

Six Years of Melbourne

July 2002 to April 2008

Maurice HT Ling

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122 images.

Forward

My first single recallable memory of science was in Gongshang Primary School arguing with my science teacher, Mrs Tay, on whether coconut has a seed. She said that the entire coconut is a seed but I remembered seeing a seed in a coconut. The following week, I got my mum to scout the market with me for a coconut seed to show her. I was 10 years old and in Primary 4 then. Perhaps that was where I really got interested in science – to learn the natural world. It is really interesting now that I really ended up as a molecular biologist / bioinformaticist.

I left Singapore on July 5, 2002, to Melbourne, Australia, in pursue of my tertiary/university education at The University of Melbourne – to do a Bachelor of Science. There was much trepidation and anxiety as the day drew close to leave Singapore. Little did I expect that very same feelings was felt when I moved back to Singapore on April 2, 2008. Almost 6 full years of my life was in Melbourne – it is a second home to me and I am very much at ease there. For the tribulations and gifts that it had given me, I am truly glad that I made this move.

I should have kept a diary when I was there or at least bring back the few journal entries that I made during my time in Melbourne. I did neither and regretted not doing so. Ronald Reagan expressed the same regret in his book for not doing the same.

The life in Melbourne is something that I do not wish to forget but the river of time is slowly grinding away the memories, except the most significant ones. To stem this normalcy, I decided to write down as much as I can recall into this autobiography, in hope for it to act as a reduced diary for the time I spent there and as a gift to the many people that I am indebted for to make this journey memorable.

Maurice Ling
November 14, 2011

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The Completion

Who developed a program for large-scale text analysis of protein-protein interactions from published literature to mine potentially novel hypotheses for the regulation of gene expression in the mammary gland of several experimental models. His work has examined the limitations of the existing text mining programs and now enables a generic and rapid survey of published data.

Walking towards the Chancellor to collect my testamur, every step is both heavy and light. Images of the 6 years in Melbourne streamed by – of fun, of happiness, of pain, of agony. I had been through. Standing here, 8 years from the day I laid my feet on Melbournian soils.

I am finally conferred my doctoral degree, dowsing my bonnet towards the Associate Dean of Graduate Studies as I walked off the stage, I am finally Dr. Maurice Ling. It is the morning of 21 August 2010 – a very chilly spring day as Edwin told me later.



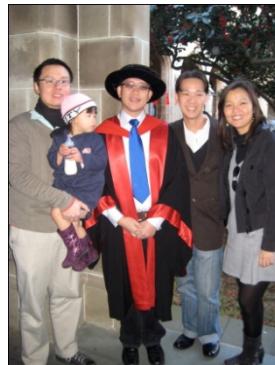
My entourage from Singapore. Left to right: Cherelle (Melvin's ex-girlfriend), Elsie (my mum), Melvin (my brother), Sally (my aunt, mum's eldest sister), Michael (my dad).



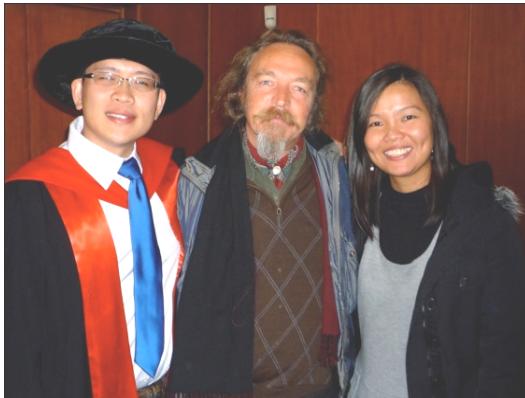
Chin How (my first project student from Singapore Polytechnic who was there for his sister's convocation).



Phil Au, Mary (Phil's supervisor), Kevin and me outside Wilson's Hall.



My friends from poly days. Left to right: Joel, Gloria (Joel's eldest), me, Edwin, and Joly.



Christophe, Joly and me.

It is coincidental that I managed to get a break from school due to the Youth Olympics Games in Singapore and we had a 3 week break in the middle of the term. Hence, I managed to squeeze in this 9-day trip to Melbourne and get my testamur together with Phil – my old time friend back in Zoology.

There is nostalgia when I dragged the luggage across the university to University College when I arrived back at Melbourne on 19 August. However, there is also anxiety this time round. On the official side, I was back for my convocation but on the unofficial side, I was looking to relive some of the old times – to meet up the people that I know, as well as finding

potential career directions. So I will say that this trip is not one to unwind myself and I do not hope to return back Singapore feeling more tired.

It soon became obvious that reliving the old times was not possible – the same people had moved onto different chapters of their lives. Edwin is now working at Richmond. Joly is in Prince Henry's Institute with Monash. Phil is with Sydney IVF. Essentially, my daily coffee-mates are all gone – no longer can I ask them for coffee at Brunetti's or Blue Zone in between experiments. Even the honours and postgraduates in Zoology looks alien to me – nevertheless, I had physically left the department more than 2 years ago. Mentally and intellectually, maybe I had not left. Just as Derek Chan said to me about 3 years ago – at this stage, I will not leave totally and all I need is to touch base regularly. Kevin's hair and beard had greyed considerably.

Not only people had moved, environment too. Over the last 2 years, the rock formations at The 12 Apostles along Great Ocean Road had changed with at least 1 apostle crumbled into the straits below.

I booked a road trip to Grampians (about 200km west of Melbourne) the day before we were due to fly back to Singapore. It is a place that was reputed to be more fascinating than Great Ocean Road. Having been there this time round, I agree.

Of all the scenic spots, I vote for MacKenzie Falls, followed by The Balcony. Perhaps The Balcony was the last spot to see, the path to it was a bit audacious as it was drizzling and very cold when we were there. The entire path was filled with igneous rocks formations.

Standing at The Balcony and looking across the vast plains of mountain ridges, one cannot help but feel the insignificance of a single human. The sky cleared up for a few minutes for us to take some photographs. Our guide said that Grampians was created probably around 350 million years ago as trilobite fossils were found along the Grampians. Trilobites dated from the early Cambrian (525 million years ago) and extinct by end of Permian (250 million years ago). It was said that Grampian ranges could probably rival the current Swiss Alps which is about 4600 metres when it was created. Over the last quarter billion years, it had lost more than half of its height to the wind and rain.



Melvin and me at The Balcony, The Grampians, with the Jaw of Death behind me. These rocks were about 450 million years old. They were once the height of Swiss Alps but weathered to the current height of about 1100 metres.

Gentle waters can grind even the toughest rock and the Grampians had lost its massive top. What can I say about humans? Maybe the change of a person is just part of the natural order of things and holding on is not.

Bill Clinton did mention in his autobiography that a moon-rock in his Oval office to remind them to put things into perspectives. Looking at the vastness of this range, I find it difficult to reconcile the idea of losing most of its original majesty. Then again, am I just being obstinate even though I know very well about the impermanence of things?

Maybe it is much better to accept the permanence of impermanence, the perfection of imperfections, as things will change. Nevertheless, the Jaw of Death is a result of impermanence. New features can only be formed when the old collapse.

It is time for me to start a new life after my doctorate. As the sun rises each day, there will be a new step to take.

The Going

“I want to go to Melbourne!” came onto my mind loud and clear after a talk on Melbourne University’s admission, organized by Cecilia Huang, my genetic engineering lecturer back in 1998. Even before that, I knew that I will want to do part of my education overseas if I have the chance and had told my mum as early as 1996.

Between polytechnic graduation and Melbourne lies a 3 year stretch for national service and the waiting time flanking it. My mind had not waivered since the initial intention. Melbourne seems to be a reasonable choice. For whatever reason, the name itself gave me a feel of gentle cosiness, less of the hassle of the Singapore city life, which I later found out to be quite true. I knew that University of Melbourne is a good choice as Adeline Koh (my plant lecturer) had highly recommended it to me. Other than this recommendation, I did not know anything about university rankings or even whether a ranking existed back then – it is an act of instinct.

I cannot remember when I applied for a place in university. It might have been around March or April of 2000. All I can remember was that it was a rainy Saturday and Joel (then we called him as Yeong Chit), my polytechnic final year project (FYP) mate, went to the education fair hosted by Australian High Commission in Singapore. It was there I came to know Alvin Chew, an adviser in Overseas Academic Link, helping people like to navigate the application process, and Penny Fairbank who reviewed my application. Penny was the international manager for science faculty in University of Melbourne.

The first letter from Melbourne was a shock – I was not given any credit exemptions when I had expected 2 years of exemption. I believe I had waited for a week before I called up the only person I can turn to – Alvin Chew – by chance, I saw his name card in my wallet. Alvin advised me to bring the package down to his office at Tong Eng Building in Shenton Way, which I did the following week. He sorted it out for me and I was granted 2 years credit exemption and only had to spend a year to get my bachelors. I believe my path might be very different if I had not kept the name card as I had already received 2 years credit exemption from Queensland University of Technology on the same day I applied to Melbourne. Since then, I kept all name cards.

It must be around October of 2000 or April of 2001 that Edwin, the other FYP mate of mine, applied to Melbourne as well. This time round, the event was held at Mandarin Marina and Edwin's application was received by Derek Chan, Deputy Dean of Science. Edwin got accepted with 2 years credit exemptions as well. I later came to know from Alvin that Melbourne only accepts polytechnic graduates with full exemptions or reject the application totally.

I decided to go for July 2002 intake as my national service ends too close to the February 2002 intake and kicked the ball rolling in December 2001. The pressure of doing well and knowing the financial burden this decision weighs on my parents, marbled into the excitement of fulfilling my dreams - I went on a roller coaster emotional ride since I got my offer. On my grandmother's birthday BBQ in July 2001, Uncle Derrick conversed with me extensively before delivering the verdict to my parents – I should have the emotional strength to leave Singapore and understood the implications of this decision. This declaration is like an auditor's statement – not much use on its own but cannot do without. Till that point in time, nobody had given me any form of assurance that I can handle it. On hindsight, this assurance did help to anchor down a few loose strings.

Sent Edwin off to Melbourne on either the 2nd or 3rd day of Chinese New Year of 2002. He had decided to go ahead a semester earlier than me and Joel, which is good – staggering out makes transition easier. Joel and I, together with Robin, were due to fly to Melbourne on July 6, 2002, on Quantas QF10. Robin is my friend in army and will be studying at Monash University.

As the day drew closer, the anxiety and pressure seems to be building up. I became increasing uncertain about my decision and the expectation is great. It is really a one-chance event. If I screwed it up, there will be no second chance. I think all of us, polytechnic graduates with modest financial support, felt the same to varying degrees. It is just that we never really spoke to each other about it. It was one of the “don't ask, don't tell” situations. To me, I just do not want to open up this can of worms and increase the anxiety in myself and others, for I know there is really no solution but to face head-on.

Between then and the fateful day, I wrote 3 poems – 5 weeks, 2 days and on the day itself.

Ongoing

Five weeks to the call
Of the summer dawn
I waited for long
To breathe frozen air
Under lighter skies

Is it cool as I may
I do beg and pray
Find a place where heart flows
Out of damn furnace
Of what?
I don't know

Doubting clouds overcast the skies
Paramountic pressures churning
inside
Silly as it seems
Out of usual raying beam
Consequent of slag
Months of cerebral depravity

Light on the end
Oncoming avalanche or fairyland
Sloughing insights from limbical
lord
Who knows what may I be prod
- 3/6/02

In 48 Hours

Tickling along little streams
Time goes by
In short brightness sun
I've been here twice

Seeing one when wake
No feel of late
That's eight rounds ago
Now to see another go

Depths of red sea
Bless them true and free
May time will see us glamour
Of spent sum
Next on list
Here sits me
Feel notes weird
Of what I wonder
Of unseekness I ponder
- 4/7/02

Churned Limbical Notes

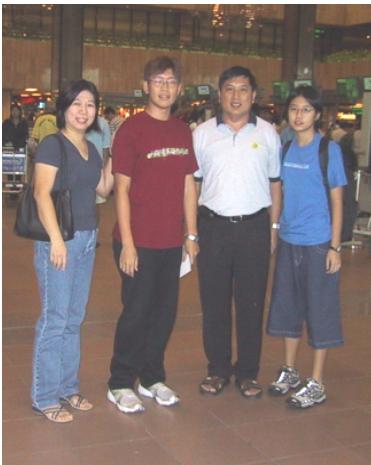
Day to move
In grimness to prove
Wierdness of feel
That refuse to appeal
Sitting on bed
I look around late
Like firstness sail
Funniness can't be said
Anxiety reads the going man
Fearness lingers at plan
Not clearing the sight
Rushed blood with melacholy sees the
light
- 6/7/02

The theme is rather clear – anxiety – the anxiety of the unknown. I had asked Keith Ng about how he had felt back then, as he went to Melbourne a semester before me to do his degree in accounting. “It feels like going to

BMT all over again” he said, and he is right. This is almost the exact feeling – as mixture of anxiety, pressure and numbness – as I board the fast-craft on that very day, 18th August 1999, my enlistment.



My family sending me off. Left to right: aunt (Jessie), Darren (cousin), me, (Yew Huey) grandma, mum.



My primary school teacher's family sending me off. Mrs Fong Jee Lian, her husband and daughter.



Army friends. Left to right: Robin, Kenneth, me, Spencer.



Joly sending Joel and my off. Joly will be joining us the following year.

The Bachelors Year

I had nearly 2 weeks before enrolment start when I reached Melbourne during which Joel and myself were exploring Melbourne City. Joel was my roommate at Calton Melbourne College (CMC). I guessed there is a little apprehension having a roommate as this is the first time I have to share a room – too used to having my own room at home. Nevertheless, it was an interesting experience despite some differences in opinions and handling each other's pet peeves. For example, our bedtimes are really different; Joel can handle heat better than cold while I am just the opposite. The first night was especially interesting because we had a double-decker bed and originally, I was on the top deck but in the middle of the night, I was sweating profusely (it was winter and we had the heater on) on the upper deck while Joel is shivering in cold on the lower deck – decided to swap the very next day. It was around this time that I gave Joel his nickname – 谢爷.

We had Ian Ong (my army friend at 20SA) at Melbourne at that point in time. He went to Melbourne a semester earlier and was enrolled in RMIT. Lucky for us, he showed us the city. The next time I met Robin was a few days later. I was supposed to meet Tristan in Chapel Street and I stupidly thought that everywhere is walkable in Melbourne. Managed to get Robin to walk with me to Chapel Street (almost 90 minutes walk) and dumped him at the Virgin music store along Chapel Street when I was to meet Tristan. Well, Robin still remembers that incident – must be one of the things he will remember for life. Luckily, it was winter and cooling, so the walk is not that bad.



Me at my desk at CMC



Joel and Peter Noris (Manager, CMC) at the lobby



Joel and myself at CMC



Robin (taken at the Royal Botanical Gardens), along our walk to Chapel Street.



No idea where this shot was taken.
Probably at Chapel Street.



Tristan (on the left). Meet at Chapel Street.

During those 2 weeks, Joel and I explored most of the university and Melbourne City by foot, walking to as far south as Melbourne Art Museum at St Kildas. It was winter. The temperature was manageable but the wind was demanding. For sure, I could not gel my hair as I usually did before – It will end up as a sculpture if I did. Melbourne is easy to navigate. The city is just 18 main roads – 9 of them running North-South, 9 running East-West. The problem is that you will have to tell someone the junction if you want to meet anyone. Daimaru just closed down and Melbourne Central was rather empty though it has its charm. Melbourne Central was built over the Shot Tower which was where they made pellets for rifles – by dropping molten lead at the top of the tower, gravity will shape the lead, cool it down before it hits the ground. I love Melbourne city for the mix of antique and modern skyline though it is terribly difficult to find a public toilet.

My first impression of Melbourne University was pretty good. I love South Lawn with the granite buildings overlooking it. There is a rustic mix of

granite buildings and brick buildings which have no bearing in the age of the buildings. For example, the building directly across CMC was called “1888 Building” as it was built in 1888 for education faculty, if I am not wrong. 1888 was less than 40 years since the foundation of the university but 1888 Building was brick. On the other hand, the buildings around South Lawn were granite. Walking into 1888 Building, I was able to see the convoluted passage ways, almost creaky floors that bear the agony of the weight and tight corridors that speak of antiquity. It was much later that I realized that the granite buildings around South Lawn, and South Lawn itself, were modelled after the Scenic walk and the Great Hall of Sydney University.



Department of Biochemistry and Molecule Biology. This building houses the Big and Small Russell Theatre but the building was demolished in 2006.



In a corner between 2 buildings.



University House – located at the end of Professor’s Walk. This is almost like an academic club which I am never a member of.



Joel standing at the entrance of Department of Biochemistry and Cell Biology. Small Russell Theatre is located at the right upon entrance.

CMC has a few interesting characters and stories. Both Joel and I were kind of “mature-aged” compared with most of the residents there who were doing their foundation year at Trinity College or their first year of university. And due to our eventual workload, we hardly clicked with anyone there. Personally, I found the communal kitchen to be a daily warzone and I do pity the cleaner. Over the year, I had seen egg exploding in microwave oven (someone tried to microwave an egg without de-shelling), pizza slices exploding in microwave (trying to microwave a stack of pizza slices). There were really good cooks and really bad ones. There was a Singaporean girl doing economics and had no idea what is bite-size. Some of the others had to help she sieve out broccoli after she had cut them and told her to cut certain pieces into 2s and some into 3s – they were just too large to stir-fry.

I did have my stupid moments in kitchen too. There was once when I tried to “fixed” printed ink onto paper to make it non-washable by microwaving, in an attempt to cross-link or cellulize the ink. It ended up catching fire instead but was put out quickly as I was watching the event unfolding in the microwave oven. Joel did not know about this at all.



Joel. This statue is located in front of Baillieu Library.



South Lawn – also in front of Baillieu Library. The clock tower area is the only granite structure in the university.



No idea where is this.



In front of Old Geology Building, where the Faculty of Science office is located.

Had decided to visit Sydney and Wollongong where Tristan was before I even left for Melbourne. It is a kind of holiday to put my nerves at ease before term start. Took a Greyhound bus to Sydney via Canberra. The entire journey was about 12 hours – about 900km. During the stopover along Hume highway, I had a bottle of chocolate milk – bad choice. Four hours after that, my tummy was churning. It was then I realized that the milk in Australia was not low-lactose milk as what I will get in Singapore. After some experimentation, I found that I can safely handle about 300ml of milk without problems. Anything more than that, I will have a stomach upset. By the time I left Australia in 2008, that was increased to about 600ml – a far cry from the litre of milk that I used to drink in Singapore.

By the time I reached Wollongong (about 100km south of Sydney), it was about 9am and got to Tristan's place. We took a walk at Wollongong beach and went southwards to Bombo and Kiama (120km south of Sydney) to look at natural rock formations there. The vastness of the Pacific Ocean before us was breath-taking. Looking behind us and seeing our own footsteps pressed into the soft, chilly sand – a realization, that's where we came from. The intertwined footsteps is a microcosm of my history – some people will come and cross my path; some will walk a distance with me and leave; at the end of the say, I start the journey alone and pretty much destined to end the journey alone. Time and memories might capture the steps but at the end of the day, all will be erased by nature itself. What's left of it all? Nothing. Suddenly, there was a sense of peace that I wanted but the peace was also a little disturbing on my psyche. It is a weird feeling – peaceful and yet too calm. Peaceful but impressionable; calm but erasing. What is really there? There is actually nothing.



Volcanic rock formations at Bombo (south of Wollongong).



Kiama train station – the southern-most train station of NSW rural lines.



Tristan and myself in a train.



Wollongong light house.



UniBar at University of Wollongong.



Strolling along Wollongong beach, with Wollongong lighthouse in a distance.



Coffee with Tristan's friends.

Sydney is a very different place compared to Melbourne – certainly messier in terms of city planning. To some extent, Sydney has some resemblance to Singapore with all the convoluted roads. Not much initial impression of Sydney except that I finally get to see Sydney Opera House for the first time and tasted wasabi ice-cream. On the negative side, I had also eaten the most horrible curry chicken in my stay in Australia – at the food court in Chinatown. It tasted like chicken soup with chilli. Luckily, there are better tasting ones in Sydney and in Melbourne. Having said that, I had also tasted the most concentrated carrot juice – 15 to 17 thick carrots juiced into a cup with no ice nor water added. It was awesome when the lady brings up a basket of carrots and start juicing them.



Sydney harbour, with Sydney Opera House in the background



I think this is Darling harbour or somewhere near Sydney Opera House.

My first semester in the university – 4 subjects, 1 practical, 16 hours per week. As final year entry students, I have to choose a major immediately. There were enough credit hours for 2 majors, I know that the best bet was molecular biology but I was not so sure of the other – either genetics or cell biology. Came to realize that cell biology and molecular biology had 2

overlapping subjects which was the tipping point to choose molecular biology and cell biology. At the same time, I was a little hesitant if I loved genetics that much then. Joel and I took the same majors with functional genomics, plant biochemistry, developmental biology, and hormone and neurotransmitter biochemistry for the first semester. In retrospect, I rationalized that I needed to boost up my plant knowledge and I could read genetics papers by me. That was pure rubbish even though that was my publicized argument. I cannot fully justify to myself, even to today, why I chose this combination and not others.

I resumed my sleeping habit in class. Not that I did not want to pay attention but I could not help it. Sleeping in class is like the best way that I learn the key points. What was shocking to me was the amount of technology in class – a number of students were armed with tape recorders and I remembered that there was a student in functional genomics that came with a video camcorder! For me, it was just my sleepy head and I. The most difficult aspect of my final year was not the content but getting used to the tone and slang of the lecturers. Most classical case was hormone and neurotransmitter biochemistry which was about phosphorylation, dephosphorylation and kinases. After 20 repetitions of those words, I just gave up and gone back to sleep. On the other hand, some lecturers were just interesting. Part of plant biochemistry was taught by Ken Gayler (eventually became Head of Biochemistry) and he never looked at anyone in the class as he lectures – just the floor, his slides and the table. Mary Familara who taught me part of developmental biology was an excited talker – the more excited she is, the faster she talks until she sounded like an accelerated Donald Duck – we have to slow her down to make sense of her words.

Mary's research area then was on gut (stomach) development. For a while, I cannot understand what is so interesting about the stomach until I went to talk to her one day after my gym session. She acknowledged that a stomach is really just a muscular bag and nothing really interesting about it. However, she needed a research focus to get her into university. So that was it. I do not have to be doing great things; I just have to be doing good and focused things. This reminded me of something I knew back then from the computing world. Someone was commenting online that he was earning good money doing dBase IV programming. Yes, dBase IV is fast declining back in 2002 but neither the education system nor anyone was really interested to pick up dBase then. As a result, the supply of dBase IV professionals was declining faster than the demand for it; thus, he was in comparatively high demand. The same concept could have applied here – I

will need to have an area where the competition is not strong so that I can stand out in the crowd. Similarly, Ken Gayler had also mentioned that there were probably only 3 research groups in the world working on chloroplast then. This concept has a great influence on me.

Looking back, I think I will still choose to take developmental biology again. There cannot be a more interesting cell biology subject with this much content of weird gene names, like *sonic hedgehog*, *son of sevenless*, *wingless*, etc. It also taught me that the notochord runs the entire length of the embryo and by virtue of that, the ass and the head are adjacent to each other in the earliest part of human development. Maybe that is why some human think with their ass. It must be a developmental error. Anyone wants to do a thesis on this hypothesis?

Only through developmental biology that I can understand Lewis Wolpert's words - *It is not birth, marriage, or death, but gastrulation, which is truly the most important time in your life*. I am not able to refute that and I do not believe anyone can.

I joined the Melbourne University Computer Students' Association (MUCSA) to get to know more people and to keep in touch with my computing. Well, I had not completed my Advanced Diploma in Computing (from National Computing Centre, UK) when I started my bachelors in Melbourne. Anyway, MUCSA was originally started by an undergraduate, Tennessee Leeuwenburg, whom I will cross path again in the future.

One of the biggest reasons that I can attribute to the pleasant experience (socially) in Melbourne was that I had Edwin and gang there before us. And it was during then that we had established some sort of a routine where we will dine out on weekends, especially Friday dinners, followed by coffee session at a different restaurant. When Edwin did not have a car, we were restricted to city. After which, we explored many other places like Boxhill, Glen Waverley and so on. I remembered that there was once we even drove to Geelong (about 110km away from Melbourne) for dinner at Smoggies. Although the dinners were good, it was the company that was more important. Till today, I love the company of friends having coffee together. To some extent, the coffee sessions were more important than the food itself. This had been the on-going theme for my life in Melbourne and still holds true for me now – nothing beats coffee or tea session after a meal. Today, Edwin will say that he is familiar with the culture of coffee after a meal. That was when this culture was forged. In fact, by my honours year, a

meal would feel incomplete without the coffee as a sequel unless there are compelling reasons not to have it, such as rushing a thesis or report.

It was also in that year that I had my first drinking buddy, Jeffrey Tan Chee Yong. He was in Melbourne for a year to do his degree and both of us love wine. So, once in a few weeks when we have more time, we will share 2 bottles of wine at his place. Jeffrey is no longer in science now. He went back to army as an officer.



BBQ in front of Selen's house. The forks are courtesy of Chris Wong (second from the left)



Carrying laterns at King Albert's Park – also the venue of F1.



At Royal Melbourne Show. Me, Edwin, Selen Tan, Kailing.



First time I bleach my hair.

Probably at around October 2002, Leslie Gondor (President of MUCSA) came up with the idea of an undergraduate computing conference on grounds that there are many conferences for postgraduates but hardly any to showcase undergraduate work. His idea was accepted by Department of Computer Science and Software Engineering (under engineering faculty) and supported by Department of Information Systems (under science

faculty). This conference came to be known as Australian Undergraduate Students' Computing Conference (AUSCC) and I was involved in the publications team, with the inaugural AUSCC held in early 2004. Looking back, I think a fair bit of learning how to run a conference and the logistics involved actually came from this experience. Since then, I was involved in 2 subsequent years as steering committee secretary, running the conference in RMIT in 2005 and in ANU in 2006.

In the second semester (February 2004), Joly came over to Melbourne for her undergraduate degree as well. She had signed on as a paramedic in civil defence since polytechnic graduation. I remembered telling her that knowing she was to do her science degree was like coming home. I was not sure where I got the impression from but I knew it instinctively that she will be back to do science eventually. To start the ball rolling into her first semester, Robin and I went to Great Ocean Road together with Joly's friends. That was my first trip to Great Ocean Road.



InterFlora exhibition in Royal Exhibition Hall – the place of exams for my second semester.



Besides Royal Exhibition Hall. Right photo: Joel, me, Joly, Karen (also known as 高妹).



The gantry of Great Ocean Road but this is not the start of Great Ocean Road. It started way before this.



The opposite side of 12 Apostles – me, Joly, Robin (the same guy that I dumped at Chapel Street).



12 Apostles at Port Campbell National Park.



Robin and myself at London Bridge – west of the 12 Apostles.

Well, my results in the first semester were terrible and that was the last time Melbourne University used Melbourne Showgrounds as exam venue – sitting in concentric circles for papers is just strange. I got a H3 for developmental biology and just a pass for the other 3 subjects, giving an average of just 63. I had expected poor results for hormone and neurotransmitter biochemistry as I had misread a question which cost me 20 marks in exams. There is nobody to blame besides myself as I was too confident and perhaps even arrogant then and submitted a 2.5-hour paper in 1.5-hour. How could I be so dumb to even have similar answers for 2 questions? This is just how blinding confidence can be – I was deaf and blind to myself. I did not expect to score so badly for the other 3 subjects. As a result of my damaged confidence, I had even considered if this was really suitable for me. I came to realise that I had belittled the subjects and had to suffer the consequences for the next 2 years, both financially and emotionally. On hindsight, I guessed life has a way to jot me back to reality when I start to get my head in the clouds and this was one of the many of such happenings to come my way. It is almost like I have a tracker in life

throws me shit every time I get too far ahead of myself. Perhaps this is how life keeps me grounded – by slapping a wet ticket on every time I needed it but never wanting it.

With this dismal result, my honours dream was in tatters. I needed an average of 65 to qualify for honours. I was back in Singapore then when the results were released and I desperately needed advice. Furthermore, I am a mid-year intake student; hence, my honours timing does not fall into the standard academic year. I met up with Alvin Chew at OAL who fixed a meeting with Penny Fairbank, International Manager for Science Faculty, when she was in town then. She suggested that I should write to Derek Chan, Deputy Dean of Science, about this as Derek was also taking care of international students. On her part, she will inform Derek as well.

That was what I did and in the email. As I am familiar with Mary, Derek got Mary to assist me in this while letting the Head of Zoology, Marilyn Renfree, know about this. The matter got rolled around and Mary introduced me to my would-be honours and PhD supervisor, Kevin Roy Nicholas. I must really thank her for this. By the time I started my second semester, there was consideration to do an honours with Kevin. And what surprised me was that Kevin did not ask me about my results. I assumed that he knew about it but I never really found out the reason, even today.

Even then, I still have to rescue my results and improve my standing. I did 2 things for the second semester. For every hour of lecture, I spent at least 30 minutes re-lecturing myself by asking questions to myself and linking the knowledge between different subjects together. For mid-year intake, this meant that I was doing the “easier” part of my majors in the second semester but I was cautious not to be complacent this time round. The good thing is that I had completed my Advanced Diploma in Computing by then. If anything else, it is a good ego-booster. In addition, I had applied to do an internship with Robbert de Jongh who taught me a part of developmental biology as well. The fact was that Robb was a potential consideration for my honours work and I needed a place to boost both my profile as well as my technical skills.

That semester was challenging because I will have to proof my worth to do honours. Even Joly had commented that I was no longer as relaxed as during my polytechnic days. She was right. I was indeed stressed up. The only notable academic incident was in Cell Biology III where one of the

assignments was a 3000-word review article. I wrote on Huntington disease and got the highest mark in class. Mary was impressed.

In the end, I managed to pull my honours entry score (average of the top 7 out of 8 third year science subjects) to 68, from 63 in the first semester. And I had decided to work with Kevin for my honours on the basis that I would be working on microarrays and will have a chance for me to see if I like to do bioinformatics.

Applying for honours in mid-year was a big issue as well. There was only 5 weeks between the releases of the exam result to the start of honours year. During these 5 weeks, we have to repeat all the administrative procedures of getting accepted, paying tuition fees, getting a Certificate of Enrollment (COE) from international office, applying of visa, medical checkups, all before the granting of the visa to start the course.

I had primed Penny on this during one of our coffee chats about 2 months before hand. Everything was a rush once exam result was released – I went to the faculty office to collect my acceptance that very morning, went to Post Office to pay my tuition fees, took the receipt to international office for processing and collected my COE the very next day.

Nearing the end of our final year, both Joel and I decided to move out of CMC. I guessed I still prefer to have my own room. To a certain extent, I think I was never fully comfortable with sharing room given that I had my own room since primary school. However, neither of us was very sure that we can make it to honours year, certainly not for me, given my abyssal results in the first semester. I still remembered that we had a discussion about this over dinner in the city – we shall just sign the bond and hope for the best. If anyone of us cannot make it to honours, then we will break the tenancy contract on grounds of lack of visa. Our new home was up a slope on Queens Street in the city.

The Honours Year

I was warned that honours year is going to be the toughest year in my tertiary education. Robb told me that he drank so much coffee during his honours year that he developed kidney stones. That is right to the very letter of the word. It is a hell of a sprint from Day 1. Some stretches were almost like a fight for survival. I got to learn the limits of my physical body, how little sleep I needed and not wanted, how much caffeine I can load into my body on a daily basis. I learnt that I only needed 4 hours of sleep a day and can execute a 70-hour day if needed. I learnt that I can survive a meal a day for a week. I learnt that I can drink 3 cups of lattes and consumed 10 teabags a day, every day, without suicide. I learnt that practically none of the original paragraph and nearly no single sentence of the first draft of my thesis made it into the final version in verbatim. My hair started to grey in this very year.

Honours programme began at a much earlier date in zoology than other departments as we had to attend a 2-week Masters level statistics course which was held 1-week in Melbourne and 1-week in Monash University. To me then, it was a waste of time. I could hardly pick up anything except maybe a few key ideas like randomization tests and so on. The biggest reason for me was that there was no data to use and the course is primarily focused on ecology which is not my interest at all. Although each day was a morning lecture and afternoons were computer classes, I skipped all computer classes. I was more tied up with the visa process and my own reading. Furthermore, by the time I needed to use statistics, I would have forgotten all of them. Frankly, I was not too happy about spending this time. It will be useful for ecologists but not for me.

Kevin is a lactation biologist who had been in this very area since his own doctoral days. Over the years I was with him, his enthusiasm for science is infectious. Both Joly and I agreed that he loves his science. There are a few things intriguing about lactation and the way he approached it. For Kevin, he just wants to deal with lactation and all his work was on mammary glands regardless of animals. So far, he had worked with pigs, cows, mice, rats, wallabies, fur seals – all mammary glands. I can even call him an organ-specific scientist. This is in contrast with Marilyn Renfree whom I call as animal-specific scientist. She is a wallabologist, solely concentrating on everything a wallaby has to offer – growth, reproduction, etc. Comparing

and contrasting these 2 scientists really helped me to shape my view and direction of science.

Thomas Kuhn argued in his book, *The Structure of Scientific Revolutions*, that scientific knowledge is essentially based on paradigms – some culturally accepted ways to look at nature – rather than looking at nature unobtrusively. It is like saying that we see a person but feel the person's bodily warmth. Physically speaking, there is no reason why we cannot feel a person and see his warmth when all are just different frequencies of electromagnetic radiation. However, we are obstructed and limited by our sensory organs. Similarly, in science, we are limited by prior concepts, prejudices and tools. All these formed the underlying assumptions that we bring with us when looking at other research or even our own. In the context of Kevin and Marilyn, there is really no advantage of one or another direction but perhaps what is most applicable for the current work and also bearing in mind the existence of the other. As my story will later reveal, evaluating these assumptions may be very challenging as it may strike at the core of someone else's belief.

My honours thesis is to elucidate the roles of insulin, prolactin, and glucocorticoid in mouse lactogenesis. That is to say, what the roles are played by each hormone to enable the mouse mammary tissues to kick off in the direction of producing milk. I am not trying to look into any more than the initial part of milk production, certainly not the sustenance of milk production.

The term lactogenesis refers to the starting of lactose synthesis and is a term coined by Peter Hartmann, Kevin's PhD supervisor, one of my academic grandfathers that is, where he measured lactose production. We know what all 3 hormones are needed for lactogenesis but it was not clear how these 3 hormones interact towards this purpose and my project was on that. There were 2 parts to my thesis. Firstly, I used casein gene as a marker for lactogenesis instead of lactose. Casein is a predominant milk protein; thus, easier to measure using standard molecular techniques such as PCR than measuring sugars. So indirectly, I am actually equating "casein-genesis" as lactogenesis. I was to show that casein synthesis can only take place in the presence of all 3 hormones and not in the presence of 2 of the 3 hormones. Secondly, I elucidated the role of each hormone in the presence of the other 2 using microarrays. For example, by comparing the total gene expression (transcriptome) of tissues treated by all 3 hormones to that of insulin and glucocorticoid, I can understand the influence of prolactin.

Initially, this was really simple mathematical logic, $\text{prolactin} = (\text{insulin} + \text{prolactin} + \text{glucocorticoid}) - (\text{insulin} + \text{glucocorticoid})$. But as I talked to others, I realized that it was not that simple as there are interacting effects. For example, insulin and glucocorticoid are not just insulin and glucocorticoid but the interaction between insulin and glucocorticoid must be accounted. This expanded the mathematical model of the 3 hormones into $\text{insulin} + \text{prolactin} + \text{glucocorticoid} + (\text{insulin} \times \text{prolactin}) + (\text{insulin} \times \text{glucocorticoid}) + (\text{prolactin} \times \text{glucocorticoid}) + (\text{insulin} \times \text{prolactin} \times \text{glucocorticoid})$, 7 factors in all. I was working with this model. Looking back, it was this very initial training that formed the basis of my multivariate statistical understanding.

Kevin's lab was sponsored by the Cooperative Research Centre for Innovative Dairy Products. We just called it Dairy CRC or CRC for short. Cooperative Research Centre was a scheme by the Australian government to bring the academics and the industry closer together. In collaboration, they put up a CRC proposal and if approved, the CRC would be awarded 14 million dollars over 7 years by the government for a start-up. The rest will come from the industry. Run like a company, every CRC almost acts like a micro-grant agency for those research groups under it. In all, the Diary CRC was a 70 million dollars research consortium which funded a number of projects in view to promote use and novel products from Australian dairy industry. Our research partners included those in Sydney University, Garven Institute of Medical Research, and CSIRO Livestock Industry.

Being in a CRC for my honours year was enriching. Tangibly, I was awarded an honours scholarship of \$2500 based on my final year results. Although it was not a large sum, it sure helped to pay a few months of rent. More importantly, it was the expansion of my worldview and vision of the research world. With my computing background, I could table discussions on open-source licences and digital signatures. Electronic records were a major problem for me as my data and analyses are too much to print out and paste into traditional logbooks. It was also about then, mid-2003, that SCO filed a patent lawsuit against IBM with respect to Linux source codes. This case brought the issue of open-source and its licences into legal perusal, especially General Public License (GLP). Being a supporter of open-source and for the purpose of self-preservation, I felt the need to keep myself informed of these events. As a result, I had spent almost a disproportionate amount of time reading up on all these legal issues.

Another thing that CRC showed me was the importance of online communications. Besides occasional phone communications and an annual conference with a few sporadic meetups, the entire consortium spanning from Melbourne to Brisbane (about 2000 kilometres) depended largely on email communications. I had my fair share of discussing my ideas with regards to electronic records, open-source licences and digital signatures via email. This really made me consider that proper online, asynchronous communication is a vital skill for the future and that proved to be true for me.

It was also about then that I decided to licence most of my computer codes in GPL or its variants whenever possible. Science is in nature an open-source, fully collaborative pursuit but commerce is not for giving up things for free. This is a tough balance but it is a balance that all scientists have to make on a daily basis.

There are 2 unique aspects about Zoology's honours programme. The first is a grant writing exercise where we had to write a grant for your project and we were not supposed to ask for more than \$30000. Each grant will be reviewed by 2 persons – 2 other honours students – and would come together as a panel to decide on the grant quantum in terms of mint sweets – one mint sweet was \$1000. The panel was chaired by Laura Parry, one of our honours coordinators. This was to let us have a feel of how grant reviews are like and the difficulty of getting any money at all. It was a challenging panel as the total quantum asked for in the grant was about 300 thousand but there was only 100 thousand in available grants (100 mint sweets so as to say). Bojun, one of the honours students, insisted that no grant awarded should be more than \$8000 and she derived this number by dividing 100 thousand by the number of grants. At the same time, we also agreed to award something for every grant so that everyone had at least a candy. It was an interesting exercise and rather brutal as well.

I asked for 27 thousand and got 3 thousand instead – for a pilot project. Only 1 grant was awarded in full as she asked for only a thousand dollars. This really got me thinking about my future and possibly the directions I wanted to take. If grants are so difficult to get, how could I survive with the least amount of money? Eventually, this very thought shaped my doctoral direction.

The second thing was that Zoology had teamed up with Botany to have a series of honours seminars where we had talks on the larger aspect of

science – science and politics especially. We had speakers like Adrienne Clark who was a former chair of CSIRO and consulting scientist in United Nations and Nancy Millis who had been on Australian stamp and was the Chancellor of La Trobe University from 1992 to 2006. Both are considered to be National Living Treasures. The emphasis of these talks was not on science itself but on the landscape, ecology and politics of science which I found to be enlightening.

During the course of my honours, I had to give 2 departmental seminars – one in the beginning to describe our project and another at the end. Using what I learnt in NCC back then, my slides were as brief as possible and Kevin made sure that every phrase in every slide was well explained and essential. A key to good presentation was not to allow anyone to have to read the slides. I remembered that I rehearsed so many times that I really got sick of my own presentation before I stood up to present to the department. If all did not matter, this amount of practices made me want to get it done and over with. That sure helped in calming every of my nerves. I think I rehearsed at least 15 times and Kevin was there every time along the way. His support was relentless and I truly appreciated that. I made a note to myself then that if I ever had my own students, I will do the same for them.

The following day, Matthew Digby, my honours co-supervisor, came and told me that the comment he heard from others while sitting through my presentation was “I had never heard such clear explanation of microarrays before.” The practices were well worth it.

The inaugural Australian Undergraduate Students’ Computing Conference finally took place during my honours year – about September 2003. It is really just a general feel of accomplishment when I see it all happening. Personally, I published my first peer-reviewed manuscript titled “Architecture of an Open-Sourced, Extensible Data Warehouse Builder: InterBase 6 Data Warehouse Builder (IB-DWB)” on my Advanced Diploma in Computing project.

Although AUSCC only survived for 3 years from 2003 to 2005, we had left behind a legacy that something like this could be done. Certainly, undergraduates are able to do something useful. Subsequently, we were interviewed by Australian Broadcasting Corporation on AUSCC as they were doing a series on “Smart Societies”.



Giving my tutorial at AUSCC.



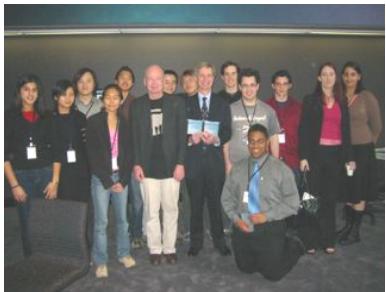
Mark Shen – Finance Officer of AUSCC. He brings the good news that we are in the black.



Myself and Michael Loke.



Partial team of AUSCC organisers.



AUSCC organizing team.



The convocation for my bachelor degree was 16th December 2003, which happened to be the hottest day of that year. Mum and Melvin touched down at Tullamarine airport at about 8.20am that day, after about an hour delay. It had been almost 1½ years since I last saw them and was pretty excited. That turned out to be a rather exhausting day – partially by the roasting sun. Our convocation was about 4pm in the afternoon. Personally, I thought that we were more interested in taking photographs in our gowns, though stewing in

our own sweat, then the actual ceremony. After the event, Kevin and Mary took me, Melvin and mum to Brunetti's for some cakes and coffee. That was the only time in memory that I had coffee with Kevin out of the lab context.



Toh Wei Seong (currently a postdoc at Harvard) and I on convocation



Left to right: Joel, Wei Seong, Edwin, Joly, me.



Melvin and mum in Union House



Joel, Joly, I in Brownless Medical Library



Outside Old Geology Building (Science Faculty)



The entire convocation crew from Singapore.



Left to right: Joel, Joly, me, Edwin



Derek Chan (Deputy Dean of Science) in centre.

Over the next few days, we went to Great Ocean Road, Puffing Billy, and St Kildas beach, other than walking in the city. Joly also took them around Chapel Street. I love Melvin – he is the only brother I have. Though I may be angry with him at times, I still love him very much. Mum told me that I made him cry in Melbourne for not remembering the directions.



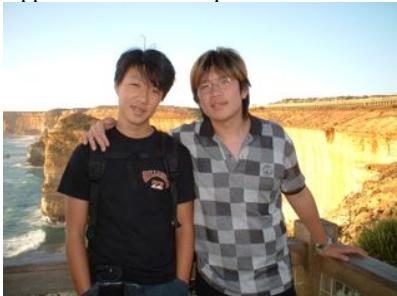
Aussie-styled BBQ lunch at Apollo Bay



Opposite side of 12 Apostles



Melvin, 12 Apostles in background



Melvin and I



Melvin and mum on Puffing Billy



Puffing Billy station

It was surprising how little I missed home until mum and Melvin came over. I saw Melvin and wanted to hug him tightly. I knew that I could be very harsh to him at times but I want him to be strong and able to survive the world himself – I cannot be always around to protect him. There was once I got him to carry out the trash and he locked himself outside until mum went out to look for him. Of course, he was scared at that time. Nevertheless, I tried not to show on my face. I was not sure even today, if that was the correct thing or expression to show but he has to be strong – perhaps even stronger than me. Despite all, I still love him very much.

They were only in Melbourne for about a week and it was at the airport sending them off that I felt sad and really missed them for the very first time. I remembered that I just sent them off to the passport control from a distance. As they started walking towards the checkpoint, I turned and walk in the opposite direction. For a moment, I could not bear to see them off – sourness swelled up in my eyes as I walked off to board the bus back to the city. I was moody and down for the rest of the day.

In the summer of 2003, we decided on a road trip to Wilson Promontory – the southern-most top of mainland Australia. That was the last thing before the turning point in many of our lives. From then on, Eugene Khoo (formally from Ngee Ann Polytechnic and did genetics honours with Edwin but in a different laboratory) was no longer close to us or part of the dinner gang. Over the subsequent 3 months since the road trip, Edwin broke up with Selen and Joly broke up with her boyfriend in Singapore. Edwin and Joly got together. Subsequently, Eugene broke up with his girlfriend, Eva, from Taiwan, and also terminated his PhD candidature. Selen eventually got a scholarship for her PhD but rejected it.

The only thing that was confirmed was that there was a rumour about Edwin and Joly and that got to Selen back in Singapore. Both Edwin and Joly denied violently then. Somehow Eugene, Eva, Pauline and Lim Bock (Joly's housemates) were all wrapped in this big smog. We had a BBQ at Han Sen's place and that was the last time everyone was on friendly terms though the rumour was already in the air and started to break things apart. I have no idea what transpired in Singapore when everyone was back for summer break but when Edwin and Joly were back in February 2004, they were essentially together. I thought that I was overly sensitive but it was Robin that alerted me that there was something going on between Edwin and Joly – the vibes, he said. Till today, what had happened is still a mystery to me.

This shook the very core of my friendship group in Melbourne. I was churning the events in my mind. At the same time, my honours work was not getting much headway and I was desperate trying to get enough RNA to run my microarrays. My literature review and magazine essay (the given broad topic was on how DNA technology changed society) did not score as well as I wanted. I started to read more papers and re-read a good part of the papers I cited in my literature review – often reading 10 to 15 papers a day. Part of me was trying to get my mind off thinking about what had happened, the other part of out of necessity. That was the time where I started to drink about 3 cups of coffee and 5 cups of double teabags every day. My hair started to grey in that summer.



Wilson Promontory. Left to right: me, Eugene, Ghim Seng, Han Sen, Edwin.



Edwin and Joly



Somewhere at Wilson Promontory



Suppose to be trekking to the lighthouse but failed. Left to right: me, Ghim Seng, Eugene, Eva, Han Sen, Edwin

By the time our half-year lease ran out in the City, Joel and I decided to experience staying in the suburbs. I thought that was a good choice as both of us hardly met each other due to our honours. Certainly, we no longer cook and eat together like the year before. For me, things were getting a little awkward though I was to bear some of the blame for even eating my breakfast in my room. There was a mutual feeling that if this was to go on, we will really become hi-bye friends. We did not really say that we do not want to live together but it was rather unsaid that it might be for the better that way. We even went to look at vacancy advertisements together so it was not the case of one not wanting to live with the other. We just thought that 1½ years as roommates, then housemates, was enough. I moved to Elsteinwick, off Kooyong Road, while Joel moved to Carnegie.

It was a shock to me during the first 2 weeks in Elsteinwick – it was so dead and empty and quiet at night. I had gotten so used to the city life that I was on cold turkey. It was stressful. A large part of me was rejecting this

suburban lifestyle where the roads were dead by 6pm. It was a strange feeling back then and I could not pin-point the reason why I got so stressful. I remembered that there were days where I clenched onto my stress ball until my hand trembled and knuckles turned white. Perhaps it was the change of environment and events and that everyone else was back in Singapore that really froze me from inside – it was a pure sense of loneliness. I cried.

I started to leave for school earlier and earlier until the day I took the first tram to school at 5.20am and reached school at 6.15am. I would leave the office at 8.30pm and got home at 9.45pm by bus. Luckily it was summer then and did not feel as bad as what it could be. At home, I was watching *Sex and the City* every night.

It took me about 3 weeks to ease into the routine. Looking back, Elsteinwick was not that rural. There are restaurants and coffee outlets that opened into the night but I guessed the environment was just a precipitating or triggering factor – it was the chill of emotions that got into me.

Not sure what did I really love about the 25th Lorne Genomic Conference – the desserts, the food, the cheeses and wine, the company or what. Well, certainly not the talks per se – they were too much for me to handle. Lorne Conferences are a series of conferences held back to back of each other and there is really just a company to run these conferences. Kevin organized the entire lab to go for the conference and we rented a beach house. A postdoc from Marilyn's lab, Danny Park, was also with us but he got a tent instead. With Sonia and Cate running most of the arrangements, everything was fine. Lorne is a town along Great Ocean Road, between Torquay and Apollo Bay. It was beautiful. The food was certainly too much and I tasted my first “Death by Chocolate” there. It is a cake – chocolate crusted chocolate mudcake, with thick chocolate fudge and topped with a chocolate truffle. No wonder it is called “Death by Chocolate” – you can die eating it without proper hydration. A slice is filling.

Poster sessions were scheduled for every evening, served with wine and cheeses – as many as 8 cakes of cheeses with 10 or more types of wines to go around. That was where I learnt a critical rule of posters – make sure that it is readable and understandable after 3 glasses of wine. In addition to that, lab equipment and consumable suppliers like Invitrogen and Qiagen sponsored beer on the tap. Conference banquet was on the very last night. That was where Cate was explaining the “sausage in the hallway” analogy –

a penis of reasonable thickness is more important than its length. I believed that Sonia will still remember how drunk I got myself into – at the start of the banquet, I was drinking wine from a glass. By the end of it, I was drinking from a bottle and thirst was quenched with beer. I would have estimated that I drank about 3 bottles of mixed wine and glasses of beer. Ended up vomiting on the beach and a severe hangover the very next day where we had to drive back to Melbourne. Sonia was the designated driver. I recalled the terrible feeling of hangover in the vehicle, and had to take the train from Spencer station back to Elsteinwick. I am sure Sonia will remember this unglamorous incident from me.

Personally, I was enjoying the food and the company of everyone but also spent a large part of my time processing my microarray data for up-regulated genes. Nevertheless, after 5 days of perpetual eating and drinking, I felt the curse of the expanding girth.



Christophe and Sonia during one of the breaks.



Christophe and Kevin.



Danny Topicic – one of the PhD candidates in Kevin's lab.



Elie Khalil – another PhD candidate in Kevin's lab.



Left: Coralie Reich (another PhD candidate in Kevin's lab). Right: Cate Pooley (a Research Officer with Kevin).



In stripped shirt is Danny Park, a postdoc in Marilyn Renfree's lab.



Left: Christophe Lefevre. Right: Sonia Mailer (a Research Officer in Kevin's lab).



From left to right: Colorado, Sonia, Christophe.

Zoology has a wallaby yard at South Watana that is under the charge of Marilyn. As Kevin needed the mammary tissues from the wallabies, all of us were scheduled for yard duties – about once a month, where we would go out to the yards and maintain the wallabies – either checking on their reproductive cycle or re-shuffling the animals. I learnt something peculiar about wallabies – they started mating immediately after summer solstice and they needed sleep to learn. You could open a gate during the day and the wallabies will not hope through it until the following day. It seems like they needed the night to learn that the gate was opened. Although it was a new experience at the yards, it was exhausting. For all these duties, Kevin got enough mammary tissues at various stages of wallabies' lactation cycle to map the transcriptome using microarrays that Christophe designed.

During one of the trips from the yards with Elie, I started talking about the main difference that I felt being an international student compared to locals.

It was finances. As an international student for more than a year, money is a critical factor – there was no safety net where we can run home to stay or get additional allowance. We run out of cash – we really run out of cash. By then, I grew to be very aware of my financial status at any point in time. That was probably the time where I started doing proper budgeting and saving plans where I set saving targets.

Although Matthew Digby was a co-supervisor for my honours, I hardly saw eye to eye with him. As a matter of fact, I learnt almost nothing from him that I could not pick up from Kevin and could really do without him at all. I think there were irreconcilable differences in our personalities to begin with. The only good thing I can say about Matthew was that he is a tentative listener in presentations and gave me constructive advices. Other than that, I really struggled to say anything good about him. It started pretty early in my honours year while we were discussing about microarray designs. To a certain extent, he had refused to take much notice of my views and Kevin's till one fine day, he stuck a piece of paper on Kevin's door which said "I think I got it" and drew the microarray experimental design which was exactly what Kevin had been talking about. To me, that was like claiming his stake in the project. When it came to microarray analysis, he almost demanded his methods to be followed and using Excel. To me, that was both difficult to document and seems rather unscientific at that point in time. In the end, I decided to venture with my own analysis – using my own programming skills and wrote my own scripts. This was the real initial reason why I had bought a book and started with Python programming. It gave me great pride and encouragement to say "I wrote those analysis scripts by myself" when he asked how I was to analyse my data without his help. Those scripts were appended to my honours thesis.

I think the last straw came when I was writing my honours thesis. All that Matthew did was to correct for my punctuation and some grammatical errors. I really needed more than that. He kept saying that I was not looking at my data more critically without suggesting how to do so. It was then that I decided that I was not going to have him as my supervisor for another project again. As such, he told me that I was "un-teachable". Perhaps it was true that our personalities were incompatible – Kevin considered his arrogance to be "supremely confident" about himself but I considered that to be incorrigibly arrogant and self-centred, even though on hindsight, I do thank him for pushing me onto the road of learning Python programming.

During my honours year, Matthew had another honours student, Matthew Peirerra, who was a semester ahead of me. He got quite poor results and never contacted Matthew again as far as I was in the department. Matthew Digby considered him to be an ingrate but the views of some others suggested that Peirerra was not guided.

Neither Phil nor I remembered how we met each other or even know of each other's existence. He was doing his final year in Bachelor of Biomedical Science while I was doing my honours, so there was no way we met in class. However, I do recall that our first meet up was in Union House and we had coffee together. That was around June 2004. Sometime down the road, he asked me to read his practical report and I had mercilessly pulled it apart. Later, he told me that he felt so confident about his work until I read it that he almost wanted to flush himself down the toilet. By about August 2004, Phil mentioned that he wanted to do an honours in reproduction biology and I suggested him to Mary. That was how we ended up in the same department and became good friends.

My honours thesis was due on April 30, 2004, and I had finished my first full draft by my birthday – March 30, 2004. It was an accomplishment even though almost the entire thesis had to be edited and almost re-written, except the literature review that had been extensively edited in the earlier part of the year. Then, I was faced with the task of synthesizing all my microarray results and discussing them in about 5 thousand words. It was a difficult task for me and I really did not know how to do it. For my first draft, I almost did not put in my microarray results but I did discuss them and that was Kevin's main criticism – I was almost afraid to put down my microarray results. Kevin taught me how to summarize and describe my microarray results. Most importantly, he taught me how to describe my results without discussing them in the results section and how to discuss my results without extensive repetition of my results in the discussion section. As a consequence of that, almost every sentence in my results and discussion sections were changed but I truly enjoyed and able to submit my thesis with pride.

A large part of honours year was the cohort that I was in. Each of us were working on different and diverse areas – Bojun was the ant lady as she was doing colonization of Argentine ants; April Reside, whom I sold my Fujitsu laptop to, was the bat girl as she was working on bats; Michael Sale was a marine biologist so he was always out diving.

There were some interesting practices back then. There was the “last weekend survival kit”. Prior to the last weekend before our thesis was due, the previous batch will bake cookies and bought us chocolate bars to help us survive that weekend. At the start of every semester, the previous batch of honours students will have a departmental BBQ to welcome the latest batch of honours students. Hence, my batch got to organize the BBQ for Joly’s batch. Joly joined Kevin’s group as an honours student. It was almost like an initiation into the family. It was great.

As the day to submission got closer, each of us got more edgy. And as Edwin would have said it, the reflective indexes of our faces increased as it got oiler. It was without a strand of doubt that honours year is a sprint. Looking back, there is no other way of describing it. The end-point is the submission of the thesis. Like a 100 metre sprinter exhausting his last burst of energy, the worst that could happen was a last minute submission extension – there was just no energy left. After my adrenaline dropped to normal levels, I slept for 20 hours or so.

As I wrote the final pages of my honours thesis, on my way home in a tram one day, I had no idea why I thought of my late paternal grandfather who passed away when I was 14 and started weeping almost uncontrollably. I had to get off the tram at St Kildas and walked the rest of the way home, about 10 km in all, just to recompose myself. Thus, I decided to dedicate my honours thesis to him.

*A decade ago, my Grandfather left abruptly.
Alone, he is, but with a smile.
I will never know what he dreamt of me.
Ten years, I had walked so far...*

*This day, twenty-five years ago, you first held me in your arms.
This day, twenty-five years later, I dedicate my thesis to you,*

*My Grandfather
who died but remains alive in my thoughts.*

I got 79 for my honours. That puts me at H2A or 2nd upper class. I did not get my first class honours as I wanted so much. My thesis is first class but my assignments dragged me down. Kevin’s group had a lab lunch that day and I was truly disappointed. I told myself “is there anything I can do in the next 24 hours to make myself better?” Yes, I talked to Kevin whom I

thought had been expecting me. He told me that entry into PhD was not an issue. That was the only consolation I had for that day. What was interesting on hindsight now was that about a year later when I was doing my PhD, David MacMillian, Head of Zoology, gave a talk in Singapore Polytechnic and told them that I got first class honours. Perhaps in his mind, I had.

The Scholarship

I had never thought of doing a PhD until when I started my honours year. Even as late as my bachelor's year, I thought that I will only finish to an honours degree or at most a master's. However, honours year showed me a lot of things; one of which is the fact that a master's and a PhD is not really that much of a difference, maybe 50% more. Secondly, I will need a PhD if I ever wanted to continue my love for research. Hence, I gave it some serious thoughts and told Kevin that I am likely to continue a PhD if possible. That was as early as October 2003 – about 3 months into my honours.

My thought then was that doing a PhD is more of a business decision. If I had started working after my honours year, the salary that I can command after taxes will be about the same as my supposed PhD scholarship. This means that a PhD will be 3 to 4 years of secured salary and at the end of it, a doctorate degree and a converted title. Should I fail to get my PhD, I will still be able to convert it into a masters degree, which is still a step more than my honours degree. Hence, I saw that I will never lose out by starting a PhD even though it will be emotionally traumatic if I failed. I decided to bet on it.

However, things were tough for me and Joel as we were mid-year intake students. This means that we will be out-of-sync with the normal scholarship cycle with Edwin and the rest of the gang enjoyed. By the time we submitted our honours thesis, all routine PhD scholarships had been given out. To make matters worse, my undergraduate results is not optimal and competitive enough for a good scholarship, certainly not IPRS. IPRS, or International Postgraduate Research Scholarship, is awarded by Australian government and is deemed as the most prestigious scholarship for international students pursuing a PhD. It covers stipends, tuition fees, healthcare insurance and even visa applications – amounting to a package of about AUD 180 thousand over the period of time.

In Melbourne University, PhD entry and scholarship is determined by a PhD entry score which is one-third of honours entry score (average of top 7 science subject in 3rd year) and two-thirds of honours results. PhD entry score has to be above 75 and at least a H2A for honours (second upper class) before I am even qualified to enter into a PhD candidature. Given my almost dismal honours entry score of 73, it will be a tough fight to even qualify for the doctoral programme, much less said about scholarship. The

only consolation is my peer-reviewed paper in AUSCC, which adds 2 points to my PhD entry score.

On a side note, this calculation made me realised the importance of peer-reviewed papers. A peer-reviewed paper equated to 2 points in the PhD entry score, which is then equivalent to 6 points in the honours entry score as one-third of honours entry score goes into PhD entry score. Given that honours entry score is average of 7 final year modules, 6 points in the honours entry score will then be the equivalent of 42 points of raw final year marks. Thus, a peer-reviewed paper is almost equivalent to half of a final year module grades. The maximum bonus points that I can get for peer-reviewed papers is 4 points or 2 papers. I think disappointment is an understatement when I realized that my final year project back in my days as a student in Singapore Polytechnic may be publishable as there was no papers in PubMed mentioning anything about combining artificial neural networks with DNA fingerprinting. At the very least, some form of such work were published since 2000. This is the main reason why I tried my best to get my students to publish their project work when I was a lecturer back in Singapore Polytechnic from 2008 to 2010. The last thing I want for my project students is to be at the same disadvantaged situation as myself, years ago.

Nevertheless, there are lots of people with PhD entry score of 85 or more, so it is going to be very tough for me. I will need scholarships to even start a PhD programme, there is no way I can ask for 200 thousand from my family at all. It is just not even remotely possible.

Other than IPRS, there are 2 major postgraduate scholarships within the university. The Melbourne International Research Scholarship (MIRS) paid \$18500 per annum for stipends or living expenses and there were 90 of such scholarship for the entire university. The Melbourne International Fee Remission Scholarship (MIFRS) paid the international student tuition fees and there were 60 of such for the entire university. Hence, it is possible to get MIRS without MIFRS, even for capable students.

I turned to Penny Fairbank for help. I still remembered I was telling her in her office – I had fought to go into polytechnic, fought to come to Melbourne, fought to get into honours, and now this... How many times must I be fighting? She said one thing that still etched in my mind – “Maurice, this is where the character is built.” Looking back, she is right. Through each trial, I became stronger to deal with more things.

Penny helped me to contact Andrew Howes, the faculty scholarship manager, to assist me with things and how the faculty can step in to help. That was around December of 2003.

Personally, I did not know what had transpired since then. The only thing I knew in concrete terms was by February 2004, 2 months before I was due to submit my honours thesis, my PhD stipend scholarship in the form of “Science Faculty Scholarship” had been signed off by an associate dean. The only condition was that I have to be eligible for PhD by myself. This means I must hit the PhD entry score of 75. This means that I have to get 77 for my honours, not accounting for the paper I published in AUSCC, or 75 if accounting for that paper. I will need a minimum of a 2nd upper honours to get in. The official requirement to get into PhD programme from honours is a 2nd class upper honours in addition to the entry score of 75. By and large, I was confirmed of my stipend scholarship and probably the only person I heard so far that got a PhD scholarship even before honours thesis submission.

The next issue was the tuition fees. As an international student, PhD tuition fee was 28 thousand dollars a year, with 3% increment every year. For this, I had numerous discussions with Mary and Kevin. Once, we even had Andrew Howes to come to Kevin’s office to explain the matter to us.

The life saver was the way PhD tuition fees got distributed. In very simplistic terms, the university will get half the amount and the other half will go to the research group and the department. As our group was funded by Dairy CRC, PhD candidates get another scholarship from the CRC rather automatically. This scholarship will give \$5000 to the laboratory and a top-up of \$9000 for stipends per annum.

Kevin had also talked to David MacMillian, Head of Zoology, on this issue and came up with a “rescue” package for me. The plan was that I will put my top-up of \$9000 and Kevin will put up both his parcel of \$5000 from the CRC and the tuition fees re-distribution to pay for my tuition fees. In addition, the department will put up \$4000 from the tuition fees re-distribution into the package. This worked up to \$23000 per annum. I will have to find the remaining \$5000 and the 3% increment by myself. Things are looking up now. I managed to get the money from back home to finance this. As such, my primary scholarships are settled.

The next good news came in March 2005, 8 months after I had started my PhD. It was from Andrew Howes again. He told me that I had been awarded MIFRS to cover my tuition fees and he was able to back-date the scholarship to January 1, 2005. I was elated and called Kevin on his mobile phone immediately to let him into the news. Like what Edwin said, Andrew struck a very positive note as the bearer of good news. As such, I became one of the rare people that got a more competitive MIFRS without lesser competitive MIRS.

A few other things in terms of finances came towards me from then on. I was awarded the Postgraduate Overseas Research Experience Scholarship (PORES) for \$4500 to fund me overseas attachment to BioInformatics Research Institute at Nanyang Technological University, Singapore, and Melbourne Abroad Travelling Scholarship (MATS) for \$1000 to fund my conference and travel to Taipei, ROC, and to Keio University in Japan. I had also gotten a total of \$1900 in FH Drummond Funds for my conference travels. These were on top of all the other miscellaneous development funds I had gotten from the Dairy CRC for my conferences and the workshops I had attended.

All in all, I did a tally of my total scholarship awards. It amounted to about \$235000 over my entire PhD candidature. This was 30% more than what I could have gotten from most prestigious IPRS.

I owed this to my thesis adviser, Kevin, who told me that whatever I need or want, I should just ask. The worst that can happen is a NO and I never lose anything to begin with.

I learnt 2 things during this. Firstly, scholarships can be pieced together. There is no need for a big monolithic or prestigious scholarship. Secondly, there is no need to go for the best. Sometimes, the second best is better. Formally, never go for Pareto Optimality, only go for Nash Equilibrium.

As a scene from *A Beautiful Mind* played out,

The Problem: You and three male friends are at a bar trying to pick up women. Suddenly one blonde and four brunettes enter in a group. What's the individual strategy? Here are the rules. Each of you wants to talk to the blonde. If more than one of you tries to talk to her, however, she will be put off and talk to no one. At that point it will also be too late to talk to a brunette, as

no one likes being second choice. Assume anyone who starts out talking to a brunette will succeed.

The Movie: Nash suggests the group should cooperate. If everyone goes for the blonde, they block each other and no one wins. The brunettes will feel hurt as a second choice and categorically reject advances. Everyone loses. But what if everyone goes for a brunette? Then each person will succeed, and everyone ends up with a good option.

--- Taken from <http://mindyourdecisions.com/blog/2008/03/10/game-theory-tuesdays-the-problem-from-a-beautiful-mind-buying-new-or-used/>

The Probation

If honours year is a sprint, then PhD is a marathon. There is no doubt about it. If anyone was to do PhD like in honours year, he will really collapse and burn out very fast.

I can never pinpoint the exact time I started my PhD other than the date I wrote on my application – 15th July 2004 – which came and gone without me noticing. Neither did I remember a point where anyone said to me in effect of “you start your PhD as of today.” However, there was a point in time where all these clicked in, and at the most unlikely place – immigration office at Casselden Place, at the end of Lonsdale Street. I had an immigration appointment in early July where I found out that I will need to re-do all the medical checkups for visa all over again and my next appointment will be after 15th July. I asked the immigration office if it will be alright if I were to start my PhD on 15th July as planned which was before I got my visa. He said “no problem, just go and start on your PhD first.” This very reply jotted me to realize that I am indeed starting my PhD.

Both Mary and Kevin are consistent about one thing about PhD – I am to start the candidature as a student and end it as a colleague, not an additional skilled pair of hands. I am to develop independent thoughts. If there is no quarrel, it is a sign that the supervision has failed. Kevin had drilled into me very early that at the end of the day, it is my thesis – I have to develop a thesis. The latin name for PhD is *Philosophiae Doctor* or Doctor of Philosophy (DPhil) in English – I have to develop my own philosophy. Only then, I will be worthy of the title of doctor.

At around that time, I had moved from Elsteinwick to Flemington / Newmarket, about 5 minutes walk from Laksa King, a nice Hong Kong / Malaysian eatery which was very popular with Southeast Asian students. I lived there for one and a half years until I came back to Singapore to do my internship. I never actually ate at Laksa King during my entire stay there. It was always “I can eat at Laksa King tomorrow” but that tomorrow never came.

I lived in Flemington for about one and a half years, with Michael Loke and his girlfriend (Juliet) as my housemate for the last year. Michael and myself crossed path due to our shared interest in artificial intelligence and that was prior to the inaugural AUSCC. I was in Sydney between the end of my

honours year and the start of my PhD when Michael was asking me how to deal with the emotions of asking a girl to be his girlfriend. I remembered giving him both route of actions for acceptance and rejection – if he got accepted, all he needs to do is to jump around his block for a few rounds until he got exhausted. But if he got rejected, well, there will be someone else for him. The last thing I know about their relationship is that Juliet is now his wife.

During the entire stay in Flemington, I walked to school for most of the days – it took about 16 thousand steps one way and about 45 minutes. I found that the walk helps me to clear my mind and think.

In order to make some money to cover for the shortfall in living expenses, Mary recommended me to take up a practical for first year biology which I agreed. It was a practical on developmental biology – to show the development of Xenopus (African frog). Upon the approval of Graeme Campbell, then the Professor of Zoology, I became the Head Demonstrator for that practical. I remembered Graeme as a man of a giant stature with a long pony-tail but very friendly and kind. Based on reliable sources, he loved to talk about sex in class – isn't that what biologists love to talk about? Probably the most amazing thing was what he did right after his retirement – have another child!!

There were 1300 biology undergraduates back then and I had to repeat the same practical for 15 times, twice a day, 3 hours per session, over 2 weeks. I can assure you that I really do not want to talk after that. In fact, I remembered walking back to office after the first week and met Mary on the corridor. I just told her off – “don’t talk to me.” She understood.

Having said that, it was a great experience and the money was great. I was paid an average of AUD 65 per hour. That was almost 3000 bucks for 2 weeks of work – my best paid job by hourly rate even up to today.

When I started my PhD, I did not know what will be my topic except that it is in bioinformatics. I ended up with a grandiose idea which is grandiose even today. I wanted a simulate-able mammary gland or cell and populate the simulation data and equations from published literature which can be used as a dry-lab equivalent of experimental platform for Kevin's group.

In my plan to Dairy CRC, in which I illustrated my grandiose idea, there are 3 stages of my work (proposal in Appendix B):

- MouseWay – a generic network of mouse biochemistry pathway extracted from mouse-specific literature. All pathways are homogeneous and there will be no compartmentalization or cellular location in MouseWay. This will be a simulate-able mouse cell.
- Refinement of MouseWay to include compartmentalization, cellular location and enzymatic rates whenever possible.
- MurioLactoLand – transformation of MouseWay for mammary-specificity by removing pathways and reactions that are non-existent in the mouse mammary gland and add missing mammary-specific pathways from the literature.

I presented this idea in the first lab meeting and Sonia commented that this will be a lifetime of work rather than a PhD. She is wrong – it will be a few lifetimes of work as I realized later – something that can be comparable to the holy grail of lactation biology. On hindsight, my final PhD thesis is really a subset of MouseWay.

Moving out of honours room but there was no space in postgraduate room, which is just opposite honours room. Hence, I was temporarily held in a lab space at 2nd floor of Zoology building with Brandon Menzies, Marilyn's PhD student, then Nanette, another of Marilyn's PhD student from Germany joined the small room. We got along pretty well. One afternoon, I did not know what happened but we were told to evacuate the room and to use the open lab space at 2nd floor. Well, we knew that the room was temporary and certainly not ideal – looked a little like a quasi-storage area – but at least it has a locked door and we can safely leave our laptops there. There was no security of any kind in the open lab area and we have to move out of the room by the end of the day. Brandon was not happy and pretty stressed. I was very distressed and fired a desperate email to Mary Familar, who was also a postgraduate coordinator, at about 3pm that day. Mary immediately flew into action and got Peter Krotsis, the department laboratory and safety manager, to look into the situation. By 4pm or so, all 3 of us secured a space in postgraduate room.

I attacked my project from 2 different ways – modelling and simulation, and extracting protein-protein interactions from published literature. I started on the modelling and simulation first. By then and due to my honours year, I had more experience with Python programming.

My difficulty then was the lack of knowledge in biological modeling and simulation, as well as text mining. However, I am determined to do something. I remembered that I had borrowed a textbook on natural language processing from the library (*Speech and Language Processing* by Daniel Jurafsky and James H. Martin) and vowed to fast until I finished the entire book of about 500 pages. I did that in 5 days and only started eating on the 6th. This is the basis I had for text mining.

I attacked the modeling and simulation aspect by looking at the currently available tools. Then, Systems Biology Markup Language (SBML) is gaining popularity while CellML is dying. I examined SBML and did not find it to be satisfactory for my use. My main reason is this. SBML model is based on functional categories. All the component definitions in a model are grouped together and the kinetic equations are grouped together. To me, this means that I am not able to abstract out different parts of the model easily. For example, I cannot easily remove a pathway from a complex cellular model unless I am willing to read the entire SBML code and remove the parts individually. SBML is function-oriented rather than object oriented. As such, my first plan was to develop an object-oriented modeling language and a simulator based on it. The result was a language called Mosirium Codes for Modeling and Simulation (MCMAS, see Appendix C) and “Mosirium” is my abbreviation for “mouse simularium”. I had even written a parser for MCMAS and a very rudimentary simulator for it. My intention was to publish MCMAS, then an interface between SBML and MCMAS, followed by a manuscript on Mosirium itself. However, ACM Transactions of Programming Languages and Systems rejected my manuscript on MCMAS on the basis that it did not solve any of the current problems in simulation. Looking back, I was pretty naïve then about the publishability of my work. It was partly due to the fact that I had not gotten a manuscript rejection then. It was around that time that I came across Kouchi Takahashi’s PhD project on ECell-3, which was done in Keio University, Japan, and started communicating with him. That was eventually how I got to visit Keio University.

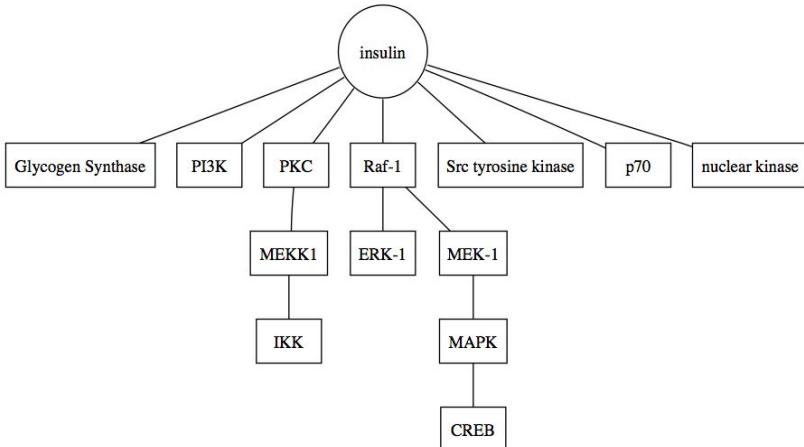
By then, I had gotten a little headway into the text mining aspect and stopped working on MCMAS/Mosirium since. The only public relic of MCMAS and Mosirium was my poster in the 3rd Asia-Pacific Bioinformatics Conference. I had been considering about restarting this work for a long time but never got to it at all up to today and I do not foresee going anywhere with this unless there is a real need to. Although I still consider MCMAS to be a feasible idea, I realized that going against the

scientific norm without substantial evidence is very tough and perhaps, not productive. At the same time, I also realized my severe lack of background knowledge in simulation and the required mathematics while reading Kouchi's thesis. That really made me re-consider the feasibility of such approach but it was not until the later half of 2005 that I stopped toying with MCMAS and Mosirium after realizing that it was just too much for me to handle on my own. The concept of MCMAS and Mosirum was still in my confirmation report. I started to proceed on text mining with full steam.

One of the biggest lessons learnt from the MCMAS experience was not to attempt to re-invent the wheel – it is just untested and certainly not novel enough for publications, not to mention that I will be spending far too much time on it. I realized that I am a user of technology with some inclinations towards technology discovery rather than technology discovery with an inclination towards application. As a biologist-bioinformaticist, I should be adapting existing technologies and innovating them for my work rather than developing the technologies myself. If I were to go back to the start of my PhD, I should have just used ECell-3. It will certainly be more efficient though I am not convinced that I will make many inroads then, as I looked back. The development of primary technologies should be left to the computer scientists, mathematicians and the like.

When I started with text processing, there were 3 choices – NLTK (a Python natural language processing toolkit), MontyLingua (a Python natural language processing system) and GATE (a Java natural language processing toolkit). I chose to go with MontyLingua as it is a full system and had been published. MontyLingua was a project of Hugo Liu in MIT media labs and I find that to be a good basis for me to learn about natural language processing.

By then, I had collected all the abstracts of mouse and rat papers from PubMed. It is interesting to realize that humans accounted for almost half of the papers (about 7 million) while there were only about 800 thousand papers on mouse and 1.2 million papers on rat respectively. I will think that there should be more mouse papers instead of rat. My task then was to deduce MAP kinase pathway from the papers as a proof of concept that my text mining pipeline is working and the result was the first case study from my thesis.



Extracted MAP kinase pathway (Source: Ling et al., 2007)

I started to call this project “Muscorian” which means “mouse librarian”. I had a chat with Kevin about the mouse versus rat issue and decided that I will consider them together instead of separate. This becomes a contentious point in my research which Terence (Terry) Fletcher, a senior lecturer in the department, pointed out as a matter of scientific curiosity after my confirmation seminar – how much of a rat is a mouse? In fact, is it possible to look from a helicopter view of what we know about mouse and rat collectively and see the differences? That may be an interesting research.

When I started to look into text analysis, I had also started to look at the expertise in text analysis in the university and came across Andrew Lonie, a lecturer in the department of information system, who was working on the kidney project. And for the formality of confirmation, I will need a person from another department to be in my confirmation committee and Andrew became that person.

For the entire first year of my PhD, I was really struggling with the idea of what determines a pass in a PhD. On one hand, I am confident that Kevin and Christophe are capable supervisors who will point me to the right direction but on the other hand, I was really worried that their area of expertise are not within what I am working on. Kevin is an excellent lactation and mammary biologist and Christophe’s work is mainly on sequence analysis and microarrays. I was terribly concerned. At the same time, my second upper honours results still hung over my head. The real

question is whether am I good enough? What if my best is not good enough? Just like in my honours year – my best was just not good enough for me to get a first class honours. Will this happen again for my PhD? Will my best be still off the mark? I just do not know what is good enough for a PhD. As such, I fired a long email to Mary airing my concerns the day before my confirmation talk. David MacMillian was notified of my concerns. I might have came out too bluntly and it seemed to be a concern of my supervision from Kevin and Christophe. David suggested that Andrew be one of my supervisors for me to get more support on the text mining side. I think that was the main reason for Andrew's involvement. And with the confirmation papers signed off, I lose my probationary status and gained a confirmed status.

There were a number of other events in my first year. The most important is the award of Melbourne International Fee Remission Scholarship (MIFRS). With this inflow of cash, I decided on two things. Firstly, I will want to contribute back to the society and was finding a way to do so. Lauren, a girl who was doing her honours in Kevin's lab at that time, introduced me to the idea of sponsoring a child. I thought that was a good idea and started to look up on WorldVision. Before long, I decided to sponsor a child as a way to give my gratitude to the society and had been sponsoring since then.

The second thought was to finish up my degree in computing since I was only left with 3 more modules and my honours project to get a full honours degree in computing with University of Portsmouth through distance learning. With that, I contacted Informatics Computer School again, the private education provider of my Advanced Diploma in Computing, to finish up my degree. There was also a financial reason to this. Back in 2000, I had dropped out of the degree to do an advanced diploma due to my National Service and a lot of unpleasantries back then. However, I had paid for a degree programme. Hence, I was really trying my luck to see if I can use my “unused cash” by topping up the additional cash for it. Well, it turned out that the school agreed to it and I was on the degree programme by mid-2005.

The Confirmed Year

After my confirmation and had Andrew as my 2nd co-supervisor, he got me a presentation slot in the Language Technology Seminar Series, organized by Steven Bird's group in the department of computer science and software engineering (CSSE). My presentation was "*Functional modeling of mouse lactation using published abstracts and text mining.*" Steven Bird is one of the big names in computational linguistics and he is also the editor of several computational linguistics journals, as well as one of the authors of NLTK. Hence, having his group's validation on my work is really crucial at that point in time. My work will be deeply involved in extracting protein-protein interactios from the literature and potentially mine for novel interactions. Existing protein-protein interactions can be evaluated using a known corpus – a set of text where all the protein-protein inteactions are known. I could then evaluate my system based on how many interactions it misses and how many interactions it got wrong. The main concern then was how to validate novel protein-protein interactions. The general consensus from Steven Bird's group was that my work seems interesting and the only way for evaluating novel hypotheses is by biological experimentation or theoretical evaluation – is there biological reason for each potentially novel hypothesis?

By then, I was working on a line of research that is in contradiction to Andrew's school of thoughts and that puts me in direct confrontation with him – something that dominates my entire second year of my PhD.

As I was reading papers on biomedical text mining, it was clear to me that there were 2 schools of thought and I subsequently wrote the literature review to examine these 2 schools of thought. On one hand, there was a school that considers biomedical text to be a specialized form of literature and cannot be adequately processed with generic natural language processing tools. Hence, a number of specialized tools were developed to process biomedical text. I called this school as the "specialists". On the other hand, some considered biomedical text to be insufficiently domain-specific that requires a completely new set of tools in order to process it. Perhaps generic tools can be used to a large extend and only develop specialized tools when generic tools have been shown to fail, such as recognizing gene and protein names. I called this school as the "generalists".

Andrew was a specialist while I am a generalist.

Instinctively, I feel that even though I accept that biomedical text has a lot of domain-specific language constructs and certainly not the type of generic writing as newspapers or emails which generic text processing tools were initially developed for, I do not think that biomedical text is as specialized as legal text or poetry. Moreover, I had read papers that employed generic text processing tools on legal text. However, Andrew did not buy my argument. Instead, he expected me to follow his line of thought. He wanted me to replicate the work of Textpresso¹, which is a specialized tool and work from there. There is nothing wrong with Textpresso. In fact, I find Textpresso to be a highly-motivating piece of work and I had learnt a lot from it. Looking back, there may be instances where I held my beliefs too strongly and failed to appreciate Andrew's arguments. Nevertheless, back then, I find this train of thoughts and actions to be contradictory to my first held principle of a PhD candidature – to develop my own philosophy.

As a result, there was a massive disagreement between Andrew and myself to the point whereby he told me that he does not think my work or the path that I am pursuing deserves a PhD and I will fail my PhD regardless. As noted by Kevin, I was quite shakened. To me, I took it that Andrew felt that nothing I did can deserve a PhD and I certainly did not take it well. Andrew had even taken one of my early chapters to be reviewed by a staff member of Steven Bird's group. That chapter was essentially a rejected piece of work from the Fourth Asia-Pacific Bioinformatics Conference. By then, I recognized that it was an absolutely terrible piece of work. Of course, the review comments from Steven Bird's group was not kind and that became part of Andrew's armory. The general comment was (as extracted from my logbook kept during that period) *"Overall this portion of the work has distinct lack of scientific rigour in a number of dimensions. There is no extant abstract experimental design, which could be reviewed and verified, hence improving the overall direction of research. Many other works are cited either completely out of context; interpreted considerably different to the original published findings; lack evidence of peer review; or all three of the above. There is little evidence of coherent understanding [of] previous work particularly in language technology, and much assumption based on scant, if any, empirical evidence. Little appreciation is shown for the need*

¹ Muller et al. (2004). Textpresso: an ontology-based information retrieval and extraction system for biological literature. PLoS Biology 2, e309.

to systematically evaluate each and every step in the workflow either against gold standard or internally for consistency via cross validation.”

Looking at it today, it is still pretty damning. Nevertheless, there was a way out – since the main concern appears to be scientific rigour, Andrew suggested in front of both Kevin and Christophe that I should write up my literature review and rewrite the terrible chapter and submit to 4 of his suggested external experts for review on the scientific rigours of my work. I see that there is no other way out and I gladly accepted this challenge. After working on it for almost 5 weeks, I had my literature review and first experimental chapter written up – about 40 thousand words in all – and sent it off to the 4 experts.

About 2 weeks later, on the second last day of the CRC conference of 2006 which was held in Seaworld in Sydney, we had some relaxation time before the conference dinner and I took a walk along the beach. The sea was calm and air was tranquil. I went into an internet café to check my email which cost me 4 dollars for an hour. That was the most important 4 dollars I spent that year – I received an email from Thomas Rindflesch, one of the 4 external experts designated by Andrew Lonie, which says,

Maurice,

In general I think your dissertation demonstrates scientific rigor regarding natural language processing for biology. Although it is a matter of style, I think it would be good to discuss the contribution of your work at the beginning of the introduction, rather than at the end of the review of the literature. I would also recommend that at this point you expand the discussion just a bit regarding the use of a generic system. You need to emphasize the significance of your contribution. As for the system itself, you need more detail about finding SVO. This is crucial in supporting the accuracy of protein-protein interactions. For example, it's not clear whether the S, V, and O have to be contiguous. Whether they are or not has a significant effect on accuracy of results. You may want to look at two of my papers related to your work. I've attached a copy of the first one; the other is readily available through PubMed. Good luck on your dissertation.

-Tom Rindflesch

In fact, that was the only reply that I received out of the 4. With this, I won the battle against Andrew Lonie. I told Kevin that I really do not need a co-supervisor that does not think I should pass my PhD. It was clear that I wanted him out of my advisory committee at that point in time. I even went

to the extent of telling Kevin and Christophe that I had drew a line with regards to Andrew's supervisory contributions towards my thesis and I do not want anything else to do with him. Andrew recognized that his designated external expert is on my side and acknowledged it when Christophe and I approached him to sign the second year confirmation papers. He then went to talk to David MacMillian, then Head of Zoology, and got himself out of my advisory committee.

At the end of it, I acknowledged Andrew's contribution as a supervisor in my PhD thesis as "*I extend many thanks to Andrew and Feng for your constructive criticisms and valuable suggestions to point me in a correct direction.*" Despite all the unhappiness, I must say that Andrew used his much needed tough love to steer me from a train-wreck even though it brought some collateral damage to him at that point in time². I deeply apologize for my terrible attitude towards him back then. I had also given him a copy of my final bounded thesis to show him that I had done it and hopes that he will be proud.

I further send my 2 chapters to 8 other experts, only 1 replied - Professor Jonathan Wren, an associate editor of Bioinformatics.

Maurice:

Interesting work, and it seems promising. I think you need to benchmark it on some more datasets. Try to get ahold of some of the BioCreative and KDD Cup datasets - they're good for benchmarking protein-protein interactions. You also need a discussion on context. Some interactions are context-specific. For example, insulin increases glucose concentration in cells. Insulin decreases glucose concentration in the bloodstream. So it depends upon your perspective.

Also, it will be very valuable and informative to benchmark it on a large dataset - millions of abstracts. Small datasets are nice & neat and all the rage, but researchers get excited when the possibility arises that some system could possibly be applied to massive datasets with reasonable accuracy. Achieving 90% precision & 80% recall sounds impressive, but if it's only from evaluating 50 abstracts, it's not. So I think you need to perform a few scale tests to see how scale affects F-score.

Good luck!

² Since I wrote this, I had emailed to Andrew to apologize for my attitude back then and made peace with him.

That was dated 12/10/06. Jonathan's comments helped me to get that chapter accepted and presented a year later at the Second IAPR Workshop on Pattern Recognition in Bioinformatics (PRIB 2007) and was published in Lecture Notes in Computer Science, volume 4774 – my first manuscript published from my PhD work. Needless to say, I felt very good about it.

Other than the long drawn-out incident with Andrew, the rest of my year went through rather smoothly. In fact, I was not in Melbourne for half of my 2nd year – I did an “overseas” attachment in Bioinformatics Research Centre (BIRC) in Nanyang Technological University, Singapore. I will describe this part of my year in the next chapter.

It was also during this year that Joly finished her honours degree and continued her PhD in Kevin’s lab – working on milk and stomach development – co-supervised by Kevin and Mary. But by that time, I was no longer an experimental biologist but a bioinformaticist. Even then, I had the tendency to pop into the lab once a day or so, just to make conversations with Sonia and the rest. It had only occurred to me much later, some five years after I had left Melbourne, that the underlying psychological need to walk into the lab for conversations is the biological lab itself. I can meet the same people in cafeteria or in pantry but it is the settings of a biological lab that was endearing – looking at rows of labeled blue-cap bottles, jars of autoclaved microfuge tubes and boxes of micropipette tips on the bench – that gave me mental comfort.

Something I learnt about this time in my life is that when someone asked for a big help, it did not always mean that the person should be helped. Asking does not mean deserving. I recalled an incident whereby a person learnt of my lab attachment stint at Robb de Iongh’s lab back in my undergraduate days and sought Joly’s and my help to recommend him for similar stint at Kevin’s lab. I did have a short conversation with Joly before recommending him to Kevin, whom very kindly accepted him in the lab. However, it turned out that his timing was inconsistent – as what I would say – appear as and when he likes. As a result, it was difficult to rely on him being around in the lab and when he appeared, he had to do something. To put it simply, he was giving more disruption than assistance. Granted that he need not be there for the purpose of his degree, he had also failed to recognize that by our recommendation, we were using putting our credibility on the line. In fact, I was even kindly asked to try not to recommend people unless I knew what I was doing. The words were kind but the message was clear. I

was disappointed with his attitude though I did not say anything to him back then. After this instance, I was very hesitant to recommend anyone else. My bar had just increased tremendously even up to today and I do have to thank this ex-friend for such an important lesson in helping others. If asked for a reference, I will consider supplying a reference but I will be very cautious about putting my own credibility to get something done for another person. Asking for help is always a first step but it has to be underpinned by load of deserving; many who ask do not deserve. It was probably about 2 years later that I told this ex-friend that he has to follow through when being helped and explained this incident, which dented some of Joly's and my credibility, and he said that I had judged him. Yes, I did and till now, I do not feel guilty about it. That was the last time I ever conversed with him.

Another person that came into my life and destined to play an important role in my life is Phil Au. As mentioned before, I had known Phil during my honours year but it was during this time that I knew him much better. Phil did his honours project under Mary – same batch as Joly. Phil went on to do his PhD under Mary and Lynne Selwood, a professorial fellow in Zoology, working on marsupial oocyte development, mainly on the oocytes of dunnarts. Phil has an interesting history. Even though he has a Chinese name, he was Vietnamese by heritage. He spent his childhood in France, which is why he can speak some Francais, before migrating to Australia. One thing about Phil's project was that he was scheduled to take care of the dunnarts during some weekends and I tend to drop into office to do my work on weekends as well before meeting Edwin and gang for dinner. We also shared the same postgraduate office. Hence, more often than not, we had coffee somewhere along Lygon Street before or after he is done with his animal husbandry task. Gradually, we became good friends and he became my morning tea/coffee mate at Blue Zone. Half the time, we had serious scientific discussions. Half the time, we were making fun of the people we saw as we were having our coffee or tea – like the “headless chicken”, a guy that walked rather briskly looking lost and turning his head rapidly like a chicken; or “Sow, the mother pig”, a guy who was always dressed in blazer for class and in gym, he will take a book and walk on the treadmill for 20 minutes. We planned to convocate together, which we did.

As part of CRC's education programme, both Joly and I got funded to attend a communication training workshop organized by Naill Byrne. The purpose was to train scientists to present their ideas in public. I recalled it to be expensive but worth it. In two days, we were taught how to talk in radio in television interviews. For the workshop, Naill had engaged notable radio

and TV presenters to give us tips. There was even time allocated for each of us to be interviewed, recorded, and commented on by the presenters. It was 2 days of fun and learning. The main thing that I got out of it was the importance of soundbites – to be quoted in any media; you have to be able to present your key ideas clearly and succinctly in 8 to 10 seconds without blabbering. This was exactly what I used when doing a phone interview with Geoff Maslen, who was writing a piece for *The Australian Financial Review* on postgraduate research in Australia.

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The Australian Financial Review

Monday 8 May 2006 • www.af.com

Centres link postgrads with industry

Postgraduate students play a crucial role in Australia's research effort, writes Geoff Maslen.

More than 260,000 Australian and international students are undertaking postgraduate courses at Australia's universities and they now comprise almost 30 per cent of all enrolments.

While 40,000 of this group are enrolled in graduate diploma programs, the largest proportion – more than half the total – are undertaking master's and doctorates by coursework.

Increasing numbers have opted to tackle their postgraduate coursework, a relatively recent development. But the students who have come forward for doctoral research represent only a small minority of those who follow the traditional path to a PhD via an original research project.

In fact, nearly all postgraduates are completing their doctorates by research and another 10,000 are engaged in research masters degrees.

They may comprise a mere 5 per cent of the total university student population, but these PhD and masters students play a crucial role in the nation's research.

Australia spends \$5.5 billion a year on research and innovation, of which \$2.2 billion is allocated to universities.

The contribution postgraduates make to the research effort is considerable. They help universities earn about \$1.5 billion a year, or some 15 per cent of the total funding revenue from consultancies and contract research with industry partners.

The vast majority of research postgraduates carry out their projects within university faculties. But more than 1700 are key participants in a unique Australian innovation that has been created to encourage links between universities and business and industry: the cooperative research centres.

The CRCs have proved the most successful means yet created for establishing joint projects between private enterprise and researchers from universities and the CSIRO, Australia's premier research organisation.

Most centres have at least 30 full-time researchers (some as many as 100) and a significant component



Maurice Ling is working on research to provide the dairy industry with access to advanced technology.

Photo: GLENN HUNT

Research powered by overseas helpers

Maurice Ling is one of more than 8000 overseas postgraduates assisting Australia's research efforts in scientific, medical, engineering and other fields, as part of their masters and doctoral research.

Ling is a member of a team of researchers involved in a seven-year, \$90 million project aimed at boosting Australia's dairy industry.

He is one of hundreds of postgraduate students from overseas assisting the CRCs. Although the CRCs operate as independent units, the students are often based on a university campus. Since its first centre opened in 1991, the Australian industry has committed \$1.5 billion to the program.

The executive officer of the CRC Association, Anna Campbell, says the centres also help to strengthen links with an increasing number of international companies.

Campbell says a feature of the CRC program is its emphasis on

bringing together researchers and those from business and industry.

Under this approach, the CRCs have established research alliances with more than 1300 large and small businesses and medium-sized enterprises in Australia and some 750 collaborative linkages with overseas groups, including 70 commercial organisations.

Education plays a key role in the CRCs, according to Campbell. She says the 72 CRCs operating in 2003-04 had 1700 PhDs (or full-time equivalents) engaged in their research projects, each with their

own supervisor. During that time, 249 PhDs graduated.

There were also 200 masters students involved in the CRCs, of whom 68 were newcomers and, during that year, 58 masters degrees were awarded. About 214 students were participating in one or other of the centres and 72 of them graduated.

Campbell says that almost 1700 CRC staff members were involved in supervising the research postgraduates while another 620 non-university staff also played a supervisory role.

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She says this reflects one of the strengths of the CRC program, whereby a student is exposed to a wider environment involving the end users of research.

"A major advantage for the postgraduates is the way they're trained in a more workplace-oriented environment," she says. "They work in teams and the way research can be commercialised – and this means they are likely to make a quicker transition into industry when they graduate."

That is not the only advantage, assisted by the fact that the group backing the centres cover a wide range of potential partners – from state and federal government instrumentalities to universities, hospital research departments, industry and big business. In 2003-04, nearly 300 research students took up jobs in industry, 167 of them with PhDs and the rest with masters.

The involvement of at least one university in a centre is mandatory while the CSIRO, reflecting its size and diversity, is associated with about two-thirds of them.

Most CRCs have some connection with the physical sciences and it is the university science faculty, with their departments of chemistry, maths, physics and so on, that attract one in four postgraduate research students. Yet the physical sciences account for 8 per cent of all those at those universities.

Similarly, engineering and its research fields have 15 per cent of research students, whereas engineering facilities enrol less than 7 per cent of the total. Information technology attracts 8 per cent of the total research students while 5 per cent of IT students are undertaking research degrees.

Health studies cover a wide range of areas, from medicine and nursing to dentistry, physiotherapy, speech therapies and veterinary studies. About 100,000 students (or 11 per cent of total enrolments) undertake health-related courses at university and of these 13 per cent are involved in postgraduate research.

Agriculture attracts some 2000 research students, less than one in ten of the total research group and 10 per cent of all students enrolled in that field.

Geoff Maslen's statistics show that although management and commerce faculties capture 30 per cent of all university students, they attract less than 6 per cent of those undertaking postgraduate research.

My featured article in *The Australian Financial Review* (Monday, 8 May 2006) by Geoff Maslen.

The Travels

For the entire period of my PhD, I went back to Singapore thrice on sponsored trip – in January of 2005 for the 3rd Asia-Pacific Bioinformatics Conference (APBC); for the first 6 months in 2006 for internship in Nanyang Technological University (NTU), during which I visited Taipei for the 4th APBC and visited Institute of Advanced Bioscience at Keio University in Japan; and finally, in October of 2007 to present my paper at the Second Pattern Recognition in Bioinformatics (PRIB) workshop.

When I started my PhD, I was very excited about the possibilities of attending conferences overseas. To put very simply, my mantra was “if you want to visit a country, find a conference there.” After almost 2 years away from Singapore, I thought that I should go home for a while and found a suitable conference in Singapore – the 3rd Asia-Pacific Bioinformatics Conference (APBC), held at Institute of Infocomm Research. I submitted a poster titled “Mosirium: A Modelling and Simulation Tool for Lactation in the Mouse”, got Dairy CRC to pay for my return air ticket to Singapore and gotten AUD 350 from FH Drummond Fund to cover the conference fees. It was surprisingly easy and I got the hang of asking for money.

Eventually, Mosirium did not make it into my doctoral thesis at all. However, I got many rewards from the conference itself. Firstly, I got to know Prof. Lin Feng, from Nanyang Technological University (NTU) in Singapore, who was working on bioinformatics. This was how I started to think of an internship in BioInformatics Research Centre in NTU when I got back to Melbourne and started my second round of fund hunting. Secondly, I saw one of the posters from Singapore Polytechnic – a FYP project under Cyril Chua – which I had used to start a series of correspondence with my alma mater and that eventuated into my first full-time job.

When I returned to Melbourne after the third APBC, I was searching for funds to attend the 4th APBC, which would be held in Taipei – I had never been there before. It turned out that there are 2 scholarships from the university that can be used. The Melbourne Abroad Travelling Scholarship (MATS) provides up to AUD 1000 for overseas conference travels and visiting a university. Postgraduate Overseas Research Experience Scholarship (PORES) provides up to AUD 5000 to undertake at least a 3-month research attachment in a foreign university. Most importantly, PORES and MATS can be applied simultaneously for the same trip if

worked correctly. Thereafter, I decided to try to secure an internship placement with Prof. Lin Feng, which I did, and during that duration, attend the 4th APBC in Taipei and visit Keio University in Japan. In addition, I can apply for FH Drummond Fund again for overseas conference. In total, I secured AUD 6800 (AUD 1000 from MATS, AUD 1300 from FH Drummond Fund, and AUD 4500 from PORES).

With that, I started my 6 months internship under Prof. Lin Feng. Since I was staying at home but the scholarship applications required me to put funding for accomodations, I had sufficient funds to get myself a motorcycle for the internship.



My last Honda NSR SP 150.

Since Honda NSR SP 150 is no longer in production, I can safely say that this is my last NSR SP. Before I return to Melbourne at the end of my internship, I sold the motorbike to my good old primary school friend, Eric Wong (also known as “Chicken”). For the record, Eric was the one who said that “What are dreams for if they are not made to come true?” Why sell it to Eric? Well, Eric had wanted a NSR SP 150 when he was getting his motorbike licence but I passed my licence before him and bought a NSR SP 150. He ended up buying an Aprilia 125 instead. I do have to thank him for graciously buying this bike from me.

I went to Taipei in late January of 2006 for the 4th Asia-Pacific Bioinformatics Conference and that was the first time I met Prof. Chung I-Fang of National Yang Ming University who is now a tenured professor, and Kuo Cheng-Ju (Zheng Ru), who was I-Fang’s masters student back then. I have a lot to thank both of them for allowing me to use their servers for my computational work.

Zheng Ru is a very interesting guy. He lives right on Yang Ming Shan in a 3-storey house with a swimming pool. No doubt that his family is very rich

and it is his own hardwork and determination that is the most admirable. Eventually, we even collaborated on 2 text mining competitions (BioCreative) and published 2 manuscripts in BMC Bioinformatics as a result.



At a cross-junction at Taipei



At Zhong Zheng Memorial Hall



At National Museum (Gu Gong)



House of Lin Yu Tang

I do have to say that by the time I went to the 4th APBC, my doctoral work had changed directions and cell simulation is no longer in the scope. My purpose to visit the Institute of Advanced Biosciences, Keio University, was for cell simulation. Even though things had changed, I have to fulfil my scholarship requirements. This trip was arranged by Koichi Takahashi, the main developer of E-Cell 3.

I think I was more amazed at Tokyo itself than anything else. The food is marvellous. I had actually seen a chain smoker when I was eating my ramen one day. This old man was sitting outside in the chill of snowy winter and smoked one cigarette after another, using the old cigarette to light the new cigarette. I am dumbstruck.



Around IAB, Keio University, at Tsurouka





Wishing tablets – mainly hoping for success in university entrance examination.



Outside Ueno train station (Tokyo)

I am really unsure how to describe Tokyo except “confusing” and “orderly chaos”. I can practically find everything there, no matter how perverse. There is even a shopping centre of pornography of all imaginations, and seriously, some genitals are not even of the same species. The subway system is unimaginable – Shinjuku station has more than 60 different exits. Actually, it was this trip to Tokyo that triggered enough interest to start to learn Japanese but sadly, only enough enthusiasm mustered to start. I will definitely have to visit this place again for all the food and “unique sights”.

My first decent manuscript from my PhD was rejected at this point in time. It was submitted to First International Conference on Pattern Recognition in Bioinformatics (PRIB), to be held in Hong Kong. One of the reviewers rejected my manuscript on basis that “my mathematics symbols do not look nice” and proceeded with a paragraph filled with grammatical errors and awkward sentence structures to describe my poor English writing. There is no word to describe that feeling. Despite so, that anger stayed with me for a long time, which fuelled my determination to start a periodical in Python language and its technology – The Python Papers (ISSN 1834-3147) – together with Tennessee Leeuwenburg as the Editor-in-Chief, while I was an Associate Editor. Tennessee is the founder of Melbourne University Computer Students’ Association (MUCSA) and that led me to realize something – once a creator, always a creator.

The rejected manuscript was revised and accepted by the 2nd PRIB, which was held in Singapore, and that gave me another free air ticket back home again. This time I met Angela Jean who eventually became a colleague at Life Technologies in 2011.

The Residential Year

I went back to Melbourne in May 2006 after my internship at BIRC in NTU and needed a place to stay since I had given up the apartment at Newmarket. I was temporarily staying with Michael Li at his apartment in College Square 2 at Faraday Street – which was when the full-blown drama with Andrew took place across the campus. I came to know Michael as a result of a Singapore students' night at Gotham Penthouse (a club located at Clarke Quay) when Michael was the President of Singapore Students' Society at Melbourne University.

Although Mike did not mind that I bunched into his place for a while, I should not stay there for too long. So I had to look for a place. One day, I saw some emails coming through that both Janet Clark Hall and University College were looking for Resident Tutors/Advisers. I applied to both and got interviewed. University College offered me a position the following day; thus, started my life as a Resident Adviser in University College (UC) for the next 2 years, until I left Melbourne on April 1, 2008. I recalled that the day I moved into UC was the intercollegial rowing competition at Yarra River. The residents were pretty rowdy during dining that evening but Genevieve assured me that that was not usual.

In the words of Genevieve Leach, Senior Resident Adviser and Director of College Welfare at University College, the role of a resident adviser (RA) is that of the night staff – we run and manage the entire college at night. There are 9 RAs including Genevieve and our duties are planned. This means that we will be on duty about 3 to 4 times a month. Each duty begins at 6pm and last till 7am the next morning for weekdays and 24-hour duty blocks for weekends.

If I am on duty, I will have to be in dining hall to see that everything is in order, eat with residents or academic visitors (there are many that I had met over the 2 years), then station in Senior Common Room (SCR) from about 7.30pm to 11pm. During this time, I will have to make 2 patrol rounds of the college to see that everything (security doors and all) are in order and the residents are behaving themselves. Each patrol round takes about 20 to 30 minutes. The rest of the time was doing my own work in SCR or talking to other RAs and academic visitors or just watching TV. We have a rule that the RA on duty is the TV channel master. At 11pm, the duty RA is free to

retire into his apartment-like room and hope that no calls or knocks from residents who locked themselves out during the night, which happens very often. As an RA, quiet and boring night is a good night.



Mid-autumn festival of 2006



Fong Chin and myself



The last formal dinner of 2006 in University College



Huiyin (currently a medical doctor) and I

Tze Chuan (Chewie) and Annie Mitchell (another Resident Adviser)

Personally, I hate it when residents lock themselves out. Even though I will wake up to unlock their doors, residents who know me even a bit know that I can be tempermental about lockouts. It is really their luck. I think the

worst night was when there were 4 lockouts and the last 2 got a scolding from me. Just bad luck – I am usually alright and can keep my cool up to the second lockout of the night. I must say that some residents are considerate enough to bunk in with their friends if they got locked out. Having said that, being an RA had really enriched my life significantly.



Taken before Commencement dinner (the first formal dinner) of 2007 at University College.



Residents at UC. Anush Tun Ismail (left, the grandson of Dr. Ismail, founder of UMNO), Jeff Chang (centre; my personal mentee), Ang Tze Chuan (right).



Commencement dinner (the first formal dinner) of 2007 at University College.

I think something out there did not like Ginny (Virginia Bratton) very much. She seems to have the most number of lockouts and unbelievable events during her duties. I remembered that it was early July of 2006 when we had some exchange students from America as residents. There was this guy whom I had forgotten his name but certainly did not strike a good impression with his language. Anyway, his friends played a trick on him and Ginny was on duty that day. His friends leaned a large bucket of soapy water on his door and knocked on his door. He opened the door and the bucket splashed on him. Instinctively, he chased after his friends down the

corridor and locked himself out in the process – topless. He went to Ginny and got a scolding from her but after knowing the prank, Ginny was very sympathetic and gotten him some bedsheets from the laundry room to help him clean up his mess of soapy water in his room. Well, Ginny has a tender heart.

There is really far too much to be mentioned about my stay in UC that it will probably take an entire book to talk about them, even if I can remember all of them. As I am writing this autobiography, I do regret not keeping a diary throughout my tertiary education days or even my postgraduate days or even just for this period in UC – there will be so much in there. I will just mention a few more memorable things and events during this period of my life.

For both years, I was living in the second largest RA apartment, which used to be the apartment for facilities manager. My apartment was the only one with a full kitchen and a decent-sized living room overlooking the courtyard. I really love that room even though I have to pay a bit more for the size. The good thing was that I would have my bathroom cleaned every Tuesday by the cleaners. Genevieve had the largest apartment; in fact, I will call it a house with a small car pouch and her herb garden. Yes, Genevieve enjoys working in her garden and enjoying the fruits of her labour. I recalled a day when she was pretty upset when she had planned to harvest snowpeas and cook for dinner the following day but woke up to find that a possum had chewed her snowpeas up before she could harvest them.

I went through 2 RA teams in 2006 and 2007, as well as a bit in 2008. Originally, I had wanted to return to UC in February to March 2008 as an academic visitor to clear up more writing before moving back to Singapore under circumstances that I will explain in the next chapter. However, I was asked by Dr. Deborah Seifert, Head of UC, if I was willing to serve as RA for the 2 months during which I was back and I agreed.

There were a total of 9 RAs, including Genevieve who was the Senior RA. We had a very diverse team of RAs in terms of academic interests and background and it was by design. The idea was that all residents have someone to talk to and seek advice from. Out of the 14 RAs that I worked with over the 2 years, there were

- Elenor Lee (a Research Assistant in epidemiology and has to deal with human organs and blood samples on a daily basis)
- Annie Mitchell (a teacher but was doing her PhD in education)

- Misty Jenkins (a PhD student working on influenza virology in Peter Doherty's lab)
- Justin Dzau (a M&A lawyer)
- Ren Yi (a Mongolian by descent with a good voice for Mongolian songs and was a Senior Research Manager in Victoria University)
- Helen Yang (from China and doing her PhD in economics)
- Michelle Segal and Scott Crawford (Michelle was a Publications Officer at University of Melbourne and Scott is her husband)
- Shelly Rodrigo (from West Indies and doing her PhD in epidemiology)
- Virginia Bratton (Lecturer in human resource management. She is now at University of Montana, USA.)
- Alexander Buirski (ex-Pentathlon sportsman)
- Matthew Hazledine (ex-UC resident and banker)
- Jonathan Coquet (PhD in immunology)

On the whole, I would say that the RA teams were closely knitted and we could and were willing to stand-in for each other whenever someone needed an urgent change of duties. Genevieve was the duty planner but we were allowed to swap duties mutually. The worst that we had ever had was a 3-way swap. Probably Genevieve had some idea but I always felt that less than half of the allocated duties were really done by the RA originally assigned. One thing I did know was that I was the swapper of the year for 2007 – whenever anyone had duty allocation issues, I would be available for swaps if I happened to be free on those days. I always felt that the negotiating to change duties to be an entertaining aspect of being an RA – if I had to swap my duties, I would have to talk to each RA until I could find someone willing to swap with me. For the record, I had never ever needed to go to a 4th RA to get my swap.

We had made it very clear to the parents on the first day when the students checked in at the beginning of the academic year that we, as a college, do not play the role of a surrogate parent. We viewed the residents as adults and we treated them as adults. Our role was to provide support and advice so that they can excel in their own field of choice. As such, residents' welfare is our priority. Personally, I always felt that I interacted better with residents who are international students compared to the locals and I made no apologies about it. I think that was something that I can bring to the RA mix. I aim to have a meal each day with the students whenever possible.

Over time, I had designed a structured routine around my meal times for residents to talk to me. I will be at the dining hall at about 7.15am to 7.30am during weekdays to start my breakfast. The dining hall sits in the middle of the college. Whenever there is hot breakfast, such as Tuesdays and Fridays, I will be earlier. I will have my toast and I love my raisin toasts with Vegemite, with a bowl of yoghurt and honey, before proceeding to a cup of hot tea with honey as well. I will leave for my office at about 8.15am to 8.30am. If I am early enough for breakfast, like 6.30am, I can even see some residents doing the “walk of shame” when they walked out of someone else’s room where they had spent the night in and going back to their own respective rooms. By about noon, I will be back for lunch and enjoy a cup of tea before meeting Edwin for coffee in the university. Together with dinner, I will be spending about 3 hours a day in the dining room which provides ample time for anyone to talk to me if needed without knocking on my door. My meal times are like my consultation hours in some sense and that seems to work pretty well. Usually I will also try to alternate – a meal sitting with the residents and another meal sitting with the RAs or academic visitors.

The college has a policy that we can order sandwich lunch if we are not in for lunch that day. We can choose the sandwich fillings. Justin, being a lawyer at CBD, will never make it back for lunch and he will order sandwich lunch everyday. Being a guy with a decent appetite, Justin will always try to pack as many different types of salads and meat into his sandwich. One day, he told me that the kitchen staffs got pissed off at him or something and gave him his designated 2 sandwiches, with a catch – one sandwich of pure vegetables and one sandwich of the meats. I just have to laugh when I heard about it that evening.

One of the unusual events that happened in college was during a Saturday evening when the power was down. That was about 2 years after the London bombing and we thought that there was a terrorist attack in Melbourne. It turned out that a nearby substation was on fire; thus, all the electrical power in Parkville was down. Shelly was on duty that evening and I decided to stay with her in the lobby throughout the night as the main doors had to be left open for students to come back and I did not feel safe to just have one RA guarding the gate.

In 2007, I had the pleasure of working with Maurice at the University College as part of a team of Resident Advisors. Maurice is a goals oriented person with a positive and cheerful disposition. In times of trouble one can count on

Maurice's support. There was an incident where power was knocked out one night while I was on duty and the security of the residence was compromised since the main doors were open. Maurice was my steadfast companion, providing repast and light relief throughout the night. Maurice has a wide range of interests from finance to biology and his conversations are always thought provoking and insightful.

-- Shelly Rodrigo (March 23, 2008)

Academic visitors formed an important aspect of collegial life. I will say that they are the icing and sparkles. Without them, college life can be rather monotonous. Academic visitors seem to provide that extra intellectual stimuli that we all need. It is really disappointing that I am not able to remember all of them, much less all of their names. This is another reason for me to keep a diary. Despite so, there are some really notable ones that I can recall their names, which is an amazing feat in itself.

John White³, FRS, is a Professor of Chemistry at Australian National University, working on self-assembly chemistries. He is a very interesting person who offered me a lot of advice and insights into the history of scientific thoughts. I believe John was the one who gave new insights into my doctoral work that I am really isolating the individual biological components and the associations between them, which can be used to model biology in a large scale. In academic world, I will consider him to be highly-decorated.

Ruth Taylor⁴ is a lecturer of management at Curtin University in Perth. She attended my final PhD seminar and is a very delightful lady to have meals with. Throughout my stay in UC, I think she stayed in UC twice to work on her doctoral thesis. I remembered an incident that she told me during one of the conferences that she had attended. The speaker was studying electric companies and had a sample size of about 100 (I cannot remember the exact number but Ruth knew about it). An audience questioned the speaker's work and said that the sample size was too small to draw her conclusions, to which, the speaker replied "but that's the entire population!" I had a good laugh even though I am not sure if it was the audience's arrogance or ignorance that I am laughing at or the fact that a population can be studied.

³ <http://chemistry.anu.edu.au/people/professor-john-white>

⁴ <http://business.curtin.edu.au/schools/management/people.cfm/Ruth.Taylor>

Douglas Arner⁵ is the current Head of Law in University of Hong Kong. Then, there was a Universitas 21 fellowship programme and Douglas was one of the fellows. In his words, it is actually a fellowship that enabled long-paid leave for academics to visit another university for an extended period. I think Douglas might have spent a total of 6 to 8 months in the law faculty at University of Melbourne. Douglas told me that nothing beats face-to-face meeting in Hong Kong, especially when job hunting is concerned, and he had flown to HK to approach the university himself. What strikes me is peculiar was that Douglas' posture in the photo on his university website is highly authoritative, with rows of colour-matched and bounded legal journals in background. Yet, he is an extremely friendly person and Genevieve did say that the authoritative image is needed for his profession and I really agree.

Arthur Forer⁶ is a professor emeritus at York University in Canada who is collaborating with the School of Botany at Melbourne University, working on chromosome movement during mitosis. Basically, the chromosomes will line up at the centre of the cell during mitosis (specifically, metaphase) and at the start of anaphase, the chromatids will move towards the poles of the cell, but why? How did the spindle poles know when to start the process and how to coordinate the speed of chromatids movement? That is Arthur's life-long research. It is amazing to me that so much is unknown even from first year genetics, and we thought that we knew all of these. How Arthur got to collaborate with Melbourne University is also interesting – apparently, someone at Melbourne University had some serious criticisms to one of his earlier papers and Arthur thought that correspondence is a poor way to resolve this conflict. Hence, he flew to Melbourne to meet up his critic whom eventually became his collaborator. Despite his age (about 70), he routinely cycles from Parkville to Mount Dandenongs during the weekends – about 100km return trip. Arthur had my admiration. I believe Arthur and his wife (a retired nurse or teacher, I cannot even remember now) came to Melbourne twice when I was an RA, during the summers. I remembered clearly that it was the middle of winter when they had to go back to Canada and dreaded the snow and the possibility of having to dig their way through the snow after a 32-hour door-to-door journey back home. He was always sad to have to go back home due to the winter.

⁵ http://www.law.hku.hk/faculty/staff/arner_douglas.html

⁶ <http://www.yorku.ca/gradbiol/faculty/profiles/arthur.html>

Christopher Lawrence – a very interesting man with a very interesting background. His family is a Nobel family and his eldest brother has the heritary title of a Lord. I am always confused as to whether Chris came from Cambridge or Oxford. He stayed in UC to translate a French play into English. We all love the way he talks and argues – extremely well-mannered even in heated arguments, and with a sporting long ponytail. Jeff once said that Chris is like one of those people from manga – even the lifting of a glass will explode stars of well-manners around him. That is certainly how I felt.

Liu Shiang-Tung⁷ is a professor in eduation in National Chiayi University in Taiwan. He was on sabbatical leave, attached to the education faculty at Melbourne University. His research area is on mathematics education and had long conversations with Annie Mitchell, an RA doing her PhD in mathematics education as well. Shiang-Tung thinks that the Chinese language actually helps Chinese to learn and process fractions as “one third” in Chinese will be written as “three parts taken one”; hence, Shiang-Tung felt that the English wordings for fractions required stack processing – remember the “one” then process the “thirds” – and that is not required to process Chinese wordings for fractions.

Out of all the routine activities, I love high table dinners, which happened every Monday and Tuesday evening. I made it a point to try to attend every high table if possible, even though the general requirement for RAs is to attend one high table a week. I was told that high table was an Oxbridge tradition where everyone will be dressed in academic gown for a semi-formal dinner. If you had watched Harry Potter, the dinner is what high table will remind me of. Of course, our real intention is to use it to educate residents on proper dining manners. Mind you, I had seen a number of cases whereby residents seem to have just discovered a fork. During the dinner, students will be sitted at the usual round tables and the college staffs, including RAs, and academic visitors will be sitted on a long table. Several residents will be invited to sit on high table (the long table) at least once a year. Genevieve is the sitting master.

Before high table itself, there is drinks reception at the Senior Common Room and I will try to be there as early as possible to serve Port or Sherry and finger foods to our guests. After the dinenr, we will also retire to Senior Common Room to have a cup of tea and continue our conversations.

⁷ http://140.130.46.2/~liust/end/new_page_3.htm

Maurice was a Resident Adviser (RA) for from May 2006 until March 2008. This position included duties such as ensuring the security of the College buildings at night, informal mentoring of students and pastoral care of students.

He was a most reliable RA, always on time for duty and very accommodating with duties for other RAs with challenging academic or social timetables.. He frequently attended both Monday and Tuesday High Tables and I came to rely on him to be there in the Senior Common Room before the arranged time and thus there was always someone to greet the apartment guests and students and to offer them refreshments.

Maurice was meticulous in carrying out his duties and could be relied upon to provide a succinct but useful report for administration personnel. He interacted with a range of students and became an informal mentor to a number of them. Following on from these interactions he was able to highlight areas in which the College could provide further assistance to students.

At the same time Maurice developed collegial relationships with several of our academic visitors, exchanging ideas and maintaining correspondence with academics from diverse areas of scholarship.

Maurice presented aspects of his academic work at seminars on two occasions at University College and the ensuing discussions were most appreciated by the audiences. He proved to be a valuable member of staff.

-- Genevieve Leach (May 22, 2008)

Well, the RA team was not without its own trauma. There was a case of suicide in Whitley College and we were alerted. Genevieve had to do overtime to provide counselling for the residents there. Thinking back, I am not even sure how that can be prevented. The student was a sportsman and popular with his peers in college, as well as appearing to be cheerful even to the day before his suicide. Nevertheless, he just hung himself in his room. I really do not know what signs I could detect if it had happened in UC.

The Dairy CRC breathed its last in 2007 when the CRC grant to Australian government was rejected. With the increasing Australian drought, dairy production dropped and fewer farmers are willing to be part of it, or so I heard. Nevertheless, I knew that the CRC was in increasing financial trouble since the end of 2005. In the summer of 2007, we had our last Dairy CRC meeting in Gold Coast, Queensland. The atmosphere was not as enjoyable as what it could have been knowing the difficult road ahead when our funding is reduced. One of the last sessions of the meeting was a career

development workshop and I am really not sure who organized it or whether the facilitators know what they are doing – they were actually guiding everyone, full professors and all, in CV writing. To a large extend, I think this is humiliating. As Sonia later put it, time will be better spent singing Au Lang Syne over a large glass of wine.



Just before the first session of the day.



Me, after lunch.



Joly, before dinner.



Elie Khalil at his poster.



Susan Cummings (also known as Grandma Susan) – Education officer of Dairy CRC.



Elizabeth Pharo (left) and Coralie Reich (right) at their poster.



Kevin, at poster session.



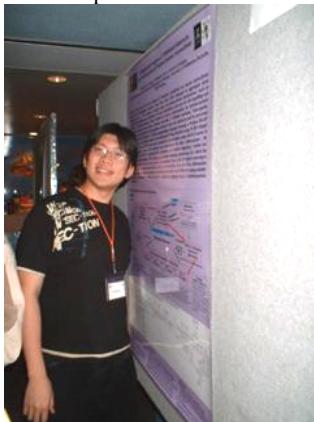
Joly at her poster on wallaby gut development.



Sonia. Taken when we are boarding the bus to airport.



Elizabeth and Sonia at morning tea.



Me at my poster on mining protein-protein interactions from the literature.

Personally, I think the dwindling and demise of the Dairy CRC has quite an impact on me. It got me to think very hard whether I want to pursue a full-time research career well knowing that this is something that is always looming across the horizon.

The subprime mortgage crisis hit on August 7, 2007, when BNP Paribas terminated from 3 hedge funds. This eventually rolled into Global Financial Crisis of 2007 to 2008 and collapse of Lehman Brothers on September 15, 2008⁸, followed by global recession of 2008 to 2010⁹ – the worse financial crisis since Great Depression in 1929. Hence, 2008 to 2010 is also known as the Great Recession. The European Sovereign-Debt Crisis or Eurozone crisis since late 2009 is a continuation of the initial effects in 2007. I estimated that I had lost about SGD 20 thousand within that time, or 18.2% of my assets. It was not a real big deal as I do not use any leverage back then. Even now, I will only use leverage cautiously. Since it happened, I had used this protracted period to toughen my nerves and I think I had emerged out of it substantially stronger.

I left UC on April 1, 2008, which was a Tuesday. I had my last high table dinner as an RA the day before. Deborah gave a short speech about me during the dinner and that was really touching. There is without a doubt that I had learned a lot and experienced a lot during my service as an RA, something that I will never be able to get should I be renting an apartment elsewhere in May 2006. I had good memories of that place – a residential college shrouded in vegetation next to the cemetery.

Deborah left her position as Head of College in May 2008 and Genevieve left UC at the end of 2008 as well.

⁸ Lehman Brothers announced the filing for Chapter 11 bankruptcy protection at around 5.30am BST on September 15, 2008.

⁹ The Financial Crisis Inquiry Report: Final Report of the National Commission on the Cause of the Financial and Economic Crisis in the United States. ISBN 978-1610390415.

The Returning

The choice to return back to Singapore is probably the only choice by the second half of 2007 – my grandmother is likely to have breast cancer. This was confirmed by October 2007 – she is diagnosed with terminal stage breast cancer. It was a tough act as I will much prefer the lifestyle back in Melbourne. On the other hand, after seeing the collapse of Dairy CRC, I asked myself – is this really worth it? Do I want to spend a third of every year writing grants that I am not likely to get?

六年返回情

三十载	语云立	坐已回守汝不级
一波浪	目异村	六春清早如一休
思当景	对今朝	心沸喜愁优乐待
欲二月	可侵猎	但有重重不可呆
离与惜	两头难	前车反复何不可
待一页	新一篇	魂归咀嚼梦作章

- 01/04/08

Looking back at the entire 6 years in Melbourne is waves after waves of emotions surging up in me – almost a turbulence of emotions. Back in 2002, I was feeling the anxiety of going to Melbourne and at the beginning of 2008, I am feeling the anxiety and nervousness about coming back to Singapore. Every year when I came back to Singapore for a break, everything changes – I am not sure if I can fit back into the society again. I really love Melbourne for all that it had given me, except the giant housefly-like creature that plagued everyone in summer which resulted in the so-called Melbourne salute. Houseflies in Singapore attacks food. Those fat flies attack holes – ear, nose, mouth and everywhere. You can really smack some of it into your friend's mouth if they are unaware.

The only consolation back in Singapore is that I had gotten a lectureship in Singapore Polytechnic (SP) which starts on April 4, 2008, about 36 hours after I reached back in Singapore.

How I got into SP was an interesting occurrence. In October 2006, Melbourne University had an open house in Singapore. I was introduced to my current director by Professor Derek Chan, Deputy Dean of Science in

Melbourne University. After a few round of discussion on the bioinformatics curriculum, Dr Thomas Chai (Director, School of Chemical and Life Science, SP), asked me to apply to them. That was January 2007. I was evaluating the bioinformatics programme in SP. For that, I wrote a proposal to Thomas as well. After about 2 to 3 meetings with Thomas, he asked in front of Dr. Pho Lay Koon (Course Manager for Diploma in Biotechnology, SP) if I will be interested to join them. That eventually got me the job offer in December 2007.

As I have to come back to Singapore, I rejected a potential job offer to Google, either to be stationed at their Sydney office or in America. At the same time, I took a lapsed candidature from my PhD from July 2008. However, this means that I will have to continue writing up and submit my thesis by July 2010 as lapsed candidature can only last for 2 years. I had reckoned that if I could stay on in Melbourne till June or July 2008, I could have finished my thesis. However, time is not on my side as my grandmother was really very sick by then.

With a very heavy heart and almost unwilling heart, I flew back to Singapore on April 2, 2008. My grandmother passed away in the afternoon of June 22, 2008, and I wrote this to conclude the acknowledgement of my doctoral thesis.

Perhaps my only regret is not able to finish this thesis fast enough for my grandmother to witness my graduation. She had passed on with dignity by removing her own oxygen supply on the afternoon of 22nd June 2008, 8 months after being diagnosed with terminal breast cancer caused by MAP kinase mutation in the insulin signalling pathway – a subject that I know intimately from this work. This thesis is for you.



Grandma when she is healthy.



The last Chinese New Year together.



The day before grandma passed away.



Grandfather and grandmother when they just got married.

I made a 3 weeks trip to Melbourne on March 2009 to try my best to finish up my thesis and to give my final doctoral seminar. Genevieve Leach and Ruth Taylor, as well as my close friends, Edwin, Joly, Joel and Phil, made it to my seminar and I am very grateful. By then, I had 2 other data chapters published, making a total of 3 of the 4 data chapters published. I think I am in pretty good shape. By then, Kevin and Christophe had moved to Deakin University to be Professor of Biosciences and Associate Professor of Bioinformatics respectively. Sonia had moved on to be a project coordinator

with another CRC. I respected Sonia a lot for all her care and concern from my honours years. Of course, the biggest memory is during Lorne in 2004.

Joly drove me to Deakin on the second day of reaching Melbourne and I can remember that Kevin was in lab meeting. We were invited to sit in. I thought I had gone through this and had decided that I am not likely to be a research scientist, which is why I had decided on a lecturing position in SP. I thought that the balance had been tipped in place but I was wrong. The balance had been un-tipped and I was in dilemma again – dilemma about my future and career path.

The Balance Un-Tipped

Two days to the South
I looked myself in the path
It seems the winds had swept
A mixed thought I thought the sand had kept

Warm rays beat the ground
Words around
Lighting glows I found
Boy, in this, can I drown

Why had I walked from this rivers
Of the pleasure it givers
The jot of hot sun delivers
With moans too, that grievers

Stacks of words in a year
For the work I can hold dear
Seen by flickerness of the wind
it may all be an unfulfilled dream

Packaged thoughts
Pain and worry
Use the line
All these game I sight
I wonder where I can light
Admist the blight

Yet yearning
The excitement forthcoming

In this seemingly homecoming
How can I be receiving
With the balance lie untipping
- 09/04/09

I submitted my thesis for examination in May 2009, 4 years 10 months since I started my doctoral route, and begin my long wait for the examination results. Thanks to Edwin who had been helping me to print and submit my thesis on behalf. Eventually, he also helped me greatly on binding my final thesis – one of each available colour.

On Christmas Eve of 2009, I reached Singapore Polytechnic at about 8.15am and went directly to Foodcourt 4 to have my usual breakfast of bread and runny eggs. Opened my email and found an email from Martin Hendrick Lee who is an examination officer at Melbourne School of Graduate Research in my university and my thesis examination came through – passed with minor revisions from 2 of the 3 examiners. The remaining examiner was critical and decided that I should not be awarded my doctoral degree as yet. No wonder my thesis examination takes this long to complete.

As examiners, they can opt to let me know who they are. In the words of the university, they can release their identity to me or not. The 2 examiners who passed me did – Peter Wynn and I-Fang Chung. The one who decided that I should not pass chose to withhold his identity. It is a stroke of luck that I was searching for someone online and I came across a CV with my name on it. I read it and found that he was the one whose name was withheld.



THE UNIVERSITY OF
MELBOURNE

MELBOURNE
SCHOOL OF
GRADUATE
RESEARCH

Dear Mr Ling

PhD Examination

The examiner(s) of your thesis have requested that certain minor amendments, which are set out in the accompanying report(s), be made to your thesis. The result has been determined by the recommendations of Examiners 2 and 3. The report from Examiner 1 has been included for your information. You should consult your supervisor and Chairperson of Examiners, **Professor M Keough**, on how to respond to the examiner(s) comments.

The amendments required are to be incorporated into the text of the thesis. There are specific requirements for the final presentation of the thesis, particularly with regard to what should appear on the spine of the thesis. Refer to "Final Form of the Thesis" requirements in the relevant handbook, located at: www.gradresearch.unimelb.edu.au. You are requested to provide an index summarising the changes for the Chairperson of Examiners to consider and approve **before binding your thesis**.

Candidates who commenced from 1 January 2007 must now submit a digital copy of the thesis, preferably in PDF format, to The University of Melbourne ePrints Repository (UMER) as a requirement for completion. All candidates who commenced prior to 2007 are encouraged to submit a digital copy but it is not mandatory. There are clear instructions to guide the uploading process on the Repository available at: www.lib.unimelb.edu.au/eprints/thesis. Information on the requirement can be found at: www.gradresearch.unimelb.edu.au/digitalthesis.

Please submit prior to **1 February 2010** two copies of the amended thesis in permanent hard cover binding (one of these on archival quality paper) to the **Chairperson of Examiners** and one digital copy to the ePrints Repository (if you commenced your degree from 2007). If you are unable to meet this deadline, you are required to complete an *Application for an Extension to Submit Final Permanently Bound Copies of the Thesis* available at: www.gradresearch.unimelb.edu.au/current/exams/submission/#forms.

Candidates are considered eligible to pass once the Melbourne School of Graduate Research has received a Completion of Degree Form from the Chairperson of Examiners, two permanently bound copies of the thesis through the Chairperson of Examiners, an approved citation (for PhD and Doctorate candidates), and a digital copy of the thesis has been deposited to the Library (for candidates who commenced from 2007). Once these requirements have been fulfilled you will receive a letter stating you have successfully completed all the requirements for the degree and will be eligible to graduate. Graduation information will accompany the completion letter.

Should you need further information please contact the examinations staff, either Angela Balshaw (abalshaw@unimelb.edu.au) OR Emma Macey (ejmacey@unimelb.edu.au) on ph. +61 3 8344 8294.

Yours sincerely

A handwritten signature in black ink.

Mary Makris
Senior Examinations Officer

cc. Professor M Keough, Chairperson of Examiners
Dr K Nicholas, Supervisor
Zoology

MM:ml

Epilogue

I started this book to document what is left of gradually fading details of my 6 years of undergraduate and postgraduate life in Melbourne in late 2011. It had taken me almost 2 years to complete this project.

If there is any overarching lesson to be learnt while writing this autobiography, to echo the words of President Ronald Reagan and President Jimmy Carter, it will be the importance of keeping a diary or a journal. There are so many things and so many names that I cannot recall – just buried in the depths of my memories. Nevertheless, all my encounters and experiences, no matter how insignificant they are or how painful they are at the point in time, played a part in the total experience that I had.

It is a wonderful experience and I had not regretted a single bit of embarking on this journey.

Maurice Ling
September 11, 2013

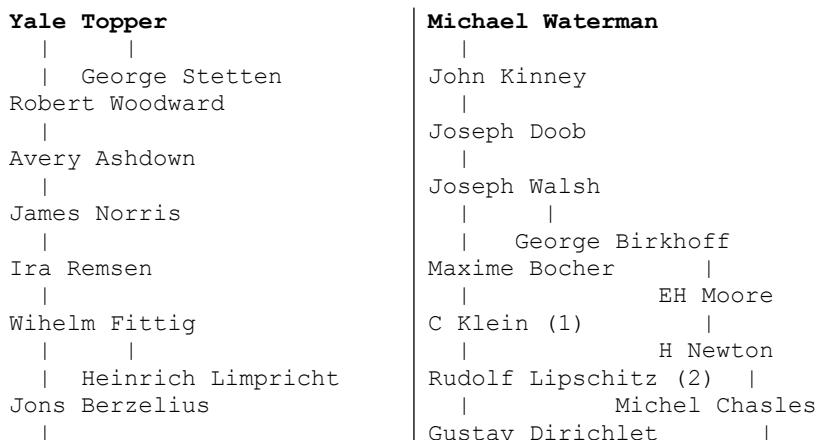
Appendix A: My Academic Genealogy

My doctoral thesis is jointly advised by Kevin Roy Nicholas and Christophe Lefevre. Kevin's doctoral and postdoctoral advisers are Peter Hartmann (Winthrop Professor at University of Western Australia) and Yale Jerome Topper (Scientist Emeritus, NIH, and deceased on October 26, 1995) respectively. Christophe's doctoral and postdoctoral advisers are Philippe Jeanteur (Professor at University of Montpellier 2) and Michael S. Waterman (Professor at University of South California).

I trace my academic genealogy from them.

Disclaimer: This genealogy is done to the best of my knowledge but I am neither an academic/scientific historian nor a genealogist; hence, I cannot be sure that all information is correct. This information may not be an accurate academic lineage in terms of doctoral advisor-candidate relationship but it is as close as academic mentor-mentee relationship.

Acknowledgement: The line pre-Robert Woodward is taken from SonBinh Nguyen's laboratory website (<http://chemgroups.northwestern.edu/nguyen/group/genealogy.html>). The line of Michael Waterman is collated from Mathematics Genealogy Project (<http://genealogy.math.ndsu.nodak.edu/>).



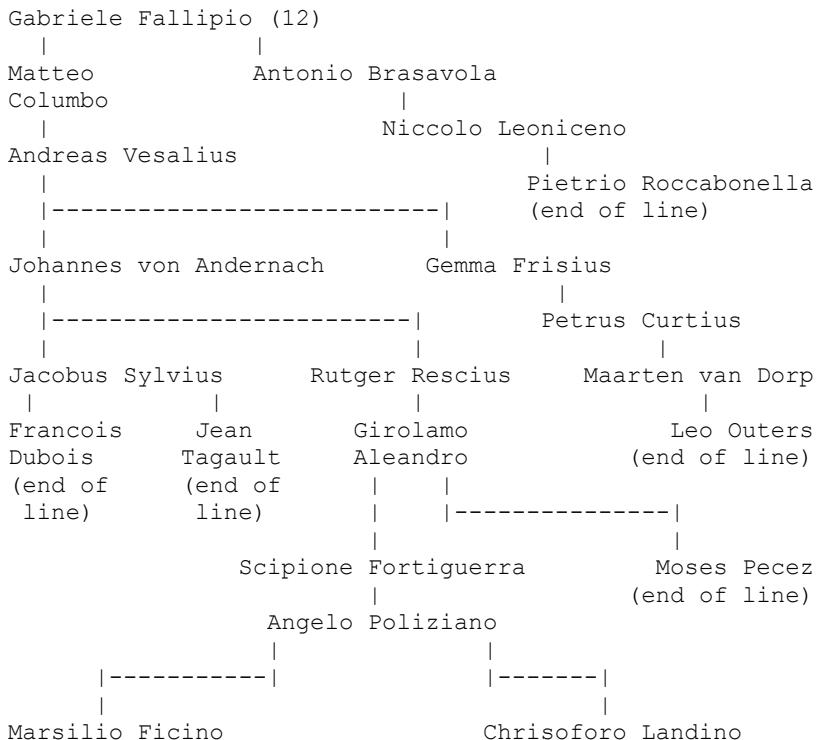
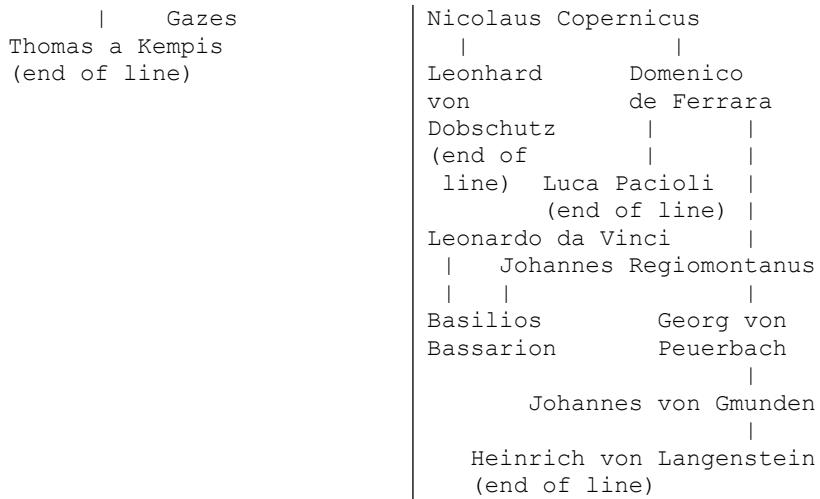
Johan Afzelius			
Torbern Bergman			Simeon Poisson
			Jean-Baptiste Fourier
	Marten Stromer		
Anders Duhre			-----
Petrus Elvius			Joseph Lagrange
Petrus Hoffvenius			Giovanni Beccaria
			(end of line)
Johannes van der Linden			Pierre-Simon Laplace
			Leonhard Euler
Menelaus Winsemius			
			Jean d'Alembert
Petrus Pauw			(end of line)
Henricus Brucaeus			Johann Bernoulli
Petrus Ramus			Jacob Bernoulli
			Nicholas Eglinger
Jean Hennuyer			
(end of line)			Theodor
====			Zwinger, Jr
Rudolf Lipschitz (2)			Johann Bouchin
Martin Ohm			Sebastian Beck
			Emmanuel Stupanus
Karl Johann Pfaff (3)			
Langsdorf			Johann Grynaeus
			Petrus Ryff (7)
Abraham Kastner			Jacob Andreae
			Theodor (end of line)
====			Zwinger (4)
C Klein (1)			====
			Julius Plucker
Johann Wichmannshausen			
	Johann Planer		Christian Gerling
Otto Mencke			
			Carl Gauß
Jakob Thomasius			
			Johann Pfaff (3)
Friedrich Leibniz			
(end of line)			Johann Bode
			Johann Busch

Johann	Rudolf	Michael	Christophe
Pasch	Camerarius (6)	Fortsch	Reuchlin
			(end of line)
Michael Walter, Jr (8)		Kilian Rudrauf	
		(end of line)	
Aegidius Strauch		=====	
Andreas		Rudolf Camerarius (6)	
Kunad		Elias	
(end of		Camerarius, Sr	
line)		Georg Metzger --	
			Emmanuel
Abraham		Johann	Stupanus
Klein		Macasius	
(end of line)			Petrus Ryff (7)
=====			
Georg Calixt (10)			
Cornelius Martini		Georg Großhain	
Duncan Liddel		Paul Jacobus	
		Rober Martini	
Paul John Craig		(end of	
Wittich		line) Cornelius	
	Theodor Zwingier	Martini	
Valentin			
Thau	Gabriele		
	Fallopio (12)		
Johannes		Balthasar Widmarcter	
Hommel Petrus Ramus			
(13)			
	Jacques	Werber Rolfinck	
	Toussain	Daniel Adriaan	
Johannes		Stennert van der	
Sturmius	Guillaume		
	Bude	Jen Spieghel	
		Jessenius	
Georgius		Hieronymus Fabricius	
Hermonius	Janus		
(end of line)	Lascaris		

	-----		=====
Basilius		Michael Walter, Jr (8)	
Bessarion	Demetrios		
	Chalcocondyles	Johann Quenstedt	

Georgio		Georg Christopher	
Gemistos	Theodoros	Calixt (10) Notnagel	
	Gazes		
		Johannes Ambrosius	
	Vottorino da Feltre	Caselius Rhodius	
	Guarino da Verona	Philipp Malanchthon	
	Manuel Chrysoloras	Johannes Johann	
		Stoffler Reuchlin	
	Demetrios Kydones	(end of	
		line)	

Johannes	Nicolas	Jacob	
von Andernach	Clenard	Loans Johannes	
		(end of Argyropoulos	
	-----	line)	
Jan van		Basilios	
Campen	Jacobus	Bessarion	
	Latornus		
	(end of	Georgios Gemistos	
-----	line)		
Johann	Matthaeus	Elissaeus Demetrios	
Reuchlin	Adrianus	Judaeus Kydones	
	(end of line)	(end of line)	
		Nilos Kabasilas	
		(end of line)	
-----		-----	
Eramus	Philipp	Melchior Jostel	
Reinhold	Melanchthon	Ernestus	
		Valentin Hettenbach	
Jakob Milich		Otto	
		Andreas Schato	
Ulrich	Desiderius		
Zasius	Erasmus	Sebastian Dietrich	
(end of			
line)	Jan	Georg von Leuchen Rheticus	
	Alexander Standonck		
	Hegius (end of		
	line)		
	Theodoros		



|
Johannes Argyropoulos
(end of line)

Philippe Jeanteur

C. Paoletti Guiseppe Attardi
|
Torbjorn Caspersson
|
Jack Schultz
|
Thomas Hunt Morgan
|
William Keith Brooks
|
Louis Agassiz
|-----| Georges Cuvier
|
Alexander Justus Loder Abraham Werner
Von Humboldt | |
|
Heinrich Wrisberg | August Richter
|
Georg Richter
|
Johann Hannemann

Appendix B: Original Ph.D. Proposal

The dairy industry is an important part of the Australia's agricultural industry and the CRC for Innovative Dairy Products is established to bring dairy farmers and academic researchers together, with the aim of developing methods to improve the quantity and quality of dairy yields through various methods, including, improvised breeding programs. Research efforts over the last four decades, using various model organisms, ranging from eutherians to marsupials, had given us substantial knowledge on the genetic factors regulating lactation. Most of this knowledge is recorded in published literature. Despite the presence of knowledge, a global model of genetic regulation, based on system biology, had not been established. Using mouse as the model organism, the goal of this project aims at developing a hypothetical model of murine lactation using the published literature.

Currently, MEDLINE had indexed more than 13 million citations of published works over the years, and is increasing at an increasing rate. A majority of the indexed citations contains the abstract to the paper, which can be seen as a more condensed form of knowledge represented. These citations, with abstracts, formed the primary source of knowledge where this project will draw upon. Previous efforts by a number of institutes had established curated databases of various nature from the literature, including, controlled vocabularies (such as, Gene Ontology and Medical Subject Headings), biochemical interactions (such as Enzyme Commission), molecular evolution (such as, Cluster of Orthologous Genes) and consolidation of databases (such as, Kyoto Encyclopedia of Genes and Genomes).

Although curated databases exist but they are relatively volatile and distributed. Hence, keeping current with these databases is often time consuming and unproductive. The first step in this project will look into a means of automated assembly and updating of murine-specific subset of these databases, known as “MouseBook” in this project.

The biochemical aspect of MouseBook will be analyzed for assembly into a primitive networked model of biochemical reactions assuming homogeneity, known as “MouseWay” in this project, using stoichiastic physical process modeling. At this stage, MouseWay suffers two major drawback, firstly, it takes no account of basic biological concents, such as, compartmentalization and localization. Secondly, it represents biochemical network of a universal murine call; thus, no concept of cell or tissue type. The rest of this project is targeted towards refining MouseWay, with emphasis on lactation, by eliminating the drawbacks described above via a semi-automated cyclic process of information extraction from the literature, remodeling and re-simulation.

Information extracted from the literature will be used for the following refinement of MouseWay. Firstly, a layer of cellular architecture will be superimposed on MouseWay, giving it an elementary structure of compartmentalization and localization. Secondly, positional information, with respect to the cellular environment, of mobile proteins, such as importins will be identified and mapped. Thirdly, knowledge about protein scaffoldings will be mined from the literature and added to the model, giving it fine structural details. At this stage, the first drawback mentioned above is largely eliminated.

The second phase of knowledge mining from literature aims to “specify” the universal murine cell into a lactogenic (mammary) cell using a reduction-addition approach, which is a cyclic process of reduction and addition. In the reduction phase, knowledge is mined specifically to identify biochemical processes that are known to be non-existent in the mammary epithelial cell. In the addition phase, biochemical processes that exist in the mammary epithelial cell but absent in the model are added.

After eliminating the drawbacks of MouseWay, the model (MouseWay) will be evolved into “MurioLactoLand: a simulatable genetic regulation model of murine lactation”, which is likely to be the eventual title for this project thesis.

Appendix C: Initial Specification of MCMAS

```
MCMAS ::= ComponentDefinition+ ModelDefinition
        SimulationDefinition
ComponentDefinition ::= ComponentClause UseClause
        VariableClause InterfaceClause OperationClause
        EndComponentKeyword
ModelDefinition ::= ModelClause UseClause
        ConnectionClause EndModelKeyword
SimulationDefinition ::= SimulationClause SUseClause
        InitializeClause SimulateClause
        EndSimulationKeyword
ComponentClause ::= ComponentKeyword Identifier
        InfaceKeyword Integer OutfaceKeyword Integer
UseClause ::= UseKeyword Identifier*
VariableClause ::= VariableKeyword VariableDefinition*
InterfaceClause ::= InFaceDefinition OutFaceDefinition
OperationClause ::= PythonOperationBlock?
        OctaveOperationBlock?
ModelClause ::= ModelKeyword Identifier
ConnectionClause ::= ConnectionKeyword
        LComponentVariable RComponentVariable
SimulationClause ::= SimulationKeyword Identifier
SUseClause ::= UseKeyword Identifier
InitializeClause ::= InitializeKeyword InitializeTerm*
SimulateClause ::= SimulateKeyword Identifier
VariableDefinition ::= StringVariable | IntegerVariable
        | FloatVariable
StringVariable ::= StringKeyword Identifier Identifier*
IntegerVariable ::= IntegerKeyword Identifier Integer?
        ConstantKeyword?
FloatVariable ::= FloatKeyword Identifier Float?
        ConstantKeyword?
InFaceDefinition ::= InputKeyword Identifier ':'
        Identifier+
OutFaceDefinition ::= OutputKeyword Identifier ':'
        Identifier+
PythonOperationBlock ::= (PythonKeyword Identifier+)*
OctaveOperationBlock ::= (OctaveKeyword Identifier+)*
LComponentVariable ::= Identifier '.' Identifier
RComponentVariable ::= Identifier '.' Identifier
InitializeTerm ::= ComponentVariable Identifier+
        | Integer | Float
```

```
ComponentVariable ::= Identifier '.' Identifier
ComponentKeyword ::= 'component'
ConnectionKeyword ::= 'connection'
ConstantKeyword ::= 'constant'
EndComponentKeyword ::= 'endcomponent'
EndModelKeyword ::= 'endmodel'
EndSimulationKeyword ::= 'endsimulation'
FloatKeyword ::= 'float'
InfaceKeyword ::= 'inface'
InitializeKeyword ::= 'initialize'
InputKeyword ::= 'input'
IntegerKeyword ::= 'integer'
ModelKeyword ::= 'model'
OctaveKeyword ::= 'octave'
OutfaceKeyword ::= 'outface'
OutputKeyword ::= 'output'
PythonKeyword ::= 'python'
SimulateKeyword ::= 'simulate'
SimulationKeyword ::= 'simulation'
StringKeyword ::= 'string'
VariableKeyword ::= 'variable'
UseKeyword ::= 'use'
Identifier ::= [a-zA-Z][a-zA-Z0-9]*
Float ::= Integer '.' Integer
Integer ::= [1-9][0-9]*
```

Appendix D: Confirmation Report

This thesis aims at initiating this framework by building a model of endocrine stimulation of lactation in murine mammary epithelial cells, using information extracted from the literature. At the same time, this project also aims to establish a set of tools necessary for building signal transduction models.

The two main tools needed are,

1. a system for handling and analysis of abstracts from PubMed, which is used to manage the process of extracting, storing and analysis of published abstracts describing the mechanisms of endocrine signal transduction in mammary epithelial cells and the subsequent induction of milk protein genes that are used as a marker for lactation; and
2. a system for the modeling and simulation of the built mouse lactation model, which will be used as a platform for managing the model built from the extracted information and provides facilities for simulation of the model.

The project focuses on two aspects. Firstly, using a published set of 5000 genes that have been implicated in the regulation of murine lactation, it seeks to understand how they are related to each other, in terms of gene-protein and protein-protein interactions. Secondly, it seeks to explore the link from the endocrine stimulation of the mammary gland by insulin, prolactin, and glucocorticoid to the set of 5000 genes.

Tasks for Second Year

- Complete SBML adaptor for Mosirium
- Run tests cases for SBML conversion to and from MCMAS/MADIR using the test suite provided by SBML Team
- Write a simulation engine for production use
- Examine the routes to add clustering support onto Mosirium
- Extract information from abstracts on prolactin signaling pathways
- Extract information from abstracts on glucocorticoid signaling pathways
- Create a model for insulin/prolactin/glucocorticoid signaling pathways in the mammary gland from hormone receptors to their response elements
- Extract information from abstracts to model the relationships between the set of 5000 genes and their products
- Examine the synergistic use of other text processing tools, such as NLTK, GATE and ConceptNet, on Muscorian
- Write chapter 2 (Mosirium) of thesis

- Write chapter 3 (Muscorian) of thesis

Tasks for Third Year

- Model the relationships (gene-protein, protein-protein) of the 5000 genes and their products
- Link between signal transduction pathways of insulin, prolactin and glucocorticoid, and the interaction model of the set of 5000 genes
- Devise means to verify the model
- Verify the model for accuracy of information
- Write chapter 4 (insulin, prolactin, and glucocorticoid signaling pathways) of thesis
- Write chapter 5 (interactions of 5000-genes and proteins) of thesis
- Write chapter 1 (introduction and literature review of lactation and hormonal signaling in lactation) of thesis
- Write chapter 6 (verification of model) of thesis
- Write chapter 7 (general discussion and future work) of thesis
- Submit PhD thesis

Expected date of completion

Expected date to stop all crucial bench work: 31st December 2006

Expected date of thesis submission: 30th June 2007

Appendix E: PORES Application

a) Name of collaborating institution

Bioinformatics Research Centre (BIRC)
Nanyang Technological University, Singapore

b) Name of collaborator

Associate Professor Lin Feng
Division of Information Systems, School of Computer Engineering
Nanyang Technological University, Singapore

c) Nanyang Technological University, Singapore has a formal university-wide exchange agreement with The University of Melbourne, Australia.

d) Period of study

6 months from 7th of October 2005 to 23rd of April 2006.

e) Nature of collaboration

A long-term collaboration is being initiated through this laboratory placement.

f) Outline of research work intended

Large volumes of research articles have been published on the molecular pathways of hormones that regulates mouse lactation. However, there has been no attempt to consolidate this knowledge into a useable framework. This thesis aims at initiating this framework by building a model of endocrine stimulation of growth and development of mouse mammary epithelial cells, leading to lactation. This project aims to use information extracted from the literature and to establish a set of tools necessary for building the model.

The two main tools needed are, a system for handling and analysis of abstracts from PubMed; and a system for the modeling and simulation of the mouse lactation model. The former is used to manage the process of storing and analysis of published abstracts to yield information, such as endocrine signal transduction and their genetic responses, that forms the basis of the lactation model. The latter will be used as a platform for managing the model built from the extracted information and provides facilities for simulation of the model.

The project focuses on two aspects. Firstly, using a set of 5000 genes [1], it seeks to understand how they are related to each other, in terms of gene-protein and protein-protein interactions. Secondly, it seeks to explore the link from the endocrine stimulus of insulin, prolactin, and glucocorticoid to the set of 5000 genes.

Current Progress

The focus of this project so far has been the establishment of tools needed to build the model. Two separate systems have been created over the course of the last 9 months. The first system is an object-oriented modeling and simulation tool, Mosirium. The architecture of Mosirium and an overview of its workings have been published as a poster in APBC 2005 [2]. The second system is a pipeline for handling and analysis of published abstracts from PubMed for information on gene-protein and protein-protein interactions. Both systems are written in Python programming language using open-sourced libraries.

With both systems in place, the current focus of the project is on the analysis of abstracts for intracellular protein-protein interactions after stimulation of mammary epithelial cells by insulin (i.e. mapping insulin signal transduction pathways), and will be extended to include prolactin signal transduction and glucocorticoid signal transduction pathways.

Outline of Research Project Intended

The proposed laboratory placement in BIRC will focus on two outcomes. Firstly, analysis of literature to examine the relationship between the genes. A process for handling and analysis of abstracts is currently being established. However, this will need to be developed further and synergistic use of text mining tools can be investigated with the assistance of computing expertise in BIRC (BioWare project). Some of the text mining tools that will be investigated in this part of the project are NLTK [3], GATE [4] and ConceptNet [5].

Secondly, the use of Mosirium on clustered computers will be examined. Currently, Mosirium is a standalone system, which is unable to use any clustering facilities that may be present to speed up the process of simulation. Hence, the possibility of cluster-enabling Mosirium will present a major improvement in the modeling and simulation system. This may be possible in two different ways, either high-level clustering or low-level clustering. High-level clustering, also known as application-level clustering, is usually implemented as networked-enabled programs, using methods like Java Remote Method Invocation or CORBA. Low-level clustering, on the other hand, works much closer or directly interfacing with the operation system's kernel through systems like OpenMosix [6] or MPI/PVM. Methods for implementation will be studied using cluster-enabled simulators, like E-Cell 3 [7]. At the same time, advantages and disadvantages of high- and low-level clustering, with respect to Mosirium, will be evaluated. This will be followed by a proof-of-concept implementation on Mosirium to enable it to take advantage of a cluster system.

Estimated Timeline of Work

An estimated monthly timeline of progress is as follows:

October: An initial analysis of abstracts for any interactions between each of the 5000 genes and their gene products. Understanding the clustering mechanism in E-Cell 3 with the assistance of Kouichi Takahashi (architect of E-Cell 3).

November: Examining possible synergistic use of BioWare and the pipeline. Examining the pros and cons of high- and low-level clustering on Mosirium.

December: Examining and testing synergistic use of NLTK with the pipeline. Studying the work of Mr. Qi YuTao (final year PhD candidate in BIRC) on clustering and with assistance from 'HPC' group, examine how it can be applied on Mosirium.

January: Examining and testing synergistic use of GATE and ConceptNet with the pipeline. Prototyping the clustering mechanism of Mosirium.

February: Testing the clustering prototype. Attending APBC 2006 and talking to the authors of E-Cell 3 in Keio.

March: Trial modeling the interactions in the gene set with assistance from researchers from 'in silico modeling' group in BIRC.

April: Clearing up work and seeking possibilities of further collaborations.

References

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Appendix F: Second Year Progress Report

Objectives of Thesis

1. The main objective of this thesis is to examine the native (un-modified) use of a generic natural language processing engine on biomedical literature isolated from PubMed for extracting binding relationships between protein entities in the mouse. The resulting system will be called “Muscorian”, abbreviated from “Mouse (*Mus musculus*) Corpus Librarian”. During this course, the issues arising will be elucidated.

Question 1: Is un-modified generic natural language processing engine inferior to its Part-of-Speech specialized counterpart in extracting un-specific protein-protein interactions from text where inferiority is determined by a reduction of 5% in both precision and recall?

Null hypothesis: Using MontyLingua as the generic natural language processing engine, un-modified MontyLingua is inferior than its Part-of-Speech specialized counterpart in extracting un-specific protein-protein interactions from text.

Alternate hypothesis: Un-modified MontyLingua is not inferior than its Part-of-Speech specialized counterpart in extracting un-specific protein-protein interactions from text.

Question 2.1: Can a system that extracts un-specified protein-protein interactions from text be specialized to extract protein-protein binding interactions with the same precision (not more than 3% difference)?

Null hypothesis: A system that extracts un-specified protein-protein interactions from text cannot be specialized to extract protein-protein binding interactions without more than 3% reduction in precision.

Alternate hypothesis: A system that extracts un-specified protein-protein interactions from text can be specialized to extract protein-protein binding interactions without more than 3% reduction in precision.

2. Secondly, adaptations to Muscorian for other relationships, such as protein activation and protein-disease relationships, will be examined.

Question 2.2: Can a system that extracts un-specific protein-protein interactions from text be specialized to extract protein-protein activation interactions with the same precision (not more than 3% difference)?

Null hypothesis: A system that extracts un-specific protein-protein interactions from text cannot be specialized to extract protein-protein activation interactions without more than 3% reduction in precision.

Alternate hypothesis: A system that extracts un-specific protein-protein interactions from text can be specialized to extract protein-protein activation interactions without more than 3% reduction in precision.

3. Thirdly, the usability of PubMed search engine as a tool for co-occurrence (co-retrieval) analysis will be compared with protein name co-occurrence analysis as information extraction methods for un-specified protein-protein interactions from text.

Question 3.1: Given that there are 3 methods of co-occurrence measurements (PubGene, CoPub Mapper, Poisson statistics), are they comparable to each other?

Null hypothesis: The 3 methods yield the same results.

Alternate hypothesis: The 3 methods are not comparable to each other, that is, yield significantly different results.

Question 3.2: Can PubMed document retrieval by protein names be used for co-occurrence analysis?

Null hypothesis: The co-occurrence results from using PubMed document retrieval by protein names yield the same results as the 3 published methods of co-occurrence computation (PubGene, CoPub Mapper, Poisson statistics).

Alternate hypothesis: The co-occurrence results from using PubMed document retrieval by protein names yield the significantly different results as the 3 published methods of co-occurrence computation (PubGene, CoPub Mapper, Poisson statistics).

4. Fourthly, Muscorian's output on protein-protein binding interactions will be compared to co-occurrence analysis of the same list of proteins on the same corpus.

Question 4: Is there a synergistic advantage from using natural language processing and various co-occurrence statistics concurrently in extracting protein-protein interactions from text?

Null hypothesis: There is no synergistic advantage by comparing the results from the combination of both sets of methods and individually.

Alternate hypothesis: There is synergistic advantage by comparing the results from the combination of both sets of methods and individually.

5. Fifthly, the expectations and problems of using a biomedical literature analysis system to aid active biological research will be elucidated to cast insights into the slow uptake of biomedical literature analysis technology by research biologists. At the same time, an application for mapping microarray results onto literature-mined relationship map using outputs from Muscorian will be developed.

Question 5: What are the expectations and problems of using a biomedical literature analysis system to aid active biological research?

Null hypothesis 1: Research biologists have a clear understanding of biomedical literature analysis technology.

Alternate hypothesis 1: Research biologists have a poor understanding of biomedical literature analysis technology.

Null hypothesis 2: Precision and recall measures are the only performance measures to biologists.

Alternate hypothesis 2: Precision and recall measures are not the only performance measures to biologists.

Null hypothesis 3: There are no problems faced by biologists in interpreting the results from biomedical literature analysis system.

Alternate hypothesis 3: There are problems faced by biologists in interpreting the results from biomedical literature analysis system.

6. Sixthly, main issues pertaining to the deployment of Muscorian for production use will be discussed.

7. And lastly, various tagged corpora used in the evaluation of Muscorian, together with the corresponding programmatic accessing routines and common evaluation tools, will be collected as a package.

Work Progress So Far

Objective 1: Completed. Manuscript preparation.

Objective 2: In progress, 50% completion.

Objective 3: In progress, 10% completion.

Objective 4: In progress, 60% completed. Computing completed, into analysis stage.

Objective 5: Not started, in planning.

Objective 6: Initiated.

Objective 7: Completed. Manuscript preparation.

Thesis Writing So Far

Chapter 1 – Introduction (Draft completed)

Chapter 2 – System Description (40% completed)

Chapter 3 – System Evaluation (30% completed)

Chapter 4 – Entity Co-occurrence and Document Co-Retrieval (Not started)

Chapter 5 – Development of Microarray-Literature Mapper (Not started)

Chapter 6 – Deployment Issues (Not started)

Chapter 7 – General Discussions and Future Work (Not started)

Plans for Third Year

1. Analyze co-occurrence data and compare it to protein-protein binding map constructed using language analysis of text.
2. Evaluate PubMed's information retrieval engine and using it as document set overlapping tool and compare results with co-occurrence statistics.
3. Extract information for protein-disease relationships and evaluate for precision.
4. Develop an application for analyzing microarray results.

5. Isolate the crucial problems towards deployment of Muscorian for production use and attempt to solve these problems.
6. Complete the thesis.

List of Publications / Presentations

- Ling, MHT, Chung, IF, Kuo, CJ, Lefevre, C, Lonie, A, Nicholas, KR, Lin, F. 2006. Biological Corpus Collection. In preparation.
- Ling, MHT, Lefevre, C, Lonie, A, Nicholas, KR, Lin, F. 2006. Re-construction of Protein-Protein Interaction Pathways by Mining Subject-Verb-Objects Intermediates. Submitted.
- Ling, MHT, Chung, IF, Kuo, CJ, Lefevre, C, Lonie, A, Nicholas, KR, Lin, F. 2006. Biological Corpus Collection. [Available at: ib-dwb.sourceforge.net/BCC.html] (Software tools)
- Ling, MHT, Nicholas, KR, Lin, F, Lonie, A, and Lefevre, C. 2005. Muscorian: A pipeline for biological text analysis. [Available at: ib-dwb.sourceforge.net/Muscorian.html] (Software tools)
- Ling, MHT, Lefevre, C, and Nicholas, KR. 2006. A Pipeline for Analysis of Published Abstracts for Information on Protein-Protein Inter-Relations. Proceedings of the Fourth Asia-Pacific Bioinformatics Conference. (Abstract)
- Ling, MHT, Lefevre, C, and Nicholas, KR. 2005. Mosirium: A Modelling and Simulation Tool for Lactation in the Mouse. Proceedings of the Third Asia-Pacific Bioinformatics Conference. (Abstract)