UCL

## Welcome to ChemUCL!

**It is a pleasure for me to introduce the 2009 newsletter and I hope this has been a productive and enjoyable year for you all. As ever there have been a lot of exciting initiatives, activities, reviews, arrivals and departures, and many of these you can read about in the following pages. In particular, we have had a highly positive review in the RAE 2008, and I'd like to thank all of my colleagues who have worked so hard to achieve this. I would like to take this opportunity to ask our alumni for advice, comment and help. Firstly I'd like suggestions on how we can best maintain contact with our alumni - would a regular electronic newsletter be of interest? Secondly, a request for help in fund raising: if any of our alumni have suggestions as to how we can raise funds to ensure that we can continue to provide the very best education for the chemical scientists of the future, I'd be very pleased to hear them or accept any offers of help.**

**I look forward to seeing many of you at the Lab Dinner.**
**Best wishes**

***Stephen Caddick, Head of Department***

## LAB DINNER 2009

**The annual Lab Dinner will be held in the Old Refectory on Friday 20th November 2009**

The provisional programme is as follows:

16.00 Afternoon tea in the Nyholm Room
17.00 RSC Graham Lecture by Prof. W. Griffith, Ramsay Lecture Theatre
18.15 Pre-dinner drinks in the North Cloisters
19.15 Dinner in the Old Refectory, speaker: Prof. K.U. Ingold OC
23.00 Bar closes.

If you are coming to the dinner, please complete the enclosed form and return it with a cheque for £40 per ticket (£30 for current students) to:

Miss Judith James, The Lab Dinner, Department of Chemistry,
20 Gordon Street, London, WC1H 0AJ

**by Wednesday November 11th**. Confirmed details of the dinner will be sent out with the cheque acknowledgement.

# ChemUCL NEWSLETTER 2009

## Hellos...

Prof. Jim Anderson joined us in April to lead the Organic and Chemical Biology section. He moved from the University of Nottingham with his group, and is an expert on many facets of organic synthesis, particularly C-C bond formation and asymmetric synthesis. This is a return to the University of London for him, having been a Neil Arnott prize winner as an undergraduate, albeit at Imperial!


*The Anderson Group*

Dr Erik Årstad has been appointed as a Senior Lecturer in Radiochemistry as part of a new collaboration between the Department of Chemistry and the Division of Medicine UCH. His research focuses on developing radioactive tracers for medical imaging, in particular Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT).

Dr Ricardo Grau-Crespo, previously a postdoc with Nora de Leeuw, has been appointed as a fixed-term lecturer in computational materials science.

## Goodbyes…

Prof. Peter Day has retired after an illustrious career, including time as Director of The Royal Institution and its Davy Faraday Research Laboratory, where he subsequently became Fullerian Professor of Chemistry. Stefan Willitsch has left us after his brief tenure at UCL for pastures new at the University of Basel. Peter Mackie retired in July 2008 after 15 years running the stores. Peter delighted in presenting a (fake) grumpy persona to his PG customers, but really liked nothing better than a chat about his beloved Arsenal. From the general office, Kay Awan has left after five years as PA to the Head of Department. Jayne Shaw, our schools liaison co-ordinator, has now moved on to work in Oxford University Department of Materials.

## Promotions

Paul McMillan has been chosen to occupy the Sir William Ramsay Chair of Chemistry, where he succeeds Robin Clark. Profs Guo and Tocher have been appointed as Pro-Provosts (China, Hong Kong & Macau, and East and South East Asia respectively) and Prof. Mike Ewing has been made Dean of Students (Academic). Claire Carmalt and Angelos Michaelides have been elevated to the rank of Professor and Stefan Howorka has been made a Reader.

## Awards and Distinctions

The Royal Society of Chemistry has distinguished our staff with a number of prizes this year. Prof. Richard Catlow won the Liversidge Award in recognition of "his wide-ranging development and application of computational techniques in Materials Chemistry". Dr Ben Slater received the Barrer award for "his innovative contributions to the development and application of computer modelling techniques to the science of microporous materials". They both gave lectures at an awards symposium in our very own Chemistry Lecture Theatre in January this year. Dr Katherine Holt won the Edward Harrison Memorial Prize for "her novel applications of electrochemical methods in materials sciences and the life sciences". Dr Stefan Willitsch was awarded the Marlow Medal and Prize for "for his studies of ions using ZEKE spectroscopy and his development of an experiment to study reactions at very low temperatures". And last but certainly not least, Prof. Robin Clark has been selected by the RSC to receive the 2009 Sir George Stokes Award for "his outstanding contribution to the application of analytical science to the arts and archaeology through his development of Raman microscopy for the identification of pigments". He was also the inaugural recipient of the biennial Franklin-Lavoisier Prize of the Fondation de la Maison de la Chimie (Paris) and the Chemical Heritage Foundation (Philadelphia). Prof. Ivan Parkin has been awarded the Kroll Medal and Prize for 2008 from the Institute of Materials, Minerals and Mining.

Prof. Peter Coveney was nominated one of the 25 most influential figures in the world of engineering and technology today, by Engineering & Technology magazine. Peter, who was cited for his leadership in the field of patient-specific medical simulation, and application of high performance computing to the Virtual Physiological Human Initiative, was named alongside luminaries such as Tim Berners-Lee, the eventual winner.

***Rosie receiving her award***
*Photographed by Tony Slade, Media Services*

Within UCL, Provost's teaching awards for 2009 were presented to Dr David Rowley and Rosie Coates (PG Teaching Assistant). This year there were 11 awards spread throughout the college, which are given for outstanding contribution to excellence and innovation in teaching.

## Big Grants

As we all know, research funding has been very tight in the past year but UCL Chemistry continues to do well. Here is a small selection of the most eye-catching grants:

- Steve Caddick is co-investigator on a £4M grant from the Wellcome Trust to study sepsis.
- Nora de Leeuw secured a renewal of an EPSRC Industrial Doctoral Centre in Materials Modelling, worth £6.6M over 9 years.
- Slices of the EPSRC funding pie for nanotechnology were enjoyed by Ivan Parkin, (£1.6M, jointly with Quentin Pankhurst, UCL) and Helen Hailes (£638K).
- Ivan Parkin and Claire Carmalt have been awarded an EPSRC platform grant of £842K for a project titled "Combinatorial CVD".
- Xiao Guo shares EPSRC consortium grants of £1.9M, £1.6M and £983K with partners from around the UK, working on carbon capture technologies.
- Richard Catlow and Nicholas Harrison (Imperial) have been awarded an EPSRC grant of £1.2M for "Modelling of Advanced Functional Materials using Terascale Computing".
- £8.7M from Cancer Research UK and the EPSRC have been awarded to establish a KCL and UCL Comprehensive Cancer Imaging Centre; contributors include Helen Hailes, Alethea Tabor, and Erik Årstad.
- Helen Hailes and John Ward (UCL) have received £720K from the BBSRC for a project "Synthetic Biology Pathways to Isoquinoline Alkaloids".
- Nik Kaltsoyannis led the UCL component of a successful multi-institution bid for EPSRC funding to study nuclear waste management, worth £4.3M in total.
- Paul McMillan, in a joint venture with Imperial, has secured £1M from the UK government's Atomic Weapons Establishment.

## Postgraduate Prizes

The 2008 Ramsay Medal was awarded to Clare Bishop (supervisor: Mark Wilson), for her presentation entitled "The Energetics of Inorganic Nanotubes Formed Inside Flexible Carbon Nanotubes". In 2009, the Ramsay Medal was given to Kim Jelfs (supervisor: Ben Slater), for her talk on "Insights into Zeolite Crystal Growth: Modelling Templates and Oligomers at Zeolite Surfaces".

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| Apley Prize | Stephen Potts (supervisor: Claire Carmalt) |
| GlaxoSmithKline Travel Award | Keith Butler (supervisor: Dewi Lewis) |

Departmental postgraduate poster prizes were given to Jenna Ahern (organic/biological), Laura Fenner (physical), Tegan Thomas (inorganic/materials) and Lisa Horsfall (Rothwell prize for synthetic chemisty).

## Undergraduate Prizes

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|---|---|
| Ronald Nyholm Prize | Colin Crick |
| Parke Davis Prize | Rahul Patel |
| Harry Poole Prize | Valerio Ferracci |
| Neil Sharp Prize | Laura Thompson |
| Franz Sondheimer Prize | Vijay Chudasama |
| Charles Vernon Prize | Vijay Chudasama |
| Tufnell Prize | Adam Ellwood |
| | Vijay Chudasama |
| Bader Prize | Vijay Chudasama |
| Faculty Medal | Vijay Chudasama |
| Ronald Gillespie Prize | Colin Crick |

C.K. Ingold Prizes: Katarzyna Hojczyk, James Cuthbertson, Claire Skipper, Martin Bernat, Qing Teo, Trang Tran, Sacha Noimark, Alice Jensen, Liang Wu.

Prof. Ronald Gillespie has endowed an annual prize of £500 for one of our graduates who will go on to work for a PhD in inorganic chemistry in the Department. Prof. Gillespie studied here as an undergraduate and postgraduate, doing his PhD work with Sir Christopher Ingold. He was on the staff from 1946 until 1958, during which period he and Sir Ronald Nyholm produced the Gillespie-Nyholm valence shell electron pair repulsion (VSEPR) model of molecular structure. In 1958 he moved to McMaster University in Canada, where is now Emeritus Professor.

**Vijay Chudasama,** already highly decorated by the Department and Faculty, found national recognition at the SET Awards ceremony in 2008. He received the 3M Award for the Best Chemistry Student, judged by the RSC.

## Reviews

We can safely claim to have been well and truly reviewed in 2008/9. Firstly, we had an IQR (institutional quality review) to ensure our teaching provision is in good order, and came out with a very complimentary and positive response from reviewers. Then came the results of the Research Assessment Exercise. For the latter half of 2007, the staff worked furiously on our submission for the RAE, which gives a quality profile of university research and is important for determining funding. The results were published in December 2008 like an early Christmas gift. Unlike the easy to understand 2001 assessment, in which the top departments (like us) were awarded 5* grades, the 2008 results were more difficult to interpret. The statistically-minded have come up with several different national rankings based upon the raw data to weight the quality of staff reviewed against the number of staff submitted. UCL Chemistry was ranked in the top seven departments in the UK when volume is taken into account. The Department submitted 100% of its academic staff to scrutiny of the panel and submitted the 6th largest grouping in the UK; all our submissions were ranked as "internationally recognised" or better.

**Steve Caddick, Head of Department said** *"I am very pleased with this performance. This RAE makes it clear that all of our staff, even those at the very earliest stages of their careers, are performing at an internationally recognised level and this bodes extremely well for the future. I'd like to thank all of my colleagues who have done so much to participate in this important review process."*

## A National Chemical Landmark: The Ingold Plaque

The Royal Society of Chemistry awards National Chemical Landmark blue plaques to laboratories where particularly important work has been done and, on November 28th 2008, one was presented to the Chemistry Department here to mark the work on reaction mechanisms carried out by Sir Christopher Ingold from 1930 to 1970. We do already have one such plaque recording the work of Sir William Ramsay on the noble gases, and now are the only laboratory to have received two. At the ceremony to mark the present award, John Ridd, who worked with Ingold, gave a lecture on Ingold's life and work. What follows is taken mainly from that lecture. The National Chemical Landmark plaque is now on display outside the main entrance to the Christopher Ingold Laboratories.


*From left to right: John Ridd, Emeritus Professor; Steve Caddick, Head of Department; David Price, UCL Vice-Provost (Research); David Garner, RSC President. The plaque reads: During the period 1930-1970 Professor Sir Christopher Ingold pioneered our understanding of the electronic basis of structure, mechanism and reactivity in organic chemistry, which is fundamental to modern-day chemistry.*

*Photographed by Tony Slade, Media Services*

Ingold was born in London on October 28th, 1893, but the family soon moved to the Isle of Wight because of the ill health of his father. After attending the secondary school at Sandown, Ingold moved to the new Hartley University College in Southampton. Here he initially studied Chemistry and Physics equally but, when it became necessary to specialise, he opted for Chemistry; he explained that, to him, physics appeared "tidy but dead" while chemistry offered the prospect of "new revelations and mysteries".

After obtaining his B.Sc. degree, Ingold moved to Imperial College London and joined the research group of Jocelyn Thorpe, the new professor of organic chemistry. In 1920, Ingold was appointed as a Demonstrator with his own research laboratory. This was the beginning of a remarkably active period of research: he published 42 papers in 1921-1923, many as the only author. Most of these papers dealt with classical organic chemistry but some with physical chemistry, including specific heats and vapour pressures. They led to Ingold's rapid movement up the academic ladder for he was promoted to a lectureship, gained a D.Sc. degree and was awarded the first Meldola Medal in 1922. Quite remarkably, he was also awarded the Meldola Medal in 1923, the only recipient ever to receive two medals, for the rules were then changed to make it impossible for an applicant to receive more than one medal. In 1924, he was made an FRS and accepted the position of Professor of Chemistry at Leeds University. I doubt if anyone else has gone from being a demonstrator to a professor in four years while collecting a D.Sc., an FRS, and two medals on the way.

There was one other important development in those years for, in 1922, he published a paper with Miss E. H. Usherwood on the specific heats of gases and, in 1923, they were married. Mrs Ingold was herself a talented chemist but after a few years she gave up her research and did all she could to support her husband's scientific work. When I first came to University College in 1945, she seemed to me to handle much of the administrative work of the Department and was often able to protect Ingold from problems since the only accepted way to his room was through her office.

At Leeds, Ingold's interests rapidly turned to what was then a very active controversy concerning the nature of chemical bonding and substituent effects. The early 1920's were towards the end of the dark ages of chemical theory where some authors still discussed chemical bonding in terms of pre-electronic theories of partial valencies, chemical affinity and tubes of force. Ingold appears initially to have made use of the Fliirscheim theory of alternating affinities but in his paper on tautomerism with Shoppee and Thorpe in 1926 he moved to the interpretation in terms of electron movements and made extensive use of 'curly arrows'. The paper contains one reference to Robinson's work on the electronic theory; it was the start of the long-standing controversy between Robinson and Ingold, for Robinson considered that insufficient recognition had been given to his earlier ideas. Ingold continued to develop the theory of electronic effects in organic chemistry using his own terminology and making a clear distinction between polarisation and polarisability effects; he also introduced the concept of mesomerism as we now know it. Thus, in the early 1930's, chemists were presented with two versions of an electronic theory of organic chemistry with many similar features but using a quite different terminology and sign convention. In discussing their results, chemists had to choose one or the other and quite quickly the Ingoldian approach became the one generally accepted.

In August 1930, Ingold moved from Leeds to a professorship at University College London and remained here until his death 40 years later. In the same year, he was joined by E. D. Hughes, a young postdoctoral worker who had just taken his Ph.D. with H. B. Watson at Bangor. This was the start of a long collaboration which lasted until the death of Hughes 33 years later. After arriving at University College, Ingold began the kinetic and mechanistic studies that form the main reason for the present award. He first grouped organic reactions according to the underlying electronic processes involved. The kinetics of these reactions were then investigated leading to the distinction between $S_N2$ and $S_N1$ reactions. A great deal of work was done on "Substitution at a Saturated

Carbon Atom" covered in 61 papers but many other reactions were studied as well. This work established a language for discussing the mechanism of organic reactions and the terminology then introduced (nucleophilic, electrophilic, homolytic, heterolytic) is now an essential part of the literature of chemistry.

The second world war was a difficult time for Ingold since the Department was split between two universities in Wales but, with the coming of peace, Ingold set about rebuilding the Department here as a centre for what we would now term physical organic chemistry. Three of his students from Aberystwyth (C. A. Bunton, Ron Gillespie, and Jim Millen) joined the staff and a strong contingent arrived from Australia (David Craig, Allan Maccoll and Ron Nyholm). Peter De La Mare came from New Zealand and Kathleen Lonsdale, the crystallographer, came from the RI. Ted Hughes had been appointed to a professorship at Bangor during the war but soon returned as a professor at UCL.

I remember well the sense of excitement in the Department at that time. Almost everyone was working with Ingold and we felt that what we were doing was important. Other chemistry departments were making compounds but we were making chemistry understandable. Ingold's production of research papers rapidly returned to the pre-war level. Much of the work in the Department during and after the war concerned the mechanism of nitration. This was studied using all of the physical methods available: kinetics, cryoscopy, and spectroscopy. Following the kinetic evidence for the rate-determining formation of a highly reactive intermediate, the nitronium ion was isolated in the form of its perchlorate salt.

In the years during and after the war the importance of Ingold's work became increasingly recognised helped, in 1953, by the first edition of his book *Structure and Mechanism in Organic Chemistry* and this led to a number of medals, awards and honorary degrees. Ingold's work was rewarded with a knighthood in 1958. He officially retired in 1960 but continued in the Department as an Emeritus Professor and Special Lecturer. He remained very active in those years after retirement with a large number of publications, and in spite of some problems with his health, he undertook a number of lecture tours abroad. In 1970, he appeared to have a minor stroke during a lecture in Venice but was able to complete his talk. Afterwards, however, his health deteriorated markedly and on December 8th 1970 he died.

And now, what can one say about the man himself? He was a kind man. In the 1930's, Ingold worked with Donnan to bring a number of Jewish refugees to England and his son Keith can remember several occasions when he had to give up his bedroom to make way for a sudden arrival. And, in personal contacts, Ingold was always a very courteous man. I remember an undergraduate lecture when a girl came in a few minutes late. Ingold stopped, waited for her to settle herself, and then said "What I have just dealt with is rather important and so I should perhaps start again". And he did. Finally I do not think I can do better than to quote the words with which Shoppee ended his obituary of Ingold: "He had extraordinary imagination, insight, initiative and ingenuity, he possessed one of the greatest intellects in chemistry in the 20th century, and he added a new dimension to organic chemistry".

## Refurbishment of the Turner Laboratory

*Elspeth Latimer (3rd year PG)*

After decades of use it was decided that the glorious wooden benches of the Turner Laboratory should be replaced by a material that was less likely to absorb the numerous chemicals spilt there. Refurbishment was long overdue: the Turner lab had not been fully refitted since the CIB was opened in 1969 and to visitors it looked dark and dated. Despite the necessity, this was a daunting and logistically challenging project. After months of work clearing the lab by the technical staff (and PhD students in search of some extra cash) the contractors moved in on the 27th May 2008 to begin the £2.3M refurbishment. Much banging and clattering could be heard coming from the lab and finally, three and a half months later, the Turner Lab was ready to welcome its new batch of undergraduates. £100K was spent to kit out the lab with desperately needed modern equipment, replacing the dated drying ovens, rotary evaporators and vacuum pumps originally purchased shortly after the CIB was built.

For those of us that had spent many hours working in the old lab the transformation was staggering: how light it was, how clean, it didn't even smell! But some people were heard to say "it's not proper old school anymore"! For the prospective students the Turner Lab now compares admirably to the other laboratories they visit around the country during their search for a university - it has now become a showpiece rather a place to avoid. The lab was belated officially opened by the Provost on the 2nd June 2009, but already had proved to be a huge success. Glen Greaves and Phil Hayes, teaching lab managers, said: "We have had many visits by previous students and when they view the lab they are amazed by the transformation… From a lab user point of view there are many plus points: the increase in storage area, the bright and clean working environment, the user-friendly fume chambers, the non-slip floor covering…". Obviously very happy with the results!


*Work in progress*

*Turner Lab completed*

## Chemistry: The Next Generation – An SEA Swansong in Cheltenham

This academic year UCL chemistry has been more involved than ever in public engagement and outreach. We have participated in two major national schemes: the *Science, Technology, Engineering and Mathematics Network* (STEMNET), and the RSC's HEFCE-funded *Chemistry: The Next Generation* (C:TNG) programme, for which our very own Jayne Shaw has been the London regional co-ordinator. A particularly successful new initiative has been the department's *Science and Engineering Ambassadors* (SEAs). The SEAs are trained and undertake a criminal records bureau check (organised by STEMNET), before being sent out into schools to help with workshops, give talks and judge competitions. Most have even developed their own workshops based on their research. Being an SEA has been a great experience for me, and for many of my fellow students, and we get excellent feedback from teachers, too.

This summer a group of SEAs received C:TNG funding to design interactive experiments to take to Science in the Garden, a weekend outdoor event that was part of the Cheltenham Science Festival, a five-day frenzy of science for the public. Our aim was to provide experiments that use real-world materials (rather than chemicals from a bottle) and that are appealing both to children and to adults. I think that we achieved this goal (but more of that from Amy, Caroline, Laura and Krishna). Whatever the degree to which we did so, it would have been impossible without the funding from C:TNG and the recruitment, training and support given by Jayne.

*Rosie Coates (3rd year PG)*

*Krishna Hassomal and Rosie Coates setting up the stall*

The stall had a collection of different rocks scattered about for passers by to pick up and have a look at, which were all different types of naturally occurring zeolite. We explained a little about zeolites and their cage like structures, and how atomic structure directly affected the physical properties of the materials. The commercial exploitation of zeolites with varying pore sizes for different uses naturally led on to the braver children being invited to lick the rock that absorbs water, and getting their tongues stuck! Finally we ended on a demonstration of water softening, one of the main uses of zeolites in the home, with the general public being amazed that all of this ion exchange is going on in their washing machines. The children carried out the experiments, which gave us the opportunity to explain how important it is to have a control to make it a fair test. The demonstration got everyone involved, and rather soapy!

We also had two interactive magnetism experiments, both requiring rare-earth magnets, which are generally much stronger than magnets the public have used before. Visitors were asked to move one of the magnets around in small circles on the surface of a plastic bag containing crushed up cornflakes mixed with water. Those with some patience and a good eye were able to see tiny black objects aggregating in the cereal underneath the magnet; these are iron filings, which are put into almost all cereals at the time of manufacture. This led on to a discussion about what iron is used for in our bodies, and whether or not our bodies can actually make use of iron in its elemental form (this is very debatable). This experiment managed to shock and delight everyone (especially adults!) who had a go, and quite a few visitors declared that they would never eat cornflakes again!

*Caroline Knapp (3rd year PG) and Laura Fenner (2nd year PG)*

## The Chemistry Girls' Cheltenham science weekender

seemed as though it was going to be a disaster. The rainy drive to Cheltenham did not bode well for our alfresco stand at the science festival. On the Saturday morning we were not disappointed. The heavens were open, but so was the fair…

After a brief nip to Argos to buy the Chemistry Department the cheap gazebo it had always wanted, and after a slightly longer amount of time putting up said gazebo, we had enough shelter to do some science. The initial interest was a little slow, due to our sub-prime setting, but then Caroline got everyone to lick her magic rocks, Laura mesmerised with her amazing magnets and Krishna pulled in the crowds with cornflakes. We were soon the talk of the fair, with children bringing their parents to take part in the science that they had enjoyed, and the parents staying to ask questions after the demonstration was complete.

By the end of the weekend we felt our mission had been accomplished. We had explained the ideas and concepts behind some of the science in people's homes. These were ideas that both adults and children could relate to and understand and was the reason for the success of our stand.

*Amy Poole (3rd year PG) and Krishna Hassomal (1st year PG)*

*Amy Poole (3rd year PG) updates us on CPS events.*

The ChemPhysSoc calender was as packed as ever this year, with chemical and physical luminaries lighting up in the chemistry department each Tuesday evening. Andrea Sella (tried) to ring in the new academic year during his talk on the properties of mercury. He illuminated our understanding with a homemade vapour lamp constructed from tissues and quicksilver, and made a rather dull thud with a mercury bell that is kept in a freezer on the third floor for such occasions.

Our olfactory senses were delighted by Charles Sell from Givaudan who arrived in the department in a cloud of scent. With his array of aroma compounds he explored the chemistry of the essential oils that produce some of the most familiar scents that surround us. My non-scientist friend particularly enjoyed the smell of the aldehydes! Apparently it is the heart of Chanel No. 5, her favourite perfume.

More general talks were given by Ben Goldacre, Philip Ball and Professor Sir Richard Brook. Ben Goldacre is a practising doctor and journalist for the *Guardian* and detailed how the current week's news writers had misrepresented the scientific facts… again. Philip Ball writes for *Nature* and is the author of several popular science books which often look at colour and patterns in nature including his most recent *Shapes: Nature's Patterns.* His lecture explored the formation of the spots and stripes that are frequently seen in the natural world: these patterns are seen in sand dunes and waves, on butterflies and leopards and in foliage and flowers. Professor Sir Richard Brook is the head of the Leverhulme Trust and the former head of the Engineering and Physical Sciences Research Council. His lecture "Science: career or calling" explored whether research should be a vocational pursuit or a commercial enterprise, and the benefits each of these approaches bring to the field and the wider economy.

As ever, there were also numerous other events including a trip to the opera, wine tasting, a rather soggy sports day and, of course, the ever popular Christmas Quiz. The talks happen each Tuesday at 6pm during the term and, thanks to our sponsors, SCI London Regional Group, are free and open to all.

**For information about upcoming lectures please visit**
*www.ucl.ac.uk/chemphyssoc/*

We would love to see you!

***This year's CPS Christmas Quiz winners.*** *From left to right: Jenna Ahern, Alan Lobo, Adam Ellwood, Mike Porter and Lauren Tedaldi (plus Sam Mann, not pictured).*

**They still haven't drunk that champagne!**



Another refurbishment of our labs to bring them up to date? The discovery of a forgotten laboratory of Turner's in the basement of the Slade? No. This was our very own Graham Laboratory as dressed for filming of a segment of the BBC's *Science Story* series which will be broadcast as part of the BBC's Year of Science. There will be a UK version presented by Michael Mosley and an international version without a presenter. Andrea Sella successfully recreated Lavoisier's famous synthesis of hydrogen using a mild steel pipe, some water, and an Argos barbecue. He also staged a partial recreation of Hennig Brand's discovery of phosphorus which, you will recall, he isolated by reductive distillation of urine. Andrea reports that he is thankful for the invention of fumehoods. "Even after using cloth nappies on my two children, nothing had quite prepared me for the awfulness of the stench. I'd take trimethylphosphine over old Hennig's brew any day."

There has been a lot of filming in the Department this summer. Andrea is a consultant for BBC4's forthcoming series *Elements,* to which he has contributed several segments. He also has a regular slot on the CBBC food programme *Gastronuts* which is presented by Stefan Gates.

***The Graham Lab in disguise: photograph by Len Parrish***

## The Next Nobel Prize – Probing Catalysis through Mass Spectrometry?

*Elspeth Latimer (3rd year PG)*

When I was asked to write this article I felt somewhat overwhelmed; I could barely remember who was awarded the 2008 prize let alone predict who would get the next one! However, as I scrolled down the list of previous winners so many of the names were familiar, and their scientific discoveries came flooding back to me. So the next question was who did I think deserved to be listed on that page along with such greats as Kroto, Herzberg, Langmuir and Haber?

The 2008 Nobel Prize for Chemistry was awarded to Shimomura, Chalfie and Tsien for their research into Green Fluorescent Protein (GFP). Initially isolated in jellyfish, GFP now makes it possible to study metabolism and reactions in cells without destroying them. Could the next prize also go to this field?

I believe that in 2009 the Nobel Prize will change tack, and should be awarded to Helmut Schwarz, who specialises in the use of state-of-the-art mass spectrometry to provide detailed insights into elementary processes. Schwarz's career began inauspiciously: he was placed in the non-academic stream by the rather rigid German school system, and trained as a laboratory technician. He entered Berlin University of Technology (TU Berlin) via a 'second-chance' scheme, after which his rise was meteoric. He completed his Masters in 1971 and PhD in 1972; he was a professor by 1978 and has remained at TU Berlin ever since.

Mass spectrometry was first developed by J.J. Thomson in the early 1900s. The underlying principle is to ionise the sample to generate charged molecules or molecular fragments and then measure their mass-to-charge ratio. The basic design of a magnetic sector mass spectrometer has, over the years, been elaborated on to include techniques such as quadrupole mass spectrometry and time-of-flight.

Schwarz has used such techniques to his advantage. One of his particular focuses has been catalysis by ions, with a view to mapping out complete catalytic cycles at thermally-available energies; he has covered examples applicable to atmospheric and surface chemistry. For example, he and his co-workers have studied the gas phase activation of methane by transition metal cations, eg platinum, which can proceed via the following reaction pathway:

$$M^+ + CH_4 \rightarrow MCH_2^+ + H_2$$

The motivation behind such research was to find an efficient method of converting methane to methanol, a fuel that could help to solve the global energy crisis.

In his research, emphasis was placed on bond-forming reactions and gas phase processes which mimic aspects of surface catalysis carried out on atomic metal ions, metal oxide cations and cluster ions. Schwarz believes that intrinsic catalytic properties of atomic ions are beginning to be understood, but he admits that there is still a long way to go to bridge the gap in our knowledge between reactions catalysed by atomic ions and heterogeneous catalysis work. In my view he is a worthy contender for the 2009 Nobel Prize in chemistry.

## Robert Le Rossignol, 1884 – 1976

Professional Chemist.

The British physical chemist Robert Le Rossignol died 33 years ago on June 26th 1976 aged 92, yet little remains of his outstanding legacy to chemistry. Few modern textbooks mention his name, in the place of his birth his achievements remain unrecognised, and even at UCL – to which he felt he owed a great debt – his echoes are faint. But in 1908 he and Fritz Haber established the feasibility of the 'fixation' of nitrogen which opened the way to an 'infinite' source of artificial fertiliser, replacing the world's dependence on the saltpetre beds of Chile whose imminent exhaustion faced the world with the prospect of starvation.

Robert Le Rossignol was born in St Helier on April 27th 1884. His early education was at Victoria College, the island's only public school. Here he quickly formed an interest in chemistry. The school's science facilities were primitive but Robert developed great skill in practical chemistry through the kindness of Frederick Woodland Toms, Official Analyst for Jersey, who allowed Robert access to his laboratory. Toms was the consummate professional who made significant contributions to the science of fertilisers and munitions and those who are aware of Haber's provenance will find some resonance here. Practical innovation was Woodland Toms' forte and Robert's career was to display the same characteristic.

Robert matriculated at the University of London in 1901. He subsequently studied chemistry under Sir William Ramsay at UCL where he secured some initial seniority because of his work with Toms. Ramsay put Robert to work on reaction kinetics with F. G. Donnan who had joined UCL in 1898. Young chemists who intended to follow an academic career after graduating at a British University spent two years in Germany engaging in research. Donnan had worked there until 1897 and helped to introduce the 'new' subject of physical chemistry into Britain. By the time Robert graduated in 1905, his work with Donnan had been published and read before the Chemical Society and he had won the UCL Gold Medal for Chemistry. Germany now beckoned, but instead he chose to remain at UCL to sit the examination for the Associateship of the Institute of Chemistry of Great Britain and Ireland. The Institute was, he said in later life, "the professional body, and I wanted to become a professional chemist". Robert passed the examination in 1906 and in the same year he was elected a Fellow of the Chemical Society of London.

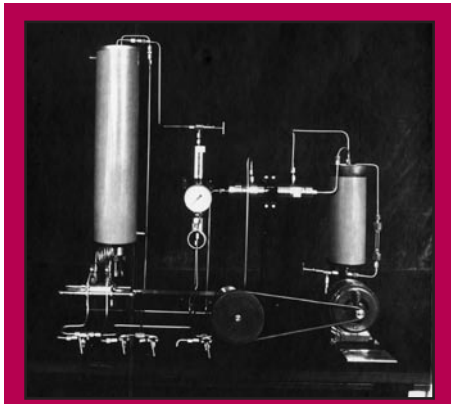
A move to Germany now became inevitable. Ramsay's connections with Europe were extensive and he used them to place his students judiciously. Two chemists in particular stood out, Richard Abegg and Fritz Haber – both practitioners of physical chemistry. Ramsay wanted Robert to study under Abegg, but Robert had heard that there were already 'too many Englishmen there'. Because of this, together with what he later described as a developing interest in 'chemical technology', he wrote to Haber at the Technische Hochschule at Karlsruhe and so began what was to be one of the most important collaborations in chemistry's history.

Robert always maintained that he owed a lot to chance in that he went first to Ramsay and then to Haber not Abegg. But there was another factor - an argument

*Staff at the Technische Hochschule at Karlsruhe in 1908. Robert Le Rossignol is seated in the front row, second from the left. Fritz Haber is at the centre of the same row. Photograph courtesy of the Archiv der Max-Planck-Gesellschaft, Berlin-Dahlem.*

between Haber and Nernst - and this resulted in Haber moving young Robert to the ammonia problem. Figures Haber had published in 1905, regarding the equilibrium proportion of ammonia in the reaction between nitrogen and hydrogen at atmospheric pressure, were disputed by Nernst and this led Haber and Robert to revisit the work. In May 1907 at a meeting of the Bunsen Society, they presented their new data but Nernst still disagreed and publicly took Haber to task over his 'highly inaccurate numbers'. Haber's vanity was bruised and together with Robert he began a more decisive examination of the equilibrium.

In a beautiful piece of work published in 1907, Haber estimated that an 8% equilibrium yield of ammonia could only be attained at a temperature of 600 °C and a pressure of 200 atmospheres. Furthermore, the best known catalysts at the time were slow, even at 700 °C and higher. But, if the formidable obstacles of pressure and catalysis could be overcome, the way lay open to the synthesis of ammonia. In Robert Le Rossignol, Haber had the ideal collaborator; his skill and ingenuity in experimental matters was admired by everyone at Karlsruhe. Work began in 1908, when Haber obtained a compressor that could achieve previously unthinkable pressures (around the required 200 atmospheres). Numerous engineering problems were overcome by Robert; the highly compressed gaseous mixture had to be circulated through the steel reaction chamber, spent mixture had to be replenished by equivalent amounts of preheated incoming gases and the product cooled and separated as it left the chamber – transferring its heat to the incoming mixture. Much of this Robert achieved himself by designing and building an apparatus with valves that tolerated the high pressure whilst still controlling the flow of the hot gases. The choice of catalyst was equally problematic but osmium, and later uranium, were eventually found to accelerate the reaction 'spectacularly'. By the time the desk-top apparatus was demonstrated to BASF on July 2nd 1909, it produced ~2 $cm^3$ of (liquefied) ammonia per minute for five hours and convinced BASF that ammonia synthesis was achievable. Subsequently, the world was capable of making 'bread from air'. In 1918 the Nobel committee seriously addressed the question as to what extent Le Rossignol had helped Haber before unanimously awarding the prize for chemistry to Haber alone in 1919. However, Haber later made full recognition of Robert's contribution together with generous financial remuneration from his prize money and various patents.



*Haber and Le Rossignol's apparatus. Photograph courtesy of the Archiv der Max-Planck-Gesellschaft, Berlin-Dahlem.*

Robert later left Karlsruhe and joined the German Osram company where he remained until the outbreak of WWI. In the autumn of 1914 he was interned but released in March 1915 to resume his work. Returning to the UK after the war, he was invited to join the new GEC research laboratory at Wembley where he remained for the rest of his career working on the revolutionary thermionic 'valve'. During WWII he continued to be concerned with valve developments, many of which were crucial to the war effort.

So how should we remember this man? One obvious way would be for chemists to always talk not just of the Haber process but of the Haber-Le Rossignol process. Another way might be to highlight the contribution his work made to the development of the thermionic valve which laid the foundations of the electronic world we live in today. Either legacy would be enough for most of us. But Robert gave us a third way. Towards the end of his life he said, "I hope I have been able to make use of some of my rewards to help those less fortunate than myself". Robert always felt that he owed a great debt to UCL and in 1961 he donated £50,000 – an enormous sum by the standards of the day – to establish a fund 'for the advancement of education generally, and in particular for the students and graduates of University College ... '. The fund still exists and stands as a testament to the most important concerns of this modest man. Which ever way we choose to do it, we should remember Robert Le Rossignol.

**Dr Deri Sheppard, MRSC, CChem.**

*Deri would be pleased to receive any information readers may have concerning Robert Le Rossignol:* *derisheppard@btinternet.com*

## An Interview with Abil Aliev

*It's been a momentous year for Nuclear Magnetic Resonance in the Department, with £667K being spent on a new, fabulous 600 MHz machine, plus upgrades to the 400 and 500 MHz instruments. Here Dr Abil Aliev, Senior Research Fellow in Physical Chemistry and NMR manager, talks to Lynsey Geldeard (postdoc with Erik Årstad).*

**Where did you study?**
I studied in Moscow, which then was the capital of the USSR. So it was quite a long time ago!

**When did you get into NMR and what made you specialise in NMR?**
At one of our departmental seminars we had a hot discussion between the speaker and our departmental NMR specialist, Dr Fomichev. I was very impressed by how passionate Fomichev was about NMR and decided to join his group. At the time I was a 2nd year undergraduate student. We had a Bruker WP80 (80 MHz) NMR spectrometer in our department, but very soon we gained access to a 400 MHz instrument in the Institute of Chemical Physics. My first project involved studying dynamic processes using NMR and writing programs for lineshape simulations. Both parts were very interesting and it never occurred to me that I could have chosen something else!

**How long have you been at UCL and how has it changed over the years?**
I have been in UCL since 1993. It has certainly become better known over the years, but I prefer the old times, before 2001, when we had no flooding in the NMR lab.

**What are the best and worst bits about your job?**
The best part is doing NMR, especially structure determinations of unknown products or analysing some unusual spectral feature. The worst part is when our air compressors start failing or when the lab gets flooded.

**Why do the machines always break when you're away?**
There is always something to go wrong with NMRs, especially when they are used every day by 50 or so different people. They also fail when I am here, but then we usually fix it immediately.

**How do you find time to do your research in between fixing all the machines?**
It is difficult, but has been possible so far.

**What are you researching?**
There is currently an interesting project on structure and dynamics elucidations of open chain flexible molecules in the solution state using a combination of NMR and computational methods. Before this, we did some extensive work on solid-state NMR of collagen and gelatine, and the dependence of their dynamics on water content.

**What's your favourite NMR experiment and why?**
A simple proton spectrum is my favourite. I also like HMBC for multiple-bond correlations and selective NOE experiments.

**Do people obey your "Quiet Please" sign on entering the NMR room and how do you shut them up?**
No, they do not. It is there for aesthetic purposes.

**What's so special about the 600 MHz machine and how much did it cost?**
It is very expensive, but then NMRs have always been amongst the most expensive equipment in chemistry departments. The 600 MHz has a cryoprobe, which compared to conventional room-temperature probes offers about fourfold increase in sensitivity. It means that we can acquire 5-7 common NMR experiments for ~1mg of sample in about an hour or two.


*The new 600 MHz instrument: it's pretty big – Lauren has climbed three steps to get there!*

**When will the 600 be automated and why is it special access only?**
Currently we have two NMR instruments running in automatic mode. The 600 MHz instrument can also be used in automation by a single user and some users are already running 5 or more samples using the carousel. There is no "special access"; those wishing to use the 400 MHz and 600 MHz instruments are usually trained on the same day of their request.

**Do you miss shimming?**
No, not really. Besides, three of our five instruments still need occasional manual shimming.

**How many samples get left behind and what happens to those tubes?**
About a third of all the samples are left behind. The unwanted tubes are offered to current users.

**Do we still need a 300 MHz machine when we have more powerful machines like the 500 and 600?**
Yes, we do. The 300 MHz instrument is a low-cost instrument and is used by both teaching labs and research groups. Besides, it has a QNP probe, which allows easy acquisition of $^{19}F$ and $^{31}P$ spectra in addition to $^{1}H$ and $^{13}C$.

**When will we get an 800?**
Definitely not this year.

## Spectroscopy in a Suitcase

Our UCL-based *Spectroscopy Days* are as popular as ever. We host about six a year, each with 80 students taking part in problem solving exercises using IR, NMR and mass spectrometry and seeing the instruments in use. The demand is insatiable but unfortunately we cannot hold many more due to the pressures of time, access to equipment and space.

As part of the *Chemistry: The Next Generation* initiative, we had access to a 'spectroscopy in a suitcase' IR setup developed at the University of Leicester, which has proved very popular with schools across England. However, in London the size and mass of the 'suitcase' proved difficult – think giant metal trunk that needed two to carry it! We therefore applied for funding through UCL's Widening Particiation unit to buy our own equipment. The Bruker Alpha IR spectrometer we purchased is the smallest in the world: it measures 22×30×17 cm and weighs about 7 kg. With a laptop, printer and an ATR attachment, which allows solid samples to be used directly, it all (just) fits in a medium sized suitcase.

*A neat fit*

*The IR spectrometer with ATR attachment, set up for use*

In addition to our student ambassadors visits, we can also loan the equipment to schools. Our aim is to deliver at least 25 ambassador-led workshops a year at all types of school, 6th form or FE college. In areas that are identified as having a low HE participation, the workshops will be free; for others, there may be a nominal cost. The actual cost of a workshop or week-long loan is around £500. The scheme is expected to become self-funding after the first year and we are currently investigating a number of funding models. However, we will not be determining who has access based on ability to pay.

*Contact Dr Dewi Lewis (see next page) for further information.*

## "Content is key and enthusiasm a must" *Mathew Waugh (2nd year PG)*

I have been involved with the STEMNET (*Science, Technology, Engineering and Mathematics*) programme; this scheme aims to bring first hand scientific research experience and enthusiasm to the classroom and has been co-ordinated through Chemistry by the tireless work of Jayne Shaw. My fellow ambassadors and I have been intrepidly venturing out into schools, armed with a miniaturised IR spectrometer to run murder-mystery workshops. These hour-long sessions introduce the students to the basics of infrared and mass spectroscopy techniques as they solve a fictional murder case and identify the lethal chemical.

Running this type of workshop has hopefully not only sparked a renewed interest in science in schools, but for me personally it has instilled a confidence and a passion for public outreach. I have gone on to write and deliver chemistry taster lectures entitled *Chemistry Around the Kitchen* for visiting school groups as part of UCL's Widening Participation scheme, and I have recently been accepted onto the EPSRC's *NOISEmakers* programme, which acts as a gateway for science communication between academia and the media.

For anybody with a passion, or even only a passing interest in communicating their research and sharing the reason why science excites them, UCL chemistry is certainly leading the way in public science communication. Where content is key and enthusiasm a must, outreach work is critical to create informed public opinion, which can steer scientific research on moral and ethical issues, guard against ill-informed backlashes for emerging technologies and ensure the next generation of scientists in this country. These schemes are helping to encourage a new generation of science communicators to share their knowledge and to ensure UCL, and the UK, remains at the forefront of education and industry across the world.

## Beacon Bursaries fund Science Soirées

The Chemistry Department is beginning a new initiative aimed at the wider community. Under the auspices of the UCL Beacon for Public Engagement project, we have been successful in obtaining funding for a series of evening *Science Soirées.* Our aim is to engage with parents and other interested adults in topics of a general, current or fun aspect of chemical science.

The format of the evening is for an academic and some of our student ambassadors to host an informal discussion evening with food and drink. The proposed topics include: *Chemistry in the Cocktail Shaker*; *Atmospheric Change – from the Ozone Layer to Global Warming*; and *Food Additives – the Nasty and the Nice*. These events designed to encourage the audience to direct discussion and participate in demonstrations. One particular target audience are those parents from 'non-traditional' backgrounds to inform them of the role of science in the world, but also to explain the careers HE study of these subjects leads to: many at present see 'science-minded child = doctor' as the only route. We want to try to answer the question "why is my child so enthralled by science?"

***If you're a teacher (or a parent)*** *and would be interested in getting your school involved with the Science Soirées or in-schools spectroscopy events, please contact* **Dr Dewi Lewis** *by emailing* ***d.w.lewis@ucl.ac.uk,*** *or phone* ***020 76794779.***

## Life at the Interface

*Over the last few years, the department has become home to numerous bright young things beginning their independent academic careers. In particular, the department now has six RCUK fellows; here, Susan Perkin shares her experiences.*

I arrived here at UCL Chemistry in September 2007, after studying for my DPhil with Jacob Klein in the Physical and Theoretical Chemistry Laboratory in Oxford and two years as Junior Research Fellow at Merton College. As an RCUK Fellow, my work at UCL involves two main components. Firstly, I am in the process of setting up and running a programme of research; and secondly I give lectures, tutorials, and have other responsibilities relating to education of undergraduate students. The Fellowship allows me more time for the former, whilst developing the skills and experience necessary to carry out the latter.

My research interests relate primarily to interfaces, and in particular soft (or 'complex') interfaces. An interface is the surface region where two substances meet. Interfaces are extremely important as they determine material interaction properties such as friction, water repellancy, stickiness, and lubrication. Since each of these properties depends only on the surface itself, a bulk material can be coated – often with just a single layer of molecules – to confer on it a certain desirable quality. Biological interfaces, such as cell membrane surfaces, cartilage surfaces, or connective tissue surfaces, are often delicately tuned to optimise a particular interaction function. For example the process of blood clotting requires the tight binding of a platelet cell onto the damaged part of the blood vessel – essential to 'stopper' the hole and prevent leaking of blood. This process must be highly specific so that the platelets do not mistakenly stick elsewhere on healthy blood vessel surfaces leading to thrombosis.

Using an ultra-sensitive force measuring instrument called a surface force balance we are able to detect how the chemistry of an interface relates to its surface interaction properties. The Ångström-level resolution allows us to see the effect of each molecular layer at the surface. Using this method we have shown that hydrated highly charged surfaces – such as hydrated bilayers or hydrated minerals – experience strong repulsion when they approach closer than a few water molecule diameters. Yet, at the same time, the hydration layers trapped at the interface create a fluid layer between the two surfaces which allows them to slip past one another easily and freely. This hydration lubrication mechanism can be found acting throughout nature from pressure-solution in geology to the lubrication of synovial joints.

*Susan Perkin in her surface laboratory.*

One implication of attempting such a sensitive measurement is that the climate in which the surface force balance operates needs to be carefully controlled: vibrations caused by passing cars or small changes in temperature can alter the measurement. UCL Chemistry has been highly supportive of my research, refurbishing a laboratory specifically to accommodate the surface force balance. Another benefit of working here is the enormous breadth and diversity of research interests, not only in UCL but in the wider London academic community. I regularly meet and discuss ideas with colleagues from the Eastman Dental Institute, the London Centre for Nanotechnology, and Imperial College chemistry department. New collaborations and projects are the result: the MSci and PhD students starting in my group during 2009-10 will work on diverse topics from investigating how bacteria stick onto human tissue to the behaviour of ionic liquids when placed next to electrode surfaces. It is hoped that this research will have important applications: preventing the first stage of the bacterial infection process could be a target for new anti-bacterial strategies, and ionic liquids are fast becoming the electrolyte of choice in new solar cells and batteries. Fundamental research in directions such as these is an essential precursor to substantial developments of new technology or medicine. I appreciate the opportunity to carry out this basic research in the welcoming and enabling environment of UCL Chemistry.

## When 'Inorg' meets 'Org'

*Antonio Torrisi (postdoc with Rob Bell)*

When I look back on my undergraduate studies in chemistry, I still remember when Inorganic chemistry and Organic chemistry (we used to call them 'Inorg' and 'Org' respectively) were simply two colossal exams which we needed to pass in order to get that final rewarding certificate. They always looked to us youths like two well-separated domains of chemistry, with their relative interpreters looking suspiciously and diffidently at each other and separated as if by a big sea or a wide desert. Of course, there was also something called 'Chemistry of Metallorganic Compounds', but, indeed, that sounded quite esoteric and strange. Only recently, in my activity as post-doctoral researcher, have I realized the richness of this middle ground between 'Inorg' and 'Org', and to discover the surprising properties that can occur from their encounter. In recent years, many studies and investigations by the chemists all around the world have been performed in this vast field and of course, in the Chemistry Department at UCL new pioneering chemists have also thrown themselves into this fascinating area of research. I would like to describe two examples of research in this field ongoing at UCL, and the very interesting properties belonging to new materials that have been developed by the union of the inorganic and organic chemistry worlds.

The first example is taken from the outstanding research that has been going in the group of Prof. Ivan Parkin, who has worked for years on the synthesis of inorganic biphasic nanocomposite films such as Au:$WO_3$, Au:$MoO_3$ and Au:$TiO_2$, using modern methodologies for the synthesis of new materials, such as aerosol assisted chemical vapour deposition (AACVD). In recent years his group has studied the photocatalytic activity of these active composites and their consequent antimicrobial activity, observing outstanding efficiency of the Ag-doped $TiO_2$ (anatase) nanocomposite towards *Staphylococcus aureus* and *Bacillus cereus* bacteria. The composite kills 99.9%

of these organisms when exposed to UV radiation for a period of 6 hours. The *B. cereus* microrganism is responsible for illnesses associated with digestion, such as diarrhoea and vomiting, while *S. Aureus* is responsible for numerous illnesses, from skin infections and abscesses to meningitis and pneumonia. Many of these bacteria are easily spread in a hospital environment and in fact recent statistics claim that each year about 500,000 patients in American hospitals contract a staphylococcal infection. The Parkin group has recently made the exciting discovery of a very efficient material for killing *Staphylococcus aureus* under laser irradiation or exposure to room lighting for just minutes. The films consist of gold nanoparticles, covalently coupled to an organic compound, toluidine blue O-tiopronin. Such film materials have potentially very promising applications in the hospital environment, where a variety of utensils and catheters could be coated with extremely thin films of these nano-organo-metallic particles, which would act under irradiation as sterilising materials against some of the most important bacteria.

The second example of interesting new materials, generated from the encounter of the 'Inorg' and 'Org' worlds, concerns so-called Metal Organic Frameworks. The presence of strong interactions between metal cations and organic molecules, via dative bonds from electro-donating groups such as amines, $COO^-$, or $PO_4^{3-}$ can lead to a 3D network, which ultimately generates a variety of nano- and meso-porous materials, called Metal-Organic Frameworks (MOFs). MOFs can have very large surface areas (up to 2,000 - 7,000 $m^2/g^{-1}$) and pore volumes (about 16,000 $Å^3$). Such features make these materials very interesting for catalytic and adsorption applications, particularly due to their reasonably easy and cheap synthesis and extremely flexible chemical composition. The groups of Rob Bell and Caroline Mellot-Draznieks here at UCL have been working in particular on modelling MOFs for $CO_2$ capture and adsorption and $CO_2$/$CH_4$ gas separation. $CO_2$ sequestration has become a key problem in recent years, with an exponential increase of the $CO_2$ concentration in the Earth's atmosphere, which might lead to a possible overheating effect on the planet. But $CO_2$ capture is also a very challenging issue from a technological point of view, because of the necessity of separating different species in gas mixtures within important energetic processes, such as the steam-reforming process used for $H_2$ gas production, for which a 100% purity is required. The problem is still under investigation. Will the encounter of 'Inorg' and 'Org' be able to generate a material which solves the $CO_2$ problem by technological application? We do not yet know, but it is true that "united we stand, divided we fall".

## Biophysical Research in a Chemistry Department?

*Stefan Howorka*

Does biophysical research really fit into a Department of Chemistry? I was exposed this question after joining UCL Chemistry as a lecturer in 2005. Given my background in biochemistry and biophysics, the chemical biology section became my new home. Once settled in, one of my colleagues jokingly mentioned that I was a biophysicist masquerading as a chemical biologist. This comment prompted me to think conceptually about the role of biophysics in chemical research. What are the benefits of combining chemical biology with biophysics? How does biophysical research fit into the Department of Chemistry?

For me, biophysics is the natural and logical continuation of chemical biology. Chemical biology has many facets; in my research group it means that biopolymers such as proteins and DNA are chemically modified to suit biosensing applications. Biophysical tools are used to describe the biopolymers' properties such as shape, structure, conformational changes, or interaction with other biopolymers. Characterising a biopolymer in this way is preferable as it usually provides hard quantifiable physical data. By comparison, the biochemical analysis using e.g. gel-electrophoresis is usually more qualitative in nature. In a way, the thorough biophysical characterisation of a biopolymer is analogous to the standard chemical analysis of small organic molecules.

Combining chemical biology with biophysical analysis offers benefits. At foremost, biophysics helps to understand the biopolymers' properties and thereby provides valuable feedback to improve the chemical manipulation of the biopolymers. For example, in one of my projects DNA-based nanoscale components were generated and equipped with chemical functional groups. The nanoscale components were designed to bind to widely used biosensor surfaces and thereby improve their analyte sensitivity. Biophysics played an important part in this study, as the favourable properties of the surface-bound units were demonstrated using the tools of atomic force microscopy and fluorescence microscopy.

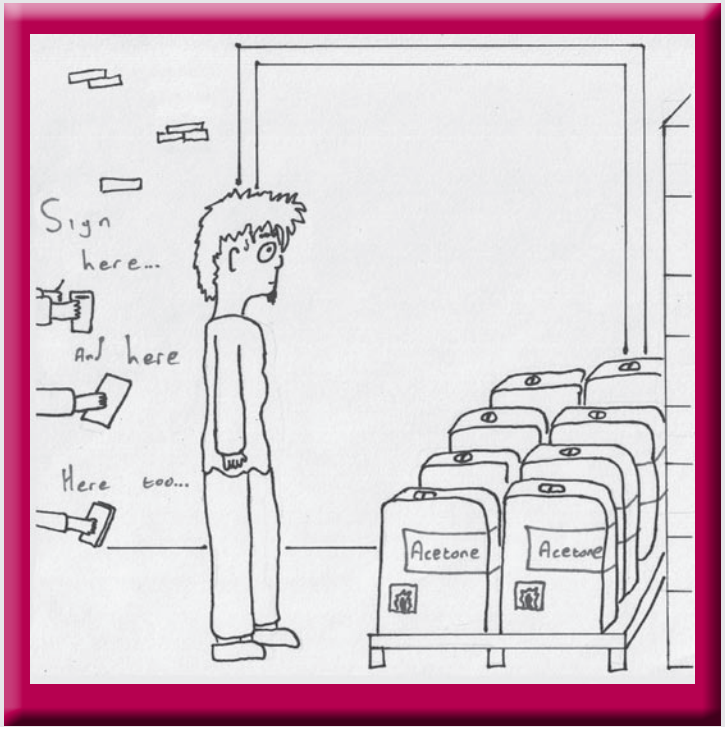
In another research project, chemically modified DNA molecules have been investigated with the biophysical method of nanopore analytics. In this relatively new analytical approach, individual molecules are electronically detected as they pass through a single nanopore; with further research and refinement, it is hoped this technique could be used to rapidly infer sequence information just by passing DNA strands through the pore. The electrical set-up is miniaturisable and therefore ideally suited for the sensing of bioanalytes in point-of-care settings. Our study showed that the analytical resolution in the sensing of DNA strands can be enhanced by attaching chemical tags to individual bases. This new insight could lead to the improved forensic detection of genetic fingerprints in samples at, for example, crime scenes.

These examples illustrate that biophysics certainly fits into a chemical research setting. Indeed, UCL Chemistry is an excellent place to carry out such interdisciplinary research. Not only has the Department invested in kits to chromatographically purify and spectroscopically analyse biopolymers, but I have also developed rewarding collaborations with several colleagues including Alethea Tabor (synthesis of peptides), Peter Coveney (computational simulation of DNA strands) and Daren Caruana (electrochemical analysis of molecules). Due to the combination of scientific expertise, collegial atmosphere, and departmental investment, UCL Chemistry is a great environment to carry out research at the interface between chemical biology and biophysics.

## Balancing the Books, 1950

When Ingold and Hughes were Heads of the Department, the Chief Technician was Bill Lambert. Bill ran the stores according to two inflexible laws.
**Lambert's First Law** said that you never issued the last item of anything from the stores, in case someone else might need it.
That might seem like an innocent idiosyncrasy, but
**Lambert's Second Law** said you never carried more than one item of anything in the stores. As essentially everything had to be ordered through the stores, that led to some forceful but fruitless discussion, but the stores turnover was remarkably small, and we never overspent the Departmental Grant. But if you underspent the grant, that of course would be catastrophic - you were obviously getting too much money, and the grant would be cut next year.

Ted Hughes said that he learned all his administration from Bill Lambert. As the end of the financial year approached, Ted would watch the platinum market, and when platinum was low, he would send Bill off to Johnson Matthey's in Covent Garden to buy platinum crucibles, so that, at the end of the year, the grant was overspent, and obviously it had to be increased. In the new financial year, Ted would again follow the market, and when platinum was up he would send Bill back to Johnson Matthey's to trade back the crucibles. Life was much easier in those days.




***Is there a lesson in there for Tony, our new storesman?***

**Please keep in touch!** Information for the next newsletter can be sent in using the enclosed form, emailed to Peter Garratt *(p.j.garratt@ucl.ac.uk)* or submitted via our webpage at *www.chem.ucl.ac.uk/alumni/*

### 1938
William Bright died on 16th September 2008, aged 90.

### 1944
Gareth Williams let us know that he and his family are now living in Bristol. Sadly, his son John died, aged 50, in 2007.

### 1957
Martin Jones writes: "Finding retirement a full-time occupation! Greatly appreciate the annual newsletter – after 50 years hardly feel qualified to call myself a chemistry graduate. If any members are either skiing in French-speaking Switzerland or sunning themselves in the southern Peloponnese, Greece, please do not hesitate to call." (For those in need of an excuse to holiday in these parts of the world, Peter Garratt has his contact details!)

### 1964
Stanley Livingstone (sabbatical stay with Ron Nyholm) tells us that he retired from his Chair at the University of New South Wales in December 1985 at the age of 65, and then worked as a casual supply high school teacher for a further 18 years until 2004 when the Department of Education ceased any longer to employ casual teachers. He is in good health having recovered from having titanium plates inserted into each knee. The fact that he lives only 700 m from Maroubra Beach, said to be one of the top three surfing beaches in Sydney, doubtless accounts for his recovery. He is recalled with affection and amazement at UCL for choosing the same meal every lunchtime, potatoes only - but cooked in three different ways.

### 1970
Bill van Bronswyk has now retired from his position as Professor of Applied Chemistry at the Curtin University of Technology, Perth, Australia.

### 1971
Sue Thackray (née Mattson) retired in July 2008 from being Head of Chemistry at Lady Eleanor Holles School, Hampton. She is looking forward to spending more time travelling, singing and doing OU courses in European Studies. She is still chair of the London Chemistry Teachers Centre, which meets at UCL.

### 1975
Peter Derrick, who was a Ramsay Fellow in the Department from 1973-1975, was appointed Head of the Institute of Fundamental Sciences at Massey University, New Zealand, in June 2007.

### 1976
Malcolm L. Franks has sent the following item: "My career after UCL was 5 years at Ilford Films (now defunct), 2 years at what was London Rubber, 1 year at W. David & Sons (car repair products), 3 years at Taylor Woodrow Engineering and then 15 years at SGS (massive world-wide inspection, testing and QA business based in Geneva) where I was on the UK board. I was very lucky to be on a fantastic pension scheme and when we all decided to move the UK HQ up to Cheshire I was able to retire at 50, and am now the co-owner of The Wine Education Service Ltd which is essentially the largest consumer wine school in the UK. We run courses, workshops and tastings to individuals and corporations."

### 1983
Lyn Penfold writes: "After leaving UCL, there followed some hard and boring years working in the IT industry. Retrained as a lawyer and am currently working for Vodafone Global Enterprise, travelling

the world, negotiating contracts and thoroughly enjoying myself. After having declared at a graduation party that I wanted to be a multi-lingual prostitute "when I grow up" this international solicitor job is a close as I want to get! Zoë, my daughter, who spent many mornings in the department ground floor waiting for the UCL nursery to open, has just graduated from Cambridge with a (technically double) first in physics and I am very proud." (Must have been some party! -Ed)

**1984**

Wang Chan is currently a secondary school teacher in Hong Kong.

**1985**

Trevor Dines is now a senior lecturer in Electronic Engineering and Physics at the University of Dundee.

**1986**

Andrew Tsotinis has been elected to a Professorship in the Department of Pharmaceutical Chemistry, Faculty of Pharmacy, at the University of Athens.

**1993**

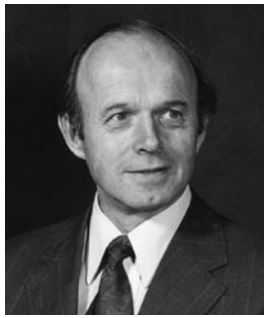
Professor Rob Withnall is now Professor in Materials Science at the Wolfson Centre, Brunel University. He acted as chairman of the XXI International Conference on Raman Spectroscopy held at Brunel in August 2008.

**2008**

Julien Plet and Amandine Lefranc, who both did PhDs in the organic section, are living in Derby and have just celebrated the birth of their first child, Alix.

Richard Hark, who undertook a sabbatical stay with Robin Clark, returned to his home University, Juniata College, Von Liebig Center for Science, Huntingdon, PA, USA, to become Chairman of the Department of Chemistry.

## Obituaries



### Sir Leslie Fowden FRS, 1925-2008

Leslie Fowden was a graduate of this department who became an expert in plant chemistry and went on to be the Director of the Rothamsted Experimental Station.

He came from Rochdale Grammar School to join the Chemistry Department in 1943 when it was still evacuated to Aberystwyth, and graduated, with a 1st class B.Sc. in 1945 after the department had returned to London. He did his Ph.D. with Sir Christopher Ingold on a kinetic study of aliphatic nucleophilic substitution. He was Secretary of the Chemical and Physical Society, and married Peggy Oakes, one of his fellow students.

In 1950 he was appointed as a lecturer in the Botany Department, then subsequently was Reader, Professor, and Dean of Science. With help from the Chemistry Department with the new technique of proton NMR, he identified more than 50 new aminoacids which occur in nuts and the stones of fruit, but not in proteins. Some of these can become incorporated into the proteins of animals, fungi, bacteria, and other plants, with a toxic effect, and apparently the plants used them as a defence mechanism.

In 1973 he was appointed as Director of the Rothamsted Experimental Station in Hertfordshire, to which was added the Long Ashton Research Station from Bristol, in 1986. He successfully carried a heavy administrative load as well as editing eight books on agricultural and environmental issues, and Rothamsted won the Queen's Award for Technological Achievement in 1976 and 1980. He was elected as a Fellow of the Royal Society in 1964, and knighted in 1982 for his services to agriculture. He retired in 1988, but continued his interest in science, travelling and lecturing widely and sitting on several scientific committees as well as being a trustee of Kew Gardens.

His friends will remember him as being cheerful, friendly, direct, and unpretentious, never losing his Rochdale accent. My personal memory includes agreeing to be Vice-Dean when he was appointed Dean, on the firm condition that he did not take sabbatical leave during his period of office. He stuck to that, but instead left for Rothamsted, leaving me acting as Dean.

He died at Rothamsted on 16 December 2008, aged 83. *Alwyn Davies*

### Derek Mills, 1952-2008

Derek Mills entered University College in October 1970 to take a B.Sc. degree in Chemistry. After the award of this degree in 1973, he stayed on to take a Ph.D. working with John Ridd on the reactions of *N*,*N*-dimethylanilines with nitrosonium ions. This work provided some of the first evidence for the formation of aromatic radical cations as intermediates in nitrous acid catalysed nitrations. He received his Ph.D. degree in 1977, and then began a 25 year career in the pharmaceutical industry with what was then the firm of May and Baker.

When he was made redundant, he still had his infectious enthusiasm for chemistry and this led him into an enjoyable and successful career as a chemistry tutor. He had, however, many other interests including exploring the countryside with his wife Jill by walking, cycling and canal boat. They were married for 26 years and celebrated their silver wedding in 2007 with a trip on the Orient Express where the above photograph of Derek was taken. It shows him in an unusually formal mode of dress for it was normally very difficult to persuade him to wear a tie. Derek's other interests included particularly the garden of their new home at Tonbridge and his allotment, and he was also a life long supporter of Queens Park Rangers.

He died aged 56 on the 19th October 2008 as a result of a heart attack while cycling. He will be remembered by many as a valued friend and his cheerful presence at Lab Dinners will be sadly missed by his chemistry colleagues. *John Ridd*

### Norman Lovelace Paddock, 1918-2009

Norman was born in Bath in 1918. He served overseas with the RAF during WW II, and on his return to England he was awarded a scholarship to Cambridge University where he pursued graduate work in Chemistry with Professors H.J. Emeleus and A.G. Sharpe. Subsequently he married Betty Hodder and was appointed Director of Research at Albright and Wilson.

For several years, leading into the 1960s, Norman collaborated with David Craig at

UCL, and achieved international renown for his work on inorganic polymers, especially the phosphazenes. Their paper on "A Novel Type of Aromaticity" in *Nature* in 1958 was a landmark in the subject. He moved to a Readership in Chemistry at the University of Manchester in 1961, and emigrated to Canada in 1966 where he took up a position as Professor of Chemistry at the University of British Columbia.

He retired in 1983 and moved to Victoria with Betty, to be closer to his grandchildren and to pursue interests ranging from the growing of rhododendrons to the study of quaternion algebra. He was also an active volunteer worker with Amnesty International and the Parkinson's and Epilepsy support group. He was a source of inspiration, wisdom and counsel for his graduate students and postdoctoral fellows, many of whom went on to senior positions in academia, industry and government.

He passed away in Victoria, British Columbia, on 25 June 2009.

**Dr. T. Thirunamachandran 1932-2008**

He was born into a Hindu Tamil family in the north of Sri Lanka, and named simply Thirunamachandran. Later, for publishing and form-filling purposes, he added the name of Thuraiappah, but otherwise he was always known as Thiru.

He went to the University of Colombo, and his academic record was such that he was appointed to the staff before his graduation results were known. The professor of mathematics, Prof. C.J. Eliezer, recognised Thiru's outstanding talents, and recommended him to come to England, so, in 1958, he came to University College to do a Ph.D. in theoretical chemistry with David Craig (who is now in Canberra).

He returned to Colombo in 1961, but in 1963 he married Siva, and returned to UCL as a postdoctoral researcher, and joined the academic staff in 1965.

His speciality was quantum electrodynamics (QED), on which he wrote a book with David Craig in 1984, which was republished in 1998, and which helped many researchers find their footing in this challenging field. He was as much a mathematician as a chemist, and for many years, he gave the Mathematics Department's course on maths for chemists. In his later years he worked alongside Edwin Power of the mathematics department, and they wrote over 50 papers together. After Edwin died, Thiru and David Andrews (one of Thiru's ex-research students, now at UEA), organised a conference in his name (*The Power of QED*), and edited an issue of the *Journal of Physics* which was dedicated to him.

He was always generous, courteous, modest, helpful, and self-effacing to a fault. He was in much demand as a referee for highly mathematical papers, and would work through the maths from beginning to end, and often come up with a simpler derivation, which would go into the paper acknowledged only by thanks to an anonymous referee. I remember one occasion when Thiru showed that the derivation was quite wrong. He rewrote the paper from beginning to end, and the author asked him to be a co-author, but, typically, Thiru refused, and was thanked only as an unknown referee. When he retired, he refused all forms of public recognition of his achievements.

Whereas preparative chemists need vast amounts of money for solvents and other consumables, for which they have to write endless annual applications, Thiru needed only pencil and paper, and the only grant which he ever applied for was after he retired, to enable Bill Meath from Canada to come and work with him for a year.

In those days, the staff had an annual departmental grant for carrying out research, to which £50 was added for each paper they published. The experimental chemists always overspent their grants. One year, Thiru's income from publication was greater than his expenditure on pencils and paper, and over the year he had made £13 profit. When he was asked his needs for the coming year, he told Max McGlashan, the Head of Department, that he needed minus £13 pounds. Few others would have been so honest or so modest.

Members of the Department will remember that he ran the Lab Dinner so successfully for ten years. Such Department chores are usually handed on after three or four years, but Thiru made the mistake of doing it too well. Each year he would say to Max "Isn't it time I handed this on to someone else?", and each year, Max would reply "Thiru, you do it so well; just one more year please", and got away with it annually until he retired.

The breadth and depth of his knowledge, and his memory, was remarkable. He had a special interest in the history of chemistry and the lives of scientists, and had a substantial library of their biographies, including a continuous set of the Royal Society's recent Biographical Memoirs. His hero was Richard Feynman, who won the Nobel Prize for quantum electrodynamics.

He was immensely proud of the achievements of his sons Rama and Gopala. He told the story of taking one of his sons to a school in London. To decide which class he should join, he was set two one-hour examination papers, one in mathematics and one in English. He did the maths paper first, but handed it in after half an hour. The master made sympathetic noises for having set too difficult a paper, then marked the answers while the English paper was being done. The maths result was 96%, and the English result was similar.

Last August, he went home one day saying that he felt dizzy. He had contracted prion disease and died in Northwick Park Hospital on 13 October, 2008.

He had a wide knowledge of contemporary affairs, whether it related to the tactics of England's cricket team, or the result of a forthcoming by-election, or merits of a potential Nobel prize-winner, and his presence will be greatly missed. Everyone who knew him will echo Tony Legon's comment that he was a scholar and a gentleman.

*Alwyn Davies*

## A Voice from the Past

*Andrea Sella*

In March of this year I received an email from our friend Prof. William Brock who drew my attention to an unusual web page. A collector of 78 records by the name of Chris Hamilton announced that he had acquired, for a mere pound, a set of four 10" discs containing a speech given by the great Japanese chemist Joji Sakurai (1858-1939).

The occasion was his election to an Honorary Fellowship of the College in 1937. It is a remarkable document in which he reminisces about the five years he spent as a student with Williamson in the later years of the Victorian era. In the speech he speaks of his debt to England and its educational system, and speaks rather wistfully of the intellectual ferment of the time: Oliver Lodge's lectures on physics, Darwin's ideas coming to fruition, the thrilling political speeches of Lord Beaconsfield and William Gladstone, Ruskin's writings on architecture, the poems of Tennyson, and the novels of George Eliot. We are extremely grateful to Chris Hamilton for transferring the records to digital format. These have been cleaned up a little to make them easier to listen to. A link will be available from our History web pages.

**For more on the history of the department, and alumni information,** visit **www.chem.ucl.ac.uk** - *a link will shortly be available from our alumni pages to request future editions of this newsletter electronically.*

## Departmental Photo

On the last day of term, just before the exam results were posted, the departmental photo was taken. Copies are now available from the CPS by request at a cost of £5 for collection within the department or £5.50 including postage. If you would like one, please send a cheque, made payable to 'Chemical and Physical Society' including details of the address to which the photo should be sent to: *David Unwin, CPS Treasurer, UCL Department of Chemistry, 20 Gordon Street, London, WC1H 0AJ*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*Anne Mortimer*