

ACROSS 2012 ANNUAL REPORT

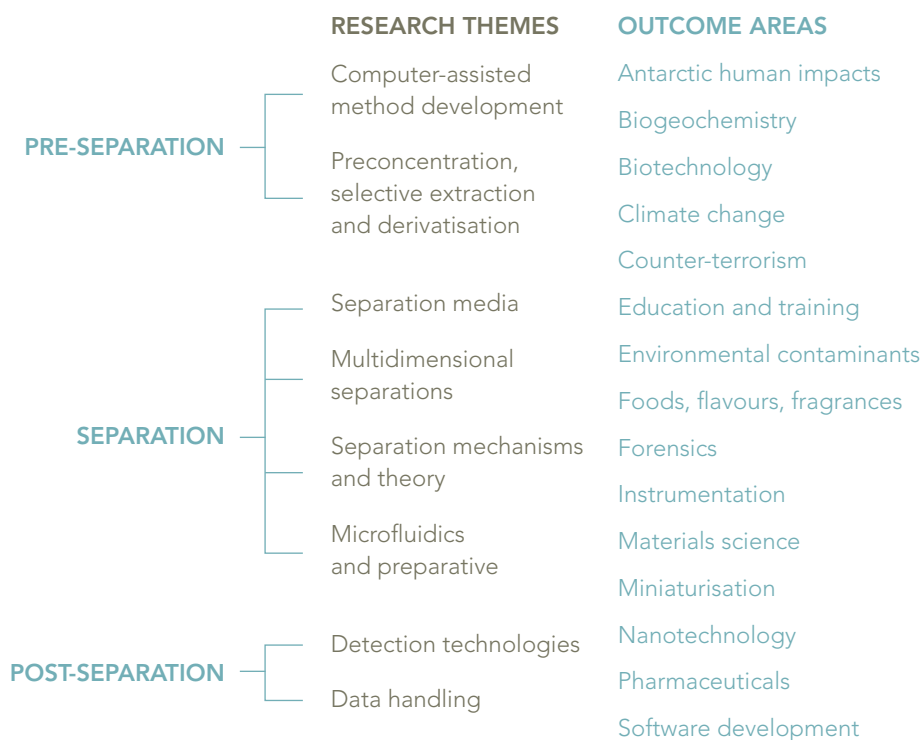


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ACROSS RESEARCH STRUCTURE

Research in ACROSS has been established using focused research themes to provide both fundamental and applied research outcomes in separation science. ACROSS draws together multi-institutional, internationally prominent and genuinely collaborative research teams, having complementary skills and synergistic resource-base expertise, and committed to focused programs of national significance. The research structure listed below groups research themes using the three major phases of a separation and also shows the major outcome areas in which these themes are being applied.



INTRODUCTION TO ACROSS

Separation science involves the study of fundamental processes and materials for the separation, isolation and quantitation of individual chemical species, or classes of chemical and biochemical compounds, from within multicomponent mixtures and/or complex matrices. As such it finds application in almost all of the chemical and biological (life) sciences, and in many areas of chemical engineering and indeed industrial manufacturing. Fundamental advances in separation science have provided the impetus for ground breaking new developments in the life sciences (e.g. genomics, proteomics and medicine), pharmaceutical sciences (e.g. drug discovery and characterisation), environmental sciences (e.g. ultra-trace residue analysis), forensic science (e.g. illicit drugs, DNA fingerprinting, and explosives residues), together with a myriad of other scientific disciplines of pronounced societal significance. The continued discovery of new modes of separation science involving analysis, characterisation and purification will be essential to help solve the future challenges in each of the above fields. Separation science spans the spectrum between nanoscale technology and exploration and macroscale materials and application, with common elements of theory and implementation. Further and greater advances in separation science will therefore be an important driver behind a very broad spectrum of Australian science for the foreseeable future, ranging from new developments in nanotechnology, to novel biomaterials, to improved manufacturing processes. Its importance as an enabling science cannot be overstated.

The Australian Centre for Research on Separation

Science (ACROSS) was established in 2001 as a strategic agreement between key researchers at the University of Tasmania and RMIT University (with University of Western Sydney joining ACROSS in 2008, and Monash in 2011) to form a consortium of prominent Australian researchers in separation science. This consortium was supported financially by the participating institutions to pursue the following aims:

- (i) Maintain an outstanding level of international renown in research on separation science.
- (ii) Coalesce and enhance Australian research on separation science into an organised structure, operating with a coordinated research plan which addresses and exploits the most exciting and innovative themes in modern separation science.
- (iii) Provide enabling research and research training of the highest quality, which supports and advances all major areas of Australian science.

Australian research in separation science has long enjoyed an excellent international reputation, earned by the individual activities of talented researchers. ACROSS offers an organisational and resource base, through which these individual researchers can work in a coordinated and synergistic manner, under a series of structured and interlocking research programs. ACROSS operates under an organisational structure established to avoid duplication of effort, allow resources and expertise to be shared, and provide value-added opportunities broadly to industry, academia and the nation. ACROSS also prides itself on providing one of the world's leading centres for education and training in the field of separation science, and indeed the wider discipline of analytical chemistry.

DIRECTOR'S REPORT

I am pleased to present this report on the activities of ACROSS in 2012.

In 2012, the management team of ACROSS included Professor Paul Haddad, as Director of the Australian Centre for Research on Separation Science (ACROSS) and Chair of the ACROSS (UTAS) Management Committee, with Associate Professor Gregory Dicinoski, Professor Philip Marriott and Professor Andrew Shalliker as the Deputy Directors. This section of the report provides a general overview of ACROSS in 2012, including achievements, research and statistics. More detailed information can be found within the report.

Staffing changes

Various staff changes took place in 2012. Dr Cristiano Funari commenced a 12-month postdoctoral fellowship funded by the Brazilian government, working with Professor Emily Hilder. Dr Wei Boon Hon and Dr Naama Karu also undertook postdoctoral fellowships with Professor Emily Hilder. Dr Parvez Mahbub was appointed as a postdoctoral fellow working with Associate Professor Greg Dicinoski. Dr Arianne Soliven commenced as a postdoctoral fellow working with Professor Andrew Shalliker. ACROSS attracted a wide range of visiting staff and students in 2012, with visitors coming from 15 countries. Details of the visitors appear in Section 4 of this report.

Research outcomes

In 2012, ACROSS continued to expand its program of fundamental and applied research, with a wide range of individual and collective research projects being undertaken. These research topics and their associated outputs are listed in full within this report. As in previous years, the research focus within ACROSS had a strong element of materials development, with an on-going program in the development of monolithic polymer phases, and new projects in inorganic materials for future stationary phases. The application of ACROSS technology and methodology in the area of counter-terrorism continued to be a important focus in 2012, as was the development and application of electrophoretic technology and microfluidic platforms, multi-dimensional approaches to complex systems, and retention modelling.

Funding

Funding for ACROSS in 2012 totalled \$4,476,988, with \$2,605,255 (58%) coming in the form of 15 nationally competitive grants from the Australian Research Council (ARC) [3 Future Fellowships, 1 QEII Fellowship, 7 Discovery Grants, 1 Linkage Project Grant, 2 Linkage Infrastructure and Equipment Fund Grants] and the National Health and Medical Research Council (NHMRC) [1 Project Grant]. Additional financial support was provided through a large range of organisation and industries, with major contributors being the University of Tasmania, government bodies, the National Security, Science and Technology Branch of the Australian Federal Government and the US Department of Homeland Security, for counter-terrorism research. Four new ARC grants (3 Discovery, 1 Linkage) were awarded in 2012, for commencement in 2013.

Achievements in 2012

ACROSS staff continue to feature prominently on the international separation science scene. Members of staff held three editorships of international journals in 2012, and also appeared on the editorial boards of no fewer than 18 other journals in the area of analytical chemistry or separation science. In 2012, researchers from within ACROSS made numerous plenary, keynote and invited presentations at most of the major international conferences and symposia on separation science.

A number of other notable achievements occurred in 2012. The research output from the UTAS node of ACROSS for the period 2006-2011 was awarded a score of 5 (outstanding research, well above the world benchmark) in the 2012 Excellence in Research Australia national evaluations undertaken by the ARC. This was one of only three such ratings achieved across Australia in the area of Analytical Chemistry. Associate Professor Andrew Shalliker was promoted to Professor. Professor Emily Hilder was the winner of the LCGC 2012 Emerging Leader in Chromatography Award. Associate Professor Greg Dicinoski received a national award for Outstanding Contributions to Student Learning and he was also the leader of an ACROSS team which received the Tasmanian Minister's Science Innovation Award for the development of Scantex technology for rapid screening for explosives. Dr Rosanne Guijt received a Tasmanian Young Tall Poppy Science Award. Professor Paul Haddad received the inaugural Tasmanian Premier's Award for Tasmanian Scientist of the Year. He was also announced as the recipient of the American Chemical Society Chromatography Award for 2013 and is the first resident Australian to receive this award.

Pfizer Analytical Research Centre (PARC)

Pfizer, the world's largest research-based pharmaceutical company, established in 2007 a new collaborative research centre entitled the "Pfizer Analytical Research Centre" (PARC), at the University of Tasmania, Hobart, Tasmania. Research in PARC targets innovation and enhanced productivity in the pharmaceutical analytical sciences. The aim has been to produce advancements in the analysis of pharmaceuticals through high-throughput, faster, and smarter analytical systems, thereby allowing these products to be brought to the marketplace earlier and in a more cost effective and 'green' manner.

The PARC multidisciplinary collaboration creates a Centre of Excellence for the development of novel pharmaceutical analytical methods by combining the expertise of ACROSS with that of world-leading pharmaceutical scientists from Pfizer. This multi-million dollar centre brings economic and financial gain to both the University of Tasmania and to the State of Tasmania. Pfizer, through a \$3.5m investment, has funded the appointment of research staff and students, purchase of equipment and the provision of running costs for the various projects. The University of Tasmania has contributed \$850k for the construction of the state-of-the-art, world-standard, purpose-built laboratory comprising 450 m² of instrumental bench and office space, in which PARC is housed. The Tasmanian State Government, through the Department of Economic Development and Tourism, has contributed \$267k for scholarships to facilitate the recruitment of international PhD students. This contribution has enabled ACROSS to recruit high calibre students from many different countries throughout the world.

In 2012, the Centre comprised of 8 staff and students, including scientists and technical employees. These personnel include a Director, Deputy Director, 3 post-doctoral fellows, 2 research higher degree (PhD) students, and a technical officer, with additional contributions from current ACROSS staff. Each Pfizer project involves close collaboration between ACROSS researchers and Pfizer scientists located in the UK or at various sites within the USA.

The 2012 projects within PARC are:

- High performance ion-exchange stationary phase for biomolecules
- Development of immobilised enzyme monoliths for sample preparation and analysis of glycans
- Non-discriminatory, universal and sensitive detection technologies for fluid based separation techniques in the pharmaceutical industry
- Monolithic polymers for blood collection
- Development of analytical approaches for vaccines: High resolution separations – under recruitment

I thank all staff and students for their contributions to ACROSS in 2012 and wish them every success in the coming years.



Professor Paul R. Haddad
FAA, FTSE, FRACI, FRSC, FFACS
Director

2012 ACROSS Performance at a Glance

Node	Research staff	PhD, MSc students	BSc Hons students	Grants (\$)	Publications	Conference presentations
UTas	25	32	3	3,398,809	53	104
Monash	3	11	2	958,800	13	25
UWS	4	8	5	119,379	10	17
ACROSS total	32	51	10	4,476,988	76	146

KEY PERSONNEL



Prof Paul Haddad

DSc, PhD, BSc(Hons), DipMilStud, FAA, FTSE, FRACI, FRSC, FFACS

Distinguished Professor of Chemistry, University of Tasmania
Director, ACROSS

Paul Haddad obtained the degrees of BSc, PhD and DSc in analytical chemistry from the University of New South Wales. He is currently Distinguished Professor of Chemistry at the University of Tasmania, and the Director of ACROSS. His research interests lie predominantly in theoretical aspects and applications of separations of inorganic ions using the techniques of ion chromatography, capillary electrophoresis, and capillary electrochromatography. He is editor of *Journal of Chromatography A*, a contributing editor of both *Trends in Analytical Chemistry* and *Encyclopedia of Separation Science*, and is a member of the editorial boards of eight other separation science and analytical chemistry journals.

Prof Philip Marriott

PhD, BSc(Hons), FRACI, FFACS

Professor of Chemistry, Monash University and Distinguished Visiting Professor, Chung-Ang University, Korea
Deputy Director (Monash), ACROSS

Philip Marriott has the degrees of BSc(Hons) and PhD from La Trobe University. He is Professor of Chemistry at Monash University and a Deputy Director of ACROSS. His research is primarily in the area of high resolution separation, in the fields of multi-dimensional and comprehensive two-dimensional gas chromatography, capillary electrophoresis, the use of selective detection including mass spectrometry in gas chromatography, micro-fluidics and cryogenic methods. He is a member of the editorial boards of the following international journals: *Journal of Chromatography A*, *Journal of Separation Science*, *LCGC Europe*, *LCGC Asia Pacific*, and *Analytical Chemistry's News and Features Advisory Panel*.

A/Prof Andrew Shalliker

DSc, PhD, BSc(Hons)

Professor, University of Western Sydney
Deputy Director (UWS), ACROSS

Andrew Shalliker has the degrees of BSc(Hons), PhD and DSc from Deakin University. He is currently a Professor in analytical chemistry within the School of Science and Health at the University of Western Sydney, and the head of the UWS node of ACROSS. His research interests are in the field of high resolution separations in liquid chromatography, which entails aspects of column and stationary phase design, multidimensional high-performance liquid chromatography, and fluid dynamics.

A/Prof Greg Dicinoski

PhD, BAppSci(Hons), FRACI CChem

Associate Professor, University of Tasmania
Deputy Director (UTAS), ACROSS
Head of School, Chemistry

Greg Dicinoski holds the degrees of BAppSci(Hons) and PhD from the University of Central Queensland. He is currently a Senior Lecturer and Head within the School of Chemistry at the University of Tasmania, and is a Deputy Director of ACROSS. His research is in the general areas of analytical chemistry, separation science, environmental chemistry, and hydrometallurgy. Specific focus is given to theoretical aspects such as the simulation of retention and mobility in separation science techniques, forensic and national security applications employing separation science techniques, the development of novel, miniaturised, field deployable and portable chromatographic platforms, and specialist applications for the separation of inorganic and organic ions using ion chromatography and capillary electrophoresis for the solution to real-world problems.

Dr Dario Arrua

PhD, BSc

ACROSS Postdoctoral Research Fellow, University of Tasmania

Dario Arrua graduated from the National University of Córdoba in Argentina, obtaining his BSc in 2003 and PhD in 2009. Before joining ACROSS in August 2010, he held a postdoctoral position at the National University of Santiago del Estero (Argentina), working in the development of polymeric materials with antiradical activity. His current research interests are related to the synthesis and chemical surface modification of macroporous polymers, to be used as stationary phases for the separation of biomolecules.

Dr Andrew Bowie

PhD, MSc, BSc(Hons), MRSC

Senior Research Scientist, Antarctic Climate and Ecosystems Cooperative Research Centre and School of Chemistry, University of Tasmania

Andrew Bowie holds the degrees of BSc and MSc from the University of Leeds and the University of Manchester in England. He then conducted his PhD research at the University of Plymouth. In 2006 he commenced a new position as Senior Research Scientist at the University of Tasmania, working jointly in the 'Ocean Control of CO₂' subprogram in the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) and ACROSS. His research interests lie in the general fields of environmental analytical chemistry and chemical oceanography, with specific emphasis on trace metal chemistry in aquatic systems. His research is strongly focused on the development of novel analytical methods to answer key questions in marine biogeochemistry.



A/Prof Michael Breadmore

PhD, BSc(Hons)

ARC QEII Fellow, University of Tasmania

Michael Breadmore was awarded his PhD from the University of Tasmania, after which he held postdoctoral positions at the Microchip Electrophoresis Laboratory at the University of Virginia (USA) and the Institute of Clinical Pharmacology, University of Bern (Switzerland). He has also been Project Leader in Microfluidics for DeltaDOT, an Imperial College London Biotechnology spin-out company. He has extensive research interests in the development of miniaturised analytical separation technology with integrated sample preparation, with applications in drug monitoring, forensics, medical diagnostics and environmental monitoring. He is a member of the Editorial Board of *Electrophoresis*.

Dr Patrice Castignolles

PhD, MSc

Lecturer, University of Western Sydney

Patrice Castignolles graduated at the National Graduate School of Chemistry of Paris and the University Pierre et Marie Curie. After a postdoctoral stay at the Max Planck Institute for Polymer Research, he was an ARC international research fellow at the Key Centre for Polymer and Colloids (University of Sydney), and a research fellow at the Centre for Nutrition and Food Science (The University of Queensland) and the Institute of Physical Chemistry (Johannes Gutenberg University, Germany). He investigates the separation mechanism of branched polymers, such as polyacrylates and starch, by size-exclusion chromatography known as SEC. His current research at UWS focuses on capillary electrophoresis in the critical conditions to characterise the structure of polysaccharides (chitosan) and smart polymers (polyacrylates) for drug delivery.

Prof Hernan Cortes

PhD, BSc

Adjunct Professor, University of Tasmania

Hernan Cortes obtained the degree of BSc from Florida International University and PhD in analytical chemistry from the University of Stockholm. He worked at the Dow Chemical Company where he achieved the highest technical level within the analytical R&D organization. His research interests include the development and application of multidimensional chromatography in the gas and liquid phases for complex problem solving, macromolecular characterisation, miniaturisation, the use of temperature for resolution enhancement in liquid chromatography, ion mobility spectroscopy and process chemistry development. He is a member of two editorial boards for journals dedicated to separation science.

Dr Gary Dennis

PhD, BSc(Hons)

Senior Lecturer,
University of Western Sydney

Gary Dennis has the degrees of BSc(Hons) and PhD from Sydney University. He is currently an associate professor in the area of physical and analytical chemistry within the School of Science and Health at the University of Western Sydney. His research interests are in the field of polymer chemistry, synthesis and characterisation, including the use and development of size-exclusion methods of separation.

Dr Cristiano Funari

PhD, MSc

Postdoctoral Research Fellow,
Sao Paulo Research Foundation
and University of Tasmania

Cristiano Funari has a BSc in chemical engineering from the University of Campinas (Brazil), MSc in drug and medicine research from the University of São Paulo (Brazil), and a PhD in chemistry from the Institute of Chemistry at São Paulo State University (Brazil).

He performed part of his PhD research at the University of Salerno (Italy) and University of Geneva (Switzerland). He has worked at AstraZeneca (Brazil), Labiana Life Sciences (Spain) and Centroflora Group (Brazil), where he developed and coordinated projects for innovation in the natural products field, as well as raising research funds for projects in partnership with universities and institutes. Before joining ACROSS in November 2012, he had a postdoctoral position at the Institute of Chemistry at São Paulo State University, focusing on green chromatography. His current research interests are related to sustainable investigation of natural products, especially in green liquid chromatography processes.

Dr Andras Gaspar

PhD, MSc

Pfizer Postdoctoral Research Fellow,
University of Tasmania

Andras Gaspar obtained his MSc in bioengineering in 2005, specialising in analytical chemistry. Studying in Budapest, his master's thesis looked at combining extraction and separation techniques with different detection methods. He then received his PhD at the Technical University of Munich in Germany, where he specialised in electrophoretic separation, coupled mass spectrometry techniques, and explored molecular level interactions between pollutants and geochemical samples. He held a further postdoctoral position at the Max Planck Institute in Germany, where he investigated the effects of pipeline fouling during upstream oil processes. He joined ACROSS 2011, where he is involved in researching the characterisation of vaccines.

KEY PERSONNEL



Dr Rosanne Guijt

PhD, MSc, MRACI CChem

ARC Australian Postdoctoral Fellow and
Part-time Lecturer, University of Tasmania

Rosanne Guijt obtained her MSc in biopharmaceutical sciences from Leiden University (The Netherlands), and her PhD from Delft University of Technology (The Netherlands), with a significant part of her PhD studies being conducted at the Institute de Microtechnique (Switzerland). Her research interests lie in the design and fabrication of microfluidic devices for application in chemistry and life sciences, especially in the development of simple and cost-effective microfabrication methods to make this research area more accessible. Applications of the microdevices include the characterisation of explosive residues, drug monitoring and organic synthesis.

Prof Emily Hilder

PhD, BSc(Hons), FRACI CChem

Professor and ARC Future Fellow,
University of Tasmania

Emily Hilder is a graduate of the University of Tasmania where she obtained the degrees of BSc(Hons) and PhD. She has held postdoctoral positions at Johannes Kepler University (Austria) and the E.O. Lawrence Berkeley National Laboratory (USA), and was an ARC Postdoctoral Fellow at ACROSS from 2004-2007. Her research interests lie in the general area of separation science, in particular the development and application of novel polymeric monolithic materials as selective adsorbents and chromatographic stationary phases. She is also interested in miniaturised analytical systems, particularly for applications in clinical diagnostics, counter-terrorism and environmental monitoring. She is an editor of the *Journal of Separation Science*.

Dr Wei Boon Hon

PhD, BBiotech(Hons)

Pfizer Postdoctoral Research Fellow,
University of Tasmania

Wei Boon Hon graduated from the University of Tasmania, receiving BBiotech(Hons) and PhD degrees. Upon completion of his PhD, he worked as a Pfizer Postdoctoral Research Fellow in developing a new material, MilliSpot, used for dried blood spot sampling technology in drug discovery. His research interests are in the development of novel polymeric monolithic materials as selective adsorbents for high-throughput sample preparation or pre-treatment, particularly for qualitative and quantitative bioanalysis using LC-MS/MS of pharmaceutical interest, and other applications in analytical chemistry.

Dr Joe Hutchinson

PhD, BSc(Hons), MPA

ARC Postdoctoral Research Fellow
(Industry), University of Tasmania

Joe Hutchinson completed his undergraduate and postgraduate studies at the University of Tasmania, and was involved in pre-concentrating small ions using various stationary phases in capillary electrophoresis. After completing his PhD, he relocated to the University of Waterloo (Canada), to assume a position as a Postdoctoral Research Fellow under the supervision of Professor Janusz Pawliszyn. During this time he developed automated solid-phase microextraction systems on the 96-well plate format for GC and LC platforms. His research interests include developing fast, automated and portable separation systems for real-world samples, including fingerprinting explosive devices to combat terrorism.

Dr Cameron Johns

PhD, BSc(Hons)

ACROSS Postdoctoral Research Fellow,
University of Tasmania

Cameron Johns obtained the degrees of BSc(Hons) and PhD from the University of Tasmania. He was an Alexander von Humboldt Research Fellow at Philipps University (Germany), from June 2004 to November 2005, working in the area of ion-exchange capillary electrochromatography. His research interests also include indirect photometric detection in capillary electrophoresis and the application of ion chromatography to forensic samples.

Dr Naama Karu

PhD, MSc, BSc

ACROSS Postdoctoral Research Fellow,
University of Tasmania

Naama Karu completed her PhD in separation science in 2012, as a Pfizer student scholar at ACROSS. Her research concentrated on the analysis of pharmaceuticals by ion chromatography, coupled to universal detectors. She stayed in ACROSS for a postdoctoral fellowship to conduct research in mass spectrometry for clinical biochemistry application. She acquired a BSc and MSc in biochemistry and food sciences at the Hebrew University in Israel, from 2000 to 2005.



Dr Tom Kazarian

PhD, MSc(Hons)
Pfizer Postdoctoral Research Fellow,
University of Tasmania

Tom Kazarian graduated from the University of Tasmania, receiving BSc(Hons) and PhD degrees. His doctorate work focused on the analysis of carbohydrates and their preconcentration using capillary electrophoresis and microfluidic platforms. After completing his PhD, he held postdoctoral positions at the Dalian Institute of Chemical Physics in China, and the Pfizer Analytical Research Centre in Hobart. He was also briefly involved with intellectual property law at Griffith Hack in Melbourne. His scientific research interests and expertise lie in the field of liquid chromatography, with a focus on the analysis of pharmaceutical formulations using a variety of detection platforms.

Prof Mirek Macka

PhD, RNDr, MRACI CChem, MRSC
New Stars Professor,
University of Tasmania

Mirek Macka holds the degree of RNDr, equivalent to MSc and BSc in analytical chemistry from the Masaryk University (Brno, Czech Republic), and a PhD from the University of Tasmania. He started his career as a research scientist in the pharmaceutical industry in Europe, and with his move to Australia in 1994, switched to an academic career. His research interests are in the areas of analytical chemistry, separation science, liquid chromatography, capillary electrophoresis, electrochromatography, miniaturised and microfluidic chip-based analysis, instrumental design, solid-state light sources, and numerical modelling and simulations. He is a member of three editorial boards, including *Analytica Chimica Acta* and *Electrophoresis*.

Dr Parvez Mahbub

PhD, MEng, BEng, MIEAust
ACROSS Postdoctoral Research Fellow,
University of Tasmania

Parvez Mahbub obtained the degrees of BEng(Hons) from Bangladesh University of Engineering and Technology, MEng from Central Queensland University, and PhD in Environmental Engineering from Queensland University of Technology. He is currently appointed as an ACROSS Postdoctoral Research Fellow at University of Tasmania to work in a counter terrorism project. His research interest includes fast and cost effective detection of improvised explosives, microfluidic engineering, environmental chemistry, and modelling of hazardous pollutants from natural and anthropogenic sources. He is a professional member of Engineers Australia.

Dr Dimitar Mitev

PhD, MSc
ACROSS Postdoctoral Research Fellow,
University of Tasmania

Dimitar Mitev completed his MSc studies at the St. Clement of Ohrid University of Sofia (Bulgaria), and was awarded his PhD at the Space Research Institute, located at the Bulgarian Academy of Sciences. Here he worked on blasting technologies for synthesis and treatment of materials, and in particular detonation nanodiamond. In 2010, he moved to the Institute of Metal Science, Equipment and Technologies at the Bulgarian Academy of Sciences, where he continued his work on the application of blasting- and pyro-technologies for anti-terrorism and defence purposes. In 2011, he moved to the University of Tasmania as a postdoctoral fellow to develop novel methods of purification and continue with the characterisation of nanodiamond at ACROSS.

Dr Blagoj Mitrevski

PhD, BSc(Hons)
Postdoctoral Research Fellow,
Monash University

Blagoj Mitrevski, a former forensic scientist for the Macedonian police, graduated from RMIT after completing his PhD in 2010. He commenced his postdoctoral research at Monash University, with the move of Professor Marriott's research group to Monash. His research at Monash involves the application of advanced GC and GC×GC methods to drugs analysis, pesticides analysis and bio-fuels analysis. Most of this is supported by selective GC detection and mass spectrometry.

Prof Pavel Nesterenko

DSc, PhD, MSc, MRACI CChem
Quantum Leaps Professor,
University of Tasmania

Pavel Nesterenko obtained his degrees from the Lomonosov Moscow State University (Russia), focusing his MSc in petrochemistry and organic catalysis, and his PhD and DSc in analytical chemistry. He is currently a professor within ACROSS at the University of Tasmania. His research area is associated with the development, investigation and application of new adsorbents and chromatographic columns for different separation techniques, including high-performance liquid chromatography, ion chromatography, chiral phase chromatography and ligand-exchange. He is a member of the editorial boards of *Analytica Chimica Acta*, *Encyclopedia of Analytical Chemistry*, *Open Journal of Analytical Chemistry* and *International Journal of Analytical Chemistry*.

KEY PERSONNEL



Dr Anne Palmer

PhD, BSc, BAntSt(Hons)
Pfizer Postdoctoral Research Fellow,
University of Tasmania

Anne Palmer holds the degrees of BSc, BAntSt(Hons) and PhD from the University of Tasmania. In 2008 she was a research fellow at ACROSS, within the University of Tasmania, and worked in close collaboration with the Australian Antarctic Division. Her research interests lie predominantly in the field of environmental chemistry and the application of separation science to enhance knowledge of trace metal speciation in natural waters.

Prof Brett Paull

PhD, BSc(Hons), FRSC, CChem
New Stars Professor,
University of Tasmania

Brett is a University of Plymouth (England) BSc(Hons) and PhD graduate, and a Fellow of the Royal Society of Chemistry. He took up his first lectureship at the University of Tasmania from 1995 to 1997, before moving to Dublin City University (1998-2011), where he currently holds an Adjunct Professorial position. In 2011, Brett rejoined the University of Tasmania as Professor in the School of Chemistry. His research interests within ACROSS specifically focus upon the production and characterisation of new materials and platforms for application within the analytical and bio-analytical sciences, and in particular advanced inorganic and organic phase materials for selective extraction and separation purposes. Brett is currently editor-in-chief of the Royal Society of Chemistry journal, *Analytical Methods*.

A/Prof Joselito Quirino

PhD, MSc, BSc
Associate Professor and ARC Future Fellow, University of Tasmania

Joselito Quirino holds a BSc in industrial pharmacy (1992) from the University of the Philippines and an MSc (1998) and PhD (1999) in material science from the Himeji Institute of Technology (HIT), Japan. He was a postdoctorate at HIT (1999-2000) and Stanford University (2000-2001), and has five years experience in the USA working as an analytical development scientist in the biotechnology and pharmaceutical industry. He is currently employed as Senior Lecturer under the Quantum Leaps Program of the University of Tasmania. His research interest are on the fundamentals and applications of on-line sample preconcentration in capillary zone electrophoresis, electrokinetic chromatography, electrochromatography, and the applications of separation science to drug discovery and development.

A/Prof Robert Shellie

PhD, BAppSc(Hons), MRACI CChem
Associate Professor and ARC Australian Research Fellow, University of Tasmania

Robert Shellie obtained postgraduate training in ACROSS at RMIT University. Prior to his arrival in Tasmania in 2005, he held a post-doctoral position at the Max-Planck Institute of Molecular Plant Physiology in Golm, Germany. Robert's research is supported by the Australian Research Council and his research interests include multidimensional separations, high-speed chromatography, mass spectrometry, metabolomics, sample preparation, and modelling of chromatographic retention behaviour.

Dr Arianne Soliven

PhD, BSc(Hons)
ACROSS Postdoctoral Research Fellow,
University of Western Sydney

Arianne Soliven completed her PhD in 2011 at the University of Western Sydney. She undertook a postdoctoral fellowship from early 2011 to late 2012 at the University of Minnesota under the guidance of Prof. Peter Carr. Arianne then returned to UWS, where she is currently employed as a research associate studying aspects of reaction flow chromatography, which is a new technique designed to improve the performance of post-column derivatisations. More recently she has returned from an invited opportunity to work with industry partners - Thermo Fisher Scientific at their Runcorn facility in the UK on various Active Flow Technology (AFT) projects.

Dr Eadaoin Tyrrell

PhD, BSc(Hons)
ACROSS Postdoctoral Research Fellow,
University of Tasmania

Eadaoin Tyrrell is a graduate of Dublin City University in Ireland, where she obtained her PhD in analytical chemistry. Prior to joining ACROSS in 2006, she spent a year as an assistant lecturer in chemistry at Dublin City University. She is particularly interested in the area of separation science, where current work includes the development of an ion chromatography system for the pre-blast screening of inorganic improvised explosive devices. Other areas of interest include the design and fabrication of microfluidic-based devices for environmental monitoring.



Dr Philip Zakaria

PhD, BSc(Hons), MPA

ACROSS Postdoctoral Research Fellow,
University of Tasmania

Philip Zakaria graduated from the University of Tasmania and completed his subsequent postgraduate training at ACROSS in 2003. Upon completion of his PhD, he spent one and a half years as an ACROSS Postdoctoral Fellow. Prior to returning as a Pfizer Postdoctoral Fellow in 2007, he worked in a commercial wine laboratory as well as working outside of the chemistry field. His specialty is in the area of separation systems, both electrophoretic and chromatography based, which have been used in a wide variety of applications including pharmaceutical analysis, environmental testing and forensic detection. His current research involves the development of a prototype explosive residue screening system.

Dr Zhong-Da Zeng

PhD, BSc

Postdoctoral Research Fellow,
Monash University

Zhong-Da Zeng is supported by an Australian Research Council Discovery Grant appointment, and brings to this group a wealth of experience in chemometrics. He has previously trained with Professor Yi-Zeng Liang, the editor of *Chemometrics and Intelligent Laboratory Systems*, at Central South University in China. His prior research appointment was as a postdoctoral researcher at the Hong Kong Polytechnic University. His key interests are in separation methods and mass spectrometry applications, with chemometric interpretation of complex datasets. He has developed many useful data handling packages and automated programs for research and industry.

TECHNICAL AND ADMINISTRATIVE STAFF

Miss Helen Barnard

Administrative Assistant
University of Tasmania

Mr Anthony Malone

Computing Technical Officer
University of Tasmania

Mr Jason Hofman

Administrative Assistant
University of Tasmania

Dr Kim Shepherd

Administrative Assistant
Monash University

VISITORS TO ACROSS

Visitor	Country	Institution	Period of visit	Location
Ms Isabel Cardeal	Brazil	University of Sao Paolo	6 months	Monash
Mr Anang Diah	Australia	University of Newcastle	3 weeks	UTAS
Ms Larisa Florea	Ireland	Dublin City University	4 months	UTAS
Ms Emilie Groison	France	University of Lyon, Graduate School of Chemistry	4 months	UWS
Dr Yohann Guillaneuf	France	Aix-Marseille University, Institute of Radical Chemistry	1 month	UWS
A/Prof Massoud Kaykhaii	Iran	University of Sistan and Baluchestan	6 months	UTAS
Ms Celale Kirkin	Turkey	Technical University of Istanbul	1 year	Monash
Dr Catherine Lefay	France	Aix-Marseille University, Institute of Radical Chemistry	1 month	UWS
Prof Matthew Linford	USA	Brigham Young University	2 weeks	UTAS
Dr XiangPing Liu	China	Chinese Centre for Disease Control and Prevention	10 months	Monash
Dr Eduardo Mateus	Portugal	New University of Lisbon	8 months	Monash
Dr Ivo Nischang	Austria	Johannes Kepler University	2 weeks	UTAS
Ms Asia Nosheen	Pakistan	Department of Plant Sciences, Quaid-i-Azam University, Islamabad	8 months	Monash
Ms Soo Hyun Park	South Korea	Seoul National University	6 months	UTAS
Ms Heide Rabanes	Philippines	Ateneo de Manila University	1 year	UTAS
Prof Alexandra Ribeiro	Portugal	New University of Lisbon	8 months	Monash
Mr Edwin Romano	Philippines	University of Newcastle and Ateneo de Manila University	3 weeks	UTAS
Dr Marcelo R. Romero	Argentina	National University of Córdoba	3 months	UTAS
Ms Sara Sandron	Ireland	Dublin City University	6 months	UTAS
Ms Laura Tedone	Italy	University of Messina	1 year	UTAS
Mrs Xiaomei Chen, Mr Chaoqun Huang, Mr Wenmao Liang, Mr Chengjie Lou, Ms Xie Wen	China	Visiting delegation from Zhejiang Entry-Exit Inspection and Quarantine Bureau	1 week	Monash

RESEARCH FUNDING

UTAS NODE

Applicant(s)	Funding scheme	Type of grant	Title	Funding for 2012
Bowie AR	University of Tasmania	Rising Stars Round 3	Rising Stars	\$17,000
Breadmore MC	Australian Research Council	Discovery Project	Integrated microfluidic device for the direct analysis of drugs and metabolites in biological fluids	\$140,000
Breadmore MC, Haddad PR, Hilder EF, Dicinoski GW, Hutchinson JP, Guijt RM, Nesterenko PN, Quirino JP, Johns CA	Department of the Prime Minister and Cabinet	National Security Science and Technology Unit Counter Terrorism	Portable multiplexed electrophoretic and chromatographic systems for the detection and identification of explosives	\$247,294
Dicinoski GW, Breadmore MC	Department of the Prime Minister and Cabinet	Research Support for National Security	Development of a commercial-ready pre-blast explosive analyser for inorganic-based homemade explosives (HME) screening	\$420,000
Funari CS, Hilder EF, Cavalheiro AJ	São Paulo Research Foundation	Postdoctoral Scholarship to CSF and Conferences	A trade off between separation, detection and sustainability in liquid chromatography	\$80,000
Guijt RM	University of Tasmania	Conference Support Scheme	BIT's 1st Annual Conference and EXPO of Analytix 2012, China	\$1,200
Guijt RM	University of Tasmania	Rising Stars Round 2	Rising Stars	\$24,864
Haddad PR	Australian Research Council	Discovery Projects	Simulation and optimisation of retention in ion chromatography with multi-step elution profiles	\$160,000
Haddad PR, Dicinoski GW	Department of Economic Development, Tourism	Tasmania Development and Resources and the Arts	Support for four international PhD students assisting in PARC (Pfizer Analytical Research Centre)	\$32,000
Haddad PR, Hilder EF, Shalliker RA	Australian Research Council	Discovery Project	Synthesis, characterisation and evaluation of novel ion-exchange polymer monolithic stationary phases for separation science	\$140,000
Haddad PR, Palmer AS, Seen AJ, Riddle M	Department of Sustainability, Environment, Water, Population and Communities	Grant	Engagement of UTAS professional services to support the AAD human impacts research program	\$35,000
Haddad PR, Shellie RA, Dicinoski GW, Szucs R, Pohls C, Dolan JW	Australian Research Council	Linkage Projects Round 2	Rapid method development in pharmaceutical analysis using quality-by-design principles	\$416,376
Hassler CS, Doblin MA, Bowie AR, Mancuso Nichols CA, Butler EC, Slaveykova-Startcheva V	Australian Research Council	Discovery Projects	Novel technologies to resolve the role of organic matter on iron chemistry and bioavailability in the Southern Pacific Ocean	\$100,000
Hilder EF	Australian Research Council	Future Fellowship	High performance chromatography based on nanostructured monolithic polymers	\$171,600
Hilder EF, Shellie RA, Candish E	SGE Analytical Science	Scholarship Top-Up	Elite scholarship support – Esme Candish	\$7,500

RESEARCH FUNDING

UTAS NODE cont.

Applicant(s)	Funding scheme	Type of grant	Title	Funding for 2012
Karu N	CASSS and Thermo Fisher	Conference Grant	24th International Ion Chromatography Symposium, Germany	\$1,500
Macka M	Australian Research Council	Future Fellowship	Solid-state light sources for bio-imaging and microfluidics	\$116,396
Nesterenko PN	University of Tasmania	Conference Support Scheme	37th International Symposium on Analytical and Environmental Chemistry, Belgium	\$1,000
Nesterenko PN, Paull B	Australian Research Council	Discovery Projects	Micro-disperse sintered nano-diamonds: A new class of versatile adsorbent for high performance liquid chromatography	\$100,000
Paull B	University of Tasmania	Conference Support Scheme	38th International Symposium on High Performance Liquid Phase Separations and Related Techniques, USA	\$1,200
Paull B, Nesterenko PN, Macka M, Haddad PR	University of Tasmania	Faculty of Science and Engineering Strategic Support	EU Marie Curie FP7-PEOPLE-2009-IRSES MASK Project	\$10,000
Quirino JP	Australian Research Council	Future Fellowship	Green sample preparation technologies for analytical chemistry	\$175,883
Reid JB, Hilder EF, Gell DA, McGuinness DS, Ross JJ	Australian Research Council	Linkage Infrastructure	Purchase of a high resolution NMR spectrometer with liquid chromatography module	\$630,000
Shellie RA	Australian Research Council	Discovery Projects	A field-portable comprehensive multidimensional gas chromatograph	\$105,000
Shellie RA	University of Tasmania	Rising Stars Round 2	Rising Stars	\$24,810
Thomson RJ, Hoy W, McMorran BJ, Jose MD, Hilder EF, Charlesworth JC	National Health and Medical Research Council	Project Grant	To search for genetic causes of renal disease in the Tiwi Island Aboriginal population	\$240,186

Total \$3,398,809

MONASH NODE

Applicant(s)	Funding scheme	Type of grant	Title	Funding for 2012
Marriott PJ	Agilent Technologies	Grant	Gift of MDGC-QQQ Mass Spectrometry System	\$295,000
Marriott PJ	Agilent Technologies	Total Agilent Experience	2012 program of training and education for Agilent Technologies	\$5,000
Marriott PJ	Australian Academy	Grant	Additional FP7 Exchange Grant to Portugal	\$7,500

MONASH NODE cont.

Applicant(s)	Funding scheme	Type of grant	Title	Funding for 2012
Marriott PJ	Australian Research Council	Discovery Projects	Integrated multidimensional gas chromatography - spectroscopic detection methodology for chemical marker discovery	\$100,000
Marriott PJ	Bruker	Grant	Gift of MDGC-QQQ mass spectrometry system	\$180,000
Marriott PJ	DSTO	Grant	Research on oxygenated products in algae-derived biofuel	\$35,000
Marriott PJ	DSTO	PhD Program Support	Improved quantitative and qualitative analysis of oxidative heteroaromatic species in middle distillate fuels using multidimensional gas chromatographic techniques	\$75,000
Marriott PJ	Monash University, Faculty of Science	Faculty Award	Innovation and external collaboration award	\$5,000
Marriott PJ	Monash University	Grant	LPAS – Linkage Project Application Scheme	\$6,300
Marriott PJ, Chaffee A, Mitrevski B	Australian Research Council	Discovery Projects	Ultra-high resolution hybrid comprehensive-multidimensional gas and supercritical fluid chromatography for explicit characterisation of petrochemicals	\$250,000
				Total \$958,800

UWS NODE

Applicant(s)	Funding scheme	Type of grant	Title	Funding for 2012
Castignolles P, Aldrich-Wright J, Jones M	University of Western Sydney	Research	Branched degradable polymers for anti-cancer drugs delivery	\$11,379
Castignolles P, Gaborieau M	University of Western Sydney	Research	Characterisation of smart polymers for anti-cancer drug delivery	\$10,000
Cojocariu A, Dennis G	University of Western Sydney	Research	Novel hybrid organic-inorganic thin films from organo-bridged silsesquioxanes precursors	\$3,000
Dennis G, Shalliker RA	University of Western Sydney & Phenomenex Australia	Research	Green preparative supercritical-fluid separations	\$30,000
Shalliker RA	Department of Industry, Innovation, Science, Research and Tertiary Education	Cadetship	Joint Research Engagement Engineering Cadetship – David Shock	\$5,000
Shalliker RA	Thermo Electron Manufacturing	Research	Active flow management chromatography columns	\$60,000
				Total \$119,379

RESEARCH HIGHLIGHTS

MONASH STORY

An Innovative Hybrid GC×GC-MDGC Gas Chromatography Platform

written by Prof Philip Marriott

Our studies investigating a high-resolution solution to analysis of oxygenated compounds in bio-fuels analysis, and research on sulfur-containing compounds in shale oils, progressed into a new approach for analysis of target compounds in these sample types.

Our new hybrid GC×GC-MDGC method has elements of both GC×GC and MDGC, in a truly 3-dimensional GC architecture. Prior class or component separation using GC×GC allows either individual components, or classes of compounds, to be excised from the 2D space, and delivered into a 3D column. This is done by careful setting of a microfluidic Deans switch heart-cut device, to repetitively sample the 2D effluent, and either pass flow to a monitor detector (see FID1 in Fig 1) or to FID2 (Fig 1) at the end of 3D. Fig. 2 demonstrates individual components can be effectively cut from the 2D GC×GC separation space; the analogy to surgical removal of the peaks to a 3D column is appropriate. The 3D column is able to then provide much greater resolution of the transferred zone of components. A number of different operational modes are available – such as cryogenically trapping components at the start of 3D, with options of either operating the oven at the prevailing temperature, or cooling the oven and achieving much greater resolution. We have good experience in these methods for MDGC analyses, and so can readily transfer this expertise to the GC×GC-MDGC environment. We have now extended this to use of mass spectrometry at the end of 3D.

This method allows much greater separation space to be utilised, and in our research has been used to exclude complex matrix components from the subsequent 3D separation. This is somewhat like doing an on-line, in-column sample prep method. It should save considerable time for samples that require prior sample prep, and permit ultra-high resolution analysis for samples that have typically resisted efforts to achieve separation of highly complex regions of components.

We are now applying this and similar multiple-column concepts for isolation of target compounds for preparative collection, and for applications of some of the most complex hydrocarbon samples related to the unresolved complex mixture in petrochemical analysis.

Based on this newly introduced method, a successful ARC Discovery with DORA grant has been awarded to the Monash team.

Further reading:

B Mitrevski and PJ Marriott. A novel hybrid comprehensive two-dimensional – multi-dimensional gas chromatography for precise, high resolution characterisation of multicomponent samples. *Anal. Chem.* 84 (2012) 4837–4843.

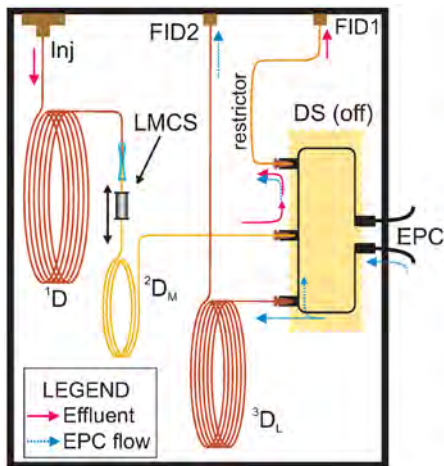


Fig. 1. The GC×GC-MDGC System

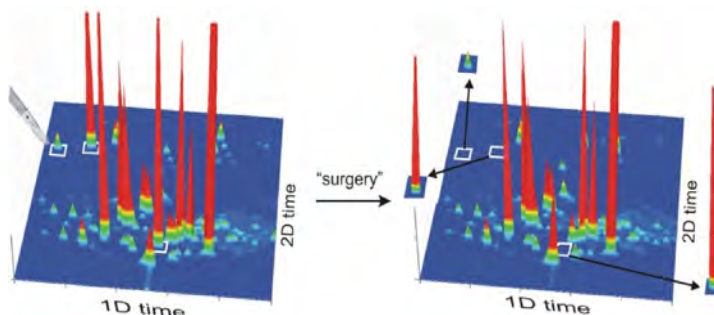


Fig. 2. Example of fine heart-cutting of components from GC×GC, which are then delivered to a downstream analytical column

UTAS STORY

MilliSpot - A new approach to bioanalysis

written by Prof Emily Hilder

The analysis of a range of species in biological fluids including drugs and drug metabolites, disease markers, peptides and proteins is important in a number of applications including preclinical and clinical studies in the pharmaceutical industry, therapeutic and illicit drug monitoring and disease diagnosis. Conventional sampling techniques employ plasma or serum for practical reasons. This approach requires relatively large volumes of venous blood to be collected. Given that parameters must usually be related back to whole blood, sampling and analysis of whole blood would be a more desirable option. Further, recent significant advances in analytical technology, including liquid chromatography with mass spectrometric detection (LC-MS) mean that smaller sample volumes can be used. Decreasing the size of blood samples collected offers substantial benefits for bioanalysis including reducing the use of animals in pharmacokinetic and toxicology studies and less invasive sampling with specific benefits for particular patient groups including the elderly, very young and critically ill. Although dried blood spot (DBS) technology has been available for decades for applications such as neonatal screening [1], the broader application of this approach is a very recent development in bioanalysis and has resulted in significant new and exciting developments in this field [2].

DBS sampling and analysis is relatively simple process involving the collection of a very small sample of blood (~15 µL) from either a finger, heel or tail prick. This blood is then spotted onto a filter paper and allowed to dry at room temperature for up to 2 hours. Advantages of using DBS instead of plasma include using smaller blood volumes, less sample processing (no centrifugation or transfer), improved sample stability in some cases and samples do not need to be stored or shipped at low temperatures. DBS samples are also not considered a biohazard, hence can be easily shipped without special precautions. Analysis of DBS samples is simple and usually involves cutting a section of the spot using a hole punch, followed by extraction and analysis by LC-MS [3]. Approaches have also been developed that allow direct analysis of the spot without cutting, resulting in significant improvements in sensitivity [4]. The benefits of this technology have been recognised in a number of new applications in recent years including pharmacokinetic studies in children, disease monitoring in remote or developing locations, health screening and biomonitoring studies.



MilliSpot porous polymer monolith for dried blood spot sampling

Traditionally DBS sampling has been restricted to qualitative analysis using paper-based cards, which have some inherent drawbacks for quantitative analysis. The benefits associated with DBS sampling have led to development of new technologies, and this has been a significant research focus within the UTAS node of ACROSS since 2009. As part of work within the Pfizer Analytical Research Centre (PARC) we recently introduced MilliSpot, a porous polymer monoliths as a new material for DBS sampling [5]. These materials have more traditionally been used as chromatographic stationary phases but can be synthesised in almost any format, including flat sheets. An advantage of this technology is that these polymer monoliths can be easily functionalised using a range of approaches [6]. This offers the potential to include specific functionalities to improve sample stability or for selective extraction [7]. Monolithic polymers are also well suited for direct MS analysis [8] offering further exciting possibilities for DBS sampling.

Protected by two current PCT applications [9,10] a \$49,680 Skills and Knowledge grant from Commercialisation Australia in 2012 was used to define the capital requirements for manufacturing scale-up versions of a product based on the technology, with the next step is to secure potential investors. This work associated with MilliSpot has also led to a broader research program within ACROSS focused on the use of porous polymer monoliths for sampling and sample preparation, in collaboration with SGE Analytical Science and supported further by Researcher in Business funding for an associated project.

1. R. Guthrie, A. Susi, *Pediatrics* 32 (1963) 338
2. R.E. Majors, *LCGC North America* 29 (2011) 14
3. N. Spooner, R. Lad, M. Barfield, *Anal. Chem.* 81 (2009) 1557
4. P. Abu-Rabie, N. Spooner, *Anal. Chem.* 81 (2009) 10275
5. E.F. Hilder, *Aust J. Chem.*, 64 (2011) 843
6. E.F. Hilder, F. Svec, J.M.J. Fréchet, *J. Chromatogr. A* 1044 (2004) 3
7. O.G. Potter, E.F. Hilder, *J. Sep. Sci.* 31 (2008) 1881
8. D.S. Peterson, Q. Luo, E.F. Hilder, F. Svec, J.M.J. Fréchet, *Rapid Commun. Mass Spectrom.* 18 (2004) 1504
9. P.R. Haddad, E.F. Hilder, E. Candish, M. Bayliss, Porous polymer monoliths, processes for preparation and use thereof in the drying and storage of body fluids including blood and blood plasma samples, WO 2011082449
10. E.F. Hilder, W.B. Hon, Use of porous polymer materials for storage of biological samples, WO 2013006904

RESEARCH HIGHLIGHTS

UWS STORY

Modern separations for advanced polymeric materials and polysaccharides

written by Dr Patrice Castignolles

Macromolecular engineering allows us to synthesise nearly all complex polymer architectures one can dream of. Since the discovery of nitroxide-mediated polymerisation (NMP) and reversible addition fragmentation chain transfer (RAFT) by CSIRO, more and more complex polymeric materials have been synthesised to obtain new properties required in, for example, drug delivery or cell culture. In parallel, peak oil and concerns about the environment are leading to an increasing pressure on replacing synthetic polymers, especially plastics, with materials from renewable and sustainable sources. Polysaccharides are first in line, and research on potential modifications to adjust to synthetic polymer standards has skyrocketed in recent years. Breakthroughs and intense research has thus led to an explosion in the number of polymers and their complexity.

In parallel, research into the separation of polymers has not had any breakthroughs since the discovery of size-exclusion chromatography (SEC, also previously known as GPC) and the universal calibration principle 50 years ago. Synthetic polymers and polysaccharides have a broad distribution of molecular weight, so they therefore require separation for which SEC currently has a monopoly. SEC however separates by hydrodynamic volume, not molecular weight (contrary to a common misconception in polymer science). Hydrodynamic volume and molecular weight have a one-to-one relation only if the polymer sample is monodimensional - it is not the case if the polymer has a distribution of compositions, or distributions related to branched topologies.

In collaboration with Dr Marion Gaborieau (UWS), We previously investigated the SEC separation of branched polymers and polysaccharides,¹ which led to an incomplete separation in SEC that we quantified through local dispersity using multiple-detection SEC. The error in determination of the molecular weights was shown to strongly dependent on the heterogeneity of the branching; more than 100 percent error has been measured on the molecular weights of some branched polymers determined by SEC. There is thus a strong need for separation methods to separate polymers by their composition of topologies.

Liquid chromatography in the critical conditions (LC-CC) has proved very powerful to characterise complex polymers. Critical conditions refer to the absence of separation by molecular weight, therefore enabling separations by the composition of the topology. This method of development, establishing the critical conditions, is very tedious. Usage of LC-CC is thus limited to the number of research groups or industries being equipped and in terms of the number of publications. The relatively poor robustness of LC-CC also prevents its application to hydrophilic polymers such as polysaccharides or polyelectrolytes. In previous work, in a collaboration with Prof. Emily Hilder (ACROSS UTAS),² we showed that free solution capillary electrophoresis has a high resolution power for oligoelectrolytes (oligoacrylates), but also that critical conditions are very straightforward to obtain.

Our current research at UWS is exploring the potential of free solution capillary electrophoresis, or capillary electrophoresis in the critical conditions (CE-CC), to the separation of polymers by their topology or composition. Poly(acrylic acid) is an important superabsorbent industrial polymer that we assessed in our current research for anticancer drug delivery. We have shown that CE-CC separates poly(acrylic acid) by its topology, with branching that leads to decreased electrophoretic mobility (see figure).³ Polysaccharides can also be separated by CE-CC, for example, according to their composition. We separated the anionic polysaccharide gellan gum⁴ which showed the robustness of the separation since the samples are only partially soluble and injected as dispersions. We also studied chitosan, a renewable and truly sustainable polysaccharide derived from crab and shrimp shells, a waste substance from the seafood industry. The limited solubility of chitosan makes its characterisation and that of modified chitosan particularly challenging. CE was able to prove covalent binding of the control agent BlocBuilder® to chitosan.⁵ Chitosan is a copolymer, whose composition is a named degree of acetylation, and with CE-CC we obtained the first separation by degree of acetylation.⁶ Finally, the composition of more complex polysaccharides is established by the determination of monosaccharides after depolymerisation. In collaboration with Prof. Emily Hilder, we showed that capillary electrophoresis leads to more robust separation than commonly used HPLC methods,⁷ and we are now applying this method to plant fibre characterisation as well as the monitoring of bioethanol productions.

1. M Gaborieau, P Castignolles. Size-exclusion chromatography (SEC) of branched polymers and polysaccharides. *Anal. Bioanal. Chem.* 399 (2011) 1413-1423.
2. M Gaborieau, TJ Causon, Y Guillaneuf, EF Hilder, P Castignolles. Molecular weight and tacticity of oligoacrylates by capillary electrophoresis - mass spectrometry. *Aust. J. Chem.* 63 (2010) 1219-1226.
3. A Maniego, D Ang, Y Guillaneuf, C Lefay, D Gigmes, J Aldrich-Wright, M Gaborieau, P Castignolles. Separation of poly(acrylic acid) salts according to topology using capillary electrophoresis in the critical conditions. *Anal. Bioanal. Chem. Special Issue* (2013) 1-12.
4. DL Taylor, CJ Ferris, AR Maniego, P Castignolles, M in het Panhuis, M Gaborieau. Characterisation of gellan gum by capillary electrophoresis. *Aust. J. Chem.* 65 (2012) 1156-1164.
5. C Lefay, Y Guillaneuf, G Moreira, JJ Thevarajah, P Castignolles, F Ziarelli, E Bloch, M Major, L Charles, M Gaborieau, D Bertin, D Gigmes. Heterogeneous modification of chitosan via nitroxide-mediated polymerization. *Polym. Chem.* 4 (2013) 322-328.
6. M Mnatsakanyan, J Thevarajah, R Roi, A Lauto, M Gaborieau, P Castignolles. Separation of chitosan by degree of acetylation using simple free solution capillary electrophoresis. *Anal. Bioanal. Chem.* 405 (2013) 6873-6877.
7. JD Oliver, M Gaborieau, EF Hilder, P Castignolles. Simple and robust determination of monosaccharides in plant fibers in complex mixtures by capillary electrophoresis and high performance liquid chromatography. *J. Chromatogr. A.* 1291 (2013) 179-186.

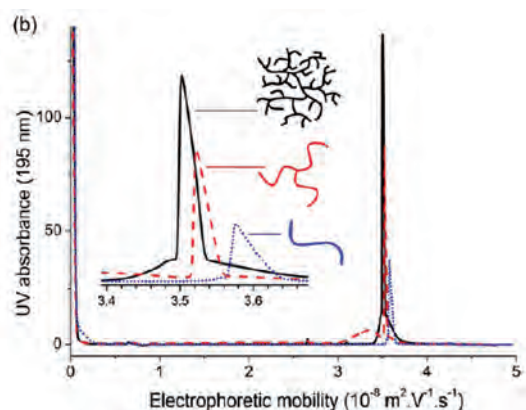


Figure: separation of linear (blue), 3-arm star (red) and hyperbranched (black) poly(sodium acrylate) using free solution capillary electrophoresis³

RESEARCH STUDENTS

Students who completed their project during 2012 are marked with an asterisk.

Name	Degree	Commenced	Thesis Title	Supervisors
Aemi Syazwani Abdul Keyon	PhD	2011	Portable analytical technology for on-site determination of phytotoxins and pollutants in water	MC Breadmore, RM Guijt, C Bolch
Ala Alhusban	PhD	2012	Sequential injection capillary electrophoresis (SI-CE) for on-line monitoring of organic acids in bioprocesses	RM Guijt, MC Breadmore, N Güven
Sharon Betwich	Honours	2012	Characterisation and cellular effect of smart polymers for anticancer drug delivery	P Castignolles, M Jones, M Gaborieau
Michelle Camenzuli	PhD	2010	Advances in HPLC volume technology	RA Shalliker, GR Dennis
Esme Candish	PhD	2011	Novel polymeric monolithic devices to aid sample preparation in bioanalysis	EF Hilder, RA Shellie, A Gooley
Tim Causon*	PhD	2009	High temperature liquid chromatography using organic polymer monoliths	EF Hilder, RA Shellie
Sung Tong Chin	PhD	2009	Multidimensional GC and MS approaches for odourants in wine and related products	PJ Marriott, G Eyres
Chris Desire*	Honours	2012	Synthesis and characterisation of monolithic materials with incorporated nanoparticles	EF Hilder, RD Arrua
Emer Duffy	PhD	2011	Development of centrifugal micro-fluidic disc (u-CD) platforms for automated analytical chemistry	B Paull, PN Nesterenko
Mari Egeness	PhD	2012	Modulation in two-dimensional liquid chromatography	RA Shellie, EF Hilder, HJ Cortes
Ross Farrell	PhD	2012	OPTIOAK – smelling the good in wood. Optimising oak aroma profiles for the wine through real-time aromatic grading and quality control	RA Shellie, MC Breadmore
Jessica Gathercole*	PhD	2007	Development of a pre-clinical diagnostic test for devil facial tumour disease	MC Breadmore, EF Hilder, RA Shellie
Adam Gaudry	PhD	2010	Detection and identification of homemade inorganic and organic improvised explosive devices	MC Breadmore, RM Guijt
Daniel Gstöettenmayr	PhD	2011	Development of a novel ultrasensitive capillary electrophoresis-mass spectrometry system for the analysis of environmental pollutants	MC Breadmore, JP Quirino
Paul Harvey*	PhD	2006	Development and application of multidimensional gas chromatography for quantitative monitoring of Antarctic and sub-Antarctic fuel spills	PR Haddad, RA Shellie, I Snape
Rowan Henderson*	PhD	2007	Revolutionising lab-on-a-chip using polymer electrodes	RM Guijt, MC Breadmore, EF Hilder, PR Haddad, W Lewis
William Henderson*	Honours	2011	Analysis of glass frictionators in 0.22 calibre ammunition	GW Dicinoski, AT Townsend
Ben Ho	Honours	2012	Assessing the impact of pharmaceuticals on stream ecosystems	PJ Marriott, M Grace
Shaghayegh Hossein	MSc	2011	Metallohelicates and their biological activity	J Aldrich-Wright, P Castignolles, M Gaborieau
Matthew Jacobs	PhD	2012	Multidimensional chromatography with resistively heated columns	RA Shellie, EF Hilder
Kara Johns*	PhD	2006	Consideration of capillary electrophoresis as an analysis technique for the therapeutic drug monitoring of antipsychotics	MC Breadmore, PR Haddad, R Bruno
Naama Karu*	PhD	2008	High performance ion-exchange chromatography for separation of organic ions	PR Haddad, GW Dicinoski
Nicha Kawila	PhD	2008	GC×GC analysis of the formation of the toxin acrylamide during processing of cereal grain foods	D Small, PJ Marriott
Manish Khandagale	PhD	2010	Non-discriminatory, universal and sensitive detection technologies for fluid based separation techniques in the pharmaceutical industry	GW Dicinoski, JP Hutchinson, PR Haddad

Name	Degree	Commenced	Thesis Title	Supervisors
Aminreza Khodabandeh	PhD	2012	Polymer nanoparticles and their supracolloidal monolithic structures for applications in separation science	EF Hilder, RD Arrua
Sunny Lee Sun Kim	PhD	2011	Development of absolute molecular configuration strategies based on multidimensional separation with spectroscopic methodologies	PJ Marriott, K Tuck
Danijela Kokic	PhD	2010	Ultra-high resolution separations of complex samples derived from biological matrices	RA Shalliker, GR Dennis
Thomas Lawson	PhD	2012	Characterisation of shell proteins and their application	B Paull, PN Nesterenko
Jim Luong	PhD	2011	Gas chromatographic applications and method developments with planar microfluidic devices	RA Shellie, HJ Cortes
Eamon McGuire	Honours	2012	Use of multidimensional gas chromatography technologies to detect illegal doping with beta-2 agonists in sport	PJ Marriott
Bussayarat Maikhunthod	PhD	2008	Herb and spice profiling by using GC×GC and MDGC methods	PJ Marriott, D Small
Alison Maniego	Honours	2012	Characterisation of smart polymers for anticancer drug delivery	P Castignolles, M Gaborieau, J Aldrich-Wright, Y Guillaneuf
Siti Umairah Mokhtar	PhD	2012	Development of routine approaches to high-resolution, fast chromatographic approaches for drug and metabolite assessment and profiling	PJ Marriott, O Drummer
Yi Heng (Ryan) Nai	PhD	2009	A new approach for characterisation of microbial communities	MC Breadmore, S Powell, M Manefield
Mitra Nouri Koupaei	MSc	2010	Towards a better understanding of uraemic molecules	EF Hilder, RA Shellie, M Jose
Yada Nolvachai	PhD	2012	Development of multidimensional GC and LC methods with mass spectrometry for analysis of flavonoids and related polyphenols in natural materials	PJ Marriott, M Hearne
James Oliver	PhD	2010	Novel substrates for bioethanol production	M Philipps, J Markham, P Peiris, P Castignolles
William Percy*	PhD	2009	Sodium transport and compartmentation in cereal crops under saline conditions	S Shabala, RM Guijt, MC Breadmore, J Bose
Anton Peristy	PhD	2011	Preparation and characterisation of diamond based stationary phases for ultra high performance liquid chromatography	PN Nesterenko, B Paull
Sui Ching Phung*	Honours	2012	Isotachopheresis of Cells	MC Breadmore, S Powell, M Macka
Samuel Poynter*	PhD	2007	Optimisation and application of pneumatic modulation techniques for comprehensive two-dimensional gas chromatography	PR Haddad, RA Shellie
Sercan Pravadali	PhD	2010	Analysis of complex samples using multidimensional separations and selective detection	RA Shalliker, GR Dennis, X Conlan
Tomas Remenyi*	PhD	2008	Quantifying dust deposition into the Southern Ocean using dissolved aluminium concentrations as a tracer	AR Bowie, PR Haddad, PN Nesterenko, ECV Butler
Kavitha Samykanno*	PhD	2008	Aroma profiling of strawberries using gas chromatography-olfactometry and comprehensive two-dimensional gas chromatography	E Pang, PJ Marriott
Benjamin Savareear	PhD	2010	Characterisation of plant extracts using high resolution gas chromatography	RA Shellie, EF Hilder

RESEARCH STUDENTS

Students who completed their project during 2012 are marked with an asterisk.

Name	Degree	Commenced	Thesis Title	Supervisors
David Schaller*	PhD	2005	Design and synthesis of monolithic and nanostructured stationary phases for chromatography	EF Hilder, PR Haddad, CJ Evenhuis
Aliaa Shallan	PhD	2011	Microchip methods for the separation of drugs and metabolites in biological and environmental samples	MC Breadmore, RM Guijt
David Shock	PhD	2008 (P/T)	Selectivity in separations	RA Shalliker, GR Dennis
Marie Sinoir	PhD	2009	Zinc as a co-limiting micronutrient: Its distribution and modelling regarding climate change (change in pCO ₂) in the Tasman Sea	AR Bowie, PN Nesterenko, ECV Butler, M Mongin, C Hassler
Arianne Soliven*	PhD	2008	In-situ modification of monolithic columns towards improved selectivity and faster separations	RA Shalliker, GR Dennis, EF Hilder, G Guiochon
Mohammad Talebi	PhD	2009	High performance ion-exchange stationary phases for biomolecules	EF Hilder, PR Haddad
Boon Kim Tan	PhD	2008	Profiling of the danshen herb by using LC/MS, LC-NMR and GC×GC/MS methods	E Pang, PJ Marriott, CG Li, S Urban
Joel Thevarajah	Honours	2012	Characterising chitosan conjugates to enable medical applications such as bioadhesives and stem-cell growth substrate	M Gaborieau, P Castignolles, C Lefay
Mark Thomas	PhD	2011	Synthesis of polymer nanoparticles by RAFT in miniemulsion	EF Hilder, R Jones
Michelle Toutounji	Honours	2012	Breakfast cereals: How much glucose does it release in our digestive system?	A Shrestha, P Castignolles, M Gaborieau
Mark Trudgett	PhD	2010	Advanced aspects of multidimensional HPLC	RA Shalliker, G Guiochon
Renee Webster	PhD	2012	Advanced molecular separation and characterisation techniques for trace oxidation and thermal degradation products of fuels	PJ Marriott, D Evans
Elizabeth Witthy	Honours	2012	Determination of cell viability and morphology after exposure to the "smart" polymer, poly(acrylic acid)	M Jones, P Castignolles, M Gaborieau
Grace Zeying Wu	PhD	2009	Comprehensive two-dimensional liquid chromatography of surfactants	PJ Marriott
Yiing Chiing Yap	PhD	2011	The microfluidic device: A novel in-vitro model of traumatic brain injury	T Dickson, MC Breadmore, A King, RM Guijt
Annie Xu Zeng	PhD	2012	Innovative chromatographic methods for fatty acids analysis in natural samples, biodiesels and related materials	PJ Marriott, A Patti

COLLABORATIONS & INDUSTRY LINKS

Collaborator	Institution/company
Mr R Minett, Mr D Tunks	Agilent Technologies, Australia
Dr R Ong, Ms HS Tan, Ms MM Tan	Agilent Technologies, Singapore
Mr G Lee, Mr C Myerholtz	Agilent Technologies, USA
Prof D Bertin, Dr D Gimes, Dr Y Guillaneuf, Dr C Lefay	Aix-Marseilles University, France
Mr G Hince, Dr M Riddle, Dr I Snape	Australian Antarctic Division, Tasmania
Mr C Frost, Mr B Jones	Australian Customs Service, Canberra
Dr P Kirkbride	Australian Federal Police, Canberra
Prof J Cooper-White	Australian Institute for Bioengineering and Nanotechnology, University of Queensland
Dr M Ellwood	Australian National University, Canberra
A/Prof A Horna	Bata University, Czech Republic
Dr P Sedwick	Bermuda Institute of Ocean Sciences, Bermuda
Prof JHT Luong	Biotechnology Research Institute, National Research Council, Canada
Dr H Bizzo	Brazilian Enterprise for Agricultural Research, Brazil
Prof M Linford	Brigham Young University, USA
Dr T Rodemann, Dr A Townsend	Central Science Laboratories, University of Tasmania
Prof S Blain	Centre d'Océanologie de Marseille, France
Prof RG Gilbert	Centre for Nutrition and Food Science, University of Queensland
Prof G Gas, Dr L Krcmova, Prof P Solich	Charles University, Czech Republic
Dr D de Tata	Chemistry Centre, Western Australia
Prof HK Choi	Chung-Ang University, Korea
Prof LC Wang	Chung Shiu University, Taiwan
Dr T McDaniel	Combating Terrorism Technical Support Office, Technical Support Working Group, Virginia, USA
Prof G Meira	CONICET and Universidad Nacional del Litoral, Argentina
Dr ECV Butler, Dr C Hassler, Dr C Mancuso-Nichols, Dr S Rintoul, A/Prof T Trull	CSIRO Marine and Atmospheric Research, Tasmania
Prof BC Lin, Prof GW Xu	Dalian Institute for Chemistry Physics, China
Dr J Adcock, Prof N Barnett, Dr X Conlan, Dr P Francis	Deakin University, Victoria
Dr D Evans, Mr P Rawson	Defence Science and Technology Organisation, Canberra
Dr HG Schmarr	Dienstleistungszentrum Ländlicher Raum – Rheinpfalz, Germany
Dr K Flook, Dr Y Liu, Mr D Moore, Mr CA Pohl, Dr J Schibler, Dr K Srinivasan	Dionex Corporation, California, USA
Dr W Winniford	Dow Chemical Company, USA
Dr M Cook, Dr P Pigou	Forensic Science Services, South Australia
Mr B Schlensky	eDAQ, Sydney
Dr M Boyce	Edith Cowan University, Western Australia
Dr M Manefield	Environmental Biotechnology Cooperative Research Centre, University of New South Wales
Prof Z Cardeal	Federal University of Minas Gerais, Brazil
Prof C Zini	Federal University of Rio Grande do Sul, Brazil
Dr W Landing	Florida State University, USA

COLLABORATIONS & INDUSTRY LINKS

Collaborator	Institution/company
Dr S Bieri	Food Authority, Geneva, Switzerland
Dr M Cook, Dr P Pigou	Forensic Science Services, South Australia
Prof G Desmet, Dr S Eeltink	Free University of Brussels, Belgium
Dr E Grosjean, Dr G Logan	Geoscience Australia, Canberra
Mr J Harcourt, Ms G de Plater, Mr M Smith	Grey Innovation, Victoria
Mr T Beaufort	Grinders P/L, Melbourne
Dr S Whittock	Hop Products Australia, Tasmania
Dr F Foret, Dr P Kuban	Institute of Analytical Chemistry, Academy of Sciences, Czech Republic
Prof AJ Cavaleheiro	Institute of Chemistry of the Sao Paulo State University, Brazil
Dr A Nikitin	Institute of Lasers, Russia
Dr D Brabazon, Dr D Connolly, Dr D Diamond, Dr B Kelleher, Dr EP Nesterenko, Prof A Stalcup	Irish Separation Science Cluster, Dublin City University, Ireland
Prof JD Glennon	Irish Separation Science Cluster, University College Cork, Ireland
Prof M Schmidt	Johannes Gutenberg University, Germany
Dr Ivo Nischang	Johannes Kepler University, Austria
Prof C Barner-Kowollik, Dr T Junkers	Karlsruhe Institute of Technology, Germany
Prof T Fornstedt	Karlstad University, Sweden
Dr R Borders	Kimberley-Clark, USA
Dr Y Sohrin	Kyoto University, Japan
Prof M Tanaka	Kyoto Institute of Technology, Japan
Dr A Tagliabue	Laboratoire des Sciences du Climat et de l'Environnement, France
Dr T Wagener	Laboratoire d'Océanographie de Villefranche, France
Dr N Nuchtavorn, Prof L Suntornsuk, Prof P Wilairat	Mahidol University, Thailand
Prof J Havel, Prof V Kanicky, Prof P Klan, A/Prof J Klanova	Masaryk University, Czech Republic
Prof R Kizek, Dr M Ryvolova	Mendel University, Czech Republic
Prof G Maliaras	Microelectronics Centre of Provence, École des Minés de Saint-Étienne, France
Prof F Svec	Molecular Foundry, Lawrence Berkeley National Laboratory, USA
Prof S Lanin	Moscow State University, Russia
Prof J Aldrich-Wright, Dr M Gaborieau	NANO Group, University of Western Sydney
Dr Francois Ganachaud	National Institute for Applied Sciences, France
Dr A Ross	National Institute for Forensic Science, Victoria
Dr P Boyd	National Institute of Water and Atmospheric research, New Zealand
Ms V Goodall, Ms A Lam	National Science, Security and Technology Unit of Prime Minister and Cabinet, Canberra
Prof M Gomes da Silva, Dr E Mateus, Prof A Ribeiro	New University of Lisbon, Portugal
Mr M Pedler	Office of Transport Security, Canberra
Dr R Bemish, Mr O Drap, Dr W Farrell, Dr P Ferguson, Dr E Groeber, Dr M Hanna-Brown, Dr N Lacher, Dr R Robins, Mr K Saunders, Dr R Szucs, Dr J Wang, Dr B Zhang	Pfizer
A/Prof H Hügel, Dr CG Li, Dr E Pang	RMIT University, Melbourne

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A/Prof S Shabala	School of Agricultural Science, University of Tasmania
Prof AJ Canty, Dr TW Lewis, Dr AJ Seen, Dr JA Smith	School of Chemistry, University of Tasmania
Dr GA Jacobson, Dr C Narkowicz	School of Pharmacy, University of Tasmania
A/Prof A Koutoulis	School of Plant Science, University of Tasmania
Dr M Jones	School of Zoology, University of Tasmania
Dr P Dawes, Dr A Gooley	SGE Analytical Science, Victoria
Mr M Buchanan, Mr R Prasad, Mr G Sidisky	Sigma Aldrich, Australia and USA
A/Prof S Battaglene, Dr Q Fitzgibbon	Tasmanian Aquaculture and Fisheries Institute, University of Tasmania
Insp J Cooper	Tasmanian Police, Australia
Dr T Edge, Dr H Ritchie	ThermoScientific, England
Prof JM Lin	Tsinghua University, China
Dr R Fieldhouse	UniQuest, Queensland
Dr V Schoemann	Université Libre de Bruxelles, Belgium
Mr GA Blanco-Heras, Prof P Lopez-Mahia	University of A Coruña, Spain
Dr J Harynuk	University of Alberta, Canada
Prof P Hauser	University of Basel, Switzerland
Prof W Thormann	University of Bern, Switzerland
Prof D Chen	University of British Columbia, Canada
Dr J Dias, Prof L Kubota	University of Campinas, Brazil
Prof C Lennard	University of Canberra, Australia
Dr J Mosely	University of Durham, England
Dr C von Meuhlen	University of Feevale, Brazil
Prof S Haswell	University of Hull, England
Prof G Dugo, Prof P Dugo, Prof L Mondello, Dr P Tranchida	University of Messina, Italy
Prof U Karst, Dr S Nowak	University of Münster, Germany
Prof M Destarac	University Paul Sabatier, France
Prof A Felinger	University of Pécs, Hungary
Dr M Lohan, Prof P Jones, Prof P Worsfold, Dr S Ussher	University of Plymouth, England
Prof J Corredor	University of Puerto Rico, Puerto Rico
Dr I Kempson	University of South Australia, Australia
Prof P Doble	University of Technology, Sydney
Dr F Gritti, Prof G Guiochon	University of Tennessee, USA
Prof B Mizaikoff	University of Ulm, Germany
Prof G Wallace	University of Wollongong, New South Wales
Prof O Schmitz	University of Wuppertal, Germany
Mr R Hayes, Mr J Kelleher, Mr J Pearson	Victorian Police, Australia
Dr F Dehairs	Vrije Universiteit Brussel, Belgium
Prof CF Ivory	Washington State University, USA
Dr S Smith	Waters Corporation, England
Dr P Lam	Woods Hole Oceanographic Institute, USA

PUBLICATIONS

Books and book chapters

L Kim, PJ Marriott. Preparative gas chromatography, in *Gas Chromatography*. C Poole (Ed), Elsevier, Oxford, England, 2012, 395-414.

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MC Breadmore, HY Kwan, J Caslavská, W Thormann. Dynamic high-resolution computer simulation of electrophoretic enantiomer separations with neutral cyclodextrins as chiral selectors. *Electrophoresis*. 33 (2012) 958-969.

M Camenzuli, T Goodie, D Bassanese, P Francis, N Barnett, HJ Ritchie, J LaDine, RA Shalliker. The use of parallel segmented outlet flow columns for enhanced mass spectral sensitivity at high chromatographic flow rates. *Rapid Commun. Mass Spectrom.* 26 (2012) 943-949.

M Camenzuli, HJ Ritchie, J LaDine, RA Shalliker. Active flow management in preparative chromatographic separations: A preliminary investigation into enhanced separation using a curtain flow inlet fitting and segmented flow outlet fitting. *J. Sep. Sci.* 35 (2012) 410-415.

M Camenzuli, HJ Ritchie, J LaDine, RA Shalliker. Enhanced separation performance using a new column technology: Parallel segmented outlet flow. *J. Chromatogr. A*. 1232 (2012) 47-51.

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E Candish, A Gooley, H Wirth, P Dawes, RA Shellie, EF Hilder. A simplified approach to direct SPE-MS. *J. Sep. Sci.* 35 (2012) 2399-2406.

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- CS Milroy, GR Dennis, RA Shalliker. Targeted isolations from complex samples using two-dimension HPLC. Part 1: Analytical scale analysis. *J. Liq. Chromatogr. Relat. Technol.* 35 (2012) 1481-1496.
- CS Milroy, GR Dennis, RA Shalliker. Targeted isolations from complex samples using two-dimensional HPLC. Part 2: A semi-continuous heart cutting mode. *J. Liq. Chromatogr. Relat. Technol.* 35 (2012) 1921-1932.
- B Mitrevski, PJ Marriott. A novel hybrid comprehensive 2D - multidimensional gas chromatography for precise, high resolution characterisation of multicomponent samples. *Anal. Chem.* 84 (2012) 4837-4843.
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JP Quirino, AT Aranas. On-line sample concentration via micelle to solvent stacking of cations prepared with aqueous organic solvents in capillary electrophoresis. *Electrophoresis*. 33 (2012) 2167-2175.

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M Sinoir, ECV Butler, AR Bowie, M Mongin, PN Nesterenko, CS Hassler. Zinc marine biogeochemistry in seawater: A review. *Mar. Freshwater Res.* 63 (2012) 644-657.

P Smejkal, MC Breadmore, RM Guijt, F Foret, F Bek, M Macka. Isotachopheresis on a chip with indirect fluorescence detection as a field deployable system for analysis of carboxylic acids. *Electrophoresis*. 33 (2012) 3166-3172.

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CA Trickett, RD Henderson, RM Guijt, MC Breadmore. Electric field gradient focusing using a variable width polyaniline electrode. *Electrophoresis*. 33 (2012) 3254-3258.

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Other publications

Plenary, keynote and invited conference presentations

MC Breadmore. Pre- and post-blast detection of inorganic explosives by electrophoresis. Invited lecture presented at *4th Trace Explosives Detection Workshop (TED 2012)*, Massachusetts, USA, 16-20 April 2012.

MC Breadmore. Simple and sensitive electrophoretic methods for the detection of pharmaceuticals in biological fluids. Invited plenary lecture presented at *Latin-American Symposium on Biotechnology, Biomedical, Biopharmaceutical and Industrial Applications of Capillary Electrophoresis (LACE 2012)*, Buenos Aires, Argentina, 30 November – 4 December 2012.

MC Breadmore. Stacking and sweeping: Why and how. Invited oral presentation at *2nd International Workshop of Capillary Electrophoresis and Microchip Technology*, Sao Paulo, Brazil, 27-28 November 2012.

MC Breadmore, A Gaspar, M Kaykhahi. Ionic liquid extraction of pharmaceuticals for CE and CE-MS. Invited lecture presented at *28th International Symposium on MicroScale Bioseparations and Analyses (MSB 2012)*, Shanghai, China, 21-24 October 2012.

M Camenzuli, JR LaDine, RA Shalliker. Enhanced separation performance using a new column technology. Invited lecture presented at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

M Camenzuli, H Ritchie, J LaDine, RA Shalliker. Multiplexed detection using a new column technology. Invited lecture presented at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

E Candish, PA Dawes, HJ Wirth, A Gooley, RA Shellie, EF Hilder. Rapid sample preparation protocols using microextraction by packed sorbent. Invited lecture presented at *14th International Symposium on Advances in Extraction Technologies (ExTech 2012)*, Messina, Italy, 24-26 September 2012.

P Castignolles, M Mnatsakanyan, P Guiglion, R Roi, A Medina-Oliva, J Thevarajah, D Taylor, J Bulanadi, C Ferris, M in het Panhuis, M Destarac, F Ganachaud, C Jones, M Schmidt, A Lauto, M Gaborieau. Separation of copolymers, conjugates and supramolecular architectures of polysaccharides, thermoresponsive and pH-responsive polymers by capillary electrophoresis in the critical conditions. Invited oral presentation at *33rd Australasian Polymer Symposium (33APS)*, Hobart, Australia, 12-15 February 2012.

D Collins, EP Nesterenko, PN Nesterenko, D Brabazon, B Paull. Controlled UV photo-initiated fabrication of monolithic porous layer open tubular (monoPLOT) capillary columns for chromatography applications. Keynote lecture presented at *9th Analytics of Siberia and the Far East (ASFE 2012)*, Krasnoyarsk, Russia, 8-13 October 2012.

GW Dicinoski. Development of rapid chromatographic systems for the screening of improvised explosives. Invited speaker at *Separation Science Asia 2012*, Kuala Lumpur, Malaysia, 27-28 June 2012.

A Gaudry, D Gstoettenmayr, P Zakaria, SC Phung, RM Guijt, CS VanDeGriend, JP Quirino, M Macka, GW Dicinoski, PR Haddad, **MC Breadmore**. Design and applications of sequential injection – capillary electrophoresis systems. Keynote lecture presented at *International Symposium, Exhibit and Workshops on Electro- and Liquid Phase-separation Techniques (ITP 2012)*, Maryland, USA, 30 September – 3 October 2012.

PR Haddad. Pharmaceutical analysis by ion chromatography with universal detection. Invited speaker at *Separation Science Asia 2012*, Kuala Lumpur, Malaysia, 27-28 June 2012.

PR Haddad. Recent developments in ion chromatography. Keynote lecture presented at *Analytix 2012*, Beijing, China, 23-25 March 2012.

PR Haddad, GW Dicinoski, N Karu, M Hanna-Brown, JP Hutchinson. Pharmaceutical analysis by ion chromatography with universal detection. Invited lecture presented at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

PR Haddad, GW Dicinoski, N Karu, JP Hutchinson, M Hanna-Brown, R Szucs, CA Pohl, K Srinivasan. Approaches to universal detection in pharmaceutical analysis. Invited lecture presented at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

PR Haddad, GW Dicinoski, RA Shellie, EF Hilder, N Karu, M Hanna-Brown. New developments in ion chromatography. Invited plenary lecture at *International Symposium, Exhibit and Workshops on Electro- and Liquid Phase-separation Techniques (ITP 2012)*, Maryland, USA, 30 September – 3 October 2012.

EF Hilder. Monolithic materials for automated sample preparation. Keynote lecture presented at *2nd International Symposium on Hyphenated Techniques for Sample Preparation (HTSP-2)*, Bruges, Belgium, 31 January – 3 February 2012.

EF Hilder, RD Arrua, C Desire, SH Rogers, PR Haddad. Nanoparticle-modified monolithic columns for liquid chromatography. Invited plenary lecture presented at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

EF Hilder, RD Arrua, M Thomas, PR Haddad, R Jones. Macroporous monolithic polymers containing embedded nanoparticles for high performance chromatography, sample preparation and catalysis. Invited keynote lecture presented at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

EF Hilder, WB Hon, E Candish, PR Haddad, A Nordborg. Monolithic materials for sampling and sample preparation. Invited lecture presented at *28th International Symposium on Microscale Bioseparations*, Shanghai, China, 21-24 October 2012.

C Johns, JP Hutchinson, MC Breadmore, EF Hilder, RM Guijt, PN Nesterenko, **PR Haddad**, GW Dicinoski. Development of capillary electrophoretic methods and instrumentation for the analysis of explosives. Invited lecture presented at *International Symposium, Exhibit and Workshops on Electro- and Liquid Phase-separation Techniques (ITP 2012)*, Maryland, USA, 30 September – 3 October 2012.

PJ Marriott. Food flavours and composition – advanced methods of analysis based on gas chromatography. Invited speaker at *Separation Science Asia 2012*, Kuala Lumpur, Malaysia, 27-28 June 2012.

PJ Marriott. How much modulation is enough? Novel systems and designs in MDGC and GCxGC. State-of-the-art lecture presented at the joint congress of *12th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analysers (HTC-12)* and *2nd International Symposium on Hyphenated Techniques for Sample Preparation (HTSP-2)*, Bruges, Belgium, 31 January – 3 February 2012.

PJ Marriott. Opening up new frontiers to separation and spectroscopic sciences. Invited plenary lecture presented at *Total Agilent Experience Symposium 2012*, Jakarta, Indonesia, 28 Feb 2012.

PJ Marriott. Opening up new frontiers to separation and spectroscopic sciences. Invited plenary lecture presented at *Total Agilent Experience Symposium 2012*, Ho Chi Minh City, Vietnam, 1 March 2012.

PJ Marriott, W Khummueng, BS Mitrevski, E Engel. Generally-applicable advanced analytical separation methods for multicomponent chemical toxicant analyses. Invited lecture presented at *Dioxin 2012 Conference*, Cairns, Australia, 26-31 August 2012.

PJ Marriott, BS Mitrevski. A new, hybrid GCxGC-MDGC method: An analytical approach to increased separation power. Invited lecture presented at *12th Asia-Pacific International Symposium on Microscale Separation and Analysis (APCE 2012)*, Singapore, Singapore, 16-19 December 2012.

PJ Marriott, BS Mitrevski. Development of a hybrid GCxGC-MDGC method: A powerful generic approach to target analysis and increased separation power. Invited oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

PJ Marriott, BS Mitrevski, R Webster, P Rawson, D Evans. Methods for separation of oxygenated degradation compound analysis in algae-derived biofuels by using GCxGC methodologies. Award lecture presented at *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

A Moyna, EP Nesterenko, D Connolly, PN Nesterenko, **B Paull**. Capillary chelation ion chromatography using functionalised monolithic polymers. Invited oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

YH Nai, ML Gutierrez-Zamora, O Zemb, M Manefield, S Powell, **MC Breadmore**. New CE approaches for characterisation of microbial communities. Invited lecture presented at *2nd International Workshop of Capillary Electrophoresis and Microchip Technology*, Sao Paulo, Brazil, 27-28 November 2012.

EP Nesterenko, B Paull, PN Nesterenko. Fast direct determination of strontium in seawater using high-performance chelation ion chromatography. Invited oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

PN Nesterenko. Highly effective chromatography of metal ions: Current state and prospects. Plenary presentation at *9th Analytics of Siberia and the Far East (ASFE 2012)*, Krasnoyarsk, Russia, 8-13 October 2012.

B Paull, D Connolly, EP Nesterenko, D Collins, S Currivan, A Moyna, X He, P Floris, H Alwael, PN Nesterenko, D Mitev, E Duffy. Polymeric monolithic materials and liquid chromatography. Invited oral presentation at *European Lab Automation, Separation and Detection*, Hamburg, Germany, 30-31 May 2012.

PUBLICATIONS

B Paull, PN Nesterenko, D Connolly, EP Nesterenko, H Alwael, D Collins, A Peristyy, E Duffy, X He. Application of metallic and carbonaceous nano-particle modified phases in micro-extraction and liquid chromatography. Invited keynote lecture presented at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

B Paull, PN Nesterenko, X He, EP Nesterenko, D Mitev, E Duffy. Carbonaceous nano-particles in separation science. Invited oral paper presented at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

JP Quirino. Approaches to high sensitivity analysis in capillary electrophoresis. Invited keynote lecture presented at *Asia-Pacific Conference on Analytical Science 2012*, Manila, Philippines, 11-13 April 2012.

JP Quirino. Online pre-concentration in capillary electrophoresis: Current state and future trends. Invited keynote lecture presented at *17th Malaysian Chemical Congress (MCC 2012)*, Kuala Lumpur, Malaysia, 15-17 October 2012.

RA Shalliker, M Camenzuli, H Ritchie, J LaDine. High efficiency HPLC-MS using parallel segmented flow chromatography columns. Invited lecture presented at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

RA Shellie. Comprehensive multidimensional gas chromatography with resistively heated capillary columns. Invited speaker at *Separation Science Asia 2012*, Kuala Lumpur, Malaysia, 27-28 June 2012.

RA Shellie. Towards a field-deployable multidimensional gas chromatograph. State-of-the-art lecture presented at *12th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analysers (HTC-12)*, Bruges, Belgium, 31 January – 3 February 2012.

P Smejkal, M Ryvolová, N Nuchtachvorn, MC Breadmore, F Foret, RM Guijt, L Suntornsuk, R Kizek, F Bek, **M Macka**. Research-flexible vs. commercial fixed purpose microfluidic platforms: Can we have the best of both worlds in field deployable chip-based electrodriven analysis? Invited speaker at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

P Smejkal, M Ryvolová, N Nuchtachvorn, MC Breadmore, F Foret, RM Guijt, L Suntornsuk, R Kizek, F Bek, **M Macka**. The potential of chip-based electroseparation bioanalysis: Electrophoresis and isotachopheresis with fluorescence detection using a field-deployable platform. Invited speaker at *12th International Nutrition and Diagnostics Conference (INDC 2012)*, Prague, Czech Republic, 27-30 August 2012.

YC Yap, T Dickson, A King, MC Breadmore, **RM Guijt**. Lab on a Chip for studying neuronal degeneration. Invited lecture presented at *3rd Australian and New Zealand Micro/Nanofluidics and Bionano Symposium (ANZ MNF 2012)*, Wellington, New Zealand, 12-13 April 2012.

Other conference presentations

AS Abdul Keyon, MC Breadmore, RM Guijt, CJ Bolch. Capillary electrophoresis for saxitoxins and analogues: Comparison of detection methods. Poster presentation at *28th International Symposium on MicroScale Bioseparations and Analyses (MSB 2012)*, Shanghai, China, 21-24 October 2012.

AA Alhusban, N Gueven, MC Breadmore, RM Guijt. Online organic acids characterisation and monitoring from bioprocess using sequential injection capillary electrophoresis. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

AT Aranas, AM Guidote Jr, JP Quirino. Simultaneous electrokinetic and hydrodynamic injection of organic cations with on-line sample concentration via micelle to solvent stacking in micellar electrokinetic chromatography. Poster presentation at *Asia-Pacific Conference on Analytical Science 2012*, Manila, Philippines, 11-13 April 2012.

RD Arrua, PR Haddad, EF Hilder. Monolithic cryostructures containing charged nanoparticles for mixed-mode chromatography of biomolecules. Oral presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

RD Arrua, RC Jones, PR Haddad, EF Hilder. Synthesis of macroporous monolithic polymers containing embedded nanoparticles with different functionality. Poster presentation at *33rd Australasian Polymer Symposium (33APS)*, Hobart, Australia, 12-15 February 2012.

DN Bassanese, A Soliven, GR Dennis, NW Barnett, XA Conlan, RA Shalliker, PG Stevenson. Investigating surface coverage of a mixed mode monolithic column using multi-location peak parking. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

S Bieri, Y Janin, B Debrus, S Rudaz, PJ Marriott, A Bugey. Enantioselective GCxGC-TOFMS for the detection of adulterated fruit spirits with synthetic aroma. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

MW Burgess, **P Castignolles**, J Aldrich-Wright, MD Temple. Analysis of platinum-based drug/DNA complexes by capillary electrophoresis. Poster presentation at the *24th Lorne Cancer Conference*, Lorne, Australia, 9-11 February 2012.

D Caldarola, PN Nesterenko, B Onida. Surface modification of silica based monolith with glyphosate for fast ion chromatography. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

M Camenzuli, HJ Ritchie, J LaDine, RA Shalliker. Enhanced separation performance using segmented parallel flow technology. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

M Camenzuli, HJ Ritchie, RA Shalliker. High speed screening of natural products using high performance liquid chromatography with multiplexed detection. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

M Camenzuli, HJ Ritchie, RA Shalliker. Using parallel segmented flow chromatography columns in gradient elution. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

T Causon, HJ Cortes, RA Shellie, EF Hilder. Rapid temperature pulsing for controlling resolution in capillary liquid chromatography. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

T Causon, HJ Cortes, RA Shellie, **EF Hilder**. Rapid temperature pulsing for manipulating resolution in capillary liquid chromatography. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

ST Chin, GT Eyres, PJ Marriott. Better sniffing – a story of high-resolution wine aroma analysis. Oral presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

ST Chin, GT Eyres, PJ Marriott. Cumulative SPME sampling coupled to GCxGC-mass spectrometry for wine volatile analysis. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

DA Collins, EP Nesterenko, D Brabazon, B Paull. Controlled UV photo-initiated fabrication of monolithic porous layer open tubular (monoPLOT) capillary columns for chromatographic applications. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

DA Collins, EP Nesterenko, D Brabazon, B Paull. Fabrication and evaluation of ion-exchange monoPLOT columns. Poster presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

DA Collins, EP Nesterenko, D Brabazon, B Paull. Novel tools for polymer monolithic capillary column production and chromatographic application. Oral paper presented at *Analytical Research Forum 2012*, Durham, United Kingdom, 2-4 July 2012.

HJ Cortes, T Causon, RA Shellie, EF Hilder. New approaches and advances in the use of temperature for resolution improvement in capillary liquid chromatography. Oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

C Desire, D Arrua, M Talebi, EF Hilder. Separation and characterisation of human immunoglobulin G variants utilising a poly(ethylene glycol)-based monolithic column. Oral presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

GW Dicoski. Application of 2D and 3D capillary ion chromatography for bromated analysis in sea water matrices. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

GW Dicoski, PR Haddad, RA Shellie, BK Ng, CA Pohl, Y Liu. Computer-assisted method development in capillary ion chromatography. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

GW Dicoski, P Zakaria, C Bloomfield, S Battaglene, Q Fitzgibbon, PR Haddad. Two and three dimensional capillary IC methods for the analysis of bromated in a complex matrix. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

GW Dicoski, P Zakaria, PR Haddad. Application of 2D and 3D capillary ion chromatography for trace analysis. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

GW Dicoski, P Zakaria, RA Shellie, PR Haddad. Multidimensional methods for the analysis of bromated. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

MJ Egeness, RA Shellie, H Cortes, EF Hilder. Comprehensive two-dimensional liquid chromatography for the separation of organic acids. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

E Engel, J Ratel, W Khummueng, S-T Chin, G Rose, PJ Marriott. Benchmarking of selective and universal detectors for multiresidue analysis of pesticides in water by comprehensive two-dimensional gas chromatography. Oral presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

P Floris, M Iacono, A Heise, PN Nesterenko, B Paull, D Connolly. Modification of porous polymer monoliths with functional nanomaterials for applications in capillary ion chromatography. Poster presentation at *International Symposium on Functional Nanomaterials 2*, Dublin, Ireland, 6-7 September 2012.

P Floris, PN Nesterenko, B Paull, D Connolly. Development of nano-particle agglomerated polymer monoliths for capillary IC applications. Oral and poster presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

M Gaborieau, G Mangiante, J Bernard, A Charlot, E Fleury, J Thevarajah, RS Roi, M Mnatsakanyan, A Lauto, P Castignolles. Characterisation of polysaccharides for medical applications and bioplastics with solid-state NMR and capillary electrophoresis. Oral presentation at *33rd Australasian Polymer Symposium (33APS)*, Hobart, Australia, 12-15 February 2012.

M Gomes da Silva, EP Mateus, AB Ribeiro, N Couto, PJ Marriott. Characterisation of rice volatiles by comprehensive two dimensional gas chromatography. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

D Gstoettenmayr, MC Breadmore, JP Quirino. Development of a novel ultrasensitive capillary electrophoresis-mass spectrometry system for the analysis of environmental pollutants. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

RM Guijt. Metal-free lab on a chip electrophoresis device with integrated electrodes. Oral presentation at *Analytix 2012*, Beijing, China, 23-25 March 2012.

X He, EP Nesterenko, D Brabazon, PN Nesterenko, B Paull. Porous nano-templated carbon monolithic rods: Preparation and application as sorbents for solid-phase extraction. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

X He, EP Nesterenko, D Connolly, D Brabazon, PN Nesterenko, B Paull. A novel porous nano-templated carbon monolithic rod for solid-phase extraction of small polar organic compounds. Oral paper presented at *Analytical Research Forum 2012*, Durham, United Kingdom, 2-4 July 2012.

PUBLICATIONS

EF Hilder, D Arrua, ME Thomas, RC Jones, PR Haddad. Macroporous monolithic polymers containing embedded nanoparticles for high performance chromatography, sample preparation and catalysis. Oral presentation at *33rd Australasian Polymer Symposium (33APS)*, Hobart, Australia, 12-15 February 2012.

JP Hutchinson, A Gaudry, MC Breadmore, RM Guijt, C Johns, EF Hilder, PN Nesterenko, PR Haddad, GW Dicinoski. Development of microchip electrophoretic devices, methods and instrumentation for the analysis of explosives. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

MR Jacobs, EF Hilder, RA Shellie. Analysis of Antarctic petroleum spill sites by resistively heated gas chromatography. Oral presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

N Karu, NW Davies, RA Shellie, R Thomson, B McMorran, M Jose, WE Hoy, S Foote, EF Hilder. UHPLC-MS analyses for the elucidation of renal disease in Australian Aborigines. Poster presented at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

N Karu, GW Dicinoski, M Hanna-Brown, PR Haddad. Suppressed ion chromatography coupled to universal detectors for the analysis of pharmaceuticals. Poster presented at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

N Karu, JP Hutchinson, GW Dicinoski, M Hanna-Brown, K Srinivasan, CA Pohl, PR Haddad. Suppressed IC of weak organic acids with universal detection. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

AA Kazarian, MR Taylor, PR Haddad, PN Nesterenko, B Paull. Characterisation of mixed-mode phases for the comprehensive analysis (APIs, excipients and inorganic ions) of binary and ternary pharmaceutical preparations. Poster presented at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

AA Kazarian, MR Taylor, PR Haddad, PN Nesterenko, B Paull. Characterisation of mixed-mode phases for the comprehensive analysis (APIs, excipients and inorganic ions) of binary and ternary pharmaceutical preparations. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

L Kim, BS Mitrevski, PJ Marriott, K Tuck. A rational approach to quantitative preparative gas chromatography with nuclear magnetic resonance spectroscopy. Oral presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

C Kirkin, G Gunes, PJ Marriott. The influence of gamma irradiation and modified atmosphere packaging essential oil yield of various spices. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

R Knob, MC Breadmore, RM Guijt, M Macka. Plot monolith capillary columns for on-line preconcentration in capillary electrophoresis. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

R Knob, MC Breadmore, RM Guijt, J Petr, M Macka. Control of the polymerisation towards porous layer open tubular capillary columns. Oral presentation at *9th International Interdisciplinary Meeting on Bioanalysis (CECE 2012)*, Brno, Czech Republic, 1-2 November 2012.

D Kocic, M Camenzuli, HJ Ritchie, RA Shalliker. High through-put and high sensitivity LC-MS using segmented flow chromatography columns. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

D Kocic, HJ Ritchie, RA Shalliker. High through-put and high sensitivity LC-MS analysis of amino acids using segmented flow chromatography columns. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

K Kouremenos, A Johansson, A Fahlgren, H Antti, T Moritz, P Haglund, PJ Marriott, H Wolf-Watz, M Fallman. Comparative metabolic profiling of staphylococcus aureus using LC-QToFMS and GCxGC-ToFMS for potential biomarker identification. Poster presented at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

MR Linford, LA Wiest, CH Hung, LK Killpack, JM Christensen, GM Brown, RC Davis, R Vanfleet, MA Vail, AE Dadson, PN Nesterenko. Van't Hoff analysis in liquid chromatography applied to thermally stable materials. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

J Luong, R Gras, HJ Cortes, RA Shellie. Multi-dimensional gas chromatography with a planar microfluidic device for the characterisation of volatile oxygenated organic compounds. Oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

PJ Marriott, BS Mitrevski. Development of a hybrid GCxGC-MDGC method: A powerful generic approach to target analysis and increased separation power. Oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

N Martins, M Cabrita, R Garcia, M Gomes da Silva, E Mateus, PJ Marriott. One dimensional and comprehensive two-dimensional gas chromatography analysis of acacia and cherry wood chips with different toasting degrees. Poster presentation at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

EP Mateus, N Couto, MG Silva, AB Ribeiro, P Guedes, PJ Marriott. Characterisation of biogenic volatile emission of rice in a Portuguese paddy field by comprehensive two dimensional gas chromatography. Presented at *9th International Symposium on Environmental Geochemistry*, Aveiro, Portugal, 15-21 July 2012.

N McGillicuddy, EP Nesterenko, D Connolly, PN Nesterenko, J Omamogho, P Jones, JD Glennon, B Paull. Next generation silica based stationary phases for high performance chelation ion chromatography. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

E McGuire, BS Mitrevski, PJ Marriott. Use of multidimensional gas chromatography techniques to detect illegal doping with beta-2 agonists. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

BS Mitrevski, MW Amer, AL Chaffee, PJ Marriott. Evaluation of comprehensive two-dimensional gas chromatography with flame photometric detection: Potential application for sulphur speciation in shale oil. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

KP Naikwadi, J Luong, T Hayward, RA Shellie, HJ Cortes. Industrial applications with novel nano stationary phase GC capillary column technology. Poster presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

EP Nesterenko, D Collins, R Thompson, P Clarke, B O'Connor, D Brabazon, B Paull. MonoPLOT columns for micro-solid phase extraction and LC of proteins. Oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

EP Nesterenko, PN Nesterenko, D Collins, F Lacroix, B Paull. Polymeric monolithic porous stationary phase in titanium columns for high temperature spectrometry. Oral presentation at *9th Analytics of Siberia and the Far East (ASFE 2012)*, Krasnoyarsk, Russia, 8-13 October 2012.

EP Nesterenko, B Paull, PN Nesterenko. The express direct HPLC determination of strontium in seawater. Poster presented at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

PN Nesterenko, ON Fedyanina, B Paull, A Cirrus, D Mitev, E Duffy. Prospects and applications of diamond sorbents in chromatography. Oral presentation at *9th Analytics of Siberia and the Far East (ASFE 2012)*, Krasnoyarsk, Russia, 8-13 October 2012.

PN Nesterenko, EP Nesterenko, B Paull. New story about old thing: Hydrophobicity of ion-exchangers for ion chromatography. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

PN Nesterenko, EP Nesterenko, B Paull. The role of hydrophobic interactions in ion chromatography. Poster presented at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

Y Nolvachai, MTW Hearn, PJ Marriott. Molecularly imprinted polymer in tips for the extraction of flavonoids, with high resolution GC analysis. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

A Nosheen, **BS Mitrevski**, A Bano, PJ Marriott. Fast profiling of fatty acids of safflower oil by using comprehensive two-dimensional gas chromatography. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

J Oliver, M Phillips, M Williams, P Castignolles. Determination of monosaccharides from chemically hydrolysed polysaccharides for the biofuel industry. Oral presentation at *33rd Australasian Polymer Symposium (33APS)*, Hobart, Australia, 12-15 February 2012.

B Paull, PN Nesterenko. The application of nano-carbonaceous materials in separation science. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

SC Phung, YH Nai, M Macka, S Powell, MC Breadmore. Isotachopheresis of cells. Oral presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

S Pravadali, DN Bassanese, XA Conlan, PS Francis, ZM Smith, JM Terry, RA Shalliker. Selectivity in detection: The analysis of alkaloids and phenols using HPLC with mass spectral UV, and chemiluminescence detection. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

S Pravadali, DN Bassanese, XA Conlan, PS Francis, ZM Smith, JM Terry, RA Shalliker. Selectivity in detection: The analysis of alkaloids and phenols using HPLC with mass spectral, UV, and chemiluminescence detection. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

S Pravadali, M Camenzuli, H Ritchie, J LaDine, RA Shalliker. Parallel segmented flow chromatography columns for efficient two dimensional HPLC. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

HR Rabanes, AT Aranas, NL Benbow, JP Quirino. Synergistic effect of field enhanced sample injection on micelle to solvent stacking in capillary electrophoresis. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

S Sandron, B Kelleher, U Dañiljevičs, EP Nesterenko, B O'Connor, R Wilson, N Davies, D Connolly, PN Nesterenko, B Paull. Multidimensional and multimodal separation of DOM (dissolved organic matter) from sea and freshwater. Oral paper presented at *37th International Symposium on Environmental Analytical Chemistry (ISEAC-37)*, Antwerp, Belgium, 22-25 May 2012.

S Sandron, B Kelleher, EP Nesterenko, PN Nesterenko, B Paull. Application of multi-dimensional chromatography to the separation and identification of the components of dissolved organic matter (DOM). Oral presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

S Sandron, B Kelleher, EP Nesterenko, PN Nesterenko, B Paull. Application of multi-dimensional chromatography to the separation and identification of the components of dissolved organic matter (DOM). Oral presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

S Sandron, K Kelleher, EP Nesterenko, PN Nesterenko, B Paull. Application of off-line 2D chromatography to the isolation and identification of single components from dissolved organic matter (DOM). Poster presented at *29th International Symposium on Chromatography (ISC 2012)*, Toruń, Poland, 9-13 September 2012.

B Savareear, RA Shellie. Multiplexed dual-secondary column comprehensive two-dimensional gas chromatography. Poster presented at *Separation Science Asia 2012*, Kuala Lumpur, Malaysia, 27-28 June 2012.

B Savareear, RA Shellie. Multiplexed dual-secondary column comprehensive two-dimensional gas chromatography. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

AI Shallan, AJ Gaudry, RM Guijt, MC Breadmore. Integrated polydimethylsiloxane membrane for protein removal. Oral presentation at *3rd Australian and New Zealand Micro/Nanofluidics and Bionano Symposium (ANZ MNF 2012)*, Wellington, New Zealand, 12-13 April 2012.

AI Shallan, AJ Gaudry, RM Guijt, MC Breadmore. On-chip nanofilters for biological sample pre-treatment for electrophoretic analysis of small molecules in whole blood. Poster presentation at *28th International Symposium on Microscale Bioseparations and Analyses (MSB 2012)*, Shanghai, China, 21-24 October 2012.

PUBLICATIONS

AI Shallan, AJ Gaudry, RM Guijt, MC Breadmore. On-chip nanofilters for biological sample pre-treatment for electrophoretic analysis of small molecules in whole blood. Poster presentation at *Micro Total Analysis System (μ TAS 2012)*, Okinawa, Japan, 28 October – 1 November 2012.

RA Shalliker, M Camenzuli, H Ritchie, J LaDine. Improving two-dimensional peak capacity and separation efficiency with segmented flow chromatography columns. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

RA Shellie. Comprehensive multidimensional liquid chromatography (ICxRPLC). Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

RA Shellie, SS Brudin, MJ Egeness, C Johns, MC Breadmore, EF Hilder, PR Haddad. Determination of ions in complex mixtures by comprehensive two-dimensional separations. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

RA Shellie, B Savareear. A new twist on GCx2GC. Lecture presented at *9th GCxGC Symposium (GCxGC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

RA Shellie, SP Whittock, A Koutoulis. Varietal characterisation of hop (*Humulus lupulus* L.) using GC-MS analysis. Oral presentation at *3rd International Humulus Symposium (IHS 2012)*, Žatec, Czech Republic, 9-14 September.

P Smejkal, MC Breadmore, F Foret, RM Guijt, F Bek, **M Macka**. Research-flexible vs. commercial fixed-purpose microfluidic platforms: Can we have the best of both worlds in field deployable chip-based electrodriven microanalysis? Oral presentation at *3rd Australian and New Zealand Micro/Nanofluidics and Bionano Symposium (ANZ MNF 2012)*, Wellington, New Zealand, 12-13 April 2012.

P Smejkal, M Ryvolová, N Nuchtachvorn, MC Breadmore, F Foret, RM Guijt, L Suntornsuk, R Kizek, F Bek, **M Macka**. Chip-based electrophoresis and isotachophoresis with direct and indirect fluorescence detection using a field deployable platform. Oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

A Soliven, GR Dennis, G Guiochon, EF Hilder, RA Shalliker. Exploiting the speed and performance of analytical scale commercial silica monoliths through an in situ modification process. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

M Talebi, EF Hilder, PR Haddad, NA Lacher, Q Wang. Epoxy-based monolithic columns for capillary liquid chromatography of small and large molecules. Poster presentation at *38th International Symposium on High Performance Liquid Phase Separation Science and Related Techniques (HPLC 2012)*, California, USA, 16-21 June 2012.

DL Taylor, C Ferris, A Maniego, M in het Panhuis, M Gaborieau, P Castignolles. Characterisation of gellan gum by capillary electrophoresis. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

E Tyrrell, GW Dicinoski, EF Hilder, MC Breadmore, C Johns, JP Hutchinson, RM Guijt, PN Nesterenko, M Macka, CA Pohl, PR Haddad. Development of a chromatographic system for the identification of improvised explosive devices. Oral presentation at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

M Vazquez, R Padovani, E Duffy, R Gorkin, J Alvarado, FA Gomez, J Ducree, D Brabazon, B Paull. Novel strategy for integration of micro-extraction columns in centrifugal microfluidic platforms. Oral presentation at *36th International Symposium on Capillary Chromatography (ISCC 2012)*, Riva del Garda, Italy, 27 May – 1 June 2012.

RL Webster, DJ Evans, BS Mitrevski, PJ Marriott. Multidimensional gas chromatographic analysis of jet fuel oxidation products. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

LA Wiest, LK Killpack, DS Jensen, CH Hung, JM Christensen, RC Davis, MA Vail, PN Nesterenko, AE Dadson, MR Linford. New hydrophobic coatings on carbon spheres for the use in high temperature and extreme pH reversed phase HPLC. Oral presentation at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

YC Yap, TC Dickson, AE King, MC Breadmore, RM Guijt. Microfluidic culture platform for studying neuronal response to axonal stretch injury. Poster presentation at *28th International Symposium on Microscale Bioseparations and Analyses (MSB 2012)*, Shanghai, China, 21-24 October 2012.

YC Yap, TC Dickson, AE King, MC Breadmore, RM Guijt. Microfluidic culture platform for studying neuronal response to axonal stretch injury. Poster presented at *Micro Total Analysis System (μ TAS 2012)*, Okinawa, Japan, 28 October – 1 November 2012.

A Zatirakha, A Smolenkov, O Kuznetsova, A Pirogov, PN Nesterenko, O Shpigun. Novel functional groups for anion exchangers for ion chromatography. Poster presented at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

AX Zeng, ST Chin, PJ Marriott. Integrated multidimensional and comprehensive two-dimensional gas chromatography analysis of fatty acid methyl esters. Poster presentation at *20th Annual Research and Development Conference (R&D Topics 2012)*, Geelong, Australia, 11-14 December 2012.

Lectures to Universities and Companies

RD Arrua. Functionalisation of monolithic polymers using nanoparticles with different functionality. Seminar presented at Dionex-ThermoScientific, California, USA, 22 June 2012.

M Gaborieau, **P Castignolles**. Capillary electrophoresis of (thermo)responsive or branched (co)polymers: Polyelectrolytes and polysaccharides. Presentation at the Institute of Physical Chemistry, University of Mainz, Germany, January 2012.

M Gaborieau, **P Castignolles**. Toward the scientific design of bioplastics and biomaterials based on chitosan, starch and other polysaccharides. What do we learn from solid-state NMR and capillary electrophoresis? Seminar presented at École Nationale Supérieure des Ingénieurs en Arts Chimiques Et Technologiques, Toulouse, France, January 2012.

M Gaborieau, **P Castignolles**. Separation of beautiful polymers using SEC and capillary electrophoresis. Presentation at the Centre for Advanced Macromolecular Design (CAMD), University of New South Wales, Australia, August 2012.

PR Haddad. New horizons in ion chromatography. Lecture presented at Chromatography Forum of Delaware Valley, Philadelphia, USA, 14 June 2012.

EF Hilder. Nanostructured polymeric materials for applications in separation science. Invited seminar at CSIRO Clayton, Melbourne, Australia, 23 July 2012.

M Macka. Solid-state light sources in chemistry and science: Utilising the benefits of light emitting diodes and laser diodes as the light sources of the 21st century in chemical analysis, detection, fluorescence microscopy, visualisation, photochemistry and teaching. Innovation lecture presented at Masaryk University, Brno, Czech Republic, 3-5 September 2012.

PJ Marriott. Advanced GC methods for volatiles analysis in foods and flavours. Invited lecture at Istanbul Technical University, Istanbul, Turkey, 6 June 2012.

PJ Marriott. Developments in multidimensional GC analysis: MDGC, GC×GC and hybrid methods deliver exceptional separation power. Invited lecture at Monash University Malaysia Campus, Selangor, Malaysia, 29 June 2012.

PJ Marriott. Earth, wind, fire and water – chemistry, separation and discovery. Invited lecture at University of Melbourne, Victoria, Australia, 13 March 2012.

PJ Marriott. Earth, wind, fire and water with discovery, resolution and endeavour. (and Captain Cook's journey to Australia). Invited lecture at University of Wuppertal, Wuppertal, Germany, 6 February 2012.

PJ Marriott. Generally-applicable advanced analytical separation technology for chemical toxicant analyses. Invited seminar at Cheng Shiu University, Kaohsiung, Taiwan, 27 November 2012.

PJ Marriott. Generally-applicable advanced analytical separation technology for chemical toxicant analyses. Invited seminar at National Pingtung University, Tainan City, Taiwan, 27 November 2012.

PJ Marriott. Generally-applicable advanced analytical separation technology for chemical toxicant analyses. Invited seminar at Cheng Kung University, Taiwan 28 November 2012.

PJ Marriott. "Hot and cold" gas chromatography for molecular discovery. Invited lecture at South East University, Nanjing, China, 24 November 2012.

PJ Marriott. The development of advanced multidimensional and comprehensive two-dimensional methods in gas chromatography, with applications and spectrometric detection. European project; Unia Europejska: The development of interdisciplinary doctoral studies at the Gdansk University of Technology in Modern Technologies. Presented at Technical University of Gdansk, Poland, 9-16 April 2012.

PJ Marriott. Molecular discovery based on "hot and cold" gas chromatography. Invited lecture at School of Chemistry, University of Marburg, Germany, 7 February 2012.

PJ Marriott. Multidimensionality in gas chromatography: Discovery of molecular information for challenging samples. Presented at ExxonMobil Chemical Europe Inc, European Technology Centre, Brussels, Belgium, 30 January 2012.

PJ Marriott. Multidimensionality in gas chromatography: Discovery of molecular information for challenging samples. Invited seminar at Research Institute for Petroleum Processing, Beijing, China, 22 November 2012.

PJ Marriott. Opening new frontiers to separation and spectroscopic sciences. Invited seminar at Agilent China User's Group, Beijing, China, 21 November 2012.

PJ Marriott. Opening new frontiers to separation and spectroscopic sciences. Invited seminar at Agilent China User's Group, Shanghai, China, 23 November 2012.

PJ Marriott. Recent developments in solid phase microextraction and gas chromatography. Invited seminar on behalf of Sigma Aldrich, to Hills Laboratory, Hamilton, New Zealand, 20 August 2012.

PJ Marriott. Recent developments in solid phase microextraction and gas chromatography. Invited seminar on behalf of Sigma Aldrich, toASUREQual, Wellington, New Zealand, 22 August 2012.

D Mitev. Detonation nanodiamond – synthesis, properties, potential applications. Presentation at University of Wollongong, New South Wales, Australia, 8 June 2012.

B Paull. Production and characterisation of surface modified monolithic materials for separation science, electrochemistry and beyond. Invited seminar at Department of Chemistry, Curtin University, Perth, Australia, April 2012.

B Paull. Separation technology – past, present and future. Invited lecture at Royal Society of Tasmania, Launceston, Australia, 5 August 2012.

JP Quirino. Capillary electrophoresis. Seminar presented at University of San Carlos, Cebu, Philippines, 17 April 2012.

JP Quirino. High sensitivity analysis in capillary electrophoresis. Seminar presented at Ateneo de Manila University, Manila, Philippines, 20 April 2012.

RA Shalliker. Active flow management: A paradigm change in HPLC. Seminar presented at Pfizer, Stevenage, United Kingdom, 8 December 2012.

RA Shalliker. Active flow management. Seminar presented at University of the West of England, Bristol, United Kingdom, November 2012.

Workshops

GW Dicinowski. Introduction to modern ion chromatography. Short course presented at *24th International Ion Chromatography Symposium (IICS 2012)*, Berlin, Germany, 17-20 September 2012.

M Macka. Solid-state light sources: How to utilise the benefits of light emitting diodes and laser diodes as the light sources of the 21st century. Invited course presented at *Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon 2012)*, Florida, USA, 11-15 March 2012.

PJ Marriott. Making the most of multidimensional methods. Tutorial presented at *12th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analysers (HTC-12)*, Bruges, Belgium, 31 January – 3 February 2012.

PJ Marriott. Present state of the art in comprehensive GC×GC. Instruments and Applications. Workshop presented at the joint congress of *36th International Symposium on Capillary Chromatography (ISCC 2012)* and *9th GC×GC Symposium (GC×GC 2012)*, Riva del Garda, Italy, 26 May 2012.

RA Shellie. Enhanced peak capacity in ion chromatography by using gradient elution and multidimensional separations. Tutorial presented at *12th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analysers (HTC-12)*, Bruges, Belgium, 31 January – 3 February 2012.

Patents

D Collins, EP Nesterenko, B Heery, B Paull. Capillary column curing system. US patent 2012/03150023 A1, 13 December 2012.

D Collins, EP Nesterenko, B Heery, B Paull. Column heater. US patent 2012/0318782 A1, 20 December 2012.



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