

Chemistry Update

Newsletter 275, 22nd July 2016

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Calls for More Research to Test the Accuracy of Low-Cost Air Pollution Monitors

The increasing popularity of low-cost air pollution monitors with members of the public could generate large volumes of untested and questionable data, two leading atmospheric scientists from the University of York have warned.

Professor Alastair Lewis and Dr Peter Edwards of the Wolfson Atmospheric Chemistry Laboratories (WACL) call on researchers to test the accuracy of low-cost monitoring devices before regulators are flooded with questionable air quality measurements.



Air pollution over London

The public is increasingly aware of the health and economic costs of air pollution. Poor air quality is linked to over three million deaths each year, and 96 per cent of people in large cities are exposed to pollutant levels that are above recommended limits. The costs of urban air pollution amount to two per cent of gross domestic product in developed countries and five per cent in developing countries.

Media attention and the increasing availability of data are reinvigorating efforts in many countries to tackle air pollution, driven as much by local and national politics as by science. For regulatory purposes, governments and scientists use the most accurate, but expensive, detectors.

And although the interpretation of the data is a subject of lively debate, the quality of readings is rarely questioned. By contrast, few of these low-cost devices have been rigorously tested.

Writing a comment piece in the journal *Nature*, the academics say: "The research and regulatory communities are behind the curve.

"The penetration of these devices into the public domain, generating large volumes of untested and questionable data available to all, is inevitable and will increasingly become a headache for those who are responsible for managing air quality.

"Although we do not wish to stifle innovation, sensors that claim to be able to measure ambient pollution levels could be required to undergo an independent testing regime, as is the case for instruments that are used in regulatory measurements.

"The academic air pollution community must engage to ensure that it does the hard yards in the lab and field on calibration and testing.

"It must also find ways to overcome some measurement challenges. Researchers should take the lead on evaluating sensor performance, creating better devices and designing research applications that are suited to the quantified capabilities of sensors."

York Chemists Lead Breakthrough in Carbon Capture



Scientists from the University of York have developed an innovative new green method of capturing carbon dioxide (CO₂) emissions from power stations, chemical and other large scale manufacturing plants.

Starbons, made from waste biomass including food peelings and seaweed, were discovered and first reported 10 years ago by the York Green Chemistry Centre of Excellence. Using these renewable materials provides a greener, more efficient and selective approach than other commercial systems of reducing emissions.

Current widespread methods of carbon capture, such as amine treating, use liquid solutions for the treatment of emissions from chemical plants and refineries. However, these are expensive to run and require a lot of input energy compared with a relatively low output.

The synthetic make-up of Starbons, which contains pores, results in the absorption of up to 65 percent more CO_2 than other methods.

Starbons are also more selective in capturing CO_2 when mixed with nitrogen, with results showing a capture rate of 20:1 rather than 5:1 - four times more selective than other methods.

The materials also retain their CO_2 absorption and selectivity in the presence of water, and have extremely fast rates of CO_2 absorption and desorption.

Such enhanced properties for carbon capture, in a material that is sustainable and low-cost to make, holds significant potential for helping to reduce emissions from many manufacturing plants and power stations in the UK and around the world.

Professor Michael North, Professor of Green Chemistry at the University of York, said: "This work is of fundamental importance in overturning established wisdom associated with gas capture by solids. It defies current accepted scientific understanding of the efficiency of carbon-capturing CO_2 , and has the potential to be of significant commercial and governmental value in helping the UK meet its CO_2 emissions reduction promises.

Professor James Clark, Head of York's Green Chemistry Centre of Excellence, said: "The high CO_2 adsorption, high selectivity, rapid kinetics and water tolerance, combined with the low cost and ease of large scale production from waste biomass, gives Starbons great potential. We hope to offer the product as a commercial capture agent for separating CO_2 from chemical or power station waste streams."

The research is published in leading chemistry journal, Angewandte Chemie.

Prof John Goodby Awarded Top Royal Society



A University of York chemist, whose research has made important contributions to the development of flat-screen displays for TVs, computers and mobile phones, has been awarded a prestigious Royal Medal of the Royal Society.

Professor John Goodby, who holds a Chair in Materials Chemistry and is a Fellow of the Royal Society (FRS), is awarded the interdisciplinary medal in recognition of advances and discoveries of new forms of scientific matter and materials.

Professor Goodby studied for his doctorate in liquid crystals at the University of Hull before moving to the world-renowned AT&T Bell Laboratories in 1979, where he became Supervisor of the Liquid Crystal Materials Group.

After nearly ten years in the USA, he moved back to the UK and became Head of the Liquid Crystals and Advanced Organic Materials Group, and subsequently Head of the School of Chemistry at the University of Hull.

He is now Emeritus Professor of Materials Chemistry at York, where his research is focused on nano-structural engineering of materials through directed self-organization and self-assembly for applications in liquid crystal displays.

Professor Goodby said: "I am overwhelmed to receive the award of the Royal Medal of the Royal Society.

"Firstly, the successes of my research, particularly in the field of Liquid Crystals, would not have been possible without the support of my brilliant staff, students and academic and industrial colleagues, many of whom have worked with me for over the past 20 to 30 years. I am also greatly appreciative of the support I have received over the years from the Engineering and Physical Research Council, The Defence Research Agency, the Leverhulme Trust, Merck KGaA, and Kingston Chemicals Ltd."

"Secondly, when I read about the details of the medal, which dates back to 1826, and saw the list of the past winners, I was surprised by how few chemists there were, and yet how many of them were household names in chemistry. That I should be associated with such chemists is daunting and yet humbling!"

Professor Duncan Bruce, Head of the Department of Chemistry, added: 'Working in the same field as John, I am very well aware of the impact that he has made and the esteem in which he is held in the field. I am delighted that the Royal Society has seen fit to recognise his achievements in this way."

Professor Goodby was elected a Fellow of the Royal Society in 2011 and in 2013 he was awarded the Derek Birchall Medal of the Royal Society of Chemistry for creativity and excellence in materials chemistry for Industry. In 2014, he won the AkzoNobel UK Science Award for outstanding contributions in self-assembling and self-organizing materials.

Kick Off for New IUK / BBSRC Project - EnzPoly

The kick off meeting for a new £740,000 collaborative project between the Green Chemistry Centre of Excellence at the University of York, the University of Liverpool and Biome Technologies was held on 1st July. The three year Industrial Biotechnology Catalyst project (IUK and BBSRC) will focus on chemo- and enzyme-catalysed polymerisation and subsequent modification to produce a range of novel bio-based polymers derived from lignocellulose. The University of York team will be led by Professor James Clark and Dr Thomas Farmer, with Dr James Comerford being appointed as a PDRA from 1st August. Dr Andrew Carnell, well renowned for his outstanding contributions to biotransformations in organic synthesis, will be leading research into the development of novel enzymes at the University of Liverpool, with Paul Mines (CEO), Paul Law and Krisztina Kovacs-Schreiner contributing towards performance testing and overseeing the project at Biome Technologies. With the project geared towards the replacement of multi million ton-perannum oil based plastics such as PET, the positive environmental impact of this research along with the development and progressive use of sustainable materials and renewable resources could be particularly significant.



From left to right: James Clark, Paul Mines (Biome), Andrew Carnell (University of Liverpool), Krisztina Kovacs-Schreiner (Biome), Tom Farmer, James Comerford, Paul Law (Biome) and Michael Carroll (IUK)

EPSRC Grant Award for Organic Team



Dr. Will Unsworth and Professors Richard Taylor and Peter O'Brien recently heard that a new EPSRC research grant proposal had been chosen for funding. It is entitled "Spirocycles, Carbocycles and Heterocycles: Unified Routes via Catalyst Selection". The project funds a postdoctoral research fellow for 3 years (EP/N035119/1; £508, 000). The research is fundamentally concerned with the development of new methods to make medicinally important molecules: a summary of the research, based on the grant application, is below.

Rapid access to structurally diverse organic compounds is the cornerstone of lead generation in the pharmaceutical and agrochemical industries, essential to meet the burgeoning worldwide healthcare and sustenance requirements. There is a growing realisation that traditional lead identification programmes have been limited in terms of their treatment of 3D structures and there is much current research based on the investigation of molecules which cover wider regions of chemical space. However, synthetic approaches to generate 3D molecular architectures are typically time-consuming and labour-intensive, and separate routes are traditionally required to access different types of structure (Figure 1a).



The concept underpinning this proposal is that synthetic routes will be designed to generate high energy reactive intermediates with broad synthetic potential, which by judicious choice of catalyst can be converted into several diverse scaffolds via different rearrangement processes (Figure 1b). It is planned to generate the key reactive precursors from cheap, readily available starting materials, initially building on research from the groups of Taylor and Unsworth in dearomatisation/C-H insertion/rearrangements, to form the requisite high energy intermediates. 3D Shape analysis and evaluation of drug/agrochemical 'lead-like' properties will be carried out in the O'Brien group.

15th Belgian Organic Synthesis Symposium (BOSS)

The 15th Belgian Organic Synthesis Symposium (BOSS) was recently held in Antwerp, Belgium between 10th-15th July and Aimee Clarke (RJKT), John Liddon (RJKT) and Sarah Chambers (RJKT/PAOB) were fortunate enough to attend. Highlights of the conference included an impressive talk from Prof. Stephen Buchwald on his progress in copper catalysed hydrofunctionalisation processes, and an inspiring talk from Prof. David Macmillan on photoredox catalysis. In addition, an educational day of lectures on fluorine chemistry was delivered by the Tetrahedron chair, Prof. Veronique Gouverneur. The conference included an engaging poster session where we were able to showcase some of the exciting work going on in the department, which was well received. We were joined by 300 other student delegates and 200 professionals from academia and industry, so there was plenty of opportunity for networking over a glass of Belgian beer. It was also a great opportunity to catch up with an ex-RJKT/IJSF group member, Tom Ronson, who is currently completing a post-doc in the Maes group in Antwerp. Thanks go to the department of chemistry and BMCS-RSC for funding.



A-Level Students Visit the POB Group

As part of the Department's outreach scheme, Annie Hodgson organised for four A level students to visit the Department and get a taste of working in a lab for a week. Two of these students, Patrick Taylor (Bosworth Academy, Leicestershire) and Phoebe Carlisle (Waldgate College, Pocklington) were hosted by Tom Downes from the O'Brien group.

During the week the students got to try their hands at a wide variety of reactions and techniques. These included setting up reactions under argon, cold temperature reactions, column chromatography and analysing results via IR, mass spec and NMR. Both students and supervisor really enjoyed their week and the students were particularly pleased when at they end of the week they completed the 3-step synthesis of their own disubstituted pyrrolidines.

Hopefully this week will have given the students a real experience of what research is like and we may even see them again in the future as undergraduates!



Suggestion Box



Reminder: There is a online anonymous suggestion box for staff under the Equality and Diversity section of the intranet: <u>http://www.york.ac.uk/chemistry/internal/</u> and a physical suggestion box located outside Room K167 for YSBL staff. Suggestions from staff are most welcome. All suggestions are discussed by the appropriate departmental committee.

Roy Fenton Scholarships

Following a generous donation, the Department of Chemistry will establish The Roy Fenton Scholarship.

Roy Fenton was, in 1968, one of the first set of graduates from the new Department of Chemistry at York, and has decided to endow a new undergraduate scholarship.

In particular, these scholarships will 'provide support to talented students who have the academic potential to study at York and who have overcome significant barriers to their educational goals'.

One of these scholarships will be awarded each year and will last for the first three years of the student's undergraduate course. The scholarship has a monetary value of £2k/annum and is to be awarded, subject to satisfactory academic progress.

These scholarships will support the department's key commitment to providing the best possible educational experiences for students from a diverse range of backgrounds.

Chemical InterActions International Picnic



The Chemical *Inter*Actions group was set up to enhance the sharing of experiences and cultures of everyone in the department, staff and students.

We want to celebrate the international diversity within the department by having an International Picnic.

We would like food from around the world, so please bring along a dish of your choice for others to try. It would be great to have a range of dishes and snacks available. We will

provide some drinks, plates, napkins etc. - you just need to bring the food! We will make some space in A-block kitchen fridge to store your dishes and there is a microwave available if you need to heat anything.

Everyone is welcome to attend - you don't have to bring food, just come along anyway! The event will start in A122, but if the sun is shining we hope to move outside to the quad.

To ensure we can plan for the event, please sign up on the Doodle poll below.

If you are going to bring food, please can you also add a line in the comments sections explaining what you will be bringing. <u>http://uniofyork.doodle.com/poll/3xgia2gy3s63c864</u>

TechYork 2016

TechYork 2016 was held in the Exhibition Centre in the University of York on Monday 27th June 2016.



TechYork is a science faculty supported event for all technical specialists in the university, across all departments. It is a chance to network and share good practice among staff.

There were 110 attendees at the event and 16 suppliers had stands, showcasing their new developments and products. The suppliers included RS Components, Farnell Element 14, Philip Harris Ltd., Edwards Vacuum, VWR International, Scientific Lab Supplies Ltd. (SLS), Rapid Electronics, MKS Instruments, Complete Office Solutions, Met Prep Ltd., Rexel, Universal AV Services Ltd., Allectra Ltd., SJ Electronics Ltd. and SMC Pneumatics. These suppliers also generously sponsored the event.

Rebekah Desport, Science Faculty Operation Manager, gave the opening introduction. This was followed by tours of the Biorenewables Development Centre (BDC) laboratories in Dunnington, the category 2 and 3 laboratories and workshops in Biology, Environment's new building, Astrocampus and backstage at Central Hall. There were also Chemistry and Biology workshops, outreach demonstrations from Electronics and attendees could step inside the Physics Cosmodome.

After lunch, Dr James Hidler from Electronics and Computer Science gave a virtual tour of the York Robotics Laboratory, looking at the facilities, the robots and research. Most of the research activity focuses on how we can use biological inspiration to work with robots, creating swarms, organisms and robust fault tolerant autonomous systems.

Kelly Vere, Business and Education Engagement Manager for The Science Council, gave a talk entitled 'Visibility and Recognition for Technicians'. The day ended with a talk from Dr Katie Read, Research Laboratories Technician in Chemistry, who looked at the Wolfson Atmospheric Chemistry Laboratories and NCAS.

The first TechYork event was held in 2005. Over the years, participation from central departments has grown and this year saw the highest number of suppliers at the trade exhibition.

Biology Operations Manager Lucy Hudson said: "We decided to change the format for our TechYork event in 2016 to recognise and share the talented and skilled technical staff here on campus.

"The day began with technicians hosting walks and talks in their working environments, an opportunity for all to discuss and question each other on their roles and to demonstrate the diverse range of work space from biological containment laboratories to the Astrocampus and the complexity of teaching and research equipment they operate and maintain.

"Our afternoon sessions included two talks from technicians: Dr James Hilder from the Robot Lab and Dr Katie Read from the Wolfson Atmospheric Chemistry Labs. Our guest speaker was Kelly Vere, the STEM technician for the year from the University of Nottingham and the Science Council who spoke about the importance of enhancing the technician's profile across University's and to encourage our technicians to apply for professional registration."

Katie Lamb Wins Poster Prize at EU Conference

Katie Lamb, a Year 3 PhD student working under the supervision of Professor Michael North, was awarded the "Best PhD Student Poster Prize" at the final Smart CO₂ Transformation (SCOT) conference on 29th June in Brussels, Belgium. The conference, titled "CO₂ Utilisation as a Strong Catalyst for the European Industrial Renaissance", was the final meeting of the 2013-2016 EU funded project (supported by the Seventh Framework programme), with the aim "to define a Strategic European Research and Innovation Agenda for Europe in the field of CO₂ Utilisation". Katie won a PhD Student travel bursary to the conference and was therefore invited to present a poster on her PhD research. Her poster was titled "Electrochemically Driven Carbon Dioxide Capture and Mineralisation", and outlined key results from one of her current research projects, which is a joint research venture between Professor Michael North and Dr Alison Parkin. Her project is currently investigating the use of electrochemistry and sustainable materials to promote low power CO₂ capture and mineralisation. She was awarded €250 along with her poster prize.



Katie Lamb being awarded "Best PhD Student Poster Prize" by Professor Peter Styring from the University of Sheffield, one of the UK Coordinators of the SCOT project. Peter joked that a prize awarded in euros in June might be worth a very different value in pounds after the EU referendum.

Graduation

The Chemistry Graduation ceremony took place on Wednesday 13th July followed by a drinks reception in the Department. Graduates and their guests joined staff for drinks to celebrate their achievements. Congratulations to all the students who graduated and thanks to Katie Stott and everyone else who helped to organise the reception.



Board of Studies Dates 2016/17

Term	Week	Date	Day / Time	Room	
2016					
Autumn	SV13	14 September	Wednesday 14:00	A102	
	7	9 November	Wednesday 14:00	A102	
2017					
Spring	4	1 February	Wednesday 14:00	A102	
	4	10 May	Wednesday 14:00	A102	
Summer	10	21 June*	Wednesday 13:30	A102	
	10	22 June*	Thursday 13:30	A102	
	SV2	5 July*	Wednesday 14:00	A102	

* Provisional dates for extraordinary meetings for examinations results

Graduation ceremony dates (provisional): Spring: Friday 20 or Saturday 21 January 2017, Summer: 12,13,14,15 July 2017

New Starters

Tomas Sherwen, PDRA, working with ME Room: G116; Extension: 4758; Email: <u>tomas.sherwen@york.ac.uk</u>

Dr Liselotte Tinel, PDRA, working with LJC Room: G116; Extension: 4759; Email: <u>liselotte.tinel@york.ac.uk</u>

Dr James Firth, PDRA, working with PAOB Room: D215; Extension: 4521; Email: james.firth@york.ac.uk

Dr Tamim Chalati, PDRA, working with DKS Room: D126; Extension: 4184; Email: <u>tamim.chalati@york.ac.uk</u>



Grant Success: Dr Kirsty High Awarded a NERC Knowledge Exchange Fellowship



Dr Kirsty High has been awarded a 3 year NERC KE Fellowship to work with Dr Kirsty Penkman, beginning in September. Dr High completed her PhD in Analytical Chemistry at York in 2014, and will be building on her doctoral research on quantifying organic deterioration in archaeological sites.

NERC KE Fellowships aim to translate NERC funded research to end user communities. As such, Dr High will be working alongside Historic England and York Archaeological Trust to build better mechanisms by which scientific data can be used to inform the appropriate management of waterlogged archaeological sites.

Dr High will join a growing network of KE Fellows, which also includes Dr Sarah Moller whose Fellowship aims to build better networks between atmospheric science researchers and DEFRA, based in WACL.

Dr Tom Dugmore at Café Scientifique

Dr Tom Dugmore of the Green Chemistry Centre of Excellence (GCCE) spoke about "Food waste to fuel the future?" at Café Scientifique in Stockton-on-Tees on Tuesday 19th July to around 50 people (a bit below average but perhaps to be expected on a hot evening in July!).



Above left: Tom next to his poster; Above right: Tom with the chair of the event, Julia Goudge.

Prof James Clark Receives Honorary Doctorate

Professor James Clark has been awarded an honorary doctorate for his work on sustainable chemistry and the bio-economy by Leuphana University in Germany. The photo below shows him receiving the degree from the President of the University.



Prof James Clark Gives Newlands Lecture



On 29th June, Professor James Clark gave the "Newlands Lecture" at Imperial College London to over 100 enthusiastic schoolchildren who then kept him for over 30 minutes with questions. James spoke about how we can achieve a sustainable society and a good quality of life through Green & Sustainable Chemistry. In particular, how we can use the combination of problems facing the World – too much waste and too little resource – to create a sustainable future.

CHEM21 Summer School and Launch of the New Online Learning Platform



On 13th—15th June, the Green Chemistry Centre of Excellence (GCCE) in collaboration with a large number of CHEM21 partners, organised and ran the CHEM21 summer school entitled 'Practical Aspects of Green Chemistry in the Pharmaceutical Industry' in the Library at Burlington House, London. * Prof. James Clark, Prof. Ian Fairlamb, Louise Summerton, Rick Taylor, Katie Privett, Dr Tom Dugmore, Eddie Monteith and Dr Sarah Kirchhecker all attended from the Department of Chemistry. The aim of the event was to showcase research highlights from the CHEM21 project and explore key themes of the project through delivery of a selection of the training and education material that has been developed throughout the lifetime of the project (and incorporated in the now live online learning platform).

The main event was preceded by a networking evening to launch the new CHEM21 online learning platform (<u>http://learning.chem21.eu</u>), the creation of which has been led by the Green Chemistry Centre over the last three years. The networking evening also included a keynote speech entitled 'Green Chemistry and Sustainability for the 21st Century' from Prof. James Clark. This was followed by a day and a half of lectures and training workshops delivered by a blend of key researchers across all Work Packages and involving a number of the small group, interactive activities.

The event was attended by 40 delegates from a range of backgrounds with graduate and postdoctoral researchers making up the majority of the attendees. The level of engagement from the delegates was very high, with a large amount of discussion and interaction throughout the event. The feedback from the event was very positive: the quality of the speakers, workshops and event



overall were unanimously rated 'Excellent' or 'Good; 'Workshops were great and the kick-off meeting/event was great'; 'Both in depth workshops were interesting and useful'.

More information on the CHEM21 online learning platform

The new <u>CHEM21 online learning platform</u> comprises a range of free, shareable and interactive educational and training materials created to promote the uptake of green and sustainable methodologies, with a particular focus on the synthesis of pharmaceuticals. The platform also showcases some of the novel research that has resulted from the CHEM21 project.

The platform has a comprehensive menu of educational and training resources covering a broad range of topics, both at an introductory level and in-depth under the following topics:

- Foundation
- Guides and Metrics
- Solvents
- Synthetic Toolbox
- Process Design
- Life Cycle Impacts and the Environmental Fate of Pharmaceuticals

The platform has been designed specifically to have the following key features:

- **Open**: the site requires no payment or log-in to access, and has been designed for ease of use and accessibility.
- **Flexible**: each learning module stands alone, so the user can pick and choose from a wealth of resources to create a learning path appropriate to their needs.
- **Shareable**: the majority of the content on the site is under a Creative Commons license, allowing the user to reuse and reproduce material in their own courses (with acknowledgement)
- **Interactive**: learning resources are provided in a variety of formats including text, video, charts and diagrams, interactive tools, multiple choice quizzes, and in-depth study exercises.



We anticipate that the resources on the platform will be used by a wide audience to enhance their training and practice. The GCCE also plans to expand this work in future with a series of specialist on line short courses and bespoke courses for and in conjunction with industry.

*This event and the online platform were delivered as part of the IMI funded CHEM21 project (Chemical Manufacturing Methods for the 21st Century Pharmaceutical Industries). CHEM21 has received funding from the Innovative Medicines Initiative Joint Undertaking under grant agreement n°115360, resources of which are composed of financial contribution from the European Union's Seventh Framework Programme (FP7/2007-2013) and EFPIA companies' in kind contribution."

Staff Picnic and Rounders Match

This year the annual Staff Family BBQ and Rounders match morphed into a Staff Picnic and Rounders match. The rain largely held off and although it was a bit slippy underfoot on the rounders pitch, luckily no accidents occurred. The picnic went well with everyone enjoying the variety of food, particular the desserts. It was lovely to see staff members and their families get together. Thank you to everyone who helped with the organisation and especially to Lisa Mayer.



Chemical *Inter*Actions

Email <u>chemical-interactions-group@york.ac.uk</u> www.facebook.com/ChemInteractions

Professor Dave Smith Presents



(Ĭ)

Raising your Profile: Professional Scientific Networking Skills in the Internet Age

Thursday 4th August 2pm in A122

In this session, we will consider online tools for scientific communication and networking, including social media such as Facebook and Twitter, as well as sites such as LinkedIn, ResearchGate, OrcID, ResearcherID, Mendeley and PURE. We will consider how professional use can best be made of such tools, and explore their relative advantages and disadvantages. This workshop will leave you better positioned to build your professional network and engage in national and international scientific discussions.

Tea and cake provided at 2pm by kind support from the RSC

Please express your intention to attend @ <u>https://uniofyork.doodle.com/poll/6fdp9twszhda7mmx</u>





Email: <u>luisa.ciano@york.ac.uk</u> or <u>daniel.raines@york.ac.uk</u>