

My Internship at the University of Agricultural Sciences in Uppsala, Sweden

01.06.2023 – 09.08.2023

General Statement:

In the summer of 2023, I had an opportunity to intern at the University of Agricultural Sciences (SLU) in Uppsala, Sweden. The internship spanned from the 1st of June to the 9th of August, under the supervision of Prof. Lutz Ahrens and Prof. Foon Yin Lai. My principal project at SLU was to help investigate the fate of antibiotics in soil systems, so that they could be characterised later on. I was assigned to work with lysimeter columns, which included preparatory work and 6 weeks of irrigating soil samples and collecting water samples.

During this period, I also compiled data about municipal waste water treatment plants (WWTPs) in Sweden into tables for an easily accessible database (to be published by a colleague). For my final task, I extracted Per- and polyfluoroalkyl substances (PFAS) from a different set of soil samples and analysed them following a standard protocol. I organized them into an excel spreadsheet, enlisting their presence and concentrations in the various soil samples. It was fulfilling to be able to apply and put both my theoretical and practical knowledge and skills to the test.

During my internship at SLU, I attended weekly research meetings and participated in routine laboratory cleaning sessions. Furthermore, I attended a few research conferences, and was able to observe how different organizations addressed issues that were geographically related to them, and to the world as a whole. It was quite interesting to network with fellow researchers, too. When I was in Stockholm, I had the opportunity to sign up for a climate conference organized by Fridays for Future. It was an exceptionally productive session and I was able to meet like minded youths, including Greta Thunberg.

During the internship, my passion for science and research was reinvigorated. I was able to broaden my knowledge on laboratory techniques and experience working in a diverse research group. It further cemented my aim of becoming a good scientist, and that there are many things to look forward to in the field of research. Upon some self reflection, I also realized that I am on the right path, career wise and that I have grown in confidence and self. I am extremely grateful to DAAD and my supervisors for the opportunity to further my career and experience in STEM, and encourage everyone to apply to this transformative programme!

Application Process, Transportation and Accommodation:

I learned about the DAAD RISE programme from alumni of the programme and from a Prof. of Chemistry at my university. Therefore, I had ample time to prepare the required documents for my application. It was in early December that I submitted my application, and in late February that I received news of my acceptance, after which I promptly contacted my project supervisor, Prof. Ahrens. We discussed the period of my internship and the project to be assigned to me. We communicated via email, and he sent some research papers that I could familiarize myself with, before the start of the internship. He also made some recommendations for accommodation in Uppsala, as well as travelling from Germany to Sweden.

The most accessible means of transport to Sweden from Germany is via train, but at the time, I was not able to access the corresponding websites to book my tickets. Another option was to take an overnight ferry, but I was not comfortable with that mode of transportation. Therefore, I decided to book a Flix Bus. In comparison to travelling by plane, it was a more affordable and environmentally conscious decision. Since I had a Schengen Visa, I did not require any other documents, except for my passport, when passing international borders. As far as I know, I did not have to worry explicitly about health or travel insurance, because it was covered by DAAD.

I was lucky in finding an accommodation in Uppsala, because *Studentboet* connected me to the owner of Sunnersta Herrgård. I recommend emailing *Studentboet*, when you have any difficulty in finding housing in Sweden. Their email address is kontakt@studentboet.se. The Herrgård was close to the university – a 25 minute walk to *Mark Vatten Miljöcentrum*, where my laboratory was located, and less than 10 minutes when cycling. I was able to meet new people at the Herrgård, mostly international students studying in either SLU or Uppsala University. Once in a while, we had *Fika* (Swedish coffee break) together.

Uppsala is a bike-friendly city, so I recommend buying/renting a bicycle. As I was only there for a short period of time, I did not want to invest in a bicycle. The other alternative to cycling/walking, was taking the bus. UL is the transportation system used in Uppsala. It is convenient for you to purchase tickets when you install the application on your phone. However, tickets are quite pricey, especially when considering the fact that we cannot get a student discount (because we need a validated card, which is not available for our short term stay).



Image 1: My room in the Herrgård



Image 2: The Northern Wing

Brief Notes on Uppsala and SLU:

Uppsala is the fourth-largest city in Sweden. It is located approximately 71 km north of the capital, Stockholm. According to the website 'Visit Sweden', Uppsala is a respected university town with a long history. Students from all over Sweden – and the rest of the world – make up almost a fifth of the population, giving it a youthful, and international feel. Uppsala is considered an important innovation city where science and business work together to create a breeding ground for new ideas. For example, the pharmaceutical company Pharmacia had its headquarters in Uppsala for half a century before it was bought by an American company. Furthermore, Maria Strømme - Sweden's youngest professor in a technical subject - developed the nanotechnology innovation Upsalite here. ¹

According to the university webpage, 'SLU is a world-class international university with research, education and environmental assessment within the sciences for sustainable life.' Its principal sites are located in Alnarp, Umeå and Uppsala, but activities are conducted at research stations, experimental parks and educational establishments throughout Sweden. SLU brings together people who have different perspectives, but the same goal: to create the best conditions for a sustainable, thriving and better world. The university is centred on science and education for a sustainable life. ²

There are numerous activities that you can do in the summer in Uppsala, and even Stockholm! There are many cultural and historical sites in the city, including Carolina Rediviva, Gamla Uppsala and Uppsala castle and art museum. Stockholm, which is only a few hours away by bus and 40 minutes by train, houses the Nobel Prize Museum! It is definitely worth a visit to the museum to see artifacts and journals of past Nobel prize recipients. The Vasa Museum is also popular among tourists. Summer in Uppsala was very pleasant, with sunny days and very little rain. The weather was ideal for travelling, especially during the weekend.



Image 3: Uppsala Castle



Image 4: Replica of Radioactive Elements in the Nobel Prize Museum

My Internship Project(s):

The main project of my internship was to investigate the fate of antibiotics in soil systems, so that their properties could be characterised. For a project of this scale, time was a constraint, which is why Prof. Yin Lai will analyse the samples that I have collected in the near future. There were some equipment and materials that needed to be prepared by the professors, so I did some light reading during the first two weeks and tested which lysimeters were working, and to what capacity. The set up of this experiment included 10 lysimeter columns, which contained sandy soil. They were spiked with an antibiotic mix, and irrigated with different water sources, including black water, influent and effluent wastewater from different systems.

Before starting the experiment, I had to clean all of the equipment that we would be using with methanol and ethanol. This became a weekly protocol, because the equipment had to be rinsed after sample collection, too. I irrigated the lysimeters every Monday, and collected the water samples every Wednesday, for six weeks. The samples were meticulously labelled and stored together in the freezer. At the end of the initial phase, there were a 110 water samples collected. They will be analysed by the same methods used during PFAS extraction.

I also did some work outside of the laboratory, which was compiling data about municipal waste water treatment plants (WWTPs) in Sweden into tables for an easily accessible database (to be published by a colleague). For this, I also read up on some research papers organized by the Swedish Environmental Research Institute.

For my final task, I extracted Per- and polyfluoroalkyl substances (PFAS) from a different set of soil samples and analysed them following a standard protocol. The analytical method used for the final analysis was LC-MS (liquid chromatography-mass spectrometry). I organized the data into an excel spreadsheet, enlisting their presence and concentrations in the various soil samples. During this process, I was able to learn new laboratory techniques like using an ENVI carb cartridge system and a nitrogen evaporator.

In conclusion, this internship was as promising and rewarding as I had thought it would be. I was able to broaden my knowledge on laboratory techniques, as well as experience working in a diverse research group. My colleagues and supervisors were very friendly and approachable, too. The working atmosphere in the laboratory was conducive to a productive work environment.



Image 5: Lysimeter Columns (Top View)

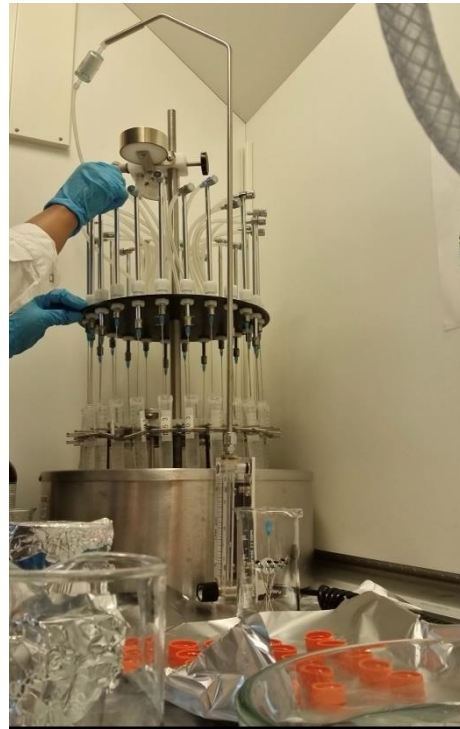


Image 6: Water collecting in Volumetric Flask from Lysimeter No. 26
Image 7: Nitrogen Evaporator

References:

- (1) *Uppsala: Kultstätte der Wikinger*.
<https://visitsweden.de/regionen/mittelschweden/uppland/uppsala-kultstatte-der-wikinger-und-des-wissens/> (accessed 2023-09-11).
- (2) *SLU - a broad and sustainable university*. SLU.SE. <https://www.slu.se/en/about-slu/> (accessed 2023-08-07).

Acknowledgement:

I am extremely grateful to DAAD and my supervisors for the opportunity to further my career and experience in STEM.