

UROP: Undergraduate Research Opportunities Programme

A Personal Perspective by Amelie Lecoeuche

Amelie had just completed the second year of an undergraduate degree in Chemical Engineering, and embarked on an UROP research experience in the summer of 2015 under the supervision of Paul Fennell (Department of Chemical Engineering).

Placement Title: Development of Novel Porous Materials used as Oxygen Storage Materials for Chemical Looping Combustion

The chief attraction of a UROP placement for me was the prospect of doing something constructive during the summer break. Not only would I be doing something intellectually stimulating, but I would be contributing to real research – something of tangible use to other people. In addition, I would be simultaneously encountering practical examples of the theory from lectures and discovering entirely new concepts. I could therefore consolidate knowledge already acquired and see how these ideas have been adapted and refined.

During the experience I would be able to develop practical and soft skills. Working in a research team would allow me to further develop various interpersonal skills and problem-solving skills in a more professional setting than ordinary undergraduate projects. Furthermore, I would be exposed to new laboratory equipment and techniques.

Finally, UROP was for me a chance to discover what working in research is like day to day, and to see how much work goes into developing new technology and knowledge. I hoped to use this experience to help me decide whether research would be a career path that I might enjoy.

Securing my UROP placement called for enthusiasm! I mainly applied to research with staff whom I already knew through lectures, as I had an idea of what kind of work they did and what they were like. In this way I could guess both what I would be doing and how easy it might be to integrate into the team. I had actively participated in Dr Fennell's lectures and problems, which meant that he knew who I was. Fortunately I had made a good impression...

After the initial email to apply to work in his research group I went to an interview, where we discussed why I wanted to do UROP with him and what I hoped to gain from it. Before the interview I made sure to read more on exactly what Dr Fennell's research was about and to identify what I found interesting about it, in order to be prepared for these questions.

Having secured my placement, I had considerable preparation and training before I was trusted to work safely in the lab. The research in Dr Fennell's group involves working with high temperature high pressure reactors, so I was given a full lab safety induction. I needed to know what to do and who to contact in an emergency, ordinary good safety practice, was reminded to wear PPE and warned that I would need to read the hazard sheet for every chemical I used and need specific training for every piece of equipment I manipulated.

Thus armed with reams of safety training and advice, I was ready to plunge into the world of research. I would not describe my UROP experience as a series of key events and troubling challenges to resolve, but rather the steady accretion of knowledge and skills through immersion into a foreign environment. I would begin by performing simple, practical tasks and the knowledge would slowly build up around it until I understood what I was doing and why.

Integration into the Team

I have drunk more coffee than could possibly be considered reasonable. Drinking coffee allowed me to discover that that one member of the group has never tried sushi, and how to say 'are you hungry?' in Chinese. Bonding with the group meant that I could ask technical questions and thus keep track of what other interesting research was happening in the group and discussed in group meetings. Paying attention to how people reported their work in group meetings meant that I learned to present to the research group the work I had done in the last week. And even explain the things I was going to do next.

Practical Lab Skills and Experiences

I have wandered parts of the college I didn't originally know existed – WITHOUT getting lost. These expeditions were largely to the Stores: a magical place which has *everything*, except maybe that piece of equipment you need. Once I had fetched the new equipment, I carried out tasks such as efficiently cleaning bits out of sieves (as well as actual sieving), mixing precise weights of powders, and measuring volumes of solutions using syringes - thankfully without causing damage to myself. As for more advanced equipment, I learned to set up and programme a tube furnace for high temperature treatment of samples. I also learned that when the furnace leaks foul-smelling fumes, I must put on a mask BEFORE attempting to fix the problem.

These tasks, whilst useful to master in their own right, also reminded me of the virtue of patience in research. The draft caused by someone walking past will disturb a measurement on the balance. Equipment, when used regularly by different people, has a habit of vanishing mysteriously. And a test might need to be repeated dozens of times with minor adjustments before the experiment is successful. Most importantly, repeating tests taught me to work out a sensible change to try if my experiment failed, and keep track of all my experiments until I find the one that works.

Academic Analysis, Reading, and Reporting

It was an important discovery that is okay if you do not recognise all of the words – sheer repetition will cause you to understand eventually. The repetition is usually in the form of scientific papers I had to read in order to find useful information for my project. Thanks to the research, I can now describe four different ways of making a material with pores in it. I can explain how, theoretically, and oxygen carrier could be used in CLC (Carbon Looping Combustion). And even explain why achieving CLC is desirable.

Proof of my new understanding is that I can explain these theories to my parents in such a way that they will understand, and link said theories to prior class work. I can also look at the results of an analysis and understand if the results are good or bad compared to what has already been achieved. Finally, I can collect all of the new knowledge I came across into a document which can convince others that I understood what was happening, because, for the most part, I did.

Final Impressions

As humans we have great skill in adapting to new situations and so once the novelty of being surrounded by equipment worth more than a month's rent in my flat had worn off, I could focus on the important aspects of being in the lab: that is, how the equipment was used to and the ideas being explored. The superficial aspects of being in a fully equipped laboratory were of course pleasant: always being able to find clean glassware is a definite advantage over undergraduate labs. However the truly extraordinary and exciting thing about the UROP placement was the knowledge being developed by the team. Theories I had been unaware of, let alone knew how to apply, were being explored, demonstrated and quantified. I was in a lab where work is being done to make industrial processes greener, and the ideas being developed to solve current problems to do with our environment were simply marvellous. I am proud to have contributed to Dr Fennell's team this summer, and feel that my time spent on the placement has helped to prepare me for when I will need to perform research of my own later in my course.