

GREAT EXPECTATIONS



Rob representing Queensland biotechnology at BIO2001 in San Diego, USA.

Our series continues in which Australian scientists describe their journeys of professional and personal development. Robert Learmonth describes his diverse experiences of immunology, biochemistry, computer-aided learning, fluorescence and viticulture.

Fluorescent Reflections

My Impact? Buildings and their Demise

How do I summarise my career, achievements and impact? Perhaps the most interesting things aren't in my CV. For example, it struck me that the buildings that I first worked in are going or gone. The Monash Medical School building at The Alfred hospital in Melbourne has been decommissioned and is scheduled for demolition. It was there that I undertook my undergraduate training in microbiology and immunology, BSc (Honours) and PhD, and delivered my first teaching as a graduate student. While at the University of Melbourne for a meeting in November 2007, I noticed a pile of rubble that the day before had been the Trikojus Theatre and Advanced Laboratories of the Russell Grimwade School of Biochemistry, where I did my first teaching as a full-time professional. I later found that there is a YouTube video of the demolition (www.youtube.com/watch?v=S0VADwHkYQM). So the first two buildings I worked in are history. Moral of the story? Watch out if you work in buildings I once inhabited! Funnily enough, the logo of my current university is the phoenix arising from the ashes.

Back to the Start

While I was in Form 5 of secondary school, my favourite subject was chemistry, and my father took me to the University of Melbourne Open Day. I remember the exciting chemistry glassblowing demonstration and that biochemistry looked very interesting. On leaving secondary education, I had decided to try to get what was called a cadetship; to work in a job and study part time. I aimed to study Food Science at RMIT, lined up a QC laboratory position and, as a result, spent my Christmas holidays gaining (very) basic experience in their factory making Luv (dog food, that is). That and a host of other part-time jobs I had over the years instilled in me the desire to do well at university! Unfortunately, due to a company restructure, the promised laboratory position fell through. I tried unsuccessfully for two years to line up a cadetship, but meanwhile, undertook a BSc at Monash University.

What a University Degree won't Get You

A strong memory I have of my first days at university was being told emphatically that university was not (a) a dating / marriage bureau nor (b) an employment bureau. Sorry, wrong on both fronts: I married Barbara (we first met in first year physics prac) during my Honours year and I had to ask for my first job start date to be held back while I completed writing my PhD thesis.

On completing my undergraduate degree, I weighed up opportunities for Honours and postgraduate studies in biochemistry, microbiology and immunology at Monash and biochemistry at the University of Melbourne. I concluded that immunology was definitely the way to go, quite funny since I've only ever been employed as a biochemist! In the following outline of seemingly disparate activities, there are two linking themes: abiding interests in cell membranes and fluorescence.

Honours and Postgraduate Highlights

A deciding factor in my Honours direction was a fascination with instrumentation to observe microscopic events. My project centred on electron microscopy of cellular membranes in tumour cell-natural killer cell interactions, aiming to solve controversy over the cytotoxic mechanism. As well as performing the biological experiments, I prepared samples and observed them under the EM. While not relevant to my project, and despite its technical flaws, the electron micrograph in **Fig. 1** had a great impact on me personally. I was absolutely captivated by this image, which shows many of the cell membrane systems I had studied previously. This stimulated my interest and demonstrated to me that I could confirm for myself that what was in the books I read was 'real'. The other significant event at that time was getting married, which by contrast, helped make my seminar presentations seem easy!

After completing Honours, I undertook a PhD investigating the immunology of inflammatory bowel disease. Highlights of this work included using one of Australia's first monoclonal antibodies against T lymphocyte subclasses, around the time leading up to the definition of AIDS. The work involved identification of cells and autoantibodies by fluorescent staining of cell membrane antigens. During this time before PCs, I began to use computers heavily to aid in data analysis and word processing and became very interested in computing and its applications in science.

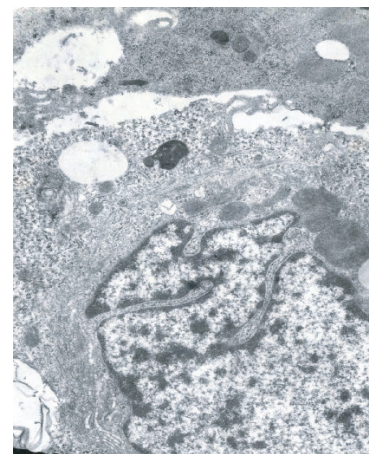


Fig. 1. The exciting electron micrograph of a cultured tumour cell in which numerous cellular membrane systems are visible.

First Position

While the norm was to undertake a postdoctoral position overseas, I decided to go for a job in the Biochemistry Department of the University of Melbourne, under Bill Sawyer's leadership. Although it was my first 'career' job interview, I nearly lost my cool on being interrogated by the resident 'terror professor', but managed to hang on and suitably answer the controversial questions. After surviving that, I gained some immunity and watched while others around me suffered. Recently, I was dismayed to be told that students in my department live in terror of me asking questions at their seminars – surely not?

In 1984, I started a 100% teaching position, coordinating and running advanced practical classes and developing computer-aided learning materials. The following year, we welcomed our first son, Craig. One of the challenging aspects of this position was teaching practical molecular biology after a six-year absence from the field during which knowledge had increased dramatically. This position allowed me to focus on my interest in developing scientific and teaching applications for computers and I completed a Diploma of Computing Studies. While I have enjoyed this work, one of the difficulties I have faced is that while it has been desirable to be skilled and active in education, what got me employment and promotion was 'traditional' biochemical research. Thus my educational activities have had to wax and wane according to opportunity, and at times, it has been a difficult juggling act to try and keep things going.

Following Positions

In 1987, I moved from the teaching position to a postdoc with Bill Sawyer, working on the role of spectrin in the erythrocyte membrane-skeleton. I used fluorescence and phosphorescence polarisation to investigate spectrin flexibility. Many thanks are due to Bill for his inspiration and mentorship. Within days of starting my second job, I moved house and became proud father of a second son, Mark. While working with Bill was immensely rewarding, I was nervous about 'the next contract' and in 1989, a year before my contract was completed, I moved from Melbourne to Armidale to take up a lectureship in biochemistry at the University of New England. I had attended the Australian Society for Biophysics conference at UNE, visited the department on finding out they had a job being advertised, wrote the application and mailed it from a friend's house in Brisbane. Adding to an interstate move, we welcomed our daughter, Amy, a month after we arrived. Believe me, driving 1600 km with a trailer in tow, a dog, two toddlers and an eight-month pregnant wife, followed by a dash to the hospital casualty department (which we had to find) in the middle of our first night in Armidale was interesting!

Highlights of the five years at UNE included starting work on yeast membranes and building my first industrial partnership with Paul Attfield of Burns Philp / Mauri Foods. This work on stress tolerance of baker's yeast progressed into research on general adaptive mechanisms. The second major achievement at UNE was establishing the Centre for Computer Aided Learning in a half-time position as Director. While this

was both challenging and enjoyable, I am sad to say that the centre has since met its demise. At the same time, I took up a position on the Editorial Board of *Biochemical Education*, as well as working alongside nutritionists and being exposed to rural industry research. The low point was running out of salary. When I got down to the last three months of my four-year contract, I managed to convince my industrial collaborators (with whom I had a \$200,000 pa ARC Linkage Grant) to fund my salary for two years, enabling me to complete the collaborative research. Four months into this contract, I moved to a lectureship in biochemistry at the University of Southern Queensland. I attended the 1994 ComBio meeting, starting as UNE staff and finishing as USQ staff. I remember saying to UNE colleagues not, "see you next week," but, "see you next ComBio!"

Is there Light at the End of the Tunnel?

I moved to USQ for yet another contract, this time three years. Younger readers may be concerned, as I was, about what happens at the end of a contract. My advice is to try not to stress too much; things will work out in the end. I was finally awarded a continuing position at USQ (on 12 months probation) after a total of 14 years and eight contracts. I even spent six months as Acting Head of Department while on a short-term contract!

Progress in my Current Position at USQ

I was appointed at USQ to an entry-level lectureship position on the basis of my experience in teaching, educational development and research. One of my directives was to assist USQ to build its research capacity. Over six years, I gained promotion through Senior Lecturer to Associate Professor, and was Acting Head of Department for six months and, later, Head of Department for six years. I was awarded the USQ Award for Excellence in Research in 2000, played a major role in establishing two research centres, participated in the review of USQ's centres policy and development of its intellectual property policy, and am currently a member of the management committee of USQ's Centre for Systems Biology. I have also been active in promotion of capabilities and interactions in the biotechnology industry, including participating in five Queensland Premier's contingents to the BIO congresses in the USA. More recently, I have been involved in setting up and managing the ARC / NHMRC Research Network for Fluorescence Applications in Biotechnology and Life Sciences, and have represented that network at national and international conferences. It has been quite an experience attending conferences from different perspectives – as a presenter in the scientific programs and also running booths at the commercial exhibitions. During this period, my research has continued to focus on basic mechanisms of yeast adaptation, but with changes in focus to brewing yeast and processes, and to current work on wine yeasts and fermentation.

I have focused a major effort in developing and applying novel techniques for fluorescence spectroscopy and microscopy for analysis of microbial populations. In 1997, I attended the first Australian fluorescence workshop organised by Bill Sawyer,

GREAT EXPECTATIONS

which had a significant impact on my career. The net result was a focus on laser-scanning microscopy technology, three ARC Linkage Grants to establish the technology in Brisbane and Sydney, and appointment to an adjunct position at the University of Queensland. At that workshop, I met Dave Jameson from Hawaii and Enrico Gratton from Illinois. Up to that time, I had been studying yeast membrane fluidity using polarisation of the probe DPH, and I was about to embark on a complex series of subcellular fractionations to further this work. Enrico gave a presentation on two-photon laser scanning microscopy, using a novel probe, laurdan, to determine membrane fluidity in cell membranes. I was so excited I simply had to get to Enrico's lab to try this with my yeast experiments. I managed to get an ARC International Project Grant to enable a month's work in 1998. That was a pioneering trip undertaken at some risk – we were seriously discussing whether due to their small size we would be able to 'see' yeast with this technology – I travelled over with fingers crossed! I felt like a pioneer venturing into the unknown and thought of Columbus. At the time, I did not know that in 1620, some of my ancestors had also made a pioneering trip to America on the Mayflower. Well, the trip worked out, but not totally as expected. I was the first person in the world to observe microbes using the technique of two-photon laser scanning microscopy. While the cells were in fact too small to optically dissect subcellular membranes, we gained important information on differential responses by individual cells in populations (Fig. 2). I followed this up with a sabbatical visit in 1999, while collaborating on funding applications to establish the technology in Australia. On another sabbatical several years later, I worked on brewing yeasts with Graeme Walker in Dundee, introducing the laurdan-based spectroscopic approach to determine membrane fluidity during brewing processes. In addition, through collaborations in the ARC / NHMRC research network, I have investigated autofluorescence spectra to identify yeasts and bacteria; it's interesting that something that I had been trying to minimise all through my career in 'labelled' fluorescence has become the object of technological progress.

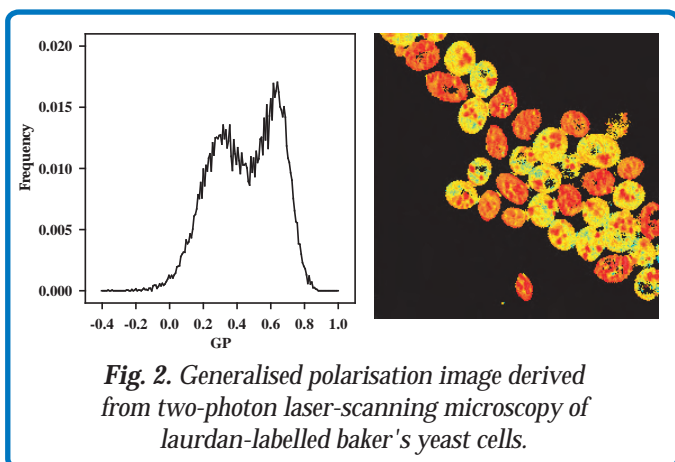


Fig. 2. Generalised polarisation image derived from two-photon laser-scanning microscopy of laurdan-labelled baker's yeast cells.

Complementary to my work with yeasts, over the last three years, I have played a major role in establishing a wine science degree in collaboration with Charles Sturt University, where I hold an adjunct appointment. I have also taken an active role in regional wine industry liaison, building up the scientific capabilities of the Queensland

College of Wine Tourism. Research has included trialling of yeast strains to optimise Queensland Verdelho and, in collaboration with colleagues in USQ, the Queensland Department of Primary Industries & Fisheries and the wine industry, research on the impact of crop yield management on quality of Merlot wines. After a lifetime of working in laboratories where eating and drinking are forbidden, producing something that you can drink is an interesting and enjoyable change! Of course, there is ample opportunity for lab-based analyses of the grapes and wine, so I still have quality lab time.



Wine Science student Tim Mackinlay and Rob bottling the first yeast trial wines made at the Queensland College of Wine Tourism, December 2007.

Putting Something Back In

Throughout my private life as well as my career, service has been an important factor. I have striven to give something back to my community, university and profession, undertaking numerous committee roles in government and in regional and national scientific and educational societies, including editorships on journals and serving as Head of Department. While the focus has been on what I can contribute to the benefit of others, I have derived no small benefit from the personal networks that have been built up through these activities.

What Does Your PhD Get You?

In closing, I'll share a couple of my basic philosophies that my experiences have led me to: (1) Be prepared to be mobile and move towards opportunities – as you can see, I have done that! (2) Qualifications are effectively a licence to work at a certain level, i.e., proof that you can. For example, I have never officially worked in the field in which I completed my PhD. I started in immunology and have moved away from the biomedical area through industry and biotechnology to work on yeast fermentation and, recently, viticulture work with plants (something I had avoided assiduously in the past). Interestingly, my wife Barb started as a botanist / biochemist and has ended up working as a veterinary serologist, so our roles have reversed and relate oppositely to our 'qualifications'. Being prepared to be flexible is the key – these days, it is acknowledged that one's 'profession' is likely to change several times over a working lifetime.