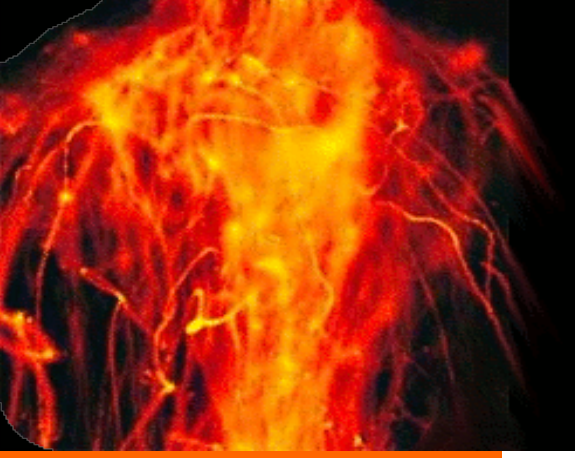


Chemistry Update

Newsletter 313, 27 September 2019

Inside this Issue

Calendar of Events

RSC - Sustainable Water Award
Speaker: Prof Dionysios Dionysiou
Date: Wednesday 2 October
Time: 1pm—2pm
Location: C/B/101

KMS Prize winners seminar and poster session
Speakers: Nick Yates, Kirsten Hawkins, Jenny Lewis and Yann Lie (PhD students)
Date: Wednesday 9 October
Time: 2pm—5pm
Location: C/A/101

Academics Assemble
Date: Friday 11 October
Time: 11am—5pm
Location: Berrick Saul Building

WACL Seminar
Speaker: Dr Hendrik Fuchs, Forschungszentrum Juelich
Date: Wednesday 16 October
Time: 11am—12pm
Location: C/G/111
(WACL Meeting Room)

Robotics Seminar
Speaker: Prof Alan Winfield, UWE Bristol
Date: Wednesday 16 October
Time: 1pm—2pm
Location: C/B/101

VC Visit—Meeting for all staff
Date: Wednesday 16 October
Time: 3pm—4pm
Location: C/A/101

Equality and Diversity Lunchtime Forum "Is Brexit making you feel like you don't belong?"
Date: Friday 18 October
Time: 1—2pm
Location: C/A/122

UCAS Visit Days
Date: 17, 21, 24, 28 & 31 October
Time: 12pm—4pm

Date of Next Issue:
25 October 2019

Improving chemical handling in teaching labs

Dr Moray Stark has developed a powerful Teaching Laboratory intervention to help students improve their chemical handling skills.

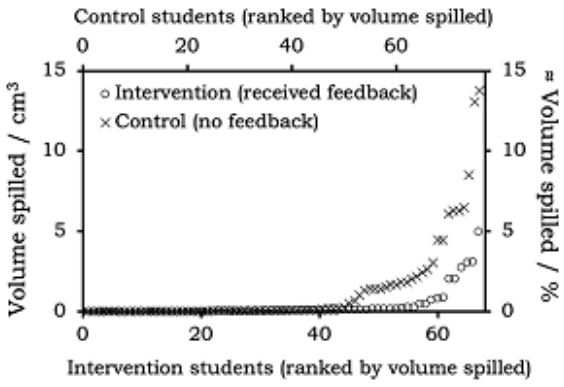
The ability to handle chemicals safely is a key aspect of the learning development of chemistry students. Previously, however, there have been no investigations of the quantity of chemicals spilled by students during lab experiments, neither are these skills routinely assessed. Clearly, spillage of chemicals can potentially have safety implications, as well as environmental implications in terms of waste.

Alongside two final year project students, Aimilia Tsokou and Alix Howells, Dr Moray Stark developed a unique intervention for first year chemistry undergraduates at the University of York. Their methodology used paper liners to allow easy assessment of the volume of liquid spilled by students during an analytical chemistry experiment. On average, the students spilled approximately 1% of the total volume handled, however, on the individual level, spillage varied greatly, by almost a factor of 1000, from 0.02% to 10% of the total.

In an innovative step, the researchers developed feedback to give to the students on the potential safety significance of the volume of chemical they each had spilled, and then carried out a randomized controlled trial (RCT) to test whether this intervention improved chemical handling. Although RCTs are the 'gold standard' and are commonly used in areas such as medicine, they are virtually never used in chemical education research.

Authors (left to right): Dr Moray Stark, Alix Howells and Aimilia Tsokou

The undergraduates were asked for consent, split into two groups and did an experiment – only one of the groups received feedback on the chemical they had spilled. Both groups of students then repeated the experiment in order to assess differences resulting from the feedback. There were significant differences in the volume of chemicals spilled by the two groups of students, with those who did not receive any feedback spilling, on average, twice as much as the group that had received feedback. At the end of the repeat experiment, the second group of students also received the useful feedback.



Data showing that students receiving the feedback intervention went on to spill smaller volumes of chemicals.

Dr Moray Stark said: "It was really pleasing to see that explaining to students the safety implications of spillage improved their chemical handling ability. The approach we have developed can provide meaningful feedback to the student, as well as potentially improving safety and skills in the laboratory."

Speaking about the design of his study, Dr Stark added: "It can be challenging, when performing educational experiments, to achieve reliable results – this randomized controlled trial approach could be more widely used in chemistry education research."

The Department of Chemistry is committed to delivering high quality, innovative teaching, as reflected in its exceptional scores in the National Student Survey and the high rankings of the Department in university league tables. Practical teaching in York is very innovative and focusses on developing students practical skills in a high-quality laboratory environment.

Dr Stark's research is published in *Journal of Chemical Education*.

European research grant award winner

Dr Lianne Willems has been awarded a five-year research grant worth 1.5M Euros to support the first phase of her career as an independent academic here in York.

The highly-coveted European Research Council (ERC) Starting Grants help individual scientists and scholars to build their own teams and conduct pioneering research across all disciplines.

The central goal of Dr Willems' research program is to improve our understanding of a relatively rare but devastating class of muscular dystrophies through the use of cutting-edge techniques in chemical biology.

Patients suffering from some forms of muscular dystrophy are unable to produce a key molecule, which is essential for the normal functioning of muscles and components of the nervous system. This molecule sits on cell surfaces and carries a long chain of carbohydrates that make important links to the surrounding tissue. Although it is known that these interactions are essential, it is unclear how cells make the carbohydrate chain.

Dr Willems' team will therefore be diving into the molecular details of this process, studying some of the key enzymes responsible for linking the carbohydrates together. This research will help us answer important questions about how certain genetic defects lead to muscular dystrophy and the way in which specific symptoms are caused. As a result, these new findings may help design new diagnostic tools and therapeutic strategies.

Dr Willems said: "This grant is a fantastic opportunity for me to boost my independent career and to start building an exciting new research program that addresses the vital role carbohydrates play in human disease."

This year's ERC Starting Grants are worth a total of €621 million, and have been awarded to a highly diverse group, with researchers from 51 different countries of origin across the world being funded to carry out research in the European Union.

New research on ancient rhino tooth could unlock evolution mysteries

Scientists from the University of York were involved in a project to extract original proteins providing genetic data from a 1.77 million-year-old rhino tooth.

It marks a breakthrough in the field of ancient biomolecular studies by allowing scientists to accurately reconstruct evolution in mammals from further back in time than ever before – offering the potential to solve some of the biggest mysteries of animal and human development.

Artistic reconstruction of *Stephanorhinus* in its natural environment. Credits: Mauricio Anton

Researchers identified an almost complete set of proteins in the dental enamel of the rhino, the largest genetic data-set older than one million years to ever be recorded.

Tooth enamel

Researchers in the Department of Chemistry played a vital role ensuring that the proteins recovered were authentic and not contaminated. Dr Marc Dickinson and Dr Kirsty Penkman have been developing a method for isolating protein trapped within fossil tooth enamel, and they applied this to the rhino tooth as well as other fossils from the site.

Dr Dickinson said: “It was exciting to see such clear evidence from our data that the proteins within the tooth enamel were original, which enables the genetic data derived from them to be used with confidence.”

Professor Enrico Cappellini, a specialist in Palaeoproteomics at the Globe Institute, University of Copenhagen, and first author on the paper, said: “This new analysis of ancient proteins from dental enamel will start an exciting new chapter in the study of molecular evolution.

“Dental enamel is extremely abundant and it is incredibly durable, which is why a high proportion of fossil records are teeth.”

Shift in understanding

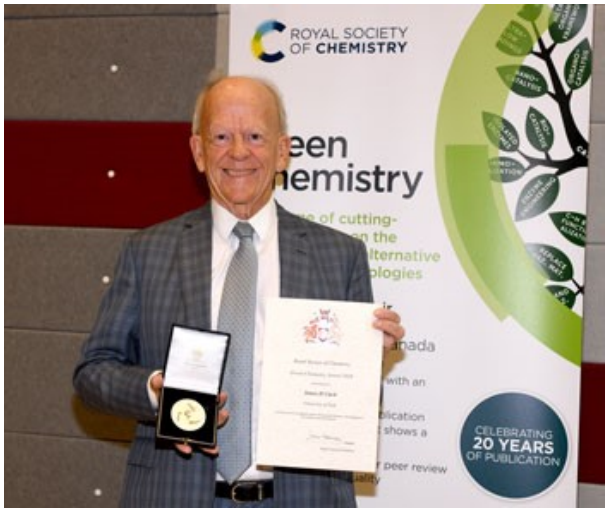
The fossil of the rhino tooth was found in Georgia at a site called Dmanisi, an important archaeological site with the oldest human fossils outside of Africa.

This rearranging of the evolutionary lineage of a single species may seem like a small adjustment, but identifying changes in numerous extinct mammals and humans could lead to massive shifts in our understanding of the way nature has evolved.

The team of scientists is already implementing the findings in their current research. The discovery could enable scientists across the globe to collect the genetic data of ancient fossils and to build a bigger, more accurate picture of the evolution of hundreds of species, including our own.

Professor James Clark wins RSC Green Chemistry Award

Professor James Clark has been awarded the prestigious Green Chemistry Award from the Royal Society of Chemistry.



Professor Clark is the founding Director of the University's Green Chemistry Centre of Excellence (GCCE) and the Biorenewables Development Centre (BDC).

The RSC Green Chemistry Award recognises Professor Clark's promotion of applied, market-driven green chemistry and engagement with industry and policymakers.

His work focuses on getting value from waste and in particular turning waste into molecules and useful products.

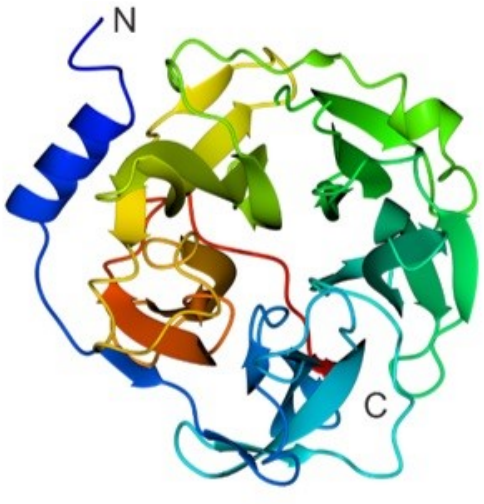
Professor Clark said: "I am delighted to receive the award from the organisation that helped me start the green chemistry movement in the UK 20 years ago."

He added: "Climate change is a consequence of our poor use of the Earth's limited resources. Too many of these resources are exploited for short-term gain to feed our consumer society but lead to long term pain through waste, pollution and consequential climate change.

"At York we are challenging the use of traditional resources and established linear supply chains with new circular models that see waste as a resource and ensure minimal environmental impact."

Sweet success of parasite survival could also be its downfall

York scientists are part of an international team which has discovered how a parasite responsible for spreading a serious tropical disease protects itself from starvation once inside its human host.



The findings provide a new understanding of the metabolism of the *Leishmania* parasite and this new knowledge could potentially be used in its eradication.

The disease the parasite causes is called Leishmaniasis and it is spread by the bite of sand flies. It kills between 20-40,000 people every year.

In a collaboration between the University of Melbourne and the University of York, researchers found that Leishmania make an unusual carbohydrate reserve, called mannogen, that protects them from fluctuating nutrient levels in the host, enabling their survival.

They then identified a new family of enzymes that use sugars scavenged from the host to make mannogen. York researchers defined the 3-D structure of these enzymes and this allowed researchers to map the evolution of this new enzyme family whose members acquired the ability to both make and degrade mannogen, and regulate the metabolism of these pathogens.

Developing new therapies

This knowledge is now being used to identify drug molecules that bind and block enzyme activity and may be used to develop new therapies.

Professor Gideon Davies from the Department of Chemistry said: “Our three-dimensional structural insight provides new opportunities for drug design against this pathogen. We look forward to targeting the disease in future. The team of PhD students and York Chemistry MChem project students did a fantastic job of the structural analyses.”

Professor Malcolm McConville from the University of Melbourne said: “As mannogen metabolism is critical for the survival of these parasites, developing inhibitors to block the enzymes that regulate this carbohydrate store is a potential way to specifically kill Leishmania parasites. We can exploit the parasite’s food preference for mannogen and specifically target this metabolic pathway, without side-effects to humans.

“Similar enzymes and carbohydrates are made by other pathogens, such as the bacteria that cause tuberculosis, and this work may contribute to developing new classes of drugs to treat other infectious diseases.”

Hiding in cells

Leishmania are able to persist for many years in their human host by hiding inside immune cells, such as macrophages. Macrophages are normally responsible for killing invading pathogens, but *Leishmania* are

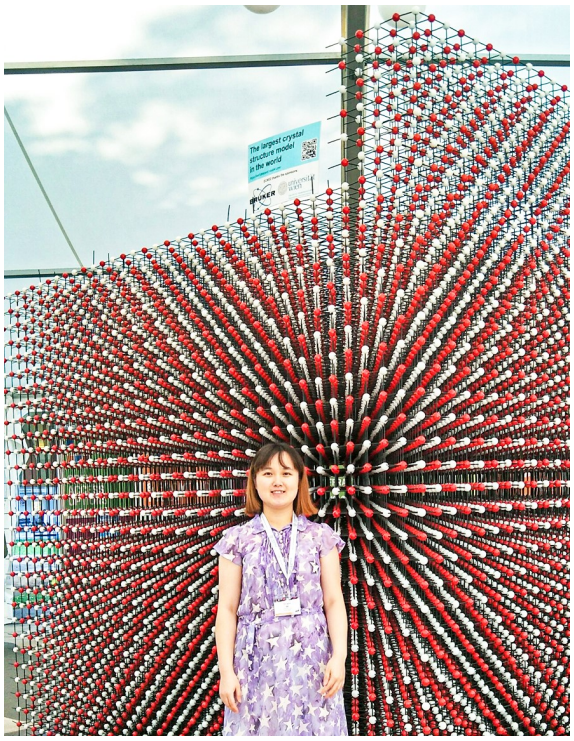
able to avoid this fate and grow stealthily within these host cells, eventually forming large 'granuloma' lesions that can lead to open ulcerating sores, organ damage and, in some cases, death.

Many people who carry the parasite remain asymptomatic, but immunosuppressed individuals, for example those with HIV/AIDs or suffering from malnutrition, are particularly vulnerable. Until recently very little was known about how *Leishmania* managed to grow within these host cells and resist most antibiotics.

Leishmaniasis is increasing in many regions of the world, including the Middle East, Africa and Central America where there are regional conflicts and breakdown in health services. There is currently no effective vaccine against it.

The research is published in *Cell and Host Microbe*.

Mengyu Ge wins poster prize at 32nd European Crystallographic Meeting in Vienna

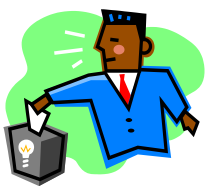


Mengyu Ge, PhD student in the York Structural Biology Laboratory (YSBL), has won a poster prize at the 32nd European Crystallographic Meeting, which took place in Vienna on 18-22 August.

Mengyu won the IUCr Journals Poster Prize (for best poster from a student in structural biology) for her poster presentation entitled 'Structural basis for RNA translocation and NTP hydrolysis by the Zika virus NS3 helicase'. The prize consists of an IUCr Journals open-access voucher, a copy of A Little Dictionary of Crystallography and a certificate.

Mengyu Ge is carrying out a PhD project under the supervision of Professor Fred Antson. Their group's interests are in understanding the molecular events that control biological mechanisms, concentrating on protein-nucleic acid interactions.

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.

We're 4th in the UK

Chemistry at York in top ten in the Times and Sunday Times Good University Guide 2020.

The Department of Chemistry has been named one of the UK's most highly regarded departments for our subject. We are ranked 4th in the UK in the Times and Sunday Times university league tables for 2020.

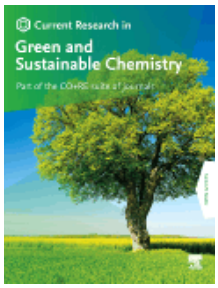
Published annually, the Times University Guide ranks 132 UK universities by undergraduate degree subjects according to teaching quality; student experience; research quality; entry standards; graduate prospects; Firsts/2:1s; completion rate; student-staff ratio; and services/facilities spend.

The rankings are based on official data collected by the Higher Education Statistics Agency (HESA), the National Student Survey published by HEFCE and the Research Excellence Framework 2014.

The following departments at York also received top 10 rankings: Archaeology, Biology, English, History, History of Art, Psychology, Social Policy and Social Work, York Management School, and Theatre, Film, Television and Interactive Media.

Dr Avtar Matharu appointed editor of new Elsevier green chemistry research journal

Dr Avtar Matharu has been appointed editor-in-chief of *Current Research in Green and Sustainable Chemistry*, a new primary research, gold open access journal from Elsevier.



Current Research in Green and Sustainable Chemistry aims to build a better understanding of where and how chemistry itself can be made more sustainable and whereby chemistry can contribute to sustainability in general. The journal includes all chemical aspects along the life cycle of chemicals, as well as chemical products and materials, such as resources, synthesis, use and after life issues. New and innovative research will be published on topics including chemical recycling, waste minimisation, biorefineries and biomass valorisation, CO_2 capture and utilisation, green processes, and new business models.

It is a companion to the highly regarded review journal *Current Opinion in Green and Sustainable Chemistry* and part of the Current Opinion and Research (CO+RE) suite of journals.

Dr Avtar Matharu is Deputy Director of the internationally-renowned Green Chemistry Centre of Excellence (GCCE). He is an expert on renewable resources and materials, in particular unavoidable food supply chain wastes. He developed the Greener Reactions and Sustainable Processes (GRASP) concept to encourage academia and industries to change from traditional methodologies to those more sustainable.

New starters

Sofia Skott, Assistant Technician, Teaching Laboratories
Room: C/F010; Ext: 4958; Email: sofia.skott@york.ac.uk

Dr Sebastian Diez, Postdoctoral Research Associate (with Dr Pete Edwards)
Room: C/G116; Ext: 4758; Email: sebastian.diez@york.ac.uk

Dr Michael James, Leverhulme Trust Early Career Research Fellow (with Professor Ian Fairlamb)
Room: C/D014; Ext: 8893; Email: michael.james@york.ac.uk

Dr Luke Wilkinson, Leverhulme Trust Early Career Research (with Professor Anne Duhme-Klair)
Room: C/E217; Ext: 2607; Email: luke.a.wilkinson@york.ac.uk

Dr Elizabeth Wheeldon, Associate Lecturer (with Dr Derek Wann)
Room: C/B103; Ext: 4539; Email: lizzie.wheeldon@york.ac.uk

Fleur Hughes, Network Manager STFC Air Quality Network+ (with Dr Sarah Moller)
Room: C/G119; Ext: 1213; Email: fleur.hughes@york.ac.uk

Fiona Lawson, PA/Administrator HoD Office
Room: C/A121; Ext: 2500; Email: fiona.lawson@york.ac.uk

Max Hill, Teaching Laboratory Demonstrator
Room: C/B103; Ext: 5872; Email: max.hill@york.ac.uk

Katriona Harrison, Teaching Laboratories Demonstrator
Room: C/B103; Ext: 5872; Email: kat.harrison@york.ac.uk

Nick Heywood, Teaching Laboratories Demonstrator
Room: C/B103; Ext: 5872; Email: nick.heywood@york.ac.uk

Change of Role

Dr Tom Dugmore, Green Chemistry Associate Lecturer (with Dr Derek Wann)
Room: C/F111; Ext: 4547; Email: tom.dugmore@york.ac.uk

Academics Assemble

The event will take place on 11 October 2019 and is a celebration of interdisciplinary research and collaboration. Interdisciplinary research is a key aspect of university research, alongside our disciplinary excellence, and often cited as necessary to tackle the challenges facing the world. Come and hear from colleagues across the Faculties about their past experiences of working in interdisciplinary networks, consider present opportunities to join and fund interdisciplinary activities, **and influence the debate about the future direction of interdisciplinarity at Yo**rk.

Registration is now open. If you would like to attend part of the day, but not all of it, please do feel free. Lunch will be provided.

For further queries please contact Ruth at research-champions@york.ac.uk.

My pronouns are….

As the start of term approaches the Equality and Diversity Group are encouraging everyone to share their gender pronouns to improve inclusiveness in the Department of Chemistry.

Gender pronouns are words that we use when talking to or about somebody, for example “he, him, his” and “she, her, hers.” People who are non-binary or gender nonconforming may use pronouns that don’t conform to binary male/female gender categorisations, such as “they, them, theirs”, see information sheet for more details.

By sharing our own pronouns, we aim to:

- Let others know what pronouns you use
- Make it easy for others to communicate their pronouns
- Create a welcoming environment for people of all genders

Recently, we have introduced a question into the first Year 1 supervision form. We intend to use this information to help personal supervisors to get to know their supervisees and when printing name badges for teaching labs. We are also exploring other ways of disseminating this information in future (e.g. on class lists or tutorial forms).

Some easy ways for you to share your pronouns:

Update your email signature - see the how to guide for instructions on creating or editing your email signature.

Introduce yourself in talks/lectures/meetings using your pronouns. Update slides/handouts to include your pronouns after your name.

Wear a badge/sticker - update name badges to include your pronouns, e.g. for welcome meetings/ networking. We will be making pronoun stickers available at the start of term.

We encourage cisgender people to lead the change by sharing pronouns. It sends a strong message, normalises the process, has little risk and makes for a safer environment for everyone.

If you have questions or suggestions related to gender pronouns, please get in touch with leonie.jones@york.ac.uk.

My pronouns are: **She/her/hers**  Chemistry@York	My pronouns are: **he/him/his**  Chemistry@York	My pronouns are: **they/them/theirs**  Chemistry@York

Athena SWAN Gold Award

DEPARTMENT OF CHEMISTRY
york.ac.uk/Chemistry

UNIVERSITY of York

Equality and Diversity Lunchtime Forum

Is Brexit making you feel like you don't belong?

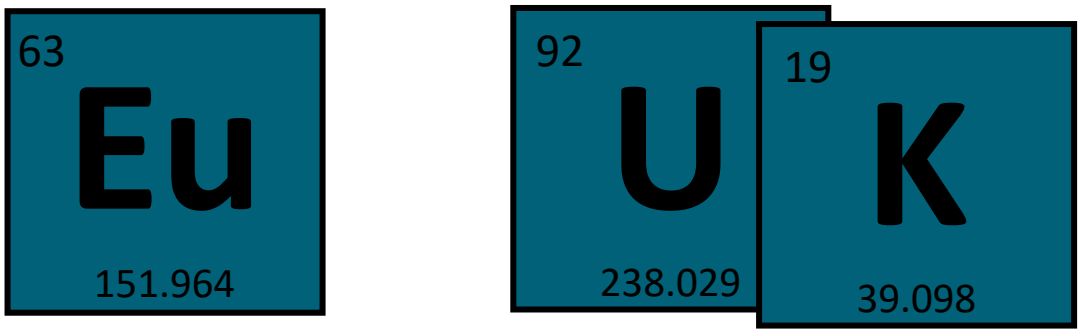
All staff and students welcome

Our Department thrives on having students and staff members from all over the world.

Is the current Brexit situation making you feel anxious, uncomfortable or just like you don't belong?

Come along for an informal chat to discuss any issues you are facing.

Friday 18th October
1-2 pm, C/A122



Bring your lunch and a mug - tea and coffee provided

Please contact leonie.jones@york.ac.uk or caroline.dessent@york.ac.uk for more information