

## Armourers & Brasiers' European Placements - Non-Technical Reports

After two gruelling years of Cambridge, my arsenal of knowledge and skills in materials had been heavily upgraded, ready to tackle on the next hurdle in our undergraduate academic paths. Yet, I was unsure whether this preparation was sufficient for me to contribute and grow in a world where science gets more competitive and the groundbreaking researchers seem to be neo-Einsteins. Thanks to A&B and EPFL, Switzerland however, CaMPUS European Placements have provided me with a second opportunity that has left me convinced of the incredible development and opportunity to thrive provided by research institutes and has strengthened my resolve to apply for a PhD and continue on my arduous but rewarding scientific journey.

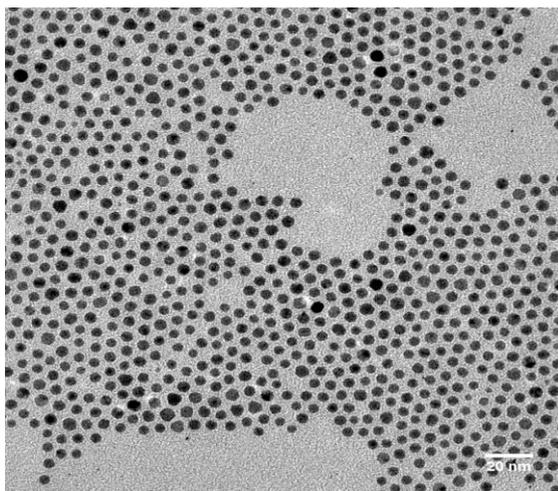


*View on the way to the Aletschgletscher – The largest glacier in the Alps.*

When given the option to select my institutes, EPFL stood out to me not only due to the fact that it was in a French speaking region, but also due to my interest level in the projects they were working on. I had learnt French back in school and did (on paper) have near native level fluency, but immersing yourself into the local culture and being able to hold conversations with them, tuned to the idiosyncrasies of the region was a completely different ballgame all together – one that I really wanted to master as far

as someone could in these 10 weeks. The Supramolecular Nanomaterials and Interfaces Laboratory (SuNMiL) were offering to host students to gain an insight into their research involving nanoparticles that have a multitude of uses today the most commonly known one to be drug delivery for treatment of cancer. However nanoscience and nanotechnology is still new – much of their science and properties are yet to be studied thoroughly so they can be explained, and eventually exploited for use in many more industrial and medical applications. This prospect of fundamental novelty and uncertainty in thriving field greatly excited and encouraged me to undertake one of their placement opportunities.

Throughout school and university I had always loathed experimental work and have always tried to get out of it by choosing theory based projects and placements. Unsurprisingly I was a very unconfident and inexperienced experimentalist. I had always imagined that working in a research environment involved limited social interaction and long hours standing behind a desk wearing a white lab coat just running experiments while logging down every failure and success. In this project, I worked to synthesise, clean and characterize a series of MDD-CBO and hexanethiol (HT) mixed ligand AuNPs. While there are various methods to synthesise nanoparticles (with the most of the accurate ones like lithography being very time consuming and cost ineffective), I embarked on a route that synthesises nanoparticles capped by Oleylamine (OAm), and optimised the method by controlling the solvent, temperature and the ratio of reducing agent and gold precursor, to obtain a better control of size, shape and



*A TEM Image of my gold nanoparticles*

polydispersity of the nanoparticles we wanted to use for the ligand exchange reaction that followed involving different feed ratios of the two ligands I used. I then attempted to optimise the cleaning procedure for the nanoparticles to remove all the free ligands remaining around the nanoparticles after the ligand exchange so as to enable an accurate determination of the ligand composition of the AuNP shell.

Finally the nanoparticles were incorporated into the liquid crystal (and other media) to characterise both the nanoparticles themselves, their ordering in the liquid crystal and their

effect on the properties of the liquid crystal itself. In doing the above, I encountered a wide variety of experimental synthetic materials chemistry techniques, analytical centrifugation, soxhlet, column chromatography as well as analytical techniques such as Transmission Electron Microscopy (TEM), Nuclear Magnetic Resonance (NMR) spectroscopy, UV-Vis spectroscopy and optical microscopy.

My colleagues were comprised of Masters and PhD students as well as post-doctoral researchers, all of whom were extremely helpful and aided me with my work every step of the way. The most impressionable aspect of this was the ease with which any of the members of the research group could be approached, and how welcoming they were to a novice, ensuring that I understood and



*A beautifully constructed cathedral in  
Lausanne's Old Town*

learned as much as I could over the 10 weeks I spent there. While I had very strict regulations in terms of having to be indirectly supervised while working in the labs for my own safety, many of the post-docs including my supervisor kindly stayed back very late in the day and to enable me to complete my work and provide me with any support I needed.

The department I worked in was highly international consisting of Masters students, PhD students and postdoctoral researchers of Brazilian, British, Chinese, Chilean, French, German, Greek, Iranian, Italian, Spanish, Swiss, Turkish and Vietnamese nationalities. English was the primary language of work-related communication. Despite the presence of French-speaking members in the group, I had close to no opportunity to practice my French within the group itself. However, that is not to say that I did not converse in French with students in other groups in EPFL or out and about in Lausanne. Speaking to native speakers had always been my biggest inhibition with any language, but over the weeks I spent there I am glad to have taken every simple opportunity to learn more from those who spoke to me

and even have held hour long doubly educational discussions during bus and train journeys. Regardless, while I was excited about the prospect of immersing myself in anything French or Swiss related, it was certainly a great relief to be working primarily in English to ensure that I fully understood the tasks delegated to me.

Switzerland is a melting pot of cultures and Lausanne even more so, with 49% of its inhabitants being non-Swiss. Regardless, there was always the linguistic challenge of the regional slang and differences in French that I had to get accustomed to, in addition to the stares of total incomprehension during my travels to the German speaking Switzerland. There were also many technical challenges I faced being very inexperienced with experimental work when I first arrived. While I was given some choice with the kind of work I'd like to do over my placement, I did not know how to use many of the equipment I was expected to despite being aware of the theory behind how it worked. This required a lot of effort on my part to observe, repeat and always ask questions whenever I was in doubt. Although it was an extremely difficult and slow learning curve in the first few weeks, I am also extremely proud of having tried my best to grab any opportunity I had to get acquainted with new tools and analytical instrumentation so I could leave at the end as a more experienced experimentalist than I would have had I stuck to my comfort zone.



*The Mighty Matterhorn! (Toblerone Mountain)*

My supervisor, who is an avid hiker, was very encouraging throughout my placement to take the opportunity to see as much of Switzerland as I could. So I took his advice and Lonely Planet books and hiked to UNESCO World Heritage sites like the Lavaux Vineyards in St Saphorin, a trip to the top of the Jungfrauoch, the highest point in Europe, the mesmerising valleys of Valais and Aletschgleischer and an extremely difficult but rewarding climb alongside the

Matterhorn, also commonly known as the Toblerone or Triangle mountains. Lazier days saw trips within Lausanne itself which boasts a beautiful view from the lake Léman at Ouchy, immaculately preserved cathedrals in the old town and even a quick 35 minute boat ride to Évian-les-Bains, the source of Evian water in France!

Within our courses we are often very focused on experimental techniques in our practicals to yield results we already know the answers to with the purpose of employing the scientific method in the process. However this placement has revealed that real research is nothing like practicals. While one can postulate what the results may yield, the scientific method is all about adapting, and adjusting our method and thinking to what the results reveal. Thanks to this placement, I am glad to realise that despite all the hard work and moments of frustration that my tasks brought along, I am now even more eager to pursue a career in bio and nanomaterials research when I realise the unparalleled sense of pride and joy each small step and each little discovery leads to.

All in all, not only have my expectations for my placement been met, they have been greatly exceeded both on the academic and personal fronts of development and I have been pleasantly surprised by how amazing the realm of research can be and how versatile the career paths within and leading to Materials are. Just as it was within my research group, physicists, chemists, biologists, materials scientists can all play an interdisciplinary role to help achieve significant advancement in their chosen field, despite fulfilling different roles in the process.



*A happy Malavika at the end of her placement hiking back down to Zermatt. Thank you for this incredible opportunity!*

Needless to say, if it were not for the great support provided by the Armourers and Brasiers' by supporting me financially along with the University of Cambridge, Professor Stellacci's group and my supervisor Dr. Stefan Guldin, I would not have been able to complete what I believe was a very scientifically and personally fruitful and enriching summer placement experience in the land of the mountains, the lakes and incredible cheese.