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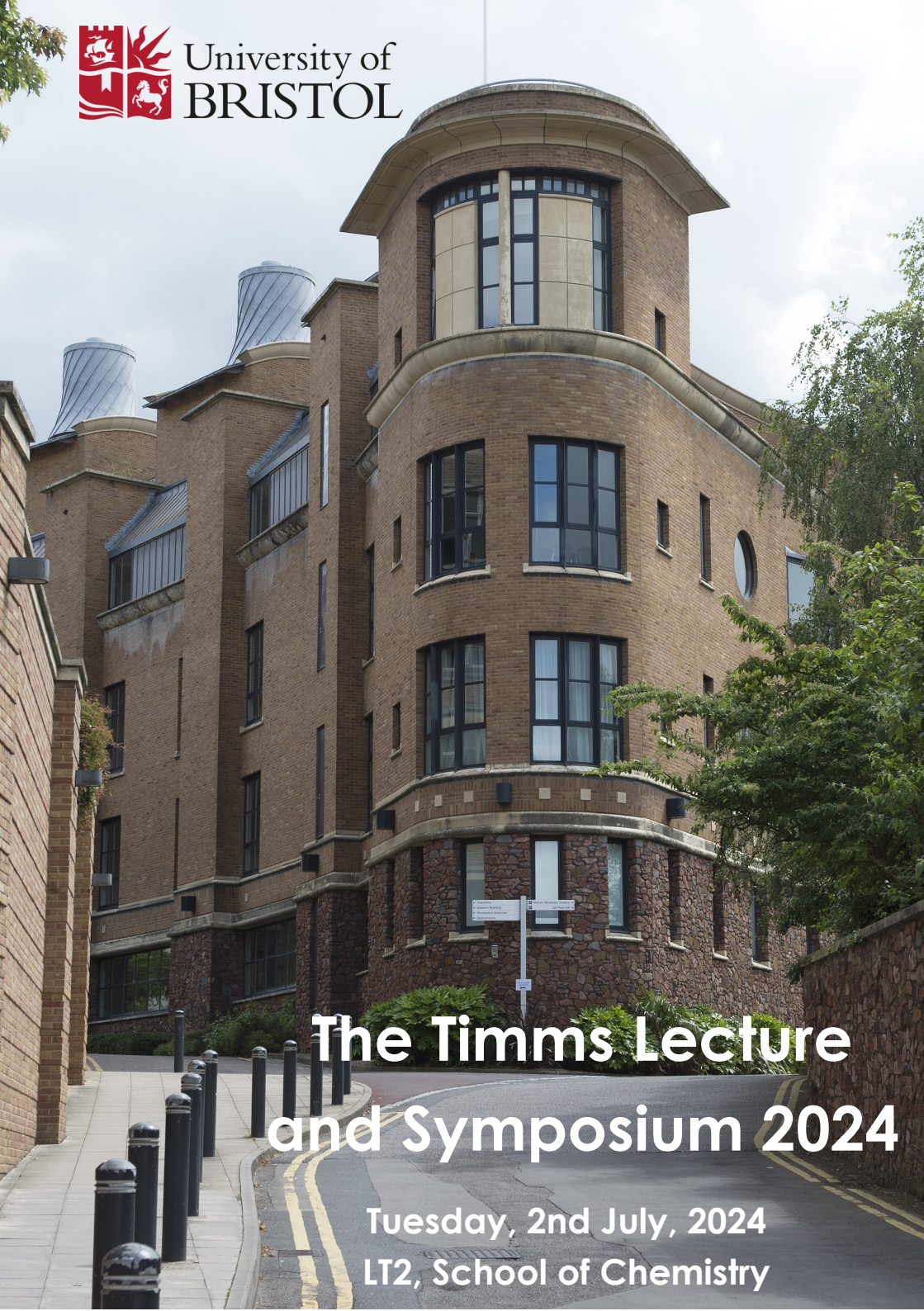

The Timms Lecture and Symposium 2024

Tuesday, 2nd July, 2024

LT2, School of Chemistry

University of BRISTOL

Welcome to the Timms Lecture and Symposium 2024

Professor Simon Hall

Head, Inorganic & Materials Chemistry

The Timms Lecture and Symposium was established in 2013 to recognise the pioneering work in inorganic and materials chemistry by Professor Peter Timms, and the significant contributions he made to the University of Bristol's School of Chemistry. This lecture has been given by a range of eminent speakers, including the likes of Craig Hawker, Bert Meijer, and Joanna Aizenburg. A full list can be found on the back of this booklet.

This year, the Timms lecture will be given by Professor Richard Kaner, who has been a Distinguished Professor of Chemistry at the University of California, Los Angeles since 2012. His research covers a wide range of inorganic and materials chemistry, especially focusing on conductive polymers, carbon compounds such as graphene, and superhard materials. His achievements have been recognised by several prestigious awards and honours, including the Tolman Award in 2009 and the ACS Award in Applied Polymer Science in 2022.

In addition to the Timms Lecture, this year we have an outstanding accompanying poster session and symposium with a keynote lecture from Professor Anna Slater (University of Liverpool), plus talks from our Bristol colleagues Dr Mike Price and Dr Ananya Mishra. We trust that these contributions will highlight the exciting breadth of inorganic and materials chemistry.

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PROGRAMME

12:15 pm

Poster session

East Foyer

13:30 pm

Chair: Professor Charl FJ Faul, University of Bristol

Introductory comments

13:35 pm

Keynote Lecture
Professor Anna Slater
University of Liverpool, UK

Flow Chemistry as an Enabling Tool for the Supramolecular Chemist

14:20 pm

Chair: Dr Avinash Patil, University of Bristol

Dr Mike Price
University of Bristol, UK

Ultrafast Coulomb Interactions in Organic Semiconductors for Next Generation Solar Panels

14:50 pm

Dr Ananya Mishra
University of Bristol, UK

Biocatalytic Programmable Protocells: Integrating Molecular Cues into Boolean Responses

15:10 pm

Tea and coffee break

East Foyer

15:30 pm

Chair: Professor Emma Raven

2024 Timms Lecture
Professor Richard Kaner
University of California, Los Angeles, USA
Exploring the Synthesis and Energy Storage Applications of Graphene

16:30 pm

Closing remarks from Professor Charl FJ Faul and Mrs Liz Timms, followed by a drinks reception and poster prizes

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The 2024 Timms Lecture

Professor Richard Kaner, University of California, Los Angeles, USA

Exploring the Synthesis and Energy Storage Applications of Graphene

Graphene is the ultimate two-dimensional material consisting of a single layer of sp2 hybridized carbon. A facile, inexpensive, solid-state method for generating, patterning and electronic tuning of laser converted graphene will be discussed (Figure 1).

Briefly, graphite can be converted into graphene oxide (GO) sheets, which readily disperse in water, and can then be reduced by various methods. Due to its unique ability to be solution processed and patterned, GO can be laser reduced to graphene directly onto various substrates without masks, templates, post processing, or transfer techniques.

This work paves the way for the fabrication of inexpensive electrochemical energy storage devices that combine the energy density of batteries and the power density of capacitors.

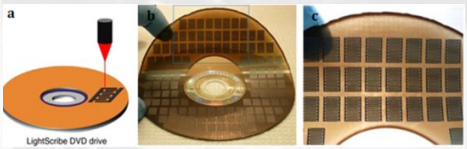

Figure 1 (a) Schematic showing the fabrication process of a graphene micro-supercapacitor using a Light Scribe DVD drive. (b,c) This technique can create more than 100 micro-devices in a single run on virtually any substrate.

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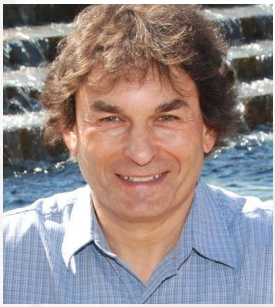
Professor Richard Kaner



Richard Kaner received a PhD from the University of Pennsylvania in 1984 working with Professor Alan MacDiarmid. After postdoctoral research at Berkeley, he joined the University of California, Los Angeles (UCLA) in 1987, earned tenure in 1991, became a full professor in 1993, a Distinguished Professor in 2012 and was appointed to the Dr Myung Ki Hong Endowed Chair in Materials Innovation in 2017.

He is among the world's most highly cited authors, publishing over 475 papers in top peer reviewed journals. His long list of awards includes Royal Society of Chemistry Centenary Prize, the Chemical Pioneer Award from the American Institute of Chemistry and the American Chemical Society's Buck-Whitney Research Award, Tolman Medal, Award in the Chemistry of Materials and the Award in Applied Polymer Science for his work on refractory materials including new synthetic routes to ceramics, intercalation compounds, superhard metals, graphene and conducting polymers.

Professor Kaner is also a fellow of numerous institutions, such as the American Chemical Society (ACS), Royal Society of Chemistry, and the European Academy of Sciences.

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Keynote Lecture

Professor Anna Slater, University of Liverpool, UK

Flow Chemistry as an Enabling Tool for the Supramolecular Chemist

The design and application of supramolecular materials and complexes is continually evolving, but their synthesis and scale-up is still challenging. When dealing with reversible, multi-component chemical processes that exploit weak interactions, reaction conditions can have a significant effect on yield and selectivity. Insufficiently controlled reaction conditions ultimately impact reproducibility, scalability, and sustainability of supramolecular processes, limiting understanding as well as translation activities.

In this talk, I will present continuous flow chemistry as a tool that can alleviate these challenges, and that supramolecular chemistry is particularly well-suited to benefit from. By describing case studies of organic cage, macrocycle, and molecular knot synthesis, and the continuous crystallisation of organic materials, I will illustrate the steps taken and the available benefits. Finally, I will briefly present an outlook on future perspectives for the field.

Professor Anna Slater is a Royal Society University Research Fellow and Professor of Chemistry at the University of Liverpool. Her research group uses continuous flow chemistry and automation to build process-structure-function relationships and discover new supramolecular materials.

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Ultrafast Coulomb Interactions in Organic Semiconductors for Next Generation Solar Panels

Dr Mike Price, University of Bristol, UK

Next generation photovoltaics promise cheap and versatile solar energy - particularly for new applications such as semi-transparent solar windows. Materials chemists have made great progress in designing new and easily processable semiconductors over the last two decades. Device physics and ultrafast spectroscopy have guided this progress, particularly in the fields of metal halide perovskites, and molecular organic semiconductors.

I will speak about previous work which generated new understanding of fundamental photophysical processes in these materials, and our efforts at implementing this understanding in useful optoelectronic devices (solar cells, LEDs and lasers). I will outline recent developments in the field of 'fused ring electron acceptors' (FREAs) for organic photovoltaics, and focus on the crucial interplay of charge photogeneration versus recombination in dictating device efficiency.

The Coulombic forces governing the behaviour and lifetimes of electrons, holes and excitons in these materials still generate active debate, and are difficult to measure, and hence are usefully studied via ultrafast laser spectroscopies. Based on some of our spectroscopic findings, I will suggest new approaches to enhancing organic photovoltaic efficiency, such as through molecular doping and crystal structure engineering.

Dr Mike Price is a Royal Society University Research Fellow at the University of Bristol. His research studies how new, functional materials interact with light, with the goal of designing and optimising these materials for sustainable technologies like photovoltaics.

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Biocatalytic Programmable Protocells: Integrating Molecular Cues into Boolean Responses

Dr Ananya Mishra, University of Bristol, UK

Boolean logic functions are central to the operations of electronic devices, whereas the living cells utilize on genetic networks for complex functions like metabolism and cell-cell communication. One of the major challenges in synthetic biology is to create cellular mimics comprising complex biological logic networks to generate precisely desired outputs in response to specific external and/or internal signalling inputs.

In this view, we have designed and synthesized programmable synthetic cells/protocells capable of generating precise outcomes in response to specific molecular inputs. We harness acoustic standing waves that generate highly ordered microarrays of the liquid-liquid phase separated coacervate droplets (protocells). These are installed with a variety of multi-enzyme cascades which receive, sort and process input biochemical signals to execute a range of Boolean functions. Significantly, the protocell-based Boolean logic operations were further advanced by establishing communication channels in single and between spatially separated populations of coacervates.

Such collective information processing gives rise to the detection of a range of molecular inputs and fluorescence and hydrogelation outputs. We envisage that such protocell-based logic gates will provide opportunities to construct complex biocomputing devices for rapid diagnostics and clinical applications.

Dr Ananya Mishra is a Research Associate in the Centre for Organised Matter Chemistry and the Centre for Protolife Research, University of Bristol. Her research area is working towards coupling systems chemistry with protocells.

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Timms Organising Committee

Professor Charl Faul completed his PhD in 2000 at the University of Stellenbosch and after a period working at the Max Planck Institute, he joined the University of Bristol as a lecturer in 2005. Promoted to professor in 2015, he was head of the inorganic and materials chemistry section from 2018 to 2023, and is currently Faculty International Director for Science and Engineering, and a University Enterprise Fellow. Charl leads a multi-disciplinary materials chemistry research group, exploring functional polymeric materials for applications in energy, environment, and soft robotics.

Dr Avinash Patil studied at Pune University, India before completing his PhD at the University of Bristol. He is currently Director of the Graduate School, and a member of the Centre for Organised Matter Chemistry and the Centre for Protolife Research. His research interests include approaches to the controlled fabrication of hybrid nanomaterials with functions that can be integrated into a range of applications.

Stephen Donovan joined the University of Bristol in 2015 and held administrative positions in the Bristol Medical School, the School of Arts, and Disability Services prior to joining the School of Chemistry in 2022. He supports the organisation of a range of events in the School calendar, including its three symposia.

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Previous Timms Lecturers

2013	Professor Geoff Cloke FRS
2014	Professor Craig Hawker FRS
2015	Professor Bert Meijer
2016	Professor Karen Wooley
2017	Professor Xi Zhang
2018	Professor Takuzo Aida
2019	Professor Ian Manners FRS
2022	Professor Joanna Aizenburg
2023	Professor Fiona Meldrum

Thank you to our Timms Symposium 2024 sponsors.

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Look out for the next Timms Symposium in 2025!