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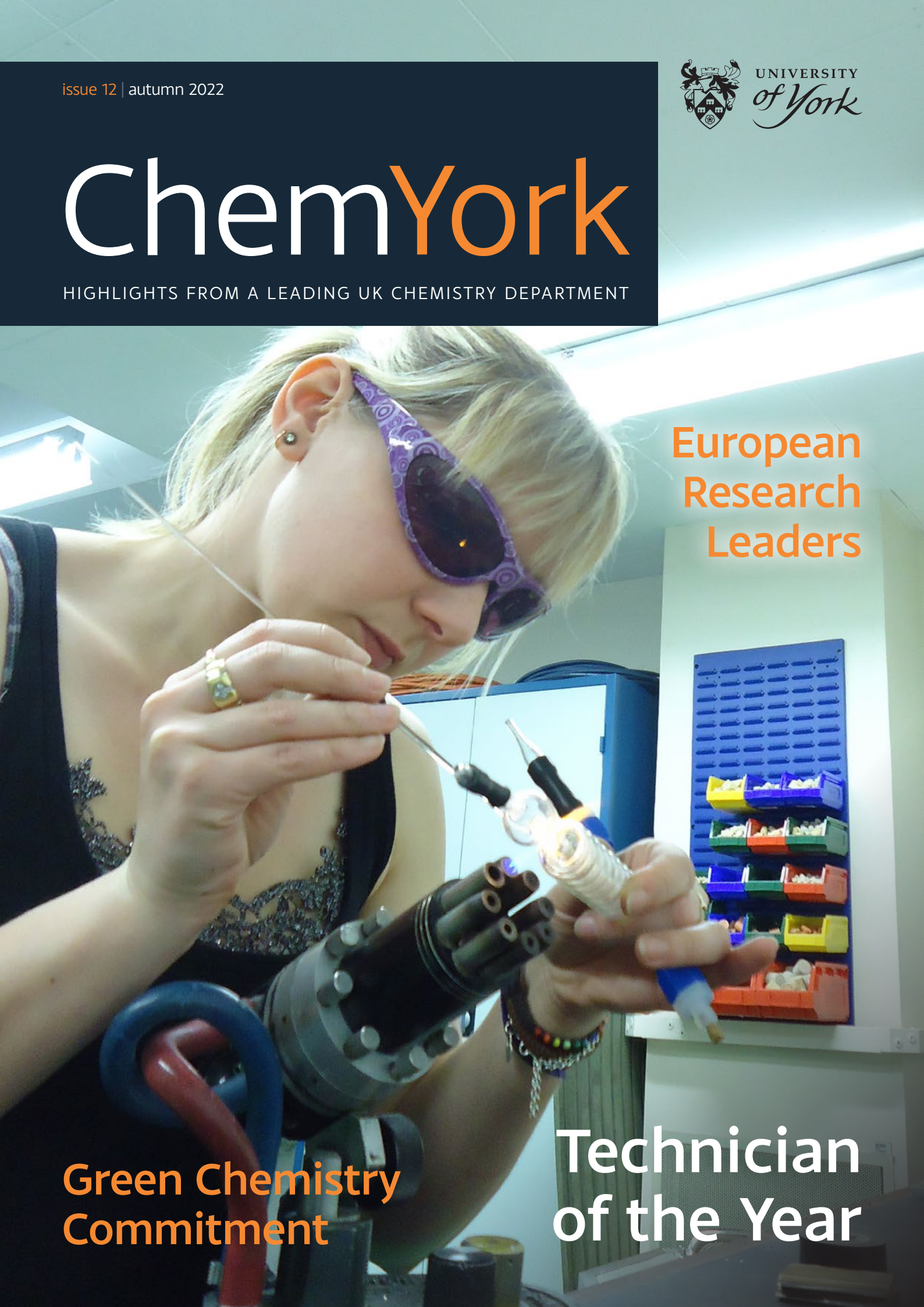
UNIVERSITY of York

ChemYork

HIGHLIGHTS FROM A LEADING UK CHEMISTRY DEPARTMENT



European Research Leaders

Green Chemistry Commitment

Technician of the Year

Team Chemistry

PROFESSOR CAROLINE DESSENT, HEAD OF DEPARTMENT, INTRODUCES THE AUTUMN EDITION OF CHEMYORK.

When I last wrote for ChemYork earlier in the year, we were already enjoying a glorious summer, but that feels a long time ago amongst the mist and murk of November. A huge amount has happened during the last six months, including the deeply concerning ongoing war in the Ukraine, the death of her majesty Queen Elizabeth II, and the comings and goings of several governments and their accompanying prime ministers. Amidst so much turmoil, the routines of a new academic year bring some much-needed reassurance. We've been delighted to welcome a new undergraduate Year 1 cohort of 185 exceptionally well-qualified students to the department, along with robust numbers of new PhD and post-graduate taught students.

> "Everyone's contributions are so essential, and it's worth remembering this as we celebrate our success"

Alongside our new crop of students, we've enthusiastically welcomed a group of new staff members to the Department. Dr Jackie Mosley has joined us as a Senior Lecturer in Mass Spectrometry, Dr Conor Rankine as a Lecturer in Machine Learning, as well as Dr Alexandra Males and Dr Connor Prior as Teaching and Scholarship Staff Members. Another key new member of staff who joined us in September is Dr Mark Shaw, who is our new Deputy Head of Faculty Operations. This is a new role that replaces the Departmental Manager position, and Mark will be working alongside me to ensure that "the wheels stay on the bus" from day to day, as well keeping an eye on necessary strategic plans to prepare the department for the future.

In recent months, I was particularly pleased to sign the Green Chemistry Commitment on behalf of the Department. You can read more about this on page 8, but the Commitment ensures that all students educated here in York will be introduced to the principles of Green Chemistry and explore the ways in which chemistry can become more sustainable and environmentally sound. We very much hope that our approach to incorporating Green Chemistry principles will enable our students to go on to have positive impacts on the world.

Over the summer, we were delighted to find out that we've been ranked 7th in the UK in The Times and The Sunday Times Good University Guide, and also in the Complete University Guide. These rankings reflect the Department's excellent performance in our teaching quality, student experience, research quality, entry standards, graduate prospects, and facilities. We have significantly risen up both tables since last year, which is a cause for pride and celebration, and again reflects the huge contributions that staff across the department make to ensure that this is such an outstanding place for both teaching and research.

It is perhaps worth reflecting just how many different roles go into delivering this success. Our amazing technical staff are crucially important in facilitating the laboratory research and keeping our facilities such as NMRs and mass spectrometers running. They also work very widely to support our undergraduate students, not only in our teaching laboratories but when they undertake research projects in research groups. You can read about one such outstanding

technician, Abigail Mortimer, on page 12. Abby is our glassblower, and was nominated for a national Times Higher Education 'Technician of the Year Award'. Our administrative staff are another group whose work is often less visible to those outside the Department, but we have exceptional administrative staff who are so important to making the Department work. These range from the research grant office team who ensure grant applications are submitted correctly and provide encouragement and support through all of the application stages, through to our student facing support staff in the Graduate School Office and the Undergraduate Student Experience Team. Everyone's contributions are so essential, and it's worth remembering this as we celebrate our success in the league tables.

Finally, as the end of the calendar year rushes towards us, I would like to take this opportunity to thank everybody in the Department for working so hard in 2022. It will soon be time for us to enjoy some rest and relaxation with friends and family during the forthcoming break, and I would like to finish by saying "Nadolig Llawen" and wish everyone a very Happy New Year.

Front cover image: *Departmental glassblower, Abigail Mortimer. (Credit: Abigail Mortimer)*

Compiled by *David Smith*

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ChemYork

Honours and Awards for Academic Staff

Lord Lewis Prize

Professor Alastair Lewis received the 2022 Lord Lewis Prize "For the promotion and application of the chemical sciences to support development of evidence-based policy and regulation in the fields of air pollution and climate change".

The Lord Lewis Prize is awarded every two years by the Royal Society of Chemistry to recognise distinctive and distinguished chemical or other scientific achievements, together with significant contributions to the development of science policy.

Ally Lewis is Professor of Atmospheric Chemistry. His personal research focusses on gas phase atmospheric chemistry and chemical metrology, with a particular focus on measurements of air pollutants. In addition to teaching and research at the University, he is a Science Director at the National Centre for Atmospheric Science (NCAS). He is Chair of the Defra Air Quality Expert Group (AQEG) and the Department for Transport Science Advisory Council where he has a direct input into government decision-making on issues including energy, emissions, air quality and net zero.

The award recognises that Ally has played a central role in providing scientific advice to Government and Parliament, including the development of the UK clean air strategy, and new post-Brexit air quality standards set out in the Environment Act (2021). Early in the pandemic in 2020 he worked with Defra, the ONS and the Air Quality Expert Group completing a rapid review of the impacts of air quality on mortality rates from COVID-19, identifying inequalities in exposure to pollutants such as NO_2 and $PM_{2.5}$ (particulate matter smaller than 2.5 microns).

Air pollution is one of the most significant causes of preventable deaths world-wide and impacts people's health irrespective of whether they live in high, middle- or low-income countries. Developing technologies and policies that improve air quality and deliver on climate objectives is complex since they must be tailored to the geography, transport and energy systems, climate and wider economy of any given location.

Reflecting on his Lord Lewis award, Ally said: "It is an amazing privilege to be given this award, and especially so given the incredible scientists that have received it previously. I'm in a very lucky position working in WACL - I get the opportunity to explain the fantastic research work done here to decision-makers and then see it translated into practical action."

Tilden Prize

Professor David Smith has received the 2022 Tilden Prize from The Royal Society of Chemistry for 'pioneering an understanding of molecular materials based on supramolecular gels'.

The Tilden Prizes are awarded annually by the Royal Society of Chemistry to recognise excellence in chemical research, impact and innovation. Recipients of the prizes are established-career academics with up to 30 years post-PhD research experience. These research prizes are amongst the most prestigious offered by the Royal Society of Chemistry.

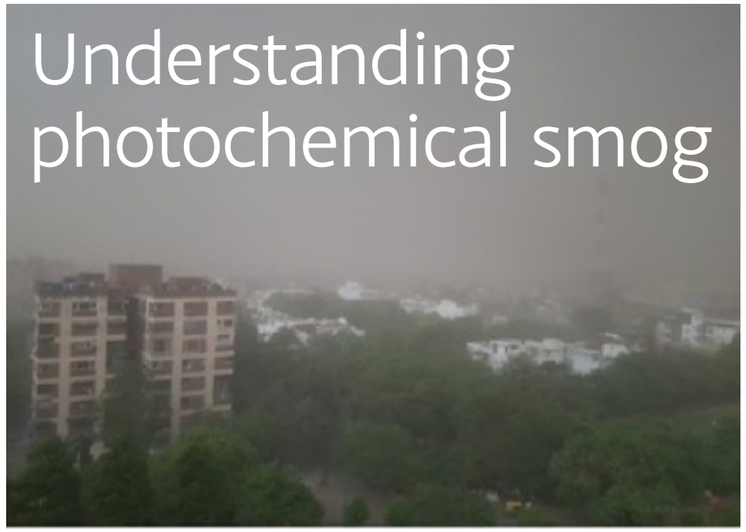
Gels are fascinating materials which surround us in everyday life - from hairgel to Jelly Babies. However, while the gels used in everyday life are typically made of polymers, Professor Smith is instead interested in 'supramolecular gels' which reversibly assemble from small molecule building blocks via intermolecular interactions. Such gels are highly tunable and can be programmed by molecular engineering to carry out unique functions.

In recent years, working as part of the Molecular Materials grouping (MolMatYork), Professor Smith has developed a new family of hydrogels based on simple low-cost building blocks, and demonstrated their potential in applications ranging from environmental remediation & catalysis to drug delivery & tissue engineering. His work illustrates that supramolecular chemistry potentially lead to high-tech applications within realistic commercial constraints.

As just one example, inspired by his own husband's health problems with cystic fibrosis and organ transplantation, Professor Smith created hydrogels capable of supporting cell growth. His research team have created innovative ways of shaping and patterning such gels in order to direct and control cell growth. Such gels have potential future use in growing organs from a patient's own stem cells, which could give rise to organs 'on-demand' and avoid problems with transplant rejection.

Reflecting on the award, Organic Group Leader Professor Ian Fairlamb said: "Dave's research has been outstanding over many years. He has pioneered new approaches and applications of supramolecular soft matter systems. He leads an inclusive research team, and provides excellent training to his group members, who have gone on to valuable careers in a range of different fields, both in academia and industry."

Understanding photochemical smog



Smog in New Delhi. Image credit: Professor Jacqueline Hamilton, University of York.

Researchers from the Department of Chemistry have discovered why reducing particle pollution is actually increasing surface ozone levels in some emerging economies, negatively impacting health, ecosystems and agriculture.

Surface ozone is the main component of "smog" and is created by chemical reactions between oxides of nitrogen (NO_x) and volatile organic compounds (VOC). This happens when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources react in the presence of sunlight.

In the last decade, when countries such as China improved air quality by reducing particle pollution – which is emitted from burning coal, steel making, vehicles, and fires – the scientific community was surprised to see ozone pollution increase. This study, published in *Nature Geoscience* (2022, 15, 536), provided a new insight into this problem.

The researchers found that some short-lived components necessary to make ozone (peroxy radicals) stick to particle pollution, preventing them from going on to form ozone. As the number of particles decreases, the peroxy radicals become available for reactions and ozone increases.

The study modelled the effects of reducing particle pollution and found it could cause an increase in ozone of 20-30% in some highly populated areas of India and China. If left unmanaged, this would have a significant negative impact.

Co-lead author of the study, Professor Mathew Evans explains: "Particle pollution and ozone pollution had been viewed by policy makers around the world as separate issues, but our study emphasises the need to look at them together. Only now are we putting the pieces of the puzzle together and seeing this relationship between ozone and particle pollution."

The researchers are calling for new strategies that take this interaction between pollutants into account. The problem can be overcome by targeting reductions in a wider range of pollutants, particularly (VOCs) from chemicals/fuels and NO_x from combustion.

Professor Alastair Lewis from the National Centre for Atmospheric Science, co-lead author, noted: "This study highlights the complex choices facing governments in how they invest to manage air pollution."

CARE-ful Synthesis of Cyclic Compounds

A new synthetic method developed in York - conjugate addition/ring expansion (CARE) - combines two different reactions to enable the simple synthesis of a wide range of cyclic compounds containing medium-sized rings. Such compounds have biological relevance and potential applications in the development of new drugs.

Cascade reactions, which combine multiple reaction steps into a single operation are highly desirable. They bring benefits in terms of making synthesis quick and easy, and avoiding the need to handle or isolate potentially toxic intermediates. In this work, published in *RSC Chemical Biology* (2022, 3, 334), Kleopas Palate, a PhD student in Dr Will Unsworth's lab, combined conjugate addition and ring expansion (CARE) into a single reaction step.

The reactions are simple to perform, generally high yielding, and broad in scope. By varying the components used in the reaction it is possible to 'program in' a wide range of different functionalities – indeed a library of around 50 different cyclic compounds was prepared.

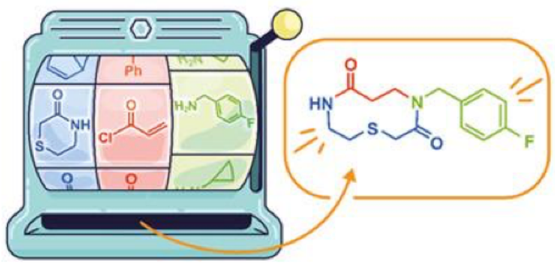
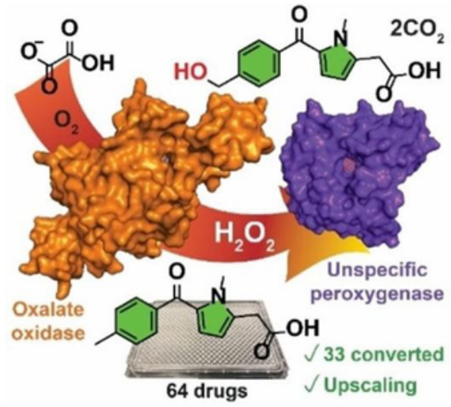


Image credit: Claudia Flandoli

Dr Unsworth said: 'Our research team have been working on the development of ring expansion reactions for several years, but our previous methods have tended to be quite time-consuming. With the discovery of CARE, we can make the molecules we're interested in much more quickly and easily, using a 'greener', more environmentally sound approach. This should increase the attractiveness of our synthetic methods for the discovery of new pharmaceuticals and agrochemicals.'

Clean oxidations for use in the pharmaceutical industry



Working with a team from AstraZeneca, Professor Gideon Grogan, alongside Dr Jared Cartwright from the Department of Biology have developed clean and effective enzyme-mediated synthetic methods for use in the pharmaceutical industry.

Oxidation reactions are key processes in synthetic chemistry and of vital importance in the pharmaceutical sector. However, mild and selective transformations often remain elusive. In particular, the oxidation of relatively unreactive C-H bonds often employs transition metal catalysts, and suffers from poor selectivity and low sustainability.

With this in mind, researchers have turned to using enzymes to try and catalyse such processes. Certain enzymes have risen to prominence, one such example being unspecific peroxygenase (UPO) enzymes. However, these enzymes require a precisely controlled supply of hydrogen peroxide – enough for the enzyme to work, but not too much to cause degradation. Practically, this can be difficult to achieve.

The researchers, writing in *Angew. Chem. Int. Ed* (2022, 61, e202207831), decided to use a second enzyme, oxalate oxidase, to provide an *in situ* source of hydrogen peroxide that can then be used by the UPO (see Figure). Oxalate oxidase is a well-known enzyme which produces hydrogen peroxide but has not been used in combination with a UPO to drive synthetic reactions. The team demonstrated that this approach works for the oxidation of a diverse range of 33 different drug molecules. They also scaled-up one of the reactions.

Professor Grogan explained: "In the human body, pharmaceuticals are often oxidised by metabolic processes. It is vital for pharmaceutical chemists to test and understand the properties of oxidised drug molecules. This new approach provides easy access to such molecules, giving valuable information to our industrial partner, AstraZeneca. We hope that in the future, oxalate oxidase will go on to find a range of uses in synthetic chemistry as a simple and controlled way of generating the hydrogen peroxide required by other enzymes."

Next Generation Benchtop NMR

An innovative method for enhancing benchtop NMR spectroscopic signals has been reported, opening new possibilities for this easy-to-use, low-cost technology to be applied in settings outside the traditional research lab. NMR spectroscopy is a powerful analytical technique which allows the structural characterisation of molecules and the analysis of chemical reactions. However, NMR typically requires high-cost instrumentation, with high field magnets, which need cooling with expensive cryogenic fluids. In recent years, low cost, portable benchtop NMR spectrometers have been developed, but they suffer from relatively low sensitivity and poor signals.

In research published in *Chemical Communications* (2022, 58, 5534), Dr Meghan Halse and PhD student Matheus Rossetto, working with researchers from the University of Edinburgh, developed and implemented a new experiment which significantly improves signal intensity on benchtop spectrometers.

This method, the so-called 'SHARPER' experiment, increases the signal-to-noise ratio up to 30-fold. It achieves this by using a carefully designed magnetic pulse sequence to convert signals into sharp, intense single peaks that can still be quantitatively analysed. This approach is particularly useful for fluorine analysis. Fluorinated organic molecules account for 20% of pharmaceuticals and 60% of agrochemicals. As such, monitoring fluorination reactions and detecting fluorinated compounds are of key importance.

Talking about the research, Dr Halse said: "Benchtop NMR offers the potential to use NMR in wholly new environments as a result of its low cost and portable nature. This 'SHARPER' approach significantly improves the spectra that can be obtained and may therefore enable a range of new applications."

Benchtop NMR spectrometer

European Research Leaders

REMARKABLY, NINE RESEARCHERS IN THE DEPARTMENT ARE SUPPORTED BY THE EUROPEAN RESEARCH COUNCIL (ERC) AWARD PROCESS. THEY EACH HOLD GRANTS WORTH AT LEAST £1M POUNDS WITH A TOTAL OF £20M IN FUNDING.

ERC Funding

As the UK edges closer towards full Brexit, recent fellowships, although awarded through the ERC process, have been underwritten by UK Research & Innovation (UKRI) under the 'Frontier Research Guarantee Scheme'.
ERC funds scientists at all career stages. The Department has researchers with awards granted through all of the main ERC programmes, demonstrating the health of the academic pipeline across the department - 5 fellowships are held by women and 4 by men.

Research Facilitator, Alison Edmonds, who helps academics put bids together, said: "This is a remarkable achievement for a single Department - many universities would like to have a funding record like this across the whole university."

Dr Pete Edwards	Starter Fellow	ERC	£1.3M
Dr Lianne Willems	Starter Fellow	ERC	£1.1M
Dr Martin Fascione	Consolidator Fellow	UKRI	£1.5M
Dr Meghan Halse	Consolidator Fellow	UKRI	£1.5M
Dr Alison Parkin	Consolidator Fellow	UKRI	£1.5M
Prof Kirsty Penkman	Consolidator Fellow	ERC	£1.0M (total £1.5M)
Prof Lucy Carpenter	Advanced Fellow	ERC	£1.8M
Prof Simon Duckett	Advanced Fellow	UKRI	£2.2M
Prof Gideon Davies	Synergy Grant	ERC	£2.7M (total £8M)

From Archaeology to the Atmosphere

The Department has great strength in analytical chemistry, ranging from the study of ancient history to modern day atmospheric science. A number of awards once again demonstrate how ERC funding is supporting researchers at all career stages.

Professor Kirsty Penkman received an ERC Consolidator Award to lead a study into the evolution and expansion of early humans in Europe over the last two million years. The 'EQuaTE' project is developing two independent, but complementary, dating techniques for commonly-occurring fossils from across Europe. The aim is to securely date the first appearance of human populations throughout the continent, and their repeated expansions and contractions in response to climate change.

Professor Penkman said: "Dating the Quaternary period (the last 2.5 million years) is very challenging, and yet this is a crucial period for understanding both climate change and human evolution. By tracking the chemical time-signals trapped in both the organic and inorganic fractions of fossils, our approach should provide a breakthrough in our ability to understand the past".

In atmospheric chemistry, early-career researcher Dr Pete Edwards holds an ERC Starting Grant to work on tropospheric chlorine oxidation. There have been suggestions that the chlorine atom (Cl) may be an important atmospheric oxidant, but a lack of meaningful observations mean that its role remains highly uncertain.

Dr Edwards reflected: "This career-changing grant is enabling me to pursue one of the great uncertainties in the field of atmospheric chemistry. It has also allowed me to build my research group in the Wolfson Atmospheric Chemistry Labs and get involved in emerging challenges in the field".

At advanced level, Professor Lucy Carpenter received an ERC Advanced

Grant to study how ozone in the lower atmosphere interacts with the surface of the sea. Tropospheric ozone has a major influence on air quality, public health, and the viability of the ecosystem. It is estimated that deposition of ozone on the Earth's surface accounts for around a third of overall tropospheric ozone removal; but it's much less certain what happens at the ocean surface.

Professor Carpenter, who helps lead the Wolfson Atmospheric Chemistry Laboratories, explains: "The objective is to unify observations of the ocean surface, offering insight into this complex yet sparsely studied interface and apply this knowledge to our global understanding of the atmosphere".

Building Excellence in Chemical Biology

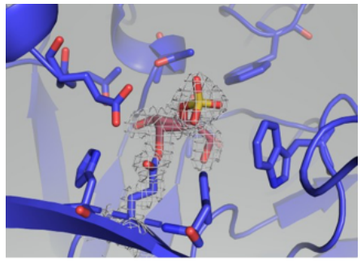
One of the important strands of departmental research strategy in recent years has been the growth of Chemical Biology. This rapidly emerging area of departmental research illustrates how ERC supports excellence across all career stages.

Early-career academic, Dr Lianne Willems, holds a five-year ERC Starting Grant. The central goal of her research program is to understand a relatively rare but devastating class of muscular dystrophies. By diving into the molecular details of this disease, to probe the key enzymes responsible for producing vital carbohydrates, she will help answer important questions about the disease, potentially helping design new diagnostic tools and therapies. Dr Willems explained: "This grant is a fantastic opportunity for me to start building an exciting new independent research program addressing the key role carbohydrates play in disease."

This year, Dr Martin Fascione and Dr Alison Parkin, who have been in York for almost 10 years, both received Consolidator Grants. These grants support academics at the career stage when they are consolidating their independent research programme.

Dr Martin Fascione's research team is developing an international profile for studying carbohydrates at the interface between chemistry and biology. By understanding how carbohydrates are perturbed in disease pathways, they aim to develop innovative approaches to prevent and treat disease, such as multidrug-resistant bacterial infections. Dr Alison Parkin uses electrochemical methods to gain detailed insight into biological systems. Her research aims gain new insights into electron transfer processes, with her grant focussing on understanding mechanisms that underpin sustainable bio-fuel production reactions.

Professor Gideon Davies has been awarded an ERC Synergy Grant with



Dr Carme Rovira from the University of Barcelona and Professor Hermen Overkleeft from the University of Leiden. Synergy grants are only given to teams of world-class researchers coming together to tackle major challenges.

The programme of research aims to develop novel chemical entities to study the enzymes involved in the synthesis and breakdown of carbohydrates, with applications in understanding and treating viral infections.

Professor Davies commented: "It's a great honour to obtain this European funding. Our collaborative work will provide truly disruptive technologies for health."

Innovative Magnetic Resonance Technologies

The Department is at the forefront of pioneering disruptive magnetic resonance technologies and this area of research has also been recognised with ERC support.

Recently, Dr Meghan Halse received a Consolidator Award. Her five-year project: 'Hyperpolarised NMR solutions beyond the laboratory (HyperSol)' aims to develop portable NMR technology that can solve analytical problems outside of the traditional laboratory environment – from field measurements to the factory floor.

She will develop a new method to amplify the NMR response of both hydrogen and carbon by factors of >1000-fold, dramatically enhancing the sensitivity and chemical discrimination of portable NMR devices.

Reflecting on the award, Dr Halse said: "In science, access to new data drives innovation. We hope to transform research by providing new quantitative information in a simple and cost-effective way".

Professor Simon Duckett's pioneering research develops methods to improve the quality of NMR spectroscopy and medical imaging. His Advanced Fellowship, 'Magnify', will pioneer a new approach to improve the ability of MRI scanners to detect diseases by making chemicals more easily detected.

Professor Duckett said: "MRI is vital to diagnose disease. Unfortunately it is very costly and suffers from low sensitivity. We will use molecular catalysis to to power dramatic improvements, with the ultimate goal of improving our ability to diagnose disease".

HyperSol: Hyperpolarised NMR Solutions beyond the Laboratory

Impactful Fundamental Research

From talking to our ERC award holders, it is clear that ERC supports fundamental, impactful research. Their research ranges from understanding the carbohydrate chemistry implicated in diseases such as muscular dystrophy, multi-drug resistant infections and COVID-19, to pioneering technologies to move NMR spectroscopy out of the laboratory and into the field. It also encompasses understanding human evolution across the European landmass, and gaining unique insight into atmospheric processes at the surface of the ocean. Our European Research Leaders have the potential to transform the chemical understanding of the world. We look forward to catching up with them in the future to see what they discover.

York signs 'Green Chemistry' commitment

THE UNIVERSITY OF YORK IS ONE OF THE FIRST UK UNIVERSITIES TO SIGN THE GREEN CHEMISTRY COMMITMENT - A CHARTER TO TRAIN THE NEXT GENERATION OF CHEMISTS ABOUT THE KEY PRINCIPLES OF GREEN CHEMISTRY.

Green Chemistry aims to remove the adverse impacts of chemistry on the environment by creating greener and more sustainable processes that offer environmentally-sound approaches to chemical products and processes.

Global

The Green Chemistry Commitment is a global initiative to help transform chemistry education by preparing students with a better understanding of Green Chemistry to ensure they are fully equipped to use methods and chemicals that are benign for human health and the environment. This has the potential to have a very significant global impact.

Other signatories to this initiative, developed by 'Beyond Benign', include The University of Bath and Queen's University in Belfast, along with over 100 universities worldwide. The signatories commit to provide Green Chemistry curriculum and specific training to their students. In particular, all students should consider aspects such as the 12 Principles of Green Chemistry, toxicology and the impact chemicals can have on human health and the environment.

In the laboratory, students should be encouraged to explore the sustainability of their processes and develop greener alternatives to chemical reactions as a part of the experiments and analysis they carry out.

Pioneering

The Green Chemistry Centre of Excellence (GCCE) here in the Department led by Professor Helen Sneddon is a world-leading academic facility for pioneering pure and applied green and sustainable chemical research through a variety of technology platforms.

Professor Sneddon said: "In an ideal world, Green Chemistry wouldn't exist as a sub-discipline. We need to move to a way of thinking where sustainability is considered as part of everything we do. Signing this commitment is symbolic of the growing integration of Green Chemistry across all Chemistry teaching and research at York. The next generation of chemists have enormous potential to accelerate the shift to greener chemistry, and it's an honour to be part of that process."

Expertise

The GCCE has expertise in developing high quality bespoke teaching on Green and Sustainable Chemistry within its highly successful MSc programme. This experience will be invaluable in ensuring that all students can benefit from the Green Chemistry Commitment.

The chemistry undergraduate degree programme is currently being revised as part of the university's transformative modularisation and semesterisation programme for students starting in 2023, and the GCCE has taken leadership for ensuring that all students will be exposed to the core principles of Green Chemistry and can develop expertise in thinking about, and practising chemistry in a more sustainable way.

Research Impact

In addition, all PhD students in the Department will have new training on the ways in which Green Chemistry can impact on their research, receiving a grounding in the Green Chemistry Principles and exploring concrete examples of how they can be applied in a research setting.

The Green Chemistry Commitment was signed by Head of Department Professor Caroline Dessent and Dean of the Faculty of Sciences, Professor Andy Dougill.

York Chemistry in the Top 10

FOLLOWING ON FROM THE NEWS REPORTED IN THE SPRING 2022 ISSUE ABOUT YORK CHEMISTRY'S EXCELLENT PERFORMANCE IN THE 2022 RESEARCH EXCELLENCE FRAMEWORK (REF), A NUMBER OF LEAGUE TABLES HAVE CONFIRMED THE DEPARTMENT'S POSITION IN THE TOP 10.

The Times and The Sunday Times Good University Guide 2023

The Department was placed 7th in the UK according to the latest release of The Times and The Sunday Times Good University Guide (2023).

Published annually, The Times and The Sunday Times Good University Guide ranks 132 UK universities by undergraduate degree subjects according to teaching quality, student experience, research quality, entry standards, graduate prospects, first-class and 2:1 degrees, completion rates, student-staff ratio, and spend on academic services and student facilities.

In total, twelve other subjects at the University of York were also ranked in the UK top 10; Archaeology and Forensic Studies (5th), Biological Sciences (6th), Criminology (10th), English (5th), French (3rd), History (9th), History of Art, Architecture and Design (7th), Iberian Languages (7th), Linguistics (6th), Natural Sciences (3rd) Philosophy (9th), and Psychology (9th).

Complete University Guide

The Department is the 7th strongest chemistry department in the UK, according to the Complete University Guide ranking (2023).

The Complete University Guide (CUG) is an annual guide which ranks 150 universities throughout the UK. The main league table is based on criteria including entry standards, student satisfaction, research quality and graduate prospects. It has been running for 25 years and its website attracts 10 million visitors a year.

Head of Department Professor Caroline Dessent said: "I'm delighted that we've been ranked at 7th in the new CUG, and the University was ranked in the overall Top 20. We are extremely proud of the outstanding teaching and research York Chemistry conducts, alongside being a department that has diversity and inclusion amongst its core values."

High-quality Teaching

THE HIGH-QUALITY TEACHING IN THE DEPARTMENT WAS RECOGNISED IN THE 2022 NATIONAL STUDENT SURVEY (NSS) RESULTS.

The NSS results indicated that York Chemistry students are particularly happy with the teaching on their course and the learning opportunities available. The NSS gathers students' opinions on the quality of their courses and reports the data in a standardised form.

92% of York Chemistry students indicated overall satisfaction with the 'Teaching on the Course', the second highest score for any Russell Group chemistry department and well above the average score of 80% for these departments. In particular, 99% of students agreed that 'the course is intellectually stimulating'.

In terms of learning opportunities, an overall score of 87% saw York as the highest placed chemistry department in the Russell Group – 10% above the average. In particular, over 90% of students agreed the course was structured to 'bring together information and ideas from different topics'.

When students were asked about their overall satisfaction with the degree, the Department was once again well-placed, with a score that was 7% above the average for Russell Group chemistry departments.

Head of Department, Professor Caroline Dessent said: "The Department of Chemistry is proud of the quality of learning opportunities it provides to its students, and will continue to develop and further enhance our degree programme so that it produces the best equipped Chemistry graduates."

Innovative graduate training to handle air-sensitive reagents

Researchers in the Department of Chemistry have pioneered a new experimental method for training graduate students in the safe handling of air-sensitive compounds.

The synthesis of organic molecules often relies on the use of air-sensitive reagents. Teaching the next generation of researchers how to safely handle these high-risk, flammable, and potentially lethal reagents in an appropriate way is a key priority.

Although some entry-level experiments using air-sensitive reagents are incorporated into advanced undergraduate experiments, there remains a need to train researchers embarking on graduate-level study in a more operationally-challenging way.

With this goal in mind, researchers at the University of York, led by Professor Ian Fairlamb, developed an innovative training experiment for new graduate students. They employed a three-step reaction, designed to teach students the safe use of Schlenk lines, high vacuum pumps, liquid nitrogen traps, cannula transfers, and syringe techniques. In particular, the experiment provides illustrations of things that can go wrong with a sensitive reaction when improper technique is employed.

Over recent years, this experiment has been used to train over 150 MSc and PhD students embarking on synthetic chemistry research degrees here in York. The team published the methodology in *Journal of Chemical Education* (2022, 99, 2656), in the hope that those responsible for training graduate students at other universities will consider incorporating this exercise into their programmes.

Professor Fairlamb said: "Laboratory safety is of paramount importance when training graduate students to become independent researchers – we clearly see many of our graduates developing their confidence as a result of this hands-on training. This experiment provides an excellent opportunity to develop skills in handling high-risk reagents, while also discussing many facets of organic chemistry, such as catalysis, drug discovery, medicinal chemistry, and most importantly, safety."

Cannula transfer of air-sensitive materials

Wellcome Trust Career Development Grant

Early career academic in the Department of Chemistry, Dr Chris Spicer, has been awarded a prestigious Wellcome Trust Career Development Grant worth £990,000.

Dr Chris Spicer was appointed as a Lecturer in the Department of Chemistry in 2018 and is part of the Molecular Materials research grouping - MolMatYork. He has been developing a reputation for his innovative research, combining chemical biology with molecular materials science with the goal of creating biomaterials for tissue engineering.

The Wellcome Trust Career Development Grants target researchers who have the potential to be international research leaders, helping them to develop their research capabilities, drive innovative programmes of work and deliver significant shifts in understanding that could improve human life, health and wellbeing. This award will allow

Dr Spicer to accelerate his research programme over the next six years by supporting four postdoctoral research fellows to work within his team.

Dr Spicer's research aims to create materials that can mimic the complex biological stimuli that nature uses to control the growth of tissues within the body. By combining cutting-edge tools in bioconjugation, biomaterial functionalisation, and dynamic covalent chemistry, these materials can then be used to support the growth of human cells, and their evolving needs over time. This will allow him to create in vitro tissue models.

These tissue models have exciting applications, helping understand and develop treatments for disease, allowing researchers to study tissue biology and the activity of new pharmaceutical agents under controlled, lab conditions, and reducing the need for animal testing.

Speaking about the award, Chris said: "I'm very grateful to the Wellcome Trust for supporting our research and excited to get started. This award will allow us to build on the early results my group has obtained since I joined York, targeting one of the most important challenges in biomedical research – how we can grow synthetic tissues in the lab that recreate some of the complex biology of actual human tissues. Support from the Wellcome Trust will allow us to bring together a highly interdisciplinary and international team of researchers and collaborators to achieve our goals, and we look forward to using our chemistry to answer real-world questions in tissue biology."

Pathways to Equity in Research

THE DEPARTMENT OF CHEMISTRY ORGANISED A SYMPOSIUM IN SEPTEMBER BRINGING TOGETHER NATIONAL STAKEHOLDERS AND RESEARCHERS TO IDENTIFY WAYS TO MAKE RESEARCH FUNDING AND CULTURE MORE EQUITABLE.

With funding from the Department and two external sponsors (GSK and Royal Society of Chemistry), over 120 people registered for the Pathways to Equity in Research event at the National STEM Learning Centre with an additional 50+ registered virtual attendees.

Attendees ranged from undergraduate students to emeritus faculty with expertise across the full breadth of STEM subjects, and with a diverse range of backgrounds and lived experiences. Nearly one third were external visitors, extending impacts from the symposium beyond the University of York.

Six talks across the morning and afternoon sessions provided valuable insights from high profile speakers, including: Professor Dame Ottoline Leyser (CEO, UKRI), Professor Anna Vignoles (Director, Leverhulme Trust), and Professor James Wilsdon (REF reform expert). Engagement from such important leaders in steering the UK research landscape ensures that equity and inclusivity considerations remain at the heart of strategy and decision-making. Through a series of focus groups, two live panel discussions, and a networking session, attendees had unique opportunities to discuss ideas with, and challenge, representatives from funding bodies, publishers, professional institutions, and industry on their future aims.

As Professor Caroline Dessent mentioned in her opening remarks, she hoped attendees and speakers would leave with inspiration and ideas for future actions. These actions might include, for example, exploring novel mentoring structures such as reverse mentoring; re-evaluating whether criteria for success allow flexibility for different capabilities; and embedding accessibility in promotion and development of technical staff.

The value of the event was echoed by speakers and attendees in widely shared social media posts, further increasing visibility of the areas discussed. This event highlighted that the University of York, and the Department of Chemistry in particular, is at the forefront of solution-building to encourage and support diverse talents in scientific research. By focusing on ways to create a positive environment for different career shapes and impactful research development, it fully embodied York's commitment to serve as a "University for the Public Good".

Outstanding Technician

GLASSBLOWER ABIGAIL MORTIMER HAS BEEN SHORTLISTED FOR THE PRESTIGIOUS TIMES HIGHER EDUCATION (THE) OUTSTANDING TECHNICIAN OF THE YEAR AWARD 2022.

The winners of the THE awards, which are known as the "Oscars of higher education" exemplify the talent, dedication and innovation of individuals and teams across all aspects of university life.

Before meeting Abby, we got a quick word from Dr Graeme McAllister, Technical Operations Manager in the Department of Chemistry, who said: "I am really thrilled that Abby has received this well-deserved nomination. Abby has the incredible ability to take a researcher's idea from a blue-sky description to a piece of quality laboratory equipment. All of us in the Department of Chemistry send our warmest congratulations."

With that ringing endorsement, we got together with Abby to find out what glassblowing in a modern chemistry department is all about.

What is a typical working day like for you?

A typical day would consist of a mix of admin, such as emails, following up on enquiries and ordering products needed for stock or specific projects, working on designs and of course the actual glassblowing. Generally I have an idea of the jobs I will be focusing on that day, or perhaps over the course of the week, but this will inevitably change as I need to react to breakages or a request for some glass needed on a short deadline.

What do you enjoy about your work?

One of the things I love about my role here at York is the research element, as it provides me with lots of interesting glassware to make and some unique challenges. For some it could be frustrating to make numerous iterations of a piece of glassware in order to get something to work as intended, but to me that is part of working for research and it's genuinely satisfying when you work through the challenges with the researcher. Of course research is often time-critical so any breakages to glassware usually need to be prioritised for repair.

What are the most complicated pieces of glassware you've made?

My most challenging pieces are usually related to electrochemistry and require a lot of access ports in the smallest space possible. I've made a number of variations of these cells over the years all with slightly different requirements and they generally end up being bespoke to the experiment they were designed for.

That must be really satisfying.

Although the process of designing and making a challenging piece of glassware is very satisfying, for me it is the fact I have solved a problem, or created a solution that enables that researcher to achieve exactly what they want to do that is so rewarding.

You must also get lots of broken glassware to mend.

When it comes to repairing or modifying glassware, something that looks to be an easy fix isn't always, depending on how the glassware was constructed in the first place. You also have to think about how to hold the piece of glass in order to repair it, which for more standard lab glassware isn't generally a problem, but for bespoke glassware, can be a bit trickier. I also need to consider how I am going to blow into the piece and be aware of any internal seals (where a smaller diameter piece of glass is sealed inside another, such as condensers or trap). Generally there isn't any way of telling whether an internal seal will crack if you reheat it. I just have to use my judgement and hope the glass gods are with me that day!

What is it like being a technician in the Department and what does the future hold?

I love being a technician as much as I do being a glassblower - I enjoy the discussions and problem solving as much as making the glassware. I think we have a strong technical team, which works together well to support the teaching and research needs of the department.

I genuinely love my job, and feel very lucky to have had the opportunity to learn this unique skill and develop my career here. When I started training almost 15 years ago, three universities had just closed their on-site glassblowing workshops and sadly more have closed since. It's such a shame, because having the on-site skills and facilities is so beneficial, especially for research. I believe scientific glassblowing is a skill that will always be needed, but where that future lies I really don't know. From a personal point of view, I am certainly hoping to be glassblowing in Chemistry for the foreseeable future.

> "It's genuinely satisfying when you work through the challenges with the researcher"