

Graduate School of Bioagricultural Sciences, Nagoya University

Young Faculty Overseas Program, Activity Report

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Host Institution: **Univ. of Greifswald/ Institute of Biochemistry (Germany)/ Bornscheuer group**

Research Topic: Bioinformatics-guided development of enzymes for sustainable use of resources

Dispatch Period: July 10, 2025 – October 1, 2025

[Purpose of Dispatch]

The purpose of this overseas study was to explore bioinformatics-assisted development of enzymes with potential application in plastic and marine polysaccharide degradation, in addition to international networking and learning about efficient organization and management of a top-level research lab.

Polyurethane (PUR) foams match the annual production of PET, but unlike PET, efficient recycling platforms have not been developed yet. On the other hand, marine polysaccharides from algae can be utilized to extract useful carbohydrates for the food industry. Exploring these topics, highly relevant for a sustainable society of Japan, served as a starting point to establish a connection between our two labs and discuss future modes of collaboration.

[Main Activities at Host Institution]

Main activities consisted of research on bioinformatics-guided design, mutagenesis, and screening of enzyme variants with potential for the above resource degradation and further use, as part of a large-scale project in the Bornscheuer group. This gave me an opportunity to interact with the Project Leader, Dr. Thomas Bayer, and associated PhD students. Besides, I participated in the lab activities, such as weekly seminars, master's and PhD thesis defenses, teaching of internship students, and promoting our graduate school to German students interested in research internships and studies in Japan. After returning to Japan, the joint hybrid symposium titled 第5回天野エンザイム酵素研究助成報告会 (Joint Symposium with Univ. of Greifswald, Germany) was organized on November 21, 2025, gathering researchers under the Amano Enzyme projects at Nagoya University and from the Bornscheuer group. Throughout my stay in Germany, I maintained most of my duties at Nagoya University through online orientation for the G30 students, online lectures, and online research group meetings.

[Major Achievements]

I designed and created 8 mutagenic libraries based on the most promising enzyme for PUR degradation, completed the screening of 4 libraries using 6 substrates of interest (aromatic and aliphatic amides, aromatic carbamates), which enabled me to recommend candidate mutant enzymes for further validation at the Bornscheuer group. The outcomes of this work are planned for the first joint publication. The future collaborative work is planned within the two explored topics.

[Impact on Education and Society]

To increase efficiency and quality of my work, I aim to apply what I learned in Germany (on experimental techniques, lab organization, student supervision) into the research and education in my research group.

[Future Outlook]

I strongly believe that this experience greatly contributes to the internationalization of our school and the quality of our researchers and their research projects. Furthermore, introducing the overseas study program as mandatory for all early-career faculty would greatly advance their professional maturation process.

At last, I would like to express my sincere and deep gratitude to our Dean, Professor Mikio Nakazono, for enabling this valuable opportunity.

