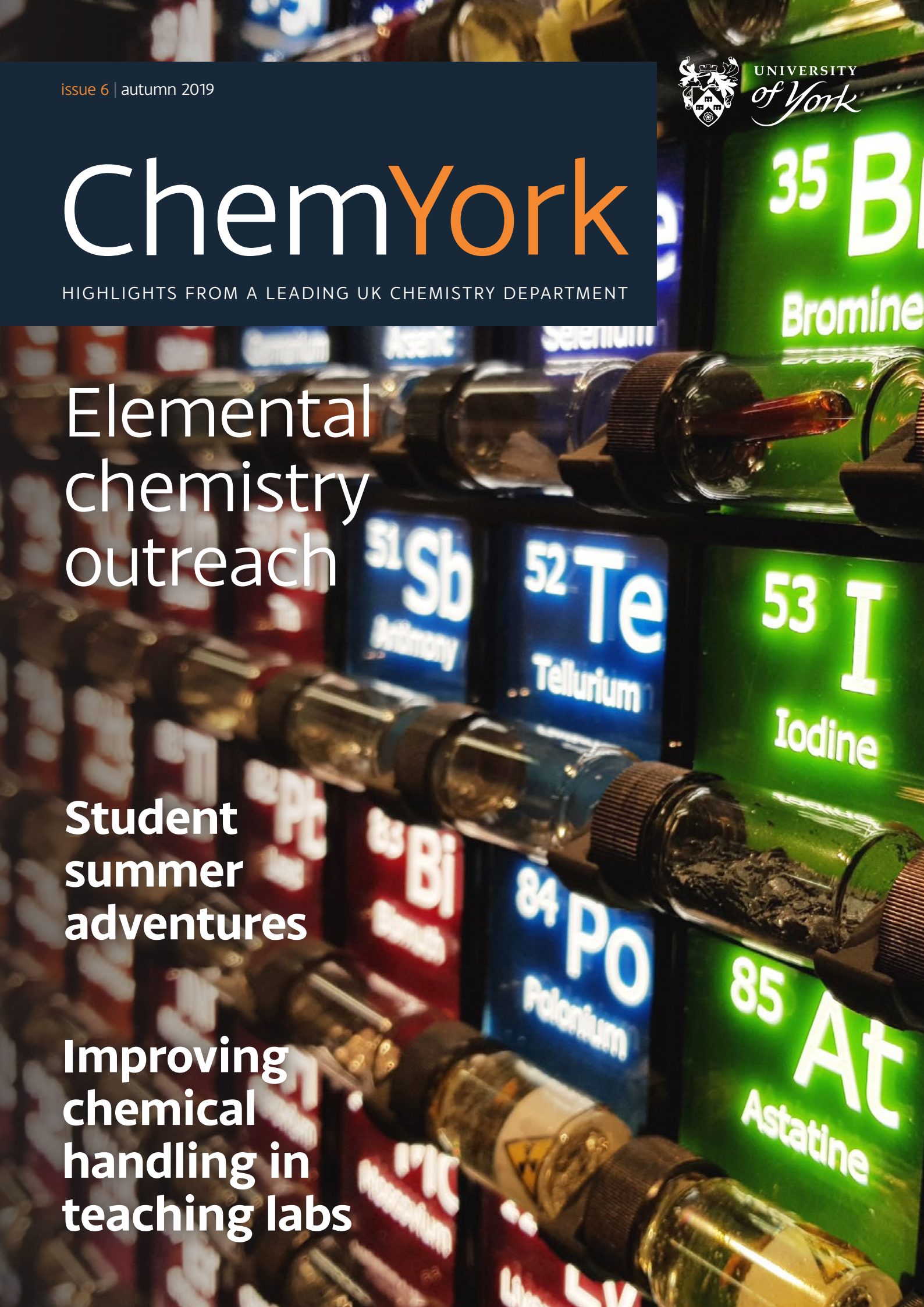
issue 6 | autumn 2019

UNIVERSITY of York

ChemYork

HIGHLIGHTS FROM A LEADING UK CHEMISTRY DEPARTMENT



Elemental chemistry outreach

Student summer adventures

Improving chemical handling in teaching labs

Welcome

PROFESSOR DUNCAN BRUCE, HEAD OF DEPARMENT, INTRODUCES THE AUTUMN ISSUE OF CHEMYORK

And so another academic year starts and our diaries are already replete with that circle of lectures, tutorials, research meetings and the like that give a certain familiarity to this time of year. As academics we look back over the summer and reflect on the papers, proposals and new and revised teaching materials with which we have been busy, the meetings we have attended and the ideas formed. There is a certain pattern to these things that is somehow quite welcome.

Yet among all of this we are in quite uncertain times and I do not need to rehearse here all that is going on around us both nationally and internationally. And so how might we cope with uncertainty? In fact, as enquiring students and academics, uncertainty is our bread and butter. Uncertain exactly how the next calculation will turn out, or what the stereochemistry of the product will be. Uncertain how best to explain a particular concept in a new series of lectures, how to organise the available time to ensure that the latest taught material is understood or how to get the best out of tutorials (as giver and as receiver). Yet that uncertainty is what can bring out the best in us. It causes us to reflect, to seek information, to piece a story together and also to talk with our colleagues or peers to find a solution, forming the all-important communities within which we study and work.

> “Diversity brings all manner of experience and thought together to provide more innovative approaches and solutions”

And the more diverse our communities, the more interesting they are and the better they can function, for diversity brings all manner of experience and thought together to provide more innovative approaches and solutions to the questions posed to us. And the process of getting there is more stimulating too.

Only yesterday – day one of term – I had the pleasure of welcoming two new cohorts of students to the Department, namely those undertaking research degrees and those embarking on our taught MSc, while tomorrow I will welcome the new undergraduates in both Chemistry and Biochemistry. Each of these individuals, more than 300 of them, brings their own perspective to the Department from the different cultures and experiences that have formed them to this point in their lives. What an exciting prospect.

In considering diversity, we reflected on the Department’s success in retaining its Athena SWAN Gold Award in the last edition of ChemYork and while we can be pleased with the recognition of the work we have done, we are challenged to do yet more to promote an ever more inclusive approach to the way we work. Mentioning Athena SWAN also caused me to go back and look at some of our achievements in the last year and what seemed so very appropriate in our renewal year was the success enjoyed by so many women in the Department and it is worth celebrating that here once more.

Lucy Carpenter was elected as a Fellow of the Royal Society and was awarded an ERC Advanced Research Grant; Jane Thomas-Oates was named British Mass Spectrometry Lecturer while Alison Parkin won both the RSC’s Roger Parsons Medal and Sir Edward Frankland Fellowship. Lianne Willems was also awarded an ERC Grant (more elsewhere), Alyssa Avestro won a Dorothy Hodgkin University Research Fellowship, Aimee Clarke was selected to present her research at STEM for Britain, Sarah Moller won an NERC Open Knowledge Exchange Fellowship and Annie Hodgson won a Vice Chancellor’s Teaching Award. Jacqui Hamilton and Kirsty Penkman won NERC grants and was also part of a successful EU ITN grant, while Anne Duhme-Klair was Principal Investigator on a large EPSRC grant. And, of course, Caroline Dessent, Helen Coombs and Leonie Jones were three of the four principal authors of our Athena SWAN submission. That’s not to say that there weren’t successes among the male members of staff, indeed there were many and in particular I would like to mention the dual successes of Mickey James and Luke Wilkinson in winning Leverhulme Early Career Fellowships.

We are fortunate to work with so many talented and inspiring individuals, and in a place where we strive to celebrate and embrace diversity. With all its uncertainties, another academic year begins. Now that is exciting.

Front cover image: *Tim Ayres*

Compiled by David Smith

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ChemYork

Award winners

Environmental Leader Top Product Award

An environmentally-friendly solvent developed in our green chemistry laboratories has won Top Product 2019 at the US industry Environmental Leader (EL) and Energy Manager Today (EMT) Awards. The awards recognise the most innovative and successful environment, sustainability and energy products and projects. The bio-based solvent Cyrene is designed to replace toxic solvents like Dimethylformamide (DMF) and N-Methyl-2-pyrrolidone (NMP). The solvent was created in response to the need for chemicals to meet stricter regulation requirements for both employee safety and environmental sustainability.

The judges said that Cyrene “replaces an otherwise toxic substance with a natural, gentler alternative without

compromising quality or function. This product has the potential to change the solvent landscape for the better.”

Cyrene was originally developed as a result of a partnership between the University of York’s Green Chemistry Centre of Excellence (GCCE) and Circa Group. Utilising its expertise in green chemistry, researchers in GCCE worked to determine potential applications for the solvent.

Professor James Clark, director of York’s GCCE said: “We are delighted to see the continued success of Cyrene which has moved from discovery to commercialisation in a remarkably short time.

Edward Frankland Fellowship

Dr Alison Parkin received the Edward Frankland Fellowship from The Royal Society of Chemistry in recognition of her research into sustained production of hydrogen in high levels of oxygen. The research recognised by the award is inspired by how nature can use the energy from the sun to produce hydrogen from water. This could ultimately yield a carbon-free fuel, which is compatible with existing natural gas networks and boilers and can also be used as a transport fuel in cars. The problem is that the naturally occurring biological systems do not work in high oxygen levels. At the University of York, the Parkin group develops new chemical tools to probe hydrogen-production enzymes from bacteria to work out how to make them continue producing hydrogen in high levels of oxygen.

YUSU Excellence Awards

Three Chemistry academics were recognised as winners in the York University Students Union Excellence Awards, based on student nominations from across campus.

Professor Peter O’Brien received the prestigious ‘Teacher of the Year’ Award. Students described him as ‘an icon of the Department’ and commended him as ‘an incredibly engaging lecturer that never fails to enthuse and enlighten’.

Dr Alison Parkin was recognised for her work as Chair of the Staff Student Committee with the Award for ‘Supporting the Student Voice’. Students described her as ‘synonymous with efficiency’ and really appreciated her strong support for student representation.

Professor David Smith received the award for ‘Most Inspiring’. He received more individual nominations than any other winner in the history of the awards, and was recognised for the way in which, by authentically being himself, he draws students into wanting to learn.

In addition to the winners, PhD student Tom Stephens, from the research group of Dr Will Unsworth, was shortlisted as ‘Graduate Teaching Assistant (GTA) of the Year’, and Dr Glenn Hurst was shortlisted for the ‘Teacher of the Year’ Award.

European Research Council Starting Grant Award Winner

Dr Lianne Willems has been awarded a five-year research grant worth 1.5M Euros to support the first phase of her career as an independent academic here in York. The highly-coveted European Research Council (ERC) Starting Grants help individual scientists and scholars to build their own teams and conduct pioneering research across all disciplines.

The central goal of Dr Willems’ research program is to improve our understanding of a relatively rare but devastating class of muscular dystrophies through the use of cutting-edge techniques in chemical biology. The researchers will be diving into the molecular details of this process, studying some of the key enzymes.
This research will help answer important questions about how certain genetic defects lead to muscular dystrophy and the way in which specific symptoms are caused. As a result, the findings may help with the design of new diagnostic tools and therapeutic strategies.

How good is your sunscreen?

DR CAROLINE DESSENT'S RESEARCH TEAM HAVE BEEN INVESTIGATING HOW SUNSCREEN INGREDIENTS INTERACT WITH UV LIGHT.

As a result, they argue that products should carry a standardised measure of when the chemicals start to break down, offering less sun protection.

In their research published in Physical Chemistry Chemical Physics 2019, 21, 14311, the researchers performed gas phase stdies with a UV laser coupled to a mass spectrometer. The team found evidence that certain forms of the sunscreen oxybenzone present at different pH values display a tendency to break down when they interact with light, limiting its ability to protect against UV rays. In particular, The team reported that shining light on the alkaline form of oxybenzone produces free radicals, which are widely known to damage the skin's DNA and cause ageing of the skin.

Although oxybenzone is no longer used in most sunscreens because of concerns about its ability to penetrate the skin, these studies provide a basis for developing more rigorous testing regimes, and will now be used to investigate more commonly-used sunscreen chemicals so that manufacturers and consumers can be better informed about the best sunscreen products for protecting themselves for as long as they are in the sun.

Dr Caroline Dessent said "The reduced rates of skin cancer as a result of methods of sun protection has shown that these products are needed, but research could offer even better protection now that we have improved methods of understanding the stability of their chemicals."

In the future, researchers would like to see bottles labelled with a meaningful measure of the breakdown rate of these chemicals, so that consumers know when to re-apply the product for lasting skin protection.

Analysis of ancient rhino tooth could unlock evolution mysteries

SCIENTISTS FROM THE DEPARTMENT WERE INVOLVED IN A PROJECT TO EXTRACT ORIGINAL PROTEINS PROVIDING GENETIC DATA FROM A 1.77 MILLION-YEAR-OLD RHINO TOOTH.

This marks a breakthrough in the field of ancient biomolecular studies by allowing scientists to accurately reconstruct evolution in mammals

from further back in time than ever before – offering the potential to solve some of the biggest mysteries of animal development. Researchers identified an almost complete set of proteins in the dental enamel of the rhino, the largest genetic data-set older than one million years to ever be recorded.

Dr Marc Dickinson and Dr Kirsty Penkman played a vital role in this research, published in Nature 2019, 574, 103, by ensuring that the proteins recovered were authentic and not contaminated. They developed a method for isolating protein trapped within fossil tooth enamel, and applied this to the rhino tooth. Their proof that the proteins in the tooth enamel were original enabled the resulting genetic data to be used with confidence.

The research has allowed the evolutionary lineage of this species to be rearranged. Identifying changes in other extinct mammals, including humans, could in due course, lead to massive shifts in our understanding of the way life has evolved.

Looking to history to predict future climate change

THE DEPARTMENT WILL PLAY A CRUCIAL ROLE IN A PROJECT TO ACCURATELY ESTIMATE GLOBAL CLIMATE CHANGE SINCE THE START OF THE INDUSTRIAL ERA, USING DATA COLLECTED SINCE THE DAYS OF THE CLIPPER SHIPS OVER 200 YEARS AGO.

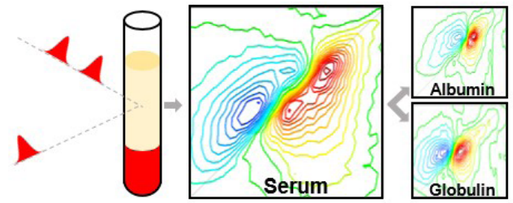
Current observational estimates of temperature change are made through a combination of sea-surface temperature from the ocean, and air temperature over land and ice; a complex process which can be prone to inconsistencies. Accurate data is essential in assessing the effectiveness of global efforts to limit increases in the Earth's surface temperature in line with the 2015 landmark Paris climate agreement.

The GloSAT project will improve consistency by creating a new observational record using air temperature over the ocean, and will use data going back as far as the 1700s. Air temperature was measured on ships for decades before sea-surface temperature, meaning scientists can extend the data record back further in time. One source of early marine air temperature observations is the fleet of the English East India Company between 1789–1834 along trade routes from Europe to India and Southeast Asia. There are also observations from land stations before 1850 that have not yet been used in global datasets.

Professor Cowtan says analysing these additional observations will enable scientists to more confidently estimate temperature change over two centuries, giving a deeper understanding of climate changes and the influence of external factors such as increased greenhouse gas concentration, volcanic eruptions and solar changes.

He added: "The University of York will be assessing the reliability of the historical temperature data by performing exhaustive comparisons between different observations. We will also try to understand how meteorological factors such as wind direction affect these comparisons."

Multidimensional approach to blood serum analysis



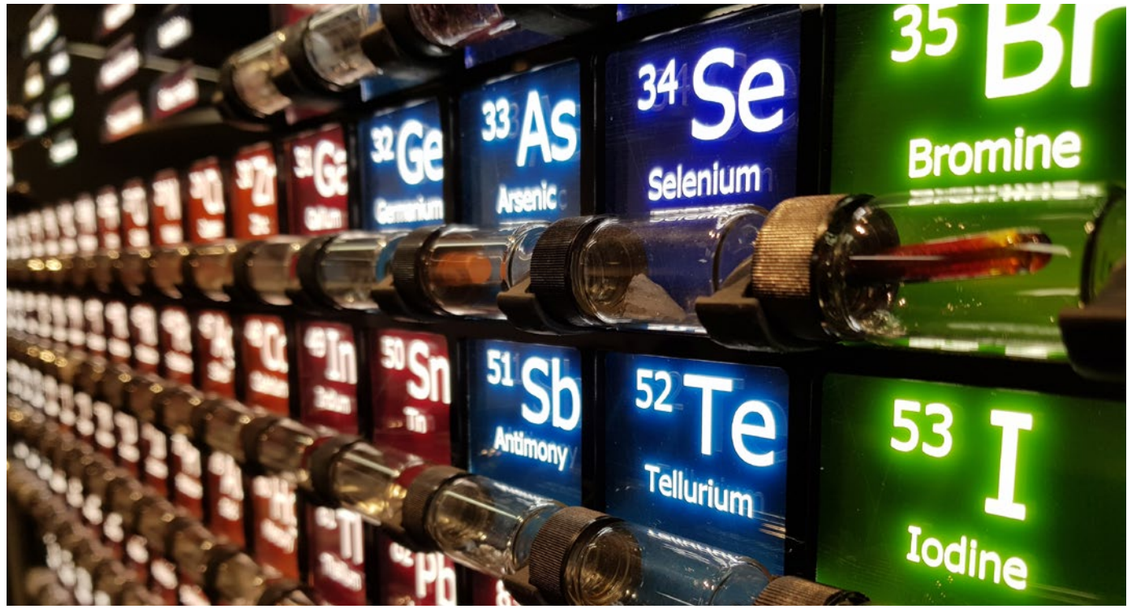
A NEW SPECTROSCOPIC TECHNIQUE THAT SUPPRESSES WATER ABSORPTIONS ALLOWS THE INFRARED SPECTROSCOPIC ANALYSIS OF BLOOD SERUM PROTEINS FOR BIOMEDICAL APPLICATIONS.

Infrared (IR) spectroscopy has long been a powerful tool used by chemists for determining the structure of molecules. IR produces a specific fingerprint for each molecule making it a potentially attractive method for analysing biofluids such as blood serum, where it could provide a broad chemical picture of the body's metabolism. This would be a useful clinical aid for the early diagnosis of disease. Until now, however, biomedical applications of IR spectroscopy have been severely hampered because water absorbs IR light at the same wavelength as proteins, masking a vital piece of the blood serum molecular jigsaw.

Research from the team of Professor Neil Hunt in York, working with Dr Matthew Baker at the University of Strathclyde in collaboration with the Science and Technology Facilities Council Central Laser Facility has now shown that 2D-infrared laser spectroscopy (2D-IR) can avoid this problem. 2D-IR suppresses the water signal relative to that of proteins, and also offers the added advantage that each protein produces a unique 2D signature that enables differentiation of proteins in complex mixtures in a way that standard IR methods simply cannot match.

In their work, published in Chemical Science 2019, 10, 6448, they demonstrated the approach by measuring the concentration ratio of albumin and globulins, the major protein fractions in serum across a clinically-relevant range. It was also shown that 2D-IR spectroscopy can go beyond the albumin to globulin ratio by detecting levels of minor globulin proteins.

Professor Hunt said: "This new technique opens up a straightforward spectroscopic approach to measuring levels of serum proteins that are currently only accessible via biomedical laboratory testing and could play an important role in the analysis of complex samples."



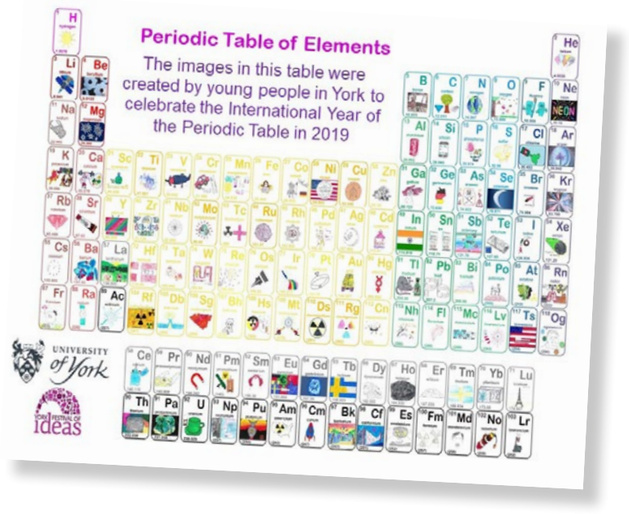
Chemistry Outreach - much more than periodic engagement

IN SUMMER 2018, DR ANNIE HODGSON, THE DEPARTMENT OF CHEMISTRY'S SCHOOLS LIAISON AND OUTREACH OFFICER, RECEIVED A VICE CHANCELLOR'S TEACHING AWARD IN RECOGNITION OF HER UNIQUE CONTRIBUTIONS TO TEACHING. IN THIS ARTICLE, WE CATCH UP WITH HER TO FIND OUT ABOUT THE REMARKABLE THINGS THAT SHE HAS BEEN DOING OVER THE YEAR SINCE AND DISCOVER HOW HER TEACHING TAKES HER FAR BEYOND THE CONFINES OF THE UNIVERSITY LECTURE HALLS.

This year has been the International Year of the Periodic Table - have you been doing anything to celebrate?

In this year's York Festival of Ideas, I gave a lecture and put together an exhibition about the periodic table. As a part of this, we created our own, brand new periodic table display. Nigel Lowe had inherited a set of samples of the elements, and we decided to display them in an eye-catching way for the exhibition. Tim Ayers and the rest of the brilliant workshops team went about designing and making a brightly coloured, illuminated display case for the sample vials. The result was a stunning centrepiece for the exhibition and acted as the starting point for many discussions with members of the public.

We also got local secondary schools in York engaged in a competition. We invited Year 7 students to research a given element and create a bold graphic design



to represent it. With invaluable help from Lisa Mayer, the winning designs for all 118 elements were incorporated into a unique version of the periodic table to celebrate its 150th anniversary. We displayed an A0 version at the exhibition in the Ron Cooke Hub and gave each of the participating schools a large poster of it for their chemistry lab wall. All 118 students with winning designs received a limited edition A3 copy of the table. We were really impressed by the imaginative designs for the elements; particular favourites of mine include neon, potassium and berkelium.

During 2019, the Department of Chemistry had its Athena SWAN Gold award renewed. Do you feel a responsibility as a female outreach officer to represent women in chemistry?

Yes, I think it is important to have women speaking about chemistry - many of the student ambassadors that I work with from the Department are female. I also think it's important to think about the stories that we choose to tell.

This year I have developed part of a new lecture about Margaret Cavendish, alongside colleagues from the English and Philosophy Departments. Margaret was an aristocrat who lived in the 17th Century. She was an incredibly prolific writer and quite a celebrity in her day. She produced works on a vast range of topics including books of poetry and essays on philosophy and science. She was probably the most published female writer of that period; and, very unusually for a woman at that time, she wrote under her own name. Her writings on natural philosophy make her one of the most significant early English scientists, but her contribution is often overlooked. In 1666 Margaret published what was, arguably, the first ever science fiction novel, "The Blazing World", which has a woman as its central character.

In 1667 she was the first woman to be invited to attend a meeting of The Royal Society, and it was this momentous event that we celebrated

in our lecture. For my part I did my best to reproduce the demonstrations that Margaret saw demonstrations that Robert Boyle performed during the visit. The biggest challenge I had was trying to work out what chemicals he had used, from the somewhat flowery descriptions that Samuel Pepys recorded in his diary and the rather vague notes left by Boyle. I spent hours experimenting in the lab, but there was one demonstration that I never did get to work – so I resorted to using modern chemicals to achieve the same visual effect. I hope that Boyle wouldn't have minded!

Thinking about excluded voices, historically, university outreach has sometimes overlooked students from less privileged backgrounds - what do you do to combat this?

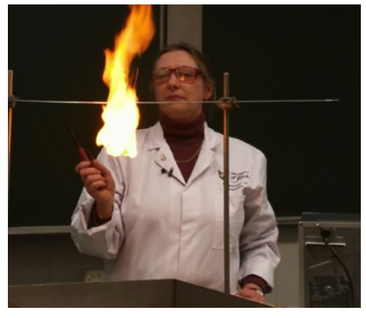
I have always worked with schools from a wide range of backgrounds. In 2018, I was delighted to receive a grant from the university's Departmental Widening Participation Initiative Fund to work with schools on the Yorkshire coast. These schools and colleges, in seaside towns such as Scarborough and Whitby, contain students from significantly disadvantaged backgrounds and are often overlooked when it comes to science engagement. I have set up a relationship with several schools and colleges along the coast; visiting them to deliver my Colourful Chemistry demonstration lectures and careers talks, and welcoming visiting groups to the chemistry Department. GCSE students from two coastal schools attended the Science@York outreach day, run by two third year BSc students and a fourth year MChem student as part of their final year projects. In this way, school students from non-traditional backgrounds were engaged with chemistry, while our own undergraduates had the chance to test out the excellent workshops they had devised and practise their communication skills.

I recently accompanied five Widening Participation A-level students to Australia so that they could attend the International Science School in Sydney. This was a remarkable experience for these students to be inspired by the modern, international world of science. A particular highlight was having lunch with Dame Jocelyn Bell Burnell - famed for the discovery of pulsars during her PhD - on the occasion of her birthday. This followed a brilliant lecture that she gave on the origin of the elements.

And what does the future hold in store?

Obviously I will carry on helping our students develop their skills, and managing their final year BSc Chemical Communication projects in schools and outreach. It is a real pleasure to develop a close relationship with our undergraduates who can be so passionate about education. I will also continue editing Chemistry Review magazine, and reaching out to enthusiastic school students across the country and beyond.

There are also, as ever, some exciting projects coming over the horizon - I am hoping that some of my educational work will soon be published in an academic journal, and I'm also planning to work with social media to spread the word about the power of chemistry. So I guess I have plenty to keep me busy!



4th in the UK

The Department has confirmed its place among the UK's most highly regarded departments for the subject of Chemistry, being ranked 4th in the UK in both the Complete University Guide, The Times Good University Guide and The Guardian University League Tables for 2020.

The Department's ranking in these league tables was based on a range of measures including graduate prospects, student satisfaction and research quality, and clearly demonstrates that York can be considered as one of the best places in the UK to study chemistry and carry out research.

The Department prides itself on providing a high-quality experience for its students, and has a carefully designed degree programme that aims to develop highly skilled chemists.

Head of Department, Professor Duncan Bruce, said "We are delighted to be recognised among the very best Chemistry Departments in the country and are particularly proud to be the most highly ranked in the Russell Group for student satisfaction."

Improving chemical handling in teaching labs

DR MORAY STARK HAS DEVELOPED A POWERFUL TEACHING LABORATORY INTERVENTION TO HELP STUDENTS IMPROVE THEIR CHEMICAL HANDLING SKILLS.

The ability to handle chemicals safely is a key aspect of the learning development of chemistry students. Previously, however, there have been no investigations of the quantity of chemicals spilled by students during lab experiments, neither are these skills routinely assessed. Clearly, spillage of chemicals can potentially have safety implications, as well as environmental implications in terms of waste.

Alongside two final year project students, Aimilia Tsokou and Alix Howells, Dr Moray Stark developed a unique intervention for first year chemistry undergraduates. Their methodology, described in Journal of Chemical Education 2019, 96, 2180, used paper liners to allow easy assessment of the volume of liquid spilled by students during an analytical chemistry experiment. On average, the students spilled approximately 1% of the total volume handled, however, on the individual level, spillage varied greatly, by almost a factor of 1000, from 0.02% to 10% of the total.

In an innovative step, the researchers developed feedback to give to the students on the potential safety significance of the volume of chemical they each had spilled, and then carried out a randomized controlled trial (RCT) to test whether this intervention improved chemical handling. Although RCTs are the 'gold standard' and are commonly used in areas such as medicine, they are virtually never used in chemical education research.

The undergraduates were asked for consent, split into two groups and did an experiment – only one of the groups received feedback on the chemical they had spilled. Both groups of students then repeated the experiment in order to assess differences resulting from the feedback. There were significant differences in the volume of chemicals spilled by the two groups of students, with those who did not receive any feedback spilling, on average, twice as much as the group that had received feedback. At the end of the repeat experiment, the second group of students also received the useful feedback.

Dr Moray Stark said: "It was really pleasing to see that explaining to students the safety implications of spillage improved their chemical handling ability. The approach we have developed can provide meaningful feedback to the student, as well as potentially improving safety and skills in the laboratory."

Speaking about the design of his study, Dr Stark added: "It can be challenging, when performing educational experiments, to achieve reliable results – this randomized controlled trial approach could be more widely used in chemistry education research."

Authors (left to right): Dr Moray Stark, Alix Howells and Aimilia Tsokou.

The Roger J Mawby Demonstrating Awards

THERE WERE SIX WINNERS IN THIS YEAR'S ROGER J MAWBY DEMONSTRATING AWARDS, WHICH RECOGNISE OUTSTANDING PERFORMANCE FROM GRADUATE TEACHING ASSISTANTS (GTAs) IN THE DEPARTMENT.

All GTAs make a valuable contribution to undergraduate teaching, but there are also those who go above and beyond the requirements of the role, and these awards acknowledge this.

The name of the awards reflects a generous bequest made in memory of Roger Mawby, one of the founding academic staff members of the Department of Chemistry and an inspirational educator. Roger gave detailed and engaging lectures, frequently using chemical demonstrations to illustrate important concepts in transition metal chemistry and catalysis. In addition, he gave stimulating and challenging tutorials that allowed students to develop and build their understanding of chemistry.

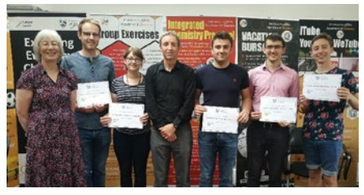


Photo: Left to right: Gill Mawby, Chris Maddocks, Kirsten Hawkins, Richard Douthwaite, Jordan Herod, Mark Dowsett and Robin Brabham (Winner Jenny Lewis not pictured).

The awards were presented to the winners by Dr Richard Douthwaite, Chair of the Awards Panel and Mrs Gill Mawby who attended the event and shared some memories of her husband Roger and his time at York. The trophies received by the award winners were crafted by Chemistry glassblower Abby Mortimer, this year celebrating the 150th anniversary of the periodic table.

Johnson Matthey Poster Competition

In the annual Johnson Matthey Poster Competition, thirty of our third-year PhD students presented their work. The panel of judges consisting of members of academic staff and postdoctoral researchers consider poster presentation, scientific content and student discussion. The four winners, who were each awarded £400 to be spent on research-related activities and items were:

Tom Stephens (Dr Will Unsworth, Dr Martin Fascione and Prof Peter O'Brien) - Iterative Assembly of Macrocycles via a Successive Ring Expansion Strategy

James Rossi Ashton (Dr Will Unsworth and Prof Richard Taylor) - Straight to the core: A Novel Approach to the Akuammiline Alkaloids

Jennifer Lewis (Prof Simon Duckett) - Exploring the hyperpolarisation potential of bio-molecules.

Mark Dowsett (Prof Mike North and Dr Alison Parkin) - Turning carbon dioxide into fuel using amines, electricity and water

Pioneer in Organometallic Chemistry to join Department

Professor Andrew Weller will be joining the Department in January 2020 from the University of Oxford. He is the holder of an EPSRC Established Career Fellowship (2015–2021) and was recipient of the Royal Society of Chemistry Frankland award in 2016.

Professor Weller has made important, innovative and pioneering contributions to the organometallic chemistry of the transition metals, most notably in the areas of novel synthetic techniques; the mechanism-led design of efficient and selective catalyst systems; C–H, B–H or C–C activation; and the generation, characterisation and use of highly reactive and novel organometallic complexes.

Blending innovative fundamental research with a focused trajectory towards delivering real-world solutions using precision catalysis, Professor Weller's research has impact on the efficient use of finite natural resources, the manufacture of new high-performance materials, and more efficient synthesis of fine chemicals for potential pharmaceutical uses.

Professor Weller commented: "I have long admired York Chemistry's approach to supporting and delivering world-class science, in particular the high quality of the faculty, the excellent environment and infrastructure, the obvious collegiality of staff, and its enviable reputation for excellence across the spectrum of the Chemical Sciences. I, and my group, are very much looking forward to joining the vibrant community at York and we are very excited by the new opportunities this will give us in the future."

Summer Student Adventures

EVERY YEAR, SOME OF OUR UNDERGRADUATE STUDENTS GET INVOLVED IN CHEMISTRY PROJECTS BOTH WITHIN AND BEYOND THE DEPARTMENT. HERE WE MEET A FEW OF THEM TO DISCOVER WHAT THEY HAVE BEEN DOING.

Alvaro Lopez-Acosta has carried out a 2-year Laidlaw Scholarship, working in the research groups of Professor David Smith (Chemistry) and Professor Paul Genever (Biology).

Can you say a little about your research?

I developed a new hybrid hydrogel, grew stem cells on it, and depending on how I tuned the chemistry of the hydrogel, the cells proliferated differently. The research has potential applications in tissue engineering.

Alavaro Lopez-Acosta and Postdoctoral Researcher from the Smith Group Carmen Piras at the European Biochemical Society Conference

How did you find the combination of chemistry and biology?

Working in biology was quite challenging, the lab techniques are very different; dealing with living organisms was a steep learning curve. Despite all the challenges, I loved it. I could expand my chemical lab skills, and learn a completely new set of skills in biology. I feel if someone masters both chemical and biological lab skills, they can achieve great things.

This year, you went to present your results at an international conference - how was that?

Going to the European Biochemical Society Conference in Dresden to present my results as a poster was crazy! The conference was huge, many people, many talks at the same time. I was lucky to go with Carmen Piras, the postdoc that helped steer the project. She taught me very useful skills, as at the end you go there to sell your project; so being efficient in networking and organizing the agenda is key. I felt a bit intimidated at first, as I was clearly the most junior person out of thousands of experts, but I met very interested people; some award-winning keynote speakers even told me to email them! At the end, we felt proud to represent Dave's research group and York. They also have a social agenda, and I joined the Young Scientists Night Out!

How did you find working with others in the research group?

Everyone was always interested in what I was doing, which ends up in interesting conversations about new ideas. One of the best parts of working in this group is the Christmas Dinner, and getting to see Dave dressed as Santa Claus giving the presents to everybody. I have it on camera! From this experience I take it that for a research group to be successful it should have a big team spirit.

Lucy Horsnell worked in the labs of Professor Gideon Grogan here in the Department of Chemistry for the first year of her Laidlaw scholarship.

What did you research in your project?

This summer I have been expressing and purifying two enzymes, a wild type and mutant. The mutant has evolved the valuable activity for the anti-Markovnikov oxidation of styrene, and the aim of this project is to obtain crystal structures to determine the structural differences which may alter selectivity.

What new lab skills did you learn working in Professor Grogan's lab?

I learnt a variety of new practical skills including: aseptic technique, protein purification (using nickel affinity column and size exclusion chromatography), as well as protein crystallisation. It has been interesting to extend my knowledge and skills further into biological chemistry methods.

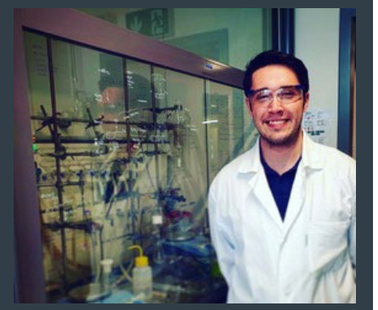
You are on the first year of a Laidlaw scholarship - how did you find the programme so far?

I have really enjoyed it. The leadership courses have enabled me to identify my own strengths and weaknesses. I am really looking forward to the opportunity to apply newly learnt techniques in an informal setting. Moreover, I have really enjoyed my research project as it challenged me to learn new skills and make my own decisions in the lab.

What will you be doing next year in your Laidlaw scholarship.

Next year I will learn about protein structure building and refinement and I will use this to inform the design of mutants, with the aim to alter or improve enzyme activity. It am really looking forward to seeing the whole project come together.

Rob Ives went to the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences in Prague for an 8-week international placement.



Rob Ives in Professor Starý's lab in Prague

What was your project about?

It was a fantastic experience to develop my understanding of synthetic organic chemistry during my time in Professor Starý's Group. I worked on a novel approach for the synthesis of dibenzo[6]helicene derivatives exploiting cross-coupling methods

Did you fit in easily in the lab?

Although I was the only native English speaker in the group, I felt I was able to integrate myself seamlessly and effectively into the research group. I was accompanied on the program by 19 other students from several European countries. My experience emphasised that science is global showing the truly international nature of a research team.

What were the challenges and best parts of being away from York?

Getting familiar with new laboratory surroundings and learning new techniques can be quite daunting. However, my supervisors were very helpful and this allowed me to settle in quickly. Being able to explore the beautiful city of Prague was, without doubt, a highlight of my summer! It's such a vibrant city with so much to offer. The program has allowed me to engage in meaningful work experience, expand my professional network and develop my skills and competencies. I also got to present my results at the IOCB Summer Science Symposium. Receiving feedback from experienced scientists was invaluable. I would highly recommend the experience to other adventurous students!

Molly Crosbie worked as part of a team in Teaching Labs under the supervision of Dr David Pugh and Dr Nick Wood.

Molly Crosbie in Teaching Labs

What tasks did you carry out in Teaching Labs?

We were improving the efficiency and safety of the undergraduate practical experiments. For example, I assessed the feasibility of altering reagents for an experiment involving the synthesis and use of LDA in the Year 2 Advanced Organic Synthesis course. I formed the enolate of 4-methylpropiophenone and reacted it with a range of benzoyl chlorides with the aim of producing a solid compound.

I believe you got a crystal structure published - can you tell me about that?

I eventually managed to obtain a solid compound for the enolate reaction (using 4-methylpropiophenone and 3-chlorobenzoyl chloride). This solid was in the form of large, colourless crystals, I submitted these for X-ray crystallography and Dr Adrian Whitwood showed us the equipment, collected data and solved the structure, which has now been published in the Cambridge Crystallographic Database. This was a real personal highlight!

There was a team of you working in there - how did you all get on?

I worked alongside another second year student and a first year student with Dr David Pugh and Dr Nick Wood as our supervisors. We were also joined in the lab by two German students for part of the placement. We all got on very well - it was a very fun and interesting three weeks Having the freedom to use such an array of chemicals and equipment that we would otherwise not have access to, and knowing that the work undertaken will contribute to the teaching lab programme in the future, was really rewarding.

Elemental Academics

IN HONOUR OF THE INTERNATIONAL YEAR OF THE PERIODIC TABLE, WE ASKED SOME OF OUR ACADEMICS ABOUT THE ELEMENTS THAT WERE SPECIAL TO THEM. HERE ARE SOME OF THEIR RESPONSES.

43 Tc

Dr Richard Douthwaite

There is something fascinating about technetium, a radioactive element at the centre of the periodic table. It has minute natural abundance, yet has life-saving properties as a radiopharmaceutical and its astronomical detection showed for the first time heavy elements are formed in stars.

78 Pt

Prof Duncan Bruce

Starting my PhD, the first metal I used was platinum and, one way or another, it has stayed with me throughout my career. From platinum-phosphine complexes as photocatalysts to split water into hydrogen and oxygen to liquid crystals making use of platinum's amenable square-planar geometry. We have also incorporated platinum into OLEDs, and shown that it can photocatalytically activate C–C bonds. So versatile, always interesting. Platinum can last a (scientific) lifetime.

64 Gd

Dr Aneurin Kennerley

I always wanted to be a secret 'agent' and even thought about applying to the MI5 graduate programme when I finished my undergraduate degree in physics. Seems apt that in MRI we use gadolinium as our contrast 'secret agent' of choice to offer us a more intelligent view of the body.

42 Mo

Prof Anne Duhme-Klair

Molybdenum is a fascinating, but often overlooked element. Investigating it properly, and understanding its vital roles in biology, has been one of the key questions of interest for my research team.

46 Pd

Prof Ian Fairlamb

Beautiful, shiny and silvery-white Palladium (Pd), non-toxic in its elemental form, is the unsung hero of our everyday lives. It helps us make our life-saving drugs, cleans up the nasty gases from our vehicles and produces green energy in hydrogen fuel cells - powering-up our cars and buses.

77 Ir

Dr Annie Hodgson

There has always been something magical to me about iridium, with its wide-range of oxidation states giving rise to a rainbow of colours. It was discovered by Yorkshireman Smithson Tennant, born less than 12 miles from my home, which also happens to be at number 77, giving me another special bond with iridium.

3 Li

Prof Peter O'Brien

Without doubt, my favourite element is lithium. I have used butyllithium in my research for 25 years, and I introduced it into our undergraduate practical course. In fact, I think I would quite enjoy being butyllithium itself, to see exactly how I interact with other molecules to remove a proton - mechanistically, we still know very little about how this actually happens even though these reactions are used to make kilograms of blockbuster pharmaceuticals.

7 N

Prof David Smith

At first glance, this is a boring, average, inert element. But in reality, within molecules, nitrogen is a highly interactive and diverse superstar element, responsible for so many of the molecular properties - for example, hydrogen bonding the DNA base pairs together in our genetic code. Throughout my career, I have always incorporated nitrogen into our molecules to help make them more functional and useful.