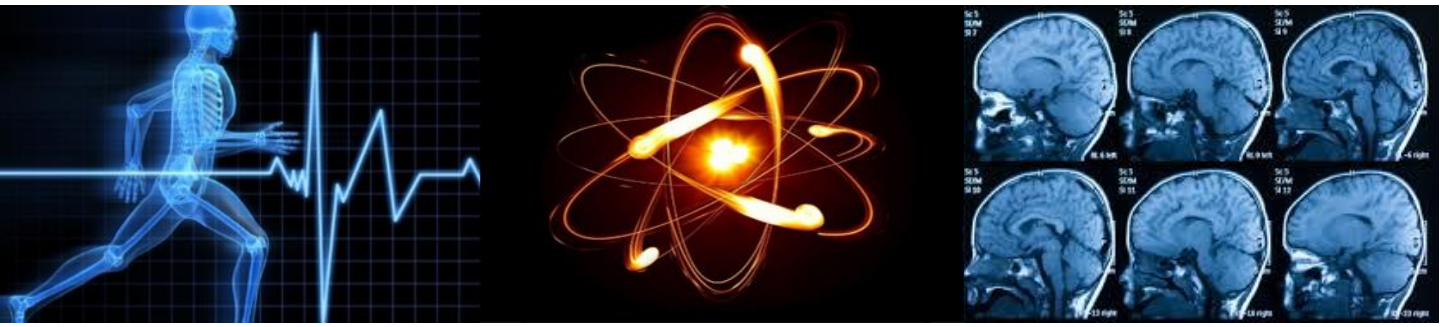
UNIVERSITY OF BIRMINGHAM

College of Engineering and Physical Sciences
College of Life and Environmental Sciences



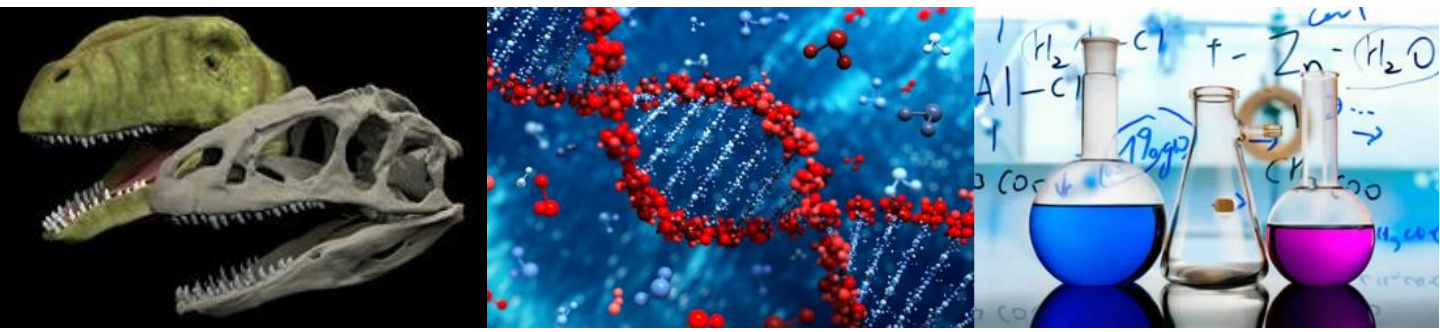
Postdoctoral Researcher Conference (EPS & LES)

Brought to you by EPS & LES PERCAT

Alan Walters building

Wednesday 26th June 2019: 9.30am-4.30pm
Drinks reception: 4:30-5:00pm

Postdoctoral and Early Researcher Career Development and Training



Welcome

On behalf of the EPS & LES PERCAT Committee, the Conference Organising Committee warmly welcomes you to the PERCAT Post-doctoral Researcher Conference 2019. We are pleased to host this conference for post-doctoral researchers within the College of Life and Environmental Sciences (LES) and the College of Engineering and Physical Sciences (EPS), and our wider community including doctoral students, academics, and post-doctoral staff from other Colleges and professional services staff.

The conference showcases the diverse research done by our post-docs/early stage researchers in LES and EPS through oral presentations and poster exhibition, and includes much more. We will be hearing first-hand from researchers about their experiences inside and outside academia, and from Sarah Cosgriff, Gender Balance Officer at the Institute of Physics, freelance science communicator and co-founder of BrumSciComm, who will deliver the keynote lecture on "Widening Engagement for Under-represented Groups". We have planned several breaks throughout the day, including free food and drinks, to allow you to meet people across different disciplines, find out about the support and training opportunities available to early career researchers and discover how our sponsors can help you with your research. On this point, we would like to thank all of our sponsor organisations for providing their generous financial support, especially our gold sponsors Sciex and Shimadzu.

We hope that you will have a productive and fun-filled time at this very special conference. We kindly ask you bring anything to our attention that may help us to ensure the success of the current conference, as well as future ones. Thank you for attending!

Best wishes from the conference organisers,
Rebeca Bailo, Sophie Briffa, Adrian Bromage, Saikat Dutta, Markus Gellesch, Azarmidokht Gholamipour Shirazi, Peter Holland, Sarah Lee, Lukas Najdekr, Holly Nel, Jennifer Thomson, Ioanna Zafeiri, and Thomas Wilks.

Programme - morning

9.00	***Registration and refreshments***
9.30	**Welcome and Opening Remarks** **Prof Chris Baber,** Deputy Director of Research, Engineering and Physical Sciences
9.45	**Oral Session 1 – Chairs: Azar Gholamipour-Shirazi, Tom Wilks**
	What do Summer Atlantic Hurricanes tell us about European Winters? **Michael Angus,** LES, Geography, Earth and Environmental Sciences
10.00	From Car Tyres to Volcanic Eruptions, Rheology: The Science of Flow **Carl Reynolds,** EPS, Chemistry
10.15	A Comparative Study of Behaviours between Children and Adolescents with Tuberous Sclerosis Complex **Stacey Bissell,** LES, Psychology
10.30	**Post-doctoral Careers and Experience**s: My Life in Science: The value of the long-term post-doc **Sarah Lee,** Research Fellow, School of Biosciences
10.45	***Refreshments, networking, posters***
11.15	**Oral Session 2 – Chairs Ioanna Zafeiri, Tom Wilks**
	Cities, People, and Wind. Towards Coexistence through Aerodynamics **Giulio Vita,** EPS, Engineering
11.30	It's all about Community: Understanding the Epidemiology of *Fusobacterium Necrophorum* in Sheep **Rachel Clifton,** LES, Biosciences
11.45	Making Robots actually useful for Nuclear Decommissioning **Mohammed Talha,** EPS, Metallurgy and Materials
12.00	**Keynote Lecture** Opening Doors: Widening Engagement for Underrepresented Groups **Sarah Cosgriff**, part of the Improving Gender Balance team at the Institute of Physics, freelance science communicator and trainer and co-founder of BrumSciComm. Chair Sophie Briffa
12.45	***Lunch, networking, posters***

Programme - afternoon

13.45	**Oral session 3 – Chairs: Markus Gellesch, Rebeca Bailo**
	Can Babies Link an Object moving in the Space and a Touch on their Body? **Giulia Orioli,** LES, Psychology
14.00	Continuous Railway Track Monitoring using Passenger Trains **Mani Entezami,** EPS, Engineering
14.15	Production of Environmentally Friendly Solvents from the Depolymerisation of Polylactic Acid **Luis Román-Ramírez,** EPS, Chemical Engineering
14.30	A New Approach to Produce an Improved Typhoon Risk Assessment and its Application for Disaster Reduction and Mitigation against Typhoons **Kelvin Ng,** LES, Geography, Earth and Environmental Sciences
14.45	**Post-doctoral Careers and Experience talk**: There and Back Again: Moving from Academia to Widening Participation, and Back **Tom Wilks,** Group Leader, School of Chemistry
15.00	***Refreshments, networking***
15.30	**Post-doctoral Careers and Experiences – Chairs: Holly Nel, Sarah Lee**
	12 years of Post-Doc and still Counting: Lessons Learnt by a French Research Fellow. **Guillaume Desanti,** Post-doctoral Research Fellow, School of Biosciences
15.45	Balancing Academia and Motherhood as an Expat **Jen Drummond,** Royal Society – Newton International Fellow, School of GEES
16.00	Alternatives to Academia: A Career in Professional Services **Jackie Deans,** Technical Manager, School of Chemical Engineering
16.15	**Prize Giving and Closing Remarks** **Prof Tim Softley**, FRS, Pro VC for Research & Knowledge Transfer
16.30	***Drinks Reception***
17:00	*Finish*

Speakers

Professor Chris Baber
Welcoming Remarks

Professor Chris Baber is Deputy Director of Research in the College of Engineering and Physical Sciences. He joined the University in 1990 and has worked in several Schools across Engineering and is now in the School of Computer Science. His research focuses on the interface between people and technology, typically looking at novel forms of technology. 'Novel' meant speech recognition in the 1980s when he did his PhD, wearable computers in the 1990s, and sensorised objects in the 2000s. He is currently exploring the nature of Human-Machine Teaming which arise when people work with computers that are capable of making information decisions. Professor Baber's research has been funded by UKRI, the EU, MoD and various industries. He has published over 100 papers in refereed scientific journals, as well as half a dozen books, and has around 350 conference contributions. He has supervised around 30 PhD students to completion.

Professor Tim Softley
Prize Giving and Closing Remarks

Professor Tim Softley is the Pro-Vice-Chancellor for Research and Knowledge Transfer at the University of Birmingham. As such his responsibilities are to lead the University's research performance with the aim of positioning the University firmly amongst the leading research universities in the UK. He takes a lead role on research resources at the University; investment in its research base and on working to improve the University's grant capture, including research funding from business and industry. He also leads the University's strategic research collaborations with partners in the UK, Europe and worldwide and is a member of the Russell Group EU Advisory Group. He oversees the work of the University's tech transfer wing, University of Birmingham Enterprise. He was previously Head of Chemistry at the University of Oxford. He chairs the University's Research Committee, which oversees the work of the Early Career Research Staff Development Operational Group.

Speakers

Sarah Cosgriff
Keynote Lecture

Sarah is part of the Improving Gender Balance team at the Institute of Physics. She helps schools implement whole-school approaches to tackling gender bias with the aim to improve gender balance in subjects where there is high uptake with one gender, such as Physics, English, Computer Science and Modern Foreign Languages. She is also a freelance science communicator and is one of the co-founders of BrumScicomm, a network of science communicators based in Birmingham.

Dr Sarah Lee
Careers and Experiences

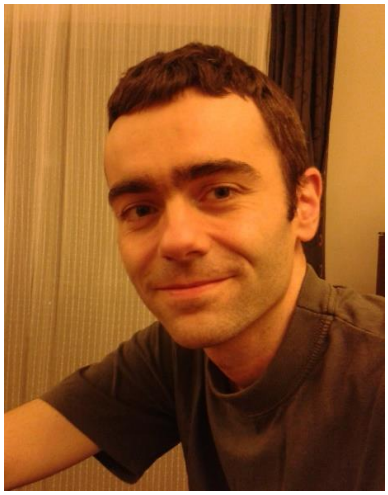
Initially, Dr Sarah Lee followed a scientific career outside academia, firstly, in the NHS as a biomedical scientist in Medical Microbiology, then a move to Roche Products, in drug discovery research in Rheumatoid Arthritis. Roche funded her undergraduate degree and provided day release. Sarah then spent a number of years teaching Biology in a Further Education College. She came late to the post-doctoral researcher role, and obtained her Ph.D. when she was over 40, when her three children were at primary school, which bought its own dynamic. Her post-doctoral research career spans seven years at the University of Warwick, followed by six years for the Head of School of Biosciences Prof. Tim Dafforn. Thus far, her pursuit of a long term post-doctoral research role has been sustainable and she loves her job. But what about the future? And what advice can she offer to others.

Speakers

Dr Tom Wilks

Careers and Experiences

Many students face huge barriers to their participation in higher education, and Dr Tom Wilks has always felt that it is our duty to do something about this. He also believes that it is part of a scientist's job to try and communicate their research outside the lab. His career to date has as a result followed anything but the traditional academic path, including stints as a Schools Liaison Officer at the University of Cambridge and Midlands Regional Director for The Brilliant Club, an educational charity. In this talk, he will describe his experience moving in and out of academia to jobs in the charity and not-for-profit sector, and share some survival tips that he has picked up along the way.



Dr Guillaume E. Desanti

Careers and Experiences

After an undergraduate degree in Life and Earth Sciences and a Bachelor degree in biochemistry (Paris Universities, France), Dr Guillaume Desanti got a MSc followed by a PhD in fundamental immunology (Paris VII University / Pasteur Institute) for his work on the characterisation of foetal spleen organogenesis and haematopoiesis. Nearly twelve years ago, he joined the University of Birmingham as a post-doctoral researcher. During that period, he worked for three different laboratories on a variety of unrelated topics and unsuccessfully applied for few fellowships and young PI positions in the UK and abroad. For this presentation, he will give a brief overview of his post-doctoral career development as well as some tips learnt while evolving in this competitive academic environment. He will also share his reflections about the life of international post-doctoral researcher working in the UK and the extra-pressures that status might involve when building-up a family.

Speakers

Dr Jennifer Drummond
Careers and Experiences

Dr Jennifer Drummond received a BSc in Chemical Engineering from the University of Illinois at Urbana- Champaign (2008) and after 3.5 years work experience, she completed a PhD at Northwestern University (2015). Her research focuses on the underlying mechanisms that control water, microbial, and fine particle (i.e. microplastics) transport within freshwater systems to assess risk within agricultural and urban systems. She has received five competitive research grants (2 pre-doctoral, 3 post-doctoral) as the principal investigator and has been involved in ten funded R+D projects, which has led her to live in the US, New Zealand, Spain, and UK. In January 2019 she started a Royal Society Newton International Fellowship with the University of Birmingham, which will be followed by a Marie Curie Individual Fellowship. Along the way, she has had two daughters born in 2014 and 2015 in Barcelona. This talk will share her experiences of balancing academia with motherhood while living outside of your home country.

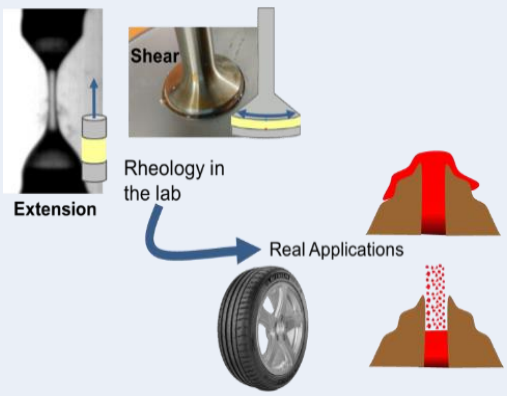
Dr Jackie Deans
Careers and Experiences

Jackie Deans has been employed at the University of Birmingham for 17 years. She completed her Ph.D. in Neurophysiology at the University of Southampton in 2002 on the effects of radiofrequency electromagnetic fields on brain tissue before moving to the University as a Research Fellow in the Neurophysiology Department (now CEM in the College of MDS), a position she held until 2009. During her 7 years in MDS she worked on several research projects related to the application of electric fields in the treatment of epilepsy and stroke. In summer 2009, Jackie moved into a redeployment role in Professional Services as a Facility Manager for the Advanced Materials Characterisation Facility in the School of Chemistry. This position involved looking after a suite of equipment including X-Ray diffraction, X-ray fluorescence spectroscopy and Raman microscopy, advising clients on method development and training staff, students and business users who accessed the facility equipment. In 2018 Jackie moved to the School of Chemical Engineering on secondment as Technical Manager and Health and Safety Co-ordinator.

Abstracts – Oral Presentations

Speaker:	**Michael Angus[1], Gregor C. Leckebusch[1], Ivan Kuhnel [2]**
School:	[1]School of Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2] CoreLogic.
Field of research:	Atmospheric Sciences
Title:	**What do Summer Atlantic Hurricanes tell us about European Winters?**
Abstract:	The Earth's climate is one interconnected system, with changes in temperature and pressure often influencing weather patterns hundreds of miles away. During El Niño events in the Pacific for example, regional impacts range from seasonal flooding in East Africa to drought and wildfires in Indonesia. Similarly, large scale climate factors play a key role in determining the number of hurricanes which form each year in the Atlantic and the number of winter windstorms which occur over Europe. As some of these large scale factors are important for both the hurricane and windstorm seasons, it is reasonable to ask how related the two are; does the severity of the hurricane season tell us anything about storms during the upcoming European winter? If so, can we use this information to better prepare for severe windstorm seasons? Unfortunately, answering this question is not straightforward, as reliable measures of seasonal activity only cover the recent satellite era (1979 to present) over which statistical relationships are unreliable. In this talk I discuss a new approach to this problem, using a large ensemble of model runs to simulate thousands of theoretically possible seasons. Estimates are provided for the worst case scenario, where extreme events occur in both the US and Europe. The climate conditions for this worst case scenario are examined to provide new information for stakeholders and prediction services.

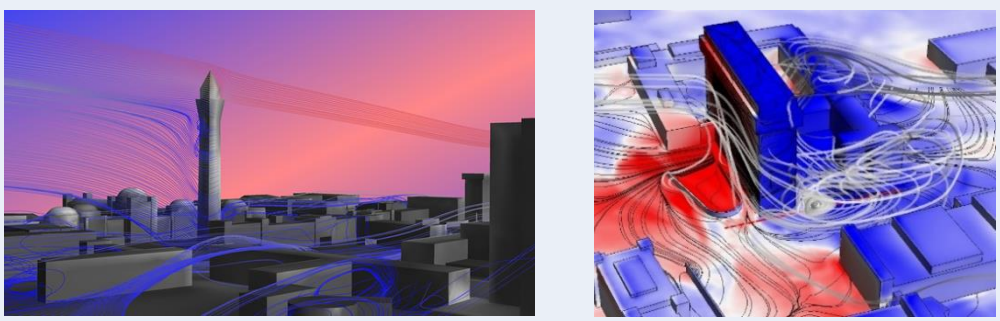
Abstracts – Oral Presentations

Name:	**Carl Reynolds[1], Richard Thompson[2], Stephen Boothroyd[2], Tom Jones[3]**
School:	[1]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Department of Chemistry, Durham University, Lower Mountjoy, South Road, Durham, DH1 3LE, UK. [3]Department of Earth, Environmental and Planetary Sciences, Rice University, 6100 Main Street, Houston, TX 77005, USA.
Field of research:	Rheology, Physical Chemistry, Earth Science
Title:	**From car tyres to volcanic eruptions, Rheology: The science of flow**
Abstract:	Rheology is the study of deformation and flow of matter, which has a wide remit. It is the science of how the materials around us stretch, bend, pour, drip and break. Tyre manufacture is a prime example of how useful rheology can be. Shear rheology can be used to predict the performance of car tyres, such as their rolling resistance or ability to brake when wet. It can also give an insight into the materials that make up the tyre, such as the branching structure of the long chain polymers that make up the rubber.[1] Experimental rheology can also be applied to much larger systems. Here, we use capillary breakup extensional rheometry, to test the stretching and breakup of golden syrup under a variety of conditions. This seemingly simple system is an excellent analogue for low viscosity volcanic magma, which is the most abundant type of magma on earth, and currently the least understood. The experimental results are used to develop a map of the conditions under which volcanic magma will behave effusively (i.e. a gradual flow of molten rock) or explode. This is a step forward in the understanding of these low viscosity magmas and has implications for hazard assessment worldwide.[2]  Figure 1: Illustration of rheological experiments and applications
References:	[1]Reynolds, C.D., "Rheological behaviour of polymer melts and its relationship with underlying structure and topology." PhD diss., Durham University, 2018 [2]Jones, T.J., Reynolds, C.D., Boothroyd, S.C., "Magma break-up during volcanic eruptions", under review, Nature Communications

Abstracts – Oral Presentations

Name:	**Stacey Bissell[1], Lucy Wilde[1], Christopher Oliver[1]**
School:	[1]Cerebra Centre for Neurodevelopmental Disorders, School of Psychology, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	intellectual disability, autism spectrum disorders, genetic syndromes, behavioural phenotypes
Title:	**A comparative study of behaviours between children and adolescents with tuberous sclerosis complex**
Abstract:	Introduction: Tuberous sclerosis complex (TSC) is a genetic disorder associated with benign tumour growth, epilepsy and intellectual disability (ID). A number of externalising behaviours are also associated with TSC, including: self-injury, aggression and repetitive behaviours. However, the profile of 'rare' forms of externalising behaviour (e.g. inappropriate vocalisations, faecal smearing) and age-groups differences in behaviour are not well-characterised in TSC. Therefore, this study aimed to explore the comparative complex behavioural profiles in children (aged 4-9 years) and adolescents with TSC (aged 10-15 years). Method: Caregivers of children (n = 17; M age = 7.16, SD = .42) and adolescents with TSC (n = 15; M age = 13.62, SD = .40) completed informant-report questionnaire and interview measures of ability and behaviour. Results: The prevalence rates of 13 externalising behaviours were investigated. As expected, self-injury (44%), physical aggression (59%) and stereotyped behaviours (34%) were prevalent in this group. However, a number of 'rare' behaviours were also prevalent, including: inappropriate vocalisations (53%) and removal of clothing (34%). Although removal of clothing, faecal smearing and pica (eating of inedible objects) occurred more frequently in children than adolescents, age-group differences were not statistically significant for any of the behaviours investigated. Discussion: Externalising behaviours that are considered relatively 'rare' in the behavioural literature were reported with unexpectedly high prevalence in children and adolescents with TSC (e.g. removal of clothing). Cross-syndrome comparisons are required to determine whether 'rare' forms of externalising behaviour are more common in TSC than other genetic syndromes associated with ID.

Abstracts – Oral Presentations

Name:	Giulio Vita[1]
School:	[1]School of Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Computational Fluid Dynamics - Wind Engineering
Title:	**Cities, People, and Wind. Towards coexistence through aerodynamics.**
Abstract:	We all live in a fluid. The air is an invisible fluid, which wraps the earth crust and sustains life itself. Due to its physical properties air reacts to the solar radiation and the ground temperature causing wind. Wind has many faces: a breeze is beneficial to our strolling in the summer, a gale can be potentially fatal, and an intelligently directed flow can be harvested to power up our homes or disperse the pollutants our activities cause. As more and more people move to cities, their activities affect wind and are affected in turn, in a highly non-linear and non-deterministic way. Understanding wind aerodynamics in cities is of utmost importance in our modern society transiting from fossil-based, unsustainable, non-resilient resource-strategies to wiser approaches where our said activities coexist, benefit, and sustain natural resources. But, understanding wind means understanding its highly unsteady, fluctuating, maybe chaotic, behaviour. Its turbulent behaviour. Practitioners describing urban winds have several techniques to choose from, each having flaws and benefits. If experiments do not offer large possibilities for wind speed measurements, numerical techniques such as Computational Fluid Dynamics mostly implement steady and simplified methods, not capable of fully encompassing turbulence characteristics. This research argues the possibility of using high-fidelity numerical methods, namely Large Eddy Simulation, to explore the urban turbulent flow highlighting the different challenges of improving our understanding of pedestrian level winds and urban wind energy harvesting, two of the main issues in dealing with wind in the city. Results show indeed a great increase in accuracy from switching to higher-fidelity methods. Our very honourable test case shows how close this matter is to us all: the University of Birmingham Campus.  Figure – Wind velocity streamlines over the University of Birmingham Campus. View of the a) Chancellor's Court and b) University Centre Square.

Abstracts – Oral Presentations

Name:	**Rachel Clifton[1], Kevin J. Purdy[2], Laura E. Green[3]**
School:	[1]Institute of Microbiology and Infection, School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]School of Life Sciences, University of Warwick. [3]College of Life and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Microbiology/Epidemiology
Title:	**It's all about community: understanding the epidemiology of Fusobacterium necrophorum in sheep**
Abstract:	Ovine footrot, a bacterial infection of the feet of sheep which results in severe lameness, is one of the most economically significant diseases of sheep worldwide. Fusobacterium necrophorum is an opportunistic pathogen in footrot that is thought to make the disease more severe. It survives on healthy animals or in their environment even in the absence of disease. The sites where F. necrophorum live in healthy sheep are poorly understood; F. necrophorum has been detected in the mouths of sheep, however it is unknown whether strains of F. necrophorum present in mouths are the same strains that are involved in footrot. Traditional approaches to characterising bacterial strains rely on isolating single strains of bacteria, and so often fail to identify when multiple strains are present as part of a strain community. Here we used a novel community typing method which generates a fingerprint of the F. necrophorum strain community. We showed that diverse and complex communities containing up to 8 strains of F. necrophorum were present in the mouths of sheep. A small subset of these strains were detected on feet, suggesting that the mouth may be a reservoir for these strains in the absence of footrot. In addition, we hypothesise that this subset of strains may have adapted to be able to grow on feet. These findings help us improve the control of footrot in sheep, and the methods we used have the potential to improve our understanding of the epidemiology of other opportunistic bacterial pathogens.

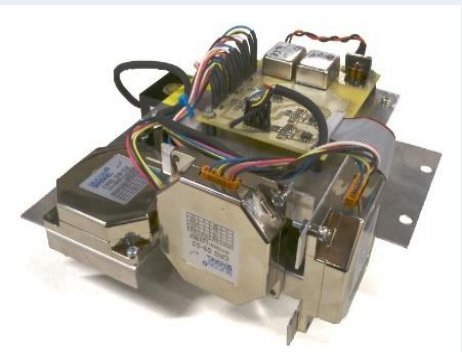
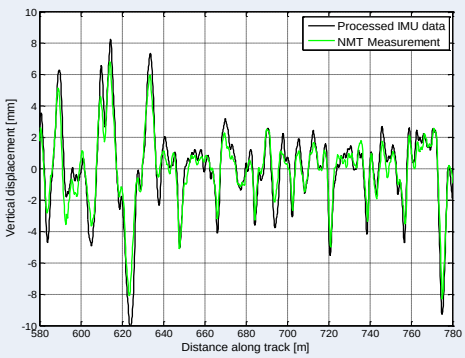
Abstracts – Oral Presentations

Name:	**Mohammed Talha[1]**
School:	[1]School Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Human Robot Interaction
Title:	**Making robots actually useful for nuclear decommissioning**
Abstract:	The UK has thus been engaging in nuclear activity for some 70 years, and this has resulted in a very large legacy waste remediation problem. The decommissioning of this estimated 4.9million tonnes of legacy waste is expected to take more than 100 years and cost in the order of £90-200billion. It is expected that a significant part of this work will have to be done by using remotely operated robots, because some materials and facilities are too hazardous for humans. Additionally, demolition work currently done by humans wearing air-fed plastic suits is hazardous, and extremely uncomfortable for workers. Furthermore, the protective suits become secondary nuclear waste. While the mainstream robotics literature predominantly reports novel mechanisms and novel control algorithms, it often neglects the end user of such systems leading to ineffective, inefficient systems. Rarely do such systems make an impact in the real world. Advances in technology mean that humans are responsible for over 80% of errors in systems. Extreme cases have resulted in catastrophes such as Chernobyl and Fukushima. In contrast, our research focuses on human factors/ ergonomics and experimental methodologies for objectively evaluating the performance of both a robot and its remote human operator, when challenged with carrying out industrially relevant remote manipulation tasks. By incorporating the user from the infancy stages of system development, we hope to achieve safer, effective and efficient systems that are also economical.

Abstracts – Oral Presentations

Name:	**Giulia Orioli[1], Irene Parisi[2], Jose L. Van Velzen[3], Andrew J. Bremner[1]**
School:	[1]School of Psychology, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Department of Psychology, "La Sapienza", University of Rome, Rome, Italy. [3]Department of Psychology, Goldsmiths, University of London, London, UK.
Field of research:	Developmental Neuroscience
Title:	**Can babies link an object moving in the space and a touch on their body?**
Abstract:	As adults, when we perceive an object moving towards us, we can accurately predict when and where it will touch our body[1,2]. But when and how does this ability develop in young infants? We are investigating this unexplored question by measuring how infants' brain responds to touches on the body that have been preceded by the motion of an object in the environment. We presented infants aged 4 and 8 months with a video showing a ball moving towards them or towards the background. Then the ball disappeared and the infants felt a light touch on their hands. While the infants were experiencing these stimuli, we continuously recorded their spontaneous electrical brain activity using electroencephalography (EEG)[3]. We then extracted infants' somatosensory evoked potentials (SEPs) in response to the touches: these inform us on how the electrical brain activity changed in the cortical areas responsible for processing tactile information in the first few milliseconds after the infants' received the touch. We showed that from 4 months infants' brains respond differently to a touch that has been preceded by the motion of a visual object towards the body part that received the touch. This suggests that a relatively limited experience of moving objects seems sufficient for babies to be able to relate motion in space to the position of their own body. These findings will help to further our understanding of how infants begin to perceive and represent their body, the space surrounding it and the relationship between the two.
References:	[1]Cléry, J., Guipponi, O., Odouard, S., Wardak, C. & Ben Hamed, S. Impact Prediction by Looming Visual Stimuli Enhances Tactile Detection. *J. Neurosci.* **35,** 4179–4189 (2015). [2]Kandula, M., Hofman, D. & Dijkerman, H. C. Visuo-tactile interactions are dependent on the predictive value of the visual stimulus. *Neuropsychologia* **70,** 358–366 (2015). [3]Hoehl, S. & Wahl, S. Recording Infant ERP Data for Cognitive Research. *Dev. Neuropsychol.* **37,** 187–209 (2012).

Abstracts – Oral Presentations

Name:	**Mani Entezami[1]**
School:	[1]Electronic, Electrical and Systems Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Railway condition monitoring
Title:	**Continuous railway track monitoring using passenger trains**
Abstract:	Maintaining the alignment of railway track is important for the smooth and safe passage of trains as poor track alignment results in reduced ride quality for passengers and increased maintenance requirements for rolling stock. Track alignment data providing an indication of track condition is therefore required in order to allow prioritisation of track maintenance so that ride comfort can be maximised. Rail infrastructure managers have dedicated vehicles to carry out track measurement. These vehicles are, however, expensive to procure and run as they need specially trained crews to operate them. Furthermore, they require uninterrupted access to the track, and so are difficult to schedule around other services. Consequently, the UK only has 6 such measurement vehicles and the mainline network is only inspected on a 4-6 weekly cycle (less regularly for other services). A relatively inexpensive fully unattended measurement systems has been developed in this work that can be installed on regular in-service passenger trains to provide ongoing monitoring of the condition of the track. The development of prototype inertial measurement equipment and algorithms have shown to be capable of producing comparable results to those obtained from the measurement fleet at a fraction of the cost, shown in Figure 1. The data are also used to predict track irregularities that are highly desired by the infrastructure managers in order to increase the efficacy of the maintenance routines.   Figure 1: (Left) UoB Inertia measurement hardware (Right) Comparison of the UoB processed data and the Network Rail measurement fleet.

Abstracts – Oral Presentations

Name:	**Luis A. Román-Ramírez[1], Paul McKeown[2], Matthew D. Jones[2], Joseph Wood[1]**
School:	[1]School of Chemical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Department of Chemistry, University of Bath.
Field of research:	Chemical Engineering, polymers, catalysis.
Title:	**Production of environmentally friendly solvents from the depolymerisation of polylactic acid.**
Abstract:	The environmental problems associated to the use of non-renewable synthetic polymers (plastics) have driven the search for new materials that come not only from renewable sources but also that are environmentally friendly. Poly(lactic) acid (PLA) is a biopolymer with the potential to replace oil-derived plastics. PLA market demand has grown in recent years since it is renewable, compostable and possess similar mechanical properties as those of the traditional plastics. However, PLA can still be a source of pollution if it is not disposed properly. A potential solution is the chemical recycling of PLA into valuable chemicals, that will not only result in a reduction in its price but also of waste. This work demonstrates that by using a complex catalyst it is possible to chemically recycle PLA into alkyl lactates which have been branded as valuable green solvent due to their low toxicity and biodegradability. Alkyl lactates are seen as substitutes to oil-derived solvents with applications in polymer manufacture, biochemicals, pharmaceuticals, agricultural chemicals among many other applications. Moreover, from the experimental data obtained it was possible to propose a reaction mechanism that explains the degradation of PLA to form the alkyl lactate. From the model, characteristic reaction parameters were obtained which are necessary for large scale engineering design of the process.
References:	Román-Ramírez, L. A.; McKeown, P.; Jones, M. D.; Wood, J. Poly(Lactic Acid) Degradation into Methyl Lactate Catalyzed by a Well-Defined Zn(II) Complex. *ACS Catal.* 2019, *1*, 409-416.

Abstracts – Oral Presentations

Name:	**Kelvin S. Ng[1], Gregor C. Leckebusch[1], Qian Ye[2], Hang Gao[3]**
School:	[1]School of Geography, Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]State Key Laboratory for Earth Surface Processes and Resource Ecology (ESPRE), Beijing Normal University, Beijing, China. [3]Swiss Reinsurance Company Ltd Beijing Branch, Beijing, China.
Field of research:	Atmospheric Sciences/Applied Meteorology/Disaster Risk Reduction
Title:	**A new approach to produce an improved typhoon risk assessment and its application for disaster reduction and mitigation against Typhoons**
Abstract:	Severe storms such as Typhoon Mangkhut and Hurricane Katrina are often in the news due to their destructiveness. One way of mitigating the severe and negative impacts on different sectors of society is the development and application of financial instruments for risk transfer and adequate response. Parametric insurance solutions for typhoons have been recently developed by the reinsurance industry. The big advantages of parametric insurance are its quick disbursement and low administrative cost as it requires no physical damage assessment after an event. As soon as a certain threshold (i.e. trigger point) is exceed, the insured party receives the agreed compensation from the insurer. Thus it is well situated to be a core financial tool to strengthen quick responses and recovery. However, the current trigger points are not optimised due to lack of quality data of meteorological extreme events and loss data. Therefore under/over-compensation can occur. Our current research aims to improve the typhoon hazard risk assessment and thus to improve the response trigger points. In this presentation, we discuss a new approach to tackle these problems, using a large ensemble of forecast model runs to simulate many thousands of theoretically possible years. Our approach can produce a typhoon hazard risk assessment independent from but consistent with the historical observations. Furthermore, our approach can capture more extremely high impact typhoons than the traditional approach which relies on the historical observations and stochastic method. Our research will provide valuable information to different sectors of the coastal society.

Abstracts – Poster Presentations 1

Name:	**Anand K. Singh[1] and Saverio Brogna[1]**
School:	[1]School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Cell and Molecular Biology
Title:	**Cytoplasmic surveillance machinery binds mRNA within nucleus: footprints of Nuclear Translation in Eukaryotes**
Abstract:	Life of an mRNA molecule is highly dynamic yet extremely well compartmentalised in eukaryotes, where transcription and processing occur in nucleus the translation is thought to be happens only in cytoplasm. The mRNAs with premature termination codon (PTC) are detected by ribosomes during pioneer round of translation and degraded by the nonsense mediated mRNA decay (NMD) machinery in cytoplasm. However, translation dependent NMD is thought to occur in cytoplasm, mRNA with PTC are found to be accumulated at the site of transcription within nucleus; indicating that the presence of termination codon on mRNA are detected along with their transcription. Since, codons on mRNA are detected only by scanning ribosomes; we sought to envisage if NMD components are present also at the site of transcription. I will present compelling evidences of presence of cytoplasmic NMD component at the site of transcription within nucleus by applying cutting edge cytological and molecular techniques. The distribution pattern of NMD component is restricted to CDS region of some genes providing the footprints of ribosome scanning of nascent mRNA along with their transcription. I will also show that NMD proteins bind most of the mRNA along with their transcription, suggesting that NMD might be a passive consequence of ribosome dissociation at PTC.
References:	Singh AK, Choudhury SR, De S, Zhang J, Kissane S, Dwivedi V, Ramanathan P, Orsini L, Hebenstreit D and Brogna S (2019) The RNA helicase UPF1 associates with mRNAs co-transcriptionally and is required for the release of mRNAs from transcription sites. eLife, 8:e41444

Abstracts – Poster Presentations 2

Name:	Mary H. Wood[1], Elizabeth K. Humphreys[2], Rebecca J. L. Welbourn[3]
School:	[1]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Department of Chemistry, University of Cambridge, Lensfield Road, Cambridge, CB3 1EW, UK. [3]ISIS Neutron & Muon Source, Rutherford Appleton Laboratory, Didcot, OX11 0QX, UK.
Field of research:	Surface chemistry
Title:	**Solving the energy crisis using bacteria**
Abstract:	In the urgent search for renewable energy sources, biophotovoltaics (BPVs) offer an extremely promising alternative to fossil fuels. Recognising that "nature does it best", BPVs make use of photosynthetic algae and bacteria to harvest energy from the sun, which is used to drive electrons extracted from water down the photosynthetic chain. The electrons are then transferred to an anode to produce an electrical current. However, whilst this technology has enormous promise, the currents achievable remain far lower than should theoretically be possible, due to slow electron transfer at the biofilm/electrode interface. The mechanism and species involved in this step remain unknown; improving our understanding of these molecular interactions is crucial for the technology's development. In this work, I used highly specialised surface study techniques to characterise the behaviour of some important electron-transfer species at the electrode surface. Cytochrome c is a protein that helps pass electrons from inside the bacterial cell across the membrane to the electrode; its efficiency is extremely dependent on its orientation as its redox centre is only accessible from one direction. Neutron reflectometry has been used to demonstrate subtle but significant changes in the protein's structure at the electrode surface as a potential is applied to the surface. Additionally, the technique revealed changes in the metal structure that were previously unknown and may be important in understanding electrode stability and performance. Further work concerning nicotinamide adenine dinucleotide on glassy carbon surfaces shows some interesting reversible behaviour as the potential is cycled that may challenge current assumptions.

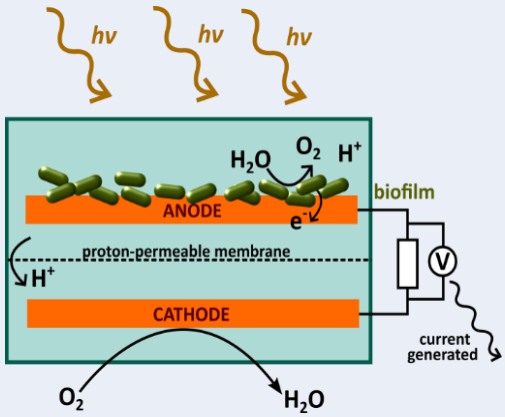


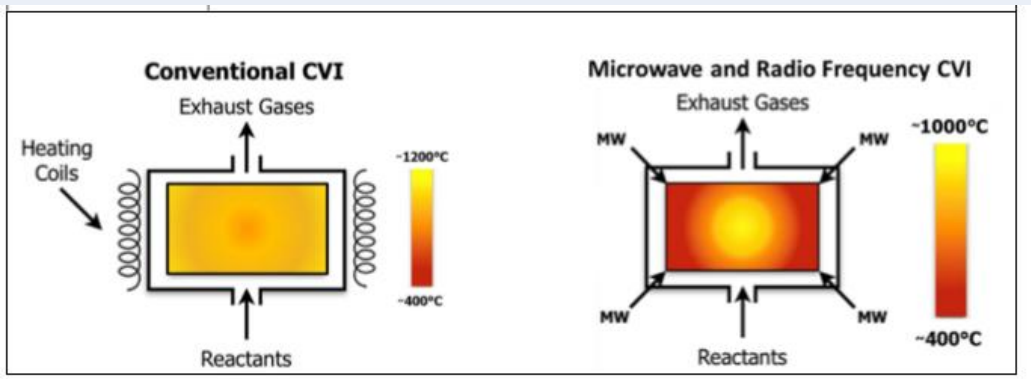
Figure 1. Schematic of a BPV: light is harvested via photosynthetic bacteria grown onto the anode.

Abstracts – Poster Presentations 3

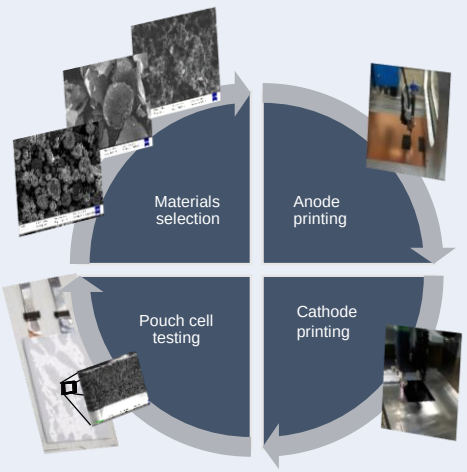
Name:	**Klaus Faserl[1]; Andrew Chetwynd[2]; Iseult Lynch[2]; James Thorn[3]; Herbert Lindner[1]**
School:	[1]Division of Clinical Biochemistry, Medical University of Innsbruck, Innrain 80-82, A-6020, Innsbruck, Austria. [2]School of Geography Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [3]AB Sciex UK Ltd., Phoenix House, Lakeside Drive, Warrington, Cheshire WA1 1RX, UK.
Field of research:	Nanoscience
Title:	**Development of Isolation Techniques and CESI-MS Methods for the Characterisation of Nanomaterial Protein Coronas**
Abstract:	Since the nanoparticle corona rose to eminence a decade ago, it has been widely investigated to characterise and derive its significance. However, work to determine the sample preparation workflow which gives the most complete picture of the protein corona has not been reported. The most published approach requires boiling NP-corona complexes in SDS buffer and running a 1D SDS-PAGE where bands of interest are excised and digested prior to LC-MS analysis. This method only characterizes a limited number of high abundant corona proteins. The aim of the current work is to characterise both high and low abundance proteins. It also showcases the first application of capillary electrophoresis (CE) for the analysis of the protein corona. The off-particle digest approach with SDS-PAGE with an in-gel digest was compared with an on-particle digest where the corona proteins were digested in-situ. All samples were analysed by CESI-MS using a CESI 8000 Plus connected to a Thermo QE HF Orbitrap. Separation was performed with a neutral capillary with 30kV separation voltage and 2 PSI pressure. The optimized on-particle digest gave 2215 peptides, 1000 more than the off-particle approach. This allowed identification of over 200 protein groups, over 50 more than the off-particle method. Furthermore, the on-particle workflow could be completed in under a day, nearly twice as quickly as that of the off-particle.

Abstracts – Poster Presentations 4

Name:	Tammana S. R. C. Murthy[1], Vinothini Venkatachalam[1], Jon Binner[1]
School:	[1]School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Non-oxide ceramics and composites
Title:	**Ceramic Matrix Composites by Enhanced Chemical Vapour Infiltration**
Abstract:	The ability of High Temperature Ceramic Matrix Composites (HTCMCs) to operate in aggressive environments such as hostile aero-thermo-chemical, radiation environments without compromising on structural integrity, whilst keeping mass at a premium, makes them suitable candidates for future aerospace propulsion, energy sectors (nuclear & solar) and maneuverability systems. Fully dense components are currently manufactured by chemical vapour infiltration (CVI) using isothermal heating and multiple machining stages to prevent residual porosity forming. As a result, the processing time is approximately 3 months long and components are very expensive. Microwave (MW) and radio frequency (RF) energy has been proposed to offer a potential solution by creating an inverse temperature profile, so densification starts on the inside and proceeds outwards. This avoids the closure of surface porosity facilitating reactant gases transport throughout the structure. Subsequently, it is expected that using the enhanced CVI methods manufacturing time can be decreased to about 72-96 hours for achieving the similar or better densities. This method is superior to many conventional sintering techniques like hot pressing, pressureless sintering in order to avoid the fibre damage and grain growth. Following schematic shows the conventional vs MW/RF CVI with temperature profiles.



Abstracts – Poster Presentations 5

Name:	**Dominika Gastol[1], Matthew Capener[2], David Lewis[3] , Emma Kendrick[1]**
School:	[1]School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]WMG, University of Warwick, Coventry CV4 7AL, UK [3]KW Special Projects Limited, Building 119, Bicester Heritage, Buckingham Road, Bicester, OX27 8AL, UK
Field of research:	Lithium ion batteries
Title:	**Digitally printed water-based electrodes for lithium-ion batteries**
Abstract:	A growing market of electric vehicles determines an increased demand in battery manufacturing and subsequently improvement in process capabilities, i.e. cost and material efficiency. In the Spraycoat project, an emphasis was placed on development of a digital process of deposition water-based electrodes for lithium-ion batteries that would exhibit reduced environmental impact and broad processing capabilities. The established aqueous inks incorporated viscos-elastic additives that prevented from sedimentation of the solid constituents and maintained homogeneity of a dispersion during printing. Alterations of the slurries' composition resulted in different architectures of the electrodes, i.e. alignment and distribution of active materials and carbon black, respectively. The conducted scanning electron microscopy analysis of the pouch cell electrodes revealed patterned micro – channels within the structure of the electrodes and conductive pathways between the primary and secondary particles. The produced anodes and cathodes were successfully assembled and tested in a pouch cell, achieving a target capacity of 3.35 mAh cm^{-2}. The developed automated process of manufacturing electrodes for the LIB highlights its feasibility of producing components with a desired porosity for an enhanced ionic conductivity and improved cycle life performance.  Fig.1 Graphical representation of the process steps of digital deposition of electrodes for LIB pouch cell.

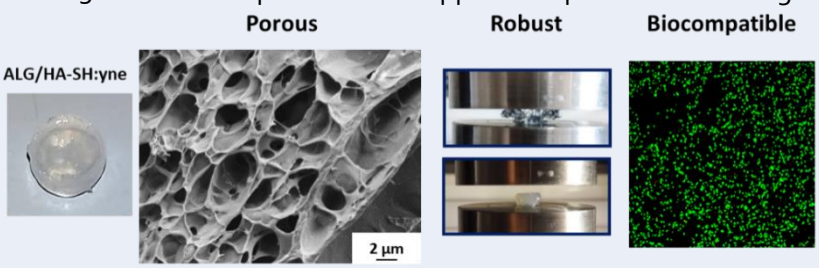
Abstracts – Poster Presentations 6

Name:	**Thorne LS, Rochford G[1], Williams TD, Giovanny Rodriguez Blanco G, Dunn WB, Hodges NJ**
School:	[1]School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	chemotherapeutic resistance, redox biology, cancer biology
Title:	**Cytoglobin expression mediates multiple phenotypic changes including resistance to cisplatin in oral squamous carcinoma cells**
Abstract:	Although the molecular and cellular mechanism of action that underpin the role of cytoglobin in cancer cell phenotypes remain to be fully elucidated, expression of cytoglobin is known to be important in disease progression in certain oral squamous cell carcinomas. In the current study, we have developed a new cell model to study the function of cytoglobin in relation to the oral squamous carcinoma cell phenotype and its response to cisplatin. Microarray analysis demonstrated that cytoglobin expression mediated transcriptional changes in a large number of genes related to stress response, redox metabolism, mitochondrial function, cell adhesion, and fatty acid metabolism. Cellular and biochemical studies showed that cytoglobin expression results in changes to phenotypes associated with cancer progression including: increased cellular proliferation and motility. Cytoglobin-expressing cells were more resistant to cisplatin-induced apoptosis and oxidative stress and furthermore, levels of the antioxidant glutathione were increased and total and mitochondrial related reactive oxygen species levels were reduced in cells expressing cytoglobin. We demonstrated that the mechanism of cisplatin resistance involved inhibiting the activation of caspase 9. To further understand the mechanism behind these phenotypic changes we employed lipidomic analysis and identified changes in the levels of the redox sensitive and apoptosis regulating cardiolipin family of lipids and found they were significantly down-regulated in cells expressing cytoglobin. In conclusion, our data shows that cytoglobin expression results in important phenotypic changes that could potentially be exploited by cancer cells in vivo to facilitate disease progression.

Abstracts – Poster Presentations 7

Name:	**Yan Zhang[1], Zhibing Zhang[1], Yulong Ding[1], Zoe Pikramenou[2], Yongliang LI[1]**
School:	[1]School of Chemical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Encapsulation/Thermal energy storage/Fluorescence sensing
Title:	**Non-destructive Fluorescence Sensing – A Turbo Booster for Encapsulation R&D and Beyond**
Abstract:	Encapsulation is a technique to seal functional substances inside a shell for protection from degradation or evaporation. The products resembling a yolk-white structure, also known as "capsules", can then release the functional cargos at a specific time or location upon triggers. It has found extensive applications in pharmaceuticals, detergents and cosmetics traditionally, and expanded its impacts into the realms of niche arenas such as Li-ion batteries. Regardless of the application, to confirm sealing of the functional substances inside the shell would be mandatory. Researchers have been using complicated quantification techniques for such characterization. However, they are expensive, complicated, time-consuming and overqualified sometimes. Bioscientists have been utilising fluorescence to visualise cells and organisms for decades. We recently discovered that its "transferable skills" may hold an answer to this long overdue requirement in encapsulation research.[1-2] We reported that by converting capsule products into sensors via fluorescent dyeing, this can be achieved easily. It requires only slight modification on any existing formulation protocols rather than a completely new synthesis route. This qualitative method can offer fast, efficacious and instantaneous results, and sometimes during the formulation process even before obtaining the final products. The potential huge impact originates from its simplicity, efficacy and efficiency. This allows chemists and materials scientist to turbo boost their R&D efficiency when routine screening of appropriate materials and process parameters is needed without being distracted by tedious sample preparation required by other overqualified techniques. This enables rapid identification of successful encapsulation in various application industries. Surprisingly, we discovered that the concept is vastly versatile and reaches beyond its initial intension. For instance, we exploited the idea and successfully visualised the phase transition of a hydrocarbon phase change material (PCM) via its colour change.
References:	[1]Zhang, Y.; Jiang, Z.; Zhang, Z.; Ding, Y.; Yu, Q.; Li, Y., Polysaccharide Assisted Microencapsulation for Volatile Phase Change Materials with a Fluorescent Retention Indicator. *Chemical Engineering Journal* 2019, *359*, 1234-1243. [2]Zhang, Y.; Zhang, Z.; Ding, Y.; Pikramenou, Z.; Li, Y., Converting Capsules to Sensors for Nondestructive Analysis: From Cargo-Responsive Self-Sensing to Functional Characterization. *ACS Applied Materials & Interfaces* 2019, *11* (9), 8693-9642.

Abstracts – Poster Presentations 8

Name:	**Maria M. Pérez-Madrigal[1], Joshua E. Shaw[2], Maria C. Arno[1], Judith A. Hoyland,[2,3] Stephen M. Richardson[2], Andrew P. Dove[1]**
School:	[1]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Division of Cell Matrix Biology and Regenerative Medicine, School of Biological Sciences, Faculty of Biology, Medicine and Health, Manchester Academic Health Science Centre, University of Manchester, Manchester, UK. [3]NIHR Manchester Biomedical Research Centre, Central Manchester Foundation Trust, Manchester Academic Health Science Centre, Manchester, UK.
Field of research:	Materials Science; Polymers and Biopolymers; Chemistry
Title:	**Alginate, hyaluronic acid and click-chemistry: towards hydrogels with superior performance as 3D cell culture platforms for cartilage regeneration.**
Abstract:	Hydrogels, which display high water content, suitable porosity, and versatile properties, have become powerful platforms as three-dimensional (3D) cell culture systems for tissue engineering applications, such as cartilage regeneration.[1] Specifically, through click reactions,[2] we can now prepare injectable hydrogels that display outstanding mechanical performance,[3] non-swellable properties[4] and the versatility to incorporate biomolecules, such as alginate, which renders them self-healing and stretchable[5] under physiological conditions (*i.e.* pH 7.4 at 37 °C). However, we have only applied it to obtain poly(ethylene glycol) (PEG)-based hydrogels, which intrinsically lack cell adhesion capability (*i.e.* cells can be encapsulated within in, but do not tend to spread or move). Hydrogels based on hyaluronic acid (HA) exhibit immense potential as tissue engineering (TE) scaffolds for cartilage regeneration because of their unique biological features. Herein, we examine how the advantages of two natural polymers (*i.e.* HA and alginate) are combined with the efficiency and rapid nature of the thiol-yne click chemistry[6] reaction to render biocompatible matrices with tailored properties. Our injectable click-hydrogels reveal excellent mechanical performance, in addition to long-term stability, adequate stiffness, and high cytocompatibility. This suitable approach, with few synthetic steps, allowed us to design HA hydrogels with superior characteristics, which facilitates their translational application as 3D cell culture platforms to support and promote chondrogenesis.  **Figure.** Alginate/HA hydrogels display adequate porosity, in addition to robustness and cytocompatibility to encapsulated cells.
References:	[1] A. S. Hoffman. *Adv. Drug Deliv. Rev.* **2002**, *54*, 3. [2]P. M. Kharkar, K. L. Kiick and A. M. Kloxin. *Chem. Soc. Rev.* **2013**, *42*, 7335. [3]V. X. Truong, M. P. Ablett, S. M. Richardson, J. A. Hoyland and A. P. Dove. *J. Am. Chem. Soc.* **2015**, *137*, 1618. [4]L. J. Macdougall, M. M. Pérez-Madrigal, M. C. Arno and A. P. Dove. *Biomacromolecules* **2018**, *19*, 1378. [5]L. J. Macdougall, M. M. Pérez-Madrigal, J. E. Shaw, M. Inam, J. A. Hoyland, R. O'Reilly, S. M. Richardson and A. P. Dove. *Biomater. Sci.* **2018**, *6*, 2932. [6]V. X. Truong and A. P. Dove. *Angew. Chem. Int. Ed.* **2013**, *52*, 4132.

Abstracts – Poster Presentations 9

Name:	**Amanda K. Pearce[1], Akosua B. Anane-Adjei[2], Robert J. Cavanagh[2], Thomas M. Bennett[3], Vincenzo Taresco[2], Phil A. Clarke[4], Alison A. Ritchie[4], Anna M. Grabowska[4], Morgan R. Alexander[2], Cameron Alexander[2]**
School:	[1]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]School of Pharmacy, University of Nottingham, UK. [3]School of Chemistry, University of Nottingham, UK. [4]School of Medicine, University of Nottingham, UK.
Field of research:	Polymer chemistry for biomedical applications
Title:	**Using polymer 3D architecture, size and chemistry to control drug-nanoparticle delivery *in vitro* and *in vivo***
Abstract:	For disease targets such as cancer, polymeric nanocarriers are a promising strategy for achieving site-specific drug delivery while minimizing off-target toxicity. Sizes, shapes and underlying chemistries of drug-delivery particles are all parameters which govern their ultimate performance in vivo. Responsive particles are desirable for triggered drug release and clearance from the body through biodegradation. Polymers were synthesised via RAFT polymerisation with architectures varying from linear, hyperbranched, star and micellar-like (sizes 5 – 60 nm), all based on the same chemical building blocks. The materials were fully characterised for their structure and size, as well as quantification of stability, degradation and protein corona attachment. All polymers had low toxicity to macrophages (RAW 264.7) and MDA-MB-231 cells. Smaller sized and degradable polymers demonstrated improved 'stealth' behaviour over non-degradable and larger materials as quantified in vitro by macrophage internalization and in vivo by organ accumulation. Candidate polymers were further functionalised with doxorubicin through an acid-cleavable linkage, and their cytotoxicity evaluated in 2D and 3D spheroid MDA-MB-231 models, which showed the polymers achieved a 2 to 10-folds increase in potency relative to free drug. These data show it is possible to direct materials of the same chemistries into different cellular and physiological regions via modulation of their architectures, and thus the work overall provides valuable new insight into how nanoparticle size, architecture and programmed degradation can be tailored to elicit specific biological responses for drug delivery. The enhanced potency achieved via drug conjugation to the selected polymeric nanoparticle highlights the potential application of these delivery systems for breast cancer therapy.

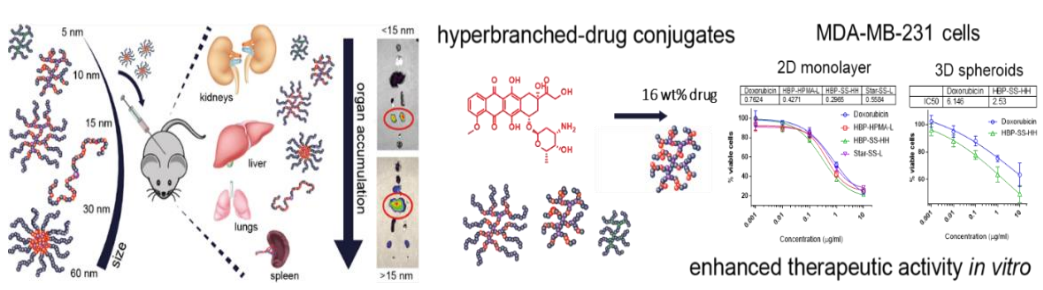


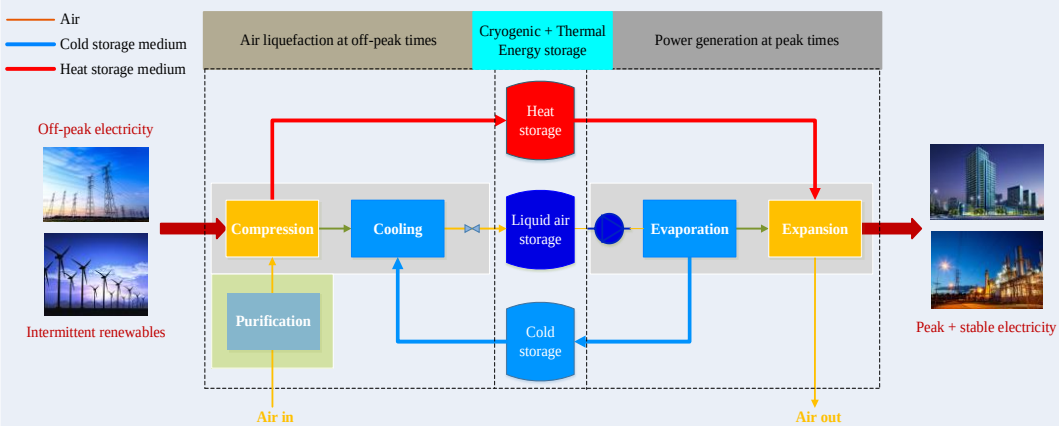
Figure 1. The screening process for the selection of candidate drug delivery polymers, based on the varying organ accumulation profiles as a factor of size and polymeric architecture. The candidate polymers were functionalised with doxorubicin and demonstrated enhanced therapeutic efficacy in breast cancer cells in 2D and 3D models.

Abstracts – Poster Presentations 10

Name:	**Santosh C.M. Kumar[1], Shahida Butt, Herbert Itabangi, Peter A. Lund**
School:	[1]School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Microbiology
Title:	**Zebrafish – Transparency and tuberculosis**
Abstract:	Tuberculosis, caused by *Mycobacterium tuberculosis* (Mtb), is the second largest killer after AIDS. Mtb evades immune attack by residing in granulomas formed principally by human macrophages. Molecular events towards granuloma formation, although are not completely understood, depend, in part, on a non-essential chaperonin homologue, Cpn60.1. Since pathogenicity and slow-growth make Mtb difficult to study, I aimed to develop an infection system using a related bacterium, *M. marinum*, that infects Zebrafish and forms caseating granulomas similar to *M. tuberculosis* in humans. I have generated *M. marinum cpn60.1* knock-out, confirmed by WGS and compared its infectivity in Zebrafish. While the mutant is indistinguishable with its wild-type in planktonic growth, it showed lower infectivity and persistence in Zebrafish embryos, resulted in lower expression of immune markers and showed differences in non-polar membrane lipid composition, suggesting an important role for Cpn60.1 in mycobacterial infections. Further, while phosphorylation-mediated oligomerization enables Cpn60.1 to functionally replace *E. coli* GroEL, mutations in the putative ATP-binding motif abolish this. Zebrafish infection studies with *M. marinum* expressing Cpn60.1 phospho-mimetic and ATPase mutants are in progress. Since Cpn60.1 plays an important role in TB establishment, these studies, therefore, bear the potential for novel non-antibiotic related treatments for TB.

Abstracts – Poster Presentations 11

Name:	**Xiaohui She, Tongtong Zhang, Yulong Ding**
School:	School of Chemical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Energy storage
Title:	**Liquid Air Energy Storage with waste cold recovery for peak load shifting**
Abstract:	Liquid Air Energy Storage (LAES) attracts much attention to smooth the intermittency of renewable energy and shift the peak load of national grid. LAES has many advantages, such as large energy storage density, no geographical constraints, fast response, etc. However, it has a lower round trip efficiency (~50%), compared with other large-scale energy storage technologies (~70%). Based on our previous research, there is a large amount of compression heat which is excess in the LAES. On the other hand, the liquified natural gas (LNG) releases much high-grade cold energy which is usually wasted in the LNG station. Therefore, there is a good integration point between the LAES and LNG. This paper uses the excess compression heat in the LAES and the wasted cold energy in the LNG to drive a Brayton cycle for power generation (denoted as LAES-LNG). The simulation results show that the LAES-LNG system could achieve a high round trip efficiency at ~72%, which is ~31% higher than the baseline LAES and is comparable with other large-scale energy storage technologies. The LAES-LNG system enhances the competitiveness of the LAES and promotes its wide application.



Abstracts – Poster Presentations 12

Name:	**Abd El-Moez A. Mohamed[1], R. S. Sheridan[1], E. Dawson[2], Kai Bongs[3], Moataz M. Attallah[1]**
School:	[1]School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Magnetic Shields Limited, Staplehurst, United Kingdom. [3]School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Additive manufacturing of magnetic materials
Title:	**Tuning magnetic anisotropy and magnetic shielding in laser powder bed Ni-Fe-Mo magnets**
Abstract:	This work mainly investigates the effect of crystallographic orientation and post processes (heat treatment (HT) and hot isostatic pressing (HIP)) on the magnetic properties of selective laser melted Ni-Fe-Mo alloy. After optimizing the microstructure using different laser parameters, the sample with laser energy density E=4.68J/mm^2 was chosen for a detailed study. The as fabricated (AF) condition of this sample shows minimum porosity and cracks, revealing poor magnetic properties. This sample was built with a tilt angle of 45^o and 35^o with the build direction, which are parallel to the easy axis magnetization in Ni-based alloys. The results show an enhancement in the magnetic properties of the AF 0^o orientation sample with changing the crystallographic orientation with tilting. For example, the magnetization saturation (Ms) changes from 228x10^3 for 0^o orientation to 325 x10^{3}A/m and 332 x10^3 A/m for the 45^o and 35^o respectively. This is because the grain growth is the easy axis magnetization in the tilted samples. Both effects of HIP and HT processes improve the magnetic properties in all orientations, and especially when we make use of both effects together and exposing the sample to HT directly after HIP. For example, the HIP+HT (of 35^o sample) shows Ms value of 551x10^{3}A/m and 194 A/m coercivity, and achieving magnetic shielding factor of 120% (axial) and 502% (transversal) for the 45^o sample orientation.

Abstracts – Poster Presentations 13

Name:	**Kyriakos Xenofon Kallis, Athanasios Tsolakis**
School:	School of Mechanical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Novel gasoline engine after-treatment system
Title:	**Greener vehicles**
Abstract:	A novel efficient and cheaper catalyst coated gasoline particulate filter (cGPF) is under research with the prospect to replace the current automotive after-treatment systems and constitute the future of the field. The emergence of green technologies is one of the most important advancements of human ingenuity for the improvement of quality of well-being. These technologies are implemented in all aspects of everyday life. One of them is the after-treatment system in automotive vehicles which constitute an important factor for the reduction of toxic gaseous and particulate emissions – that can be harmful for the natural environment and human health, especially in the epitome of Man's ecosystem, the city. Despite the great performance improvement of the internal combustion engines, the ones so necessary for our transportation, it is evident that further engineering advancements are considered to enhance their environmental behaviour. The three-way-catalyst (TWC) introduced a method of converting dangerous gaseous emissions such as nitrogen oxides (NO_x) or unburned hydrocarbons into less detrimental products while gasoline particulate filters (GPF) presented a way of removing harmful particulates from the exhaust of vehicles. However, the cost of the after-treatment system is considerably high due to the use of precious metals, and as such, improvements can be made, either by enhancing the performance or reducing the cost of the after-treatment system for vehicles. Therefore, research focused on introducing more active and cheaper catalysts and filters. That is the basis for the novel coated GPF which is a combination between a TWC and GPF manufactured using cheaper materials. In the Mechanical Engineering test facilities we are investigating this novel technology that is developing in research labs and industry and evaluating its performance. The modern four-cylinder gasoline direct injection (GDI) engine at our disposal provides invaluable feedback about particulate matter and pollutant emissions characterization, to the manufacturers due to the real-life conditions that these catalysts are subjected to, while at the same time irreplaceable on-line information is assembled and analysed for multiple physicochemical phenomena, during the removal of the emissions. The data is then used to assist the manufacturers and to support the research of the novel coated GPF.

Abstracts – Poster Presentations 14

Name:	**Lin Chen, Brij Kishore and Emma Kendrick**
School:	School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Electrochemical Energy Storage and Conversion Devices
Title:	**Effect of Electrolyte Additives and Cell Formation on the Performance of Na-ion Batteries**
Abstract:	Na-ion batteries (NIBs) have garnered attention as a replacement for Li-ion batteries (LIBs). These are believed to work as a drop-down technology to the existing LIBs with the added advantage of abundant resource and low cost[1]. As Na lies below Li in the periodic table, it becomes the default choice for Li replacement due to similar element properties but there are differences as well which manifest in battery behaviour. This is because of different ionic radii of Li^+ and Na^+ ions which alters the choice of the electrode materials used, intercalation reactions potentials, electrochemical reaction the electrolyte, and formation and stability of solid electrolyte interface (SEI), etc. which govern a good working battery. In particular, a good SEI is very important for cycle life of batteries. During battery formation, the electrolyte decomposes on the surface to form Na-organic/inorganic compounds which is also referred as SEI layer. This layer should have good ionic conductivity and the formation is anticipated to provide stable SEI at higher voltages[2,3]. Typically, LIBs undergo several weeks of formation procedure before hitting the market. The authors are investigating various aspects of formation[4] i.e. reducing formation time, finding right electrolyte additive and formation protocol, and quantifying the contribution towards SEI of the compounds formed for NIBs. For this purpose, full cells were assembled using sodium-transition metal oxide as cathode, hard carbon anode and 1 M $NaPF_6$ in EC:DEC as electrolyte. Various organic additives were added to the electrolyte and different formation protocols were performed on these cells. These results will be discussed.
References:	[1]S Roberts and E Kendrick, *Nanotechnology, Science and Applications*, 2018, **11**, 23—33. [2]S J An, J Li, Z Du, C Daniel and D L Wood III, *Journal of Power Sources*, 2017, **342**, 846 – 852. [3]E Kendrick, K L Smith and J C Treacher, US Pat., 20180219248, 2018. [4]T S Pathan, R Muhammad, M Walker, W D Widanalage, and E Kendrick, *J of Physics: Energy* Submitted.

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Name:	**Eva Illes-Toth, Emma Sisley, Anna Simmonds and Helen J. Cooper**
School:	School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Mass Spectrometry
Title:	**Probing protein-ligand interactions of bovine carbonic anhydrase by native LESA mass spectrometry**
Abstract:	Native LESA (Liquid Extraction Surface Analysis) mass spectrometry is a technique that enables direct sampling of proteins from a variety of substrates under near native conditions. Our aim is to utilise this tool to characterise protein-ligand interactions with respect to stoichiometry and binding affinities directly from their physiological environment. Here, we explored the binding of bovine carbonic anhydrase (CAH) with chlorothiazide, dansylamide and sulfanilamide using both LESA and direct infusion electrospray in combination with high resolution- and ion mobility mass spectrometry. For LESA, solutions containing CAH in 25 mM NH_4OAc mixed with each ligand at a series of concentrations were deposited and dried onto glass covered with Al foil. Subsequently, the dried sample spots were extracted using 25 mM NH_4OAc. Relative intensities of bound ligands showed good agreement between LESA and direct infusion. We illustrate that chlorothiazide binds most tightly, followed by dansylamide and then by sulfanilamide. Ligand binding was first observed with chlorothiazide at a protein:ligand ratio of 1 : 0.01, with dansylamide at 1 : 0.15 and with sulfanilamide at 1 : 0.5. Respective collision cross sections of the protein-ligand complexes have been determined. Our data demonstrate the suitability of LESA for studying protein-ligand interactions under native conditions. Future efforts will focus on determination of binding affinities (K_ds).

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Name:	**Shivangi Sharma, O. Jegede, J. Radcliffe, A. Sciacovelli**
School:	School of Chemical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Phase Change Materials based Thermal Energy Storage
Title:	**Techno-economic evaluation of Phase Change Materials (PCM) based Thermal Energy Storage (TES) technologies**
Abstract:	The intermittent nature of renewable energy sources necessitate the use of TES systems for increasing the overall system efficiency as well as reliability. The market for TES is expected to exceed USD 1,300 million in revenue globally within 2015–2019[1]. Within the UK, 80 % of fossil fuel based energy supply for approximately half the heating demand, out of which space heating accounts for 63 % and water heating, 14 %. Decarbonising the heat sector, can contribute immensely to the targeted 80 % GHG emissions reduction by 2050. Thermal energy storage technologies can play a vital role in achieving these targets. Traditional thermal storage technologies based on sensible heating media (water etc.) require a big volume of storage thereby increasing the space and insulation requirement. With the upcoming latent heat energy storage technologies using PCM, the high energy density of these material promise a more compact storage for a longer period of time with minimal insulation. Although latent TES technologies have a great potential in providing higher energy storage density, they are still upcoming and are at lower technology readiness levels. There are different configurations available for the PCM based TES solutions in various applications. This study addresses the need to distinguish PCM based configurations by providing a bird's eye view to compare the available options for policy makers as well as the end-users. In this study, a qualitative and a quantitative comparison has been performed for four main types of PCM configurations as given below: A. PCM in containments B. PCM in shell-&-tube type C. Encapsulated PCM D. Form-stable PCM In addition, a case study based on a UK University future energy scenario with real time data has been undertaken with an aim to use fuel cells and heat pump supply aided with PCM to reduce/control the overall cost of campus energy demand.
References:	[1]Safari et al., Renewable & Sustainable Energy Reviews, 2017. Vol. 70: p. 905-919.

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Name:	**Liam Kelleher[1], Carl Banbury[1], Michael Clancy[1], Pola Goldberg Oppenheimer[1]**
School:	[1]School of Chemical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Raman spectroscopy of traumatic brain injury
Title:	**The wiggles that tell the story of traumatic brain injury**
Abstract:	Raman spectroscopy is a method of studying how light interacts with molecules through the vibrational modes of the molecule.[1] Light from a laser excites energy levels of the molecule that result in different vibrations which are characteristic to different bonds and molecules. Raman spectroscopy is an ideal analytical tool as samples need little to no preparation, it is non-destructive and highly selective.[2] Research in the ANMSA group has a focus on developing methods using Raman spectroscopy to diagnose and monitor traumatic brain injury (TBI). TBI is an injury to the brain caused by trauma to the head and is classed as mild (mTBI) or severe (sTBI). A common differentiation between the types of TBI is duration of unconsciousness, where a mTBI is defined as a loss of consciousness of less than 6 hours, with sTBI resulting in unconsciousness of 6 hours or more. The Glasgow Coma Scale and Neuroimaging is used for assessment and in the sTBI case an intracranial pressure (ICP) monitor is used to monitor swelling due to the injury.[3] Using an *ex vivo* study researchers in the ANMSA group have identified key differences in Raman spectra from mice that have had no injury, mTBI and sTBI. Raman spectra show differences in the response of lipids and proteins that are found in the brain and cerebral fluid.[4] The study has built the foundation for development of a Raman spectroscopy probe to monitor TBI progression and recovery. In people this could be run in vivo to better inform clinicians of the injury progression and the effect of the administered medication. Currently a commercial probe is being tested in a simulated environment with lipids and proteins that would be detected *in vivio*. Other investigations are looking to use fiber optic probes that will have a smaller size due to the use of novel filtering systems to allow only a Raman spectroscopy signal to be detected. This will reduce the size of hole needed to be drilled into the skull and allow faster healing when removed. Current ICP monitoring devices have a diameter of up to 13 mm.
References:	[1]Larkin, P. *Infrared and Raman Spectroscopy*. (Elsevier, 2018). [2]Marklund, N. *et al.* Current and emerging Technologies for Probing Molecular Signatures of Traumatic Brain injury. *Front. Neurol.* **8**, 1–20 (2017). [3]Orešič, M. *et al.* Human Serum Metabolites Associate With Severity and Patient Outcomes in Traumatic Brain Injury. *EBioMedicine* **12**, 118–126 (2016). [4]Goldberg-Oppenheimer, P., Rickard, J. J., DI Pietro, V. & Belli, A. Surface Enhanced Raman Scattering Apparatus and Method. 1–47 (2018).

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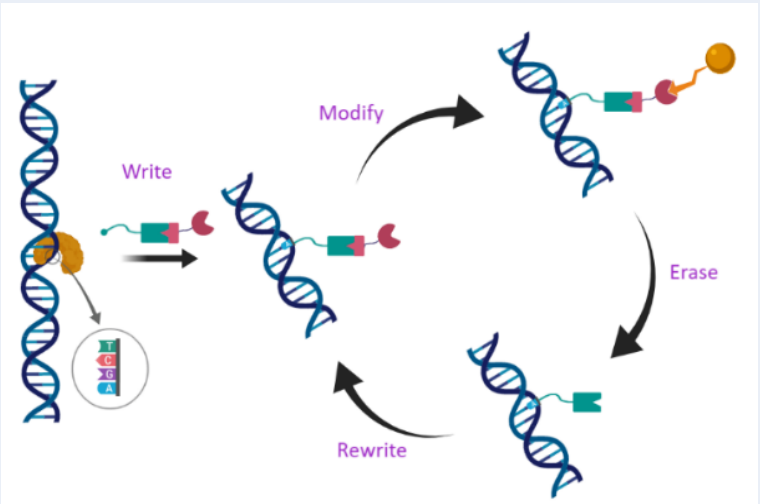
Name:	**Elodie Jagu, Andrew A. Wilkinson, Francisco Fernandez-Trillo, Robert K. Neely**
School:	School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Chemical Biology
Title:	**Write, modify, erase and rewrite DNA**
Abstract:	DNA contains all the information necessary for life. This information is stored as a code made up of only four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). The order of theses bases, or sequence, determines information available for building and maintaining an organism. This sequence is divided into genes and we know that these genes can be turned on or off by simple chemicals modifications, which do not alter the DNA sequence. This phenomenon is known as epigenetics. Methyltransferase enzymes play a huge role in epigenetic regulation of gene expression. This protein catalyses the transfer of a methyl group from the cofactor S-adenosyl-L-methionine (AdoMet) onto DNA, RNA or protein targets. DNA methylations occur on precise sites and modulate gene activity. In addition to methyl groups, methyltranferases can catalyse DNA transalkylation reactions with extended chemical moieties. In our lab, we use this enzyme as a tool to modify DNA. To a certain extent, we can attach any chemical moiety to a specific site of DNA. In particular, we used new S-adenosyl-L-methionine derivatives, containing hydrazone or oxime linkers at the sulfonium center. This way, we combine enzymatic methods to site-selectively write chemical functionality on DNA, bioconjugation techniques to modify the introduced chemical functionality, and dynamic covalent chemistry to erase and rewrite functionality.  We believe the impact of the presented chemistry will go beyond the reversible labelling of biomolecules and should stimulate research in fields such as biotherapeutics and drug delivery, bionanotechnology or biomaterials research.

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Name:	**Valter Luiz Jantara Junior, Mayorkinos Papaelias**
School:	School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Unmanned and autonomous survey activities at sea
Title:	**Development of an autonomous sea surveying vehicle powered by hydrogen (ENDURUNS)**
Abstract:	The main ambition of the ENDURUNS project is to develop an autonomous underwater vehicle system capable of operating under deep ocean conditions and performing a wide range of missions, targeting the increase of scientific knowledge as well as industrial capability and performance. Due to its versatile nature, the ENDURUNS system will be suited to perform scientific missions, such as seabed mapping, profiling, geological and geophysical surveys, commercial missions, such as inspection of infrastructure and assets, mineral and seabed mining exploration missions and public authority missions such as surveillance, search and find missions (e.g. aircraft wreckage), equally well. The ENDURUNS system will be powered by hydrogen fuel cells, which will enable long endurance missions for the first time. The ENDURUNS system is expected to significantly outperform all existing autonomous underwater vehicles, in terms of endurance, positioning, survey capability, resolution, and sensitivity.

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Name:	**Kawa Manmi[1], Nina Vyas[2], Qianxi Wang[1], Damien Walmsley[2]**
School:	[1]School of Mathematics, College of Engineering and Physical Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]School of Dentistry, College of Medical and Dental Sciences, University of Birmingham, Mill Pool Way, Birmingham, B5 7EG, UK.
Field of research:	Applied Mathematics – Numerical Modeling
Title:	**Numerical Analyses of Cavitation Generated by a Vibrating Ultrasonic Dental Scaler Tip**
Abstract:	Cavitation and acoustic streaming occurs in the cooling water around ultrasonic dental scaler tips and could be used as a novel treatment method to remove debris without damaging the surface. In this research, we carried out a numerical study for an ultrasound dental scaler with a curved shape tip vibrating in water, using ABAQUS based on the finite element method. The numerical model was well validated with the experiments with the excellent agreements for displacement at the free end. A systematic parametric study has been carried out for the cavitation volume around the scaler tip in terms of the frequency, amplitude and power of the tip vibration.

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Name:	**Tanveerkhan S. Pathan[1], Scott F. Gorman[1], Emma Kendrick[1,2,3]**
School:	[1]School of Metallurgy and Materials, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]WMG, University of Warwick, Coventry, CV4 7AL, UK. [3]Dept. Of Chemical Engineering, University College London, Torrington Place, London, WC1E 7JE, UK.
Field of research:	Energy Materials
Title:	**Lithium-Ion Batteries: The Green Energy**
Abstract:	Lithium-ion batteries (LIBs) are extensively used as a power source for portable electronic devices and the electrification of the modern transportation sector has driven growth in demand for LIBs[1–4]. Current manufacturing processes are based upon the methods developed by Sony in the 1990s[5]. The active materials are first mixed with a binder and conductive additive in a solvent to prepare an ink. The rheology of the ink is optimised for the coating process, and for high energy electrodes, this is performed on a slot die or comma bar coater. The ink needs to flow when a shear force is applied, and stop when the force is removed. Once the ink is deposited on the current collector, the electrode is dried and then calendared, this process creates and optimises the porosity and the electronic conductive pathways. The electrodes are then cut and assembled into stack or wound cells. Tags are welded onto the ends of the cathode and anode stacks or rolls, and then the stack is placed into a container. For pouch cells the electrolyte is injected into the pouch, and the pouch is evacuated and the electrolyte displaces the air in the pores of the electrode. After filling, the cells are sealed and then undergo a formation process. Here we present an example of a typical LIB manufacturing process from raw materials to the final product.
References:	[1]Mao, C. *et al.* Balancing formation time and electrochemical performance of high energy. *J. Power Sources* **402**, 107–115 (2018). [2]An, S. J., Li, J., Du, Z., Daniel, C. & Wood, D. L. Fast formation cycling for lithium ion batteries. *J. Power Sources* **342**, 846–852 (2017). [3]Long, B. R. *et al.* Enabling High-Energy, High-Voltage Lithium-Ion Cells: Standardization of Coin-Cell Assembly, Electrochemical Testing, and Evaluation of Full Cells. *J. Electrochem. Soc.* **163**, A2999–A3009 (2016). [4]Myung, S. T. *et al.* Nickel-Rich Layered Cathode Materials for Automotive Lithium-Ion Batteries: Achievements and Perspectives. *ACS Energy Lett.* **2**, 196–223 (2017). [5]Roberts, S. & Kendrick, E. The re-emergence of sodium ion batteries : testing , processing , and manufacturability. *Nanotechnol. Sci. Appl.* **11**, 23–33 (2018).

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Name:	**Ted Mackereth, Andrea Miglio, Fiorenzo Vincenzo, Josefina Montalban, and the ASTEROCHRONOMETRY collaboration**
School:	School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Astrophysics
Title:	**Galactic Archaeology: Excavating the fossilised Milky Way**
Abstract:	One of the most prominent and outstanding problems in modern Astrophysics is the understanding of how galaxies formed and evolved through cosmic time, from the Big Bang to the present day. Galaxies in the Universe display a startling variety. We find ourselves inside a relatively large, disc shaped galaxy, looking out on this zoo of galaxies external to ours, yet we have very little understanding of its own history of formation and evolution. By unveiling the history of our own Galaxy, and comparing this with what we have learned and are learning about external galaxies, we can begin to form a generalised picture of how galaxies evolve, furthering our understanding of one of the main components of our Universe. We study the Milky Way by observing its populations of stars. As we see stars in our Galaxy which were formed at different epochs in its evolution, they act like a 'fossil record', and their structure, motions and the abundances of elements inside them betray the detailed history of our Galaxy, in the same way that the layers of fossils in a cliff face betray the biological history of life on Earth. This poster will act as an introduction to the field of 'Galactic Archaeology', and show some of the key findings which have been made in the field in the past decade, and what these tell us about the place of the Milky Way in the Universe.

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Name:	**Christopher B. Eaton[1,2], Rhys H. Thomas[1], Khalid Hamandi[3], Gareth C. Payne[3], Michael P. Kerr[1], David E.J. Linden[1], Michael J. Owen[1], Adam C. Cunningham[1], Ullrich Bartsch[4], Siske S. Struik[5], Marianne B.M van den Bree[1]**
	[1]MRC Centre for Neuropsychiatric Genetics and Genomics, Cardiff University [2]Cerebra Centre for Neurodevelopmental Disorders, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [3]The Epilepsy Unit, University Hospital of Wales [4]School of Physiology, Pharmacology and Neuroscience, University of Bristol, [5] Immunodeficiency Centre for Wales, University Hospital of Wales
Field of research:	Neurological, cognitive and psychiatric outcomes in children with rare genetic syndromes
Title:	**Are epileptic seizures overlooked in young people with 22q11.2 deletion syndrome?**
Abstract:	Objective: Young people with 22q11.2 deletion syndrome (22q11.2DS) are missing ~45 genes from one copy of chromosome 22[1]{McDonald-McGinn, 2015 #292}. This increases the risk of mild-moderate intellectual disability, psychiatric disorders (e.g. schizophrenia) and epilepsy[2,3]. The true prevalence of epilepsy in 22q11.2DS is unknown however, as previous prevalence estimates relied on medical record review[4,5,6] and may therefore have missed individuals with brief, non-convulsive seizures who did not see a clinician. Methods: The primary caregivers of 108 deletion carriers ($\overline{x}$= 13.6 years) and 60 unaffected control siblings ($\overline{x}$= 13.1 years) completed a validated epilepsy screening questionnaire. A sub-sample (n=44) underwent a second stage of assessment with interview, prolonged monitoring of brain activity (electroencephalography, EEG) and medical record and epileptologist review. Results: During the first assessment stage, eleven percent (12/108) of deletion carriers were reported with an epilepsy diagnosis (controls 0%, p=0.004). However, 59.4% (57/96) screened positive for seizures or seizure-like symptoms in the absence of an epilepsy diagnosis (controls 13.3%, 8/60, p <0.001). A fever-related ('febrile') seizure was reported for 24.1% (26/108) of deletion carriers (controls 0%, p<0.001). During the second assessment stage, one deletion carrier was newly diagnosed with epilepsy and two more with 'possible' absence seizures. Significance: Even when accounting for deletion carriers diagnosed with epilepsy, reports of seizures and seizure-like symptoms are common in 22q11.2DS. These may be 'true' epileptic seizures in some cases, which are overlooked during routine clinical care. This study is also the first to show that the deletion greatly increases the risk of febrile seizures.
References:	[1]McDonald-McGinn DM, Sullivan KE, Marino B, et al. 22q11. 2 deletion syndrome. *Nature Reviews Disease Primers* 2015;1:15071. [2]Schneider M, Debbané M, Bassett AS, et al. Psychiatric disorders from childhood to adulthood in 22q11. 2 deletion syndrome: results from the International Consortium on Brain and Behavior in 22q11. 2 Deletion Syndrome. *American Journal of Psychiatry* 2014. [3]Mudigoudar B, Nune S, Fulton S, et al. Epilepsy in 22q11. 2 Deletion Syndrome: A Case Series and Literature Review. *Pediatric Neurology* 2017. [4]Wither RG, Borlot F, MacDonald A, et al. 22q11. 2 deletion syndrome lowers seizure threshold in adult patients without epilepsy. *Epilepsia* 2017. [5]Kao A, Mariani J, McDonald-McGinn DM, et al. Increased prevalence of unprovoked seizures in patients with a 22q11. 2 deletion. *American Journal of Medical Genetics Part A* 2004;129:29-34. [6] Kim E-H, Yum M-S, Lee B-H, et al. Epilepsy and Other Neuropsychiatric Manifestations in Children and Adolescents with 22q11. 2 Deletion Syndrome. *Journal of Clinical Neurology* 2016;12:85-92.

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Name:	**Guillaume E. Desanti[1,#], Paula I. Seoane[1,#], Elizabeth R. Ballou[1], Robin C. May[1]**
School:	[1]Host and Pathogen Interaction (HAPI) lab, Institute of Microbiology and Infection (IMI), School of Biosciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [#] Equal contribution.
Field of research:	Immunology, Microbiology, Infectious Diseases
Title:	**The human fungal pathogen *Cryptococcus neoformans* inhibits the adaptive immune response.**
Abstract:	*Cryptococcus neoformans* is a globally distributed fungal micro-organism that mainly infects human beings via the airways. In healthy individuals, *C. neoformans* is a potent immunogen that generates a protective and long-lasting adaptive immune response during early childhood. However, several lines of evidence suggest that antigen presentation is disrupted during an active cryptococcal infection; a finding that may have major implications when the same individual is simultaneously coinfected by *C. neoformans* and other micro-organisms such as the flu virus or the tuberculosis bacteria[1-3]. We hypothesize that this disruption originates from a *C. neoformans*-mediated inhibition of dendritic cell (DC) and T cell interactions taking place during an immune response. To test this hypothesis, we loaded DCs with chicken ovalbumin antigen in the presence or absence of a hypo-proliferative *ras1D C. neoformans* strain. CFSE-labelled Ovalbumin-specific CD_4 T cells were added to the culture and their proliferation monitored by flow cytometry after 4 days of co-culture. The immune mediators secreted during these co-cultures were measured Luminex assays. We demonstrated that *C. neoformans* actively inhibits T cell proliferation following chicken ovalbumin antigen stimulation. This inhibition does not rely on physical competition between *C. neoformans* and immune cells and is, at least partially, driven by soluble factors shed by *C. neoformans*. This work suggests that a low level of *C. neoformans* infection can weaken the immune response against new exogenous pathogens and have a detrimental effects on individuals' health.
References:	[1]Mukaremera L. et al., *J. Fungi.* 2017, **3**: 64. [2]Leopold Wagner C.M.. et al., *Front Microbiol..* 2016, **7**: 105. [3]Ferreira LaRoque-de-Freitas I.. et al., *Scientific Reports.* 2018, **8**: 16378.

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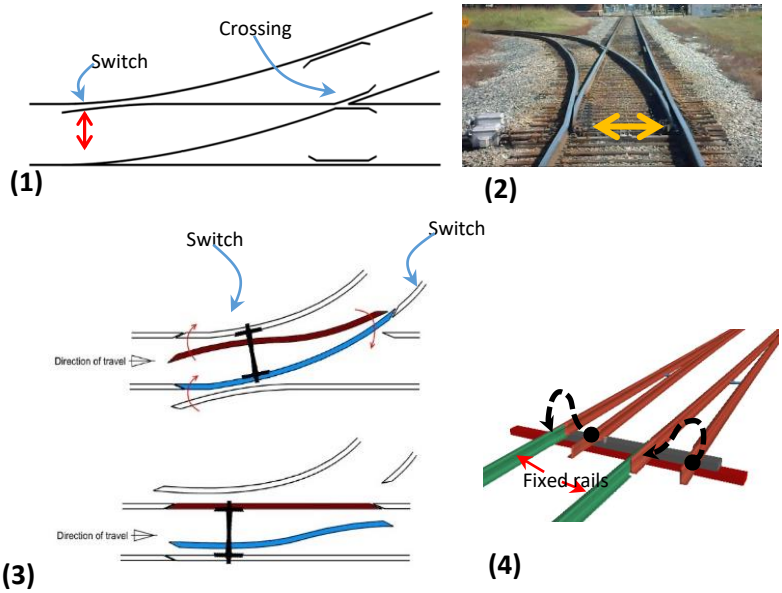
Name:	Ramakrishnan Ambur [1] , Hitesh C Boghani[1], Jou-Yi Shih[1], Roger Dixon[1]
School:	[1]Birmingham Centre for Railway Research and Education, School of Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Railway Engineering
Title:	**A novel route selector on railway tracks**
Abstract:	A switch and crossing (S&C) on railway tracks are the basic elements with which trains are steered into different routes. The switch is pushed to left or right (Fig. 1, 2) depending on the route of the train to be driven. They are prone to frequent failures as they might be stuck mid-way between its left-right motion. This paralyses the railway network and hence one of the bottlenecks for its capacity. The novel S&C concept (Fig. 3) works on the principle of bistability where the rails are lifted in a bell curve fashion (Fig. 4) to ensure that the switch does not remain in an intermediate position.  Figures (1, 2) Conventional S&C and (3, 4) Novel S&C. The crossing section of the conventional S&C needs a gap (seen in Fig. 1) so that wheels of vehicles in either route can pass through it, and rails here take higher forces from the vehicles. These gaps are replaced in our new concept with another switch. This novel S&C concept was modelled and their benefits were evaluated by performing train-track simulations. It was found that the new concept is feasible to operate and the wheel-rail contact forces along the novel conceptual S&C were lower compared to the conventional S&C.
References:	http://www.s-code.info/impacts/

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Name:	**Berta Bonet[1], Iseult Lynch[1], Stefan Krause[1]**
School:	[1]The School of Geography, Earth and Environmental Science, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Ecotoxicology at community level + climate warming effects
Title:	**How climate change enhances nanoparticle toxicity towards freshwater biofilms**
Abstract:	Release of toxicants such as engineered nanoparticles (ENPs) into aquatic systems and their effects on these ecosystems remain poorly understood. The combination of ENP pollution and the acceleration of global climate warming (ENP + ΔT°C) could have significant consequences for aquatic life[1,2]. This study focus on responses of fluvial biofilms (Fig. 1), as key points of ENP entry into aquatic food webs, and examines the effects of the combined stressors (ENP + ΔT°C) at community and ecosystem levels using an extended set of analyses as an integrated approach using the EcoLab, an outdoor mesocosm system (40 recirculating flumes). After 4 weeks of biofilm colonization at 2 different temperatures, ENP were added obtaining 4 treatments (x5 replicates each): control, AgNPs, Ag2SNP (AgNP aged) and $AgNO_3$ (positive Ag+ control). Sampling was at the beginning of ENP exposure (0h), and after 1, 3, 15 and 30 days. Functional and structural changes were assessed using a range of analyses. Metabolism increased with rising temperature but reduced in the presence of AgNP and Ag+. Surprisingly, under warm conditions Ag2S decreased the photosynthetic activity and algal biomass like the Ag+ control, while AgNP increased both. Increased water temperature also caused homogenisation of biofilm composition and structure, and combined with AgNP or Ag+, an increase of dead cells and a decrease of biofilm extracellular polysaccharide matrix. These results indicate that warmer water can enhance AgNP and Ag+ toxicity as well as modifying the behaviour of "non-toxic" variants like Ag2S. Results from chemical and further biological analyses will be presented.

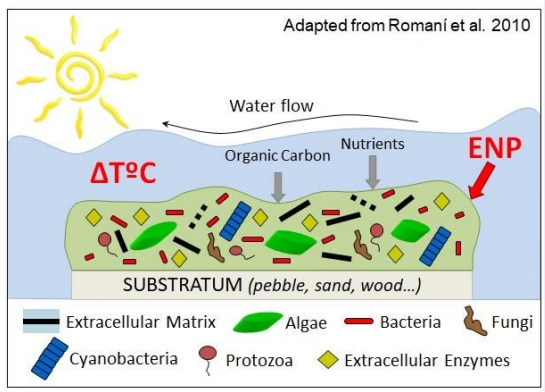

Fig. 1. Environmental (increase of temperature, ΔT°C) and toxic impacts (as engineered nanoparticles, ENP) on fluvial biofilm performance

References:	[1]Lynch et al. 2015. Philosopical transaction of the Royal Society. Biological Science 370(1661), Article Num. 20140162 [2]Reidy et al. 2013. Materials 6(6): 2295-2350

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Name:	**Panayiota Katsamba[1], Sébastien Michelin[2], Thomas D. Montenegro-Johnson[1]**
School:	[1]School of Mathematics, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]LadHyX, Département de Mécanique, Ecole Polytechnique, CNRS, 91128 Palaiseau, France.
Field of research:	Applied Mathematics, Fluid Mechanics
Title:	**SPT: Slender Phoretic Theory of Chemically Active Filaments**
Abstract:	Artificial microswimmers have the potential to revolutionise non-invasive medicine and microfluidics. A large class of these swimmers self-propel by generating concentration gradients in a surrounding solute, and recent work has suggested that fabricating such swimmers from flexible, thermoresponsive filaments allows their precision navigation. In order to efficiently model such swimmers, we develop a Slender Phoretic Theory (SPT) for the chemohydrodynamics of microscale autophoretic filaments of arbitrary centreline, as a one-dimensional substitute for inefficient numerical solution of 3D partial differential equations. We show that, unlike other slender body theories, azimuthal effects that appear at first order for curved shapes have a leading order contribution to the swimming kinematics, and consider the effects of curvature for U-, S- and helical filament shapes.

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Name:	**Amir M. Hajiyavand, Anjana Kothandaraman, Karl D. Dearn**
School:	School of Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Mechanical engineering
Title:	**Charming Conception for Infertile Couples**
Abstract:	186M women in the developed world are affected by infertility, equivalent to one in five adults. The infertility symptoms of approximately 55M of these women can be attributed to tubal patency problems. The fallopian tubes are an essential part of reproduction and are the site of conception. They act as a bridge between the ovaries and uterus and guide the fertilisation procedure through specific mechanisms. Tubal occlusion is defined either the fallopian tubes are blocked and prevent the essential support to transport the oocyte within transudate fluid. Hysterosalpingography (HSG) is diagnostic imaging techniques used to assess tubal patency. Studies have focused on understanding whether the choice of contrast media used in HSG influences subsequent reproductive success without any other therapeutic involvement. Two types of contrasts are used for HSG, either a water-based and or a poppy-seed oil-based contrast. A recent study observed that patients receiving HSG using the oil-based contrast had 10% higher success rate than the patients receiving water-based contrasts in both natural and clinical pregnancy. Our research sets out ambitious goals of measuring the tribological properties within the fallopian tube and employs novel method to nondestructively measure the frictional properties of an oocyte in transit through a simulated fallopian tube using direct observation, mechanical modelling, and machine-learning algorithms. Our research will benefit infertile couples to increase their chances of pregnancy after the first trial.
References:	Dreyer, K., Van Rijswijk, J., Mijatovic, V., Goddijn, M., Verhoeve, H.R., Van Rooij, I.A., Hoek, A., Bourdrez, P., Nap, A.W., Rijnsaardt-Lukassen, H.G. and Timmerman, C.C., 2017. Oil-based or water-based contrast for hysterosalpingography in infertile women. New England Journal of Medicine, 376(21), pp.2043-2052.

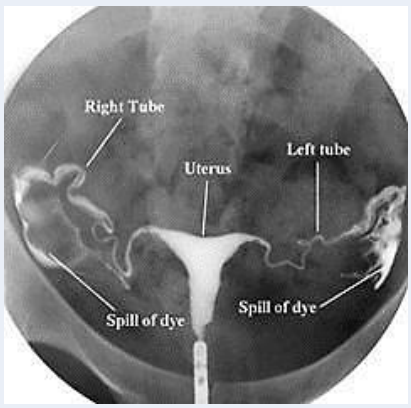

Figure 1 - Reproductive system during HSG*

*https://dallasivf.com/fertility-testing/hysterosalpingogram-hsg/

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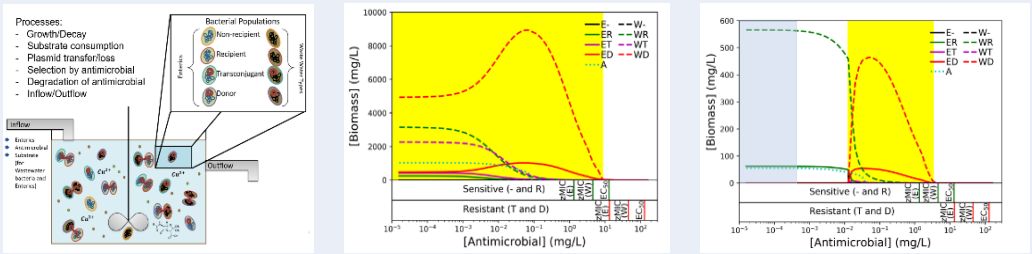
Name:	**Roberto de la Cruz Moreno[1], Helen R Wilson[1], Joanna Kimberley Summers[1], Sara Jabbari[1], Iain G Johnston[1], David Graham[2], Barth Smets[3], Jan-Ulrich Kreft[1]**
School:	[1]University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Newcastle University, Newcastle upon Tyne, UK. [3]Technical University of Denmark, Lyngby, Denmark.
Field of research:	Mathematical Biology
Title:	**Hot spots for antimicrobial resistance exchange**
Abstract:	Wastewater treatment plants (WWTP) are one of the principal routes for the release of antibiotic resistance genes (ARG) and antibiotic resistant bacteria (ARB) into the environment. It is well known that the concentration of ARG and ARB in rivers downstream of WWTP discharges is greater than upstream. What is the reason for this? There are several plausible answers. There may be selection for antibiotic resistance by antibiotics or ARG persistence through horizontal gene transfer. In order to shed light on this question we have developed an enhanced version of a well-known WWTP mathematical model in order to include resistance plasmid dynamics and antibiotic effects. Such model predicts, on the one hand, that resistance plasmids can be maintained without selection by antibiotics if the sewage is concentrated enough and, on the other hand, that minimum antibiotic concentration required for resistant selection by antibiotic pressure is much higher than concentrations typically found in WWTP.  Figure: Our model (Left); Middle and Right: The yellow zone is where the plasmid persists and the blue zone contains the typical values of the concentration the antibiotics in WWTP. E Enterics, W Waste water types, A Autotrophs. - non-Recipients, R Recipients, T Transconjugants, D Donors
References:	Henze, M. et al., 2006. Activated Sludge Models ASM1, ASM2, ASM2d and ASM3, Scientific and Technical Report Series. Rizzo, L. et al., 2013. Sci. Total Environ. 447, 345–360. Brown, P.C. et al., 2019. Sci. Total Environ. 649, 1171–1178.

Abstracts – Poster Presentations 30

Name:	Erik A B Hughes
School:	School of Chemical Engineering , University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Healthcare technologies
Title:	**Chemobrionics: Engineering a pipeline of bone repair materials**
Abstract:	Despite considerable advances in regenerative medicine, producing novel regenerative scaffolds remains challenging. For example, autologous bone remains widely considered as the "gold standard" over synthetic alternatives for replacing hard tissue. New approaches are therefore required to realise next-generation healthcare technologies. Chemobrionics describes understanding, controlling and exploiting the chemical and physical phenomena behind self-organisation reactions that result in the formation of abiotic micro- and nano-material architectures (Figure 1A) [1,2]. A range of mineralised hierarchical microstructures can be derived from chemobrionic systems that have great potential as regenerative tissue scaffolds (Figure 1B). Besides supporting cell growth, these complex 3D structures may be engineered to facilitate exchange of signaling molecules and nutrients, whilst possessing mechanical and topological attributes to drive cellular differentiation and enhance tissue formation. Several candidate biomaterials have been identified through this research, including: (1) Biomimetic constructs comprised of interconnected calcium phosphate tubes that closely resemble the native architecture of bone on the microstructural level (Figure 1C); (2) Composites possessing highly aligned internal tubular channels surrounded by a solidified hydrogel or polymer matrix that can be mineralised with further processing (Figure 1D); (3) An augmentation device that is able to unify through interfacial mineral fusion and tubule entanglement within hard tissue defects (Figure 1E) [3]. As an up and coming synergistic field, chemobrionics will open exciting new avenues of exploration for biomaterials research and engineering. Adopting this approach may further enable the generation of regenerative materials with advanced capabilities of function and cellular interaction.

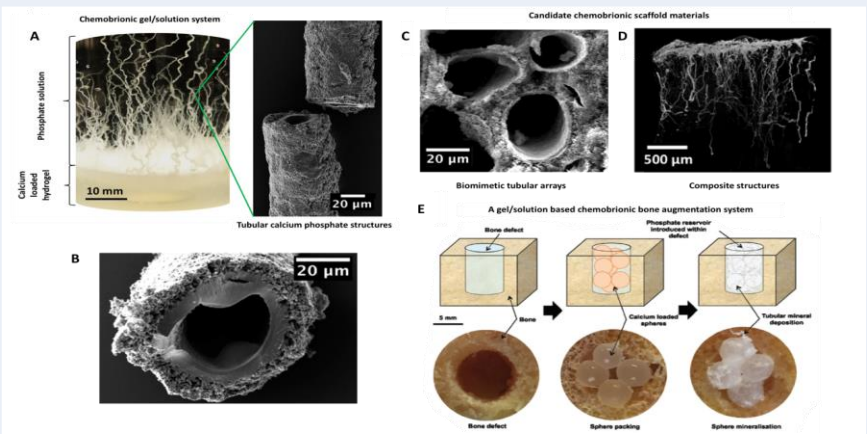


Figure 1. Candidate chemobrionic bone repair materials: (**A**) Chemobrionic calcium phosphate tubules grown from a gel/solution system (**B**) Cross-sectional microstructure of a calcium phosphate tubule (**C**) Cross-sectional microstructure of a biomimetic tubule array (**D**) 3D reconstruction of a chemobrionic composite showing internal tubular channels (**E**) Demonstration of a bone augmentation system using an *ex vivo* human tissue model

References:	[1]Barge, L. M. *et al.* From Chemical Gardens to Chemobrionics. *Chem. Rev.* **115,** 8652–8703 (2015). [2]Hughes, E. A. B., Williams, R. L., Cox, S. C. & Grover, L. M. Biologically Analogous Calcium Phosphate Tubes from a Chemical Garden. *Langmuir* **33,** 2059–2067 (2017). [3]Hughes, E. A. B. *et al.* Interfacial Mineral Fusion and Tubule Entanglement as a Means to Harden a Bone Augmentation Material. *Adv. Healthc. Mater.* (2018). doi:10.1002/adhm.201701166

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Name:	**Maria C. Arno[1], Ruairì P. Brannigan[2], Joshua D. Simpson[3], Kristofer J. Thurecht[3], Andrew P. Dove[1].**
School:	[1]School of Chemistry, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]Department of Chemistry, University of Warwick, UK. [3]Centre for Advanced Imaging, the University of Queensland, Australia.
Field of research:	Chemistry, Drug Delivery.
Title:	**Biodegradable Polycarbonate Nanoparticles: A Versatile Platform for Drug Delivery.**
Abstract:	Polymeric nanoparticles are widely investigated to enhance the selectivity of therapeutics to targeted sites, as well as to increase circulation lifetime and water solubility of poorly soluble drugs. Among them, stimuli responsive nanostructures are particularly attractive for their ability to release their cargo in response to specific extracellular or intracellular stimuli. We designed a simple procedure to create biodegradable polycarbonate graft copolymer nanoparticles *via* ring opening polymerization and subsequent post-polymerization modifications. The polymer, designed with both pH-responsive acetal linkages and a norbornene functionality,[1] allows for highly efficient post-polymerization reactions through a range of chemistries to conjugate imaging agents, drugs, and solubilizing arms to direct self-assembly. To demonstrate the potential of this approach for the delivery of drugs, an anticancer therapeutic was conjugated to the polymer backbone through the norbornene functionality and its ability to interfere with cancer cells proliferation was evaluated *in vitro*.
References:	[1]Biomacromolecules, 2018, 19, 8, 3427-3434.

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Name:	**Andrea Mazzeo[1], Andrew Quinn[1], Michael Burrow[1], Ajit Singh[2] Francis Pope[2]**
School:	[1]School of Civil Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. [2]School of Geography Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.
Field of research:	Air Quality modelling
Title:	**Impact of anthropogenic emissions on urban air quality of East African big cities: The case of Nairobi, Kenya.**
Abstract:	Sub Saharan East Africa (SSEA), since 1990, is experiencing population growth accompanied by an increase in industrial activities, private and public vehicle use and use of solid fuels for cooking and heating (WPP, 2015). This growth has consequently contributed to the worsening of urban air quality (NUA, 2017). The ASAP Project (ASAP, 2018) explores the air pollution levels of SSEA using different modelling systems for atmospheric chemistry processes and road transport emission projections. Also, a new merged emission inventory projected for the year 2017 has been developed. The results of validation of these models are presented for the city of Nairobi, Kenya. The validation of the modelling system has been done using meteorological observations from MIDAS database (Met Office, 2012) from several regional sites and $PM_{2.5}$ observations from field sampling in Nairobi and from the rural site of Nanyuki (Pope et al, 2018). The new inventory shows the majority of $PM_{2.5}$ emissions allocated to industrial activities and wood burning whilst NO_X emissions are driven by road transport and industrial activities. Results show that the modelling system is able to describe the main meteorological patterns at different altitudes (up to 2100 m a.s.l.) as well as for the main chemical species and $PM_{2.5}$ simulated for the urban the rural sites. Average $PM_{2.5}$ concentrations plotted according to the WHO limits (WHO, 2006) and Air Quality Index (EEA, 2018) show high levels of air pollution in the majority of the districts highlighting a serious risk for the health of Nairobi's citizens.
References:	ASAP, 2018 *"A System Approach to Air Pollution for East Africa"* – www.asap-eastafrica.com EEA, 2018 *"European Environmental Agency Common Air Quality Index (CAQI)"* - https://www.eea.europa.eu/themes/air/air-quality-index/index Met Office, 2012: *"Met Office Integrated Data Archive System (MIDAS) Land and Marine Surface Stations Data (1853-current)"*. NCAS British Atmospheric Data Centre, date of citation. http://catalogue.ceda.ac.uk/uuid/220a65615218d5c9cc9e4785a3234bd0 NUA, 2017 *"New Urban Agenda. UN-Habitat"* - http://habitat3.org/wp-content/uploads/NUA-English.pdf Pope F., Gatari M., Ng'ang'a D., Poynter A. and Blake R. *"Airborne particulate matter monitoring in Kenya using calibrated low-cost sensors"* – Atmos. Chem. Phys., vol. 18, pp. 15403 – 15418, 2018 WHO, 2006 – "Air Quality Guidelines – Global update 2005" – The World Health Organization - https://www.who.int/phe/health_topics/outdoorair/outdoorair_aqg/en/ WPP, 2015 *"World Population Prospect: "The 2015 Revision, Key Findings and Advance Tables"* – United Nation Department of Economic and Social Affairs/Population Division" – http://esa.un.org/unpd/wpp/DVD

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In addition to highlighting the achievements of our early career researchers, the conference also features stands providing information about support services available to researchers at all levels:

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The Research Support Offices in the College of Engineering and Physical Sciences and the College of Life and Environmental Science provide the first point of contact for advice and assistance with all research-related issues. The teams are able to help with most aspects of the grant application process. They offer a range of services including bespoke funding searches, advice and guidance on funder terms and conditions, and non-technical grant application review.

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People and Organisational Development (POD), provides a wide range of learning and development opportunities for staff at the University. This includes specific training courses for research staff aimed at helping you identify how you wish to move on in your career and develop the skills you need to do so.

POD webpages

BEAR

The Birmingham Environment for Academic Research (**BEAR**) is a collection of complementary IT resources managed by IT Services that are designed to help research, free at the point of use for all bar those with exceptional needs. BEAR provides a variety of short courses and workshops to help researchers develop their IT skills.

BEAR webpages

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Research Planning and Public Engagement webpages

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We aim to foster this by providing access and information to a range of training courses, career advice, funding opportunities, workshops, seminars and other development events. PERCAT is led by a steering committee composed of key stakeholders within each College and postdoc representatives from every school in the Colleges.

PERCAT helps to ensure that the Colleges recognise and work towards meeting the principles set out in the Concordat to Support the Career Development of Researchers, 2008, and employ best practice in support of the Vitae Researcher Development Framework.

For further information email Jennifer Thomson, PERCAT Officer: j.l.thomson@bham.ac.uk

Visit the EPS & LES PERCAT webpages:.

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People and Organisational Development (POD)
People and Organisational Development (POD), provides a wide range of learning and development opportunities for staff at the University. This includes specific training courses for research staff aimed at helping you identify how you wish to move on in your career and develop the skills you need to do so.
https://intranet.birmingham.ac.uk/staff/development/index.aspx

Vitae
Vitae is a non-profit programme which seeks to enhance the skills and careers of researchers and to strengthen institutional provision for the professional development of their researchers. The University of Birmingham is a Vitae member institution, meaning that individuals just need to register to gain access.
https://www.vitae.ac.uk/

Career Development Tools for Researchers
The Career Development Toolkit for Researchers is provided by jobs.ac.uk and is aimed at post-doctoral researchers who have gained one to two years' experience in academic research. This toolkit offers some general starting points for those wanting to reflect on their career to date and to begin to formulate an ongoing career strategy.
https://www.jobs.ac.uk/careers-advice/resources/ebooks-and-toolkits/career-development-toolkit-for-researchers

Further resources can be found on the EPS & LES PERCAT webpages and in the fortnightly EPS & LES PERCAT email bulletins.

EPS & LES PERCAT Reps

The PERCAT Reps provide a voice for post-doctoral researchers within their school, shape the development and direction of the PERCAT programme and provide a link for two-way communication with post-doctoral researchers within their own school. The PERCAT Reps are at the heart of the PERCAT programme, ensuring that it genuinely reflects the needs of the post-doc community.

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