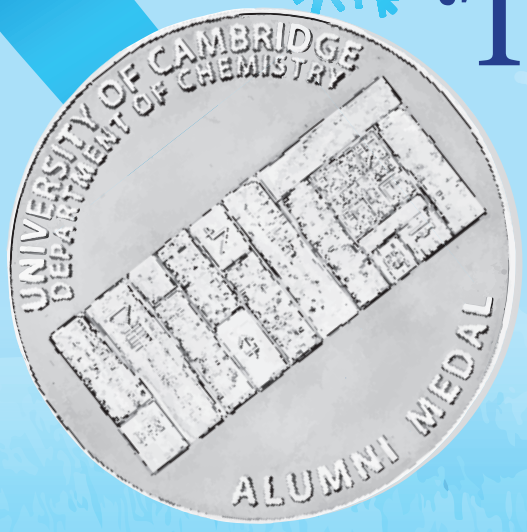
UNIVERSITY OF CAMBRIDGE

Chemistry at Cambridge Magazine

WINTER 2017 | ISSUE 56

'Tis the season for... awards



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Cope & Shoolery Awards

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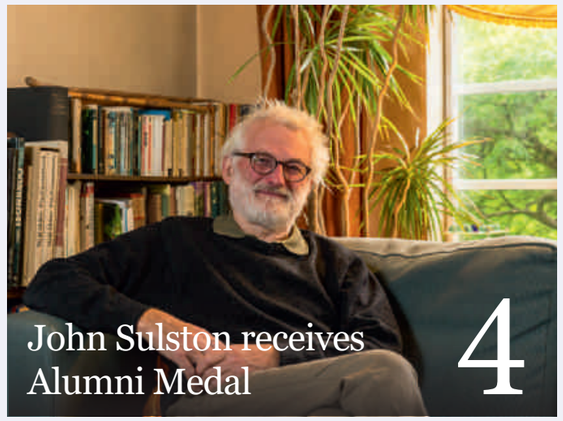

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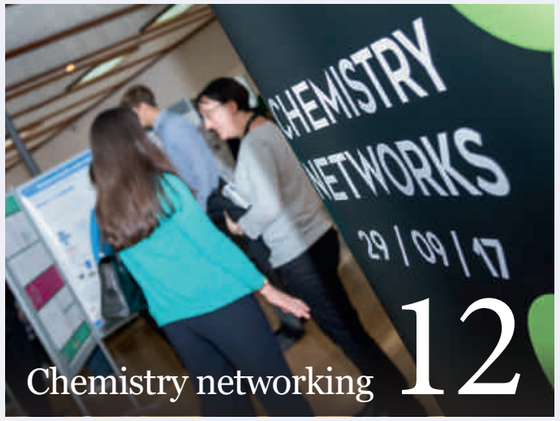

WOMEN IN CHEMISTRY

RESEARCH

Welcome

This issue - as you will see - features scientists associated with the department whose work has been recognised at the highest level by the award of the Nobel Prize.

First is Sir John Sulston, to whom we were delighted to award the department's Alumni Medal in October. John played a key role in sequencing the very first animal genome and went on to become the founding director of the Sanger Institute, from where he led UK research in the Human Genome Project – without which the exponential advances we've seen in genetic science would not be possible. John and two colleagues received the Nobel Prize in Physiology or Medicine in 2002. To find out more about John and his achievements, read his Q&A on page 4.

We also celebrate the award of the Nobel Prize to our former colleagues – Lord Todd 60 years ago, and Sir Ronald Norrish and Lord Porter 50 years ago. Their work opened up new fields of research and paved the way for scientific breakthroughs that were previously unthinkable. Many of our readers may have memories of these departmental legends. (See our Nobel section on pages 26-28.)

Our research section highlights some of our current initiatives, from Silvia Vignolini's investigations into the fascinating mechanisms by which plants attract pollinators like bees, to a recently funded collaborative effort involving the Bender, Colwell and Goodman research groups to improve safety in medicines. (See the Research section on pages 29-34.)

Life after the Chemistry Department doesn't look the same for everybody. Look out for our talks with several alumni about where life has taken them after their studies here. 'Abroad' seems to be the answer: on page 16, two young women scientists tell us about the leadership programme they enrolled in that culminated in a trip to the Antarctic. On page 18, a former undergraduate who is now BP's Vice-President of Group Research explains how his career has taken him to live in Russia and China.

And we have some fascinating alumni 'postcards' from the World Solar Challenge across Australia and a space satellite conference in Japan. (See the Correspondence pages 20-21.) We hope you enjoy reading them.

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Views expressed in this magazine are not necessarily those of the Editor, the Department of Chemistry or the University of Cambridge.

Print: Sterling Solutions

Chem@Cam is published twice a year, and is sent free to chemistry alumni, postdoctoral researchers, retired staff and friends of the department.

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The editor would like to thank and acknowledge all who contributed to this issue.

Q&A

John Sulston

Sir John Sulston CH FRS is the recipient of the Department of Chemistry Alumni Medal. He read Natural Sciences and Chemistry at Pembroke College and received his PhD in organic chemistry here in 1966. John shared the 2002 Nobel Prize in Physiology or Medicine with Sydney Brenner and Bob Horvitz for cell lineage research in the nematode worm, *C. elegans*. In 1992, he became founding Director of the Sanger Centre (now the Wellcome Trust Sanger Institute) and from there led UK research in the Human Genome Project.

Why Chemistry?
I was always intrigued by biology, which was mysterious and fascinating. I opted for Physiology in Part I, but it turned out to be not very interesting, mainly learning labels and names. Ian Fleming [*now Emeritus Professor in the department*] was at Pembroke and was young, personable and really sparky about how things worked. That made a huge difference to me and inspired me to study chemistry.

What was Pembroke like in 1960?
Dreadful. Almost no women, a very odd monastic set-up.

What led you to a PhD in Chemistry?
I had signed up for Voluntary Service Overseas but my programme fell through. I came, hat in hand, to the department and was interviewed by Alexander Todd, who was austere but amazingly accepting of this 'refugee' with his 2.1.

What was working here like?
Like being at my home – but with better and bigger machines. Quite early on, I found a spot in a chromatogram which shouldn't have been there. I had discovered a reaction people hadn't known about. I was immediately in an exciting position of having discovered something new.

My supervisor was Colin Reese, the second person I owe a lot to. He organised us unmercifully and told us what to do, but didn't restrict us. My thesis was on oligonucleotide synthesis – an exciting area because people were just realising the genetic code could be worked out.

What were you like as a boy?
Intrigued by biology. I was always fiddling about with meccano sets, electric wiring, an aquarium, and growing things in my bedroom.

You and Bob Waterston were the first to sequence an animal genome. Why the nematode worm?
Sydney Brenner chose it because of its simplicity and quick growth. (There were lots of jokes about 'Sydney's worm', as we called it.) I joined his group [in the MRC Laboratory of Molecular Biology] on returning to Cambridge after postdoctoral research at the Salk Institute in California.

By 1983 we had a lot of mutants in the worm, but then the genes had to be located and isolated for study, and each one took a huge amount of work. I thought 'This is crazy. We need to map the genome'. Sydney agreed.

We talked about the methodology. The worm has 100 million bases and sequencing technology at that time could only do a few thousand. We thought we could chunk the genome into pieces, cloning and rearranging them in a jigsaw pattern. So Bob Waterston, Alan Coulson and I built the clone map. You have the genetic map, so you know the order of genes in the genome, you align the two maps, then take each clone in your region and check to see whether your gene is in it or not.

By that time people had got adept at injecting pieces of DNA into the worm and seeing how it was affected. By the end of the 1980s we could pull genes out with much less trouble. By 1990 the Sanger method had been automated and speeded up, so we started sequencing the genome. The worm was the first animal ever sequenced. I'm very proud of that.

What led you to the Sanger Centre?
In the early 1990s, the Wellcome Trust accepted a proposal for tackling the human genome and to build a new research centre. I agreed to become involved because I wanted to get the nematode done.

In the Laboratory of Molecular Biology, we had managed 3 million base pairs of the nematode, but we needed space for the other 97 million. By then we were also making huge inroads into the human genome – we eventually managed a little under one-third of the human genome at the Sanger, working with colleagues in America. Nowadays, [the department's] Shankar Balasubramanian and David Klenerman have taken us into Next Generation sequencing with Solexa, which is vastly faster.

You learned about your Nobel Prize...?
From a message on the answering machine on my desk at Sanger. I didn't believe it, but figured I should phone them back!

Which chemist do you most admire?
Fred Sanger. There was something about him: he spoke quietly, in a non-flamboyant way, but with great intelligence and knowledge.

What trait do you most deplore in chemists?
Greed. Not just financial, but the unwillingness to share data and discoveries, including not giving credit to others. This contributes to many of the problems in science today.

What's your biggest discovery?
Finding a way to watch cells divide in the living worm. I'm a mapper at heart.

What was your worst job?
Working in an asbestos factory as a school holiday job. We emptied big sacks of the stuff into the hopper. I've no idea how many died as a result.

What music do you enjoy?
Everything. My wife Daphne plays piano and chooses CDs and I love it all. When I was on Desert Island Discs in 2001, they called my choices "eclectic". [John's chosen luxury was "the microscope used to examine the lineage of the roundworm"…]

How has the scientific world changed since you started?
I used to feel my job was to get on with my work and leave the world to be run by politicians who have the skills and experience to do it properly. But now I believe in the importance of greater and genuine involvement by scientists in deciding the sort of world we want. This was partially caused by the bid, by Celera in 1998, to make the human genome project private. It seemed to me self-evident, on both moral and practical grounds, that the human genome is an inappropriate subject for commercial ownership. [A subject John wrote about, with Georgina Ferry, in *'The Common Thread – Science, politics, ethics and the Human Genome'*, published in 2002.]

How does it feel to receive the Alumni Medal?
A complete surprise. I tried to demur – who am I? Others are more suitable than me. But I accept it with gratitude.

What advice would you give young scientists today?
I still think it's true that you should do what you enjoy doing. If you do something you like, at least you have that, and there's a higher chance it will take you somewhere.

Three key words in your career?
Serendipity. Mapping. Open access.

Where do we go from here?
In our journey of understanding the universe we have no limit.

Nobel Laureate lectures

We have enjoyed talks by two visiting Nobel Laureates in the last few months. In June, the day after he received an Honorary Degree from the University of Cambridge, Professor Jean-Marie Lehn came to the Department of Chemistry. A former Alexander Todd Visiting Professor of Chemistry, his talk to a packed lecture theatre was on 'Perspectives in Chemistry: From Supramolecular Chemistry towards Adaptive Chemistry'.

In 1987, Professor Lehn won the Nobel Prize for Chemistry with Donald Cram and Charles Pederson for their innovative work on synthesising cryptands, the molecules that bind atoms together. He is Honorary Professor at the Collège de France and Emeritus Professor at the University of Strasbourg where he was the founder of its Institute of Science and Supramolecular Engineering.

He was followed, in October, by Professor Tom Cech who came to give the 2017 Herchel Smith Lecture. His talk was on 'Shedding Some Light on the Dark Matter of the Genomic University - Ribozymes, Telomerase and Regulating Epigenetics'.

Professor Cech is Distinguished Professor at the University of Colorado Boulder, Director of the University of Colorado BioFrontiers Institute, and Investigator, Howard Hughes Medical Institute. His work has been recognised by many national and international awards and prizes including the Nobel Prize in Chemistry in 1989. The talk was organized by the Herchel Smith Professor of Medicinal Chemistry, Sir Shankar Balasubramanian.

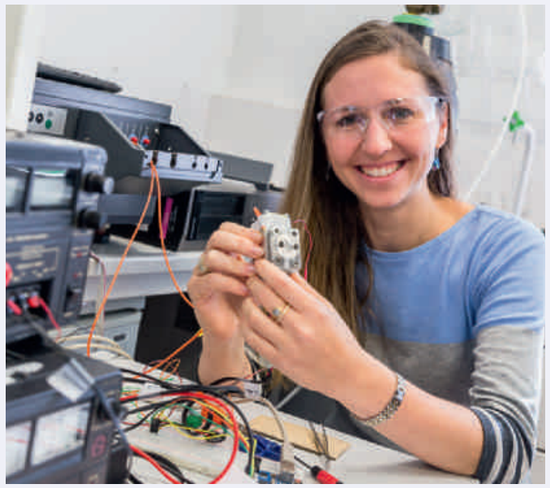
- We're commemorating the department's own Nobel Laureates. See pages 21-23.

Shankar with Tom Cech
Photo: Kim Liu

Research fellow's start-up wins commendation

A company started up by Research Fellow Dr Tanya Hutter to develop robust, small and cheap sensors for detecting toxic gases has just won a commendation in a new awards scheme. SensorHut was chosen as a finalist in the Cambridge Independent's inaugural Entrepreneurial Science & Technology Awards. At the ceremony in late September, the company was Highly Commended in the 'Cleantech' category.

SensorHut was co-founded in 2013 by postdoctoral researcher Dr Tanya Hutter, who first had the idea for developing her innovative sensor technology while studying for her PhD here.



Now the Henslow Research Fellow at Darwin College, and a member of the multidisciplinary Elliott research group in the department, she multi-tasks, juggling work for the company around her full-time academic research.

The sensor technology that SensorHut is developing can be used to detect and monitor volatile organic compounds (VOCs) – gas molecules that are present in air, chemical processes, food and waste. Many of these can be toxic and harmful to humans and the environment. But they are widespread, used in products ranging from mattresses to furniture, solvents, paints and aerosols.

Optical gas sensors that are based on molecular spectroscopy measure molecules that are dispersed in air. The sensitivity of detection depends on the length of interaction of light with the gas molecules. The longer the path-length over which this interaction is measured, the stronger the signal. But to do that requires bulky and expensive gas flow cells.

The SensorHut technology uses nanotechnology to reduce sensor size. Light is shone through an optical nano-structure that behaves like a 'sponge', concentrating the molecules. This can reduce the interaction path-length from several metres to one centimetre, enabling the sensors to be much smaller. And, Dr Hutter says, the SensorHut technology is also significantly more sensitive and selective to the compounds than others.

She adds: "We are working closely with Alphasense Ltd to take the technology to a commercial product. Alphasense is a leading UK gas sensor R&D and manufacturing company, also working with the Atmospheric Chemistry group, focusing on the industrial safety and air quality markets."

The work is at an early stage. "We are still in the research phase, working to understand the scientific principles," Dr Hutter says. However, the first product using SensorHut technology could go on sale – if the testing is successful – next year.

Department welcomes prospective postgrads

Around 100 potential postgraduate students attended the department's Graduate Students Admissions day in October. The event was laid on to inform them about the how's and why's of pursuing a postgraduate degree in Chemistry and included departmental tours and information sessions.

The heart of the day was a series of 'flash' research presentations given by academics representing the department's five Research Interest Groups. Between the presentations, student volunteers gave lab tours and Graduate Students Advisor Dr Rachel MacDonald hosted information sessions on the issues sometimes faced by applicants, such as visa rules, language requirements and fee status.

Visitors were also able to speak to current students and postdoctoral researchers, many of whom presented their research posters in the Cybercafé at lunchtime and during the closing reception.

"The day always requires a great deal of organisation," said Head of Graduate Recruitment Dr Rebecca Myers, who runs the event. "I'd like to thank everyone who contributed. Without them all pitching in, these events would not be as popular as they are."

This year for the first time, videos of all the presentations have been made available on the department's Graduate Admissions website. They can be seen at www.ch.cam.ac.uk/pgapp

BP Lecture on energy conversion

Leading Chinese academic Professor Yuhan Sun, came to the department in early October to give the BP Keynote Lecture 2017 on approaches to energy conversion and storage.

Prof Sun is Vice President of the Shanghai Advanced Research Institute of the Chinese Academy of Sciences (CAS). From 2009-2014, he was Board Chairman of the CAS-BP Clean Energy Technology Centre.

In his lecture during the annual BP Day to students, academics and invited guests, Prof Sun discussed the importance of carbon-oxygen bond activation for carbon dioxide/carbon monoxide utilisation.

As he said: "CO_2 / CO utilisation is becoming one of the most severe challenges for human society nowadays. In recent years, tremendous efforts have been put on CO_2 / CO utilisation, trying to convert them back to chemical products or energy." He went on to talk about the important role of catalysis by nanoparticles in the development of new technologies for CO_2 / CO utilisation, and key factors in this work.

BP Day is an annual event here. It brings executives from the company – which has had a long research relationship with the department – to hear from PhD students about their research.

As Dr Angelo Amorelli, Technology Vice President, BP Group Research, explained: "For a company like BP, it's great to engage with academics and students working on the latest types of research. Some of these projects are funded by us. But many that we are hearing about today we are not directly involved with – but they stimulate ideas for us to pursue in the future. And that's a really exciting aspect of participating in a day like this."

- Dr Amorelli was an undergraduate here in the department. Find out more about him in our 'Life after Cambridge' feature on page 18.

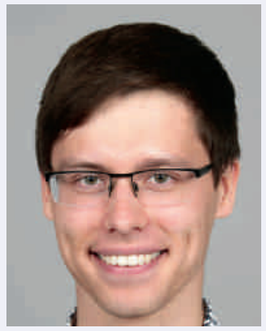
Young researchers work with Nobel Laureates

Two of our young researchers – research fellow Dr Karen Stroobants and PhD student George Trenins – were selected to attend the 2017 Lindau Nobel Laureate Meeting, which was dedicated to chemistry.

Early-career scientists who want the opportunity to share conversations, research and ideas with Nobel Laureates at the annual Lindau Meetings have to undergo a rigorous application process. Successful applicants, say the organisers, "undoubtedly represent the emerging generation of leading scientists and researchers."

Karen had the opportunity to present her research with four other young scientists alongside Aaron Ciechanover, winner of the 2004 Nobel Prize for Chemistry.

She says: "It was a unique experience working with a Nobel Laureate who gave his own insight and opinions on the current academic landscape. The Laureates are also interested in seeing how young people are taking their original research forward."



George says: "I enjoyed the discussion session with Prof Rudolph Marcus, who shared with us an account of how he entered into theoretical research, despite doing a PhD in synthetic chemistry during World War II. It was reassuring to hear that even some of the most prolific academics may have a false start in their research career. It was also inspiring to meet a person who has made such a contribution to science, despite much adversity in his early years in academia."

Karen has a particular interest in science policy and therefore especially enjoyed participating in the closing panel discussion on Ethics in Science. "We're all really involved in ethics because we have to make ethical decisions every day as scientists, from how we treat data to how we treat our colleagues," she says.

The session happened to take place on her 30th birthday and, she says, "I was very happy to be in it. I am still a bit overwhelmed by that particular day."

George adds: "One message from the meeting that is close to my heart as a PhD student in theoretical chemistry was about the importance of fundamental research. It suffers from the PR problem of not furnishing society directly with immediate benefits. Yet fundamental research is capable of unearthing solutions that one would never suspect were there in the first place. It should not be deprived of the attention it deserves."

- Read more about Karen Stroobants in our 'Women in Chemistry' feature on page 22.

Steven Ley receives Arthur Cope award

Congratulations to Professor Steve Ley who has received the 2018 Arthur C. Cope Award – the first time this prize has been awarded to a scientist working in the UK.

The award is for achievement in the field of organic chemistry research and is one of the highest honours in the field.

The Arthur C. Cope Award recognises "outstanding achievement in the field of organic chemistry, the significance of which has become apparent within the five years preceding the year in which the award will be considered."

Steve has pioneered the use of immobilised reagents and flow techniques in multi-step organic synthesis, which now incorporates flow chemistry for multistep organic synthesis applications in the Innovative Technology Centre (ITC), a state-of-the-art flow chemistry facility located in the department.

Jane Clarke retires

A Protein Folding, Evolution and Interactions Symposium was held in early September to celebrate the retirement of Department of Chemistry Professor Jane Clarke FRS.

Jane retired from the department at the end of September – and went straight on to her next role as the first female president of Wolfson College.

Jane said: "In part, this conference was to celebrate my retirement. But rather than the traditional retirement symposium, I chose to host a most impressive selection of international speakers on Protein Science here in Cambridge. The aim was to offer an outstanding chance for young scientists to meet with the world leaders."

Keynote speakers included Professor Sir Alan Fersht of the University of Cambridge and Professor Dame Carol Robinson of the University of Oxford. Professor Clarke acted as chair.

Shoolery award for James Keeler

Dr James Keeler, Deputy Head and Director of Teaching, has won the 2017 Shoolery Award which recognises important contributions to small molecule NMR (nuclear magnetic resonance) spectroscopy.

The award was established in 2014 in honour of James Shoolery, a respected developer of the use of NMR in chemistry and an educator of the wider chemistry community in the potential value of NMR spectroscopy in their research. The award was presented at the Small Molecule NMR Conference in Italy in September 2017.

Dr Keeler (second from right) receiving his award

Dr Keeler said: "I was very touched and gratified to receive this award for 'lifetime achievements and contribution in NMR'."

He adds: "My greatest achievement, if it can be described as such, is the successful and varied careers that my former students and co-workers have gone on to. If I had any part in their success, that is reward enough for me."

As Director of Teaching, Dr Keeler has overall responsibility for the delivery of the undergraduate chemistry course. His own teaching is mainly in the area of introductory physical and theoretical chemistry.

His research interests have been in the area of high-resolution nuclear magnetic resonance (NMR), particularly in the development and application of new techniques.

Dr Keeler is Editor-in-Chief of the journal Magnetic Resonance in Chemistry and immediate past Chairman of the Royal Society of Chemistry's NMR Discussion Group. He is also the author of the book 'Understanding NMR Spectroscopy' (Wiley).

Chemistry of Health building tops out

The new Chemistry of Health building, currently under construction at the back of the Department of Chemistry, has reached its highest point. To mark this, a topping-out ceremony was held in June on the rooftop of the £22.8 million four-storey building. When finished, this new facility will provide space for the study of neurodegenerative disorders such as Parkinson's and Alzheimer's Diseases.

Suitably dressed in boots, hardhats and hi-vis jackets, guests – including the principal contractor Kier Construction Ltd, Head of Department Professor John Pyle, The Centre for Misfolding Diseases co-directors Professors Chris Dobson, Tuomas Knowles and Michele Vendruscolo, and the project team Ramboll & R H Partnership architects – took a tour of the building site. They then headed up to the roof where they watched as the final bolt was fitted to the building's steel frame.

The Chemistry of Health building is due to open in summer 2018. Dennis Cotton, Operations Director at Kier Construction Eastern, thanked the project team for their incredible progress rate.

He said: "Kier is proud to be delivering a project that will drive forward research that could change medication and treatment for future generations."

Professor John Pyle said: "It is a fantastic development that will enable us to translate our research into future treatments to combat some of these devastating neurodegenerative conditions."

The new 2,600 sq metre facility will be connected to the existing Lensfield Road building and will house the Centre for Misfolding Diseases (CMD), a Chemistry of Health Incubator, and the Molecular Production and Characterisation Centre (MPACC).

As part of the ceremony, Professor Chris Dobson gave a symbolical 'nod' to the workers by pouring a bottle of Elgood's Cambridge Bitter on the building after which sparkling wine was served in place of the more traditional beer.

New lecturers take up their posts

We welcomed three new interdisciplinary lecturers to the Department of Chemistry in October. The lectureships are among nine that the School of Physical Sciences has created, each to be held jointly in two departments within the School. The three lecturers who have joined Chemistry are Anja Schmidt, Hugo Bronstein and Robert Jack.

Anja is lecturer in Climate Modelling, jointly with the Department of Geography. She joins us from the University of Leeds School of Earth and Environment where she was an Academic Research Fellow. She combines expertise in atmospheric science and volcanology to advance the current understanding of volcanic impacts and hazards. The week she joined us, it was announced that Anja had been awarded the Arne Richter Award for Outstanding Early Career Scientists of the European Geosciences Union (EGU). Many congratulations to her.

Hugo has taken on the role of lecturer in Functional Materials, jointly with the Physics Department. He joins us from University College London, where he was a Lecturer and ERC starting grant holder. His research focuses on how to synthesize conjugated organic materials for use in next generation electronic devices.

Robert has joined us as lecturer in Statistical Mechanics & Soft Matter, jointly with the Department of Applied Mathematics and Theoretical Physics, from the University of Bath where he was a Reader and an EPSRC Career Acceleration Fellow. His research brings together statistical mechanics and soft matter, including fundamental aspects of non-equilibrium processes.

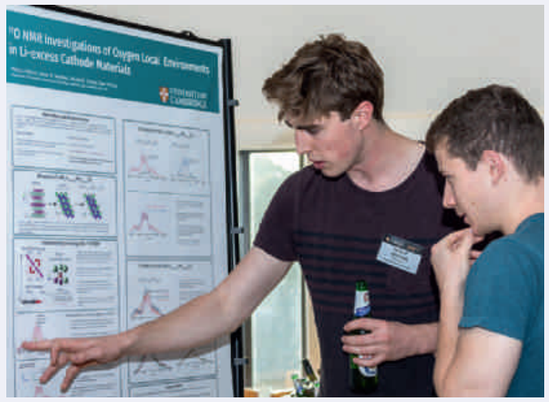
Researcher wins ERC grant

Royal Society University Research Fellow Dr Robert Phipps has received a €1.5 million European Research Council (ERC) starting grant. Dr Phipps' research group is developing new methodology in synthetic organic chemistry. His group currently supports six PhD students; the grant will allow him to recruit a number of postdocs and to purchase equipment to expedite and expand the group's research.

ERC starting grants are designed to help early career researchers develop their research. The grants are highly desirable because they provide a considerable sum that can be used relatively flexibly over five years. This enables researchers who are just starting out to recruit members and invest in equipment without the pressure of writing constant grant applications.

Dr Phipps said: "This grant will help continue and further expand our group's research into incorporating non-covalent interactions in catalytic processes by allowing us to greatly broaden and diversify the projects we are examining in this area, predominantly through recruitment of further researchers to join the group." He adds: "We published our proof-of-concept work that forms the basis of the ERC proposal at the end of last year. It's great to see that the ideas and scientific goals going forwards have been well received by the ERC."

• See more about Dr Phipps' work in the feature in the Research section on page 30.



Showcasing Chemistry

The Department of Chemistry threw open its doors in September to academia and industry and put itself - and its students - on show.

Our postgraduate students were given the opportunity to present their work in public at a **Chemistry Showcase Week** held for the first time this year – a valuable chance to hone their presenting and public-speaking skills.

The second-year PhD students each produced a poster that they had to discuss and defend while the third-years competed to give the best 15-minute presentation. The winning presenters were asked to speak at the Chemistry Networks event (see story right), which took place on the final day. All the second-years presented their posters there.

"Such presentations have not in the past been a compulsory part of the PhD programme," says Deborah Longbottom, Head of Graduate Education. "But being able to stand up and talk to groups of people about your work is such a valuable skill that we wanted to offer this as a learning opportunity across the board."

Faculty members support the introduction of these presentations as a compulsory part of the PhD programme because it adds to the students' experience here. And they are not alone, says Deborah.

"The whole week was arranged by an organising committee made up of PhD students and postdocs. The feedback from the entire student body at the end of the week was very positive. Indeed, the majority would like this to be embedded in the experience of every PhD student educated in this department."

The winning talks were:

- Biological: Daniel Chan, 'Structural and Fragment Screening Studies on EthR-DNA by Native Mass Spectrometry'
- Materials: Olimpia Onelli, 'Natural Disordered Photonic Structures as Inspiration for Novel Materials'
- Physical: Alexander Carr, 'Three-Dimensional Super-Resolution Imaging and Single-Particle Tracking in Eukaryotic Cells using a Double-Helix Point Spread Function'
- Synthesis: Holly Davis, 'A Single Ligand Enables the Meta-Selective Iridium-Catalysed Borylation of Aromatic Ammonium Salts and Amides via Ion Pairing and Hydrogen Bonding'
- Theory: Leen Kalash, 'Computer-Aided Design of Multi-Target Ligands against Key Proteins in Neurodegenerative Diseases'

The department welcomed researchers from academia and industry at the end of September when it held its annual **Chemistry Networks** event – a networking day for current and prospective research partners. Among the guests were pharmaceuticals firm Astra Zeneca, which sponsors a number of PhD students in the Synthesis Research Interest Group.

The day, organised by our Knowledge Transfer Facilitator Dr Yolande Cordeaux, is held to give an overview of the department and the wide array of science research going on here within our five core research areas: Biological, Materials Chemistry, Physical Chemistry, Synthetic Chemistry and Theory. Head of Department Professor John Pyle told guests: "Our Chemistry Department is made up of around 60 academic leads covering a truly wide spectrum of forefront science."

The Chairs of the five Research Interest Groups outlined the work being undertaken by their members and its relevance to real world challenges and industrial applications such as drug discovery, oil recovery, ageing, energy research, fuel cells and batteries, synthetic medicine, computer memory and sensors.

This year for the first time, guests also heard from some of our PhD students who had been taking part in the week-long departmental Chemistry Showcase. *(See story left.)* Professor Pyle told attendees: "This event has grown since last year. About 20 companies are here, including collaborators old and new and spin-out firms. We also have representatives here from local government and the charitable sector. We hope you will all get a lot out of the day and will want to take forward work in areas of mutual interest."

The attendees clearly enjoyed the day. Cambridge ATS (the Cambridge Academy of Therapeutic Sciences) tweeted during the event: "Fascinating insight into the range of research @ChemCambridge. #ChemistryNetworks."

And Bioscience Impact tweeted: "Visiting our colleagues in @ChemCambridge this afternoon for their Chemistry Networks event. #interdisciplinary #research."

Sir John Sulston receives Alumni Medal

Sir John Sulston – who worked on the sequencing of the very first animal genome and went on to lead the UK research in the Human Genome Project – has received the Department of Chemistry Alumni Medal. It was awarded to him in a special ceremony held at the end of October.

The medal is presented "for service to the community that has brought honour to the University of Cambridge Department of Chemistry." Head of Department Prof John Pyle said: "This medal recognises alumni of the department who have made major contributions to society, either locally or globally. It is an opportunity for us to thank and honour them."

He added: "John is a fabulous scientist and we are very proud to be associated with him. His scientific work has been recognised in many ways, including by a Nobel Prize. He has also been a passionate advocate in areas where science and scientists interface with society – not least in arguing the moral position against the exploitation of the human genome for profit and helping keep genomes in the public domain."

Professor Chris Abell, Pro-Vice-Chancellor for Research at the University of Cambridge and Professor of Biological Chemistry here in the department, agreed. "Without John's stand, we wouldn't be in the situation we are now, where we can use genomic information to drive medicine forward and create more personalised and effective treatments. That, to me, ranks as a very high achievement."

Sir John, who prefers to be known as John, came to Cambridge first as an undergraduate in 1960 and stayed on to study for a PhD in organic chemistry under the supervision of Professor Colin Reese, who spoke at the ceremony about his memories of working with John.

He shared the Nobel Prize in Physiology or Medicine in 2002 with Sydney Brenner and Bob Horvitz, for cell lineage research in the nematode worm that gave access to genetic regulation of organ development. In parallel, John and Bob Waterston worked on the nematode worm genome, and were the first to sequence an entire animal genome. John became founding Director of the Sanger Institute in 1992 and from there led UK research in the Human Genome Project.

Other speakers at Alumni Medal award ceremony included Professors Sir Shankar Balasubramanian and David Klenerman, who described their conception and development of next generation Solexa sequencing as a legacy of the Human Genome Project led in the UK by John. Their work has contributed to doctors' ability to sequence individual human genomes rapidly, in less than a day, thereby enabling them to identify drug resistance pathways in cancer patients receiving chemotherapy and alter their treatments accordingly.

John Sulston is the second recipient of the Alumni Medal. The first was Dr Yusuf Hamied in 2016. And there will be more, Prof Pyle reminded the audience, which included many of the department's current students. "We attract great young people to this department. I have no doubt that there are future winners of the Alumni Medal, whose work will bring delight and honour to this department, sitting in this audience now."

Celebrating Bill Jones

An Englishman, a Croation and an Albanian walked into a Materials Chemistry conference... If this sounds like a joke, it's rather appropriate as the former students, postdocs and collaborators who came from far and wide to mark Professor Bill Jones's retirement celebrated a highly-regarded researcher - and a mentor who inspired and challenged them and made them laugh. In between presentations, on topics from crystal engineering to mechanochemistry, speakers shared memories of working with Bill, who came to Cambridge in 1978 on a three-year research fellowship and has just retired 39 years later.

Dr Krešo Bučar came to work with Bill in 2011 as an International Research Fellow and is now a lecturer and Excellence Research Fellow at UCL. He says: "I consider myself very lucky to have spent time in Bill's group; he's a clever, out-of-the-box-thinking kind of scientist whose accomplishments have a tremendous impact on materials research going on in both academic and industrial settings. Bill is also an outstanding mentor, kind and supportive. I learned a lot from him. And I love his sense of humour!"

Former PhD student Chris Greenwell, now a Professor of Earth Sciences at Durham University, agreed. "Bill's sense of humour has caught many people out. One year he told some of his PhD students, just before their viva, they would also be tested on all the postgraduate colloquia they'd attended during the year. This caused complete consternation. They didn't realise Bill's deadpan expression meant he was winding them up..."

Guests at Bill's conference ranged from his own former PhD supervisor, Professor Sir John Meurig Thomas, to his last ever PhD student Gabi Schneider-Rauber. They celebrated Bill's work and contributions to teaching and research, where he established himself initially in the areas of Mössbauer Spectroscopy, transmission electron microscopy, clays and heterogeneous catalysis before working more recently in the area of pharmaceutical materials science. He was described as an exemplary group leader and inspiring mentor.

Dr Dritan Hasa, a recent postdoc of Bill's who is now a Pharmaceutics Lecturer at De Montfort University, said: "I call Bill a 'beautiful mind'. It is always a pleasure to have one-to-one meetings with him, it just opens your mind." Nilwala Kottegoda, Professor at the University of Sri Jayewardenepura and a Principal Scientist in the Sri Lanka Institute of Nanotechnology, says: "I gained many skills under Bill's guidance and from him encouraging me to think differently. I was a more independent person after my PhD than I was when I arrived."

Antarctic Adventurers

Two recent graduates of ours were selected to travel to Antarctica on the 'Homeward Bound' programme, an initiative to help women with science backgrounds into leadership positions. PhD student Hannah Laeverenz Schlogelhofer and fellow Chemistry alumna Alison Davies – now a meteorologist at the Met Office – tell us about their journeys.

Two recent graduates of the Department of Chemistry have been selected for an international leadership programme that culminates in a three-week trip to the Antarctic.

Alison Davies studied Natural Sciences from 2010-2014, specialising in Chemistry for her last two years, and now works as an Operational Meteorologist with the Met Office. For her, the three-week trip on a ship to explore Antarctica on the Homeward Bound expedition in December 2016 was the fulfillment of a long-held dream.

"I'd wanted to go to Antarctica since I was really young and saw documentaries about it," she says. "Experiencing it for myself was humbling as it feels like one of the last true wildernesses. It was a magical place: silent, except for the noise of the boat and the occasional crash from newly-formed icebergs calving from the glacier front."


Hannah working in the lab.

The trip, which comes at the end of a year-long initiative to foster leadership skills in women scientists and create an international network to support them, was not the only highlight for her, she says. "The other woman in my cohort were really inspirational and had a huge range of ages, backgrounds and areas of expertise," she says. "I am ambitious, but I realise that reaching a senior position needs a range of skills and experience. So for me it was really beneficial to start thinking about my skills beyond my academic ones, such as emotional intelligence, visibility, presentation skills and networking. The programme has given me so much to think about and work on – and a group of amazing women to discuss it with when I get stuck."

Homeward Bound is an ambitious international programme aiming to heighten the influence and impact of women with a background in science, technology, engineering, medicine and maths on policy and decision-making.

Around the world, the organisation says, "women are under-represented in leadership positions. Though they are a significant percentage of college graduates and the workforce, they are in the minority when it comes to executive decision-making roles." Homeward Bound hopes that by giving them leadership and strategic skills, a sound understanding of the science, and a strong network, "they will be able to impact policy and decisions towards a sustainable future."


Alison in the Antarctic.

In the year leading up to the Antarctica trip, the women selected take part in leadership coaching. "It's been a very big component of the training," says Alison's fellow Chemistry alumna Hannah Laeverenz Schlogelhofer, who will be travelling to Antarctica in February 2018. Hannah took her Natural Sciences degree here, graduating in 2013, and later returned to the department to work on a project with Dr Silvia Vignolini as part of a Nanotechnology doctoral training programme before embarking on her PhD studies in the Physics and Plant Sciences Departments.

"We're learning about ourselves, as to know how to lead others, you first have to know yourself. That has included a 'life skills inventory' that assesses our personality traits and behavioural traits from a 360-degree perspective."

Like Alison before her, Hannah has a mix of personal and professional motivations for taking part in Homeward Bound. The daughter of an Austrian father and a German mother who spent her holidays ski-touring in the mountains, she says "I have always really valued being outdoors and in remote places where you are surrounded by the natural environment."

And for her too, the trip to Antarctica is much more about the ideas, networks and opportunities it can offer her after she completes her PhD research (into the nutrient interactions between algae and bacteria and the cooperative networks that they form). "The opportunity to be part of a growing network of women in science is key. Homeward Bound aims to take 1,000 women on this journey over 10 years. The idea of this network seems to me so visionary and supportive – particularly to someone like me who has always really enjoyed academic life but is not yet sure where it will take me in the future."

Hannah adds: "An important part of leadership is the narrative that you tell yourself about yourself: it can put you down or lift you up. The Homeward Bound training helps you identify why you have that narrative and to make it positive, so that you can really be the best version of yourself. It's hugely valuable."

READ MORE:

Find out more about the Homeward Bound programme at: https://homewardboundprojects.com.au/about/

See more about Hannah's upcoming Antarctica trip, and the progress of her fund-raising to support it, at: https://chuffed.org/project/female-scientists-journey-to-antarctica-and-into-leadership

"Getting to see and experience Antarctica for myself was incredible and humbling as it feels like one of the last true wildernesses."

Life after Cambridge

"I wanted to specialise in Astrophysics – until Chemistry seduced me." So says alumnus Angelo Amorelli.

"Being here brings back memories," says Angelo Amorelli as he looks round a large lecture theatre in the Department of Chemistry. "Thirty-six years ago, I was sitting here myself. The presentation tools today are different – computers rather than chalk boards – but the content and intellectual stimulation never goes away."

Dr Amorelli is now Vice-President of Group Research at BP and enjoys the fact that this role brings him back to Cambridge regularly because of BP's research collaborations with the university. In October, as every year, he came along to the department with a group of his colleagues for BP Day. This offers an opportunity for executives from the company to hear from PhD students about their research, and for students and academics to attend the BP Keynote Lecture. (See story, page 7.)

"For a company like ours, it's great to engage with academics and students working on the latest research," Dr Amorelli says. "Some of the projects are funded by us. Others may not be, but stimulate ideas for us to pursue in the future. That's an exciting aspect of participating in a day like this."

Dr Amorelli came to Cambridge as an undergraduate in 1981 to study Natural Sciences and ended up falling in love with Chemistry. "I originally wanted to specialise in Astrophysics, but after taking different courses, Chemistry seduced me. In my final year, Professor John Meurig Thomas was lecturing on catalysis and that really excited me. That's ultimately what led me into joining BP: I went into a refining process group where I could practise catalysis at large scale."

And he has stayed at BP ever since, taking the opportunities to work in a variety of areas and countries. "I was always in love with science and felt my career would be framed by working in technology. But my journey has been quite varied. Though I'm a chemist by discipline, I've also worked as a process engineer at an oil refinery, as an economist in corporate strategy and planning, and in business development. And I have gone back to technology: I spent a long time in renewables (solar, wind, biofuels and hydrogen) and helped create BP's alternative energy business."

Such activities have taken him around the world. Dr Amorelli spent time in India and China as part of his work. "I lived in China for four years, working with academics and our businesses in that country," he explains. "China has huge energy challenges to sustain its economic development so that was a really stimulating period of my career."

BP Day in the department also gives the company an opportunity to recruit students for roles at the company going forward. And Dr Amorelli has some advice for anyone pursuing that path: "My career has given me a lot of interesting opportunities. I'd advise any entrants into BP to pursue jobs that they find stimulating and are going to enjoy doing because that is how you are going to do well."

The Chemistry of wine

We held our very popular "Call My Bluff" wine tasting event again in September as part of the University of Cambridge Alumni Festival. Three 'bluffers' – Head of Department Professor John Pyle, Dr Silvia Vignolini and Dr Nick Bampos – held forth on the qualities and properties of the wines being tasted. Audience members had to decide who was telling the truth and who was bluffing, thus proving the untruth of the proverb "In Vino Veritas."

Tasks for the guests included 'guessing the grape' of the two sparkling wines on their tables, completing a wine quiz, and choosing their team names, which included "Blanquetty Blanc" and "Knowledge Holds You Back". (Editor's note: Not necessarily apropos of Cambridge…)

Watch out for next year's event which, as this year, will take place as part of the Alumni Festival.

Physical Chemists reunite 50 years on

It is famously said that if you can remember the 1960s, you were not there. Nevertheless, 50 years on in July more than 20 postgraduate and postdoctoral researchers from that era travelled to Cambridge from across the world to celebrate the time we spent together in the (then) Department of Physical Chemistry. At the start of the decade the legendary Nobel Laureate Professor Norrish was at the helm, followed later by Professor Linnett. Not surprisingly the department had great strength in photochemistry and kinetics, but was also active in electrochemistry and theoretical chemistry. Each of these areas was represented in the July gathering.

The reunion began in the Lensfield Road building. Professor Sanders' welcome address gave a vivid picture of the department's achievements and the challenges faced today in maintaining world class status. We then moved outside for a group photo next to the official lab photograph from 1967 on which many of us featured! Lunch followed at the Panton Arms, a favourite watering hole in the 1960s. In the evening, we dined at Emmanuel College with Professor Brian Thrush as guest of honour. The toasts were to 'absent friends' and the department. We finally took our leave after lunch the following day at The Orchard in Grantchester with friendships renewed and promises to do it again soon!

After Cambridge, many of us assumed roles in academia or research institutes. Others took up new challenges in industry or the public sector. Some moved out of science altogether. All, however, share affection for the time we spent in Cambridge and will look back on this reunion as a very special celebration of that time. We left grateful to the department for hosting us, and that its future looks to be assured. If any readers from our time who we failed to contact would like to join our network, an electronic copy of the reunion publication, 'A Treasury of Short Memoirs', can be obtained from David Rand by emailing David.Rand@csiro.au

John Connor 1963-1969

Write to us

We are always delighted to receive your emails and letters.

Email your comments to: news@ch.cam.ac.uk
Post your letters to: Chem@Cam, Rm142, Department of Chemistry, Lensfield Road, Cambridge CB2 1EW

Alumni Correspondence

Dear Professor Pyle

I hope the Alumni Medal event went well. I sorely missed meeting you all but I have been preoccupied with matters after the sad demise of my husband, Michael Heyrovský. We were both alumni of the department. The following is drawn from the obituary of him that appeared in the journal *Electroanalysis*:

"Michael was the son of the Nobel Laureate Jaroslav Heyrovský, Professor of Physical Chemistry at Charles University, Prague. Michael studied chemistry at Charles University and, after graduating in 1957, came to Cambridge to study for his PhD (in Electrochemical Photoeffect) with Ronald Norrish. He then joined the Institute of Polarography [later the J Heyrovský Institute of Physical Chemistry) of the Czechoslovak Academy of Sciences, where he stayed for the rest of his life. Up until the end of 2016, he was there daily and despite his age, he worked with collaborators on publications, helped with translations, and organised Heyrovský family documents. Sadly, his health deteriorated in 2017.

"For many years, Michael worked closely with his father and would accompany his father on visits abroad as an assistant. Probably the only exception was the visit by Professor Heyrovský to Stockholm in 1959 to receive the Nobel Prize. The communist regime – presumably fearing the family might emigrate – did not allow Michael and his sister Jitka to travel.

"Over many years, Michael's scientific work contributed to our understanding of the photovoltaic effect, mechanisms of oxygen reduction on the mercury electrode, interactions of particles in the electric double-layer, and interactions of molecules and ions with the surface of the polarized electrode. He investigated π-electron interaction of the bipyridyl ion with the electrode surface, catalytic and photocatalytic reduction of water, and electroreduction of bipyridyl and its derivatives. Michael was strongly interested in the history of chemistry, and that of polarography in particular.

"Michael continued to work years after many contemporaries had retired from active science. A man of deep humanistic and scientific education, he epitomised dedication and integrity." (*Electroanalysis* 2017, 29, 2001-2002.)

Best regards. Raji Heyrovska, PhD (1964–1968)

Greetings from…
Tokyo, where I was doing a major review of the AKARI space satellite data archive for the Japanese Aerospace Exploration Agency. It completed an all-sky survey of infrared sources to aid our understanding of how galaxies were formed and how star and planet systems are born. The agency wants to measure the impact of the legacy data in informing current research and follow-up observations.

I had a great time
Eating Japanese food and drinking sake at the AKARI conference 'sky banquet' on the 43rd floor of the Tokyo Dome hotel. This was my third visit to Japan I have collaborators in Sapporo and Tokyo and I really enjoyed it. A fascinating country, many interesting technologies and lots of very smart people to talk to about science.

It was a great trip
And now I'm back at the Open University where I'm an astrochemist, researching star and planet formation. I've come full circle from the sub-millimetre spectroscopy I did with Professor Paul Davies for my PhD (1994-98) in Cambridge, detecting spectra from radicals formed in the upper atmosphere, halo-oxides and HFC photoproducts. Though I left atmospheric spectroscopy (thinking it would not be the basis for an academic career!) for astrochemistry, I'm now using those skills and the knowledge from my PhD in my current research; last week I was hunting for halo-oxide signatures in interstellar spectra, and with one of my PhD students we are developing a unique experiment employing gas phase sub-mm spectroscopy to study the complex molecules found in star-forming regions of the universe.

The picture shows
Me at the Red Gate at Tokyo University.

Dr Helen Fraser (1994-98)
Senior Lecturer in Astronomy , Open University

Greetings from... The Australian Outback where I've been as part of the scientific faculty managing the Bridgestone World Solar Challenge. Hans Tholstrup and I co-founded this 3,000 km event across Australia for cars powered only by direct sunlight 30 years ago. It's a design competition to find the world's most efficient electric car.

Having fun... In the 1960s, I did my PhD with John Agar in the Department of Chemistry, researching fuel cells. The Space Race was on and these power sources were key for spacecraft. It was a lot of fun – and turned me into an electrochemist. Since then, I've been on a fascinating journey on the electrochemical road to sustainability via the increasing uptake of renewable fuels.

We had a great trip... Emigrating to Australia in 1969. I walked into my new office at almost the exact minute Neil Armstrong set his left boot on the surface of the moon. I immediately thought of Agar's friend Tom Bacon, a regular visitor to the Department of Chemistry, whose pioneering work on fuel cells had enabled Apollo 11 to undertake this epic journey into space.

The picture shows... Me (left) at this year's World Solar Challenge with Hans Tholstrup and his Quiet Achiever - the world's first solar car in which, in 1983, he travelled 4,500km across Australia from Perth to Sydney.

David A J Rand AM PhD ScD FTSE
Honorary Research Fellow, Commonwealth Scientific and Industrial Research Organisation

- David was one of the organisers of the Physical Chemists' 50 Year Reunion last July. See page 19 for story.

Karen Stroobants

Women in Chemistry

Dr Karen Stroobants is a postdoctoral researcher in the Centre for Misfolding Diseases. She researches membrane protein aggregates and their potential role in neurodegenerative diseases.

"The most rewarding thing for me as a scientist is discovering things," says Dr Karen Stroobants. "There can be many days when your experiment does not work. But then there are a few days a year when an experiment suddenly works out well, or you discover something, and that balances out the frustration."

Toy microscope

Karen's interest in science started when she was a girl. At home in Belgium, she had a toy microscope and made an X-ray machine out of a cardboard box to scan her stuffed toys. When she started Chemistry lessons aged 14, one proved pivotal. "The day I learned about Marie Curie, I came home and told my mother I was going to become a chemist," she says.

It therefore means a great deal to her that, after receiving her undergraduate, Masters and PhD degrees from the University of Leuven, she secured a Marie Sklodowska-Curie Fellowship to fund her research in the Centre for Misfolding Diseases (CMD).

Karen's research has always straddled the borders of chemistry and biochemistry. As part of her Masters she had spent a year in industry with Phillips Research in the Netherlands, "working on cardiovascular disease detection devices, where the final goal was to take blood from a patient and inject it into a chip-like device that could determine the risk of cardiovascular diseases by detecting certain molecules in the blood," she says. It was there she began using the biophysical techniques that have become a theme in her research.

She built further on her experience of using them on her return to postgraduate research, this time characterising the interactions between proteins and inorganic complexes that were being developed as artificial enzymes. This experience proved helpful when, after her PhD, Karen's curiosity turned to medical-related topics. When she discovered that the Centre for Misfolding Diseases uses biophysical techniques to study the protein aggregation important in Alzheimer's and other diseases, it seemed an ideal match. After several visits, Karen started as a postdoc in the CMD in February 2015.

Misfolding proteins

Here she has been investigating the propensity of membrane proteins to misfold and self-assemble into amyloid fibrils, which are associated with a wide range of medical conditions such as Alzheimer's and Parkinson's diseases. Up to now, Karen explains, most studies have focused on cytosolic proteins, even though membrane proteins make up approximately 30 percent of the human proteome. But in a paper published in *Biochemistry*[1], Karen and her colleagues demonstrated that membrane proteins, like cytosolic proteins, can form amyloid-like fibrils under destabilizing conditions.

"It generally is more difficult to study membrane proteins, which often require expression and purification procedures in lipid or detergent environments before they can be studied," says Karen. But membrane proteins have a high propensity to aggregate because of their hydrophobic nature, which led Karen and her colleagues to suspect they might have an important role in diseases associated with protein misfolding.

Karen chose to study lactose permease (LacY) from *Escherichia coli* because it is an established protein that has been well characterized. The team used different biophysical techniques such as spectroscopy, X-ray fibre diffraction, circular dichroism spectroscopy and transmission electron microscopy to study the protein. The *Biochemistry* paper was well received. A subsequent viewpoint article described the work as setting the stage for future biophysical and biological studies of membrane protein aggregation, concluding: "This particular study is important, because transmembrane proteins make up such a large percentage of the human proteome."[2]

Karen has been influenced by several role models. They include Professor Dame Athene Donald, the Master of Churchill College where Karen is a Postdoctoral By-Fellow. "She is not only a brilliant physicist but also has a profound interest in science policy."

Karen also admires Professor Dame Carol Robinson, who became the first female Professor in Chemistry both in Cambridge and Oxford, after taking an eight-year career break to take care of her children. But above all, there is Marie Curie. "I have been intrigued by her life path and accomplishments from the first time I heard about her, and she remains my most important role model."

Beyond the bench

Outside the lab, Karen is current president of the Cambridge University Science and Policy Exchange (CUSPE), an organisation run by early career researchers that aims to provide insight into the process of policy design, raise awareness of the communications difficulty commonly experienced during science-policy exchanges and build stronger links between its members and policy-makers. Karen, who has a strong interest in science policy, believes in the importance of good communications between academia, industry, policy makers and society. She devotes time to CUSPE and other activities, including the policy work group of the Marie Curie Alumni Association, hoping that "these efforts might be valuable and contribute to restoring the importance of evidence-informed policy in a world currently ruled by 'alternative facts'."

"I'm thinking about going into policy," she adds. "It's something I love as much as chemistry." What does Karen think the future will bring her? She says: "With the right balance between science and policy initiatives, I'm keeping my options open for now. The future will tell."

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2. *Transmembrane Proteins: Amyloids hidden in plain sight?* Nicholas L. Truex and James S. Nowick, Biochemistry (2017), 56 (36), pp 4735-4736 (DOI: 10.1021/acs.biochem.7b00758)

As I see it...

Clair Castle

She used to manage business collections and curate rare volumes of natural history. Now, as Department of Chemistry Librarian, Clair Castle works more with data than books. As she told a meeting of the International Federation of Library Associations and Institutions in Warsaw earlier this year, research data management is a big challenge for departments like Chemistry. But collaboration and training mean it is not insurmountable.

"To 'curate' means to take care of. While we are curating data, we are curating people as well."

Being the librarian here is more about managing information than it is about printed collections.
I used to work for the University's Department of Zoology, looking after a very valuable collection of rare natural history books going back to the 15th century. Many contained beautiful illustrations of specimens collected by early travellers and explorers, like the Victorian ornithologist John Gould who went to Australia in the 1840s to document the animals there. I miss that part of my job. But I came to Chemistry because after 13 years in Zoology, I needed a change. Here, we work with information more than we do with books and I wanted to get experience in that.

I got involved with Research Data Management because...
It was becoming an increasing obligation for researchers to make their papers open-access. Higher Education funders and research councils were stipulating that the research should be accessible by the taxpayers who are funding it.

As a result, we needed to know how to help researchers comply with this requirement. And now, there's a requirement in many cases for the research data that supports the published paper to be made openly available too. So the challenges of research data management have spiralled. In this department, datasets can range from spreadsheets to magnetic resonance images to dynamic simulations that can be terabytes of data each. That's a huge amount of information and we are now training researchers in ways to store it, share it and preserve it for their own benefit as well as for that of society.

I am training PhD students to manage their research data.
The University's Office of Scholarly Communication was looking for people to help them with research data management. They also wanted to train PhD students in this, to help get them into good research habits for the future. They asked me if some of our first-year PhD students would trial the training programme they were offering. I talked to Deborah Longbottom, our Head of Graduate Education, and she was very open to the idea. We ran the training in collaboration with them and it was very successful. That was two years ago and since then it has grown. It is now a compulsory part of the PhD programme and I have customised the training materials specifically for this department. And in addition to working with PhD students, I am now rolling out training to postdocs as well.

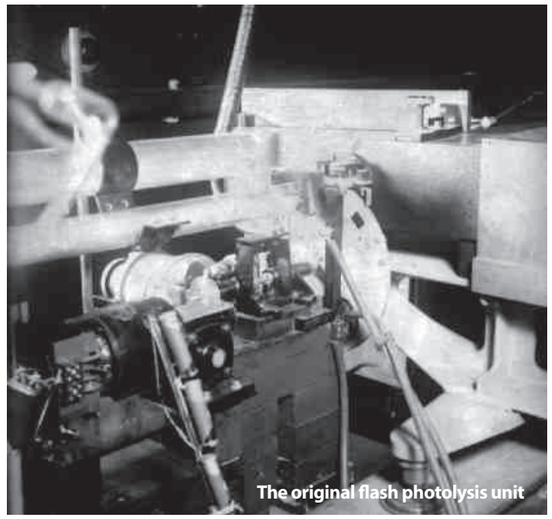
While we're curating data, we're curating people as well.
At the conference in Warsaw, another speaker talked about our role in curating people as well as data. It struck a chord with me. I thought, 'yes, that's right'. We have to interact with people, encouraging researchers and helping them develop their skills so they know what they need to do and are not going to jeopardise their funding in future by failing to comply.

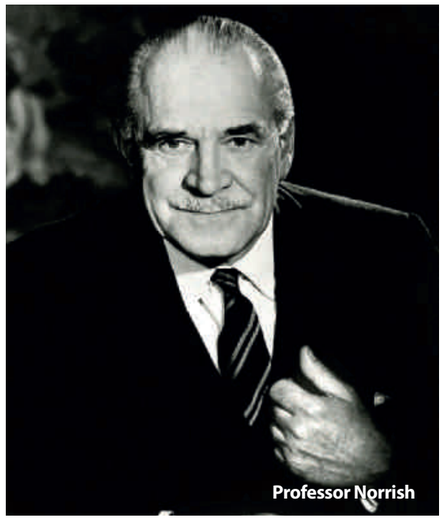
Librarians like to help.
As professionals, we enjoy helping researchers. I've been mentoring three 'data champions' in the department. Today I watched one of them, a postdoc, voluntarily running a course showing other researchers how to use a data management tool for effective version-control of files. It was very satisfying seeing him developing his skills and sharing his knowledge with others.

The next big challenge...
... in Chemistry is text and data mining – the computational process of discovering and extracting knowledge from data such as the scholarly content in journals. There's conflict – publishers wish to maintain control of how their content is used. It's a skill that librarians are well placed to support researchers with.

Quick as a Flash

Professor Ronald Norrish and Lord Porter built their first flash photolysis unit to study extremely fast chemical reactions in the late 1940s. They did so using army surplus kit bought for a song from local scrap merchants. The resulting work opened up a new field of research and won Norrish and Porter the Nobel Prize for Chemistry. On the 50th anniversary of the prize Professor Brian Thrush, Norrish's former research student, tells the story.


The original flash photolysis unit


Professor Norrish


Professor Thrush

The past, as L P Hartley observes at the start of *The Go-Between*, "is a foreign country: they do things differently there." They certainly did things differently in Cambridge after the Second World War. The country was still constrained by rationing, so food was scarce. But government surplus stock was available and could be bought very cheaply. That was a boon to enterprising scientists like Professor Ronald Norrish (who as a child had conducted his first chemistry experiments in the garden shed) and George Porter, a former radar engineer officer in the navy, who came to work with him in 1945.

"We could get the equipment for next to nothing," Professor Thrush says. "Local scrap merchants had rows of rather fancy valves, and the radio receivers that were used for radar. We could buy such things for not much more than the cost of their weight in scrap metal."

Unlikely as it sounds now, the device Norrish and Porter built with these items would go on to win them the Nobel Prize for their "studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very short pulses of energy". Their work opened up a new way of looking at short-lived species in elementary chemical reactions, in particular the molecular fragments known as free radicals.

("This would lead to lots of jokes during the McCarthy era," Professor Thrush recalls. "Norrish once went to the USA and when officials asked the subject of his lectures, he foolishly replied 'free radicals'. It took him four hours to get through immigration…")

Norrish and Porter wanted to study, by flow techniques, the free radicals produced in gaseous chemical reactions using short pulses of light. To progress this work, they decided to make a flash lamp of the kind photographers use, but thousands of times more powerful.

"To get enough free radicals to measure, you need to use a very intense light source," Prof. Thrush says. "Norrish's first idea was to use a very powerful searchlight to focus ultra-violet light on flowing gases and to break the molecules up sufficiently that you could see the free radicals produced. But the searchlight mirrors proved to be poor reflectors of ultraviolet light."

So Norrish and Porter turned to using the flash discharge tubes that had been developed for use in night-time aerial photography of enemy targets by British planes. "These were brighter by orders of magnitude," says Professor Thrush, "though with a very short duration, so that a second flash had to be used to record the absorption spectrum of the resulting products."

He became Norrish's research student in 1950 and was involved in building the second, improved, flash photolysis unit. "Free radicals only last about a thousandth of a second so you need to observe them quickly using a second flash of light taking a long path through the reaction vessel to photograph an absorption spectrum. (The photograph shows the original unit in which the two flashes were timed by a rotating wheel.) I designed and built an electronic timer to control the period between the two flashes, and I got it down by a factor of a hundred. And that was for my PhD."

The flash photolysis method Norrish and Porter developed would later be lauded in the Nobel Prize presentation speech for enabling the study of many fast reactions that scientists previously had only been able to guess at. The award of the Nobel Prize to the two men came, by happy coincidence, two days before Norrish's 70th birthday. "I had already arranged a dinner to celebrate it and George had been invited to present him with a Festschrift written by his former students who were there. And it was quite a dinner: it began at seven in the evening and we finally got up from the table at 2 am!"

The work of Norrish and Porter has had quite a legacy over the years, says Professor Thrush. "The technique of flash photolysis has found many applications and the equipment used has ranged from commercial bench-top items to the large grating spectrographs of Gerhard Herzberg's group in Ottawa, who obtained and analysed the spectra of many small free radicals, which the Cambridge group had sought."

Professor Jeremy Sanders adds: "This fundamental science has led to a revolution in our understanding of atmospheric chemistry, including the ozone hole (and how to cure it) and climate change."

READ MORE:
"The Nobel Prize in Chemistry 1967". Nobelprize.org. Nobel Media AB 2014. www.nobelprize.org/nobel_prizes/chemistry/laureates/1967/

"This fundamental science has led to a revolution in our understanding of atmospheric chemistry, including the ozone hole and climate change."

Remembering our Nobel Laureates

Sixty years after Lord Todd won the Nobel Prize in Chemistry, his work and legacy is remembered by Professor Sir Shankar Balasubramanian.

"Organic chemistry deals with matters of truly vital importance and in some aspects it may prove to hold the keys to life itself." These words are taken from the Nobel Lecture given by Lord Todd, who received the Nobel Prize in Chemistry in 1957. This year we celebrate the 60th anniversary of the award to Lord Todd, who was appointed Professor of Organic Chemistry here in 1944. He worked during the golden era in which organic chemistry made enormous contributions to our understanding of natural products important to biology.

In those days the chemical structures of complex biomolecules had to be defined and proved by degradation to simpler components followed by organic synthesis. Todd completed the total synthesis of a wide variety of natural products, though was best recognised for his synthesis of nucleotides and nucleotide coenzymes. During the 1940s, he contributed to the understanding of the structure and conformation of nucleosides, particularly establishing the beta configuration of the glycosylic linkage. He also pioneered synthetic methods for phosphorylating nucleosides to form nucleotides, the constituent building blocks for the nucleic acids (RNA and DNA), and a number of coenzymes.

His work, carried out with Dan Brown, established the correct chemical structure of nucleic acids, allowing James Watson and Francis Crick to then determine the three-dimensional structure of the DNA double helix. Todd mastered the synthesis of adenosine di- and tri-phosphates (ADP and ATP) as well as developing chemistry for the synthesis of dinucleotides. Together with Michelson (1955) he achieved the synthesis of a dinucleotide with a 3′ to 5′ phosphate diester linkage, marking the first step towards developing methods for oligonucleotide and ultimately DNA and RNA synthesis. Todd was awarded the Nobel Prize in Chemistry in 1957 in recognition of his contributions to nucleotides and nucleotide coenzymes.

"His work... allowed James Watson and Francis Crick to determine the three-dimensional structure of the DNA double helix."

AN ALUMNUS REMEMBERS LORD TODD

David Rand: I had the temerity in the early 1960s to seek an interview with Lord Todd with the prospect of conducting post-graduate research on nucleotides. It was an unnerving experience. I entered a room that surely was more befitting a stately home than a chemistry laboratory.

Lord Todd, a tall man, was reclining so far back in his chair that I was obliged to converse throughout with the soles of a pair of shoes which rested atop the highly-polished desk. I have no memory of what passed between us except for my interrogator's final words, delivered in a strong Scottish brogue: "Remember, laddie, many are called, but few are chosen!" When the examination results were published, I was not among the happy few who were summoned to the Department of Organic Chemistry to become 'Toddlers'..."

- Do you have memories of Lord Todd? If so, please share them with news@ch.cam.ac.uk

'Blue halo' helps bees

Vignolini Group

An interdisciplinary group of researchers including Chemistry's Dr Silvia Vignolini has found that 'messy' microscopic structures on the petals of some flowers manipulate light to produce a blue colour effect that is easily seen by bees.

These nanostructures scatter light particles in the blue to ultraviolet colour spectrum, generating a subtle effect that scientists have christened the 'blue halo'. By manufacturing artificial surfaces that replicated 'blue halos', scientists were able to test the effect on pollinators, in this case foraging bumblebees. They found that bees can see the blue halo, and use it as a signal to locate flowers more efficiently.

The study was conducted by a multidisciplinary team of scientists from the Departments of Plant Sciences, Chemistry and Physics along with colleagues from the Royal Botanic Gardens Kew and the Adolphe Merkele Institute in Switzerland.

While the ridges and grooves on a petal surface line up next to each other "like a packet of dry spaghetti", when analysing different flower species, the researchers discovered they vary greatly in height, width and spacing – yet all produce a similar 'blue halo' effect. In fact, even on a single petal these light-manipulating structures were found to be surprisingly irregular. This is a phenomenon physicists describe as 'disorder'.

"The huge variety of petal anatomies, combined with the disordered spacing of their nanostructures, would suggest that different flowers should have different optical properties," said Vignolini.

"However, we observed that all these petal structures produce a similar visual effect in the blue-to-ultraviolet wavelength region of the spectrum – the blue halo."

The researchers conclude that these "messy" petal nanostructures likely evolved independently many times across flowering plants, but reached the same luminous outcome that increases visibility to pollinators – an example of what's known as 'convergent evolution'. "We had always assumed that the disorder we saw in our petal surfaces was just an accidental by-product of life – that flowers couldn't do any better," said senior author Professor Beverley Glover, plant scientist and director of Cambridge's Botanic Garden.

"It came as a real surprise to discover that the disorder itself is what generates the important optical signal that allows bees to find the flowers more effectively.

"Many flowers lack the genetic and biochemical capability to manipulate pigment chemistry in the blue to ultraviolet spectrum," said Vignolini. "The presence of these disordered photonic structures on their petals provides an alternative way to produce signals that attract insects." And the research may have applications beyond enhancing our understanding of how flowers attract pollinating insects.

"We were interested in the way that plants use these simple but messy nanostructures for light management – and found that though they are simple one-dimensional structures, they are really powerful. This could potentially help us understand how to improve light management in man-made structures," Vignolini says.

REFERENCE:
Moyroud, E. et al. *'Disorder in convergent floral nanostructures enhances signalling to bees. Nature;* 18th October 2017; DOI: 10.1038/nature24285

Tailoring catalysts to incorporate non-covalent interactions

Phipps Group

Researchers in the Phipps group have developed novel catalysts which are able to engage in non-covalent interactions with substrates. With judicious design, they are able to control positional selectivity in the conversion of common C-H bonds to versatile C-B bonds in a range of different molecules.

As usual, Royal Society University Research Fellow Dr. Robert Phipps is thinking about molecules. "I'm trying to create molecules in a selective and different way," says Robert, who was recently awarded a prestigious €1.5 million European Research Council grant to further his research into exploring new approaches to molecule assembly. (See story on page 11).

New molecules have many applications, from consumer goods such as paints and computer chips to the fungicides used in industrial agriculture. They are perhaps used most widely in the pharmaceutical industry to develop drugs ranging from antibiotics, anti-inflammatories and asthma treatments to the latest anti-cancer drugs.

Synthetic chemists tend to be most familiar using covalent bonds to assemble molecules. Robert says: "If you go back to a fundamental level, the normal way we think about chemical bonds is we think about two atoms with a shared pair of electrons between them, which is what we're taught as undergraduates.

"But there is this parallel type of interaction which is called a non-covalent interaction—in the simplest sense it's still two atoms interacting with each other, but they're not sharing a pair of electrons in the same way. The attraction is typically weaker and the key aspect for us is that it is readily reversible." This type of interaction has been used extensively by supramolecular chemists to construct all manner of fantastic molecular structures, but Robert and his research group are interested in incorporating them into new catalyst designs.

"Considering in biology how effectively enzymes use non-covalent interactions to perform nature's catalysis and achieve amazing feats of selectivity, we thought maybe we could learn something from that. It's quite a different approach to how we as synthetic chemists would traditionally go about making molecules," he says.

"And in fact over the last 15 years there's been a new field of chemistry emerging called organocatalysis, where synthetic chemists have realised they can incorporate these non-covalent interactions into small molecule catalysts. You don't need the elaborate structure of an enzyme to get synthetically useful levels of selectivity."

A major concern in this area is how to control enantioselectivity – the selective synthesis of one mirror image form of a molecule over the other. Whilst this is an important goal, the Phipps group sees the potential in harnessing these interactions to tackle a different selectivity challenge – that of regioselectivity, which necessitates being able to control what position in a molecule a reaction occurs at.[1]

"This is very important because, to use the example of pharmaceuticals, the shape of the molecule is hugely significant. You could have the same molecular formula, but a different shape could cause a totally different effect in the body," says Robert.

In their early explorations, group members have been focusing on the conversion of an aromatic carbon-hydrogen bond to a carbon-boron (C-B) bond. C-B bonds are very versatile, meaning they can be transformed into numerous other types of bonds, including carbon-nitrogen, -oxygen, -halogen, and of course carbon-carbon bonds.

"If you can put the boron in selectively at the desired position then you have numerous avenues open for its elaboration in very short order." This is a particular advantage in drug discovery where the ability to make many analogues as quickly as possible is highly sought after.

Last year, PhD students Holly Davis and Madalina Mihai found that they could use an ion-pairing interaction between a negatively charged catalyst and a positively charged substrate to control the position at which the C-B bond formation occurred.[2]

"The use of ion pairs to influence this type of positional selectivity was quite unprecedented. Up until now most people would think the lack of directionality would scupper such a strategy, but our study showed this not to be the case," says Robert about their work.

Furthermore, Holly also discovered that the catalyst they had designed to operate in 'ion-pairing mode' was also able to operate very well in 'hydrogen-bonding mode'. If the substrate molecule contained a hydrogen bond donor, such as an amide, the anionic catalyst was able to engage in a hydrogen bonding interaction which was also highly effective in directing the position of C-B bond formation. Working together with PhD student Georgi Genov, they found the scope to be very broad and the results of the study were published very recently[3]

Robert emphasises that these studies are just the beginning. "We are very excited about these results as they prove that our approach is not only viable but also has the potential to be very powerful and general."

REFERENCES:

1. HJ Davis, RJ Phipps: *Harnessing non-covalent interactions to exert control over regioselectivity and site-selectivity in catalytic reactions.* Chem. Sci. (2017) 8, 864. DOI: 10.1039/C6SC04157D

2. HJ Davis, MT Mihai, RJ Phipps: *Ion Pair-Directed Regiocontrol in Transition Metal Catalysis: A Meta-Selective C–H Borylation of Aromatic Quaternary Ammonium Salts*. J. Am. Chem. Soc. (2016) 138, 12759. DOI: 10.1021/jacs.6b08164

3. HJ Davis, GR Genov, RJ Phipps: *Meta Selective C-H Borylation of Benzylamine, Phenethylamine and Phenylpropylamine-Derived Amides Enabled by a Single Anionic Ligand*. Angew. Chem. Int. Ed. (2017) 56, 13351. DOI: 10.1002/anie.201708967

Silk micrococoons could protect sensitive molecules

Knowles Group

Led by Professor Tuomas Knowles, Chemistry researchers have created microscopic versions of the cocoons spun by silkworms. The tiny capsules, invisible to the naked eye, can protect sensitive molecular materials and could prove a significant technology in areas including food science, biotechnology and medicine. Writing in the journal *Nature Communications*, the researchers suggest that these "micrococoons" are a potential solution to a common technological problem: how to protect sensitive molecules that have potential health or nutritional benefits but can easily degrade and lose these favourable qualities during storage or processing. The study argues that sealing such molecules in a protective layer of silk could be the answer.

"It's a common problem, having active molecules that possess beneficial properties but are challenging to stabilise for storage," Professor Knowles says. "A conceptually simple, but powerful, solution is to put them in tiny capsules. These are typically made from synthetic polymers, which can have a number of drawbacks. We've been exploring the use of fully natural materials for this purpose and are excited by the potential to replace plastics with sustainable biological materials for this purpose."

The capsules were made using a specially-developed microengineering process that combines the power of microfluidic manufacturing with the value of natural silk. The process mimics on the microscale the way in which *Bombyx mori* silkworms spin the cocoons from which natural silk is harvested. The resulting micron-scale capsules comprise a solid and tough shell of silk nano-fibrils that surround and protect a centre of liquid cargo, and are more than a thousand times smaller than those created by silkworms. The same technology could also be used in pharmaceuticals to treat a wide range of severe and debilitating illnesses. In the study, the researchers successfully showed that silk micrococoons can increase the stability and lifetime of an antibody that acts on a protein implicated in neurodegenerative diseases.

REFERENCE:

Silk micrococoons for protein stabilisation and molecular encapsulation, Nature Communications 8, 15902 (2017).

New compound targets brain tumours

A new compound that in tests has shrunk brain tumours without causing harmful side effects has been developed by a team of researchers including the Department of Chemistry's Professor Robert Glen.

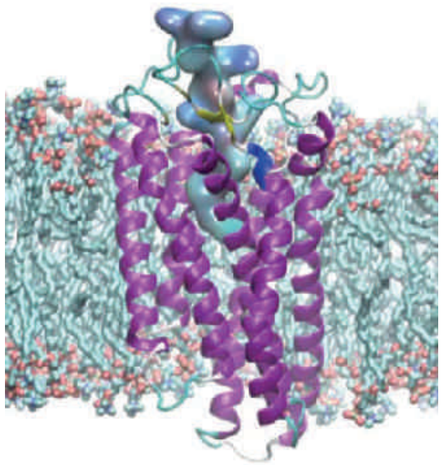
The research, which also involves collaborators at Cambridge's Addenbrookes Hospital and the University of Nantes, has just been published in the journal *Brain*.

Together, the researchers have been studying a potential new treatment for glioblastoma, the most common and lethal primary brain tumour in adults. "In humans, glioblastoma is a very nasty disease," says Professor Glen. "Following diagnosis, most patients only live 15-16 months even after surgery to remove the tumour, chemotherapy and radiotherapy."

Traditional cancer therapies target the tumour itself. But to try and find a chink in this cancer's armour, the researchers have taken a different route. They have designed a compound, known as MM54, which is an antagonist that blocks the action of an important g protein-coupled receptor called apelin. The natural agonist for the apelin receptor is a peptide, secreted in the blood vessels around the tumour, which helps to sustain them.

"The antagonist MM54 blocks the expression of this peptide and in doing so, it denies the tumour the growth potential it needs to survive," says Professor Glen.

When researchers in Nantes grew tumourspheres from human glioblastoma cells *in vitro*, the researchers could see the apelin blocker MM54 slowing their growth. Further tests in the lab have shown the compound shrinking the tumour *in vivo*. "One of the most exciting images from the *Brain* paper is the complete arresting of tumour growth and reduction in tumour size after dosing with MM54," Professor Glen says.



He adds, "We think this compound could also work on a number of other tumours, for example, tumours developed in lung cancer, renal cancer and colorectal cancer. Blocking the action of the apelin receptor blocks the messages that sustain the cancer."

Professor Glen has been collaborating for several years with Dr Anthony Davenport at the Division of Experimental Medicine and Immunotherapeutics at Addenbrookes Hospital. It was while looking for potential drug targets for vascular disease that they discovered MM54, the first competitive antagonist (or blocker) for apelin, a receptor on the surface of cells that carries specific signals from the outside of the cell to the inside. They then looked to see what MM54 could do.

It was reported in the literature that apelin is involved with blood vessel formation. This was of interest because researchers have been exploring for years how to block angiogenesis – the production of blood vessels – in tumours. Additionally, apelin turned out to have other effects, such as maintaining cell viability in low oxygen (ischaemic) environments like the centres of tumours.

For these reasons, apelin looked like a promising target, so Glen and his Cambridge colleagues set up a collaboration with researchers in Nantes to test MM54 (and also a newer version antagonist called MM193) in different models of the cancer glioblastoma. The subsequent testing has looked so promising, with MM54 showing remarkable anti-cancer properties in the models, that the researchers are now hoping to move it to the next stage.

"The *Brain* paper shows that apelin receptor expression is up-regulated in these cancers – i.e. that the cancer cells are interacting with the apelin peptide derived from endothelial cells in the blood vessels around the cancer. We're trying to switch off that mechanism."

Professor Glen adds, "It's very exciting. This is a different kind of cancer treatment entirely because unlike the current therapy, temozolomide, this is not a genotoxic drug, and it is synergistic with the current therapy."

REFERENCE:
Elizabeth Harford-Wright, Gwennan Andre-Gregoire, Kathryn A Jacobs, Lucas Treps, Sophie Le Gonidec, Heloise M Leclair, Sara Gonzalez-Diest, Quentin Roux, François Guillonneau, Delphine Loussouarn, Lisa Oliver, François M Vallette, Fabienne Foufelle, Philippe Valet, Anthony P Davenport, Robert C Glen, Nicolas Bidere, Julie Gavard: *Pharmacological targeting of apelin impairs glioblastoma growth*. Brain, awx253, https://doi.org/10.1093/brain/awx253

Thermal gradients shown by numbers

Frenkel Group

Electric charges are ubiquitous, yet isolated magnetic charges ('magnetic monopoles') have never been detected in experiments. In 2016, Professor Daan Frenkel predicted that heated or cooled nanoparticles should interact with each other as if they are monopoles and that they should move in inhomogeneous fields[1]. However, unlike normal electrical charges, they would not move under the influence of an applied homogeneous field.

Now a team of researchers from Frenkel's group, in collaboration with Christoph Dellago of the University of Vienna, have confirmed this prediction.

Using molecular simulations, the team were able to demonstrate that a pair of heated or cooled colloidal particles in a dipolar solvent behave like oppositely charged electric or magnetic monopoles. In particular, they showed that the field distribution around these particles agrees quantitatively with the theoretical predictions for a pair of oppositely charged electric or magnetic monopoles. However, in other respects, the nonequilibrium colloidal particles do not behave as monopoles: they cannot be moved by a homogeneous applied field.

Lead author, PhD student Peter Wirnsberger said: "This intriguing result advances our understanding of the complex interactions in nanoscale systems out of thermal equilibrium. It is likely that there are many closely related phenomena in nanoscale devices. However, the effect has not yet been observed in experiments."

REFERENCE:
1 Hot nanoparticles in polar or paramagnetic liquids interact as monopoles, Frenkel D (2016) J Phys Chem B 120:5987-5989.

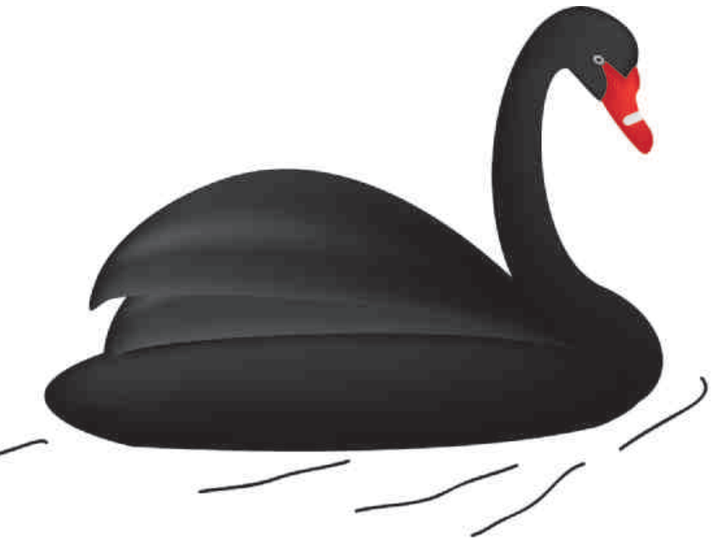
RESEARCH:
Numerical evidence for thermally induced monopoles, Wirnsberger P et al, (2017) PNAS 114:19, 4911-4914.

Predicting medicine's 'Black Swans'

Bender, Goodman & Colwell Groups

The first project of the Cambridge Alliance on Medicines Safety will be a three-year collaboration to predict the safety of current and future medicines.

Members of the Bender, Goodman and Colwell research groups, all located in the Department of Chemistry, will work together to analyse data to determine the links between a compound's structure and its potential adverse effects when used as a medicine. The project focuses on what the team call "Black Swans" – the toxic effects of compounds that could have been predicted in hindsight.



Up to now, this type of data analysis has been difficult to perform because of the lack of available data, both in quality and quantity. Now the researchers will not only have access to public sources, but also to the historical compound profiling data held by GlaxoSmithKline, which has funded the three-year project.

The team will examine the data using high throughput screening techniques and mathematical analyses to derive Adverse Outcome Pathways (AOPs) that reveal the links between compounds and their adverse effects.

"Currently, this step is difficult to perform due to paucity of data as well as many AOPs not being sufficiently quantitative in nature, which is what the current project aims to improve upon," said Dr Andreas Bender, one of the group leaders. He expects other major pharmaceutical companies to join the project, which will provide even further data for analysis.

The Cambridge Alliance on Medicines Safety is part of the Cambridge Academy of Therapeutic Sciences (CATS), which has been operational since March 2017. CATS aims to connect industry and academic expertise to drive therapeutic development. It spans across disciplines in the University, as well as teaching and research aspects related to drug discovery and development.

READ MORE:

Cambridge Alliance on Medicines Safety: www.ats.cam.ac.uk/what-we-do/cambridge-alliance-medicines-safety
Cambridge Academy of Therapeutic Sciences: www.ats.cam.ac.uk

Noticeboard

Recognitions and awards

Professor Clare Grey
Elected a Fellow of the Electrochemical Society.
Awarded the 2017 Société Chimique de France French-British prize.
Named as the first ever recipient of the International Solid State Ionics Galvani-Nernst-Wagner Mid-Career Researcher Award.

Professor Michele Vendruscolo
Awarded the Giuseppe Occhialini Medal and Prize jointly by the Institute of Physics and the Italian Physical Society.

Dr Volker Deringer
Awarded a Leverhulme Early Career Fellowship.

Professor Ali Alavi
Elected to the International Academy of Quantum Molecular Science.

Recognition
Immaterial, a start-up founded by alumnus **Dr Andrew Marsden**, has made the top 20 in the Innovation Forum's Imagine IF! global accelerator programme and will pitch for thousands of dollars in prizes in an international head-to-head in December. Andrew completed his undergraduate degree in Chemistry here before studying for a PhD in Protein Biophysics.

Appointments and promotions

New teaching fellows
We are delighted to have appointed two new teaching fellows in the department.

- **Dr Robert Less** is a joint teaching fellow between the Department and Murray Edwards College in inorganic chemistry.
- **Dr Stephanie Smith** is a joint teaching fellow between the Department and Pembroke College in organic chemistry.

We are looking forward to working with them both over the next three years.

Promotions
The Department of Chemistry is pleased to announce several academic promotions.

Stuart Clarke, Sophie Jackson and **Erwin Reisner** (below left) have been promoted to professor, **Silvia Vignolini** has been promoted to a readership, and **Janet Kumita** (below right) has been promoted to principal research associate.

Congratulations to our colleagues on their accomplishments.

Upcoming events

Lewis Lectures
Speaker: **Professor Lutz Gade**, Heidelberg University

27 February 2018:
'Identification of Active Species and Mechanistic Pathways in the Enantioselective Catalysis with 3d Transition Metal Pincer Complexes'.
Wolfson Lecture Theatre, 14:00-15:00.

1 March 2018:
'Perylene-Based Poly(N-Heterocycles): Organic Semiconductors, Biological Fluorescence Probes and Building Blocks for Molecular Surface Networks'.
Wolfson Lecture Theatre, 14:00-15:00.

Chemistry Open Day
17 March 2018

For details of more talks taking place in the department, please see www.ch.cam.ac.uk/talks/all-upcoming

Season's Greetings from the Department of Chemistry

'Tis the season for... giving and receiving

Prestigious awards such as the Nobel Prize rightly recognise groundbreaking research. But an additional reward is when we see that research applied in tackling significant real-world problems.

Genomic information is now being used to drive medicine forward, enabling more personalised and effective treatments for cancer patients. Such life-changing discoveries wouldn't be possible without the work of scientists like our Alumni Medal recipient Dr John Sulston, who led the UK's contribution to sequencing the human genome, and our academics Shankar Balasubramanian and David Klenerman whose development of next-generation sequencing has helped dramatically speed up the process and reduce the cost.

If you would like to help us find the next Nobel Laureate or life-changing discovery by supporting our students, researchers and academics, or providing the environment and the tools they need to excel, please contact Head of Department Professor John Pyle at **chemhod@hermes.ch.cam.ac.uk**