Report: MERIT Long-term Overseas Dispatch

2015/7/22 – 2015/9/14

Department of chemistry and biotechnology, 3rd year PhD student

Yusuke Ota

In this MERIT long-term overseas dispatch, I have stayed Bernhard Breit group, the university of Freiburg for about two months and performed the research. Breit group is focusing not only on developing novel reactions using transition-metal catalysts but also on synthesizing natural products by using the reaction developed by them. During the stay in the laboratory, I have mainly tried the development of the reaction. Furthermore, I could learn how they expanded their research to total synthesis based on the reactions they had developed. These experiences would be helpful for me to think of new research proposals.

Background and research

Although the main subject of my research is polymer synthesis, I have also been interested in synthesis of natural products, and the synthesis of natural product is now going with coworker. During the study, I was interested in regio- or stereoselective reaction achieved by binding a substrate to a ligand. The interest motivated me to go to the laboratory focusing on such reactions. Furthermore, I would like to learn total synthesis, in particular, the way to plan a retrosynthesis by using the developed reaction. Then, I decided to go to Breit laboratory that conducted the reaction development and total synthesis. I came up with the research proposal of regioselective hydroformylation, and sent it to Prof. Breit. He kindly accepted my visit to there for two months.

In the first day I visited, research plan during my stay was first discussed. In the discussion by e-mail before that, He told me that they had already tried the reaction I had written to him and the reaction had not gone well. First he told me the side-reaction that occurred during the reaction and discussed on it. The reaction was the one I had expected when the research proposal had been written and I had an idea to suppress the reaction. He also had another idea to realize the proposed reaction. I chose his idea between them as the research for two months. Then I started the research, synthesis of the ligand. Although he proposed a synthetic scheme to me, I came up with another synthetic scheme, which was based on my experience of the synthesis of phosphine ligands. Although the synthesis included an unreported reaction, the reaction proceeded smoothly and the ligand was obtained, suffering from purification due to the instability of the ligand

Then I tried hydroformylation by using the obtained ligand. As the result, the different regioselectivity was compared to that by using a conventional ligand, although it was not high enough.

Figure 1. University of Freiburg, the building for chemistry and biochemistry

Research and daily life in Germany

Freiburg, located in south end of Germany and closed to Switzerland, is one of the most popular city in Germany because weather is fine and it is one of the warmest city in there. I did not feel any anxiety for safety during the stay. I could not communicate fully in English at supermarket and restaurant, although some word could be understood. The recollection of German words, which I have learned around 8 years ago, was more useful than English to live there. The big difference in daily life is that almost all of the shops in Germany are closed on Sunday, except museum, restaurant and kiosk in the station. Also people are rarely seen in the main street.

Since laboratory members can speak English, I did not feel any trouble in the conversations. In the laboratory of meeting, it is held in English in the case people who do not speak German join it. when I had lunch with them, they talked in English and I could enjoy talking with them. They are interested in Japanese culture and life and often asked to me, “How about in Japan?" or "How do you say in Japanese?" It was difficult for me to find words exactly corresponding to Japanese ones.

Laboratory equipment was satisfactory; there is one rotary evaporator for each person. In addition, they have taken care of safety; organic solvent which has been stored to a final shelf of firm door made of metal, when using a gas with toxicity need to borrow a key for cylinder racks from human officer there were.

Most of the lab members started their research at around 9am, and left to home at around 18:00. After 7pm, nobody was there in most cases. In addition, Saturday was off. For the first time, I felt I did not have enough time to do experiment, but later I got used to doing experiments well during the time.

There are some chances to join the meeting in spite of the summer vacation period. Among them, I participated Mid-term presentation for undergraduates. Although I could not understand what they talked because the presentation was held in German, I could understand the content they talked from slides, in particular, from chemical structure in it. I felt that common language, chemical structure in this case, made it easy to overcome the differences in languages. In addition, they presented their research very well, although it was the first time for them to present their research. They have probably practiced presentations many times. I wondered if I had more chance to practice the presentation when I had been first or second year bachelor’s course student, because my presentation in mid-term presentation for undergraduates was almost first time presentation in my life.

I also joined the meeting, in which current research was introduced. Compared to the meeting in the laboratory I visited during MERIT Errantry to the United States, fewer questions were asked by students. On the other hand, professor joined the discussion whole the time, the same as the meeting I joined previously. Also in both laboratory, meeting was held drinking beer, which I have never seen in Japan. I felt that It would sometimes activate the discussion.

Lastly, I am grateful to MERIT program and Prof. Nozaki for giving me a great opportunity to conduct my research abroad, and Prof. Breit for kindly accepting my stay in his laboratory. I would also like to thank members of Breit group, who taught me the experiment kindly and talked to me friendly.