Chemistry Update

Newsletter 348, 30 September 2022

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Calendar of Events

KMS Winners Seminar
Date: Wednesday 12 October
Time: 3pm—5pm
Location: C/B/101

Physical Chemistry Seminar
Speaker: Prof Jonathan Reid, University of Bristol
Date: Wednesday 19 October
Time: 1pm—2pm
Location: TBC

Green Chemistry Seminar
Speaker: Dr Katherine Wheelhouse, GSK
Date: Tuesday 25 October
Time: 1pm—2pm
Location: C/F/106

UCAS Visit Day
Date: Thursday 27 October
Time: 12pm—4pm

Date of Next Issue:
28 October 2022

Innovative graduate training to handle air-sensitive reagents

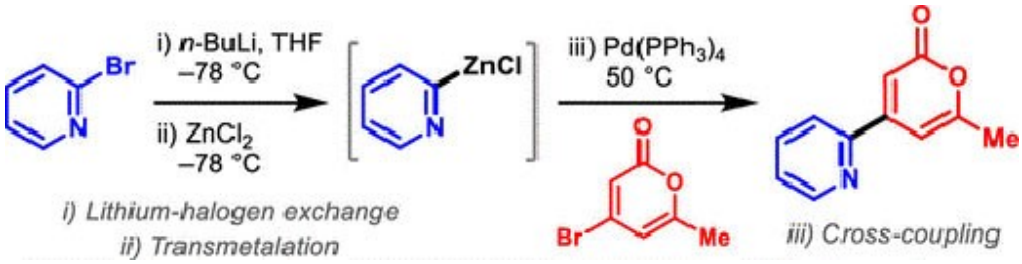
Researchers in the Department of Chemistry have pioneered a new experimental method for training graduate students in the safe handling of air-sensitive compounds.

Cannula transfer of air sensitive materials

The synthesis of organic molecules, with applications ranging from pharmaceuticals and agrochemicals to next generation molecular materials, 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 laboratories, 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. This three-step reaction process (see Scheme) was 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 important illustrations of the many things that can go wrong with a sensitive reaction when improper technique is employed.



Synthetic procedure used for training graduate students

This experiment has now been used to train over 150 MSc and PhD students embarking on synthetic chemistry research degrees here at the University of York. By publishing the methodology in *Journal of Chemical Education*, the team hope that those responsible for training graduate students at other universities will also consider incorporating this exercise into their programmes.

Professor Fairlamb says: "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, laboratory safety."

Full details can be found in the paper written by Dr Michael James, Dr George Clarke, Dr Charlotte Lee and Professor Ian Fairlamb in the *Journal of Chemical Education*.

Abigail Mortimer shortlisted for Outstanding Technician of the Year Award

Glassblower Abigail Mortimer has been shortlisted for the prestigious Times Higher Education (THE) Outstanding Technician of the Year Award 2022.

The winners of the Times Higher Education (THE) awards, which are known as the "Oscars of higher education", will be announced in November in London. Each year the awards attract hundreds of entries that exemplify the talent, dedication and innovation of individuals and teams across all aspects of university life.

Abigail Mortimer is a scientific glassblower in the Department of Chemistry, supporting our undergraduate teaching laboratories, and a wide range of research activities through the design and production of bespoke apparatus.

Abby produces large volumes of specialist glassware and provides an almost endless repairs service – every undergraduate passing through York Chemistry Department has used something either made or fixed by Abby. Graduate students and postdoctoral researchers enjoy dropping into Abby's workshop to discuss the innovative things she could create to support their research projects.

Often behind the scenes, much of the department research and teaching output could not happen without Abby. In addition, Abby is a passionate proponent of the Technician Commitment, and has been pivotal in its launch, development and success at the University of York.

Dr Graeme McAllister, Technical Operations Manager in the Department of Chemistry, said: "I am 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."

The University of York also received nominations for International Collaboration of the Year and Outstanding Support for Students.

Online Department suggestion box

The online Equality and Diversity suggestion box has been extended to be a suggestion box for the whole Department. You can submit your thoughts/suggestions/ideas for general Departmental matters as well as matters relating to Equality and Diversity. You can find the Google form at this link.

Climate change puts availability of vital renewable energy source at risk, research reveals

Climate change is putting the availability of biomass fuels and technologies – vital alternatives to fossil fuels – at risk, according to new research.

The study has found that as temperatures rise, the window of opportunity to maximise the use of biomass from plants, wood and waste as a renewable energy source and an alternative to petrochemicals is closing.

Published in *Nature* and led by researchers at the universities of York and Fudan in China, the study investigated the sustainability of biomass exploitation.

The researchers found that if urgent action is not taken to reduce fossil fuels in favour of bioenergy and other renewables, climate change will decrease crop yields, reducing the availability of biomass feedstocks. Reducing food production is also likely to incentivise cropland expansion, increasing greenhouse gas emissions from land use change and further accelerating the rate of climate change, the researchers say.

Stark

Co-author of the paper, Professor James Clark from the Department of Chemistry, said: “Biomass fuels and feedstocks offer a renewable source of energy and a viable alternative to petrochemicals, but the results of our study act as a stark warning about how climate change will put their availability at risk if we continue to allow global temperatures to rise.

“There is a tipping point where climate change will severely impede our ability to mitigate against its worst effects. Biomass with carbon capture and storage including the manufacture of bio-based chemicals must be used now if we are to maximise its advantage.”

In the latest report by the Intergovernmental Panel on Climate Change (IPCC) and in many assessments of climate mitigation, bioenergy with carbon capture and storage (BECCS) has been highlighted as a crucial element of the strategy for meeting the target of 2 °C or 1.5 °C warming set out in the Paris Agreement.

Jeopardising

The researchers used global data to model the responses of crop yields to rising average temperatures, atmospheric CO_2 concentration, nitrogen fertilisation intensity and precipitation. They found that if a switch to BECCS is delayed to the second half of this century, biomass production would be largely reduced by climate change, resulting in a failure to achieve the 2 °C goal and jeopardising global food security.

For example, when BECCS is delayed from 2040 to 2060, the researchers found reduced yields of agricultural residue for biomass technologies would decrease the capacity of BECCS and increase global

warming from 1.7 to 3.7 °C by 2200, with a decline in global average daily crop calories per capita from 2.1 million calories to 1.5 million calories.

The researchers calculate that in this scenario the scale of the food trade would need to increase by 80% from 2019 levels in order to avoid severe food shortages in many parts of the developing world worst affected by climate change.

Hope

Professor Clark added: “If negative-carbon mitigation technologies relying on biomass could be widely deployed in the short term, there is still hope that we can alleviate global warming and a global food crisis.”

This research was carried out by an international team of scientists in the UK, China and Spain. *Delayed use of bioenergy crops might threaten climate and food security* is available here.

Operation London Bridge - a bellringer's story

Some of you may know that Alison Edmonds is a keen church bellringer and a long-time volunteer at York Minster. There have been plans in place for a number of years as to what bellringing would be required nationally on the death of the Queen, and Alison was invited to be part of York's London Bridge protocol. The first part of this was to ring Great Peter, York Minster's 10-ton bourdon bell, 96 times, at 20-second intervals starting at the first noon after the death was announced. This was followed that evening with a quarter peal, a continuous piece of bellringing where each of the Minster's 12 bells rings at least 1,260 times in a strict sequence which takes 12 people just over an hour to complete. Special bell ringing continued over the ten days of national mourning, ending with another two quarter peals on the largest ten bells on the evening of the funeral, and then on the eight biggest bells at the Minster which were rung immediately before the start of the funeral service on Monday 19 September.

Whilst normally all the bells sound very loudly, they were fully muffled; that is, leather pads were fixed over both sides of all the clappers for a much-reduced sound, except for one side of the tenor (the biggest bell), which is only heard on the death of a monarch. Half-muffled ringing covers one side of each clapper and is heard every year on Remembrance Sunday and for other funerals and memorials.

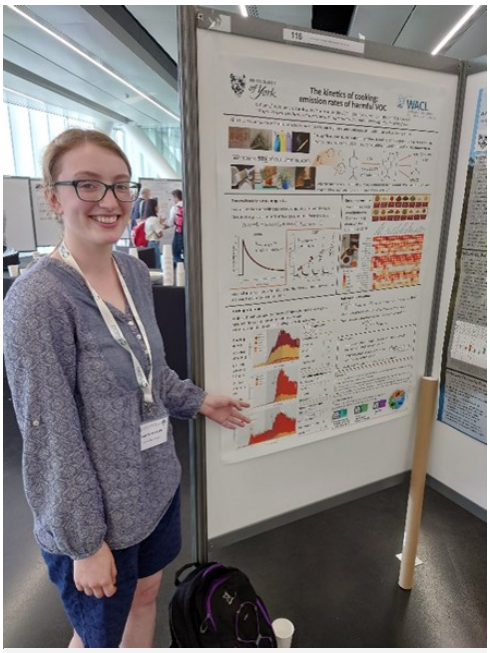
Here are two short clips, the first is of the Great Peter tolling at noon on Friday 9 September, and the second is from the quarter peal that evening. You should easily be able to hear the difference in sound level between the muffled bells and the tenor, which is only muffled on one side.

There are a number of bellringers amongst the students and staff in the Department and at the University, and many of them have been involved over the ten days of national mourning.

York scientists at International Symposium on Gas Kinetics

The York kinetics team were thrilled to attend the *26th International Symposium on Gas Kinetics and Related Phenomena* in Rennes, Brittany. The event took place across the week of the August bank holiday at the remarkable *Couvent des Jacobins*, a world-class conference facility hidden beneath a 14th century monastery. The symposium has a history stretching back over fifty years, and has featured many notable, even Nobel Prize winning, contributions. Most recently, it is a showcase for the best in combustion-, atmospheric- and astro-chemistry research. Covid cancellations meant there had been only one such event since York, 2016, so Cate Mapelli, Ruth Winkless, Terry Dillon and Andrew Rickard had much to discuss with everyone.

View from the old town square. Do they know we're coming?

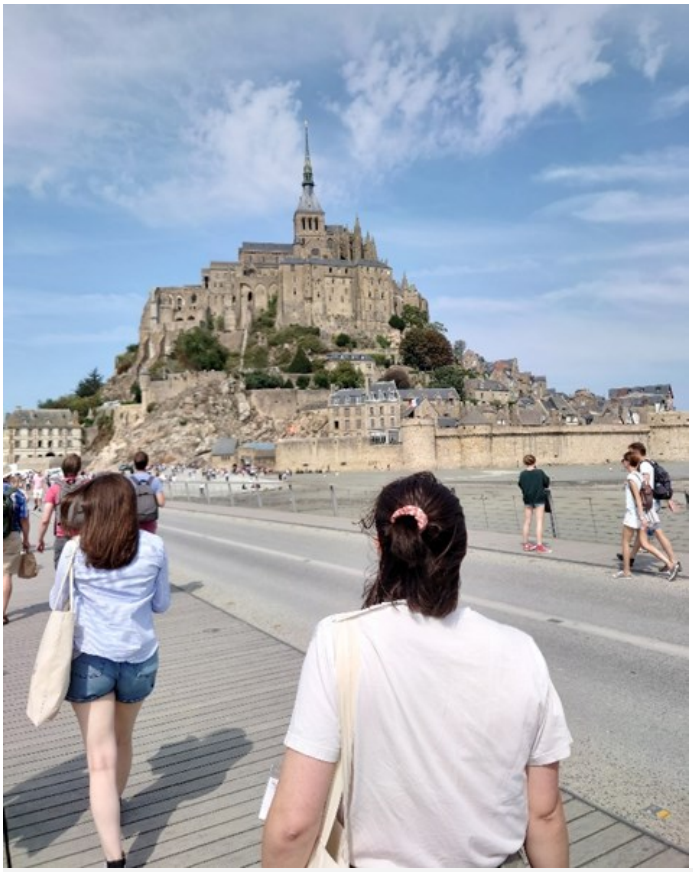


Ruth and "the kinetics of cooking".

Monday was far from a bank holiday for Cate, as she delivered the fourth talk of the symposium "Atmospheric chemistry of a new green solvent, TMO". Green solvents were new to this audience, as indeed they had been to the WACL team prior to starting a collaboration with Rob McElroy in 2018. Cate's talk was very well received, with the delegates feasting on complex, non-Arrhenius oxidation kinetics, and breakdown pathways governed by quantum mechanical tunnelling out of pre-reaction complexes. In the evening poster session, Cate was inundated with visitors as she presented on breakdown of four other green solvents.

On Tuesday, Ruth presented her MSci research, craftily worked into a poster on "The kinetics of cooking". Again, this was another topical first for the gas kinetics crowd, for whom the "pump" in pump-probe experiments had never been chicken stir fry! In the evening, we all enjoyed a cocktail reception at *l'Hotel de Ville de Rennes*. Particularly memorable was the excursion to Mont St. Michel, a UNESCO world heritage site dating from the 14th century. Andrew recorded close to 30,000 steps on that day - some distinctly heavier than others. A walk around the bay (Europe's largest) included practical classes on "escape from quicksand" - a new skill for us all!

The symposium closed with the award of the prestigious RSC Polanyi Medal to the queen of combustion, Frederique Battin-Leclerc of CNRS, Nancy. Then off to a champagne reception and gala banquet at *Chateau d'Apigné*, where Cate was deservedly awarded the *International Journal of Chemical Kinetics* prize for "Best talk by an early career scientist". In winning this award, Cate saw off many experienced PDRA researchers - a tremendous testament to her enthusiasm and dedication throughout her PhD. Celebrations lasted well into the early hours, prior to the long journey home.




Left: The approach to Mont St. Michel; Right: Andrew with two kinetics legends at l'Hotel de Ville de Rennes.

One final, remarkable, feature of the whole week was the complete lack of disruption over 1,500 miles of railway. What chance similar good fortune in 2024, when the symposium returns for its 27th iteration, at University of Leeds?


Left: Pre-dinner team photo outside at *Chateau d'Apigné*; Right: Winner!

The Future of Physchem Convene in York

The Department of Chemistry played host to the RSC's "Recent Appointees in Physical Chemistry" in the second week of September. New talent from all over the UK, including our own Cate Anstöter and Conor Rankine, convened for an opportunity to network and consider best practice. The meeting had fallen into abeyance some years before Covid, but former Faraday President Claire Vallance was determined to get things up and running again. Claire and current president Dwayne Heard were both on hand to lend their wisdom and assist local organisers Katherine Manfred, Julia Sarju and Terry Dillon. The meeting got underway with delegate science presentations, after which past and present York came together in a research funding session featuring Alison Edmonds, Neil Hunt and led by Helen Niblock from EPSRC.

Left: Chris Armstrong ready for innovative teaching; Right: Annie introduces outreach.

A particular highlight was the sumptuous dinner at the Ivy followed by a very late night on the town. York alumnus Chris Armstrong had the unenviable task of picking-up the morning after, but soon got everyone contributing to "innovative physchem teaching". The meeting closed with the bog body, giant-bubbles and pollution-catchers all making an appearance in a barnstorming outreach session from Annie Hodgson. An extremely encouraging take-away was how impressed delegates and even the more


Two bubbly trios enjoying the outreach demonstrations. Left: Sam, Julia and Valentina; Right: Sam, Cate and Valentina.

experienced guests were with support available within Chemistry at York. Altogether it was a friendly, fun and hopefully fruitful few days, all made possible by the generosity of the Department, of the RSC and of sponsors Lambda, Laser2000, Leybold and NCAS.

Chemistry benches - meet colleagues for coffee or lunch outside

These are located outside B block / NMR entrance and at the end of E block.


Avestro Group PhD student, Ruhee Dawood, attends 71st Nobel Laureate Meeting

The picturesque Lindau island, Germany (www.mediatheque.lindau-nobel.orgmeetings/2022/gallery)

"Nobel Laureates are often seen as distinguished symbols of prestige and powerhouses of knowledge. Therefore, it was an honour to be one of 600 participants selected from 91 different nations attending the 71st Nobel Laureate Meeting dedicated to chemistry this year. The Nobel Laureate Meetings take place in Lindau, Germany every year and serve as a forum for exchange between Laureates and Young Scientists from across the globe. The six-day conference, held in person for the first time in two years after disruptions due to the pandemic, hosted about 30 Nobel Laureates. Attendees included some of the regulars such as Professor Venki Ramakrishnan (2009 Nobel Prize winner), but Lindau also welcomed more recent Laureates for the first time, including 2021 Nobel Prize winners Professor David MacMillan and Professor Benjamin List. Even though the meeting was dedicated to chemistry this year, Laureates from other disciplines also made appearances, including Professor Donna Strickland (2018 Physics Laureate) – the only female Laureate at the meeting – and Professor William Kaelin (2019 Laureate in Medicine/Physiology). The meetings aim to empower young scientists and the impact it ended up having on me was the realisation that Laureates are just normal people, similar to you and I, and that we all have a common curiosity towards understanding and impacting the world we live in.

"Eager and excited for the coming week, young scientists started to arrive as early as two days in advance and were located all over Lindau or on the mainland, in hotels, hostels and with some even living with local host families. I was fortunate to be situated just across the road from the Inselhalle – the main auditorium where most sessions for the week took place. The meeting took place from 26 June – 1 July 2022 with a packed schedule of lectures, as well as smaller group discussions in Agora sessions and open exchanges. Young scientists also had the opportunity to either go on a science walk around Lindau with a Laureate or a Laureate Lunch at a local restaurant in Lindau.

The Laureate Lunch in Lindau with Ben Feringa.

"In addition to meeting Laureates in more formal settings, a Laureate could be spotted during each break with a large group of Young Scientists around them, enthusiastically engaging in conversation. I had the amazing opportunity, along with nine other Young Scientists, to have lunch with Professor Ben Feringa (2016 Laureate), allowing me not only to connect with other researchers with similar interests to me, but also getting career and life advice from a Laureate in my field of supramolecular chemistry. One of the experiences that especially stood out to me was an Open Exchange session with Professor Jean-Marie Lehn (1987 Nobel Laureate), which turned into an NMR spectroscopy lesson from a scientist who has become known as the father of supramolecular chemistry.

"The programme also included panel discussions, which were designed to focus on pressing topics to engage both Laureates and Young Scientists in meaningful debates. Topics such as trust in the sciences and within chemistry itself in relation the pandemic, artificial intelligence and the power of predictive algorithms in chemistry and catalysis and green chemistry were covered. The final day of the conference included a boat trip to Mainau Island and was the perfect way to conclude such a thought-provoking and stimulating few days. Our very own Professor Paul Walton chaired the final panel discussion after arriving on the island, which focussed on the diversity challenge - an issue which became apparent even during the meeting in terms of representation during sessions. The highlight for me was definitely meeting Young Scientists from all over the world – there was so much to learn from each and every person I met (and I was even meeting new people on the final day of the conference!)"

Chemistry at York placed 7th in the UK by The Times and The Sunday Times Good University Guide 2023

York's department of Chemistry placed 7th in the UK according to the latest release of The Times and The Sunday Times Good University Guide (2023).

This week, York's Department of Chemistry confirmed its place among the UK's most highly regarded departments for the subject of Chemistry. Our Department is ranked 7th in the UK in *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.

The rankings are based on official data collected by the Higher Education Statistics Agency (HESA), the National Student Survey and the Research Excellence Framework 2021.

Professor Caroline Dessent, Head of Department

"I am absolutely delighted that York Chemistry has been ranked 7th in the UK this year. Our high ranking reflects our excellent teaching and research, as well as the dedication and hard work of everyone who helps to make York Chemistry a special place to study."

York's overall position

In total, thirteen subjects at the University of York were ranked in the UK top 10; Archaeology and Forensic Studies (5th), Biological Sciences (6th), Chemistry (7th), 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).