Message from The Head

As announced in the last issue of ChemConnections, I became Head of the Department of Chemistry from July, 2003. It goes without saying this is a challenging task where time is not your own, and the next deadline was yesterday! I follow in the footsteps of those I admire a great deal who led the department through some tumultuous periods in the past 15 years or so: Professors Sim Keng Yeow, Lee Soo Ying, Lai Yee Hing and Andy Hor. Except for Professor Sim who retired in 2003, the others are still important members of the Department (although we see a little less of Professor Lai, who was appointed Principal of the NUS High School of Mathematics and Science in mid-2003). The good thing is that we are not only colleagues but also our personal friendships go back a long way since we first joined NUS. Advice is thus just around the corner!

“Life is a laboratory. Experiment.”

Thank you, A/P Lee Swee Yong.

A/P Lee graduated with a BSc in chemistry from Nanyang University in 1960 (the first batch of students to do so). After working for a year as a teaching assistant at the department, he left Singapore for graduate studies and obtained his PhD in organic chemistry from the University of Minnesota in Minneapolis in 1965. After working for 4 years as a supervising chemist at the Esso Refinery at Port Dickson, Malaysia, he started lecturing at his alma mater. During his time at NU and NUS, he supervised 14 MSc/PhD students and published 173 research papers. He also served as Vice-Dean of Science and also Head of the Department of Chemistry at NU, and was instrumental in setting up the first environmental programme in tertiary education in Singapore. He also helped in the acquisition of the first analytical NMR instrument in Singapore. He served as a member of the Technical Committee for Chemistry under the Singapore Standards Council for almost 30 years, and as a technical consultant for the SAC-SINGLAS Laboratory Accreditation Scheme for petrochemical testing for more than 15 years. We wish A/P Lee a happy retirement, but expect to see him at our events from time to time!

Lee Hian Kee

ChemConnections
Time flies. When I first returned to Chemistry Department, it was in January 2002 giving a short course for year 2 chemistry. Today, I am back again after a 21-month stay at the California Institute of Technology (Caltech), USA. For some who may not be familiar with Caltech, it is ranked as second in the world for its relative impact in chemistry research within the period 1997-2001 (according to ScienceWatch 2002 report). Within the Chemistry Division alone, there are two Nobel Laureates – Rudolph A. Marcus, awarded the Nobel Prize in 1992 for “his theory of electron transfer reactions in chemical systems”, and Ahmed H. Zewail, who awarded the prize in 1999 for “his studies of the transition states of chemical reactions using femtosecond spectroscopy”. Not to mention, there are many other great chemists there who stand heads and shoulders over their peers in specific fields.

What makes Caltech a special place and a renowned institute for research? Of course, one will say “it’s funding”. For example, when I arrived at Caltech in April 2002, Gordon Moore and his wife Betty have just donated US$600 million dollars to Caltech, the largest academic donation in history. As recent as a month ago in Dec 2003, the Gordon Moore Foundation donated US$35 million dollars to Caltech for collaborative work with the University of California to build the world’s largest telescope. There are definitely not meager sums, and from a donor! There are other reasons for Caltech’s success - excellent faculty members, high quality researchers, multi-disciplinary research, small informal communities, strong alumni ties and so forth, which are well established facts known to those who have gone to Caltech as students, researchers, or visitors. These reasons are obvious, but I believe there are more to what one can observe from the outside. As I sat down to think and reflect upon my own personal experience which my advisor put me through, its freedom to pursue one’s ideals single-mindedly. In my own work, I set out to work on nanostructured semiconductors and it culminated with writing a proposal and getting my advisor on board with the aim of establishing a collaboration between us on equal terms. Although this proposal was not accepted eventually, it was indeed a great experience for me and I was glad that my ideals and ideas were acceptable by the international researchers within and without Caltech. More importantly in research, I understand the value of hanging onto an ideal and not give up along the way.

The second point which I believe is necessary for research to progress at the pioneering level is the open communication of ideas. The atmosphere in Caltech is very informal and casual. Meeting up with any faculty member is as easy as talking to a friend who happens to walk down the corridor, even though the person you speak to may be the most knowledgeable professor in your field or a Nobel laureate. Ideas are discussed openly and there is little inhibition to which ideas are shared and to which individuals. Research work is then carried out based upon these ideas which have been tossed around, discussed through with relevant experts and tested out with preliminary experiments. Ideas are the main driving force for breakthrough work! But wait, how can this be possible? What about the possibility
of ideas being ‘scooped’ by another research group? Well, this is where I believe the third ingredient comes into play, necessary for one to embark on his or her idealism and supported by the free discussion of ideas.

This third reason is integrity. There is an unspoken ethical code among the faculty members on not ‘scooping’ each other’s work, but to help build up one another’s research whenever possible. This culture emanates and radiates down to even the postdocs, graduate students, as well as undergraduate students. For example, most and more coursework, including examinations are take-home assignments. Therefore, there must be a strong community awareness of and adherence to this ethical code against plagiarism, as well as strong pride in individual ownership and achievement. I vividly remember an incident when my advisor used my results in a presentation while I was absent during the meeting. Immediately, one faculty member came by and highlighted this fact personally to me, just in case my advisor was using my data without my permission. Such is the strong community awareness and watchfulness in issues concerning plagiarism. In my own words, this ethical code will sound like: “If this is your work, make sure you do an excellent one. If this work belongs to another, then help him if it is within your capability.” This frees up the individual researcher to pursue his or her dreams with passion and not to be overly concerned with spending time and effort protecting one’s turf.

Zewail attributed his success to “being at the right place and at the right time” in his concluding remark to István Hargittai (in Candid Science, I. Hargittai, Imperial College Press 2000) and one of his “right places” is Caltech. This comment has intrigued me right from the start when I stepped into Caltech and prompted me to identify the important ingredients that make Caltech so unique and successful. Now, after having spent some time as part of the Caltech community, I believe ideals, ideas and integrity are the three necessary ingredients in the creation of a highly successful research culture in Caltech. It is a culture that makes the research experience for researchers such a memorable one.
The year 2003 ended on a high point for the Department of Chemistry with the organization of the 3rd Singapore International Chemical Conference (SICC-3) together with the Singapore National Institute of Chemistry (SNIC) from December 15-17 at the Shangri-La Hotel.

Right in the beginning, the conference faced daunting obstacles. First, there was the SARS scare that resulted in the cancellation of many events earlier that year. Second, there were the budget cuts in the department due to bad economic conditions. And third, a conference, the ICMAT (International Conference on Materials for Advanced Technologies) had to be postponed from July to just a week before the SICC-3. Several topics of the ICMAT overlapped with themes of the SICC-3 and international visitors often had to decide which conference to participate in. In addition many of our own staff members were involved with ICMAT. Despite all these problems, the conference turned out to be a great success. The SICC-3 had more than 400 participants with 178 scientific presentations and over 130 posters.

The theme of the conference this time was “Frontiers in Physical and Analytical Chemistry”. This subtopic covered not only a part of the Department of Chemistry that had not been previously presented at the SICC series but also domains in which the Department of Chemistry has recently hired many new staff members. On the three days of the conference, 5 sessions ran in parallel: Analytical Chemistry, Catalysis, Chemical Engineering, and Materials Science.
Biology and Biophysics, Computational Chemistry, and Spectroscopy. And, in spite, or rather because, of this diverse and broad scheme the conference was well received by our international guests who were pleasantly surprised how the SICC-3 managed to bring people from all these different fields together and "got them talking", leading to many interesting discussions between researchers of different domains. With this selection of topics and form of organization the Department of Chemistry underlined its commitment to multi-disciplinary research which is not limited by the boundaries of traditional Chemistry.

The highlight of the conference was not the plenary lecture by Professor Richard Zare on the "Use of Photopolymerized Sol-Gel for Chemical Analysis" - although an event that nobody should have missed - nor any of the 25 keynote lectures that were very well received, but (a) the public lecture by Professor Zare on "Chemical Fizzics" which brought the dynamics of bubbles with many practical experiments close to a wide public, and especially to kids who loved to play with the dry ice, bubbles and foam and the older audience who concentrated more on the part of the lecture concerned with beer … and bubbles; and (b) the talk by Professor Peter Atkins on "Modern Trends in Chemical Education" in which he discussed the basis of teaching in the most fundamental disciplines in Chemistry. This talk was part of another key theme of the conference: Chemical Education. Dr Alan Szeto organized a Workshop on Chemical Education in which more than 50 science teachers in our schools participated. In this workshop the teachers had the chance to listen to some of the most internationally recognized Chemistry lecturers and discuss with them the problem of dispelling the fear of science and bringing science closer to the public, especially school children and university students.

SICC-3 thus achieved several goals. It confirmed the conference series as a fixed point in the long-term schedule of the Department, asserted the conference as a highly recognized international event, and underlined the priorities of the Department: strengthening of traditional chemistry, extension into multi-disciplinary fields, and putting emphasis on modern education at the university and for the public.

The success of the SICC-3 is due to several factors: The great support from the international community. Just take a look at the international advisory board of which many members actually came to the conference and gave keynote lectures; the unrelenting engagement of Professor Zare who gave not fewer than 3 lectures during the conference; the great work of our supporting staff and graduate students who manned the conference secretariat, operated the audio-visual equipment, and helped in every way to make the conference run smoothly; those who sponsored the conference; and last but not least, the organization of A/P Richard Wong Ming Wah, the chairman of the organizing committee, and his team and the secretary who dedicated much of her working time in the last three months to the organization of the conference details, Dr Lam Yulin. We are very grateful for the support and help from the organizations including the exhibitors that made this conference such a success. We are now planning to hold SICC-4 in 2005.

Forum between the speakers and participants after the SICC3 workshop evening.
Singapore-India Collaborative and Cooperative Chemistry Symposium

Nine members of the Department of Chemistry led by Professor Lee Hian Kee visited the Indian Institute of Technology (IIT)-Bombay, Mumbai, India, from November 7-9, 2003 as a follow-up to the establishment of the 1st Singapore-India Collaborative and Cooperative Chemistry Symposium (SInCCCS-1) in December, 2002. There, they presented lectures at SInCCCS-2 hosted by IIT-Bombay, and organised by Professor A.K. Singh of IIT’s Department of Chemistry, and conducted discussions to further develop research collaborations, faculty and student exchange, etc. with top Indian research institutions and universities. Apart from IIT-Bombay, faculty members from other IITs (Delhi, Guhawati, Kharagpur, Madras) and universities (Delhi, Hyderabad, Pune) also participated.

It is clear that our Indian counterparts remain committed to establishing research collaborations (including faculty and student exchange) with NUS-Chemistry, and the possibility of having NUS as the fulcrum (to use the description of Professor M.K. Mishra, Head of the Department of Chemistry, IIT-Bombay) of a three-way relationship with China as the third party, was suggested. The Department, always receptive to refreshing ideas, will consider this arrangement for a future event. Signing memorandum of understanding (we understand that IIT-Bombay already has an MOU with NUS’ Faculty of Engineering) will also facilitate the process, particularly when it concerns intellectual property rights. This will be explored in the coming months.

We were impressed with IIT-Bombay. Its campus is spacious and green and has only 5000 students who are rigorously selected for admission. Interestingly, the campus abuts a forest reserve where leopards roam (and climb with ease over the 3-metre high fencing to get into the campus!). Indeed, since we were housed on campus, we were advised by our IIT colleagues not to wander about after midnight unless we wanted to come face to face with one of these beasts! We took the advice unreservedly since on the evening before we arrived, campus security officers had caught their eighth leopard in the previous two months (we can certainly vouch for the veracity of the Straits Times report in December, 2003 of leopards terrorising people and pets in the Powai district in which IIT-Bombay is located).

The faculty members in the Department of Chemistry are enthusiastic and motivated towards their research and have that “fire-in-the-belly”, as all academics should.

The Chemistry research laboratories, especially the newly renovated ones (like us currently, IIT’s renovation is progressing on a step-by-step basis) are of high quality. Each faculty member has at least 2 wide benches (for 8 PhD students; 2 on each side of a bench) and four 2-metre fume hoods. There are several ventilated chemical storage cabinets in each laboratory. There are good research facilities available, including high-field nuclear magnetic resonance instruments, mass spectrometers and x-ray diffractometers.

Even before the Symposium ended, there was already interest in establishing collaborative research with NUS-Chemistry. Professor Lee, Associate Professors Leung and Ng, and Drs Wohland, Bettens and Loh have initiated discussions with their Indian colleagues, and it is hoped that these will eventually materialised into concrete research links. The fact we were able to interact with more of our Indian counterparts by our travelling to India underscored the point Professor Lee made about the preference for the third symposium to be held in India, although perhaps to reaffirm NUS’ pioneering role and fulcrum in this endeavour, we should consider hosting this event in Singapore perhaps once every two or three years.

The trip to IIT-Bombay was a success. For most of us who have never visited India, much less a top-rated research institution there, we were very impressed during our short visit. We managed to squeeze in some sightseeing on our last day in Mumbai. We had a good look at the city (at least around the touristy parts) and visited Elephant Island, an island with a 2000-year-old temple carved out of solid sandstone. Mumbai Harbour, from where we took the boat to Elephant Island, boasts an impressive monument (see accompanying photograph) that was erected to commemorate the 1911 visit of King George V and Queen Mary to the city. We came away with the general impression Mumbai was a vibrant modern city.

Finally, the Department of Chemistry records its thanks to IIT-Bombay for organising the Symposium at which many high-quality papers were presented. The hospitality was first-class. The Department also thanks the Faculty of Science, NUS, for supporting, both in spirit and financially, its participation. It is anticipated that SInCCCS-3 will be hosted by the University of Hyderabad in 2004.

Lee Hian Kee
The Royal Swedish Academy of Sciences handed out the Nobel Prize in Chemistry in 2003 to Professor Peter Agre (Johns Hopkins University School of Medicine) for discoveries concerning channels in cell membranes and to Professor Roderick MacKinnon (Rockefeller University, Howard Hughes Medical Institute) for structural and mechanistic studies of ion channels. Thus the Nobel Prize committee awarded the prizes in the domain of Biochemistry, a research field that has become more and more important in the last 50 or so years. This is particularly so in the field of membrane proteins, under which the research of Professors Agre and MacKinnon falls, that is highly important to the pharmaceutical industry, since the majority of drugs on the market are aimed at precisely these kind of proteins. So what was so important about their work? To explain this let us go one step back and look at a human body. Humans contain around 70% of water and this content is usually kept quite constant. So if the water contents decreases we get thirsty. Too much water, the excess is discarded. Much of this water is actually contained in the cells of our body. So how can we transport water into cells and out of cells which as we know have cell walls that are usually not permeable to water. The answer was thought of already a hundred years ago when it was suggested that there are little channels in the cell membrane through which water can pass. However, at that time proteins were not understood and nobody knew how these supposed channels could work. And it was not until 1988 when Professor Agre found a protein, which he called aquaporin, that we finally found this crucial channel that allowed the exchange of water with the outside. How important these channels really are you can be seen from the following example. Your body produces on the order of 150 L of "primary" urine. Imagine we would have to pass that amount every day and replenish it by drinking! The aquaporins are responsible of taking up most of the water in the primary urine so it can be reused in our bodies and only a small amount of urine is ultimately discarded.

And Professor Roderick MacKinnon’s work? He was able to resolve the atomic structure of another channel protein, a potassium channel. Since our cells, especially our nerve cells, require electrical potentials to work, we have so-called ion channels in cell membranes that can transport ions into or out of the cell. With the detailed structure of the potassium channel MacKinnon obtained he was able to explain how that little molecular machine worked and brought us one step further to understanding the design of life.

What is interesting in last year's prize is that it was given for discoveries that were made relatively recently (1988 and 1998). This is very rare, and further underscores the importance of these discoveries.

So what were the other "important" prizes of the last year? Have you ever heard about the IgNoble Prizes (http://www.improb.com/ig/ig-top.html)? This was given in Chemistry this year to Professor Yukio Hirose of Kanazawa University, for his "Chemical investigation of a bronze statue, in the city of Kanazawa, that fails to attract pigeons". And in Physics it was given to Professor Jack Harvey et al. of Australia, for their irresistible report "An Analysis of the Forces Required to Drag Sheep over Various Surfaces". Who says science is not fun?

So how do we stand in relation to this research (I am talking about the Nobel one here)? In the Department of Chemistry, we have developed in recent years more and more research projects in biology-based and related fields. Note, for instance, the medicinal chemistry programme that focuses on the discovery of new drugs and their production that can act on membrane proteins, which are the major drug targets, or research that looks at new ways how to observe these proteins in living cells and how to test drugs on these proteins by new labels. We have also recently been involved in the establishment of the Chemical Sciences programme that is recruiting students for the Chemistry undergraduate course who would then move on to graduate research in Chemistry or Life Science. Take a look as well at current work on microchip technologies in our department, and the participation of our staff members in the nanoscience and quantum dot areas that are aimed at developing new devices for fast detection of these proteins and their interacting partners. In addition, the department remains committed to teaching. Our curriculum is undergoing review and biochemistry courses are given a more important role (in accordance with American Chemical Society guidelines).

As you can see, we are developing our research and curriculum in step with cutting edge science, whether this is in the life sciences, in nanotechnology, or other fields, and we continue to improve our teaching programmes to an advanced, modern and relevant level.

Thorsten Wohland
This story applies to anyone in any field. Happy reading.

Tom and Jerry joined a wholesale company together, just after graduation. Both worked very hard. After several years, the boss promoted Tom to Sales Executive but Jerry remained a sales rep.

One day, Jerry could not take it anymore, tendered his resignation and complained to the boss that he did not value hard working staff, but only promoted those who flattered him. The boss knew that Jerry worked very hard over the years, but in order to help Jerry realize the difference between him and Tom, the boss asked Jerry to do the following. “Go and find out if anyone is selling watermelons in the market.”

Jerry returned and said yes. The boss asked him how much were they charging per kg? Jerry went back to the market to ask and returned to inform the boss it was $12 per kg.

The boss told Jerry, “I will ask Tom the same question.” Tom went out and on returning, reported to the boss: “Only one person selling watermelons. $12 per kg, $100 for 10kg, he has inventory for 340 melons. On the table 58 melons, every melon weighs about 15 kg, bought from the South two days ago, they are fresh and red, good quality.”

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Jerry was very impressed and realized the difference between himself and Tom. He decided not to resign but to learn from Tom.