# Chemistry Update

Newsletter 303, 30 November 2018

## Inside this Issue



## Calendar of Events

**Disability History Month Seminar**
Speaker: Prof Robin Perutz & Dr Julia Sarju, University of York
Date: Monday 3 December
Time: 1pm—2pm
Location: D/L006

**Physical Seminar**
Speaker: Dr Jenny Clark, University of Sheffield
Date: Wednesday 5 December
Time: 2pm—3pm
Location: C/B101

**RSC Stephanie L Kwolek Award Winner Lecture and Molecular Materials Mini-Symposium**
Speakers: Prof Jeff Moore, University of Illinois; Dr Alyssa-Jennifer Avestro, Durham University/University of York; Dr Chris Spicer, University of York
Date: Monday 10 December
Time: 2pm—4.30pm
Location: C/A101

**Christmas Chemistry Staff Meeting followed by Mulled Wine & Mince Pies**
Date: Tuesday 11 December
Time: 2pm—4pm
Location: C/A101 & C/B102

**Inorganic Seminar**
Speaker: Prof Duncan Wass, University of Bristol
Date: Wednesday 12 December
Time: 1pm—2pm
Location: C/B101

Date of Next Issue:
19 December 2018

# York student brings chemistry outreach to Twitter

**Chemistry student shares his longstanding passion for communicating chemistry by suggesting new competition for #RealTimeChem week on Twitter.**

Third-year chemistry student, Alex Bytheway, suggested the idea for running a chemistry outreach competition to #RealTimeChem curator/organiser Jason Woolford, in response to a call for ideas. Jason, a Royal Society of Chemistry Senior Editor, who tweets as @Doctor_Galactic, accepted the idea and asked Alex to be one of the judges during the week.

#RealTimeChem week, which this year ran from November 12 to 18, is a seven-day event where chemists worldwide tweet about their chemistry as they are doing it, using the #RealTimeChem hashtag and connecting with other chemists around the world in the process. The best tweets in various categories, such as #ChemSelfie, #ChemVideo, #ReactionPic are published in *C&EN Magazine* and also receive an award.

Explaining how his involvement in this year's event came about, Alex said:

*"I pointed out that the #RealTimeChem community at the moment just concerns chemists, but obviously there's a much wider audience on Twitter, so why not use hashtags to get chemistry out there a bit more? Jason liked the idea and went to Hindawi, an open access publisher, who offered to donate a tablet as the prize."*

*"We exchanged emails on how it was going to fit together, as it all needed to relate to #Chem4Life, which is the theme for this year, and wrote a piece explaining how using simpler, clearer language in the tweets helps make chemistry accessible to a wider audience. So for example if you're describing filling up an NMR machine, instead of saying 'As part of my job I use cryogenics to cool superconducting magnets', you can say 'I use liquefied gases because they can go to very low temperatures without freezing.'"*

Alex has been communicating chemistry on social media since his early teens when he had his own chemistry YouTube channel. His talent was spotted early on when his videos were featured on the RSC's ChemNet website for 14-18 year olds, and he was later given an administrator's role, facilitating users' questions and answering them, for which he received an award. Alex has been communicating chemistry ever since in a variety of ways, such as visiting schools on the STEM Ambassador Programme, volunteering at RSC events, and he has also contributed articles to the magazine *Chemistry Review*.

To participate in the #Chem4Life Outreach Competition, chemists tweeted about their chemistry using the competition hashtags #realtimechem and #chemistry4life, and also included one of the following, depending on the day of the week, to engage a wider audience: #MondayMotivation, #TuesdayThoughts, #WednesdayWisdom, #ThursdayThoughts, #FridayFeeling.

# UK-Brazilian approach to a global problem

**As part of the UK-Brazil Year of Science and Innovation, Professor Michael North has written an article explaining how researchers in York and Brazil are working together to develop new methods to convert excess carbon dioxide into sustainable materials for battery technologies.**

The large increase in carbon dioxide over the last 100 years, leading to global warming with planet-wide effects, is a very significant problem that urgently needs mitigation. One way of limiting emissions is to develop carbon capture and utilisation (CCU) technologies. This approach aims to capture waste carbon dioxide from emissions and convert it into useful products. Major carbon dioxide emission sources occur globally and the atmospheric concentration of carbon dioxide is the same everywhere. This means carbon dioxide, unlike the original fossil fuels from which much of it derives, is an ideal source of carbon for the developing world as it is freely available and has complete security of supply. Furthermore, if these useful products are part of cleaner technologies, this approach creates a virtuous circular economy that will assist the transition towards clean energy.

In his article, Professor North explains how in collaboration with the group of Professor Claudio Mota at the Federal University of Rio de Janeiro in Brazil, the Green Chemistry Centre of Excellence (GCCE) aims to use carbon dioxide as a feedstock to develop a completely sustainable synthesis of a class of chemicals called cyclic carbonates, which are used as the electrolytes in lithium ion batteries. These batteries power the mobile electronic devices such as mobile phones, tablets and laptop PCs prevalent in modern society, and even more vitally will underpin the next generation of electric vehicles that will assist in the transition to a sustainable economy.

It is essential for CCU that the other chemicals needed, and any energy required, are supplied renewably. Brazil is an ideal country in which to develop such sustainable CCU systems. It has a large and diverse landmass supporting a wide variety of biomass from the Amazon rainforest to sugar cane plantations. The sustainable use of, preferably waste, biomass can then provide the other chemicals needed to facilitate CCU.

The teams of chemists and chemical engineers are developing ways to utilise waste carbon dioxide sources in Brazil, such as from gas fields and bio-ethanol production sites, and then combine the carbon dioxide with chemicals available from Brazilian biomass to provide a sustainable route for the large-scale preparation of cyclic carbonates. If successful, the project will help Brazil to continue developing its economy whilst avoiding further increases in carbon dioxide emissions.

The UK-Brazil Year of Science and Innovation is a year-long programme of events and partnerships in science, technology and innovation between the UK and Brazil.

Read Professor North's original article.

# Alpine ice shows three-fold increase in atmospheric iodine

**Analysis of iodine trapped in Alpine ice has shown that levels of atmospheric iodine have tripled over the past century, which partially offsets human-driven increases in the air pollutant, ozone.**

Iodine trapped in Alpine ice has given scientists data to use in climate models

The study showed, however that, although iodine can destroy 'bad' ozone, there isn't enough to counter all of the production. Researchers say it is now important to include iodine data in climate models that predict future global environmental outcomes.

Analysis of the Alpine ice, by scientists at the University of York, Université Grenoble Alpes, and Desert Research Institute, shows that iodine concentration began to increase after the Second World War following the growth in motor vehicles and electricity generation.

Nitrogen oxide emissions from vehicles and power plants since the 1950s increases surface ozone, and this reacts with chemicals in seawater to release more iodine into the atmosphere, which partially, but not completely, destroys some of these harmful gases.

**Human health**

Professor Lucy Carpenter, from the University of York's Department of Chemistry, said: "Iodine's role in human health has been recognised for some time - it is an essential part of our diets.

"Its role in climate change and air pollution, however, has only been recently recognised, and up until now, there have been no historical records of iodine in populated regions such as Europe.

"Due to the difficulty in accessing this kind of data, the impact of iodine in the atmosphere is not currently a feature of the climate or air quality models that predict future global environmental changes."

**Long-term**

The study in the European Alps has now provided new long-term insight into the delicate balance of ozone in the atmosphere.

Ozone in the lower atmosphere acts as an air pollutant and greenhouse gas, but ozone is also the main driver of iodine emissions from the ocean. Once released into the atmosphere iodine acts to destroy this 'bad' ozone.

The more ozone humans produce, the more iodine is released from the ocean which can then help destroy the ozone produced by humans. This means that iodine levels in the ocean can, at least partially, act to keep ozone gases in the lower atmosphere in check, but there isn't enough to counter all of the production.

**Industrial revolution**

Dr Tomás Sherwen, from the Department of Chemistry, said: "When we look at the concentrations of iodine over time, we can see that it was fairly steady during the industrial revolution.

"However as more cars appeared on the roads in the post-war period, we get more emissions of nitrogen oxides causing more ozone in the atmosphere and therefore more iodine.

"Surface ozone concentrations have stabilised over much of Europe and the Atlantic ocean, although are still growing in other regions.

"We can now start to think about factoring in our knowledge of iodine chemistry into climate and air quality models to help us better predict what the future of our atmosphere will look like around the globe."

The research is published in the journal *Proceedings of the National Academy of Sciences*.

# The green formula for education

**The Green Chemistry Centre of Excellence (GCCE), in collaboration with the Department of Education, has created a book about green chemistry for secondary / high school children using a 'students as partners' approach.**


Led by Dr Glenn Hurst, as part of their degree programme, students from the Department of Chemistry and the Department of Education worked as a team, also comprising of Louise Summerton and Dr Clementine Beauvais, to produce 'The Green Formula'. Illustrations in the book were completed by undergraduate student, Samantha Eastwood, after winning an institutional-wide art competition administered through the college system at York.

The book is aimed at children aged twelve and over, linking well to the school curriculum and follows the story of four very different children who must work together to develop their school's entry to the 'National Awards for Technology and Science'. This research-led book introduces green chemistry concepts through the diaries of the children and together with an accompanying narrative, provides a number of fun, hands-on experiments and activities to try at home.

Dr Glenn Hurst has recently been shortlisted by Times Higher Education (THE) as the 'Most Innovative Teacher of the Year' based on how he has communicated chemistry, particularly green chemistry, in new ways.

*The Green Formula* can be downloaded for free from iTunes.

# Nova Prize nominee

**Final year MChem student Melissa Davie has been nominated for the inaugural Nova Prize in Chemistry.**

Melissa is studying for a degree in Chemistry at the University of York, and the Nova Prize nomination recognises her as a female student who has made outstanding early-career contributions to STEM (Science, Technology, Engineering and Maths).

Reflecting her talent, Melissa was awarded funding from The Wellcome Trust to help support a summer project in the research lab of Dr Martin Fascione, in which she focussed on the addition of unnatural reactive groups to enable the modification of a range of biomolecules.

Her final year MChem project is an industrial placement at the John Innes Centre in Norwich, where she is working on natural product biosynthesis. In particular, she aims to unlock the potential of naturally-occurring antibiotics.

During her degree, Melissa has been involved in science outreach and communication. She helped present the 'Antiobiotic Hunters' stand at the Norwich Science Festival, talking to members of the public about the vital need for new antibiotics, and the key role of chemistry in discovering them. She is also running a 'Women in STEM' stand at an event in Norwich for Year 11 pupils, to help inspire the next generation of great female scientists.

The Nova Prize recognises female students who have made outstanding early-career contributions to STEM, with awards being made in the six categories of Chemistry, Physics, Biology, Maths, Technology and Engineering. From hundreds of entries, five exceptional women were selected from each category to be put in front of a panel of expert academics, who chose the winners. The Nova awards are sponsored by EY.

# Clarke Group news

Dr Paul Clarke gave an invited lecture entitled "Adventures in Asymmetric Heterocyclisations and Total Synthesis" at Lilly Pharmaceuticals on 12 November. The lecture featured the PhD research of Sam Griggs, Chris Maddocks and Giacomo Lodovici. During the visit to Lilly, Paul also consulted on a number of medicinal chemistry problems and synthetic routes.

Paul headed "down under" for the second time this year on 16 November to continue his new research collaboration with Professor Mick Sherburn at the Australian National University (ANU).

# NERC Doctoral Training Awards

**Chemistry receives a share of £100M funding to train the next generation of environmental scientists.**

The Department of Chemistry has received a share of £100m funding to train the next generation of environmental scientists. The Department is involved in two of the successfully funded Doctoral Training Programmes (DTPs).

The funding is provided by the Natural Environment Research Council (NERC). It supports two DTPs:

- ACCE (focussed on adapting to the challenges of changing environment)
- PANORAMA (encompassing aspects of the atmosphere, biosphere and geosphere)

The ACCE programme will support 14 new PhD students a year for the next five years in ecology, evolution and conservation. This programme brings together the academic strengths of the Universities of Liverpool, Sheffield and York, and also benefits from the unique scientific expertise and resources of the Centre for Ecology and Hydrology and the Natural History Museum. Within Chemistry here at York, there is specific research expertise in the use of analytical chemistry methods to understand environmental change.

The PANORAMA DTP will support 13 studentships a year for the next five years in multidisciplinary studies of the science of the Earth's Atmosphere, Geosphere and Biosphere. The programme is a collaboration between the Universities of Leeds, Hull and York. The Wolfson Atmospheric Chemistry Labs (WACL) in York play a key role in helping lead on atmospheric science studies.

These multidisciplinary graduate training programmes aim to develop confident and multi-skilled PhD students capable of undertaking cutting-edge research and tackling questions of global significance.

The 2018 DTP call was an open and competitive process that identified 17 DTPs to host PhD studentships funded by NERC. Each DTP was assessed on the basis of excellence through a transparent, peer-reviewed application process.

# New starters

**Aminata Sakho**, Marie Skłodowska-Curie Early Stage Researcher ETN Zulf with Professor Simon Duckett
Room: CHM113 (CHyM); Ext: 8890; Email: aminata.sakho@york.ac.uk

**Dr Richard Meek**, PDRA in Chemical Biology with Professor Gideon Davies , YSBL
Room: B/K266; Ext: 8276; Email: richard.meek@york.ac.uk


**Tabitha Petchey**, MSc Support Technician with Hannah Briers
Room: C/F119; Ext: 4972; Email: tabitha.petchey@york.ac.uk

# Inorganic aromaticity switching

**New theoretical studies predict that $S_2N_2$ is the first example of an inorganic ring that can switch its aromaticity on electronic excitation.**


Disulfur dinitride ($S_2N_2$) was first formally reported by Frank Burt, working at University College London over 100 years ago. Burt reported passing $S_4N_4$ vapour over a silver gauze, producing a blue film or bronze coloured crystal and suggested that its immediate precursor was a very volatile substance. Other researchers went on to establish that this volatile substance was $S_2N_2$, which subsequently polymerises to $(SN)_x$.

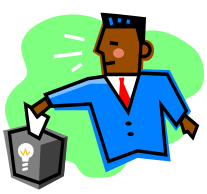
In the years since, the nature of the bonding in the square, four-membered inorganic ring has been the subject of considerable controversy, with a variety of bonding models being suggested on the basis of theoretical studies, and incorporated into textbooks.

The latest study from Dr Peter Karadakov and co-workers calculates and analyses the magnetic shielding surrounding the molecule for each electronic state. In this way, they have shown that for $S_2N_2$, whereas the ground state is aromatic, and has delocalised bonding electrons around the ring, the singlet excited state is profoundly anti-aromatic – to the extent that bonding interactions are completely removed. This helps explain the experimental observation that $S_2N_2$ can decompose explosively when being struck or heated above 30°C.

$S_2N_2$ is therefore the first example of an inorganic ring for which theory predicts aromaticity switching upon electronic excitation. The results of this study demonstrate that the range of compounds with "Jekyll and Hyde" behaviour in different electronic states is wider than previously thought, providing new directions in the search for molecules with tuneable properties, for applications in electronics, photovoltaics and molecular motors.

The research has been published in *Chemistry A European Journal*, where it was selected by reviewers and editors as a *Very Important Paper*.

# Online Department suggestion box

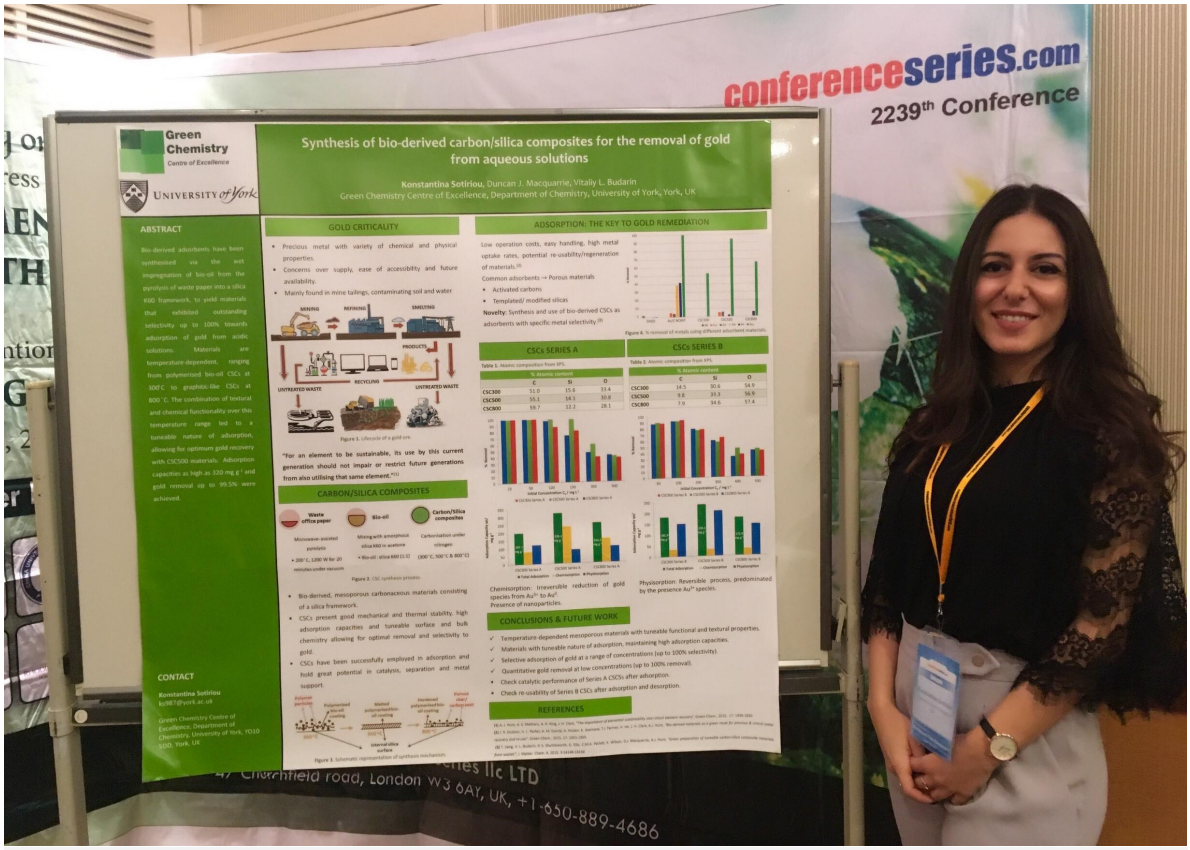


The online Equality and Diversity suggestion box has been extended to be a suggestion box for the whole Department. You can submit your thoughts/suggestions/ideas for general Departmental matters as well as matters relating to Equality and Diversity. You can find the Google form on the intranet homepage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

# Konstantina Sotiriou wins poster prize at Japan conference

On 22-23 October, GCCE third year PhD students Konstantina Sotiriou and Jenny Attard attended the Joint Meeting on 2nd Annual Congress on Environmental Pollution and Health Hazards and 9th World Convention on Recycling and Waste Management in Osaka, Japan. The conference featured oral and poster presentations given by researchers from around the world based on the theme "Advocating waste disposal and recycling practices for clean and green environment".

Jenny gave an oral presentation on "Recovery of gold from WEEE using bio-based mesoporous materials: Starbons®" and Konstantina presented a poster on "Synthesis of bio-derived carbon/silica composites for the removal of gold from aqueous solutions". After discussing the work with other conference participants, the judge awarded Konstantina the first and only poster prize, based on content, presentation and communication skills.




Konstantina Sotiriou with her prize winning poster

## Craft & Chat

**Tuesday 18 December 12.30-13.30 in C/A/137**

Do you have a craft project on the go, such as knitting or embroidery? If it's something you can bring along and chat while you do it, join us in C/A/137 for a craft/social lunchtime!

- Kate, Leonie & Christina

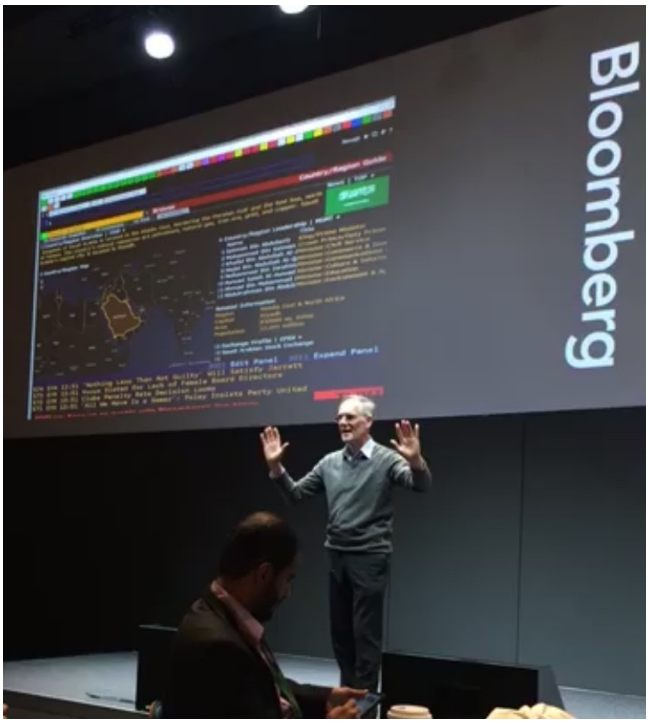
# Green Chemistry MSc student participates in Saudi 'Future Career Path' initiative

**Ahmed Al-Jameel, a current student of the MSc in Green Chemistry and Sustainable Industrial Technology at York, has participated in a Saudi 'Future Career Path' initiative, after being selected from a large pool of applicants.**


The "Future Path Essentials" programme is run by the MiSK Foundation in collaboration with Bloomberg. MiSK Foundation is a Saudi non-profit foundation established in 2011 to discover, develop and empower Saudi youth to become active participants in the future economy. The foundation specifically focuses on four key areas: education, creative and digital media, technology, and culture and arts. It pursues this agenda both through its own programs, and through partnerships with local and global organisations.

The "Future Path Essentials" programme aims to support and to advance career progression as well as to provide the tools for success in a highly competitive environment in order to become inspirational and successful future leaders. Ahmed Al-Jameel participated in the programme held at Bloomberg headquarters in London on 30 October.

The programme was divided into sessions and began with an introduction about Bloomberg and its mission and role in the world for economy, finance and news. There were seminars on how to successfully apply for jobs and one -to-one mock job interviews from Bloomberg recruiters who gave feedback on these to interviewees. Participants were also given an opportunity to tour the Bloomberg sustainable building, and Ahmed was very impressed with the sustainable energy supply and the modern architecture. Afterwards, the group participated in pitching presentations, and were given products from Bloomberg to try and sell. Finally, they called it a day with a presentation from an expert in Bloomberg about new initiatives.




Ahmed commented "I had a very nice impression about the event. I met many people from different backgrounds including law, computer science, economy, health and politics. I introduced my field of green chemistry to them and its role and importance, especially in circular economy and policy making. I was very proud to belong to the Green Chemistry Centre of Excellence and the University of York".