issue 10 | autumn 2021

UNIVERSITY of York

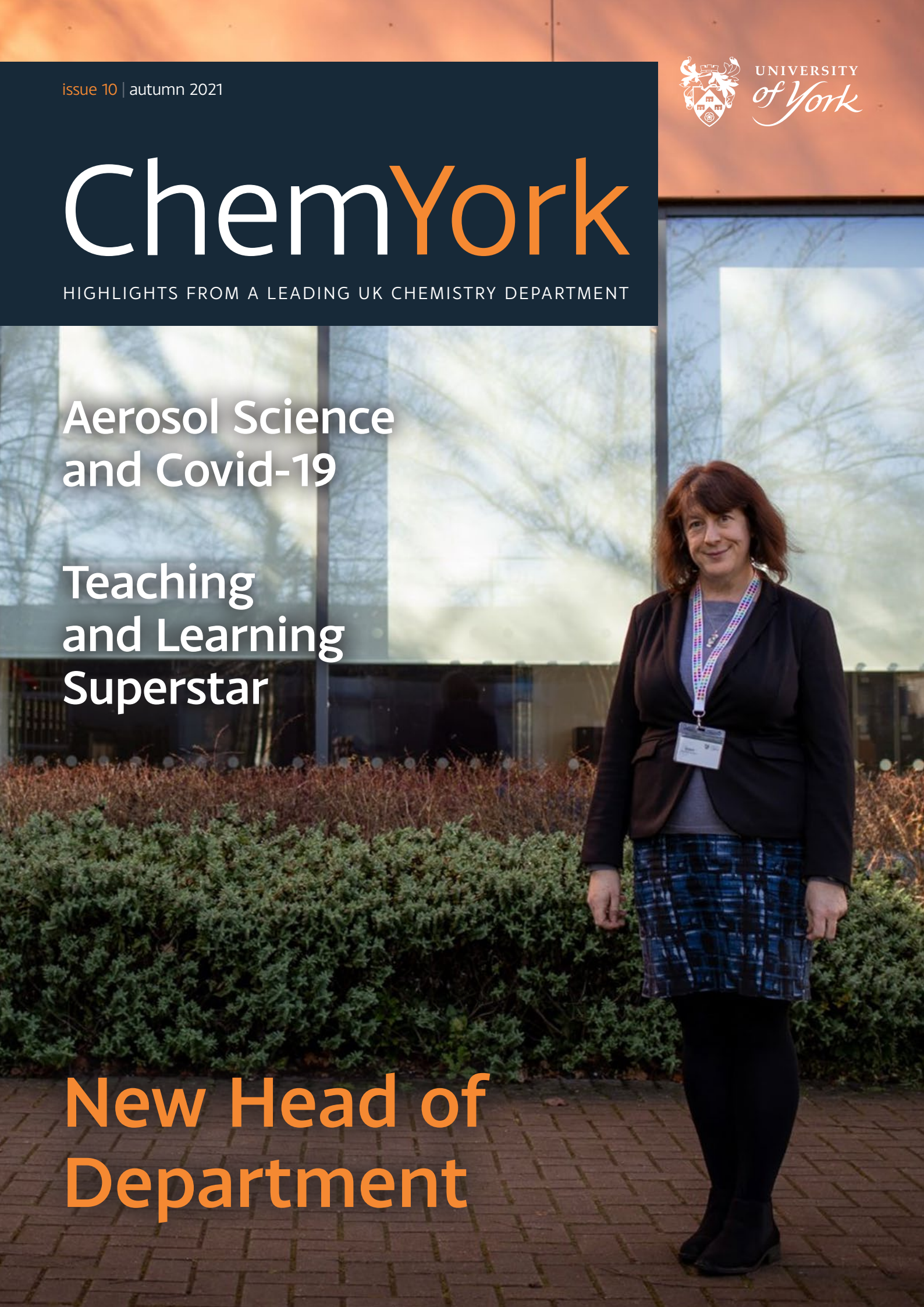
ChemYork

HIGHLIGHTS FROM A LEADING UK CHEMISTRY DEPARTMENT

Aerosol Science and Covid-19

Teaching and Learning Superstar

New Head of Department



Team Chemistry

PROFESSOR CAROLINE DESSENT, OUR NEW HEAD OF DEPARTMENT, INTRODUCES HERSELF AND THE AUTUMN EDITION OF CHEMYORK.

I write as the new Head of Department, having officially taken over from Duncan Bruce in early September. As a Department, we owe Duncan an enormous debt of gratitude for all the work he has done over the last six years. In one of his recent introduction pieces to ChemYork, he compared the Department's staff to swans who appear to glide effortlessly across the surface of the water, while their feet paddle furiously underneath. Probably nowhere is this more true than for the Head of Department who must maintain a serene and in-control composure whatever events have crossed their desk (or e-mail inbox) that day. Duncan certainly faced greater challenges than most, since it fell to him to steer us through the exceptional situation of the early pandemic. He deserves our thanks for having safely reopened our research laboratories much earlier than many other UK Chemistry Departments, allowing our PhDs and post-docs to continue their research work through

> "Our department is one where people tend to arrive and then happily stay, and that has certainly been true for me"

the second and third lockdowns. This has put us in a strong position where our research has quickly started to thrive again. However, Duncan's tenure as Head of Department should also be remembered for many other things including our outstanding new cryo-electron microscopy facility, our latest Athena SWAN Gold Award, colleagues elected as Fellows of the Royal Society and the consistently excellent standards of teaching and research that have been maintained across the Department. So, from all of us, I'd just like to say a huge 'thank you'.

To introduce myself, I grew up in a mining community in South Wales, was an undergraduate in Oxford, and then completed my PhD at Yale University before arriving in York over two decades ago. My background is one that would now be described as "widening participation". Our Department is one where people tend to arrive and then happily stay, and that has certainly been true for me. I'm a Physical and Analytical Chemist, and my research group studies the interactions of molecules with light using a combination of lasers and mass spectrometers. We focus on chemical systems that are important in health applications and the natural environment. To give an example, one area involves studying the fundamental photochemistry of organic sunscreen molecules to inform the future development of better sun-protection products.

I've been a member of the Departmental Management Team for the last four years through my role as Chair of the Department's Equality and Diversity Group (EDG). York Chemistry's reputation for diversity and inclusion is international, and I've relished being able to contribute to this. You can read about the Department's approach to the inclusion of disabled students on page 11. I'll certainly be bringing all of my passion for diversity and inclusion into my role as Head of Department, and look forward to leading a department that aims to get the very best out of all of its students and staff.

As I write, we've just passed the half-way point of the Autumn term. We made the decision to return our teaching to face-to-face delivery, simply because we think that this is the best way to allow our students to thrive. It has been strange to return to giving lectures to rooms full of real people, but our students have been delighted to have their teaching delivered in this way, and it's been incredible to feel the life returning to the Department as our undergraduates come and go. Vaccination rates are very high across campus with the result that cases of COVID-19 have been extremely low so far this term. In the Department, adherence to wearing masks has been high, no doubt in part due to the work of Professor Jacqui Hamilton. Jacqui, an expert on aerosols, has produced materials to educate our students about the benefits of mask wearing for reducing COVID-19 transmission. You can read more about this on page 10 – as a department, we are absolutely "following the science"!

I'll leave you to enjoy the rest of the magazine, with a special mention for the article on page 3 about the recent RSC Horizon Prizes awarded to several groups of our researchers. The awards are special because they are the first RSC prizes to be awarded to teams for group efforts in delivering scientific advances. It seems very appropriate to me that three of these prestigious new awards have come to York Chemistry. York Chemistry is a Department with an amazing team spirit, and it will be my privilege to lead the team over the next four years.

Front cover image: *Suzy Harrison*

Compiled by *David Smith and Christina McCormack*

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New horizons

In 2021, the Royal Society of Chemistry re-launched its portfolio of prizes. In particular, they wanted to have some of their awards focus more on collaboration and teamwork than on the traditional model of the 'lone genius'. With this in mind, the RSC developed their 'Horizon Prizes'. The Department of Chemistry in York has always prized itself on its unique research environment which puts people first, and encourages a highly collaborative approach to science. It was therefore a genuine delight when members of the Department were part of teams that won inaugural RSC Horizon Prizes. Here we explore those awards, and the teams that won them.

Sustainable drug synthesis

A team of scientists, led by Professor Gideon Grogan from the Department of Chemistry, were awarded a Rita and John Cornforth Horizon Award, for developing more sustainable approaches to drug synthesis.

The prize recognized the discovery, characterisation and application of enzymes – 'RedAms' - that catalyze a reductive amination reaction, an important reaction in chemical synthesis for the formation of amines, molecules that are important as pharmaceutical compounds and their precursors. Using enzymes to catalyze amine synthesis enables more selective, green and sustainable synthesis of amine-containing drug molecules.

The interdisciplinary nature of the project was crucial to its success. York scientists were able to apply their expertise in molecular biology and protein structure, to help understand how the RedAms work, and suggest ways of improving their activity using protein engineering. The structural work at York was performed by Professor Gideon Grogan, postdoctoral researcher Dr Mahima Sharma (see

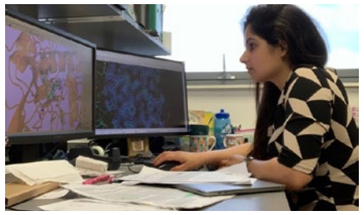


photo) and PhD student Henry Man. More work on the enzymology and chemistry was performed at the University of Manchester, led by Professor Nick Turner. Partner company Prozomix have discovered many new and different RedAms in nature, allowing their application in the formation of many different amines. Researchers at GSK worked on scaling up the enzymatic reactions for use in the synthesis of a medicine in its oncology portfolio.

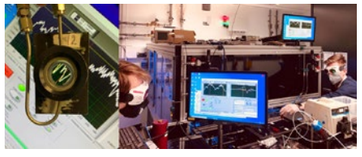
As a result of close cooperation between the partners, the time from discovery to application was less than four years. The team's work led to the development of a drug for treating small-cell lung cancer and acute leukemia, as well as an improved synthesis of a widely used antidepressant.

Mechanistic insight into sustainable chemical synthesis

Professor Ian Fairlamb and Dr Jason Lynam, from the Department of Chemistry, were part of a team awarded the Perkin Prize in Physical Organic Chemistry after they created and studied reaction processes that could allow thousands of products to be made in a more sustainable way. In particular, the team gained important insights into powerful chemical reactions that enable the direct reaction of otherwise unreactive carbon-hydrogen bonds.

Dr Lynam said "An interdisciplinary team was vital to the success of this project. The interplay between synthetic and mechanistic chemistry in York, the state-of-the-art spectroscopic methods at the Central Laser Facility and working closely with industrial process chemists ensured that the key steps in important catalytic reactions could be observed. This has provided a step change in how we can probe and understand such reactions."

The combination of techniques enabled the team to observe chemical events which occur on timescales ranging from a trillionth of second through to hours. Understanding these important chemical reactions across all timescales is important, particularly when optimising syntheses for commercial-scale manufacture – for example in the agrochemical industry.



New methods for understanding enzymes

Dr Jon Agirre was recognised as part of an extensive international research team that developed understanding of a biologically-important enzyme that plays a key role in adding sugars to proteins. The multidisciplinary team, led by Dr Ben Schumann (The Crick, UK) and Professor Carolyn Bertozzi (Stanford University, USA), used the 'bump-and-hole' approach to work with a modified version of the N-acetylgalactosaminyl transferase (GalNAc-T) enzyme, and made it capable of accepting tagged substrates that can be tracked in living cells. With these new tools, the scientists managed to pinpoint the 'landing area' of the modified substrates with unprecedented accuracy, hence identifying which individual proteins can receive a sugar substrate from GalNAc-T.

Dr Jon Agirre (YSBL, Department of Chemistry), who works in structural biology and currently holds the prestigious Royal Society Olga Kennard Research Fellowship, assisted the team with the refinement of the atomic structures of the complexes. Dr Agirre is an expert in the refinement of carbohydrate structures, and ensured that the resulting atomic structures made chemical sense.

Chemistry helps study remarkable evolutionary change

Analyses of ancient protein by Dr Marc Dickinson and Professor Kirsty Penkman in the archaeological chemistry team have helped show that an extinct species of dwarf elephant experienced a spectacular size change (with a weight loss of 8 tons and shrinking by almost two metres) as it evolved from one of the largest land mammals that ever lived.

The study, involving collaboration with Nottingham Trent University, the University of Potsdam in Germany, the Natural History Museum, the University of Iceland, the University of Palermo and the University of Cambridge was published in Current Biology 2021, 31, 3606.

The collaborative research team used DNA and fossil evidence to prove that the island-dwelling Sicilian dwarf elephant – thought to have become extinct about 19,000 years ago – was just 15% of its original body mass by the time its dwarfing process was complete. As a result of the isolated, insular nature of islands, evolution in such settings is a process which can lead to extreme changes in a short timeframe. For each generation of evolution, the dwarf elephant was reduced in weight by as much as 200kg and by up to 4cm in height. To put the extent of the size reduction of the dwarf elephant into context, it would be comparable to modern humans dwarfing to approximately the size of a Rhesus monkey.

The team successfully recovered ancient DNA from dwarf elephant remains from Sicily's Puntali Cave. It is thought that elephants originally arrived on the island from the mainland as *Palaeoloxodon antiquus*, and then the dwarfing process began once the Puntali elephant diverged from its mainland relative.

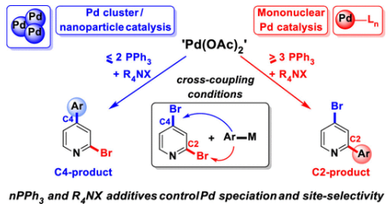
As part of the study, researchers from York's Department of Chemistry used a technique called intra-crystalline protein degradation (IcPD) dating. This assesses the breakdown of proteins and amino acids found in the elephants' fossil tooth enamel, and estimates the age of the sample. Dr Marc Dickinson, a postdoctoral researcher in the Department of Chemistry, said "It was brilliant to be able to use IcPD analysis to help date these dramatic changes to elephant body size, and to contribute to such an exciting multidisciplinary study."

Remains of the dwarf elephant Palaeoloxodon mnaidriensis uncovered in Sicily's Puntali Cave. Credit: Gemmellaro Geological Museum

Switching catalyst selectivity

Recent research from Professor Fairlamb's group has shown that the selectivity of palladium-catalysed reactions can be dramatically switched using very small changes in reaction conditions.

Palladium-catalysed reactions are of key importance in synthetic chemistry, being widely applied in pharmaceutical and agrochemical sectors of industry. In particular, cross-coupling reactions offer a straightforward way of converting carbon-halogen bonds into new carbon-carbon bonds, building-up the complexity of molecular frameworks. However, achieving the desired selectivity in systems that have multiple halogen atoms, each of which can be a potential reaction site, can be extremely challenging.

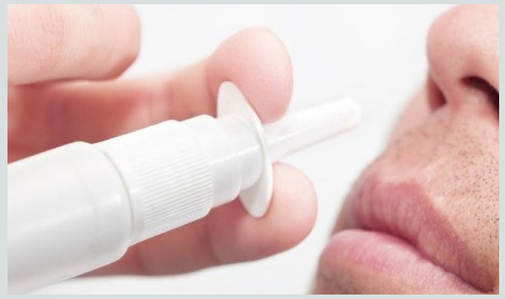


In work published in Journal of the American Chemical Society 2021, 143, 9682, Professor Ian Fairlamb, working in collaboration with Dr Charlotte Willans from University of Leeds and Dr Mark Ford from Bayer AG explored innovative ways of controlling the selectivity of such reactions. They discovered that the selectivity of very well-established catalyst systems could be completely altered by making very small changes to the reaction conditions.

Careful studies led them to conclude that the small change in reaction conditions converted the catalyst from a mononuclear species with a single palladium centre (red, see Figure), to a palladium cluster (blue, see Figure). This change in catalyst speciation led to the resulting switch in reaction selectivity.

Professor Ian Fairlamb explained: "General rules about palladium catalyst speciation are not so easy to develop, but we are working hard towards that goal. Furthermore, future research in Pd-catalyzed cross-coupling chemistry needs to focus on using very low palladium loadings, particularly with sustainability and cost in mind – we therefore need to do everything we can to enable catalyst systems to do more using less."

Step-closer to nasal spray drug delivery for Parkinson's disease



Research from Professor David Smith's lab has made significant progress towards a nasal spray treatment for patients with Parkinson's disease. They developed a new gel that can adhere to tissue inside the nose alongside the drug levodopa, helping deliver treatment directly to the brain.

Levodopa is converted to dopamine in the brain, which makes-up for the deficit of dopamine-producing cells in Parkinson's patients, and helps treat the symptoms of the disease. However, for current treatments, the body can break down the drug before it gets to the brain where it is most needed. After extended periods of use, increased dosages become necessary, and in later stages, sometimes, instead of tablets, the drug has to be injected. Investigations into nasal sprays are interesting because there is a direct route to the brain via the nerves that service the nose. However, the challenge is to find a way of making the drug adhere to the nasal tissue long enough to release a good dosage.

In research published in Advanced Science 2021, 2101058, the gel developed by Professor Smith's group was shown to give the drug better adhesion inside the nose, which allowed for better levels of uptake into both the blood and brain. Testing in animal models by Professor Khuloud al Jamal and her team at King's College London indicated very good levels of delivery to the brain - far better than if a simple solution of the drug was applied in the nasal cavity, or if the drug was injected intravenously. The team are now working to optimise the gels further and incorporate them in nasal spray devices, to ultimately progress to clinical trials in humans. The approach may also be relevant to delivering drugs for other neurodegenerative diseases such as Alzheimer's.

Understanding 'The Great Famine' at a molecular level paves the way for potential future plant disease prevention

The microorganism *Phytophthora infestans* is known to cause potato late blight, a devastating plant disease that led to widespread starvation in Europe and more than a million deaths in Ireland in the 1840s, in what became known as 'The Great Famine'. Plant infection continues to cause billions of dollars' worth of damage to global crop production each year and threatens world food security.

New research, led by biologists and chemists from the University of York, and published in Science 2021, 373, 774, describes a new family of enzymes found in *Phytophthora infestans* that enable the microorganism to degrade pectin - a key component of plant cell walls. This allows the pathogen to break through the plant's defences to infect the plant. Importantly, the team showed that disabling the gene that encodes this enzyme rendered the pathogen incapable of infecting the host. This could open up new ways of protecting crops from these pathogens.

The researchers discovered the new enzymes that attack pectin are lytic polysaccharide monooxygenases (LPMOs). Professors Gideon Davies and Paul Walton in the Department of Chemistry have particular experience in working with this type of enzyme. They used their skills in carbohydrate and bioinorganic copper chemistry to help understand the specificity of this virulence factor for pectin.

The work was the result of interdisciplinary collaborations with the Department of Biology in York, as well as plant pathologists at the James Hutton Institute, and genomicists at CNRS Marseille.

SINCE ARRIVING AT YORK IN 2014, DR GLENN HURST HAS RECEIVED A REMARKABLE NUMBER OF ACCOLADES FOR HIS INNOVATIVE WORK IN TEACHING AND LEARNING.

Teaching and learning superstar

Dr Glenn Hurst was recognised by Jisc as one of the top ten social media superstars in higher education in 2017 and was a finalist in the Times Higher Education 'Most Innovative Teacher of the Year' category in 2018, In 2019, he was highly commended for 'Teaching Excellence' in the Educate North Awards 2019 and won the American Chemical Society Committee on Environmental Improvement Award for Incorporation of Sustainability into Chemistry Education. In 2021, he won the JoVE 'Innovation in Instruction' Award. His groundbreaking work in Teaching and Learning was recognised with a Royal Society of Chemistry (RSC) Higher Education Teaching Award, and most significantly, he received a National Teaching Fellowship from Advance HE.

We therefore decided we should get together with Glenn to find out the secrets of his success.

You were awarded a National Teaching Fellowship - these are hugely prestigious awards that recognise your whole approach to teaching. How would you describe your teaching philosophy?

My vision is for students to be effective, influential, and fulfilled scholars who are able to work in interdisciplinary teams to solve grand challenges as outlined by the United Nations Sustainable Development Goals (UN SDGs). I want students to synthesise and apply diverse knowledge and skills that will not only equip them to achieve within their programmes of study, but also allow them to succeed in their endeavours after university.

And strategically, how do you do this?

I design programmes, modules, and sessions, allowing students to achieve a deeper understanding of subject matter. This is done using a 'systems approach' that identifies connections across disciplines. This is a research-led and strongly contextualised methodology, which engages students with the subject matter. To deepen this engagement, I have integrated technology-enhanced learning methods and made use of social media.

You have consistently won awards for integrating social media into undergraduate teaching - could you tell us about some of the benefits of this?

Social media is an effective tool and I have used it to enhance student engagement, provide contextualisation with everyday applications, and offer a glimpse into life as a researcher. In particular, I have used it as a tool to allow students to appreciate how explanations and arguments are built up into a discipline. More recently, I have moved from an instructor-led approach to one that is student-led, where the students themselves create their own content, enhancing their own personal skills in the process, and ultimately inspire and educate others.

> “Through close cooperation, I believe we do very exciting work together, intimately connecting research and teaching, so that together, we are both training the next generation but also tackling the big societal problems that our planet is facing.’

Yes, it's very clear that you see students as 'partners' as well as people to be educated - how does this influence your teaching?

Working with students as partners has always been fundamental to my approach. Students become active participants, and contribute their own valuable expertise towards shaping learning, teaching, assessment, governance, and institutional-level work alongside academic and professional support staff. Working closely together produces the most impactful results; this was especially true during my time chairing the Blended Learning Expert Panel, which was established to advise the University on its transition towards online and blended learning environments in response to the COVID-19 pandemic.

Your educational approach clearly empowers students to find their own voice - have there been times they have particularly impressed you?

I continue to be impressed and proud of the students I work with. It is particularly rewarding to see students who have conducted pedagogic research with me find their own voice in communicating their research through conference presentations and publications.

You have around 25 publications of your educational work in research journals. What are the benefits of doing this?

Publishing educational work is very important for several reasons. A significant portion of the work I publish is in conjunction with students, which helps them disseminate their own research and learning, and makes their CVs more distinctive, enhancing their employability. Importantly, these publications share good practice more widely, and have led to collaborations across the globe. A particularly exciting piece of current work is acting as an expert for the United Nations, where we are collaborating to produce a framework manual on global green chemistry education - some of the interventions showcased were developed by our students at York!

At the University level, you lead the Learning and Teaching Forum - how do you ensure good educational practice gets spread across campus?

There is a multi-faceted approach to sharing educational practice across the institution comprising our Annual Learning and Teaching Conference, a programme of workshops, a magazine that is published biannually and a blog. Recently, we have introduced an early career sub-grouping, designed to support staff in their continuing professional development towards the start of their career. The work of the Learning and Teaching Forum also extends beyond York with contributions from our partner institutions, Maastricht University and CITY College Thessaloniki.

As educators, we are also constantly learning ourselves, what do you see as your own personal next big challenges?

I am on the leadership team for a highly collaborative project with $250,000 funding from the Argosy Foundation to establish 'The Green Chemistry Teaching and Learning Community' (GCTLC). The GCTLC, which is set to officially launch in 2023, will serve as a central online networking hub where users from across the world (including educators from primary school through to higher education, students, and industry stakeholders) can share resources, collaborate, receive mentorship, and connect with one another. The potential to truly transform green chemistry education by supporting students and instructors in this way is incredibly exciting!

What do you think the next steps for the Department of Chemistry should be in terms of chemistry education?

For me, 'Team Chemistry' is what makes Chemistry at York so special. The people. I am proud to work in a Department with such talented and committed students alongside such innovative and dedicated colleagues. Through close cooperation, I believe we can continue to do very exciting work together, intimately connecting research and teaching, so that together, we are both training the next generation but also tackling the big societal problems that our planet is facing.

Two Vice-Chancellor's Teaching Awards

Chemistry lecturers, Dr Julia Sarju and Dr Lizzie Wheeldon have received the Vice-Chancellor's Teaching Award 2021 in recognition of 'excellent contributions' to learning and teaching activities in the Department. The University of York Vice-Chancellor's Teaching Award celebrates significant achievements in teaching and learning support.

Dr Julia Sarju has been a Lecturer in the Department since October 2016, contributing widely to the Department's teaching. She has recently contributed to the development of a new research-led Masters-level chemistry course, designed to connect students to authentic research taking place at York, and has designed and supervised Year 3 mini-research projects developing synthetic routes to antimalarial target compounds. Julia has led prize-winning inclusive teaching and accessibility training for GTAs, is an active member of the National Association of Disabled Staff Networks and is passionate about working for the inclusion of disabled scientists. She is the Departmental Disability Officer for Chemistry. You can read more of Julia's thoughts about the inclusion of disabled scientists on page 11.

Dr Lizzie Wheeldon has been an Associate Lecturer in the Department since September 2019, delivering tutorials and workshops across all years on a range of modules and topics. As module coordinator for Year 1 practical chemistry, she has led the first year students through the previous challenging academic year in labs, and has been experimental coordinator for practical experiments in all 3 years. As a supporter of outreach and widening participation, Lizzie gets involved in many opportunities including the Royal Society of Chemistry Top of the Bench competition, and Salters Festival of Chemistry, and has run a successful outreach mini-project for third year MChem students. During the COVID-19 pandemic, she produced training materials to help other academic staff make the transition to online teaching methods.

PhD Supervisor of the Year Award

Dr Alyssa-Jennifer Avestro was recognised as 'PhD Supervisor of the Year' in the York University Students' Union (YUSU) Excellence Awards. YUSU Excellence Awards are given on the basis of student nominations across ten categories, with up to four finalists in each category. In Chemistry, Nick Heywood and Aidan Carr were nominated for GTA of the Year, Dr Julia Sarju and Dr Jason Lynam were nominated as Supervisor of the Year and Dr Seishi Shimizu was nominated as Most Inspiring.

However, it was Dr Avestro's nominations which particularly stood out to the student judging panel. The nominations described her 'forward-thinking guidance', her help to 'build self-confidence and professional networks' and spoke of being given 'the opportunity to develop beyond the work of my PhD'. One nominating student wrote, 'As an international student, finding funding to offset the costs of pursuing a PhD

in the UK is tough – Alyssa made it easier by supporting scholarship applications as well as giving me feedback to help strengthen my personal statements. She went beyond... As a first-generation PhD student, the advice has helped me to familiarise myself with academia and how to navigate through it to have a successful career. Her determination to not allow barriers such as country of origin affect my ability to do research has been inspiring and I'm excited to do similar things when I can mentor students.'

Dr Alyssa-Jennifer Avestro joined the Department of Chemistry in January 2019 as a Royal Society Dorothy Hodgkin Research Fellow, leading research in molecular materials for energy and is a key member of the Molecular Materials Research Group. She leads a team of 8 York-based researchers (3 PhD students, 2 postdoctoral research fellows, 3 undergraduates) as well as 2 final-year PhD students at Durham University, working towards the rational design of 'multidimensionally conjugated' electroactive materials.

Dr Avestro said: "Thank you to everyone who nominated me, I am delighted. I view the award as being about the whole team, since they are certainly the ones who enable me to do my best!"

The Roger J Mawby Demonstrator Awards

THE OUTSTANDING PERFORMANCE OF SIX CHEMISTRY GRADUATE TEACHING ASSISTANTS (GTAS) WAS RECOGNISED IN THIS YEAR'S ROGER J MAWBY DEMONSTRATING AWARDS.

These annual awards recognise the important contribution made by GTAs to undergraduate teaching in the Department of Chemistry. Prizes are awarded thanks to a generous bequest made to the Department in memory of Roger J Mawby, an inspirational educator and one of the founding academic staff members of Chemistry at York. Up to six students who have gone above and beyond the requirements of the GTA role, as judged by the Awards Panel, receive the award each year. Each of this year's winners received a cash prize of £150:






Rosalind Booth For highly conscientious demonstrating, particularly in helping students link between theory and practice in the laboratory.

Rebecca Donovan In particular recognition for efforts in the mentoring of new demonstrators and consistent high quality demonstrating.

Chloe Howman For consistently high quality demonstrating, especially when supporting students who find practical work more challenging.

Alastair Robinson For the development of resources to assist teaching during the pandemic and consistent high quality demonstrating.

Rachel Steen For delivery of consistently high quality teaching, support and management of student groups in the laboratory.

Nik Vagkidis For exceptionally diligent management of student groups in the laboratory, ensuring support to all students and helping to link the context of undergraduate practicals with research in the Department.

Johnson Matthey poster competition

The Department of Chemistry's annual Poster competition for PhD students was held online for the first time. The competition, which is kindly sponsored by Johnson Matthey, requires participants to display a poster about their research, and this is then scored by a panel of judges who consider Poster Presentation, Scientific Content, and Student Discussion.

"The event usually takes place in a busy room, with lots of poster boards and the buzz of conversation," said Rachel Crooks, event organiser in the Department of Chemistry. "Having had to cancel the event in 2020, this year we moved it online and used Zoom and breakout rooms to allow participants to share their work."

Twenty-four posters were on display and both judges and members of the Department were able to move between rooms to talk to participants and enjoy an opportunity to talk science and share work. After the viewing, guest speaker, Dr Mike Bainbridge from Johnson Matthey talked about his career path, and current work at Johnson Matthey, particularly related to technologies for hydrogen production.

The winning poster participants who each win £300 to spend on items related to their research.

Gayathri Athavan (Professor Ian Fairlamb and Professor Robin Perutz). Understanding the Role of Ag(I) Salts in the Pd-catalysed C–H Activation of Fluorinated Aromatics

Rosalind Booth (Professor Anne-Kathrin Duhme-Klair, Professor Keith Wilson and Professor Gideon Grogan). Optimising Artificial Enzymes by Altering the Nature of the Active Metal Complex

Jonathan Churchill (Professor Peter O'Brien, Professor Victor Chechik and Dr Alison Parkin). Synthesis of Sterically Hindered Tertiary Amines by Electrochemically Generated ß-Amino Radicals

James Race (Professor Andrew Weller). Rhodium Complexes of Ortho-aryl substituted DPEphos ligands; Understanding Anagostic Interactions and Agostic Bonds

Rhianna Rowland (Professor Gideon Davies). Insect-Baculoviral Production of Human ß-Glucocerebrosidase Enables Atomic Resolution Analysis

Aerosol science and COVID-19

PROFESSOR JACQUI HAMILTON WORKS AS PART OF THE WOLFSON ATMOSPHERIC CHEMISTRY LABORATORY HERE IN THE DEPARTMENT OF CHEMISTRY. HER RESEARCH TEAM SPECIALISES IN UNDERSTANDING THE FORMATION OF ORGANIC AEROSOLS IN THE ATMOSPHERE.

Jacqui is Vice President of the UK and Ireland Aerosol Society. As the COVID-19 pandemic progressed, the ability of the virus to transmit in aerosol particles became increasingly evident, and Jacqui realised her research expertise had particular relevance.

What was your original degree, and how did you become a specialist in aerosols?

My original degree was in Forensic and Analytical Chemistry at the University of Strathclyde. After this I did a PhD in Leeds developing new techniques to study the organic composition of the atmosphere. As an independent researcher I started to look at the composition of pollution aerosols, using high resolution methods to give detailed chemical information.

What is an aerosol, and how do you study them in the lab?

The term aerosol means a liquid or solid droplet surrounded by a gas. In the case of atmospheric aerosols, the gas is our atmosphere's air. Aerosols can be emitted to the atmosphere from natural sources such as sea spray, pollen and dust. Human activities also release aerosols such as cooking, vehicle exhaust and combustion sources. We collect atmospheric aerosols in the field and we can carry out lab simulations in our Aerosol Flow Reactor in WACL to understand the oxidation chemistry that leads to secondary particle formation.

What should the general public know about aerosols that would help them better understand a disease like COVID-19?

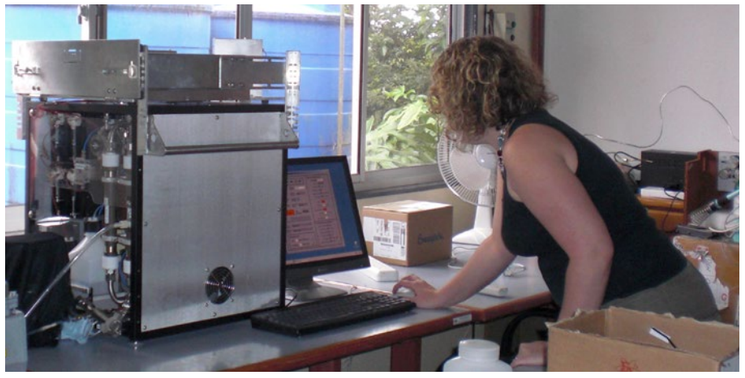
Humans emit aerosols and droplets - these can contain virus particles. Even breathing emits aerosols, but you get increased levels when singing, coughing or sneezing. For disease transmission, aerosols are smaller particles - less than 100 micrometres in diameter. Droplets are larger and heavier, and rapidly fall to the ground due to gravity. This is the basis for the 2 m social distancing rule. However, aerosols are much lighter, so don't deposit as quickly. This means their levels can build up in poorly ventilated spaces. There is increasing evidence that aerosols are the dominant route of transmission of the SARS-CoV2 virus. Face masks and improved ventilation are the key ways to minimise transmission via aerosol inhalation. Early in the pandemic, there were suggestions that masks only stop you infecting other people. But aerosol physics clearly shows that masks work in both directions and can help reduce your own risk of exposure to aerosol transmission.

How does this link to your own interests in aerosols?

In my Year 3 aerosol chemistry course, I teach students how to estimate the settling velocities of different sized particles and to understand the different loss processes of aerosols - obviously directly relevant to COVID-19 transmission. In terms of research, I am really interested in the use of filtration in indoor spaces to remove aerosols. There has been a huge increase in unproven technologies, such as plasmas and ionisers, being sold for reducing aerosol exposure. But many of these are unregulated and use air cleaners such as OH radicals and ozone, which could have unintended consequences on indoor air quality.

What have you done to try and influence policies with regard to the COVID-19 pandemic?

Early in the pandemic, the UK and Ireland Aerosol Society set up a series of seminars to discuss the role of aerosol transmission for COVID-19. A group from the EPSRC DTP set up an online literature review and database bringing together the most up-to-date literature on COVID-19, highlighting the uncertainties. I have given advice to a number of groups trying to improve access to higher quality masks in the NHS and been signatory to open letters to urge organisations to address aerosol transmission, including the UK, Australian and Canadian governments. At the University, I have given advice to the COVID-19 contingency group on the use of masks and managed to ensure masks were introduced in all shared spaces in the University at the start of the 2020 academic year. Before COVID-19, I didn't really use Twitter but it's been a great way to communicate aerosol science with a wide range of people and provide the best possible advice on minimising aerosol transmission.



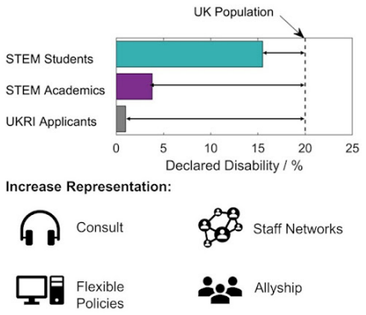
Towards genuine inclusion of disabled scientists

THE COVID-19 PANDEMIC HAS IMPACTED US ALL BUT THE CONSEQUENCES HAVE NOT BEEN FELT EQUALLY. IN A RECENT ARTICLE PUBLISHED IN CHEMISTRY A EUROPEAN JOURNAL, LECTURER IN CHEMISTRY EDUCATION DR JULIA SARJU SUGGESTED STRATEGIES FOR THE GENUINE INCLUSION OF DISABLED SCIENTISTS, ARGUING THAT THE TIME HAS NEVER BEEN MORE IMPORTANT TO TAKE ACTION.

Disabled people are a sizable minority, with 1 in 5 people in the UK and 1 in 8 people in the US identifying as having a disability. In 2018–2019, 15.5 % of first-degree STEM students studying in the UK declared at least one disability, but analysis of the destinations of STEM graduates found that STEM graduates with a known disability are more likely to be unemployed six months after graduation compared to their peers with no known disability. Furthermore, the rates of known disability in academia and STEM careers are lower compared to the general population, and this difference becomes more significant with increasing seniority. Discrimination, insufficient accessibility, and attitudinal issues all contribute both to the under-representation of disabled scientists and an unwillingness to declare disability status.

There are at least two major issues here. The first is that there is a large number of scientists who do not feel they can be their whole selves in their workplaces, are not accessing accommodations or support to remove barriers, and may have to moderate what they say and how they act to "pass". The second is that disabled people simply do not have equitable access to scientific careers.

In terms of the COVID-19 pandemic, the UN Sustainable Development Goals were updated to highlight that disabled people are amongst those "being hit hardest by the pandemic" and that "existing patterns of discrimination may be entrenched by the crisis". Disabled scientists have experienced significant and diverse challenges, including difficulties and delays accessing health, and social care, and variable levels of digital accessibility. Scientists who have been shielding for medical reasons have not been able to access labs and equipment and may have also felt isolated from colleagues and networks. Uncertainty, health and hygiene concerns, and isolation have been particularly challenging for many with mental ill-health.



Furthermore, frequent, and public discussion of underlying health conditions has made some feel that their rich and important life as a disabled person is somehow less valued.

Reflecting on the experiences of disabled scientists, Dr Sarju said: "Scientific institutions and workplaces must learn from the experiences of disabled scientists, champion and support disabled leaders, ensure the visibility of positive senior disabled role models, and adopt inclusive practices and policies. A culture change is required to ensure that disabled people are valued and recognised as scientists, innovators, and leaders. By ensuring we are inclusive of and supportive to as diverse a range of scientists as possible we can make sure that scientists represent the wider population, making space for new ideas, and ultimately new and exciting scientific developments."

IN HER ARTICLE, DR SARJU MADE A NUMBER OF KEY RECOMMENDATIONS:

Decision-making: Ensure meaningful consultation with disabled staff and representation of disabled staff in committees and decision-making groups.

Advocacy: Allies must advocate for scientists from under-represented groups to lessen the burden and risks of activism.

Networks: Work with and support disabled staff networks.

Web-accessibility: Ensure online content including websites, learning management systems, and apps are accessible. At the minimum they should meet the EU Web Accessibility Directive by being perceivable, operable, understandable, and robust.

Flexibility: Continue to offer flexible and remote working polices as recommended by the World Health Organisation, and to continue to allow virtual attendance of conferences and meetings, with a plan for inclusivity.

Yorkshire Asian Young Achiever

PHD CHEMISTRY STUDENT RUHEE DAWOOD WON A PRESTIGIOUS AWARD AT THE YORKSHIRE ASIAN YOUNG ACHIEVER AWARDS (YAYAS).

Ruhee Dawood, 23, won the 'YAYAs Achievement in School or College' award category for mentoring in STEM subjects. The category looked for candidates who "show others just what can be achieved by application, hard work and determination". Ruhee was shortlisted along with 33 candidates, and heard that she had won in front of a live audience of 250 invited guests at the Cedar Court Hotel in Bradford.

The YAYAs, which launched in 2020, celebrate young people aged 16-30 of South Asian heritage who were born, or are living or working in Yorkshire. The awards are run by QED UK, a social enterprise that seeks to improve the social and economic circumstances of disadvantaged communities in the UK and Europe.

Of Indian origin, and born and raised in Kenya, Ruhee was awarded a Sharifah Sofia Albukhary Scholarship to study Chemistry at the University of York. Despite all of the challenges posed by the pandemic, Ruhee graduated at the top of her year. She was also awarded the Department's Whinfield Medal for her achievements. Ruhee then won a further scholarship, a Chemistry Wild Fund Platinum Award, to fund her PhD at York in the Molecular Energy Materials group led by Dr Alyssa-Jennifer Avestro.

Ruhee recognises the importance of role models and in giving back to the wider community and works as a mentor in the STEMi Women Kuongoza Program, which seeks to empower women and girls across the Middle East, South Asia and Africa.

Ruhee said: "I want to offer a big thank you to QED and all the sponsors for a wonderful evening at the YAYAs Award Ceremony and Dinner. Also a big congratulations to all the nominees and winners of the night!"

She added: "I was very lucky to find a role model during my undergraduate degree to help inspire me to perform at my highest level, and support me through my PhD and scholarship applications. If you can find someone who understands your circumstances and truly wants the best for you, you can really flourish, and I now hope to be that person for others. I have taken up active mentorship roles to encourage and support international students from ethnic minority groups to pursue studies in STEM subjects by helping them lower barriers for themselves."

> "If you can find someone who understands your circumstances and truly wants the best for you, you can really flourish, and I now hope to be that person for others."

Indeed, one of Ruhee's mentees from Nigeria has been inspired to pursue further studies in the USA, and Ruhee has also supported a student from India in a successful application for the same PhD scholarship as her own.

Having served as the undergraduate representative in the Department's Equality and Diversity group, Ruhee is now a postgraduate representative. She recently contributed to Chemistry's efforts to decolonise the curriculum through co-authoring a paper in the Journal of Chemical Education along with senior professors, including Chemistry's Head of Department Professor Caroline Dessent. Through her contributions, Ruhee hopes to inspire changes which might level the playing field for all who wish to pursue an academic career.

Dr Alyssa-Jennifer Avestro (see page 8), Royal Society Dorothy Hodgkin Fellow from the Department of Chemistry and Chemistry Postdoctoral Champion, said: "All of us in the Avestro Group and the wider Molecular Materials Research Group are ecstatic about Ruhee's success. It has been an honour of my career to mentor a bright rising star like Ruhee and to witness her growth into a confident woman and BAME scientist. She has overcome many barriers to be where she is today - though I regret to say that she may likely face additional ones in the future. This I know, being an international woman researcher of BAME background myself."

"However, the QED Foundation and the YAYAs programme reminds us that despite these challenges, our presence in STEM is valuable. Ruhee realises this, and I am so thrilled to know that she is adopting further leadership and mentoring roles to help drive this change for young women and minorities in the sciences."