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Vanderbilt University | Max Planck Institute for Terrestrial Microbiology

RISE 2023 Final Report

During my DAAD RISE internship, I was based in Marburg, Germany, where I conducted bacteriology research at the Max Planck Institute for Terrestrial Microbiology. Marburg has a rich history in German culture, being an inspiration for the Brothers Grimm and their fairy tales. Over the course of ten weeks, the small university town won over my heart with its beautiful castle, churches and half-timbered houses. My impression of research in Germany was of a very welcoming lab environment, important focus on work-life balance, and exciting new technologies in microscopy. I also noticed and appreciated a commitment to environmental sustainability in Germany overall, which included reduction of plastic waste and more energy saving policies.

My research focused on bacterial type III secretion systems, also known as injectisome, which serve as a molecular needle that injects proteins into host cells during infection. I found my lab's novel approach of using optogenetics to study these systems particularly interesting. By using different wavelengths of light to control the mechanism of protein interactions, we were able to probe functions at a very precise level. My project involved investigating the gatekeeper complex, a component of the injectisome of *Yersinia enterocolitica* using microscopy and optogenetically-controlled secretion assays. Although I found my previous experiences in microbiology research to be highly transferable to this project, I also learned a lot of new techniques during this experience. In addition to my own project, I was also able to shadow work done by other PhD students, such as single-particle tracking microscopy, which was super exciting.

A typical day in my internship started with a short bus ride to the Institute, located at the top of a steep hill in Marburg. I would arrive around 9:30 am and meet with my mentor, a PhD student, to discuss what we would be doing that day. I usually worked on parts of molecular cloning projects, such as PCRs and running gels in the morning. I would also prepare the optogenetic setup, consisting of blue lights around an incubator, that we used to control the bacterial secretion of proteins. On Mondays, we would have lab meetings where a member presented their recent data and everyone would give insight on troubleshooting experiments and future steps. Occasionally, I also attended seminars given by visiting professors and students in other departments, like an AlphaFold workshop I found to be useful even for my research in the U.S. Since the Max Planck Institute hosts scientists from all over the world and my lab had students from France, Italy, China, and the Philippines, all meetings and seminars were held in English. At 12 pm, my mentor, a few other PhD students and I would have lunch in the atrium. On sunny days, we would sit outside in the courtyard and enjoy the good weather. Afterwards, I would run SDS-PAGE to check for protein secretion or do microscopy with new mutants

generated during the cloning process. Around 3 pm, the students and I liked to take a coffee break to refresh our minds for the remainder of the day. I would arrive home around 6 pm depending on the length of the experiments. For dinner, me and two other RISE intern friends would go out and try new restaurants in the city together at least once a week. Other times, I would do some grocery shopping and cook in my apartment after work.

I would highly recommend opening a WISE account and debit card (for interns from the U.S. and Canada) prior to leaving home for Germany. This is an easy way to receive the DAAD stipend and be able to use the money at most stores. For traveling around Germany, the 49 euro ticket covered regional transportation including trains and buses. As of 2023, this deal is helpful for saving money on local transport, but does not include high speed trains (ICE). For long distance trips, it was even possible to take regional trains to places like Berlin and Hamburg, provided that you are willing to make more train connections. Short-term housing may be limited in some cities, so it may be necessary to keep sending out messages on WG-Gesucht, an apartment finding website. Also, Airbnbs were another popular and reliable option for summer interns.

Some highlights from my internship included getting to travel around Europe with friends and family. I went to Paris with my family when they were visiting me in the middle of my internship. After finding a student travel agency that hosted affordable weekend trips across Europe, I also went to Prague and several cities in Italy with my friends from DAAD RISE. In my daily life, I loved connecting with people living in Germany and having cultural exchange through our discussions. I highly recommend the RISE program to students as a life-changing experience that expanded my worldview scientifically and personally.

“I agree that my report and accompanying pictures may be used by the DAAD in printed materials, presentations, and on websites in order to inform funding organizations, sponsors, and students about the RISE program.”