



### **“What advice would you give to students starting your course?”**

“Has it worked this time?” I asked myself. In the darkness, the red and green fluorescent blobs under the microscope morphed into a hazy scene where I was signing copies of my *Nature* publications at a prestigious international conference in Hawaii. Snapping out of my reverie, I found myself staring at my hundredth attempt at growing brain cells in culture, an experiment I had been toiling over for months. Surely three years of research would provide me with huge swathes of results beyond my wildest dreams. I was wrong. If I could only give one piece of advice to students at the start of their PhD, it would be this: “Don’t expect to make ground-breaking discoveries.” During your doctorate, the *process* of training to become a good scientist is more important than the quantity of data you produce or the topic you study.

With the benefit of hindsight and a few more wrinkles, I have recorded several pearls of wisdom that I wish I had known about earlier.

#### **Don’t expect experiments to work every time.**

‘Effort is proportional to results,’ or so I thought. I changed my mind after it took me more than two years of failed experiments before my cultured brain cells sprouted axons in culture. Sheer determination may eventually lead to positive results but the path can be littered with failed attempts. It is hard not to feel disappointed when an experiment fails but the key is to dust yourself down and try again. However, don’t be a slave to the bench. I wish somebody had told me this earlier as I could have avoided exhausting but fruitless long hours in the lab. Stubbornly repeating an experiment with no improvement is like bailing water out of a boat using a bucket full of holes, oblivious to the shortcomings of your tools. Taking time out from the task at hand to patch up the holes in your bucket, by reading a few papers, enjoying some much-needed sleep or simply treating your lungs to some fresh air, can do wonders for your research. In my case, changing a few materials and getting advice from another laboratory made the difference between success and failure. Luckily my supervisor and a wonderful post-doc gave me lots of useful advice when times were hard. Rather than spoon-feeding me ideas, they encouraged me to be independent.

#### **Read but don’t forget lab work.**

Keeping up-to-date with the published work in your subject is vital. Research and review papers provide useful background information, prevent duplication of effort and often serve as primers for your own experiments. I was lucky to have a head-start as my Wellcome Trust-funded PhD required that I write a grant proposal outlining my research plans over the next three years. This proved daunting but forced me to read papers that gave me an overview of the type of experimental methods other labs had used in my field of brain development. Although reading is important, get your hands dirty in the lab too. You will not get a PhD through reading alone. I remember that the learning curve was steep during my first few weeks. Not only did I have to learn new techniques but I also had to memorise a dozen or so different combination codes to gain entry to various parts of the lab. If in doubt, simply ask a member of the lab. It saves a lot of time in the long run and ensures that you are practising good science from the start. Remember that experimental techniques are the means by which a result is reached and that these results will be held up to scrutiny by fellow scientists. The study of living things is variable enough without having to worry about spurious results from sloppy practical work.

#### **Record every little detail.**

Recording your experimental methods and results on a daily basis is absolutely vital. Not only does your lab book allow you to keep track of your research and provide a doodle-pad during those five minute incubation periods, it is essential during the writing-up process. Record *everything*, even details that seem unimportant at the time. These may help with interpreting your results and provide the missing pieces in the jigsaw at the end of your PhD.

### **Network.**

Throughout my PhD I have presented posters both within the University and at several international conferences. These opportunities allowed me to meet the scientists behind anonymous 'Smith et al., 2000' tags of journal papers. Even though conferences can be daunting, especially if they are huge and full of eminent Professors, they provide a wealth of unpublished information, contacts and support and potentially your next job. I came back from all my conferences feeling energised, motivated and bursting with new ideas, knowing that I had international contacts whose expert support I could draw upon. Meeting other PhD students, sharing experiences and hearing that their experiments did not always work offered a strange type of consolation. As PhD students, we are all in the same boat but some have to row harder than others.

### **Think about your future.**

When you first step onto the PhD treadmill, it is easy to be lulled into the false sense that three years is plenty of time to think about your next step. However, it is never too early to prepare for life after your doctorate. Here at Edinburgh University, I have been able to take advantage of the 'transferable skills courses' ranging from web design to presentation skills. Some of these involved cheek-reddening moments, such as a video playback of my presentation in-front of the class but they all helped me immensely. Moreover, these courses helped bring PhD students together from all over the University, creating a support network among postgraduates. I was also lucky to get involved in science communication activities as well as instigating a series of careers seminars aimed at postgraduates. Rather than acting simply as brownie point-collecting exercises for future employment, these activities restored my sanity by relieving me from the intensity of life at the bench.

Looking back, more than three years after I started, I now appreciate how much I have achieved throughout my PhD. The road has been crazy but the end is in sight. My last wish? Merciful examiners in my viva.