chem@cam

Chemistry at Cambridge Newsletter

Summer 2009

Chemistry Olympiad in Cambridge

Protein folding – **and misfolding**

The automation of **chemical reactions**

Enthusing the chemists of tomorrow

Cambridge alumnus Kelly Chibale is setting up a drug discovery centre at the University of Cape Town. He tells Sarah Houlton more

How did you end up in Cape Town?

I'm originally from Zambia, and studied chemistry there before going to work for a company specialising in making explosives for the mining industry. I was doing everything from nitrating glycerine to its formulation as dynamite powder and the waterproof gelignite forms, and I was even assembling detonators! I was fortunate then to be awarded a Cambridge Livingstone Trust scholarship for a PhD at Cambridge. I didn't really know anything about the academic staff in the department, but I looked through the booklet they sent me and I was seduced by Stuart Warren's curly arrows! So I came to work with him, and he really laid the foundations for the man I am today. I then moved to Liverpool on a British Ramsay Fellowship for a postdoc with Nick Greeves, and afterwards with a Wellcome Trust International Prize travelling research fellowship went to work with KC Nicolaou at the Scripps Institute in La Jolla, California.

All along I knew I wanted to go back to Africa when the time was right. Before I went to Scripps, I'd been talking to Jimmy Bull, then head of organic chemistry at the University of Cape Town, but it was at the time of the first elections – 1994 – and I was worried that the country would descend into civil war, so I took the second postdoc instead. But I kept in touch with Jimmy, and in 1996 when they advertised for a new lecturer I applied. I visited Cape Town and fell in love with it. In some ways it reminded me of La Jolla – coming from a landlocked country and being exposed to the ocean there, I didn't want to leave the sea!

Is South Africa a good place to be an academic scientist?

Absolutely. At the time I came back to Africa I had also been applying for jobs in industry in the US and Europe, but I really wanted to return. Funding is a problem wherever you go – people here often think that in the US and the UK things are easy, but I know that they're not. And in the US and UK, there are so many good people who are very talented and gifted, and they still have trouble getting funding. There, I felt I would be a very small fish in a very big pond, and my impact would be negligible, but if I came to Cape Town I would be able to make a much bigger impact. And now I'm setting up a drug discovery centre at the university that hopefully will contribute to Africa discovering its own drugs.

So what's the idea behind the centre?

There is a strategy now from the government here to promote innovation, but if you look at the value chain in drug discovery, South Africa lacks capacity and competence in a number of areas. One of these is integrating drug metabolism and pharmacokinetics into medicinal chemistry. I think there's a misconception, which I was also guilty of in the past, that the synthesis of biologically active molecules is the same as medicinal chemistry, and it's not! It's more than making compounds – it's knowing which are the right compounds to make in the first place.

I've worked on projects with GlaxoSmithKline, the World Health Organization (WHO) and the Medicines for Malaria Venture (MMV), and spent some time last year in Pfizer's labs in Sandwich, Kent. By being exposed to these projects I've learnt a lot about what needs to be done in the drug discovery process if it is to succeed. If this could be shared with my fellow Africans, it will help add value. Too often people think that just because they've made a molecule that kills a virus in a test tube, they've got a drug. There's so much more to it than that.

My project with GSK involved making small libraries of compounds in the tuberculosis area, and then my lab was selected to be a centre of excellence for synthetic medicinal chemistry, working on hit-to-lead and lead optimisation programmes with WHO. I realised everything I'd done up to that point had not got very far as I just didn't have this ADME [absorption, distribution, metabolism, and excretion] and toxicology capability – or even know that it was needed to drive the chemistry! And without this ADME involvement in the WHO programme, we wouldn't be where we are today.

What do you hope the centre will achieve?

The idea is to generate know-how and skills in ADME within South Africa for the first time. These are things that are well established and precedented elsewhere, but have never been done in South Africa on this scale before. We can learn from the experiences and failures of those who have already embraced ADME principles, and benefit from being able to find out what is happening to the compound.

The aim is to be able to deliver quality preclinical drug candidates that will be developed in partnership with pharmaceutical companies. We hope to build a critical mass of people who understand medicinal chemistry in terms of integrating ADME into drug discovery, and we're building a technology platform for South Africa. MMV is willing to help me build this platform using malaria projects as a starting point, and it could then be expanded into other areas. We've also been given funding by the Cape Biotech Trust – one of the government's regional biotech development agencies – for the ADME platform itself. This funding will also be used towards the synthesis and purification platform. The idea is that it will be a centre of excellence for the country, and ultimately we will spin out a company.

How do you think it might help promote science in South Africa?

Historically, South Africa has not managed to create an entrepreneurial culture where people can use science, and many South Africa-trained chemists do not return after a PhD or postdoc in Europe or the US. It's not just money – I think the primary reason for this brain drain is that people do not have the opportunity and environment to fulfil their potential at home.

The answer is to create a good science base here, but there's no precedent for Africans themselves setting up entrepreneurial science-based organisations – they always looked to people from outside to set things up. I believe we need success stories that show it can be done in Africa, by Africans. There are Africans with the right skills and know-how, and they don't have to stay in the US or Europe to use their science.

Despite decades of natural products research in Africa by Africans, this is yet to translate into tangible modern pharmaceuticals. The challenge for African scientists is to integrate natural products chemistry research into modern drug discovery. This is more likely to deliver modern pharmaceuticals, but will also contribute immensely to the training of scientists who are capable of competing internationally.

Africa has a high burden of disease, and the continent has been associated with wars, bad government, poverty and disease, but I think it's not sustainable to expect others always to be solving our problems – they also have their own problems they need to solve! So it's important to develop the skills base needed to empower Africans. Of course, we can't do it alone, but we must be able to play an active role. We blame politicians for not helping us, but perhaps they don't think it's important as they haven't seen science solve anything. Maybe we can change this mindset by creating something that shows what science can do, and that it can create jobs. That may make our political leaders respond in a positive way to put investment into science.

CV Kelly Chibale

Born: Zambia

Status: He met his wife Bertha in Zambia, and they married during his PhD; she runs a catering business. They have three sons: 17 year old Kalaba was born in Cambridge, Suwilanji, who's 15, was born in Liverpool, and Sechelanji is 7 and a Capetonian. 'We thought our family was completed with two children, but God had other ideas!' he says.

Education: Degree in chemistry from the University of Zambia, and a PhD in Cambridge with Stuart Warren

Career: Postdoc with Nick Greeves at Liverpool, then a second postdoc at Scripps with KC Nicolaou. He was appointed as a lecturer at the University of Cape Town in 1996, and was made a full professor in 2007. He's also the director of the South African MRC drug discovery & development research unit.

Interests: Football, running half marathons and going to the gym. 'I believe in God, hard work and ice-cream with hot chocolate sauce, even though my personal trainer tells me it's bad for me!'

Did you know? The name Chibale means 'big plate'; Kelly claims that must be why he likes food so much!

Fatherly thoughts

Dear Editor,
By a rather circuitous route, I have received a copy of the Spring 2009 *Chem@Cam*, and I was most interested to read the article on the 50th anniversary of the Lensfield Road Lab.

My memories go back to the arrival of my father in Cambridge in 1944, when I was not quite 5 years old. I do remember the gloom of the old Pembroke Street lab, being taken to have balloons filled with hydrogen by research students and watching Ralph Gilson, the lab administrator, make glass animals for me. I can remember attending the ceremonial cutting of the first sod at Lensfield by my father, with many of his then research group in attendance and a small barrel of beer part of whose contents were solemnly poured into the hole!

I was at school at The Leys during most of the construction period and from there watched the steel skeleton of the new lab gradually rising above the intervening buildings. I remember my father's excitement when he was able to move his office into the first section to be completed. Unfortunately, I could not attend the Opening Ceremony, where my younger sister Hilary presented a bouquet to the Princess. Seeing the photo again, I wonder how much she understood of purpose of the building she was opening!

I spent a few weeks in the lab in the summer vacation of 1959, at the end of my first year at Oxford, working under Dan Brown's supervision on a part of the aphid pigment project. This was quite appropriate, as my tutor at Oriel, Ben Brown (no relation), had worked on the project himself when he was a post-doctoral student in Cambridge, before his appointment as a Fellow of Oriel in 1955. (Ben was also an Olympic and international soccer goalkeeper. A number of his fellow-students from Cambridge, together with my father and myself, went to Wembley to see him play in the Pegasus team, composed of Old Blues of both shades, which won the FA Amateur Cup in 1952)

My own D Phil thesis (1964) was on a topic related to the aphid pigments, and one of my examiners was Don Cameron, then working as a postdoc on the project in Cambridge before he returned to Australia to become professor of chemistry in Melbourne.

When I was working in the Lensfield lab in 1959, I remember the shout every evening about 6 o'clock, in a broad Australian accent, 'Is anyone coming for a beer?', at which a very international group would repair to the Panton Arms much as their predecessors had gone to The Eagle in Bene't Street.

I'm not sure whether the Lensfield archives contain a copy of the 'poem' my father composed in the style of William McGonagall:

In Lensfield Road stands the great new chemical laboratory
Opened by the Princess Margaret with a great deal of oratory
A great many men were employed on building it daily
From Rattee & Kett, Kerridge and Johnson & Bailey.

I hope that these ramblings will be of some interest to you and those who remember the early days at Lensfield.
Yours sincerely, Sandy Todd

Glowing students

Dear Editor,
I enjoyed reading about Lensfield Road 50 years ago, and I have quite a few memories both personal and chemical. I was in Lensfield Road from October 1956 (for Part 2) until August 1960 when I submitted my PhD

In October 1956, Professor Longuet Higgins started a theoretical chemistry lecture at 9am with the question, 'Does anyone know if we are at war or not?' The Suez crisis affected all of us – those deferred as well as those who had done their military service. Would we be able to complete our Part 2 and go on to research?

In 1957 after moving into one of the new research laboratories for a few days, someone came into the laboratory with a Geiger counter to reveal that we were radioactive. The store of materials had been placed over our room without knowing we were there.

That perhaps reflected some of the casual practices that would never be allowed now. I had in my possession a Winchester full of monofluoroethanol – sufficient to poison everyone in Cambridge. A senior member of the department came and removed some in order to deal with a wasp nest at home. It undoubtedly did the trick, but what we would have happened had there been an accident as he cycled home?
Yours sincerely
David Bronnert
david.bronnert@talk21.com

Lap of luxury

Dear Editor
I have followed these articles with interest, because I was in the first group of undergraduates to use these laboratories for practical chemistry at the start of the Michaelmas Term of 1956-7. This was when they were opened for Part II students. I took up my allocated space on Friday October 12 1956, and wrote to my fiancée that the labs were 'very luxurious' and that 'I had more cupboard space there than in my rooms'.

In keeping with the newness of the environment I had a new white lab coat. For Part I in Pembroke Street I had worn a brown lab coat. This had been a very practical garment, except that other students frequently assumed that I was one of the permanent laboratory technicians.)

I was at Corpus Christi College, and John Harley-Mason was my supervisor in organic chemistry through all three years. I also remember most of the lecturers pictured in the Spring 2009 edition of Chem@Cam.

Just before I graduated, in June 1957 my fiancée, mentioned above, became my wife, and remains so to this day. Within two weeks I began a long career with the company then known as Glaxo Laboratories, and I stayed with them in their various corporate manifestations until I retired in the mid 1990s as the external projects manager of the chemical development division of Glaxo Group Research.
Peter Sandford
2 The Drive, Chalfont St Peter, Bucks SL9 0BD

Turn to page 20 for more readers' reminiscences!

chem@cam
Chemistry at Cambridge Newsletter

Contents

News 4
Research 7
Alumni 11
Chat lines 12
Puzzle corner 15

Cover

The Chemistry Olympiad, held in Cambridge in July, included a five-hour practical exam!

Photograph: Nathan Pitt

This newsletter is published three times a year by the University of Cambridge Chemistry Department. Opinions are not necessarily those of the editor, the department, or the university.

Editor-in-Chief: Steve Ley
Editor: Sarah Houlton
Photographers:
John Holman, Nathan Pitt, Caroline Hancox
Editorial Board:
Brian Crysell, Bill Jones, Jonathan Goodman, Rosemary Ley, Jeremy Sanders

Address:
Chem@Cam, Department of Chemistry, University of Cambridge, Lensfield Road Cambridge CB2 1EW
Phone: 01223 763865
email: news@ch.cam.ac.uk
website: www.ch.cam.ac.uk

Taming white phosphorus

Photo: Nathan Pitt

Jonathan Nitschke's recent Science paper on describing how it's possible make white phosphorus non-flammable caused a bit of a stir in the media. The paper, entitled 'White phosphorus is air-stable within a self-assembled tetrahedral capsule', described work Jonathan has been carrying out with Kari Rissanen of the University of Jyväskylä in Finland.

They have developed a metal–organic cage from iron(II), and had already found that it would host molecules such as cyclopentane and cyclohexane. But what else might fit? White phosphorus, or P4, is about the same size as these organic solvents, so they gave it a try – and they found that it did indeed fit.

Not only does it fit, but it prevents the phosphorus from decomposing on contact with oxygen, as the intermediate is too large to fit in the cage. Far from being highly flammable, it renders the phosphorus stable for months. It is easy to remove from the cage, by simply adding a competitor guest molecule such as benzene.

Jonathan was surprised by the amount of interest in the work. As well as the chemistry and science magazines, he says it made it into several newspapers as far afield as the Netherlands and Australia, and was even featured on German TV!

Unilever extends funding

Unilever is continuing to fund the department's Unilever Centre for Molecular Science Informatics for another five years.

The company is providing a further £3.2 million to support the centre's groundbreaking science.

A group of senior scientists from Unilever visited the department in July to see for themselves how the centre is getting on, and take a look at some of the work that's being done there.

Opened in 2000, it focuses on creating, manipulating and storing molecular data that deepens the understanding of molecules and their properties, and allows novel *in silico* experimentation.

The centre's director, Bobby Glen, is delighted that Unilever has decided to continue its funding. 'The support they have given us over the past decade is invaluable,' he says. 'It has enabled us to do exciting science, and we look forward the important work we will be able to do in the future.

Unilever and the centre also marked the retirement of one of its strongest supporters, CV Natraj, by hosting a retirement symposium and dinner in his honour.

Photo: John Holman

L–R: Alex Lips, Unilever research project director; CV Natraj, Unilever corporate research senior vice-president; Sir Dai Rees, Unilever's former head of research, and Bobby Glen, pictured at CV Natraj's retirement dinner, which was held within the Unilever Centre

Merck lecturer Andy

Photo: Nathan Pitt

This year's Merck lecturer was a familiar face – Andy Holmes. The former head of the Melville lab is now based in the Bio21 Institute at the University of Melbourne in his native Australia, but returned to Cambridge to give the lectures in May.

The Merck Lecturer gives a series of three lectures in one week. Andy's gave an insight into his diverse research interests – the first was about light-emitting polymers, the second about alkaloid synthesis, and the final talk looked at his work probing intracellular signalling processes.

The end of the lab book?

The department is starting the roll-out of a new electronic lab notebook system. The E-Workbook for Chemists software was developed by software company ID Business Solutions, and enables chemists to capture, analyse, search and report their experimental data, as well as share it with colleagues.

It can be used to draw reaction schemes and chemical structures, as well as calculate reaction rates. Research can be linked with and searched using any chemistry data source. The project is being led by Bobby Glen and Steve Ley, in conjunction with Tim Dickens and the computer officers.

The first handful of chemists will move over to the new electronic lab book in the coming term, and the plan is to roll it out to other users during the year. Look out for more about the system in a future edition of *Chem@Cam*!

Teaching the teachers

The Prince's Teaching Institute, an independent educational charity, runs annual summer schools for teachers. Several Cambridge academics, including Paul Barker, gave lectures about their research at this year's event, which was held at Queens' College.

These lectures are embedded within a varied programme of debates, lectures and discussion forums in what is a very influential environment, and Paul reports that the academics' lectures are exceptionally well received by the teachers. 'Much of what was presented was a real eye-opener for them,' he says.

Paul's lecture looked at whether multidisciplinary research requires multidisciplinary teaching, using the example of bioelectronics. He described how biology does electronics, the evidence for molecular electronic devices in biology and the current state of research into engineered bioelectronic devices.

He also posed the question of what scientific education provides the best training for research in this area, and argued that the answer is, of course, fundamental chemistry, physics and biology – plus a bit of maths.

His talk was so well received that the organisers are very keen to have practising research chemists talk at these events in future. 'Secondary school teachers need all the support and inspiration they can get to ensure the curriculum they have to teach remains relevant for what we need in higher education,' Paul says.

If anyone is interested in delivering a lecture in 2010 to an interested, receptive and very enthusiastic audience, contact Paul at pdb30@cam.ac.uk and he can tell you more about it.

Photo: Nathan Pitt

One of the recent distinguished visitors to the department was Martin Mackay, who's president of r&d at pharmaceutical company Pfizer. He's in charge of the industry's largest r&d programme, and he gave an insight into the company and some of the most important projects in the company's research portfolio

How not to set fire to the laboratory…

Bill Jones hones his firefighting skills (left), and Tina Jost shows just why solvent fires can be so dangerous – and alarming if you've not seen one before

There's a real risk of fire in chemistry labs, however careful you are. So it's essential that chemists know what to do if that fire happens. And that's why the department runs regular fire training sessions, so that in the unlikely event that a fire occurs, it won't be the first time the student or staff member has had to deal with one.

The university's fire safety unit has been providing us with live fire safety training for some time. This used to take place using vats of flammable solvents up at Madingley Hall, but after a tree was set on fire they changed their approach and started to use a trailer which could be moved to different sites.

However, this didn't really address the sort of fire a chemist is likely to encounter – fires in chemistry labs aren't like most other fires because of the flammable liquids that are usually involved. So departmental safety officer Margaret Glendenning worked with the fire safety unit to develop something that provided better training for chemists.

'We tried to replicate the sorts of fire we see in the lab, and looked at the types of flammable liquid that are commonplace in the chemistry lab,' she says. 'The new training session was designed with the reality of the chemistry lab in mind, and as well as giving information about what all the different sorts of fire extinguishers are for, participants get to try their hand at using them. We even demonstrate just how easy it is to knock glassware over with a CO_2 extinguisher!'

Mags says that they made an interesting discovery while working on the new training programme – a fire blanket is worse than useless in an ether fire. 'The hot, flammable vapour passes straight through the blanket and reignites above it!' she says. 'Even the ex-firemen in the fire safety unit were surprised at that, and we managed to set one fire safety officer's arm on fire while practising!'

She adds that they tried to replicate some of the fires involving metals that have occured in the department in the past, but found they were pretty hard to recreate. 'No matter how much sodium we threw into a pool of water – the darn stuff wouldn't ignite, and the BuLi wasn't playing ball either!' she says. 'I guess that just demonstrates the unpredictability of chemistry…'

They are also trying to develop the sessions further. For example, in the light of the recent tragedy in the US where a student died after setting her sweater on fire in a t-BuLi fire, they hope to be able to demonstrate just why wearing a lab coat is such a good idea. This will be done by dressing mannequins in different clothing, and showing how different types of clothing burns – and how a lab coat offers protection.

The new live fire training sessions are now taking place every month up on the West Cambridge site, and Mags says they are going to be mandatory for anyone who will be working in the department for a year or more. 'We're really grateful for all the help we've had from the fire safety unit,' she says. 'We now have something specific for chemistry, and hope it will ensure that if the worst happens and there's a fire in a lab, everyone will know what they should do.'

Photo: Nathan Pitt

Cambridge hosts the Chemistry

In July, more than 250 schoolchildren from around the world descended on Cambridge for the Chemistry Olympiad, which we hosted as part of the 800th celebrations. Chris Adriaanse reports on the big event

For 10 days in July, 253 school pupils descended on Cambridge to take two of the toughest chemistry exams they'll ever sit: a five hour practical exam and a five hour written exam, all for the chance of winning gold, silver or bronze medals in this year's International Chemistry Olympiad. This is the first time the Olympiad has been held in the UK, and it was jointly hosted by Cambridge, Oxford and the Royal Society of Chemistry.

Peter Wothers, once a participant in the Olympiad, has been planning the event since 2003, overseeing everything from the exam questions to the opening ceremony. He was particularly pleased with the range of countries winning gold medals. 'It was great to see Israel, Romania, France and Japan all up in the gold medals,' he said. Peter was also pleased with the Brits' performance. 'It was one of the better years. Four silver medals was very good indeed.'

Each of the 65 participating countries sent their four top pupils plus a mentor, who were hosted by Trinity, St John's, St Catharine's and Robinson colleges. Between exams, the students could relax, and enjoy excursions to London, Belvoir Castle, and the high-wire adventure GoApe, while the mentors, confined to Oxford for the first half, were busy translating the papers, before returning to Cambridge to mark them.

Billed as a cultural and chemical exchange, the Olympiad's opening ceremony took on a pantomime theme with 'Jack and the DNA Stalk.' After welcoming speeches from the vice-chancellor, the president of the RSC and the chairman of the Olympiad's steering committee, the pantomime began, and the participants' first introduction to English culture was from a middle-aged man in a dress.

The first exam was the practical. Students were split between the departments of chemistry and zoology – five labs in total – and had three tasks to complete. There was an environmentally friendly aldol condensation, a titration of a copper(II) complex, and a calculation of the critical micelle concentration of a surfactant. This final task was particularly unusual because the students had to plan their own experiment and it challenged students to think on their feet – this is something that was new for this year's Olympiad.

Thoughts afterwards were fairly

Left and above: flying through the trees at Go Ape! in Thetford Forest

Belvoir Castle, where activities included falconry and a tug-of-war competition

Olympiad

Photos: Nathan Pitt and Caroline Hancox

Seeing the sights of Cambridge on a City Trail (left) – and learning how to punt (above)

unanimous. While the students didn't find the practical particularly demanding – these are some of the brightest young chemists in the world – completing them in the given time, and correctly, was the real challenge. 'The exam wasn't difficult but there wasn't enough time,' said one of the Turkmenistan students. 'We were very busy. There were so many things to do,' claimed another from Singapore.

After a day's break, next up was the five-hour written exam. There were six title questions: an estimation of Avogadro's constant, the interstellar production of hydrogen, protein folding, synthesis of amprenavir, epoxy resins and transition metal complexes.

The paper was perceived as long and difficult to complete. 'More time would have meant more points,' said a Swedish student. 'The time given was absolutely too short'. One from Japan agreed, 'We didn't have enough time, if we had, then the paper would have been OK'.

That evening, with the exams finished, the mentors and students were transported to London's Natural History Museum, where 600 guests dined in style in the grand entrance hall.

The results were announced during the closing ceremony in King's College Chapel. Participation certificates, for those who didn't qualify for a medal, were given in alphabetical order, whereas medals were announced in reverse rank. In total, 28 students were awarded gold medals, with students from China, Israel and Taiwan ranked 1st, 2nd and 3rd.

Many people contributed to the success of the Olympiad. Zoltan Ritter and Emma Powney have been working full-time on it for the past year. The support of the chemistry department was also essential. The lab technicians did a fantastic job of setting up the practical exam, and the NMR staff analysed all the students' samples to check the purity of their organic products. Each country was also given a guide – mostly bilingual Cambridge students – to translate and keep the students out of trouble.

Other support from sponsors included the Goldsmiths' Company who provided the medals, and also from Cambridge Assessment, the Salters' Institute and the Department of Business, Innovation and Skills (formerly the Department of Innovation, Universities and Skills).

The event was deemed a success, with many of the students taking home wonderful memories. One Slovenian student declared the event as 'the best 10 days of my life'. Peter Wothers was also pleased with how the event went and the group participation. 'Many of the other Olympiads haven't had quite the same atmosphere,' he said. 'A few people have told me that it the best one ever.'

Students get stuck into the five-hour written exam – and the five-hour practical exam!

More prizes for Cambridge chemists





From top left: Dobson, Sanders, Balasubramanian, Ley, Paterson, Scherman, Fersht, Clarke, Huck and Robinson





It must be awards season as we've got plenty of prizes won by members of the department to report this issue.

Chris Dobson and Jeremy Sanders have both been awarded important medals by the Royal Society. Chris has been given a Royal Medal for his outstanding contributions to the understanding of the mechanisms of protein folding and misfolding, and the implications for disease.

Three Royal Medals, also known as the Queen's Medals, are given every year; this is the second such award won by Cambridge chemists in as many years, after Alan Fersht received one last year. You can read more about Chris's chemistry on page 10.

Jeremy Sanders has been awarded the Davy Medal for his pioneering contributions to several fields, most recently to dynamic combinatorial chemistry at the forefront of supramolecular chemistry.

This medal is awarded annually for an outstandingly important recent discovery in any branch of chemistry, and Jeremy is in august company. Famous names from the past who've won it include Robert Bunsen, William Perkin, Svante Arrhenius. Previous Cambridge chemistry recipients include Chris Dobson, Alan Fersht, Steve Ley, John Meurig Thomas, Alan Battersby, Ralph Raphael and Lord Todd. 'I'm astonished and overawed to join such a distinguished list of chemists,' Jeremy says.

A third Royal Society prize, the Mullard Award, has gone to Shankar Balasubramanian. This is given to a scientist whose work makes a contribution to national prosperity in the UK. Shankar's DNA sequencing technology, spun out into the company Solexa (since sold to Illumina), is making a profound impact on medical r&d because of its speed.

Various other members of staff have won prizes, too, several of them from the Royal Society of Chemistry. Steve Ley has been given the Perkin Prize for Organic Chemistry for his outstanding creative work and innovative solutions in the art of organic synthesis.

One of this year's RSC Tilden medals goes to Ian Paterson for his is outstanding achievements in the total synthesis of complex natural products. And Oren Scherman was awarded a Harrison-Meldola Prize for for his work on supramolecular polymers, in particular in aqueous environments.

Alan Fersht's latest prize is the Wilhelm Exner medal of the Austrial Trade Society, for his contributions to biotechnology. Exner was an Austrian promoter of economy and tehcnology, and the medal has been awarded to more than 200 scientists and inventors over the years, 17 of whom were Nobel Laureates. Alan describes the list of winners as an 'eclectic mix', ranging from Lord Rutherford and Lise Meitner to Ferdinand Porsche.

Jane Clarke has been awarded the 2010 US Genomics Award for the outstanding investigator in the field of single molecule biology for pioneering the study of the mechanical properties of proteins, protein folding and stability.

Meanwhile, Wilhelm Huck has received the Humboldt Bessel Research Award, and Carol Robinson has been made a fellow of the Academy of Medical Sciences.

Congratulations to all!

The Corporate Associates Scheme

Arecor
Astex Therapeutics
Astra Zeneca
Asynt
Biotica Technology
Boehringer Ingelheim Pharma
BP
BP Institute
Bristol-Myers Squibb
Cambridge BioTechnology
Cambridge Medical Innovations
CambridgeSoft
Chemical Computing Group
Cornelius Specialties
Dr Reddy's Custom Pharmaceutical Services
GlaxoSmithKline

Thanks to the generosity of the department's Corporate Associates, we have been able to benefit the education and environment for students and staff. For example, the Associates pay for university-wide access to SciFinder Scholar and ChemOffice. They also make significant contributions to the library for journal subscriptions. Moreover, they provide exam prizes, faculty teaching awards and summer studentships, and have recently funded the refurbishment of a state-of-the-art meeting room with teleconferencing and display facilities.

Corporate Associate membership not only provides essential support for the department, but also provides numerous benefits to help members work with us and achieve their business objectives. Members enjoy many benefits through their enhanced partnership with the department, such as:

- Visibility within the department;
- A dedicated meeting room and office for members to use while visiting the department;
- Invitations to recognition days and networking events at the department;
- Access to emerging Cambridge research via conferences, special briefings and various publications;
- Access to the department library and photocopying/printing facilities;
- Regular communications about upcoming events and colloquia;
- Subscriptions to department publications, including *Chem@Cam;*
- Priority notification of and free access to departmental research lectures;
- Ability to hold 'Welcome Stalls' in the department entrance hall;
- Preferential conference rates;
- Free access to the teaching lectures held within the department;
- The full services of the Corporate Relations team to facilitate interaction with students, staff, and other parts of the University of Cambridge to help achieve your corporate objectives.

If your organisation would be interested in joining the Corporate Associates Scheme, then please email Jane Snaith at cas-admin@ch.cam.ac.uk, or call 01223 336537.

Heptares
Illumina
Johnson Matthey Catalysts
Lectus Therapeutics
Maruzen International
Merck Sharp & Dohme
Novartis
Pfizer
Proctor & Gamble
Roche
Sigma-Aldrich
Society of Chemical Industry
Takeda Cambridge
Unilever
Uniqsis

Chemistry for non-experts

One of the ways the department is celebrating the university's 800th anniversary is by offering the a series of open lectures. These will be given by academics, but squarely aimed at non-academics, and are open to everyone.

The idea is to give people an insight into the significance of the research that is taking place within the department.

Head of department Bill Jones kicked off the series of lectures in April with a talk about his work in materials science, and Carol Robinson spoke about her research into biological mass spectrometry in June.

The next lecture will be given by John Pyle on 21 September, and will look at his work in the field of atmospheric chemistry.

Photo: Nathan Pitt

Bill Jones in lecturing action

Yusuf meets his compatriots

Chemistry alumnus Yusuf Hamied was in Cambridge in May, and popped into the department before a meeting with the vice-chancellor. He took the opportunity to have lunch with PhD students, postdocs and a Part III student who hail from his home country, India.

Yusuf worked with Lord Todd back in the 1950s, and is now chairman of Cipla, the Mumbai-headquartered pharmaceutical company that was founded by his father in the 1930s.

They met for lunch in the Todd-Hamied Room – the former G14 seminar room that was refurbished three years ago thanks to Yusuf's generosity, and named after his former supervisor.

The group is pictured above with Yusuf and Bill Jones before lunch. They are: Nagaratna Shridhar Hegde (PhD with Shankar Balasubramanian), Soumya Daturpalli (MPhil with Sophie Jackson), Suresh Rameshlal Chawrai (PhD with Finian Leeper), Santoshkumar Patil (postdoc with Chris Abell), Prashant Kapadnis (postdoc with David Spring), Dwaipayan Chakrabarti (postdoc with David Wales), Prasenjit Mal (postdoc with Jonathan Nitschke) and Part III student Nandhini Ponnuswamy.

Chemistry from Dan Pantos and Jeremy Sanders graced the front cover of a recent issue of the RSC journal Physical Chemistry Chemical Physics. Certain amino acid derivatives of naphthalenediimide assemble through hydrogen bonding into non-covalent polymers that have the form of helical nanotubes. The two enantiomers can be distinguished by their unusual circular dichroism spectra, but the origin and meaning of the spectra was unclear. This new paper, the result of collaboration with theoreticians Jonathan Hirst and Ben Bulheller at Nottingham, shows that calculated spectra based on the known crystal structure reproduce the solution spectra remarkably well. This shows that the solution structure matches that in the crystal, and also holds out the hope that CD could be used to characterise the length of experimental helical nanotubes

Academic promotions

Three members of staff will be promoted in October: Paul Davies is to become a professor, Jonathan Goodman a reader, and Paul Barker a senior lecturer. Congratulations!

Farewell to Carol

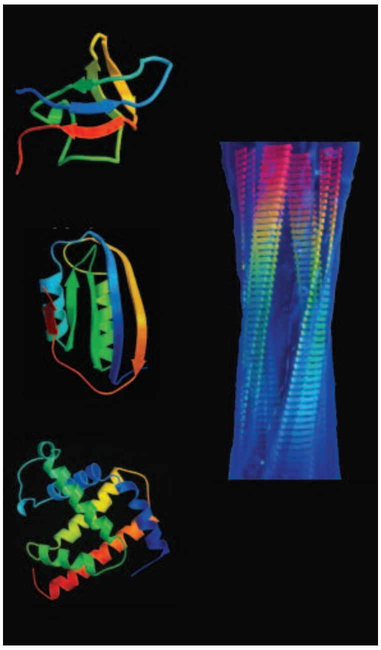
We're bidding a fond farewell to Carol Robinson, who is returning to Oxford, where she has been appointed to the prestigious Dr Lee's Professorship. She starts there in October.

Carol has made very important contributions to the field of mass spectrometry while she has been in the departmetn, first as a Royal Society URF, and more recently as a Royal Society Research Professor. She also received invaluable and generous support she received from Walters Kundert Trust

'I have very much enjoyed my time here in the department, and I hope very much to continue with all my existing collaborations,' she says.

The problems caused by misfolded

Proteins fold up into beautiful shapes that give them their functions. But what happens when protein folding goes wrong? Chris Dobson is looking at the effects misfolded proteins have on biological processes



Right: the three folded proteins are SH3, AcP and myoglobin, and while their folded structures are very different, but the amyloid structure of all three is essentially the same, as shown on the right

Chris Dobson's research has for many years focused on protein folding but, more recently, he's been even more interested in their misfolding. Proteins fold up into beautiful shapes with distinctive features that give them their biological functions, but what if that folding process goes wrong?

'Protein misfolding is associated with many different diseases, from cystic fibrosis through to some forms of cancer, but it's particularly important in the so-called amyloid disorders,' he says. 'These include Alzheimer's and Parkinson's diseases, prion diseases such as "mad cow" disease, and Type II diabetes, in all of which thread-like deposits called amyloid fibrils are formed, and we are realising all the time that more and more diseases are associated with misfolded proteins.'

The problem with misfolded proteins is not just that they lose their biological activity, but that the misfolded species tend to aggregate and become insoluble, leading to deposits such as the amyloid fibrils and plaques that are associated with Alzheimer's disease.

'All our proteins have evolved to be able to be present in their folded and soluble forms under normal situations'. But he describes aggregation-related diseases as post-evolutionary diseases, as we are now moving outside the range of conditions which evolution had expected, and within which our proteins can remain correctly folded. 'We live much longer and our proteins are not in fact good enough to last forever. In addition, we take less exercise, change our diets, put ourselves on long-term medical treatment, and even feed young cows on old cows. All these 'risk factors' increase the probability that one or more of our proteins misfolds and aggregates, and perhaps becomes toxic instead of functional.'

In the past five years or so, his group has broadened its activities from carrying out *in vitro* biophysical experiments into trying to determine how these experimental data relate to what is happening in a real living system. 'To do this we've generated a range of collaborations, which go from nanoscience to neuroscience, and we've been working with people whose science is as diverse as Mark Welland, head of the nanoscience centre in Cambridge, and David Lomas, who's deputy director of the Cambridge Institute for Medical Research,' he says.

Many of the experiments that have been carried out in his group in recent years have involved looking at what

CV Chris Dobson

Born: Rinteln, Germany

Status: His wife Mary is an author, with a new book due for publication early next year. They have two sons, Richard and William

Education: A BA in chemistry at Oxford, followed by an Oxford DPhil with Bob Williams

Career: He spent three years as an assistant professor at Harvard, then returned to Oxford as a lecturer. He was made professor in 1997, and moved to Cambridge and the John Humphrey Plummer chair in 2001. He's also now Master of St John's College.

Interests: Watching cricket, travelling and theatre

Did you know? His father was a British Army Officer who was posted to Nigeria, and Chris spent three years of his childhood in Africa

proteins

controls the rate and nature of the folding process, how it can go wrong and how this can result in aggregate formation. Experiments in a test tube are all very well, but what happens when misfolding takes place in a real living system? 'We have been looking at cells and model organisms such as the fruit fly *Drosophila melanogaster* and the nematode worm *Caenorhabditis elegans* to find out how we can use our understanding of basic physical phenomena to understand why processes related to protein misfolding occur in living systems,' he says. 'And our conclusion is that there seem to be some very "generic" phenomena that occur, and a surprising number of these can be understood by looking at the basic physics and physical chemistry of protein molecules.'

Fundamentally, in order to understand the behaviour of the different protein molecules whose aggregation leads to different types of disease, only a few core parameters seem to be important. 'In conjunction with Michele Vendruscolo and his group, we have found it's becoming possible to set out equations that enable us to make predictions,' Chris explains.

'We can predict from our knowledge of the principles of protein aggregation the probability that a fruit fly with a mutation in a protein will develop neuronal damage relative to another fruit fly with a different mutation in the same protein that makes it aggregate in a different way. We can also do experiments that allow us to predict from very simple equations when a transgenic mouse will develop a prion disease, just from understanding the basic physics of the process.'

'The assumption has always been that proteins fold up into the wonderful structures with which we are all familiar, and that's their normal state,' he says. 'Our view is now that the most stable structures of proteins are normally aggregated species such as amyloid fibrils. But biology has found some sequences that will fold up into these globular states, even though they are not as thermodynamically stable as the amyloid form, and it is these varied and soluble states that have evolved as the functional forms of proteins.'

Chris and his group, pictured outside St John's – at least Chris was ready for the photographer!

Diseases such as Alzheimer's and Parkinson's therefore appear to show that if the regulatory control of the biological machinery within the cell is lost, proteins tend to revert to these amyloid forms, which are not only non-functional, but also often toxic. 'Until we reach old age, human biology has usually got everything completely controlled, with quality control and degradation mechanisms keeping the inherent tendency of proteins to form amyloid fibrils at bay,' he says. 'But changing the balance of these interactions can lead to toxic forms appearing.

LIVING ON THE EDGE

'All of our proteins are destined eventually to turn into aggregates, so we're living right on the edge between health and disease,' he says. And this conclusion could result in new ways of preventing or even curing diseases. 'Very small changes can cause us to go into a disease state rather than remaining healthy, but one of the corollaries of this is that relatively small changes can also take us from a disease state to a healthy one.'

And very small perturbations of the system could, for example, enhance our natural protective mechanisms. 'Finding ways of reducing the concentrations of these aberrant species could have very dramatic effects,' Chris concludes. 'Because it's a kinetic phenomenon, relatively small changes in the system can increase enormously the length of time before misfolding diseases develop.'

The power of collaboration

Chris describes his group and his collaborators as an extraordinarily diverse set of people who select their own projects and self-assemble into subgroups with common interests. 'Some of this extended group are by origin neuroscientists, some chemists, some theoretical physicists, and we have both experimentalists and theoreticians working closely together,' he says. 'They get together and decide what they want to do, and they have the freedom to collaborate with whoever they need to. I think it's a very effective way of doing interdisciplinary science, as long as you have people who are both smart and well-motivated.

'It brings out the best in the individuals, and allows them to develop their own ideas and thoughts about complex interdisciplinary problems, whether they're the newest Part III student or the most seasoned PhD students.They take responsibility for their own research programme to a large extent, but of course they talk to me and other senior members in the set of collaborating groups who can put what they are doing into perspective. We are able to build up a picture of science across a wide area, because people talk to each other a lot so there's a continuity of activity rather than a series of separate projects.

'The opportunity to collaborate with a lot of people working in different disciplines as well as chemistry is a huge privilege. It's a very positive aspect of being in Cambridge – there are so many fantastic scientists interested in working together to tackle major problems, such as the origins of neurodegenerative disorders or diabetes, and who make collaboration both a pleasure and a success.'

Making magnetic materials

Some organic materials have magnetic properties, and Jeremy Rawson is investigating how these properties can be manipulated

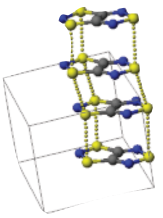
Most magnetic materials are based on metals and metal oxides, but aromatic organic molecules can also exhibit magnetic properties if they possess unpaired electrons. The precise nature of their magnetic properties depends on how the molecules pack together in the solid state, and Jeremy Rawson is looking at ways in which those magnetic properties can be manipulated by changing the structure and nature of the molecules themselves.

'During my PhD, most of my work revolved around sulfur–nitrogen ring chemistry, and after that, as a postdoc, I studied the magnetic interactions between transition metal ions,' he says. 'My current studies, which look at the magnetic properties of sulfur-nitrogen thiazyl radicals, amalgamate these two different areas.'

MODIFIED PACKING

There are many different heterocyclic thiazyl radicals, and Jeremy's group focus on using versatile synthetic strategies that allow derivatives with different steric and electronic properties to be made. Changing these properties also modifies the crystal packing and, therefore, their magnetic properties.

'If you change the way the molecules pack, it can have a dramatic effect on its magnetism,' he says. 'We've found that even very small changes, such as the position of substituents on an aromatic ring, can lead to vastly different physical properties and orientational changes affect the way the radicals communicate with each other,' he says.



Spin switching in the thiazyl radical $C_2S_3N_3$ on heating and cooling is associated with a solid state phase transition between a diamagnetic low temperature phase (above) and a paramagnetic high temperature phase (below)

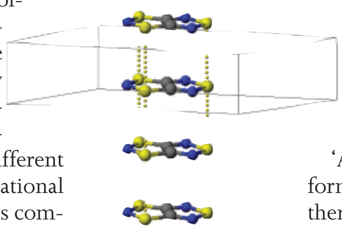


Photo: Caroline Hancox

Radicals have a tendency to pair up, forming bonds. If the unpaired electron is of π-character, then the molecules often self-assemble via π-stacking in the solid state to form these bonds between the unpaired electrons. However, the bonds are relatively weak and, in some cases, if energy is put into the system, the bonds can be broken. This forms new phases, whose magnetism is vastly different from the original.

'At low temperature, the molecules dimerise, giving a diamagnetic material, but on warming the bonds break and these materials becomes strongly paramagnetic,' Jeremy says. This approach of fine-tuning at the molecular level has led to the design of a series of compounds which undergo such abrupt phase transitions across a broad temperature range from around -220°C to room temperature.

'Although the diamagnetic "bonded" form is more stable at low temperature, there is typically an energy barrier associated with the phase change which leads to a lag in its return to the diamagnetic state on cooling.'

The result is a series of compounds which can be both diamagnetic ('bonded') or paramagnetic (with unpaired electrons) in a well-defined temperature range. 'It is now possible to switch the magnetic properties of these materials by applying heat, light or even pressure,' he says. 'This sort of responsive material which reacts to different stimuli could have interesting applications, and I've recently been discussing potential applications with colleagues in the engineering department.'

Making these spin-switching radicals turns out to be a synthetic challenge. The ideal starting materials are aromatic 1,2-dithiols, but few are commercially available. His former student Rob Less, now with Dominic Wright's group in the department, developed an elegant (if smelly!) synthetic route to a wide range of derivatives.

The key step is the reaction of 1,2-dihaloaromatics with sodium t-butylthiolate. 't-Butyl thiol is the chemical that is added to natural gas in minute quantities to make it smell,' Jeremy says. 'Although the chemistry is undertaken careful with a bleach scrubber – and after informing the departmental safety officer through the 'nasty niffs' procedure – it's still best used at the weekend when no-one else is around!'

He's currently looking at coordinating these radicals to transition metals such as manganese and iron. 'We're interested in finding out how the electrons on the metal and the radical communicate with each other,' he says. 'We've already made several complexes and have determined their crystal structures. We're now in a position to begin to probe their magnetic properties.'

CV Jeremy Rawson

Born: Rugby, but moved to Leeds when he was 4 and the Isle of Man at the age of 9, and considers himself a proud Manxman.

Education: After school on the island he had to move, like other islanders, to 'The Mainland' to pursue a university education. He studied chemistry at Durham, followed by a PhD there with Arthur Banister.

Career: A postdoc in Edinburgh with Richard Winpenny was followed by a brief return to Durham as a temporary lecturer. He's been a lecturer in Cambridge since 1996, and is currently both director of studies for physical natural sciences and undergraduate admissions tutor at Magdalene.

Interests: Visiting France (and polishing up the language skills he developed on a three-month spell at CNRS in Toulouse during his PhD). He's a keen walker, and is particularly fond of North Wales and the Lake District. 'They're much more topographically interesting than Cambridge!' he says.

Did you know? Science seems an unusual career for someone from the Isle of Man – most of the residents people have heard of have some link with wheels, from F1 champion Nigel Mansell to Jeremy Clarkson. And star cyclist Mark Cavendish is a native. Jeremy says there is a famous Manx scientist, though – X-ray diffraction pioneer William Bragg went to the same school as him, albeit rather earlier!

Automatic for the chemists

A machine that takes the hard work out of optimising reactions would save masses of time. Ian Baxendale's developing one

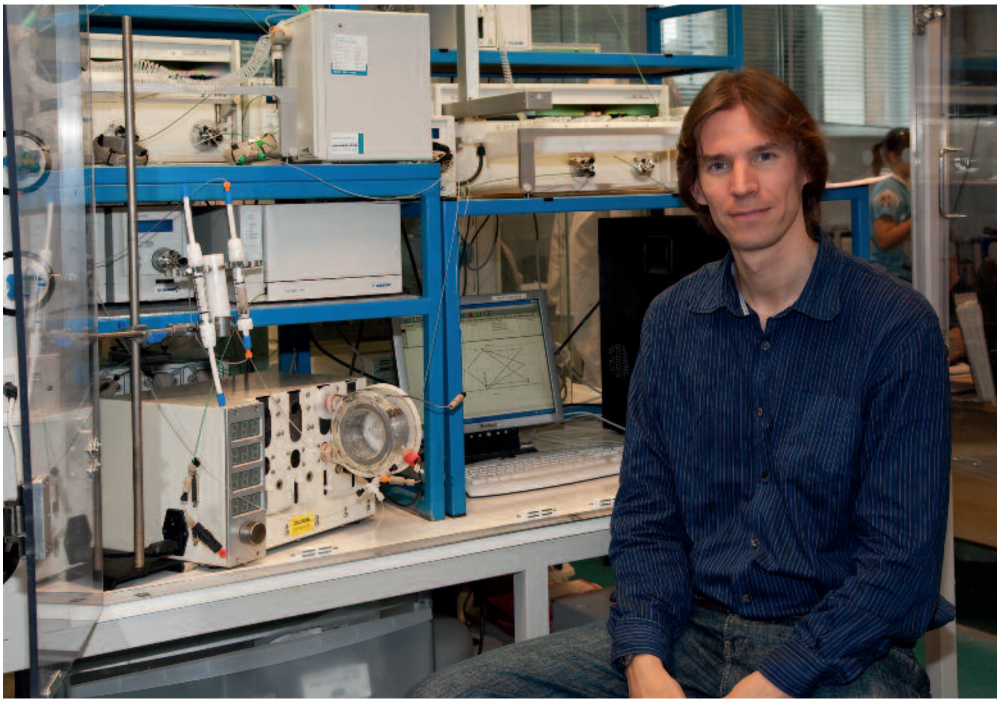


Photo: Caroline Hancox

Synthetic chemists are extremely skilled at inventing new reactions and synthesising complicated molecules. However, optimising reaction conditions and performing multi-step syntheses takes time. So what if machines could take much of the drudge work out of it? It would make the whole process faster and more efficient, leaving the chemist with more precious time to develop new reactions and syntheses. Ian Baxendale is trying to develop new automated systems that will speed up routine chemistry.

MAKING MOLECULES

'There's a big disconnect between what chemists would like to be able to do, and what they can do practically within a lab,' he says. 'Synthetic chemists are very imaginative, and these days have incredibly powerful search tools and databases that help them formulate and rationalise a synthesis, but there is still the issue of making the molecules in the lab. I want to create technology in a format that is easy to use so that any synthetic chemist with an idea can use its automation capabilities to translate their idea into an actual molecule, or optimise the conditions for a reaction.'

A key enabling technology is flow chemistry. Instead of using a standard glass flask, the reaction takes place in a narrow tube. The reagents are pumped into the tube, and product emerges at the other end, in a continuous fashion. 'This can give us improved reaction kinetics, better conditions and we can alter reaction parameters such as temperature and pressure very rapidly. This cannot be achieved at anywhere near as quickly in a standard lab reaction,' he says.

However, Ian's not just looking to create blind robotic systems – the idea is that they will also be intelligent. 'We want to be able to give a machine something more than an on–off button – we also want it to be semi-smart about what a chemist would want to do,' he explains. 'The idea is to give it some sort of interpretive capability that will allow it to do automatically the sorts of trivial things a chemist would spend hours doing and re-doing, such as running multiple reactions based on temperature gradients.'

And he's already making progress. 'We're now at the point where we can happily walk away from a machine that has set itself to optimise a reaction. It doesn't always optimise in the way it want it to yet, but it's got the ability to optimise by changing parameters such as temperature, pressure and residence time of the reagents within the flow tube,' he says.

The machinery he's using is a combination of equipment that has been bought and modified, and he's also worked with a lot of the commercial vendors and manufacturers that are operating in this area. 'We also have quite a lot of kit that has been created for us in the department's workshop,' Ian says. 'When we walk through their door it always goes quiet while they worry about what on earth we want them to make for us next! They either start smiling or frowning very quickly.'

AN INTELLIGENT MACHINE?

At the moment, he says, what they have is a machine that takes a lot of the routine synthetic procedures that can replace a chemist in the lab, but it's not intelligent enough to replace the chemist's brain. 'However, what it does do is free us up to develop the next version, or to be outside the lab while it's doing the chemistry for us.'

It gives incredible scope for optimising reactions and creating data about those reactions, and Ian believes this will ultimately mean a system that creates data rather than compounds will be possible. 'At the moment, we tend to create compounds as vials of unpurified reaction mixtures which we then interpret. I want to create a system that delivers just the information based on all the chemical reactions it's done. We can then sift through them to pinpoint the right conditions for a full-scale reaction.

'This will save a huge amount of time – at the moment you could spend two weeks in the lab screening random reactions, and there is no way you could screen all the thousands of variables you really should. So you hope for the best, and are likely to miss the best option. The machine doesn't get bored, and can try them all!'

CV Ian Baxendale

Born: Exeter, Devon in a hospital that's now on the site of a dry ski slope

Status: Single

Education: Studied chemistry at the University of Leicester, followed by a PhD in Organometallic Chemistry there with Pavel Ko ovský.

Career: Spent time working at AgrEvo near Saffron Walden, but in 2000 met Steve Ley in a pub (!) and ended up moving to the department as a postdoc in Steve's group. He's now been awarded a Royal Society Research Fellowship, which will help support his research for the next five years

Interests: Scuba diving and travel – the two rather have to go together living in Cambridge, he says. He has also been sighted drinking beer on the odd occasion…

Did you know? Ian is, apparently, an accomplished mass-murderer. 'I went on a murder mystery weekend, and I was such a good murderer on the first day I carried on murdering people for the next two days too!'

Chemistry excites the kids

The department was filled with kids finding out how much fun chemistry is on open day. Caroline Hancox, Nathan Pitt and John Holman took the photos

This year's chemistry department open day was another resounding success, with hundreds of schoolchildren and their parents visiting the department to find out more about chemistry.

Pete Wothers' demonstration lecture this year was entitled 'Just add water', and he gave it three times on the day (and several more times during the week!). He explored some of water's extremely surprising properties, answering questions such as how a drop of water start a fire or cause an explosion, why you can't put a chip pan fire out with water, and why it's impossible to boil an egg on Mount Everest.

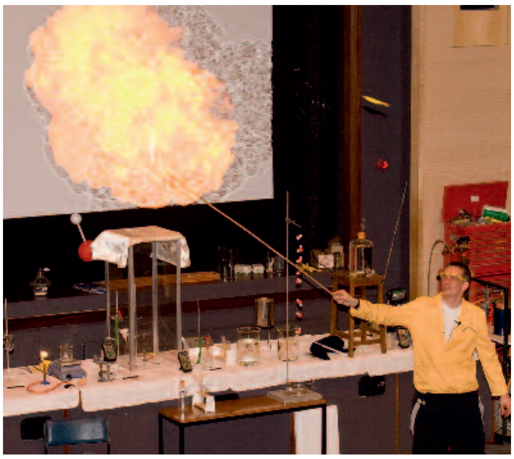
There was also plenty of opportunity for the kids to get their hands on some real chemistry experiments. They could extract DNA from strawberries, make volcanoes using carbon dioxide, use sugar to make rainbows and lava lamps, and clean dirty coins using household ingredients. They could grow crystals, print photos in Prussian Blue, make putty from everyday chemicals, and use chemical reactions to make light.

The amazing – if messy – cornflour slime tank made a welcome reappearance, to show it's possible to walk on liquids. They even got the chance to eat ice-cream, freshly made using liquid nitrogen.

We also had an interactive exhibition from the Centre for Atmospheric Research and the British Antarctic Survey explaining what they do in Antarctica, and a display from the Nanoscience Centre showing how materials 50,000 times smaller than a human hair could change our lives. The Royal Society of Chemistry were also there with a collection of fun chemistry-based games.

These are just a few of the many highlights of the day. Our thanks go to Eric and Katharina Walters for their generous support once again. The day wouldn't have been possible without all the help from students and postdocs who supervised and ran the experiments, as well as the many undergraduate volunteers. Last but not least, huge thanks to the teaching technicians for all their help with the activities and Peter's lecture – they go well beyond the call of duty.


DO NOT
EAT



Memories of Alfie Maddock

Alan Williams remembers Alfie Maddock, who died in April

Alfred Maddock – normally called Alfie – was born in London in 1917, and graduated from Imperial College, London in 1939. He began a thesis on silane chemistry with Harry Emeléus, but the war changed the direction of his research.

He was seconded to a special unit dealing with chemical problems such as how to render military stores too malodorous for the enemy to use: this brief excursion into tellurium chemistry is generally referred to by his wife Margaret as 'the time when Alfred smelt'.

He was then sent to Cambridge to join Tube Alloys, the British atomic bomb project. This later moved to Canada, where he met another Imperial chemist, Geoffrey Wilkinson, with whom he kept in contact until Wilkinson's death in 1996.

SECRET SCIENCE

Alfie's scientific papers from the period in Canada are still classified as secret, but one story has become famous. At some point the whole stock of plutonium (some 10mg) was spilt on a bench. He immediately sawed out the contaminated part of the bench, dissolved or burnt away the wood (the story varies) and managed to recover about 95% of the plutonium. His co-workers were surprised to discover a neat round hole in the bench the next morning.

After the war, he returned to the UK and helped to set up the atomic energy research establishment in Harwell. A lot of scientific equipment was then available from the armed forces, and he found it 'difficult to spend more than £10'000 a day without being extravagant'. However, an academic life was always his ambition and he moved to Cambridge where Eméleus was now professor.

Although he published a few more papers on silane chemistry, his research followed from his experience in Canada, and more specifically actinide chemistry and the chemical effects of nuclear reactions. Actinide chemistry was then in its infancy, and the development of efficient methods of separation was just as important as studying the chemistry. He worked on separation of protactinium, plutonium, neptunium and residual uranium. The crowning achievement was the isolation of more than 100g of protactinium, in collaboration with the AERE and AEA, starting from what he called '60 tons of radioactive sludge'.

Protactinium is found in very low concentrations as a daughter product of ^{235}U decay, but significant amounts were present in residues of pitchblende treatment. This must be one of the last occasions when an inorganic chemist isolated 100g amounts of a new element, and the protactinium obtained was important for establishing the chemistry of this element. The study of solvent extraction methods and radioactive tracers was a recurrent theme in his research.

The Szilard-Chalmers effect was still new when he began his work, and virtually nothing was known about the chemical effects of nuclear reactions on materials. His many papers on hot atom chemistry were often written in collaboration with labs outside the UK. International collaboration is now fashionable; in the 1950s and 1960s it was considered highly exotic, but Alfie believed strongly in encouraging the growth of science everywhere in the world.

He carried out several missions for the International Agency for Atomic Energy. Most of the hot-atom work was carried out on solid-state samples, and required development of analytical methods to identify the chemical changes in radioactive samples, and careful analysis of the effects of defects and of thermal annealing to characterise the solid state reactions.

Alfie was a pioneer in the chemical applications of Mössbauer spectroscopy. Together with Mike Bancroft and Michael Clark on the theoretical side, he carried out elegant studies of chemical bonding in iron and tin compounds and developed additive models which related the spectra to the donor and acceptor properties of the ligand. He also studied other nuclei including tungsten, iridium, gold, and tellurium.

With Mike Bancroft and Roger Burns he established the potential of Mössbauer spectroscopy in mineralogy. The technique allows not only the identification of iron occupancy of different sites, but also to follow redox reactions in minerals. He spent a sabbatical leave in Strasbourg in 1976 and studied positron annihilation and the chemistry of positronium. He has been acknowledged for his great help in setting up carbon-14 dating in Cambridge, but I have been able to find no publications in this field with his name. He received many awards and his contributions to nuclear chemistry in the broadest sense were quite outstanding.

Alfie had boundless enthusiasm for almost everything, coupled with almost equally extensive knowledge. He was a great conversationalist, and delighted in argument, never fearing to adopt rather extreme positions to stimulate discussion. He could be a little mischievous, but never unpleasant, and he was held in respect and affection by the graduate and undergraduate students he taught.

WINES AND STORIES

He loved travelling and had a particular affection for France, believing any year without a visit was wasted. He had an equal affection for and knowledge of the wines of this country (and of any other) and I can recall the astonishment of my Swiss colleagues when at a summer school he obtained the highest marks in a blind tasting of Swiss wines.

It would be impossible to finish without some comment on the many stories concerning him. Easily the best were those that he told himself, where he generally managed to establish that the remarkable happenings were the result of a perfectly logical series of events where he was in no way responsible.

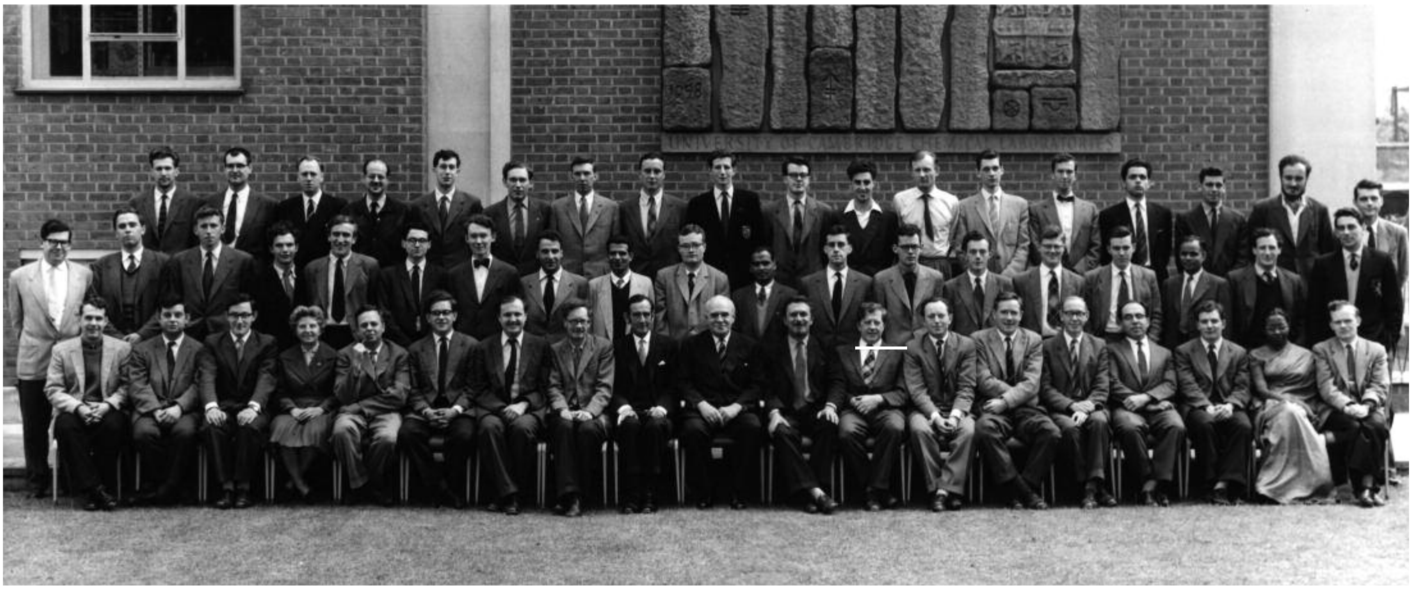
It is certainly true that it was not his fault that a visit to Buenos Aires to give a lecture on radiochemistry led the Daily Express to run the front page headline 'British Atom Scientist flees to Péron'. Sadly there is not enough space to recount the cases of the flying graduate student, the scandal on Salisbury Plain, or Miranda the radioactive sheep.

Alan Williams, University of Geneva

Alfie as he was in the 1950s and, below, a photo taken at in his garden at his 1984 retirement party

The 50th anniversary revisited

In this second instalment of our look back over the Lensfield Road labs' 50 year history, Ian Smith recalls some of the people in Physical Chemistry, and overleaf David Watson brings us up to date



Above: The department of physical chemistry in 1960, with only two women

Ian Smith on Physical Chemistry

I arrived in Cambridge in 1957, and at that time the chemistry and physics departments were in buildings bounded by Pembroke Street and Free School Lane – I'd originally signed up to do the Natural Sciences Tripos with the intention of studying physics! Evidence of chemistry's presence in Free School Lane is still there – if you go to the Whipple Museum and cast your eyes upwards before you enter, you will see 'Laboratory of Physical Chemistry' chiselled in the stonework, in a way that will probably last several hundred years. I still remember attending first year physical chemistry lectures in that building, although any memory of practical work has faded away completely. In my second and third years, my lectures were in the new building in Lensfield Road.

To use a term more common in the US, I was one of the class of '57, along with three other stalwarts of the Cambridge academic staff – Stuart Warren, Martin Mays and Anthony Stone. I think we've all matured pretty well! Of course, the class of '57 might have been unsurpassed in the brilliance of its members – but I think that all four of us would agree that it wasn't only a good time to be young, it was also a good time to be looking for academic positions. My colleagues spent all their academic careers in Cambridge, and I was fortunate enough to have a position here for most of my academic career. We shared it around a bit – so Anthony went to theoretical, Martin to inorganic and Stuart to organic, which left me to the department of physical chemistry.

Morris Sugden – not as fiendish as he looked!

Of course, physical chemistry was still a separate department at that time, and I think this photo from 1960 was the first departmental photograph taken outside the Lensfield Road labs. I can only identify two women, Delia Agar, and Mrs Pereira, who came from what was then Ceylon and was Tony Callear's first research student – I was his second. And, of course, in those days everyone possessed a jacket and tie, and they thought it appropriate to wear them if there was a departmental photo. There is one who is tieless – but I think he's wearing a cravat!

The overwhelmingly male ethos of the department meant that we found a lot of amusement in playing hearty games, and the Sunday morning football team from that period wasn't distinguished by its silky footballing skills, but it did contain several future professors of physical chemistry!

Two other aspects of life that have changed somewhat between then and now – probably for the better – are the two linked matters of smoking and safety. I remember one academic safety officer used to come in to your laboratory to talk to us about safety and he'd be inclined to tap his pipe out on your glass gas-handling apparatus. Nearly all of the academic staff smoked, perhaps most famously Morris Sugden, who became Research Director at Shell and subsequently Master of Trinity Hall. He generally looked more friendly than this photo where there's a fiendish glint in his eye!

The department was led at that time by RGW Norrish, who claimed a share of the Nobel Prize in 1967 for his development of flash photolysis – one of his co-recipients was George (later Lord) Lord Porter, who had been Norrish's

Below: no threat to Manchester United... Standing, from the left: 'Ziggy' Hathorn, John Clark (?), MIchael Pilling, Ross Dickson, Bill Hardy, Albert Pearson, Adrian Tuck and Ian Smith; on the ground are Gus Hancock, John Billingsley and David Pettit

Left: Norrish shows Princess Margaret around at the official opening – without a glass of Scotch in his hand!

research student shortly after the Second World War, and was on the staff of the department for a while. The photo with Princess Margaret, taken at the department's opening ceremony, shows Professor Norrish in rather characteristic style. I ought to scotch rumours that there was a glass in his left hand filled with a well known product of Scotland – he did have a reputation for enjoying what he used to call a snifter or two.

Of course there were other important people in the department, particularly if you had an equipment-based type of project, as I had, and they were the technical staff. Ernie Cox was the implacable man who ran the physical chemistry stores. He had a rather unusual concept of a storeman's task, which seemed to involve protecting, at all costs, the precious items in his stores. It was quite difficult to extract anything from him that you needed for your research. Occasionally, conversations could get a little heated.

Eric Smith was the photographer, a very important role because at that time the most sophisticated way of recording your experimental data was on a photographic plate. And Fred Webber was the chief glassblower; he also blew quartz, which is rather more difficult but was necessary for my research and for some other people's.

The more recent photos were taken at retirement parties of the individuals shown. Eric looks pretty much the same, and he's pictured with his brother Cyril from the glass shop, who probably won't thank me for saying that he taught me all the glassblowing I knew – he more or less gave up on me I think. Donald Oliver was in the machine workshop and was extremely helpful and valuable, and finally there's Brian Challis, who sadly died a few years ago, who had a general factotum role, including some glassblowing.

Norrish retired in 1965, a couple of years before he won the Nobel Prize, and he was replaced by Jack Linnett as 1920 Professor and Head of the Physical Chemistry Department. His research looked at aspects of theory, surfaces and kinetics. He became Master of Sidney Sussex, and for two years was Vice-Chancellor of the university. Shortly after he'd given up the vice-chancellorship, he died suddenly and tragically young.

John Meurig Thomas arrived as 1920 Professor and Head of Physical Chemistry in 1978, and in 1988 the long awaited amalgamation of the two chemistry departments took place and we all became good and happy friends under the one umbrella. Brian Thrush was the first head of this joint department.

At about the same time, Dave King arrived and took up the 1920 Professorship. He became head of the joint department in 1993, and served until 2000. John Pyle kind of replaced me, I think, in the 1980s, when I left to join the University of Birmingham, His appointment represented another change in the physical chemistry sector's interests with astrong move into atmospheric chemistry. With Rod Jones and Tony Cox, the Department covered all the aspects of atmospheric chemistry – modelling, observations in the atmosphere, and lab work, and, of course, John was made 1920 Professor in 2007.

David Watson on transformation

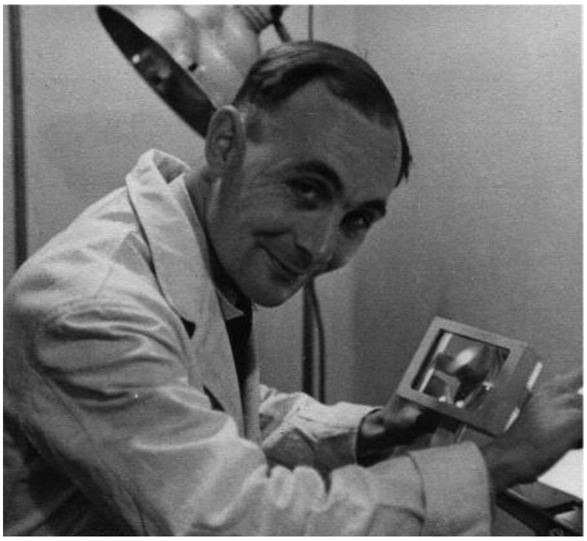
When the department was officially opened, it had already been inhabited by research workers for several months. Many of them wished to make their mark on the wonderful new building, and some of them succeeded rather well.

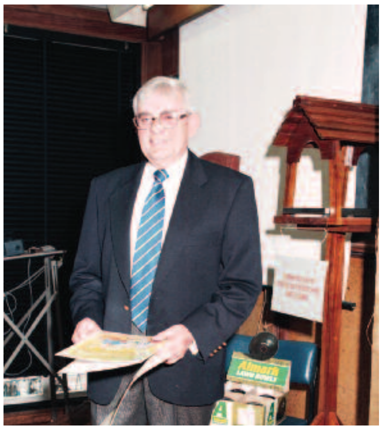
Perhaps the most memorable mark was made by one of Alfie Maddock's students, who was working with protactinium-231 in one of the third floor labs. But he dropped the vial. Sod's law being what it is, the vial broke, but the student knew what to do – he knew there was a telephone at the far end of the corridor, and so he headed over to the phone, and put into action all that needed to be done for a spillage of radioactive material.

A couple of days later, the decontamination squad came along, and traced every single one of his footprints down the corridor. They all had to be cut out – and that was part of the new building gone already!

People mourned the loss of the bun shop and the Eagle which were in close proximity to the old Pembroke Street labs, but all was not lost as there were five pubs in close proximity. Only two of these are still here today! But perhaps more important was the fact that occupying the space now inhabited by John Pyle's ozone secretariat was a bakers. So

Clockwise from below: Eric Smith, Fred Webber and Ernie Cox





Above: Eric and Cyril Smith, Donald Oliver and Brian Challis

there was hot, fresh bread for lunch, and cream doughnuts to die for.

It's important to reiterate that when the lab first opened it actually contained two chemistry departments. In the latter years, many chemists managed to come across the same experiment independently – they found that if they left Raney nickel overnight in a filter paper, it would dry out and spontaneously ignite. We have had lots of lovely fires over the years.

Another fire nearly brought our NMR section to a premature end. Back in 1973, an exothermic reaction which well and truly lived up to its name occurred on the third floor. It burnt through the high pressure water supply tank, which produced a marvellous fountain on the third floor, which flooded down through the second and first floors, onto the ground floor and then into the nmr machines in the basement. According to Brian Crysell, these were only on loan, and were not insured at the time!

The year 1988 was an important one – the two departments were finally joined together. Brian Thrush was the first head of the new department, which was something of a challenge as he had to sort out all the facilities that had previously been duplicated – two glassblowers, two mechanical workshops, two photographers, two electronics sections and so on.

The next head of department was Dave King, and during this time there was an incident that would provide a considerable catalyst to the future of the chemistry department – an explosion in a second floor fume cupboard belonging to one of Jim Staunton's group.

The fume cupboard was severely dented, but Dave felt that enough was enough. So in his quiet unassuming way (!) he let it be known to the mandarins down at the Old Schools and the funding councils that wet chemistry might well have to cease in Cambridge if something wasn't done about the state of the labs.

The pleas didn't fall on deaf ears, and after a lot of hard work in presenting cases the sum of £28.5m was provided to the department under the JIF programme. The refurbishment process took more than five years, but for the first time the academics could actually say to the architects how they wanted their labs built. We had to do away with the rolled gold and some of the sterling silver that they'd placed on their request sheets, but nevertheless it was a real bonus!

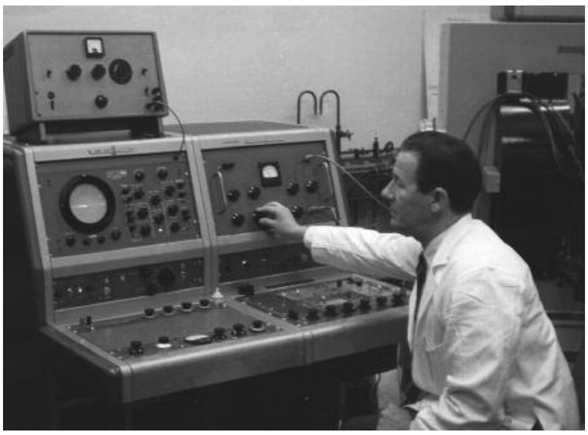
The icing on the cake was that Dave and Jeremy Sanders, who was assistant head at the time, came up with the idea of a dedicated technical services centre. The original boilerhouse housed two massive boilers, each at least the size of a double decker bus, and they converted that huge, dark area into a dedicated technical services area.

A lot of the technicians needed persuading – and you can't blame them as all they could see was a dark dingy place – it turned out to be fantastic. An additional advantage was that it gave more space in the other two wings of the building.

After Dave King's five year tenure as head of department, Jeremy took up the fight. He had been made assistant head largely to deal with technical staff matters, which I think most of the technical staff will agree was done superbly well. The £28.5 million quickly rose to a much higher sum, and as we moved towards 2000 Unilever gave £6.5 million for the molecular science building that is headed up by Bobby Glen. That came online in 2000, and also allowed us to move the library. Its old space on the west end of the third floor now houses theoretical chemistry.

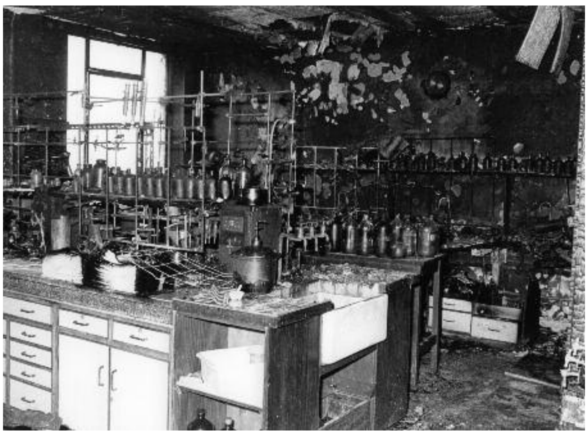
Jeremy saw through just about the end of the JIF programme, and now Bill Jones has taken over and is continuing to find money for refurbishments, including the recent extension to the Melville lab on the first floor. The next stage is refurbishing the old radiochemistry labs, which will become labs for the new Moorehouse Gibson professor, Clare Grey. It's a huge job, as it involves large amounts of radioactive decontamination.

In conclusion, I recall a retirement party many years backs for Ivor Meadows, who was a wonderful character. He said in his speech that the building is relentless, and we smiled a little at that. What he perhaps should have said was that the people who drive the building are relentless, whether academics, researchers or support staff. And I cannot help but think that we will continue to go from success to success.



Left: Eric Liddell at the NMR in 1967

Right: Some of the aftermath of the 1973 fire



Colloid chemistry in 1940s Cambridge

Dear Editor
Further to your correspondence about the Colloid Science department, here is a photograph of the members of that department in 1944.

The department came about after the death of the professor of physical chemistry, T. Martin Lowry, in 1936. At the time, the senior man was EK Rideal and he would normally have been appointed, but he was seriously ill and not expected to survive, so his main assistant, RGW Norrish, was appointed instead, in 1937.

Rideal unexpectedly recovered, and his prestige was such that the university set him up as professor of a separate department of colloid science. The department had no fixed teaching duties like the main physical chemistry department, and Rideal was expert in obtaining research grants from industry, so it carried out much more research than the main department.

I joined the department after I graduated in 1940, when I was recruited to join AF Alexander to study aluminium soap gels as an alternative to the rubber gels that were then used for flamethrower fuels and incendiary bombs. The invasion of Malaya by the Japanese led to a shortage of rubber.

The Fuel Research Station, Greenwich, had developed aluminium soap petroleum gels for flamethrowers, and we tried to find a suitable mixture for incendiary bombs. In my basement den I had 100 incendiary bombs with yellow phosphorus in the base, filled with water. We filled them with our mixtures and exploded them at the University rifle range. I invented a machine called a 'splashometer', which tested the mixtures in the laboratory.

The project was taken over by the Americans when they entered the war, and their particular mixture used the aluminium soaps of naphthenic and palmitic acid, napalm. I believe the current mixture uses polystyrene instead.

I then carried out a program of studying the flow birefringence properties of aluminium soap gels, using the equipment that had been developed by my predecessor, James Robinson, and eventually obtained a PhD for this work.

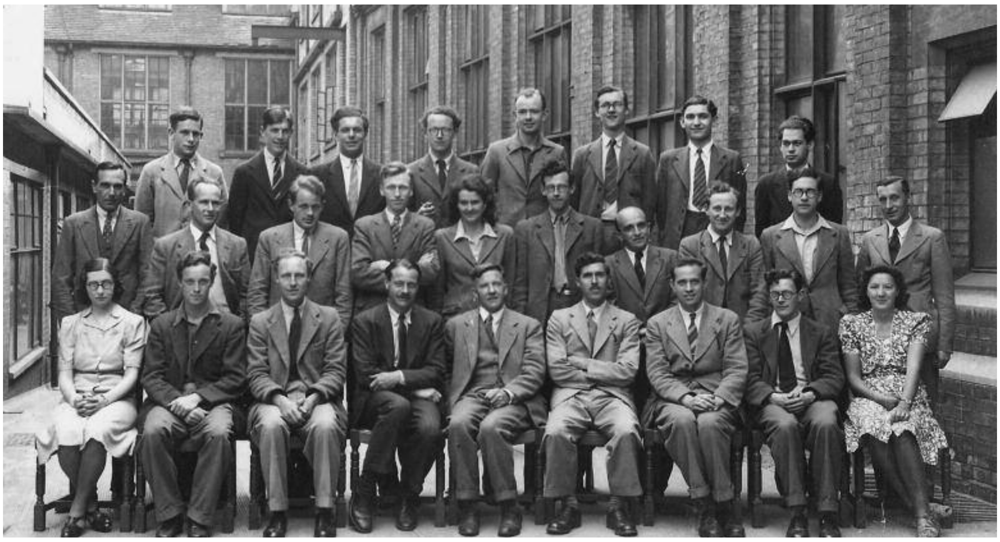
Robinson recently died in Dunedin, New Zealand, at the age of 91 after a long and distinguished career as Professor of Medicine at Otago University. He obtained a PhD degree in 1938 for research in the colloid science department 1935-1938, where he studied the flow birefringence of solutions of tobacco mosaic virus under the supervision of Joseph Needham.

Although I have been in New Zealand for 38 years, I never met Robinson to thank him for the use of his equipment. It now seems it is too late.

I recently met another former member of the Colloid Science Department, Lyndsay Gordon, at a Wellington science meeting. He was there some years after I left in 1946 and was able to recall the final departure of Professor E K Rideal who went to the Royal Institution in London and regretted it.

I do hope that now you can make use of my memories and my picture, which recalls a group of dedicated and enthusiastic scientists who influenced chemistry on a worldwide scale.

Yours sincerely
Vincent Gray
75 Silverstream Road, Crofton
DownsWellington 6035, New Zealand



Back row: GDS Mclennan, Eric Hutchinson, Dr Hurst, Philip George, Alan Robertson, Vincent Gray, Dan Reichenberg, HH Jellinek

Middle row: Len Saggers (technician), Fritz (Fred) Eirich, AA Cameron. RA (Bill) Blease, Elizabeth Frith (Mrs Tuckett), AJB Robertson, GD Coumoulos, Paley Johnson, Geoffrey Gilbert, Cyril Smith (glassblower)

Front row: Miss Morgan (secretary), RF (George) Tuckett, GH Twigg, Jack Schulman, EK Rideal, AE Alexander, EFG Herington, DC Pepper, Cathy Alexander.

Wot no mechanisms?

Dear Editor
I was surprised by the comment that F G Mann was a traditional chemist who included no mechanisms in his lectures. In the early 1950s I went to BC Saunders' organic lectures, but had supervisions with Mann in his room at Pembroke Street. To me, he seemed very good on explaining the mechanisms of organic reactions from the general structures of the reactants.

I also had supervisions from Charles Kemball in physical chemistry, during which he puffed on a very aromatic pipe loaded with Mick McQuaid's cut plug tobacco, and I think rather despaired of me. Also from Dr S R Nockolds in mineralogy, and remember that he had awful trouble balancing the three SU carburettors fitted to his ancient Rover tourer - this was before the days of electronic tuning.

Apart from Saunders, lecturers then included John Agar on electrochemistry and thermodynamics, Professor Norrish on photochemistry, Dr Ashmore on catalysis, Dr Johnson on colloids, Dr Kenner on stereochemistry, and Drs Sharpe, Palmer and Boys on inorganic chemistry. Sharpe was very keen on fluorine chemistry, which I later encountered in the chemical industry.

Dr EA Moelwyn-Hughes lectures on physical chemistry were memorable, varying from very loud to almost inaudible, as I think he was then rather deaf. He went to the trouble of informing us that '(Little) g is not the same here that it is on the top of Snowdon!' We also had physical lectures at 4.30pm on Saturdays, rather a poor show, given by a gentleman whose name escapes me, but he always had the air of having just returned from Newmarket.

Regards
Paul Stickland (Trinity 1951)
pandjs@tiscali.co.uk

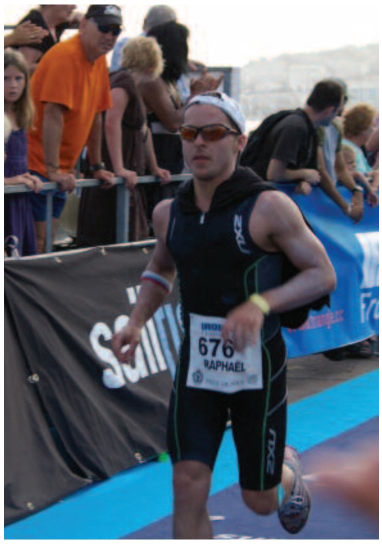
Gone in a flash

Dear Editor,
Cyril Smith (brother of Eric Smith), the chief glassblower in the department of physical chemistry, once told me that they had to move some giant searchlights, presumably for pre-flash photolysis experiments, from the department next to the old Cavendish, but one of the searchlights rolled out of the removal van was seen to be tumbling down Lensfield Road!

Yours sincerely
Rhobert Lewis (Christs 1976)
rhlewis@glam.ac.uk

We always love hearing readers' reminiscences – contact us at the address on page 3 if you've anything to share with fellow readers!

Raf's triple success



Swimming in the Med (he's in there somewhere!), cycling and running his way to an impressive 13.5 hour finishing time

Triathlons are hard work – you've first got to swim, then it's a cycle, and to round it off, a run. They vary in length, but the truly hardcore go in for the Ironman form of the event – a 3.8km swim, 180km on the bike, and as if that weren't enough, it's rounded off with a full marathon.

And in a fit of bravery (or should that be recklessness?) Raphaël Rodriguez, a postdoc in Shankar Balasubramanian's group, went for the ironman option for his very first triathlon in July.

'It was in Nice, and the swim was in the Mediterranean,' Raf says. 'Then the bike ride had 1,800m of climbing! I'd never swum with nearly 3,000 other people before, and I had no experience of the transitions between the different stages. I didn't know whether I could cope with such a long distance!'

He describes the swim as 'very violent', and after accidentally managing to drink about a litre of seawater, he was left with tummy-ache for the rest of the race. And he'd hurt his knee a month before the race, which led to the run taking him five hours, where he'd normally expect to be an hour and a half faster than that. The weather wasn't kind either – the last 40km of the cycle was into a fierce head wind, and the sun came out during the run, sending temperatures soaring to 36°C. Many of the competitors were forced out of the race through dehydration.

Raf did amazingly well for a first-timer, completing the race in just over 13.5 hours, beating more than 1,000 of the other competitors. 'Surprisingly, I wasn't particularly exhausted afterwards, although my legs were a little weak!' he says. The experience hasn't put him off – he's now planning to compete in the Lanzarote ironman next year, which is reputed to be the most difficult in the world. And he hopes to finish in under 11 hours.

But why did he take part? 'I promised a good friend that I would do the race if she succeeded in her university application. She succeeded, and I raced!' he says. 'I decided to raise funds for Amnesty International as I believe we have the responsibility to protect human rights. I was honoured to represent them.'

Chemistry challenged!

Chemists have been gracing University Challenge again – this time representing Clare College. Undergraduate Matt Cliffe and former chemist Gary McDowell, who's now in the oncology department. Gary reports that there was even some organic chemistry involved!

'We had a fantastic time, but it was completely different being on the show compared with shouting the answers out at home!' he says. 'Jeremy Paxman was incredibly friendly, and was very taken with our college mascot, Vin Weasel – he even told us it was a very nice weasel and was only too happy to have his picture taken holding it.'

The team lost their first round match, but scored well and we're now waiting to find out whether they get through to the next round as one of the highest-scoring losers. Fingers crossed!

James' varsity victory

Man-of-the-match at this year's rugby league varsity match was a chemist – James Shearman – who is in the third year of his Cancer Research UK PhD in medicinal chemistry, jointly supervised by Steve Ley and James Brenton at Addenbrooke's.

The match was played at the Twickenham Stoop – home of the Harlequins teams of both codes – and was even televised live on Sky Sports.

A band of chemists made the trek down to Twickenham to support him. 'It was my fourth varsity match, having previously won one and lost two,' he says. 'I was playing prop, and it was fairly close until the last 10 minutes when we scored two tries in quick succession to win by 20 points to 4.'

James bulldozes his way through an Oxford tackle

Katy's wedding in a castle

It wouldn't be *Chem@Cam* if we didn't have a wedding to report – and this issue's *Hello Magazine* moment is Katy Bridgwood, who's just finished her PhD in Steve Ley's group.

Katy married another chemist, Ian Casely, at Dalhousie Castle, just outside Edinburgh. Amazingly for Scotland, she reports that there was no rain! The wedding ceremony took place in the castle's chapel, followed by drinks and canapés before the wedding breakfast. Events were rounded off by a ceilidh, and a chocolate fountain.

Steve and Rose Ley and several other group members made the long journey north for the festivities. 'We had bacon rolls at 10.30pm – and Steve Ley and Whiffen 'lab daddy' Colin Pearson ate most of them!' Katy says.

The happy couple honeymooned in Florence, before moving to the US. 'Ian had finished his PhD in Edinburgh two weeks before the wedding, and we're both now postdocs at the University of California Irvine – I'm working for Larry Overman and Ian for Bill Evans,' she says. 'So now we get to to enjoy the nice sunny southern California weather. It's a pretty good start to married life!'

Don't drop her! Hubby Ian is second from the right

Cambridge goes to the Proms

The Royal Albert Hall was packed with Prommers for the Cambridge celebrations

A group of department members and assorted family and friends had a very special evening out at the Albert Hall on Wednesday 22 July, *reports Liz Alan*. There were16 of us in total, including Bill Jones, Tim Dickens, Chris Wilson, Jane Snaith, Vicky Spring, Sian Bunnage, Howard Jones and Mags Glendenning, plus three members of Jeremy Sanders' group.

For me, the journey began more than two years ago, when I was still working with Jeremy as head of department. He was chair of the 800 Committee, and had his first, hush-hush, meeting with Nicholas Kenyon, then director of the BBC Proms, to discuss a possible Cambridge Prom as part of the University's 800th Anniversary celebrations.

Between them, Jeremy and Bill had managed to get a handful of the prized tickets, and Bill put on a minibus to get us there. As soon as we'd left the outskirts of Cambridge we ate our sandwiches – and enjoyed pointing out landmarks on the way in to London, arriving outside the Albert Hall in plenty of time to get a restorative drink!

Once inside, having been given flags and badges at the door, we did some celebrity spotting, picking out the vice-chancellor and Prince Charles.

The Albert Hall was stunning in plum and gold, and we had a splendid view of the huge stage, soon occupied by about 300 members of the combined Cambridge Choirs (including Frank Lee, one of the Department's Computer Officers), and the BBC Symphony Orchestra. The atmosphere was celebratory: the leader of the orchestra ,and then the conductor, Andrew Davis (a Cambridge graduate), were greeted with rapturous applause.

The music got off to a suitably buzzy start with Vaughan Williams' Wasps Overture, and was followed by a specially commissioned orchestral piece by Ryan Wrigglesworth (a Fellow of Corpus Christi), The Genesis of Secrecy. When the composer came on at the end he received a well-deserved and rousing cheer! Vaughan Williams' Five Mystical Songs followed – a very varied piece, and an appropriate ending for an enjoyable and diverse first half.

After the interval came Stanford's Magnificat, and Nunc Dimittis – one of the loveliest versions of these familiar psalms that I've ever heard. It was awe-inspiring to hear 300 voices united in perfect harmony. At this point, the full choirs left the stage and the spotlights turned to the younger choirs of St John's and King's College. Their unaccompanied Come Holy Ghost (Jonathan Harvey) was appropriately haunting, and Ascending into Heaven by Judith Wier was by turns challenging and lyrical.

Then the lights came up again for the last piece: Symphony No 3 (Organ) by Saint-Saens. I knew I was going to like it as soon as I saw the size of the percussion section! However, despite noting the word 'organ' in the title, I wasn't prepared for the amazingly mighty chord, played with all the stops out, which vibrated through the whole auditorium. It was thrilling! We all (including the VC and HRH) waved our flags like mad at the end and stamped and shouted our approval.

I expect that for some the highlight was the choral singing, for some the soloists and for others the Cambridge connections which ran through the entire programme, but for me, that organ symphony was magnificent!

We were still exhilarated when we boarded the minibus for our return trip though when I looked back later most people were gently dozing. Quietly we drove in to the car park at 12.30 am – and all agreed we'd had a lovely time the night we went to London! Thanks to Jeremy and Bill.

Photo: Caroline Hancox

Computer officer Charlotte Bolton has moved on – not to another CO role, but to become a student again as she's starting an MRes degree in ocean science at Southampton in the autumn. Past and present COs were on hand to give her a send-off. From the left: Greg Willatts, Mike Rose, Chris Chalk, Dave Pratt, Phil Marsden, Charlotte, Tim Dickens, Catherine Pitt, Robert Cumberland and Stuart Taylor

A little more Sudoku

M	S				H	C		
		I	T				S	E
				S	C			
		C	E			R	Y	
E								T
	T	Y			M	I		
			R	T				
T	Y				E	S		
		E	M				R	Y

As most of our puzzle correspondents rather like Chemdokus, it would seem churlish to deprive them of their puzzling hit this issue. As suggested by Tom Banfield, this time it's simple – not elements but the nine letters of the word 'CHEMISTRY'. But how simple is the puzzle? I guess the judge of that will be how many entries we get...

The usual £20 is on offer to the first one randomly picked in whatever manner we decide next time around!

Last issue's winners

Benzene resistance

We also got a great response to Graham Quartly's benzene resistance puzzle. Those who got it wrong shall remain nameless… but these people remembered enough O-level physics to send in the correct answer: John Carpenter, Victor Ostanin, Peter Jenner, David Wilson, Richard Brown, Kevin Rogers, Julian Huppert, Godfrey Chinchen, Christian Hill, Dave Stone, John Nixon, Norman Sansom, Dorn Nixon, John Jacobs, David Griffin, Annette Quartly, Jeff Smith (who says that idly flicking through *Chem@Cam* during a coffee break, he thought the answer was so obvious he must have misunderstood the problem!), Mike Barlow, Dave Borthwick, John Wilkins (who says thank goodness the puzzle didn't use buckminsterfullerene), Paul Stickland, Stephen Marsden, Richard Moss and AJ Wilkinson, Jim Dunn, Gordon Hall, Reg Lewis, Hugh Aldred and H. Stokes.

And the winner is John Jacobs, who asked for his £20 prize to be donated to the Phyllis Croft Foundation for Canine Epilepsy – set up by one of his contemporaries, and those with long memories may remember that *Chem@Cam* interviewed chemistry alumnus Phyllis about her wartime experiences and subsequent career as a vet back in 2005.

As luck would have it, John – who now lives in Altadena, California – sent in a solution inspired by Lewis Carroll. He says: 'The problem is a linear one and may be scaled linearly, hence it may be worked using 1-ohm resistors. The Red Queen: "What's one and one and one and…" Between any two para-carbon atoms there are two paths, one of two ohms and the other 2.5 ohms. This results in a net (no pun intended) resistance of 1.1111111.....ohms (That should please the Red Queen, too) Now add one ohm each for the two bonds to the para-H atoms and multiply by 99. Voila, 308!

ChemDoku

ChemDoku continues to attract plenty of correct entries, and our 'gets personal' puzzle in the last issue was no exception.

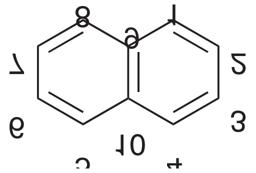
Correct entries were received from H Stokes, Robin Cork, Reg Lewis (of the infamous 1946 class), Tony Pike (who says he's from the famous 1945 class), Mark Roberts, Ian Fletcher, Peter Entwistle, Bill Collier, John Turnbull, Jim Dunn, AJ Wilkinson, Andrew Milner, Mike Barlow, Tim O'Donoghue, Paul Littlewood, Tom Banfield, Annette Quartly, Mike Harris, Richard Chambers, Alison Griffin, Neil McKelvie, Dorn Nixon, Norman Sansom, Christian Hill, Godfrey Chinchen (now in retirement after many years of an enjoyable career in catalysis research at ICI), Richard Brown, David Wilson (who saved the puzzles for a 24 hour ferry crossing from Portsmouth to Santander) and Roger Duffett.

The lucky winner picked by this issue's random number generator is Andrew Milner, who's in the maintenance section here in the department. Congratulations!

Naphthalene resistance

Not to be outdone by Graham Quartly, when he'd finished the benzene resistance problem from the last issue on his long ferry trip, David Wilson decided to go one better, and devised this puzzle, based on naphthalene. He was tempted to try hexabenzocoronene, but that would have been just a bit too brain-mangling!

Anyway. The technician at St. Richard's heard about his fellow technician at St. Anne's making a model of benzene using resistors, and decided to go one better by making a model of naphthalene. Thus he connected two resistors in parallel to represent a double bond, while single resistors stood for a single bond.



He used the standard Kekulé model of naphthalene, as shown, but on this occasion simply constructed the carbon skeleton, leaving out the hydrogen atoms. The resistors that he used were each 160 ohms.

He intended to connect the nodes representing carbon atoms successively in pairs to obtain a set of different effective resistances. He recognised that there would be a number of trivial duplications arising from reversal, reflection or rotation, but nevertheless expected to get eighteen separate resistances, thus:

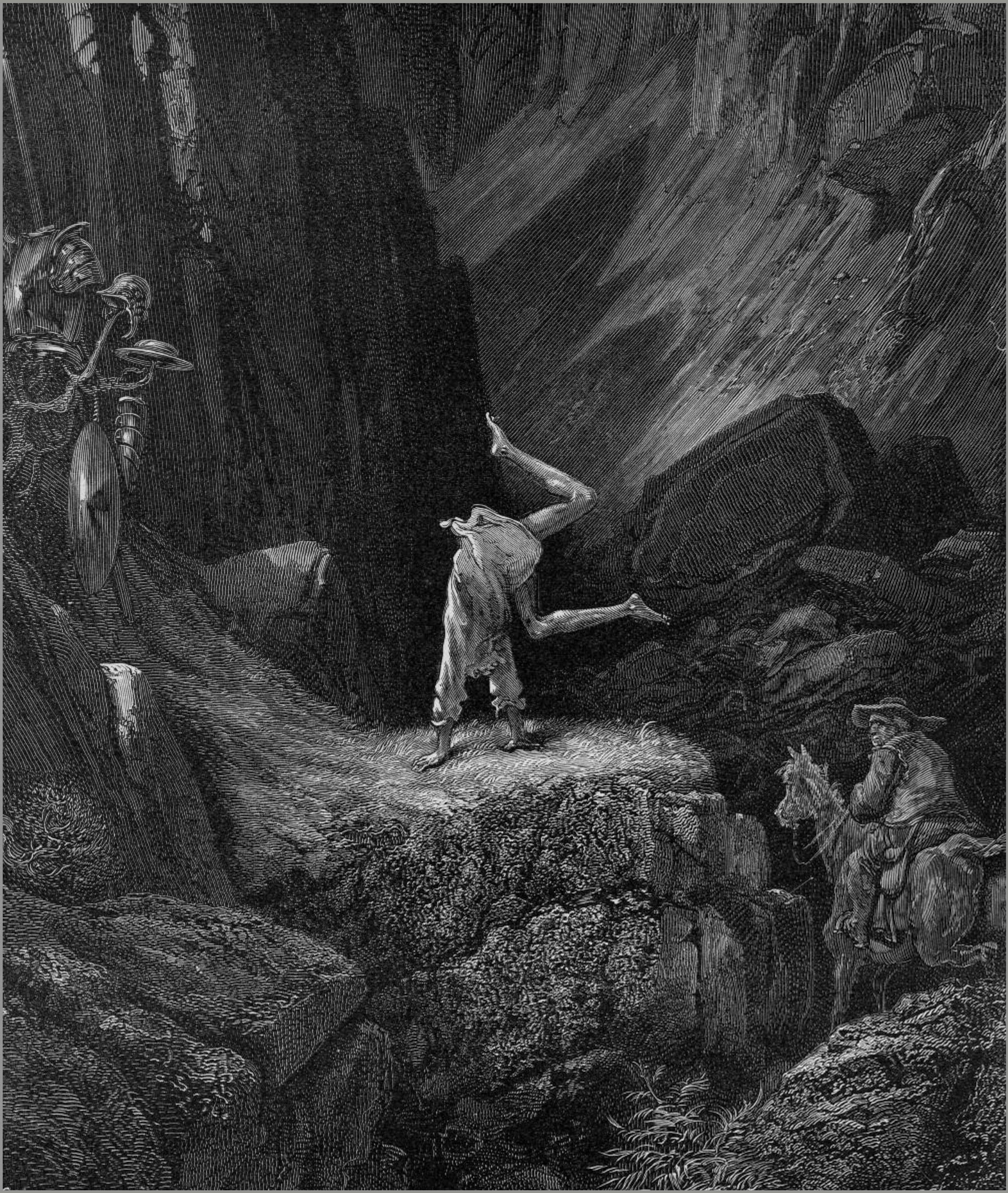
1→2, 1→3, 1→4, 1→5, 1→6, 1→7, 1→8, 1→9, 1→10
2→3, 2→4, 2→5, 2→6, 2→7, 2→8, 2→9, 2→10 and 9→10.
(→ denotes direction of flow of current)

On checking, however, there proved to be only fifteen values of effective resistance available. Explain, for his benefit and without using calculation, which pairs of nodes when connected yield duplicate values.

He then investigated the current flowing from node 9 to node 10, using only the connections listed above, that there were two instances in which no current flowed, and just one in which the current was reversed and flowed from 10 to 9. Again, explain without calculation which nodes were involved.

Unfortunately, your editor is a hard woman and thinks that besides sending in these explanations, you should earn your £20 prize by actually calculating the resistance in each case! (The good news is that only in the last case do you need more than the standard formulae for combining resistances in series or in parallel). The inevitable £20 will wing its way to the first complete set of correct answers we randomly select.

£20 prizes are on offer for each puzzle. Send entries by email to jsh49@cam.ac.uk or by snail mail to Chem@Cam, Department of Chemistry, University of Cambridge, Lensfield Road, Cambridge CB2 1EW



The students' sense of relief when the five-hour exams had finished was palpable

UNIVERSITY OF CAMBRIDGE

Chem@Cam is written, edited and produced by Sarah Houlton

Printed by Callimedia, Colchester