# chem cam

Chemistry at Cambridge Newsletter

Summer 2008

**Enthusing children** about chemistry

**Climate change** and biogenic emissions

**Predicting properties** using informatics

**The oil industry's** chemical challenges

**Oil exploration doesn't just offer a career for engineers – chemists are vital, too. Sarah Houlton spoke to Schlumberger's Tim Jones about the crucial role of chemistry in the industry**

### People don't think of Schlumberger as a chemistry-using company, but an engineering one. How important is chemistry in oil exploration?

It's essential! There are many challenges for chemistry in helping to maintain or increase oil production. It's going to become increasingly important, particularly for recovery, as oil reserves become more difficult to get at. We don't as an industry do a good job of recovering known reserves in reservoirs. As well as geological problems, there is an enormous surface chemistry aspect to the displacement of oil to get it out of the porous rocks. Usually, this is done with an immiscible fluid like water, but the pores are generally only a few microns across, and capillary forces dominate, so the rock naturally retains the oil. We are fighting the natural wetting properties of the reservoir, as well as the nature of the crude oil itself which often contains surfactant-like molecules which want to keep the reservoir oil wetting and prevent the water we introduce from displacing the oil.

### There must be challenges with issues like materials, too.

Definitely, and this is becoming increasingly important. When I first joined the company 25 years ago, materials chemistry was little known in the oil industry, but now we are finding that the materials and molecules we need aren't readily available and we have to develop and make them ourselves. We now need polymers that will survive high temperature and contact with water over long periods of time, and the conditions of the reserves we're now trying to find and extract are becoming more hostile. Typically, in the North Sea, sea depths are up to 500m, but now oilfields in the Gulf of Mexico and off the coast of Brazil are creeping towards the edge of the continental shelf, and the sea floor might be 3km below the surface. As well as the engineering challenges, the chemistry gets more difficult, too. If the oil comes out of a warm reservoir and goes into a cold pipe, it will cool down and deposit wax on the surface of the pipeline.

### Yet the chemistry effort in the oil companies themselves has dwindled in recent years, hasn't it?

It's definitely fair to say that the chemistry effort in the upstream oil industry is less than it was a generation ago, particularly because we've seen a decline in the research activities of the major oil companies. We have to fight very hard to bring chemistry expertise into the upstream oil industry, and not just be seen as having isolated chemists who are put on problem issues. It's clear that if we're not going to be finding large numbers of giant oil and gas fields, we have to manage the resources we have, and get better at extracting the oil from them, and chemistry is going to be incredibly important in that.

We can't rely on being able to find suitable chemistries in other industries, either, mainly because of the high temperatures and pressures that we have to be able to work at. Typically, the upper temperature norm is now 175°C, but we're increasingly looking to go over 200°C. For heavy oil, where we heat the oil up with steam to reduce its viscosity to make it easier to extract, the high temperatures also provide challenges for making measurements.

Another example of a problem this causes is with the cement that is pumped into boreholes. Preventing it from setting too quickly is a challenge if it's being pumped several kilometres! As the temperature goes up, reaction rates also increase, and it sets more rapidly, so we have developed additives to retard the setting process. Other additives are also needed to stop it separating into its solid and liquid components, and we need dispersants to ensure it remains pumpable. Conversely, if we're dealing with a shallow well, we actually need to accelerate the set process as we don't want to be waiting for days for the cement to set!

### Making measurements in those environments must also be difficult.

Oh yes. We have excelled at doing physical measurements and have developed instruments to measure pretty much everything you can think of – from density to natural gamma rays, and we even do low field NMR at 2MHz to look at the relaxation rates and diffusivity of protons. But chemical sensors are an entirely different proposition. Even seemingly simple things like pH are difficult to measure. While physicists have the advantage of being able to use electromagnetic or acoustic waves to measure things, to make a chemical measurement you first have to capture a sample of the molecule. You then have move it into a sensor that's ideally very clean because the crude oil, sand and salty water will affect the outcome, and then move it out again afterwards to leave the sensor free for the next measurement. Measuring hydrogen sulfide levels is also a problem, as it is scavenged by the metalwork of the tools. So we are developing an in situ sensor using a variety of new materials, including boron-doped diamond electrodes which minimise fouling.

### What about environmental issues?

One area we're looking at is trying to reduce the amount of gas that's flared on oil fields around the world. It's a major issue, as all it does is put carbon dioxide into the air for no benefit. A couple of years ago, the World Bank estimated that 150 billion cubic metres of natural gas are flared every year – if that could be liquefied it would satisfy about 1.5% of global demand for liquid hydrocarbons. We're hoping that it will soon be economic to recover it. We also have several active engineering projects working on $CO_2$ sequestration.

### So are you finding it increasingly difficult to attract good chemists?

It can be a challenge, yes. Many of the company's chemists are recruited here, and they often move on to other sites such as Houston or Paris, but finding them in the first place can be a challenge. Maybe one reason is that the oil industry doesn't have the greatest profile in chemistry, and people think it employs engineers, not chemists. But it's something the upstream oil industry cannot manage without, even if they don't realise it! For me, maintaining – if not enhancing – our recruitment is perhaps one of the biggest issues we face. And to do that, we show young chemists how exciting the chemistry challenges facing the industry are.

**Tim Jones CV**

**Born:** Overton, Hampshire, the small village where banknotes are made

**Status:** He met his wife Deborah Patterson when he started at Schlumberger, and she was setting up the library. She now works in the Cambridge university development office. They have two children – Michael has just finished his first year at Sheffield studying history, and Emily is in Year 10 at school.

**Education**: He went to grammar school and sixth form college in Basingstoke, then studied chemistry at Imperial. He moved to Sussex for a DPhil on the surface chemistry of liquid–liquid interfaces with Ernie Boucher

**Career:** After three years at BP in Sunbury, he moved to Schlumberger in Cambridge in 1983, a year or so before the tent was finished. 'We worked in a Portakabin – calibrating the balance was impossible!' he says. He is now a Scientific Advisor, starting and working on new research projects.

**Interests:** Reading – mostly non-fiction and history – and classical music, particularly piano, although he doesn't play himself. He also has a curious love of church architecture, particularly Romanesque. And he admits to taking mountains of scientific papers home to read.

**Did you know?** Tim used to play blindfold chess – all done by memory – and used to beat his (unblindfolded) friends as a student.

## A very brave man

Dear Editor,
Your Spring newsletter was excellent, and the alumni pages particularly interesting. Although I am of a somewhat earlier vintage than the photograph which accompanies Mary Ashworth's letter, I can add a little information to it.

C. (Costi) Edeleanu gained a PhD for corrosion research, and was latterly a Cambridge ICI liaison representative in the days when ICI was a power in the land. H.M. Kimberley was a centre three-quarter and captain of the University XV.

I remember Fred Dainton as a very busy but conscientious Part II supervisor. In his later years as an academic administrator he had the hardidood to tell Margaret Thatcher to belt up (in a politely coded way) so that he could make his contribution to a discussion.

She did not hold it against him and his memoirs are prefaced by a notably civil letter from her. His book, strongly recommended, is 'Doubts and Certainties', published by Sheffield Academic Press in 2001.
Regards,
**Bob Throssell (Caius, 1941–3 and 1946–51)**
*2 Lodge Court, Hollins Hall, Harrogate HG3 2WX*

## Of opera and clarity

Dear Editor,
I write as one who appreciated Martin Mays' recollections of Alan Sharpe.

There are two additions that I would offer: one concerns his passion for music, which passed through a period in which Wagner's operatic compositions were in favour; the other was his talent for concise and clear communication, a copy of Fowler's 'Modern English Usage' ready at hand.
Yours sincerely,
**Michael Dove (Jesus 1955–61)**
*48 Parkside Gardens North, Nottingham NG8 2PQ*

## A very kind man

Dear Editor
The lovely article by Ian Fleming about the late David Husain brought back memories of the department of physical chemistry and, in particular, the small lab I shared with one of his PhD students, Peter Cross.

David would do his rounds daiuly and tell us about the latest book he was reading – China was his subject at the time. He would then leave with a joke or a terribly bad attempt at a Welsh accent (loosely based on Fluellen' in Henry V).

He was a remarkably kind and considerate man.
Yours sincerely,
**Rhobert Lewis (Christ's 1976)**
*Faculty of Health, Sport and Science, University of Glamorgan*

## Putting things straight

Dear Editor,
There are some inaccuracies in the obituary of David Husain. 'He became Norrish's assistant, his last…', is false: J.F. Ogilvie was appointed assistant in research on 1 January 1964, but had been acting in that capacity a little earlier.

'Writing his papers and research lectures' is also false: each research student of Norrish was 'expected' to write a paper on the research project before writing his thesis; the student would then make an appointment with Norrish to discuss the patper, and a mutually satisfactory version would then be submitted for publication. Norrish always prepared his own lectures, and others were not directly involved.

Neither David Husain nor J.F. Ogilvie was involved in 'running his [Norrish's] group as it wound down'. Norrish was quite capable of executing that task himself. Perhaps the remoteness of Professor Fleming from the department of physical chemistry is the basis of these inaccuracies.
Yours sincerely,
**J.F. Ogilvie**
*ogilvie@cecm.sfu.ca*

chem@cam
Chemistry at Cambridge Newsletter

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**Cover**

Adrian NAME, who works for Jane Clarke, helping Annalie and Hugh Barker with the science day experiment extracting DNA from strawberries

**Photograph:**
Caroline Hancox

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.

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Jean-Pierre Hansen has been awarded an honorary degree by his alma mater, the University of Liège. He was presented with the Docteur Honoris Causa degree by Jean-Pierre Gaspard at a ceremony at the Belgian university in April

## New head of the CCDC announced

The Cambridge Crystallographic Data Centre will have a new executive director at the beginning of October when Frank Allen retires. Colin Groom is moving from UCB, where he's currently head of computer-assisted drug discovery and investigative chemistry.

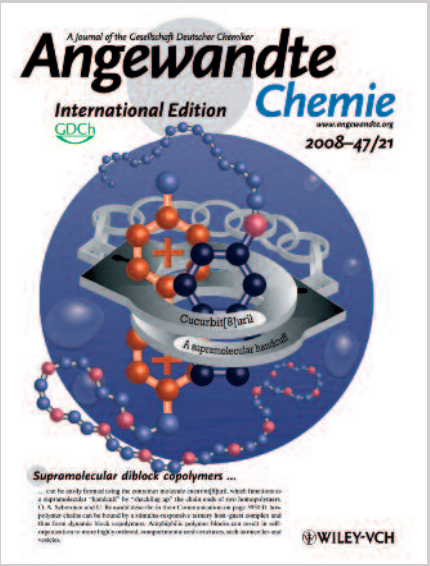
'We are delighted with eh appointment,' says William Town, chairman of the CCDC governors.' He brings a unique combination of relevant experience in crystallography and in the application of structural knowledge in the life sciences industry. With his appointment, the challenge of continuing to develop the CCDC as an important resource in crystallography, structural chemistry and molecular informatics passes to a new generation.

# Award joy for Rachel

Rachel O'Reilly has been awarded the Meldola Medal by the Royal Society of Chemistry. These awards are made annually to British chemists under the age of 32 and recognise their 'meritorious and promising original research'.

As well as the medal, she will be giving a talk at the one-day RSC awards day in Birmingham in November. It also comes with a cheque for £500, which she plans to spend on a slap-up dinner for her group in college. 'I'm very pleased to have won the award,' she says. 'And I am very lucky that my group is so good – I would never have won without their talents.'

However, Rachel will be leaving us in January to take up a position at Warwick University. She has been awarded a career acceleration fellowship by EPSRC to support her work there – £750,000 over five years. 'I'm sad to be leaving Cambridge, but I'm very excited by the new challenge I will be facing,' she says.




Oren Scherman's chemistry recently featured on the front cover of the journal Angewandte Chemie. The paper it illustrates, co-authored with Urs Rauwald, describes supramolecular diblock copolymers, which can be easily formed using the container molecule curcurbit[8]uril. This functions as a supramolecular 'handcuff' by shackling up the chain ends of the two homopolymers

## Richard becomes inorganic

The new head of the inorganic sector is to be Richard Lambert, who's crossing the divide from the physical sector. He replaces Jeremy Sanders, who's to become head of the school of physical sciences in January.

# A new look for the surface chemistry labs

Photo: Nathan Pitt

Part of the newly refurbished labs – complete with violently pink door!

The refurbishment of the surface chemistry labs on the ground floor is almost complete – with some rather fine new fuchsia coloured doors.

'Thanks to the asbestos legacy, it took rather longer than we'd hoped,' says Steve Jenkins. 'But it's great to be back in the labs, and we're really pleased with the results.'

Steve has been principal investigator on the group's major grant since last year, and has thus taken on the formal leadership role within the group, which also includes Dave King's students.

'Dave is still supporting his students, and aims to be in once a week,' Steve says. 'And I've suddenly realised how much there is to do on top of the science!'

# A Nobel opening for the new Melville extension

A very special visitor performed the official opening of the new extension to the Melville lab – Nobel laureate Bob Grubbs form Caltech.

Bob was in the department as this year's Merck lecturer. He gave three lectures, two in the department and one at Merck Sharp & Dohme's labs in Hoddesdon. All three featured aspects of his pioneering work on the olefin metathesis reaction, for which he shared the Nobel Prize with Richard Schrock and Yves Chauvin.

The chemists who work in the Melville are delighted with their swish new lab space. And it's also been welcomed by head of department Bill Jones. 'These are great new facilities, and will provide the Melville with great opportunities for research over the coming years,' he says.


Clockwise from above: Bob Grubbs gives one of his Merck lectures; admiring the new lab; celebrating the opening; lecturer Oren Scherman and Melville lab director Wilhelm Huck; Bob unveils a plaque

Photos: Caroline Hancox and Nathan Pitt

# Alan awarded a Royal Medal

Alan Fersht has been awarded one of this year's Royal Society Royal Medals. These medals are given to Commonwealth scientists, two for the most important contributions to the advancement of 'natural knowledge', and the other for distinguished contributions in the applied scientists.

Alan has been honoured for his 'seminal work in protein engineering, which he has developed into a fundamental tool in enzyme analysis and the problem of protein folding'.

'This medal means a lot to me because of its long history and the illustrious scientists to whom it has been awarded over the past two centuries,' Alan says. 'john Dalton of atomic theory was awarded it in 1826, Michael Faraday in 1835 and 1846, James Joule in 1852, Charles Darwin in 1853 and A.W. Hofmann in 1854. Very few Cambridge chemists have received a Royal medal: Alex Todd in 1955, Alan Battersby in 1984, Ray Freeman in 2002, and Jack Lewis in 2004. Sydney Brenner, Francis Crick, John Kendrew, Cesar Milstein, Max Perutz and Fred Sanger at the Laboratory of Molecular Biology have also been recipients.

'It is a great honour for me to appear on a list with them, and it is a link with British scientists beginning with those historical figures I learned about as a student, and those senior colleagues I have had the pleasure of knowing personally, and who inspired me by their work and deeds. I would not be the scientist I am but for the examples they set.'

# A double celebration at Jeremy's 60th bash

Jeremy poses with Carol Robinson, Dudley Williams and Chris Hunter

Jeremy Sanders recently celebrated his 60th birthday, and to mark the occasion his group organised a conference, held in the department in May.

Organised by Dan Pantos and Nick Bampos, the conference's speaker line-up featured numerous of Jeremy's present and past co-workers. 'Many of my ex-group members made the effort to come from all over the place,' Jeremy says. 'Some who couldn't attend even emailed video messages. The power of modern technology!'

The event was organised at extremely short notice, so Jeremy was particularly pleased at the number of people who were able to attend. 'I've told Dan he's got to start planning my 65th birthday event much earlier,' he claims.

The event turned into a double celebration, as the day before it was announced that Chris Hunter, who did his PhD with Jeremy, had been made an FRS. 'He's my first academic child – and Dudley's first academic grandchild – to be honoured in this way,' Jeremy says. 'I'm incredibly proud, even if it does make me feel dreadfully old!

Nick Bampos (left) and Dan Pantos (below) in action at the conference

Photo: John Holman

# Ready, set, chemistry!

Photo: Nathan Pitt

This year's chemistry Olympiad was held in Budapest, and as Chem@Cam went to press, the UK team was spending an intense week here in Cambridge practising.

We also played host to the Australian team as they recovered from their jetlag before the big event. Pictured above are the Aussie team (in blue labcoats) and the British team – Nilpesh Patel, Pete Aisher, John Morgan and Sasha Kasas, all four of whom are coming to study in Cambridge in the autumn – with the mentors and technicians who helped them hone their skills.

Next year's Olympiad will be held here in Cambridge to coincide with the university's 800th anniversary celebrations. This will be the first time the event has been to the UK

## Academic promotions

Four chemists are to be promoted in October. David Wales is to be given a personal professorship; Sophie Jackson and Michele Vendruscolo are being promoted to personal readerships; and David Spring is to become a senior lecturer.

## Cambridge chemist to run Oxford University

Former Cambridge chemist Andy Hamilton is to be the new vice-chancellor of Oxford University. Andy, currently the provost at Yale, is to take up the position in October next year.

He was in Cambridge in the late 1970s, when he did a PhD with Alan Battersby, and his chemistry remains at the interface of organic and biological.

# Joe Spencer: a massive loss

**Joe Spencer was killed in a car accident near Cambridge on 6 April, at the age of just 47. Chris Abell and Finian Leeper remember their friend and colleague**

The tragic death of Dr Joe Spencer robbed the department of an enormous talent. The suddenness was a shock that many of us are still finding it hard to come to terms with. The chemistry department is so much a part of our lives that the loss of a colleague one assumed would be around for many years to come has been traumatic. We knew Joe as a friend and are pleased to write this in his memory.

Joe came to Cambridge in 1994 as a Royal Society Research Fellow, having just completed a postdoctoral period with Professor Ian Scott at Texas A & M. By this time he had already made very significant contributions in two areas, understanding the stereochemistry of the assembly of 6-methylsalicylic acid (an iconic aromatic polyketide), and delineating aspects of the pathway to vitamin B12.

These were both topics of intense interest at Cambridge, where Jim Staunton and Peter Leadlay were revolutionising our understanding of type I polyketide assembly, and Alan Battersby and Finian Leeper were locked in competition with Ian Scott in racing to sort out the complexities of B12 biosynthesis. Cambridge was very aware of Joe's talents even before he arrived. Given this background of competition it was maybe surprising Joe chose to come here. But then, knowing Joe, it was no surprise at all.

Joe was one of a cohort of Royal Society Research Fellows (along with Shankar Balasubramanian, Sophie Jackson and Jonathan Goodman) who joined the department in the early 1990s. It was a demanding environment in which to start a research group as space and resources were limited. This did not hold Joe back, as he put together a spectacularly ambitious research portfolio. He was fearless moving into areas where there was strong competition and he always found new and important questions to ask.

Joe started his research at Cambridge by looking at key steps in aminoglycoside biosynthesis. He recruited a precociously talented student, Yu Jinquan, now a professor at Scripps, for this project. Not only did Yu make progress on aminoglycosides, he also initiated studies on the mechanism of organometallic reactions that became another extremely fruitful research area for Joe. The breadth of scientific topics he worked on is remarkable.

Joe collaborated with Dudley Williams on the biosynthesis of the vancomycin family of glycopeptides, and subsequently with Tom Blundell on related structural studies. Following Jim

Staunton's retirement he increasingly collaborated with Peter Leadlay on polyketide biosynthesis, with an especial interest in polyethers.

He also was involved in important collaborations outside Cambridge. He made a major contribution to the biosynthesis of fluorinated metabolites with David O'Hagan at St Andrew's, and had recently started a collaboration with Prof Tomi Baasov from the Technion in Israel on assembling novel aminoglycosides.

Trips to the Panton Arms with Joe would inevitably involve deep discussion of some new set of experiments he was involved in. His creativity and insight were remarkable. Two examples that illustrate this are his discovery of the use of a protecting group strategy in an aminoglycoside biosynthetic pathway and his speculations on the stereochemistry of very complex polyketide marine natural products (e.g. maitotoxin). It is a tribute to the respect with which Joe's work is held that the eminent Scripps Institute chemist K.C. Nicolaou has put in a great deal of synthetic effort to see if one of Joe's predictions is correct.

Joe's passion for science was somewhat at odds with the laid-back and relaxed attitude he presented. By his own admission, organisation and punctuality were not his strong suits, but somehow with Joe it did not matter. He did get this grants in on time (with one minute to spare on one occasion) and he did eventually get to the meeting (and when he arrived he always had something interesting to say).

Joe contributed to the academic community in many ways. In the Department he was a member of the teaching committee, and the Centre for Biological Chemistry's management committee. He taught several courses, including the Part III biosynthesis course with Finian. In St John's College he was a tutor. He was an active member of the Royal Society of Chemistry's Chemical Biology Forum, and had been involved in organising several meetings on aspects of natural product biosynthesis.

We also knew Joe socially: our monthly bridge evenings (Alison Smith from Plant Sciences making up the table) were always a highlight. The standard of card playing was never very high, but that was secondary compared to the pleasure of getting together to catch up on news over a few glasses of good wine.

Joe's home life was very important to him. He had been married since his student days to Deborah, a remarkable woman who understood what it means to be married to an academic who often worked late, and disappeared for weeks to go to conferences. She supported him him and at the same time developed her own career and brought up their three children, Chris, Emma and Dominic, in Little Eversden. It is a measure of the warmth for the family that so many from the village, as well as from the Department and College, attended the funeral in the village church.

It is now several months since Joe died. It has been a difficult time for many people, particularly his family. However in that time we have learnt something about ourselves, what it means to lose a colleague, how complicated and interdependent our lives are, and how many different communities we touch. Joe will not be forgotten.

There are plans to commemorate his life in various ways, and a fund has been set up in his memory. If you would like to contribute, please send us an email.

Chris Abell (ca26@cam.ac.uk) and
Finian Leeper (fjl1@cam.ac.uk)

# Science day wows the kids

**Once again this March, we threw open our doors to local children to show them how much fun chemistry is. John Holman and Nathan Pitt too the pictures**

Every year, we think our contribution to the Cambridge Science Festival cannot get any better. But once again, thanks to a superlative effort from more than 200 memebers of the department, we delivered a brilliant all-round show.

Conservative estimates put the number of visitors at more than 2500. There was something stimulating on offer to all of those who flocked in to the department. Peter Wothers' lecture was entitled 'Free Range Chemistry', the Cambridge Antarctic Survey and British Antarctic Survey ran a climate change activity, and the Royal Society of Chemistry ran another called 'Fuelling the future'.

And, of course, there was the usual wonderful array of hands-on experiments run by the students. From the slime pond, the plated coins and the crystal growing, there was much fun to be had, all with a chemistry background. Other highlights included a live weblink to BAS scientists in Halley Bay, Antarctica, Mentos/Coke explosions at warp factor two, nanoparticle hedgehogs, and a rather surprising answer to the question of what you can do with a tea strainer and a strawberry.

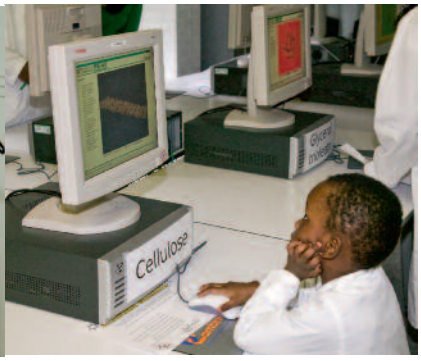
I am grateful to all who contributed, staff and students alike, but I would like to give special thanks to Amy Stevens, Ron Oren and Adam Moughton for their bouindless enthusiasm and vision in the face of hard work, and to the stalwarts of Open Day, Emma Powney, Pat Chapman and Julie Lee, without whom the event would simply not happen.

Prizes also went to several students for their hard work on the activities. Adrian Nickson, our cover star, won the benefactor's prize for strawberry DNA. Chris Jones won the head of department prize for the coke fountain; Richard Clarke got the academics' prize for cornflour slime, and Samantha Wynne and MRC the parents' prize for crystal clear. Jameel Zayed got the children's prize for the disappearing coffee cup, and the organisers' prize went to Tom Wilks and ChemSoc.

Book next year's event in your diary now – the provisional date is Saturday 14 March.

*Paul Barker*


Science Festival
DEPARTMENT OF CHEMISTRY
Science Festival


Cellulose

# Studying chemistry in the rain

**What effects do the gases plants produce have on the environment and the chemistry of the atmosphere? John Pyle is trying to find out as part of a large research project in the Borneo rainforest**

It's not just humans that emit climate-unfriendly gases into the atmosphere – plants do, too. John Pyle is part of a project that is looking at the impacts on climate and atmospheric chemistry of the gases plants produce and, conversely, what effect climate change has on the composition and quantity of gases emitted.

'I've been thinking about looking at this for years,' John says. 'We're actually doing something about it now, with the project I'm involved with based in Borneo. I've been out there several times already in the past 18 months, and there are several more visits to come.

The big NERC funded campaign there involves several UK universities – it's being led by a group from Lancaster and, as well as Cambridge, the universities of Edinburgh, Leeds, Manchester and York are also participating. John's group has two different objectives – making measurements of various biogenic emissions, and running computer models to try to understand the impact of the emissions both locally and globally.

'We are running numerical models of the atmosphere, including its chemistry, at various scales to look at the regional impact these emissions have,' he says. 'We want to run box models to try and understand the measurements we have created.' A box model, he explains, is simply a computer model in which you try to describe the chemistry at that location.

'The model can be constrained by observations, and typically we will be solving time-dependent differential equations for how the species evolve. For any range of measurements, you can specify some of them in the model, and see how well you can predict the other related measurements you've made. This tells you how well – or how poorly! – you are describing the chemistry that's going on.'

Photo: JOhn Holman

Of course this is a very simplistic view – the atmosphere isn't an isolated reaction vessel. 'What's interesting about atmospheric chemistry is that the gases that are emitted into the atmosphere are moved around by the win systems, and mix in extremely complex ways,' John says. 'We have developed models where we have tried to describe these transport and mixing processes, as well as the chemistry itself.'

The ultimate aim is to answer questions such as what the impact of replacing rainforest with palm oil plantations would be on the environment, both locally and, potentially, globally.

'One of my students is trying to understand the environmental impact of this type of biofuel production, which is a big deal in some of these tropical countries where rainforest is being placed by palm oil plantations to meet western desires. It's clearly complicated– it's an economic problem as well as a chemistry one – but whatever these countries decide to do in the future, it is important to be able to provide advice so the forest is managed in the best way possible.

Palm oil trees are very big emitters of the hydrocarbon gas isoprene and, depending on the background conditions, isoprene can have a significant effect on air quality. 'If you go from a forest that is a moderate emitter of isoprene to onethat emits more of it, in other words from raindorest to palm oil forest, that could change air quality,'; he explains. 'But we've got to be very careful. I gave a talk in Malaysia a few moths ago, and was accused by someone from the palm oil industry of attacking his business. That's not the intention. What we are trying to do is provide the best possible scientific advice and input into managing the effects on the climate.'

A wide range of measurements is being made by the different groups involved in the project. As well as isoprene, these include some of the more traditional atmospheric species, such as ozone, nitrogen oxides, and a group from Leds is looking at hydroxyl radicals, which are key intermediates in the chemistry.

'My group is also measuring halocarbons,' he says. 'We have built a little gas chromatograph to measure them in the rainforest, and the next step is to put an instrument on the coast as well. Many of the halocarbons in the atmosphere, particularly bromoform, are actually emitted from the ocean. The aim is to make long-term measurements at a

## CV John Pyle

**Born:** Worsley, between Manchester and Bolton

**Status:** His wife Liz teaches geography at Perse Girls' school just across the road from the department. Their three children have failed to follow in their father's scientific footsteps, however – Mark has a degree in economics, Joanna has just graduated in psychology, and Emma is reading politics and history. 'I think I scared them all off science!'

**Education:** He went from a Catholic grammar school in Salford to Durham for a degree in physics, which led to a DPhil at Oxford in atmopheric physics, and his first brush with ozone. This was followed by a postdoc in the same department.

Career: John worked for a short time at the Rutherford Appleton lab near Oxford, before moving to Cambridge as a New Blood lecturer in 1985. He was promoted to professor in 2000.

**Interests:** He reads a lot and enjoys drinking a glass of wine or two. His sporting prowess these days is limited to walking and a bit of running – he played county rugby, and he continued playing until a hip replacement operation put paid to his exploits as a full back on the pitch. 'Impact sports aren't so wise any more!' he reckons.

**Did you know?** He remains a Bolton Wanderers fan, despite their current form providing sever provocation to change his allegiance. 'I hate to say it, but they really deserved to be relegated last season!'

# forest of Borneo

coastal site. The instrument we have made is highly autonomous, and can be left to make its measurements without checking it every day. We just have to download data occasionally. In principle, this could be done remotely using mobile phone technology so we could watch it in real-time here in Cambridge, but given that mobiles don't work in the forest, that's a bit of a challenge at the moment!'

From the first phase of their Borneo work in April, the group now has several weeks of data on bromoform, dibromomethane and various chlorinated species that could be emitted by the forest. 'There is a lot of speculation that the forest itself could be emitting them,' he says.

## HALOGEN CHEMISTRY

'It's rather an exciting problem as it makes the chemistry of the halogens in the troposphere even more complicated than we thought. But what's more is that Borneo is in the region of the globe with the strongest convection, so material can be lifted up from the surface to the lower stratosphere in the timescale of hours.

'We've known for a long time that chlorine and bromine compounds are very important in the stratosphere, and are responsible for ozone depletion in polar regions. People didn't think they were very important in the troposphere – the bottom part of the atmosphere where the weather is – as there is about 1000 times less ozone there. But ozone is actually very important in terms of air quality, and we've recently realised that bromine compounds are probably playing a role in regulating ozone levels in the troposphere. This is why we want to measure their levels above tropical waters, where they are emitted.'

It's clear, John says, that not all of the bromine in the stratosphere comes from manmade sources such as the halons used as fire retardants – it now looks like a fair amount of it may actually come from biogenic emissions from the sea.

'The big clouds that form in a matter of hours in the tropics connect the troposphere and the stratosphere, lifting the bromine compounds up and depositing them in the stratosphere,' he says. 'One of the first reasons we started making these measurements was to understand what the potential source of these compounds in the stratosphere was. We're now tying two different problems together, which is great.'

A preliminary measurement campaign in Cape Verde of west Africa last year showed that air parcels containing high levels of bromoform had passed low over the ocean in regions with high biological productivity. 'A whole range of factors could be implicated in some of the species we measure,' he says. 'For example, we saw some high concentrations of chloroform in Cape Verde, and it's possible that some of these are related to emissions from burning biomass. A huge amount of detective work is needed to track down events that might be affecting air quality.'

The second phase of the Borneo work was in July, and the group will now be spending months interpreting the data. 'We have left one of our instruments out there to make long-term measurements so we can see an annual cycle,' he says. 'Most of the measurements that have been made for these compounds in the past have been over short periods. Bromoform has a lifetime of a couple of weeks in the tropics, and the quantities are very variable. We also think there is a correlation between bromoform and dibromomethane levels, suggesting that their sources are similar.

'By looking at the way levels of different compounds vary with time, we can build up a picture of what's going on in terms of atmospheric chemistry and emissions. If we could get a couple of years of measurements, with readings taken every 15 minutes, we should be able to tie them in with a range of other factors, such as where the air is coming from and the weather, to highlight where we think the primary sources of these compounds are, and the factors that alter them.'

Last November, John was appointed as 1920 Professor of Physical Chemistry and head of physical chemistry in succession to Dave King. As well as his atmospheric work, this means he is now having to concentrate on the future of the wider physical chemistry sector. 'The issues that face the department and physical chemistry are strategic ones – we need to be thinking very carefully about the future direction of the subject, and how it contributes in a changing department in a changing university,' he says.

'A lot of what now goes on is interdisciplinary – my group works closely with people in applied maths, and increasingly we are trying to work with other departments. Many of my physical chemistry colleagues are working with other departments, too – the boundaries are blurring into materials science, physics, biology and many other fields. But it's important to ensure that the core physical chemical skills are still available.

'We need to consider the long-term strategy. It's clear the nature of science is changing, and we have to move with the times. The role we ought to be playing here in Cambridge is as a leader to ensure chemistry remains central. It's how we align ourselves to make sure we are most effective that's important.'

John on location in the rainforest (left) and the 'very portable' GC being carried by Andrew Robinson and one of the local technicians

# The power of data harvesting

**John Mitchell's work focuses on using computers to order chemical and biological data, and also to predict the properties of molecules**

John Mitchell works at the interface between chemistry and biology – but purely using computers. One of the projects he's been building up over the past few years is the MACiE (Mechanism, Annotation and Classification in Enzymes) database of enzyme catalysed reactions. 'We've been looking at the mechanisms nature uses in catalysis, and the database now contains more than 200 enzyme reactions, with a total of about 800 reaction steps,' he says. 'The aim is to look at which amino acid residues in the enzymes are involved in catalysis, as this gives an obvious starting point towards designing new and better enzymes.'

His group has been working closely with Janet Thornton at the European Bioinformatics Institute. 'We find well-known enzymes whose structures have been characterised, and then hunt through the literature for mechanisms of their reactions,' John explains. 'Unfortunately, these papers are usually written by biochemists, and we don't always believe the mechanisms! But when we find good ones, they are put into the database.' The data are tagged with chemical mark-up language, or CML, so MACiE is chemically intelligent for search purposes.

Photo: Nathan Pitt

## MAPPING MECHANISMS

Enzymes have, historically, been classified in a hierarchical 'pyramid' system, where the sub-subclasses at the next-to-bottom level essentially equate to specific chemical reactions. John's group has deliberately tried to create a database with a wide, representative spread of different reactions, and they have now filled 156 of these 183 sub-subclasses. The next task is to begin studying enzyme evolution by mapping these catalytic mechanisms onto specific parts, or domains, of the enzyme proteins.

They have started with a different database of enzymes (Structure-Function Linkage Database, from UCSF where his ex-student Daniel Almonacid now works), which includes several homologous superfamilies of enzymes that are much more closely related than those in MACiE.

'Looking at the reactions they carry out, it seems that each different chemical reaction has evolved, on average, 2.5 times,' he says. 'There is no detectable evolutionary similarity between the different enzymes, but they are catalysing the same reaction.' This is a measure of convergent evolution; they have also shown divergent evolution, as each family of related enzymes, on average, carries out 1.5 different reactions, and each reaction is carried out on an average of 1.5 different substrates.

John also works in the more traditional chemoinformatics field. 'Computational chemistry is divided into two kinds,' he says. 'In traditional theoretical chemistry, the problem can be addressed by applying knowledge of physics, chemistry and maths, and the relevant equations are solved using computers. In chemical informatics, we look at problems that are too big and complex for this, so rather than trying to use knowledge of how the real world works, we set up a "black box" that links the data we put in together to generate the answers .'

The aim is to determine various properties of molecules, just by looking at the structure. 'It involves teaching the computer what molecules are like. We start with chemical structures, and link those structures to different properties. These could be simple things like molecular weight or hydrophobicity, but they could also be the presence of specific functional groups, or the presence of pairs of functional groups certain distances apart, or atoms in a particular environment. It could even be topological information like number of rings.'

An important application of this technique is to predict which potential drug molecules in a virtual library might be active, and which probably won't be. 'It's like an email spam filter – it picks out features that are likely to make a molecule inactive or cause problems,' he says. They start by giving their algorithm a set of training data so it can learn what it is looking for, and it is refined as it learns which predictions were correct. Thus far, they have looked at 230 different protein drug targets with nearly 100,000 molecules, some with more success than others. 'Just over two-thirds of the time our first choice prediction is correct, and overall one of our first three choices is right 82% of the time,' John claims.

A third area of interest is predicting the properties of molecules that are useful in food, pharmaceuticals and personal care products. A good example is solubility, which is crucial for a drug molecule. 'If you can predict that something will be insoluble at the virtual screening stage, it would save a lot of money,' he says. 'Again, we're using a "black box" to make predictions. The crystal lattice has to be broken up to get it into solution, so we have to think about the enthalpy and entropy of the solvation process.'

Solubility is notoriously difficult to predict using quantum mechanics methods, and it is not easy to measure accurately, either. 'So far, we have managed to predict solubility with an error of about 0.7 of a log unit,' John says. 'That might sound a lot, but given the experimental error, it's a challenge to get a better model on data harvested from the literature!'

**John Mitchell**

**CV**

**Born:** Hammersmith, London

**Status:** His wife Helen did a PhD with Stuart Warren, and now teaches chemistry at Long Road sixth form college in Cambridge. They have two children: Zoe , who's seven, and four-year-old Marcus.

**Education:** John went to school at Bedales, and then a degree in Natural Sciences at Cambridge. He stayed here for a PhD in theoretical chemistry with Sally Price.

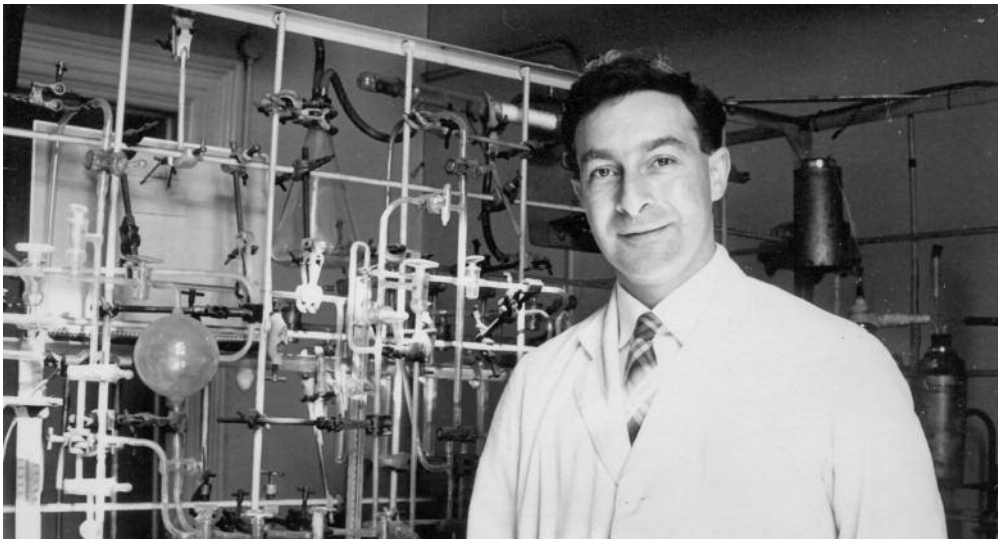
**Career:** He went to postdoc with Janet Thornton at UCL, followed by another spell with Sally Price. He returned to Cambridge in 2000 as a lecturer.

**Interests:** He claims that outside work, church and children, there's not much time for anything else!

**Did you know?** Earlier this year, John and his daughter came last in the Zone 1 challenge. 'You have to visit all 64 stations in zone 1 of the London Underground as fast as possible,' he says. 'The starting station is drawn randomly, and I'd gone seriously underprepared with a circular route that was great from some starting points, and not so good for others – like King's Cross, where we actually started. It was all Zoe's idea – and she's dead keen to do it again, hopefully inside the four-hour cut-off time!'

# An Aussie in Cambridge

**Norman Greenwood came to Cambridge 60 years ago. He recalls his time here – rationing, royal visits and the old laboratories**



This year marks the 60th anniversary of my arrival in England when, like many other Australians in the immediate post-war era, I came to Cambridge as a research student. I had been awarded an Exhibition of 1851 Overseas Scholarship to work under Professor Harry Emeléus, the foremost inorganic chemist in the UK at that time.

Emmy (as he was always affectionately known) put me in a side lab with another beginning graduate student Gordon Stone, but after Gordon had had a series of explosions in his vacuum line I prudently moved out into the main lab. Others in the lab during my first year included Joan Banus, Gustav Brandt (Finland), Viktor Gutmann (Vienna), Mimi Newing (Melbourne) and Alf Woolf. The research staff were Alfie Maddock, Alan Sharpe and Bob Hazeldine, who had himself just been awarded a PhD for research with Emmy.

The three years I spent in Cambridge were a revelation to me and resulted in a dramatic expansion of my scientific and intellectual horizons. Fortunately I was keeping a daily diary and so have a vivid contemporary record of my early impressions. I was struck by the apparent paradox that rapid cultural changes and dramatic scientific advances were occurring within a community that was still operating under rigid, indeed quaint and often anachronistic rules. When I look back now over the sixty years since my arrival, I am astonished at the extent of the institutional and cultural changes that have occurred – almost all of them beneficial.

In 1948, there were 19 colleges for men and two for women. No college was 'mixed' or co-educational. Students were *in statu pupilari* and college officials were *in loco parentis* – presumably because the age of majority was then 21 and most undergraduates were, therefore, minors.

The Compendium of University Regulations at the time makes fascinating reading. Students had to wear a gown after dusk, get proctorial permission for any dinner or party in a hotel or public room if more than 15 people were to attend, etc. It was forbidden to gamble, to have dealings with money-lenders, light bonfires or climb University buildings. It was likewise prohibited to enter into a hire-purchase agreement or even keep a motor vehicle in Cambridge.

I recall the first time I was 'progged', in February 1950 for being briefly out of college one evening without a gown. The fine for this offence was 6/8d (33p) for an undergraduate but, as I had BA status, it would be 13/4d (67p). Fortunately the Proctor accepted my explanation that I had just slipped out to see a friend to the bus station and was hurrying to return before 10pm to avoid being 'gated'. He let me off with a caution.

I had a modern set of rooms in Sidney Sussex, a delightful College which, in addition to the luxuries of central heating and plumbing (at least in my building), had the further advantage of having a squash court within its lovely gardens.

Food rationing, though, was an unwelcome discomfort, as it was for everyone in the country, and was even more stringent than during the war: one week's entitlement comprised 1 egg, 1oz cooking fat, 1oz cheese, 2 pt milk, 6oz butter, 8oz sugar and 13oz meat. I began to realise why my mother and aunt had quietly been sending food parcels to England for many years. However, next door to Sidney was the Dorothy Café, renowned for its morning and afternoon tea dances which could accommodate 1500 at any one time: table d'hôte luncheon was 2/6d (13p).

Shortly after my arrival in Cambridge a momentous event occurred (on Thursday 21 October, 1948). Her Majesty Queen Elizabeth (mother of the present Queen) was awarded an Hon LLD Degree, and so became the first woman ever to receive full membership of the University. It seems astonishing nowadays that women had to wait until 1948 to be allowed to graduate from Cambridge. They took the same courses and sat the same examinations (often doing better than their male counterparts) but they were denied the status conferred by graduation. Instead, they were awarded a 'titular degree' which was degradingly abbreviated to 'BA(tit)'.

Mixed (co-residential) colleges were well into the future, but at least from 1948 onwards women could graduate with substantive degrees, and those who qualified before 1948 were given the possibility (which many took) of converting their titular degree into a full degree. On the great day of the royal visit I had an excellent view from my position at the corner of Petty Cury as the walking procession moved from Christ's College (where the master, Canon C.E. Raven, was vice chancellor) along Sidney Street to the Senate House.

Shortly after this memorable occasion I learnt of another royal event. I was returning from the laboratory late on the evening of 14 November when I was greeted at the College gate by the Senior Porter who said, 'It's a boy, Sir'. 'What is a boy?' I enquired. He looked at me with some surprise but volunteered the further information: 'The young Princess, Sir. She's had a baby son'. 'Oh!' I replied, weakly, 'I didn't realise she was pregnant.' A look of respectful regret momentarily crossed his face at my reaction to the news of Prince Charles's birth.

On a related theme, I recall that the only woman member of staff in the department of chemistry when I arrived was the demonstrator in inorganic chemistry, Dr (later Dame) Rosemary Murray who was much involved with the group working to found a new college for women in Cambridge and who, indeed, became the first President of New Hall when it eventually came into existence in 1954. Subsequently, she was the first woman to hold the office of vice chancellor of the University, from 1975 to 1977.

The 'Old' University Chemical Laboratory in Pembroke Street where I started my research had been built ➢


in 1887, and considerably extended in the early part of the 20th century. But when Alex (later Lord) Todd arrived as head of department in 1944, the labs were still lit by gas and were very poorly serviced.

With Ralph Gilson as his incomparable superintendent of laboratories, he set about a drastic reorganisation and improvement in facilities. He also recruited Harry Emeléus to build up the inorganic section. The theoretical chemistry section was already well developed under Professor Sir John Lennard-Jones who, in 1932 had been appointed as Plummer Professor of Theoretical Chemistry, probably the first such chair anywhere in the world.

In all, the University Chemical Laboratory housed some 25 members of staff and about 65 postdoctoral fellows and research students. This did not include members of the department of physical chemistry under Professor Norrish which was a rigidly separate department housed in Free School Lane next to the Cavendish Laboratory.

There was no doubt there was a real buzz of intellectual excitement in the air. As I was soon to find out in my research and in the lectures and other activities I attended, the quality of the place was palpable. I was continually meeting and discussing things with internationally famous people from all around the world who were themselves pursuing their own often epoch-making researches. The feeling that everything was happening around me and that I was actually part of it was a tremendous stimulus to achieve something myself.

In addition to my research work in the laboratory I took the opportunity to attend various courses of lectures. Some of these, such as those by Emeléus and Lennard-Jones, were chemical, but there was also a tempting variety of other lectures on offer. In my first year I went to Bertrand Russell's series on 'Introduction to Philosophy', a riveting performance by the perennially challenging doyen of English philosophers.

The lectures were on Thursday afternoons during the Michaelmas and Lent Terms and were held in the Large Examination Hall which was packed to capacity. At 5 o'clock precisely Russell entered the Hall, a slightly built man with a shock of silver hair. There was instant silence and he began: 'I have called this series of lectures "Introduction to Philosophy". I hope this will not mislead anyone. Perhaps I should have called it "Introduction to *My* Philosophy". I shall make no attempt to give an impartial survey of what used to be called Philosophy up to now. I am concerned mainly to discuss…' and so on.

In his characteristically thin, high-pitched, almost rasping voice he spoke simply and forcefully, and with complete conviction that he was on a plane with previous great philosophers. It was a bravura performance and a masterly exposition which was all the more remarkable for being given by a person who was already in his 77th year. Not everyone stayed the whole course, but for those of us who did the experience was enormously rewarding.

Quite different was the course of lectures on 'Quantum Mechanics' that I attended in my second year with my fellow Melbournian, Ray Martin. The lectures were given by the Lucasian professor of mathematics, Paul Dirac, who in his mid twenties had produced his relativistic theory of quantum mechanics which accounted naturally for electron spin and predicted the positron, antimatter, and the mutual annihilation of colliding electrons and positrons. He shared the 1933 Nobel Prize for Physics with Erwin Schrödinger. Dirac was an inspiring person and a superb lecturer.

I was also much impressed by the personality and lecturing style of Sir Lawrence Bragg who with his father, Sir Willam Bragg, had invented the technique of X-ray crystal structure analysis which was subsequently to play such a dominant part in the development of biophysics throughout the world but spectacularly so in Cambridge. They shared the 1915 Nobel Prize for Physics.

Sir Lawrence was a delightful speaker – informal but authoritative. He impressed me with his liberal ideas on 'Culture for Scientists', the subject of his Cavendish Lecture which I attended in October 194). Indeed, he arranged for one hour of practical work time each week for Part I Tripos students to attend lectures specially given by arts faculty members, for those who wished to attend. The idea was an enormous success and huge numbers of science students attended.

In addition to lectures by prominent scientists, conferences on diverse subjects, and my own research work into the novel electrochemical properties of low-melting coordination compounds, I was able to find time for many other activities during my three years in Cambridge. The intellectual stimulus I received, the firm friendships I formed, and the enriching experience of living and working in such beautiful and elegant surroundings have been an abiding joy and benefit throughout my life.

**Norman N. Greenwood**
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# Alan Sharpe – a student remembers

Dear Editor
Both my wife and I were very sorry to learn of Alan Sharpe's death, and its apparent suddenness, as there was no indication of major problems in his last card that we received for New Year 2008.

All of the comments about him in Chem@Cam, however, I can endorse as one of his early PhD students (1952–55). So perhaps some personal reminiscences of him would be appreciated.

He was certainly determined to develop independence in his students who, at that time, consisted of a relatively small group: myself. Ramchand Paul, D.W.A. (David0 Sharpe, and a couple of others whose names have vanished in the mists of time.

One of his first questions as I started my research was,' Do you speak German?!' When I said that I didn't, he responded that I should learn it so that I could read the German chemical journals 'where all the best chemical work is being published' – so I did. The first two papers in J. Chem. Soc. on my research were co-authored. But for subsequent papers he declared that it was about time that I wrote my own papers, as I needed to get experience with the reviewers' comments!

At that time, we were preparing complex fluorides from many of the transition metals, determining their crystal structures by X-ray diffraction, and looking at the bonding in the resultant compounds. I think it was thought then that there might be some errors in the bonding suggested by Linus Pauling. However, in the end I think it turned out that Pauling was right.

Fluorinating metals with bromine trifluoride was not as dangerous as many

# Health & safety – it's not what it used to be!

Dear Editor

Your article on portraits of the 1950s prompted recollections of chemical research in those days and how far techniques have changed during the last 60 years. This photo (right) is of the main Inorganic Research Laboratory in Pembroke Street, taken in 1951/2.

Most of the research topics were concerned with the chemistry of fluorine or boron or both, and usually involved manipulating gaseous reactants or products, hence the large number of glass flasks in which these were stored. One of the first tasks a new research student had to learn was how to blow glass! Professor Emeléus was quite an expert at making internal joints – he always took his pipe out before starting and rested it on the glassblowing bench. We had to use soda glass as Pyrex was too expensive. Conical cones and sockets were at a premium (because of their cost,) and one had to ask Mr Gilson before being able to draw these from the stores.

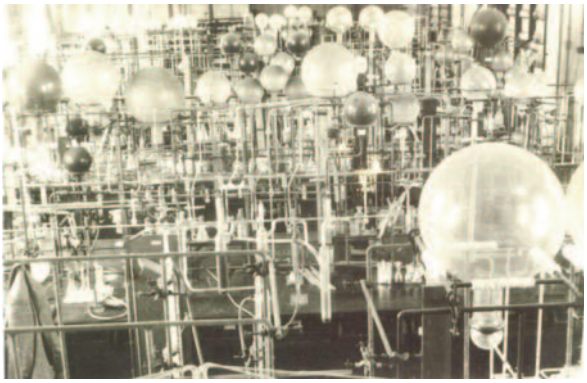
How would we have coped with the new health and safety requirements? One used asbestos wool to close the open ends of glass tubing when blowing, and always had a conical flask full of carbon tetrachloride on the bench to clean the glass taps. Mercury manometers measured the pressure in the equipment and spillages of mercury were quite common, in fact cracks in the benches usually contained small globules of mercury.

Fractional condensation was a common method for separating gaseous products and this involved using freezing mixtures of common organic solvents. Winchesters of benzene, toluene, carbon tetrachloride, carbon disulphide, chloroform, ether and pentane were kept on the side shelves in the lab. Liquid oxygen or nitrogen was tipped into an open vacuum flask containing the solvent and the mixture stirred with a wooden stirrer until a semi-fluid slush was obtained. Goggles were always worn during this operation in case the vacuum flask imploded.

I well remember one Saturday afternoon when my girlfriend (a mathematician from Newnham) came to see what I was doing (and to help?) She wanted to try her hand at making up the freezing mixture; in this case chloroform. Unfortunately she must have stirred too vigorously as she managed to break the flask with the result that the semi-solid chloroform imploded all over her face and within 30 seconds she was out for the count.

Fortunately, there was another student working in the lab at the same time and we decided immediately that we would have to get her out of the lab in case the prof should appear. The only secure place was the gents' toilet so we rapidly carried the body there and I was left to ensure that she recovered consciousness. Fortunately she came round quite quickly, the prof never knew, the only evidence was some burn marks on her face which left no permanent scars. And she has been my wife for the last 54 years.

Many of the gaseous reactions were carried out under pressure in thick walled glass tubes – which we closed ourselves. These were heated in circular ovens on the side shelves or in the fume cupboards. The glass tubes were put in steel cylinders with a screw cap. Occasionally the contents exploded – usually because the thermostat on the oven failed and the temperature went far higher than planned, and the end cap was blown off. Once, this travelled the length of the laboratory but, fortunately, no-one was in its path. Larger scale reactions were carried out in steel autoclaves which were sealed by screwing down the top flange to compress a



lead sealing washer. This requires considerable force to be applied and Tiger, our lab assistant, often gave a hand to apply the necessary force to the metre-long spanner we used. The autoclaves were heated in oil baths on the roof – in case they blow up.

I suppose the most corrosive chemical we used was bromine trifluoride. There was a cylinder of this in the end fume cupboard and one always wore an asbestos apron and large asbestos gloves as well as a full face mask when opening this cylinder. Any drips of liquid on to the concrete base of the fume cupboard caused the latter to 'ignite'.

Those were the days! At anyone time there were about 10 research students in the inorganic laboratory, two-thirds from the United Kingdom (usually Cambridge graduates) and the remainder from overseas – Australia, New Zealand, Canada, Sweden, Germany, the US and Egypt during my three years. But of the 20 or so students during that period, we produced one Nobel laureate, two Fellows of the Royal Society, and at least eight professors. There was only one female student, Barbara Tildersley, and I never knew what happened to her!

**Bernard Steele**
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people thought. We wore asbestos gloves and face masks (most of the time!) and used to demonstrate the 'dangers' to lab visitors by putting a glove down on an asbestos sheet and 'accidentally' pouring a little bromine trifluoride onto it – when the glove promptly burst into flames!

Much of the work was done in silica vacuum systems, with the reaction rate controlled by a dewar of liquid air around the reaction vessels. If the reactants warmed up too rapidly, the resulting reaction could be spectacular. Seeing flaming molybdenum hexafluoride flowing through the tubes of the vac system was something you did not do twice!

In the 1950s, a number of other labs were working on fluorine chemistry, and Alan kept us in touch with their work. I remember a visit to the IC research lab in Widnes where my main recollection is of learning to shoot bluebottle flies down in flames with a couple of squirts of chlorine trifluoride from a pressurised bottle and a flexible nickel (?) tube. Life with Alan had its amusing moments in addition to serious research!

Alan was a very personable supervisor who often invited students to his home for dinner. However, you only received a second invitation if you helped with the washing up, and enjoyed listening to his opera recordings – Purcell was the favourite then. When my wife (then fiancée) visited one May week, we were both invited for dinner and formed firm friendships which have continued through Christmas cards and my infrequent visits to Cambridge.

Alan was a guest at our wedding in 1955, and soon after that my career took us to Canada. In his last card, he bragged that he had finally retired, complained about difficulties getting about, and his declining eyesight – but gave no indications of anything more serious. He will be missed.

Yours sincerely,

**Brian Cox**
*Professer emeritus of nuclear engineering, Univeristy of Toronto, Canada*

# The class of 1946 reminisces

**Mary Ashworth's letter in the last issue prompted a number of responses from former classmates. Are there any more out there?**

**Here's an updated list of names. Can anyone fill in any more of the blanks? We'd love to hear from you!**
**Back row:** Olga Rutherford, ? Webb, J. Sawyer, V.M. Clark, Heather Platt, W. Rosenfelder, Helen Frenkel, W. Burne, Mary Ashworth; **Middle row:** Akbar Imam, Costi Edeleanu, Alec Sutton, ? Poyntin, Reg Lewis, J. Cave-Brown-Cave, H.M. Kimberley, ? Webber, Alan Sharpe, Peter Gray, A. Wild, D. Goodison; **Front row:** Susan Neuberger, Joan Banus, B. Whittaker, Leslie Hunt, A. Hutchinson, Ernie Elborn, Audrey Free, Jennifer Turner, Shirley Wickham-Jones.

Dear Editor,
It was interesting to see the photograph of the Part II chemistry group in the Spring issue of Chem@Cam. I have that same photograph, and can give you a little more information.

I was very friendly with Joan Banus (later Joan Mason) who died a couple of years ago. She had received an MBE for services to women's rights. She married Stephen Mason FRS who was an Oxford chemist, but they were both working at Exeter before he took a chair at UEA. Later, he became a professor at (I think) King's College London.

Joan worked for the Open University, but was also concerned with the history of science department in Cambridge when she and Stephen retired there. He died earlier this year.

Peter Gray is also a dear friend, and I have stayed with him at Caius and in his present Cambridge home. I saw Olga Rutherford at a Girton gathering in 1998 when we went down to the Senate House to receive belated apologies from the university for not getting a full degree in 1946.

After leaving Cambridge, I worked for a year or so on the Journal if the Institute of Metals, and then returned to the Goldsmith's Laboratory to work on non-tarnishing silver (at that stage a chemical problem) until I married and came to live in Exeter. My husband died young and I had three children but, with help from the families and much encouragement from the professor of philosophy Daniel O'Connor, I took a PhD in 1973 writing on the epistemological function of scientific theories.

I have taught elementary chemistry and some physiology at Exeter College, andhave also worked in the history of science department of the Open University. I have published several textbooks, some of which have been on the Cambridge reading lists. I have recently published a memoir, and a rather lighthearted and short reminiscence was recently published in Varsity.

I noted that you also have pictures of Professor Norrish (*very* fierce, as I recall)and Jack Schulman. Eric Rideal also lectured to Part II students. Both he and Schulman were very difficult to follow. There was also Moelwyn Hughes, who lectured on rates of reaction.

Muriel Tomlinson was my director of studies for all my time at Girton, and I remember her with great affection. In fact, like so many I remember my time at Cambridge with joy, and feel grateful and privileged to have had such a wonderful undergraduate life.
Your sincerely
**Jennifer Trusted (née Turner)**
*15 Victoria Park Road, Exeter EX2 4NT*

## A few more names

Dear Editor,
I am the left-most person in the front row of the picture, and have just a few bits of information for you.

Heather Platt in the back row became Heather Broom and lives in the San Francisco Bay area, I believe in Woodside. Alec Sutton (middle row) was from South Africa. He emigrated to the US in 1952, and I believe settled in the Seattle area.

Joan Banus (front row, next to me) became Joan Mason. Much later, she taught at the Open University. She was also the driving force behind WISE, Women in Science and Engineering.

The first names of the three women on the right of the front row were Audrey, Jennifer and Shirley. Funny what one remembers.

Like Mary Ashworth, I remember Delia Agar, Fred Dainton and our lab technicians very well. I didn't stay with chemistry, though.

Yours sincerely,
**Susan N. Koenigsberg (née Neuberger)**
*SKKong@aol.com*

## Chemistry to library

Dear Editor,
What a nice surprise – leafing through the latest Chem@Cam, our Part II class photograph. I too have a copy of this, and can supply a few missing initials. Conversely, the labelling shown fills in a few gaps in my list of names.

I enjoyed reading the comments on our various lecturers. I well remember the Dainton 'lunch' episode. I also remember Delia Agar (then Simpson) who supervised some of us who were weak in physical chemistry, and who realised that we were having difficulty. She concentrated on teaching us how best to cope with exam questions, seeing that we were not going to get much further in the subject. 'Teaching to the exam' – how frowned upon/

I was an organic chemist, and after graduation stayed on for a further three years as a research student under Dr Kipping. We worked in XL lab on the ground floor of the old Pembroke Street building. We could reach the more advanced research lab on the floor above by way of an iron spiral staircase. Health and safety officials now would have fits to have seen us carrying winchesters of concentrated acids up and down this construction.

Malcolm Clark also worked in this lab, and so did John Davoll, who was working on the synthesis of nucleosides under Dr Lythgoe in Professor Todd's team. John and I were married in 1947.

I submitted my thesis on analogues of pyridoxin (vitamin B6) in 1949, but

was told it was not quite up to standard. I was offered an MSc degree (then Cambridge-speak for a failed PhD) or the option to do more work on the topic and resubmit. I wanted to do the latter. At this point, in 1949, Professor Todd recommended John for a two-year post in New York, at the Sloan-Kettering Institute for Cancer Research.

He also arranged for me to have facilities to do some further work for my thesis in the biochemistry department of Cornell University Medical Department, which was just across the road from the Sloan-Kettering.

This department was headed by Fr V. du Vigneaud, known for research on insulin and other hormones. After I completed my own further work, which eventually gained me my PhD, I worked for a while as part of du Vigneaud's research team on the structure of oxytocins.

I stopped work a couple of months before the birth of our elder daughter in 1950. We returned to England in 1951, and John then worked in the research lab at Parke Davis in Hounslow. We lived in Shepperton, and I stayed at home happily looking after our house, garden and eventual three children.

In 1965, I took a part-time job at the Milk Marketing Board in Thames Ditton. In pre-computer days, this involved finding and supplying technical information as required to regional managers, dairy chemists and vets at artificial insemination centres country-wide. This meant searching the technical literature to find answers to their queries and was varied and interesting work.

I retired in 1991, and we moved to Bookham. I found new interests and friends through the local branch of the University of the Third Age. I also still continue with my hobby of Scottish country dancing.

We have paid short visits to Cambridge over the years. A series of annual reunion dinners of research chemists who had worked with Professor Todd at Manchester before he and they moved to Cambridge, was held between 1972 and 1996. John was included in these gatherings.

In the later years, wives also joined the Toddlers. On one of these visits, John and I walked straight across the grass in the centre of Trinity Great Court. This sacrilege was permissible because we were accompanied by Denis Marrian, a fellow of the college.

Our two daughters went in turn to Girton and took degrees in natural sciences – but not in chemistry.

Yours sincerely,

**Helen Davoll, née Frenkel**
*7 Proctor Gardens, Great Bookham, Leatherhead KT23 4BY*

## A missionary life

Dear *Chem@Cam* friends,

I was delighted to see the picture of my Part II chemistry class of 1946, and grateful to Mary Ashworth for sending it with comments.

I am the first on the left in the back row. Standing on the left in the middle row is Akbar Imam. He and I were the only two of the class to study in the colloid and surface chemistry department, which was a separate section under Professor Rideal. I think Akbar was either at Trinity or Trinity Hall. Akbar Imam could have been a title, but that was how we knew him. I would be delighted if I could have further contact with him.

Muriel Tomlinson was my director of undergraduate studies at Girton. Unfortunately, she returned to Oxford, because she found no acceptance as a woman in the Cambridge chemistry department. I remember Dr Dainton as being a brilliant tutor.

We met one or two friends from those days when we celebrated the 50th anniversary of women becoming part of the university.

After leaving Cambridge, I trained as a teacher, taught at Bedlington Grammar School in Northumberland, then studied at the China Inland Mission training home before leaving for Japan as a missionary in 1952. I spent 34 years there.

Returning to England, I felt very much out of touch with Cambridge and chemistry. I have appreciated Chem@Cam bringing me in touch again, and especially with Reg Lewis and Vincent Gray. I am busy writing my autobiography.

Yours sincerely,

**Olga Abrahams (née Rutherford)**
*77 Elizabeth Gardens, Stanmore HA7 4UD*

# The Corporate Associates Scheme

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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.

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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.

# It's beginner's luck for novice fisherman Jacek

Jacek Klinowski indulged in a spot of fishing on a recent Caribbean trip – and it's fair to say he caught a big one in the sea between St Lucia and Martinique.

'On impulse, I took a trip ona deep sea fishin gboat, and the two fellows you can see ion the photo challenged me to try the fishing rod,' he says. 'Two minutes later, I had a blue marlin on the hook, but it took me 45 minutes – and some considerable effort – to get him in.'

The fish tried all the tricks in the piscatory book to evade capture, Jacek reports. 'First, he went 80 metres down – I know how deep because the colour of the line changes every 10 metres – and then jumped above the surface. When I saw how big he was, it nearly gave me a heart attack.'

But Jacek was victorious, and it turned out that he really had caught a big one – the blue marlin weighed in at a hefty 140lbs.' I let him go after about 45 seconds,' he says. 'He did me no harm, and I do not supply rare fish to restaurants – which upset the two fellows I was fishing with because they were hoping for a cut of the profit!

'An ex-pat Brit commented that my luck was comparable with finding a gold sovereign in the streets of Aberdeen. There were five other rods on the boat, but nobody except me caught anything all day.'

It's not a bad result for someone whose only prior fishing experience was angling for trout in a pond in Poland many years ago!

# Star student Caroline

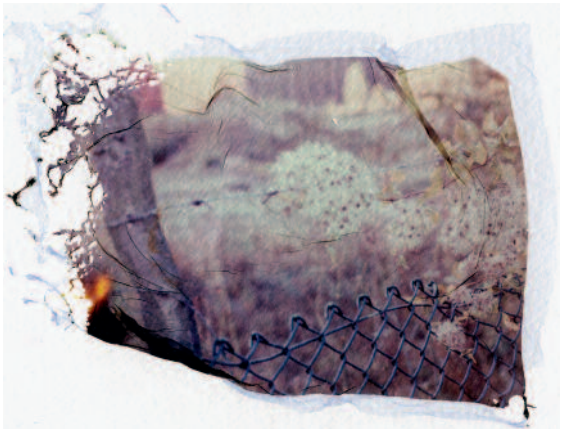
Caroline Hancox, who's worked in the photography section for the past couple of years, was named 'student with the most potential' on her college course.

She's studying on day-release at Hertfordshire Regional College, and has just finished the second year of a foundation degree in professional photography.

Her course involves one day a week at college, with the course starting at 2pm, and she studies through until 9pm at night.

Fortunately, this still leaves her with plenty of time to take great pictures for *Chem@Cam*!


Above: Caroline steps out from behind the lens; below: an example from her portfolio; a far cry from her Chem@Cam cover shots!



# Deborah's latest synthesis

Baby William looking cute at just 30 minutes old. Aaaaah!

Congratulations to teaching fellow Deborah Longbottom, who gave birth to her first baby on 27 June.

William James Moss (he's taking her husband Steven's surname) weighed in at a fairly solid 9lb 3oz, which rather took Debs by surprise as she'd been led to believe she was expecting a small-to-average sized baby.

'He's a good little soul and sleeps well at night between eating!' she says. 'And being a mum is great. It's early days, of course, but I'm just really happy with the whole experience, and my husband loves being a dad.

'And he is just a lovely looking baby, although perhaps that is mummy's biased view…'

# Alan turns 65 in the pub

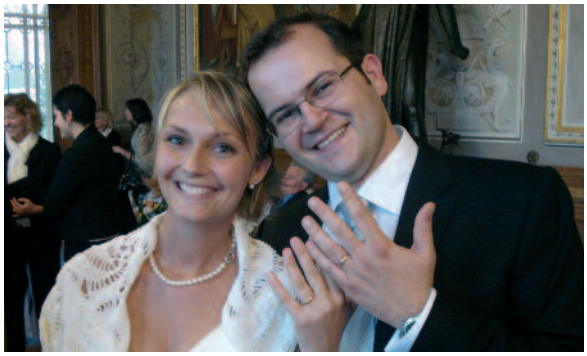
Alan Parsons from the workshop recently turned 65. His colleagues thought he should celebrate it in style, which turned out to be by throwing a party in the Regent pub. Plenty of beer and a good time was had by all – and we can also report that while Alan may have hit retirement age, he has no intention of retiring just yet. So we've got to wait a while for the photos from his retirement party!

## Graeme's happy day

Graeme Day, a Royal Society URF in the department, married his long-term girlfriend Aileen Gray in May. The happy occasion took place at Bedworth Baptist Church in Warwickshire, and there was a good turn-out of people form the department to wish them well.

Graeme met Aileen during his PhD days at UCK in London, where he worked for Sally Price. He hails originally from Halifax in Canada, but has been in the UK for more than a decade now. He's been working here in Camrbdige since 2002.

For the honeymoon, the pair travelled to Angelsey, but rather than a normal hotel, they stayed in an old windmill. 'Married life is great!' Graeme says.



It was Italian wedding joy for Andrea Pinto, who until recently worked in Steve Ley's lab as a postdoc, and Lucia Tamborini, who also worked in the Whiffen for a year as a visiting PhD student. Steve and Rose Ley and Ian Baxendale were among the guests

## And finally… Sarah gets wed too!

*Chem@Cam* is always nagging people in the department to send her their wedding photos for the magazine. She got married herself a couple of months ago, and it was pointed out to her that she could hardly avoid putting one of her own wedding in.

So… On 4 May, *Chem@Cam* editor Sarah Houlton married Tony Wood, who's the head of discovery chemistry at Pfizer in Sandwich, at the church she attended as a kid in Sheffield. 'I figured that now I'm 40, I ought to do something properly grown-up!' she claims.

The reception was held at a beautiful little hotel in Grindleford in the Peak District, and Sarah reports she might possibly have been on bride's rations of champagne all day. The weather wasn't particularly kind, but a brilliant time was had by all. And you can't tell in the photo, but her necklace is a string of silver amino acid structures, which make up the 'happy hormone' beta-endorphin.

The newlyweds headed off to Spain for their honeymoon, where they stayed in several different Paradors, including two castles and a fortress. They even had a night in the Alhambra in Granada.

Sarah and Tony first met when he was a postdoc in Steve Ley's group at Imperal way back in 1990, and she was doing a PhD with Willie Motherwell in the lab next door.

Little did they know then that 16 years later they'd bump into each other at an extremely tedious work meeting in London, he agreed to help her with an article for *Chemistry and Industry* magazine, and that led to them realising what they were missing out on. 'It's strange how things work out,' says Tony. 'But we're really happy that they did!'



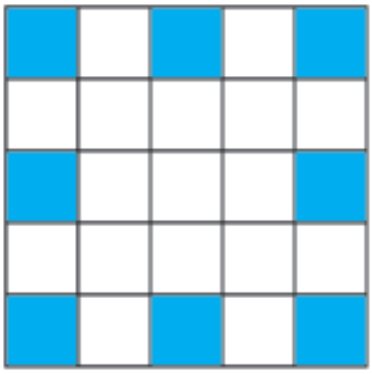
# This issue's puzzles

## Elementary – but clueless

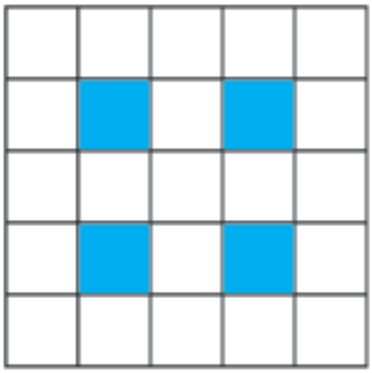
Graham Quartly's back, with more elementary crossword entertainment. This time he's supplied two puzzles – and no clues. Chemical elements are again placed in the boxes to form words reading across and down, but rather than making it easy by giving you clues, the idea is to arrange the sets of elements that are printed to the right of the grids so that each one appears once in each grid to make a full set of words.

All words will be found in a good English dictionary, and no proper nouns, such as FRaNCe are allowed. Good luck!

C



Al Ar B C C C
Ca Er He K Li N
Ni Ra S S V



Al Au C C Ce
Dy I Lu Mo Na
Ne P P Ru S S S
S Si Ti Ti

## Secondary schooling

Here's another puzzle from Keith Parsons. And here's hoping it doesn't prove quite as difficult as his last couple! As ever, first correct answer plucked at random from all those that arrive in the Chem@Cam pigeon hole or inbox, wins £20.

And the puzzle... In a complete reversal of the usual sequence, Stuart, 63, who graduated in his early twenties, felt the need to improve his skills in basic maths. He enrolled in a cramming school which provided one-to-one tuition and where all the exams were marked out of a possible 200, in order to grade the pupils more precisely. He obtained 71.5% in Algebra, 62.0% in Calculus, 725% in Trigonometry and 65.5% in Statistics. What percentage did he obtain in Geometry?

£20 prizes are on offer for both puzzles. 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

Even the thermodynamics lectures left the students open-mouthed with excitement

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Chem@Cam is written,
edited and produced
by SARAH HOULTON

Printed by Callimedia, Colchester