodiscs via Lateral Association of α-Helices by Disulfide Cross-Linking." Langmuir 38(22), 6977–6983 (2022). doi:10.1021/acs.langmuir.2c00533

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