UROP student perspective

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Undertook the UROP in the Dept of Electrical and Electronic Engineering at the end of Year 2 of a 4-year MEng

My motivation for doing the UROP

During my first and second year, I took the "semiconductor devices" module taught by Dr Fobelets. In this module, I was able to know the fact that the computer revolution has been driven by the continued size reduction of transistors in the constituent integrated circuits. Curiosity motivated my interest in semiconductor devices which play a key role in the integrated circuits development. However, what I learned was not able to satisfy my curiosity. Therefore, I have a strong desire to pursue a PhD at a later stage so as to seek a greater depth of knowledge. In order to gain more insight into this subject area, pave the way for a PhD and raise my awareness of how research is pursed, I was motivated to undertake a UROP.

How I secured my research experience

I went to Dr Fobelets during term-time of my 2nd year of undergraduate study. I showed her my interest in the field of Semiconductor Devices, and she was very kind to offer me a research experience. She provided me with two research topics which I might be interested. I picked the one entitled "*the measurement of FinFET characteristics*" because I'd like to know why FinFET has better performance. Besides, it is a very new technology, and new things are always attractive.

Preparation I undertook before my research experience commenced

After finishing the 1st year "Semiconductor Devices" module, I decided to further the study of this course in the 2nd year as an elective module. The 1st year course gave introductions to the major semiconductor devices, and basic concepts behind them. While the 2nd year course emphasised on non-ideal behaviours which usually need to pay more attention. Before starting the research, I did my reading, including a book titled *Fundamentals of Ultra-Thin-Body MOSFETs and FinFETs* by Jerry G. Fossum, and many relevant documents online. This prepared me well for my UROP because I was able to understand key concepts and familiarised myself with the device I was going to investigate

Training and other orientation undertaken at the beginning of my research experience & The skills and experience gained or enhanced from undertaking my research experience

At the beginning of my research experience, I was offered a desk in the office of the PhD students who would help with introducing and getting to know the other members of the team. Supervision would be shared between Dr Fobelets and her PhD students. My research involved simulating and taking real measurements on FinFETs. In the first couple of weeks, I received the key review papers in the field and searched a wide range of useful materials online. The tool I used to simulate the device was TCAD Sentaurus, which is a very powerful software capable of creating device models and simulating electrical

characteristics of semiconductor devices. Many thanks to Mr. Ali Hamid, a PhD student who supported me in Sentaurus. The tools I used to take real measurements on FinFETs was probe station, which could source and measure signals on the internal nodes of device, and Keysight Semiconductor Device Parameter Analyzer, which could collect the data points and plot the electrical characteristics on screen. Thanks too go to Dr Fobelets and Mr Christoforos Panteli for training me to use the tools.

It was really tough to use the probe station. I had to be very patient to adjust the screw on manipulators and run the measurements over and over again to check it was really measuring the device but not the air. After extracting the data points, I worked out the MATLAB code to plot the characteristics as well as deliver the results.

Sentaurus is very advanced. I'm very grateful to have the opportunities to try it out. It was so powerful that completely understanding it seemed to be impossible but learning the way to use it allowed me to know how it worked and expanded my mind. This is a very rewarding experience for me.

How it has helped my professional and personal development.

In terms of technical knowledge, I gained more appreciation of the device FinFET and other concepts which are all out of the scope of classes. Moreover, I enhanced my skills in MATLAB. Some of the introduction and work in the practical area were very beneficial for me as it gave me a much broader insight into the semiconductor research field.

I also gave several presentations to the group, which made me think about how to organise my experiments so that I could clearly demonstrate my outcome and my thoughts to people who might not be experts in this area.

In addition, I realised the importance of keeping a clean and clear logbook during the research, which helped with recording what I had done as well as any ideas that just popped up in mind together with the clues, so I could trace back at any time.

How it might influence the remainder of my course and my future career pathway.

I had the opportunity to talk with PhD students and ask them how they started their academic career.

To summarise, it is critical to find your own interests, be resourceful and hard-working.

I'd like to thank them all for being so friendly and giving me a helping hand during the 8-week UROP and helping to me realise that research could be for me after all.

Finally, thanks go to all the rest of the group and other people who have made my time for UROP in the EEE Dept at Imperial so great.