

THE DNA OF INNOVATION: VOLUME V

NEW VOICES: NEW IMPACT

THE **DNA** OF INNOVATION: VOLUME V

NEW VOICES, NEW IMPACT

CONTENTS

06 Professor Patrick G Johnston
President and Vice-Chancellor
Foreword



08 Mr Scott Rutherford
Director of Research and Enterprise
Introduction
New Voices, New Impact



10 Dr Merav Amir
School of Geography, Archaeology and Palaeoecology
Crossing borders in cultural and political geography



12 Dr Miryam Arredondo-Arechavala
School of Mathematics and Physics
In a darkened room – the light of discovery



14 Dr Peter Boyd
School of Pharmacy
Bringing new engineering techniques to drug delivery



16 Dr Bronagh Byrne
School of Sociology, Social Policy and Social Work
Passionate champion of young people and disabled people



18 Dr Katrina Campbell
School of Biological Sciences
The diagnostic detective safeguarding our food supply



20 Dr Marilina Cesario
School of English
Fiery dragons, ancient texts and astrophysics



22 Dr Chris Colvin
Queen's Management School
Chasing the big economic stories from history



24 Dr Kieran Connell
School of History and Anthropology
History through the lens of everyday experience



26 Dr Gareth Conway
School of Electronics, Electrical Engineering and Computer Science
The digital bandage that's checking vital signs



28 Dr Victoria Coyle
School of Medicine, Dentistry and Biomedical Sciences
Leading a new study of physical activity and cancer survival



30 Dr Johnathan Dalzell
School of Biological Sciences
Turning the tables in the war against plant parasites



32 Dr Shane Donohue
School of Planning, Architecture and Civil Engineering
Earthworks, seismic waves and the impact of climate change



34 Dr Victoria Durrer
School of Creative Arts
Expanding the dialogue that will shape cultural policy



36 Dr Andrew Hamilton
School of Mechanical and Aerospace Engineering
Self-healing materials and the lessons from nature



38 Dr Ruth Hogg
School of Medicine, Dentistry and Biomedical Sciences
Images guiding us to a healthier tomorrow



40 Dr Isabel Hollis
Institute for Collaborative Research in the Humanities
Cultural memory: a journey towards understanding



42 Dr Tori Holmes
School of Modern Languages
Building bridges between Belfast and Brazil



44 Dr David Jess
School of Mathematics and Physics
Finding global benefits through solar imaging



46 Dr Heather Johnson
School of Politics, International Studies and Philosophy
The voice of the migrant and how to make it heard



48 Dr Karen Kerr
School of Education
Creating a new school for science in the great outdoors



50 Dr Iosif Kovras
Institute for the Study of Conflict Transformation and Social Justice
The economic crisis and the lessons not being learned



52 Dr Anna Krasnodembkaya
School of Medicine, Dentistry and Biomedical Sciences
Understanding stem cells and their impact in lung disease



54 Dr Fiona Lynn
School of Nursing and Midwifery
The ground-breaking survey on the maternity experience



56 Dr Panagiotis Manesiotis
School of Chemistry and Chemical Engineering
Recovering vital resources being lost through waste



58 Dr Simon McDade
School of Medicine, Dentistry and Biomedical Sciences
New strategies in cancer research from a next generation innovator



60 Dr Gillian Prue
School of Nursing and Midwifery
Helping people adjust to life during and after cancer



62 Dr Alex Schwartz
School of Law
Building new stability in post-conflict society



64 Dr Danielle Soban
School of Mechanical and Aerospace Engineering
The aerospace engineer adding value to design



66 Dr Malgorzata Swadzba-Kwasny
School of Chemistry and Chemical Engineering
Opening up new directions in green chemistry



68 Dr Laura Taylor
School of Psychology
The civic challenges for the generation born after peace



70 Dr Raj Singh Thakur
School of Pharmacy
Bringing comfort to patients in treatment of eye diseases



72 Dr Hans Vandierendonck
School of Electronics, Electrical Engineering and Computer Science
Big data and big challenges at the core of computer science



Note: The content features are listed in alphabetical order by the surname of the researchers
Interviews: Keith Baker
Photography: Queen's University Belfast Photographers
Design: Darragh Neely Design Works

This publication was produced by the KTP and Business Networks team in the Research and Enterprise Directorate, Queen's University Belfast: www.qub.ac.uk/home/ResearchandEnterprise Tel. +44 (0)28 9097 2568

FOREWORD



Professor Patrick G Johnston

This is an exciting time for research at Queen's. Our reputation has never been higher – and with good reason.

In REF 2014, which assessed the quality of research in the UK's higher education institutions, we were placed in the top eight universities for research intensity, with 76 per cent of our research activity rated as internationally excellent or world-leading.

That is an important acknowledgement of the outstanding work being carried out at Queen's and the impact being made across so many areas for the good of wider society.

New Voices, New Impact introduces us to an inspiring new generation who are adding to that success, opening up new pathways in research leadership. These talented men and women are in the early stages of their careers but they are already deeply engaged in work which is internationally important.

Some of them have been Queen's academics for a number of years, while others are more recent arrivals. All are making an impressive contribution

to the fulfilment of our University's ambitions – while at the same time they are learning from the achievements of our established world-leading research teams.

The 32 researchers who are profiled here come from all over the world. They work across international boundaries and academic disciplines on projects that have global and local benefit. They collaborate with other universities, with local companies and major industries, and with some of the world's leading research and philanthropic organisations.

Their work has the potential to change lives – not least their own, as they advance in their careers. I offer them my congratulations for what they are achieving and I thank them for their commitment to the growth of our University.

Professor Patrick G Johnston
President and Vice-Chancellor
Queen's University Belfast



“ The 32 researchers who are profiled here come from all over the world. They work across international boundaries and academic disciplines on projects that have global and local benefit... Their work has the potential to change lives. ”

NEW VOICES, NEW IMPACT



Mr Scott Rutherford

The profiles in this new volume in our *DNA of Innovation* series paint a picture of vision and ambition. They tell the story of inspiring new talent with exciting new ideas, emerging leaders building global careers, enhancing the reputation of their University through research of extraordinary diversity and impact.

These colleagues are working across disciplines, collaborating with other universities, with industries and institutions in the UK, Europe and around the world, advancing knowledge and helping to find answers to some of our greatest problems.

Research at Queen's is a truly international activity. We have more international staff now than at any time in our history. The researchers

in this publication are from the UK and Ireland, from right across Europe, as well as from Russia, the USA, Canada, Israel, India and Mexico.

They are making strides in the treatment of cancer and other diseases. They are involved in major population studies and clinical trials. They are driving forward advances in food security, supported by global philanthropic giants such as the Gates Foundation.

At home they are examining the effectiveness of maternity services and exploring new approaches to the teaching of science while their research is also adding to the debate about contemporary world problems like Greece and the euro and to geopolitical crises such as the rising migration numbers.

Initiatives such as *The DNA of Innovation* series, with **New Voices, New Impact** being the latest volume, and the awarding of the annual Vice-Chancellor's Research Prizes bring all of this work to wider public attention.

Research in every Faculty is securing our University's vision for excellence and impact. We are expanding our culture of research ambition; we are forming new Global Research Institutes to tackle global challenges; we are fostering a vibrant postgraduate and postdoctoral community, in particular enriching the environment of learning, research and innovation through our new Graduate School.

Underpinning all our research is its relevance to society. Research and innovation are a continuum: the needs of society drive the way we tackle our research as much as our research shapes what society needs. We are putting strategies in place to engage with the world beyond, to validate our ideas and accelerate the impact we create.

Vision 2020 – the vision for Queen's – is of a world-class university that supports outstanding students and staff, working in world-class facilities, conducting leading-edge education and research, focused on the needs of society.

New Voices, New Impact provides a vivid illustration of the progress being made to achieve that vision.

Mr Scott Rutherford
Director of Research and Enterprise

“ Underpinning all our research is its relevance to society. Research and innovation are a continuum: the needs of society drive the way we tackle our research as much as our research shapes what society needs. ”

“ I'm thinking about what it takes to get beyond a persistent post-conflict situation which still plays out in everyday life. ”



Dr Merav Amir
School of Geography,
Archaeology and Palaeoecology

CROSSING BORDERS IN CULTURAL AND POLITICAL GEOGRAPHY

Since arriving at Queen's, Dr Merav Amir has become established in a short time as an important new voice among the University's influential group of scholars engaged in research on conflict and post-conflict societies.

A lecturer in the School of Geography, Archaeology and Palaeoecology, she has also become a Senior Research Fellow at the Institute for the Study of Conflict Transformation and Social Justice (ISCTSJ) and is broadening the scope of her research through new projects and collaborations.

When she came to Belfast in 2013 she already had an international reputation. Her PhD at Tel Aviv University related to – 'the way in which borders come into play in regions where there are no normative border divisions. I looked at how border elements are played into spatial control in the Occupied Territories.

'I developed that to include questions of security and how it is associated with different types of technologies to manage populations identified as bearers of risk and how it reaches beyond conflict zones into more mundane, everyday environments.

'I'm also looking at activism, especially how the very physical embodiment of activists can intervene in the dynamics of power and how it sometimes has effects that haven't been conceived by the activists themselves or by the people they're engaging with.'

She is also examining where activism fails when the intentions and plans of activists go astray and she is looking at the way in which gender identities play a part in these interactions.

As someone involved with research of this nature, the prospect of working in Belfast had an appeal. 'There aren't strong parallels between Northern Ireland and Israel-Palestine but there are similarities – although the minute you try to interpret one conflict through a different one, you're at a loss.

'However, I find that people here have an understanding of the complexity that comes with conflict. It feels as if the conversation starts from a different level, simply because people have experienced conflict at first hand.

'But I'm now thinking about the concept of post-conflict, what it means and where we're headed and what it takes to get beyond a persistent post-conflict situation which still plays out in everyday life. We need to think about how we can really create a cohesive society.'

Her aim is to develop a project that examines different regions in different post-conflict stages, to enable not only collaborative work with Queen's colleagues but to provide a very broad perspective on conflict resolution.

With Dr Evi Chatzipanagiotidou, from the School of History and Anthropology, she has led an ISCTSJ Interdisciplinary Research Group with the theme of Reshaping Security in Conflict and Beyond – 'looking at security and conflict in the everyday.' The concluding conference involved a gathering of Queen's and international academics.

For the second year in a row she has also led the Political Concepts Workshop. This brings academics from around the world together with the aim to create a revised political lexicon to help us better understand the world in which we live and act, with the social sciences and the humanities at large making a significant contribution. This two-year project was chosen to be supported by the University's International Engagement Fund.

Merav acknowledges the support of several colleagues, among them Professor Hastings Donnan and former colleague Professor Peter Shirlow at the Institute and Professor David Livingstone and Dr Nuala Johnson at the School of Geography, Archaeology and Palaeoecology.

She says, 'There's something happening in Geography generally in the UK but particularly here. Elsewhere it's very conservative, bound within the limits of its own discipline. At Queen's, there's much more openness, it's much more diverse and I'm very happy to be able to do my research at Queen's.'

IN A DARKENED ROOM THE LIGHT OF DISCOVERY

When the famous physicist Dame Jocelyn Bell Burnell came back to her native Northern Ireland in spring 2014, it was to take part in a Queen's University event encouraging other women to follow in her footsteps.

Women in Physics – Ireland was a celebration of the achievements of women who study and work in this traditionally male-dominated discipline.

'Her talk was inspiring,' says Dr Miryam Arredondo-Arechavala, joint organiser of the event, which attracted young women from across the island, 70% of them A-level students. 'It opened their eyes to new possibilities, showed that they can really go places.'

Miryam herself is an outstanding example of someone doing just that. Her journey has taken her from Mexico, where she obtained her first degree – in materials

science engineering – to a PhD funded by the Mexican government at the University of New South Wales in Sydney, followed by a postdoctoral period at a Max Planck Institute in Germany on microstructure analysis.

It was when she was back home in Mexico that she learned about an interesting position coming up in Belfast. As a result, in 2012 she joined the Centre for Nanostructured Media at Queen's as a lecturer in materials microscopy, a post funded by global company FEI, world leaders in this field.

'I've been given the support to take electron microscopy further here at Queen's. It's the key tool in this new world of research where everything is at the nanoscale, getting smaller and smaller. To be able to fully understand physical phenomena at the atomic level is crucial.

'My senior colleagues in the Centre, people like Professor Marty Gregg who mentored me through my probation, have been just fantastic. They push you to achieve more and they keep you on the right track.'

Her work has led to joint funding worth more than €1m in a project involving Queen's, Tyndall National Institute in Cork and the Illinois Institute of Technology to find new ways of harnessing converted energy.

Working with a substance called gallium nitride, Miryam and fellow researchers are seeking to understand the material so that it can be used to convert high voltages to more manageable levels without high-energy losses.

For Miryam, collaboration is key. 'At Queen's I strongly believe that we all need to pull together if we are to be as excellent as we want to be. Recently, I've been successful in getting involved with colleagues in engineering and chemistry, for example, showing them how microscopy can help and the advantage of using different techniques.

'I have strong links with other international centres, such as in Toulouse, Eindhoven, Juelich and the national advanced microscopy facility in Daresbury, UK. If I can take projects to other facilities, working with the experts who have the

latest equipment, then I'm promoting Queen's and showing that we are competitive players.

'When students show an interest in doing a project with me, I always ask – how do you feel about sitting in the dark for hours on end, at a large microscope, trying to reveal the nature of materials magnified a million times?

'You may feel you are looking for a needle in a haystack, but being able to see what the world is made of, atom by atom, is just wonderful.'



Microscopy is the key tool in the new world of research... being able to understand physical phenomena at the atomic level is crucial.



Dr Miryam Arredondo-Arechavala
Centre for Nanostructured Media,
School of Mathematics and Physics

“ There is the potential for highly-personalised multi-drug delivery systems that were unimaginable 10 or 15 years ago. ”

BRINGING NEW ENGINEERING TECHNIQUES TO DRUG DELIVERY

In his office at Queen's School of Pharmacy, Dr Peter Boyd talks of drug delivery, dosage forms and subdermal implants. Given the setting, it is the kind of conversation you would expect – except Peter is a mechanical engineer. So what has led him to these surroundings?

The story begins with his PhD at Queen's which focused on carbon nanotubes and their incorporation into thermoplastics, 'so my background is very much on the processing side', Peter says. After graduation, he took up a post with the Ministry of Defence (MoD), 'but I quickly discovered there was a great disparity with the kind of research I was used to – much less of a hands-on approach. It was frustrating.'

Through the MoD he was seconded to projects with companies working with Queen's. 'At that point an opportunity was identified

within Pharmacy with Professor Karl Malcolm and Professor David Woolfson, Head of the School, who were looking for an engineer.

'Their background was in the development of vaginal rings, but they were interested in scaling their manufacture to a level similar to commercial-scale operations, using the same kind of techniques and equipment. That fitted me very well.

'Since then it's been a massive learning curve. Engineers aren't used to the terminology of pharmacy so I had to get to know a whole range of new theories and concepts. And Karl has learned a lot about processing and GMP – Good Manufacturing Practice.'

Bringing these disciplines together has had results. 'Once a proof of concept is developed, we can tech-transfer it to a company or clinical manufacturing organisation much more rapidly. A lot of laboratory-based processes are very manual and there can be human error so that when you move to these automated industrial processes, problems may be identified which

weren't apparent at the laboratory stage. The benefits of the equipment we've brought in and the capabilities we have means we're able to detect problems much more easily.'

And now there is 3D printing. 'With conventional plastic manufacturing you add drug into a thermoplastic and produce filament strand material which gets chopped up and put back into an injection moulder to produce the final dosage form. With 3D printing you take drug-loaded filament strand and build up an object in layers.'

Peter sees enormous potential in the technique. 'The convention has been to have large plants producing identical dosage forms on a massive scale and at a certain cost and also because there wasn't a way to tailor dosage to an individual. With 3D printing it should be possible for dosage forms to have various concentrations of drugs with tailorable release rates.'

His expertise has led to involvement in a number of related projects. He is funded by the

World Health Organisation to develop ways to measure adherence during clinical trials, that patients are using their vaginal rings. He sits on a Scientific Advisory Panel for the Population Council in New York's vaginal rings programmes.

'Their aim is to bring contraceptive methods to the developing world and one of their main strategies is the vaginal ring. We're helping them to look at ways to manufacture rings most cost-effectively.'

To take his own ideas further, Peter has secured funding through the Medical Research Council Confidence in Concept scheme designed to help accelerate the transition from discovery science to early stage development.

'I'm focused on developing a platform technology which could have many applications but my particular interest would be implants for localised drug delivery. There's a large body of research that needs to be done but there is the potential for highly-personalised multi-drug delivery systems that were simply unimaginable 10 or 15 years ago.'

PASSIONATE CHAMPION OF YOUNG PEOPLE AND DISABLED PEOPLE

When Dr Bronagh Byrne was 17, she took part in an event at Queen's for young deaf people. It was organised by Mary McAleese, at the time an academic in the School of Law, whose brother is deaf.

The main speaker was Professor Michael Schwartz from Syracuse University New York. 'He was the first deaf professional I ever met,' Bronagh says. 'Being deaf myself, I'd been wondering if I was good enough to go to university. Listening to Michael was an inspiring moment.'

Years later, their paths have crossed again. Bronagh is now a lecturer in Social Policy at Queen's where Michael has been Visiting Professor, a Fulbright Scholar (January-July 2015). And they have collaborated on a research project examining access to healthcare for deaf people in Northern Ireland.

Bronagh's portfolio focuses on the themes of disability rights and children's

rights. These are more than research interests – they are her passion.

Graduating in Economics at Queen's in 2000 she spent a year with the Royal National Institute for Deaf People. 'That really triggered my enthusiasm – the idea that you could effect change and make an impact based on research and real-life experiences.'

She went back to Queen's for a PhD at the School of Sociology, Social Policy and Social Work, then joined Disability Action, becoming involved in lobbying the UK to ratify and sign up to the UN Convention on the Rights of Persons with Disabilities.

She returned to Queen's – to the School of Education – as a Children's Rights Research Fellow, also finding time for a Masters in Human Rights Law and beginning a long-standing professional relationship with Professor Laura Lundy 'who continues to inspire me.'

In 2010 they were commissioned by the NI Commissioner for Children and Young

People (NICCY) to look at barriers to effective government delivery for children. A second project, funded by ESRC, examined what children's rights legislation would look like if implemented in Northern Ireland.

'One of the recommendations we made was for Government departments to have a statutory duty to co-operate with each other. Now a Children's Services Cooperation Bill is making its way through the Assembly, partly informed by our research, and we're following that by looking at best practice in other jurisdictions which NICCY are hoping to use to inform the development of the Bill.'

And then there is disability research. In 2012, when Bronagh applied for her current post, 'one of the things I said at interview was that there should be a hub where different people engaged in disability research across the University could come together to identify research gaps and work together to influence public policy.'

That aspiration is now a reality. The Disability

Research Network at Queen's, co-chaired with a colleague in the School, includes representatives from Education, Law, Social Work, Nursing, Medicine and Drama. 'We also have a steering group with representation from the Assembly Office of the First Minister and Deputy First Minister, Department for Employment and Learning, from Health, along with Non-Governmental Organisations and, most importantly, disabled people themselves.'

'We're trying to shape the disability research agenda in Northern Ireland to make sure that disabled people's voices are heard. One in five in the population is disabled so it's an important policy priority.'

Her own experience plays a part. 'One of my key research areas is the transition of young deaf people and young disabled people from school to further and higher education. Many still don't think they can make it, in large part due to the barriers that exist. I'm highlighting evidence that can be used to break down these barriers so that they are able to exercise their rights.'

“ We're trying to reshape the disability research agenda to make sure that disabled people's voices are heard. ”

Dr Bronagh Byrne
School of Sociology, Social Policy and Social Work

THE DIAGNOSTIC DETECTIVE SAFEGUARDING OUR FOOD SUPPLY

“To see our research being used to detect a particular toxin prevalent in a region and to prevent human illness is something we're very proud of. It's truly global reach.”

Dr Katrina Campbell
Institute for Global Food Security,
School of Biological Sciences



The visitors' book at Queen's University's Institute for Global Food Security is filling up rapidly.

'Our door is always open to people from around the world with an interest in what we do here,' says Dr Katrina Campbell. 'Visitors from different backgrounds, especially academia, industry and government, are very enthusiastic about our work and they're impressed by the high standards of our research facilities.'

Katrina is a lecturer in bioanalytical systems and heads the biosensors strand in ASSET, the Centre for Assured, Safe and Traceable Food. She and her colleagues have been steadily building a reputation in food security but she sees two reasons for the current growth in profile.

'The Institute received a major accolade with the results of the 2014 Research Excellence Framework, assessing UK higher education institutions. We were ranked number one for research intensity in the area of Agriculture, Veterinary and Food Science. Thanks to that, we're getting much more attention – from

potential industrial and academic collaborators, from prospective students and from candidates looking for career opportunities.

'Second, our research is increasingly published in world-leading scientific journals such as *Nature*. We're conducting research of global importance and it's being reported internationally.'

Katrina graduated from Queen's in 1995 with a degree in Biochemistry, then did a Masters in Ultrastructural Anatomy and Pathology before working for Randox Laboratories for a year. She returned to Queen's for a Galen-sponsored PhD in Pharmacy.

Following her PhD she took up a Research Fellow post in the Veterinary Sciences Division of the Department of Agriculture at Stormont under the supervision of Professor Chris Elliott. She has been collaborating with him ever since. 'As a leading figure in the field Chris encourages us all to think about food security in global terms.'

Katrina's own focus is on the development of innovative rapid diagnostic tests. 'We use

the phrase – from farm to fork. I prefer – from environment to farm to fork. The range of compounds I look for are toxins that are in our environment naturally and man-made chemicals that we add to control pests and disease, but also pathogenic species that may have a harmful effect on humans and animals. We need to be able to monitor, control and prevent them getting into the food supply chain.'

To develop the tests, Katrina and colleagues produce biorecognition molecules – protein or nucleic acid-based molecules that can detect small molecular weight chemical contaminants present in food.

She has collaborative research grants through the EU, the Food Standards Agency, the US government, biosensor technology companies and with food diagnostic companies.

'Our over-arching aim is ensuring safer food. It's to allow producers to add a quality assurance to their supply chain through the use of these diagnostic tests or for regulatory bodies to prevent natural toxins in the environment entering the food supply chain. With changes to our climate the threats from food

contamination are becoming more prevalent but we can offer a means of mitigating these threats through better monitoring.'

A recent collaboration with the University of Tasmania involves implementing new toxin diagnostic strategies for the Australian shellfish industry which had suffered major problems, including a multi-million dollar global recall and company closures due to a lethal paralytic toxin.

'We also collaborate on marine and freshwater toxin analysis with US agencies such as the Food and Drug Administration, the National Oceanic and Atmospheric Administration and Centre for Disease Control.

'To see our research being used to detect a particular toxin prevalent in a region and to prevent human illness is something we are very proud of. It's truly global reach. We're applying our skills and innovation wherever they're needed, anywhere in the world, and having a major impact.'

FIERY DRAGONS, ANCIENT TEXTS AND ASTROPHYSICS

A first degree from the University of Calabria – a job in a medieval castle – a PhD at the University of Manchester – a first Lectureship at Brasenose College Oxford and now a Lectureship at Queen’s School of English...

It’s doubtful if anyone could have predicted the academic journey of Dr Marilina Cesario. But prediction – or prognostication – is at the heart of her research. And it is closely linked with two passions – astronomy and ancient medieval texts.

‘I started getting interested in medieval astronomy from Italian sources at home in Italy but then I decided to work on the Anglo-Saxon period, looking at the weather, which I found fascinating. Now I’m completing a book on meteorology in that period.’

The award of a Leverhulme Research Fellowship has allowed her the time to do it. ‘I’m dealing with astro-meteorology in early medieval manuscripts but I’m working with the help of modern astronomers, both in Oxford and here at the Queen’s Astrophysics Research Centre. We’re trying to check medieval descriptions of celestial occurrences, particularly solar, lunar eclipses and comets, against modern tabulations to see if the Anglo-Saxons really did witness certain phenomena.’

‘There’s a beautiful description in one chronicle of fiery dragons in the sky at the time of the Viking attack on Lindisfarne in 793. Generally the readings have a religious and allegorical interpretation but there’s also a genuine astronomical interest. I’m arguing that the fiery dragons are a reference to an aurora borealis seen in the north of England.’

She is using her deep fascination for Old English as a tool for a much broader interdisciplinary research pursuit. ‘Sometimes

publications by historians of science dealing with phenomena in classical and medieval sources show understandable limitations regarding the original language and the complex textual transmission. I have limitations too in dealing with the modern side which is why I think working with astro-physicists would be beneficial for all the disciplines involved.’

‘We’re looking at how people in the early medieval period engaged with the weather – which took in earthquakes as well as comets and diseases. So can all this contribute to our modern knowledge about climate?’

After the book is written, her plan is to apply for funding to create an international network, bringing together academics, Armagh Observatory, the Royal Meteorological Society and the Science Museum in Oxford to shed more light on this period and provide further modern benefit.

‘The concepts of modern scientists about

science are very different from those in medieval times but that doesn’t mean there was no science. I’m trying to establish the idea of a continuum. Science in that period may not be as we term it today but there was still an attempt at understanding the world.’

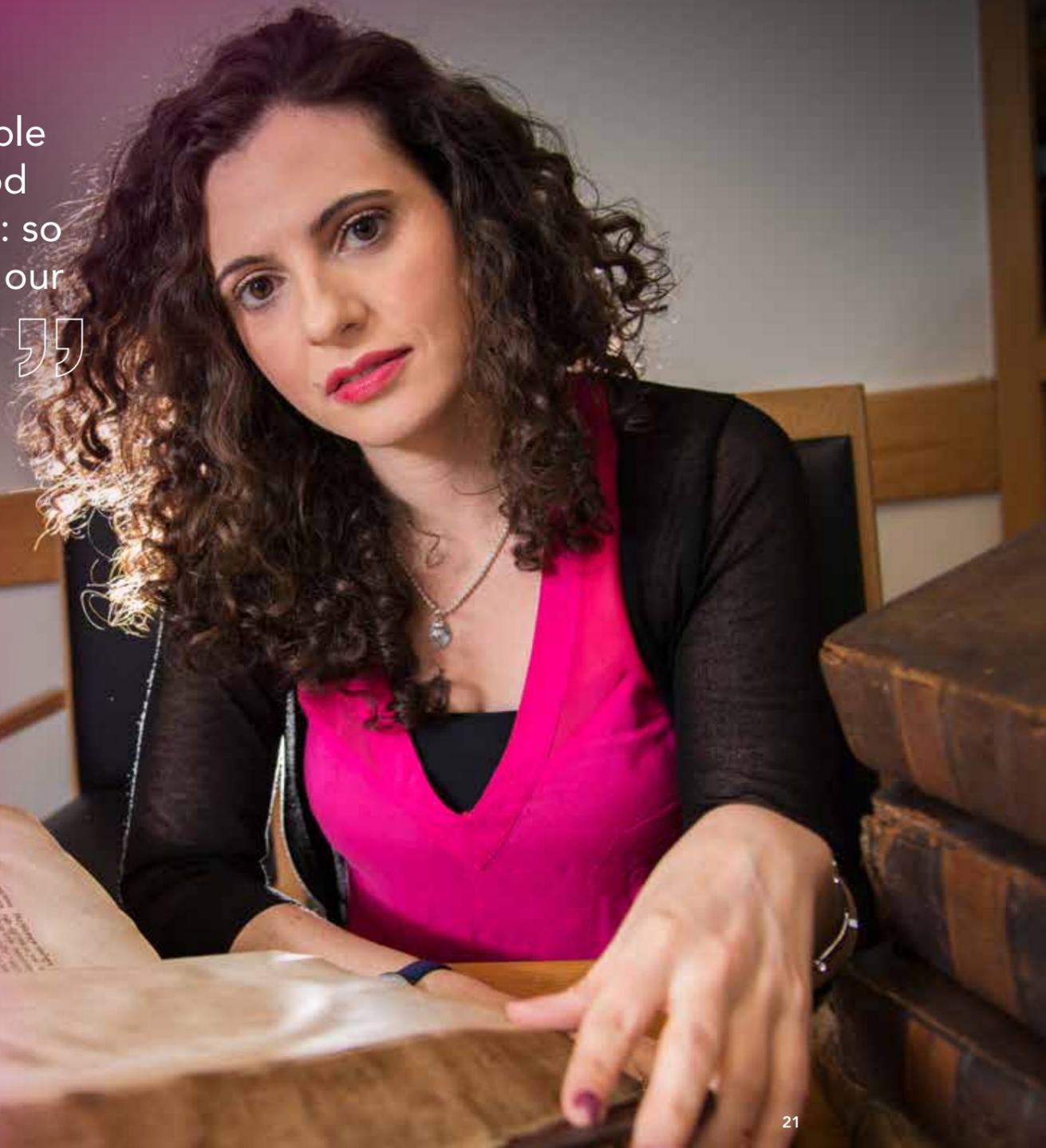
So what kind of forecasts – prognostications – would a medieval television weather presenter provide?

‘There wouldn’t be a five-day forecast. It would be for a year and it would depend on when the beginning of the year falls. You can find texts telling you that if it falls on a Sunday there will be a bad summer and a very bad winter. Then you get predictions that old men will die, there’ll be many battles, there’ll be news and rumours about princes and kings and so on.’

‘There was as much concern with the weather in the medieval period as there is today. Imagine how important that was in a world so rural and agriculturally-based.’

“ We're looking at how people in the early medieval period engaged with the weather: so how can this contribute to our knowledge about climate? ”

Dr Marilina Cesario
School of English



CHASING THE BIG ECONOMIC STORIES FROM HISTORY

“ Only by understanding how crises unfold in the absence of government intervention can we see how best to shape future financial regulation. ”

Dr Chris Colvin
Queen's Management School

Dr Chris Colvin's decision to pursue a career as an economic historian was a loss to another early interest – the world of journalism.

'I'd wanted to be a financial writer,' he says. 'I became very involved with student journalism at university and even did some work experience in local papers. That taught me how to write and even though I didn't go into journalism in the end, it is something that has stood me in good stead in my research work.'

Chris grew up in the Netherlands but moved to England when he was 18. An economics degree from Bristol was followed by a Masters and a PhD from the London School of Economics, then a postdoctoral fellowship at the European University Institute in Florence. Now he is a Lecturer in Economics at Queen's Management School and a Research Associate at the Queen's University Centre for Economic History.

'Queen's has a first class team of economic historians which has recently become the biggest such group in the UK and Ireland outside the LSE and Oxford, so I'm at the centre of a growing new field.'

Since coming to Queen's he has been involved in a project investigating the causes of the banking crisis in the Netherlands in the 1920s, until 2008 the most significant financial shock to hit that country both in terms of scale and its impact on the structure of the financial services sector.

The project is a collaboration with Abe de Jong and Philip Fliers, financial economists based at Erasmus University in Rotterdam. The team has now published an article in the influential journal *Explorations in Economic History*.

Chris explains, 'Economic history is a very applied field. We start with the historical problem and then we move to the economics

to try to solve it. It's just the same as the way journalists start with something that needs to be explained, then build a picture based on the evidence available. We're pragmatic and we're agnostic with respect to theory.'

His research has been discussed in the Dutch media where it has been framed as a case study from history through which policymakers can learn about banking crises in which there were no government guarantees. He is now extending the work to look at the Netherlands' fledgling central bank in this period.

'Who will study our research and learn from it? Our big targets are bankers themselves and the policymakers who are currently redesigning the regulation of the financial services sector.'

'It's about understanding what happens in crises in the absence of banking regulations and expectations of government intervention. Only by studying that can we really say what

legislation we should use. It's very difficult to do that with the current crisis because government was involved so much that you can't see what caused what.'

In his research, Chris is grateful for the support of John Turner, Professor of Finance and Financial History and Head of the Management School. 'He's the reason I wanted to come and work here. He's definitely my research mentor and I'm exploring ways in which I can co-author with him in the future.'

'This Management School gives you time to focus on research and it encourages collaboration. Working on my Dutch project, I spent long periods at Erasmus Rotterdam. Becoming involved with another institution gives you a new perspective. It improves your research which, of course, leads to better publications and is ultimately good for the standing of Queen's.'

HISTORY THROUGH THE LENS OF EVERYDAY EXPERIENCE

Dr Kieran Connell has a strong belief in how best to research and teach contemporary history – involve the people who took part in it.

He says, 'It's impossible to focus on contemporary history without thinking about engagement. We can't just be privileged observers. The people whose history you're writing are still here and they need to have a say.'

Born and educated in England, Kieran is a newcomer to the staff of Queen's, which he joined in 2015, but he has family connections with Northern Ireland – his mother grew up in Belfast.

After a BA Hons in History from Bristol University, he studied at the University of Birmingham for a Masters in Cultural Studies and a PhD which he describes as 'somewhere between cultural studies and history.'

He is currently engaged in a research project, funded by the Arts & Humanities Research Council (AHRC), based around a previously

unseen archive of photographs taken in the late 1960s in Birmingham's Balsall Heath area, at the time one of Britain's most notorious red light districts. A retrospective exhibition is being staged in 2016 in the city's IKON gallery.

'What Janet Mendelsohn, the photographer, did was to humanise the sex workers. She befriended one young Irish woman and pictured her not only on the streets but in her home, as a mother, as a partner, as a daughter.'

'The sex workers are long gone but other issues are still there, like poverty, deprivation, high unemployment and mass immigration.'

'Rather than going into a community and giving them a lecture about it, this project is linked to the knowledge these people have. We talk a lot about knowledge transfer but it shouldn't be a one-way street. It should be more of an equal exchange.'

Workshops are being set up with local people so that they can 'respond to these archive pictures, to think about

the area and what it's like today, with the aim of creating a new archive.'

At Queen's he is teaching a module based on his PhD which dealt with another period – the 1980s. 'It was about race and immigration and the inner city riots in areas with high numbers of people from ethnic minorities. But rather than concentrating on the violence, I'm interested in people's everyday experiences.'

He has written about the reggae music created at the time by bands in areas like Handsworth in Birmingham. 'They were young black people writing about things that happened to them – like being stopped and searched by the police on a daily basis. They were writing about unemployment. What is that, if not a form of social history?'

For Kieran this is a fascinating time to be teaching this subject to Northern Ireland students, especially in Belfast, which is dealing with issues that have been common in other UK cities and where increasing levels of diversity have led to some new community problems.

He is enthusiastic about the support he has been given at Queen's. 'Professor Sean O'Connell's work has been an absolute foundation and he has been instrumental in getting me to think about projects down the line. His module on oral history is exciting, really ahead of the curve.'

He also singles out Dr Michael Pierse of the Institute for Collaborative Research in the Humanities. 'If you're doing contemporary history you have to be interdisciplinary. The most exciting work happens when you move yourself out of your comfort zone.'

“ We can't just be privileged observers. The people whose history we're writing need to have a say. ”

Dr Kieran Connell
School of History and Anthropology

THE DIGITAL BANDAGE THAT'S CHECKING VITAL SIGNS

“ There are economic benefits for the health service and patients are happier too. They're not confined to bed when they don't need to be. ”

Dr Gareth Conway
School of Electronics, Electrical
Engineering and Computer Science

A Fox News report online tells the story of an innovative medical device being used with patients in a California hospital. A BBC report shows the same device being tested in trials at a hospital in Brighton.

The device is a wearable wireless monitor – sometimes called the digital bandage – that checks vital signs every two minutes and may revolutionise routine patient care. It is being marketed by Sensium Healthcare, part of the UK Toumaz Group, but the antenna technology which has been the key to its success is the product of research by Dr Gareth Conway at Queen's.

Wearable sensors and their potential were the focus of Gareth's PhD at Queen's in 2005. 'They were being developed a lot for military use but I realised the medical application was there and I knew that would give me most satisfaction.

'I could also see a massive gap to be addressed in terms of performance. An antenna is designed to work on the side of a building,

for example, not on the human body, so that's where my research was focused.'

In 2008 he joined a Scottish company working on underseas communication but then he was contacted by Professor William Scanlon at Queen's. 'William had a project, with an EPSRC grant, that only I was eligible to do.' So Gareth came back as a Research Fellow to work on a Knowledge Transfer Secondment with a new commercial company – Toumaz.

'It doesn't matter what wearable application a wireless sensor supports, the antenna is usually the most inefficient part of the system. Toumaz were trialling in California but the antenna failed on some of the patients and that wasn't acceptable. It would never be passed clinically.'

Gareth worked on the project for 18 months. Part of his strategy was to develop a test that was likely to work on everyone. So he created a phantom.

'Rather than testing one person with one set of tissue thicknesses and one set of body properties, the phantom, a

prototype human, more or less, was more representative of the population.'

And it was a success. Toumaz went on to fully fund commercial research for Gareth to develop their antenna. 'It was a good collaboration but I don't think it would have worked if I hadn't spent time in industry, learning what's expected from an academic.'

Another challenge was disposability so that it could be replaced every five days to reduce the risk of patient infection. Gareth solved that problem too, developing a prototype made from conductive nano silver ink, printed out of an inkjet printer.

'We're at the stage where UK hospitals have accepted the system and it's being trialled at a private hospital in Brighton. The NHS are interested and a lot of European hospitals are going to adopt the technology.

'There are definite economic benefits for the health service and patients are happier too. They're not confined to bed when they don't need to be. They're not connected to machines

and case studies show that this is having a beneficial impact on their mental wellbeing.'

Gareth has also been recognised by Queen's, winning the 2014 Vice-Chancellor's Impact Prize for an Early Career Researcher.

He says, 'It all opens new possibilities. Quality of care is moving out of the hospital and into the home. There's an expensive infrastructure in a hospital but you might in future have a modem that you could use in your house.'

And he has another project in mind – implants for cancer patients. 'Just think – if you could implant sensors around your body and link that to a database to monitor your own health. With someone having chemotherapy, what an advantage it would be to have a sensor beside the tumour to detect changes and report on the effectiveness of the drug treatment in real time.'

LEADING A NEW STUDY OF PHYSICAL ACTIVITY AND CANCER SURVIVAL

Dr Victoria – Vicky – Coyle’s commitment to cancer care has brought her to the forefront of a global project aimed at improving patient outcomes and quality of life.

A consultant medical oncologist, she will be leading the UK arm of an international collaborative study, to start in 2016, looking at how a physical activity intervention for patients with colon cancer might improve outcomes and survival.

She says, ‘We know physical activity has a lot of health-related benefits unrelated to cancer but this is very different.’

The Colon Health and Lifelong Exercise Change (Challenge) Trial has been developed by experts at the National Cancer Institute of Canada Clinical Trials Group and is now running in Canada and in Australia with the Australasian Gastro-Intestinal Trials Group.

‘This is a global trial to recruit almost 1000 patients with Stage 2 and Stage 3 colon cancer who have completed their initial surgical treatment and chemotherapy. Half those patients will be allocated to a supervised behaviour change and exercise intervention over three years.

‘This is the first study to attempt to find a definitive answer to the question of exercise and survival. Population studies suggest there is a strong benefit from exercise in this patient group. If so, it means the benefit might be the same as the benefit from chemotherapy but without the cost and side effects of drug treatment.’

Vicky has applied for grant funding of £750k from Cancer Research UK’s Population Research Committee for a UK arm of the study (Challenge-UK). The study is currently being set up and will be led from Belfast and organised by the Northern Ireland Clinical Trials Unit. A total of 160 patients from across the UK will be recruited.

She says, ‘This study has major impact for the UK, for Northern Ireland, for Queen’s and for the Belfast Trust.’ And it is a major achievement for Vicky herself.

A Queen’s graduate, she treats cancer patients with drug or systemic therapies and has a particular interest in bowel cancer and melanoma and in developing clinical trials. She completed her PhD in 2009 and has been a full-time consultant with the Belfast Trust but returned to Queen’s in 2013 to help drive forward clinical research.

‘I also took time out to work at the Sir Bobby Robson Cancer Trials Research Centre in Newcastle upon Tyne to see how they organised and delivered trials, with a view to bringing that experience back to Belfast.’

She says, ‘My research is focused in general around a combination of laboratory and clinical research, looking at how we use existing treatments, seeing if we can use them in a more targeted fashion. Can we identify biomarkers that will allow us to treat certain groups of patients better?’

‘In the Challenge-UK study we want to look at feasibility, at the impact on patients of trying to deliver exercise within a UK-wide population, and the health economics associated with that.

‘The fact that this is part of a global trial is really important. We need global recruitment to ensure that we get the right number of patients in order to answer the research questions definitively and to ensure that the results have a general relevance.’

Vicky is certain that gaining the UK leadership of the project is an acknowledgement of Queen’s expertise and influence in cancer research. She herself is a member of the National Cancer Research Institute (NCRI) Supportive and Palliative Care Clinical Studies Group. Among others involved in the study will be Professor Richard Wilson, Clinical Director of the Northern Ireland Cancer Trials Centre, who is also Chair of the NCRI Clinical Studies Group for colorectal cancer.

She acknowledges the support of her mentors, Professor Wilson, Professor Richard Kennedy and Dr Karen McCloskey, and of one of her PhD supervisors, Professor Patrick Johnston. ‘Learning from his expertise in how to set research strategy and deliver on it has been invaluable.’

“ This is the first study to attempt to find a definitive answer to the question of exercise and survival. We know physical activity has a lot of benefits unrelated to cancer but this is different. ”

Dr Victoria Coyle
Centre for Cancer Research and Cell Biology,
School of Medicine, Dentistry and Biomedical Sciences

TURNING THE TABLES IN THE WAR AGAINST PLANT PARASITES

“ Global food security is the issue here. It's about feeding people in Africa but it has major implications for crop protection in the rest of the world. ”

Dr Johnathan Dalzell
School of Biological Sciences

From his laboratory at Queen's School of Biological Sciences, Dr Johnathan – Jonny – Dalzell is leading a research project to improve lives 7,000 miles away in sub-Saharan Africa.

The work, funded by a grant of \$1m from the Bill and Melinda Gates Foundation, is combatting plant parasitic nematodes – microscopic worms which are one of the major dangers to plant crop health and a threat to global food security.

This has been Jonny's focus since he graduated in Zoology at Queen's in 2007 and went into postgraduate research with Professor Aaron Maule. 'But when I enrolled in the Zoology course I never thought I'd develop a career in plant parasitology. It was Aaron's teaching that got me hooked.'

During his PhD they employed various tools to try to understand the molecular basis of

nematode behaviour. 'We used a mechanism called RNA interference to knock down the expression of specific genes and we were able to use this approach to link neuropeptide-signalling molecules with host-finding behaviour.'

After his PhD he began to exploit the fact that the nematodes assimilate molecules from the outside world, transporting them back along neurons towards the nematode brain where neuropeptides are involved in a complex molecular decision-making process.

'We started screening neuropeptides as behavioural disruptors. We found that when neuropeptides were absorbed by nematodes from outside, it interfered with normal signaling. It disorientated and inhibited their ability to find a host plant.'

This work led to an Early Career Fellowship from the Leverhulme Trust, a Phase 1 grant of \$100,000 from the Gates Foundation and a EUPHRESKO plant health fellowship to develop the approach further – leading to the larger \$1m Phase II Gates Foundation Grant.

'We're collaborating with researchers from the International Institute for Tropical Agriculture which is Africa's main biotechnology hub. We're working on transgenic crops with colleagues in Kenya, including Leena Tripathi, who's a world expert on transformation of cassava, an important staple food crop which the poorest subsistence farmers use to feed themselves.'

'The Gates Foundation have incredible resources and they're committed to funding the project as long as it's viable. This is Phase 2. We're testing plantain resistance in glasshouse trials. Then, after two years, if this is successful, we'll be looking at a Phase 3 project which will involve field trials in Kenya or Uganda.'

Jonny emphasises the need to engage with the local farmers. 'We'll be going out and talking to them. We have to be sensitive, to understand cultural habits and needs. We have to bridge the gap between research in the lab and the people themselves.'

He also sees evidence of how the work is impacting on the growing global reputation

of Queen's. 'We had a track record in parasite neurobiology but now we're really stepping out and translating that into an applied end point.'

'As a result, I was asked to be part of a Gates Foundation strategy meeting in Nairobi, developing projects focused on yam, another major crop. One project had funding of \$5m, another was \$2.5m, so to be involved in scenarios of that magnitude and importance is really something.'

'Global food security is the issue here. It's about feeding people in Africa but it has major implications for crop protection in the rest of the world.'

'We've shown the Gates Foundation we have something that can work effectively. Plant parasitic nematodes are responsible for £100bn losses to agriculture globally each year. That's a massive issue so coming up with new approaches that are safe and effective is crucial.'

EARTHWORKS, SEISMIC WAVES AND THE IMPACT OF CLIMATE CHANGE

Dr Shane Donohue is developing a research strategy to help prevent a problem becoming a crisis for the railways of Britain and Ireland.

A study by Network Rail has revealed that up and down Great Britain 50 per cent – 5,000km – of earthworks, such as embankments, are in a poor or marginal state.

'This infrastructure is not in good shape,' Shane says. 'Every year they spend around £60m to £80m purely on repairs and maintenance, dealing with failures, the effects of landslides and so on. It's a very serious situation.'

In a research project funded by EPSRC, he has been using seismic waves to investigate the condition of these earthworks. 'Traditionally, failures of earthworks are dealt with after they happen. We're developing techniques which produce 2D and 3D images of the geotechnical properties affecting stability. This will enable early intervention by identifying the incremental development of internal conditions that trigger failure.'

A graduate in Geophysical Science at UCD, Shane's PhD was in Geotechnical Engineering. He remained at UCD as a Pierce-Newman Fellow in Civil Engineering and later won an EPA Research Fellowship. He was also President of the Geophysical Association of Ireland in 2009.

He spent 18 months as a lecturer at the University of Bath before taking up his current post at Queen's. 'Just before I arrived, there had been some substantial grant success in this field by Dr David Hughes and Dr Vinayagamoothy Sivakumar. That influenced me, as well as the fact that I had previously worked with Dr Ray Flynn from the School.'

His current project is a collaboration with the British Geological Survey (BGS). 'A lot of the earthworks on these islands date from the 19th century and they were very poorly constructed. That was the first problem. The second problem is climate change, how that's going to affect this infrastructure and how we can safeguard it.'

'In 2012 there were 144 Network Rail failures. That was the second wettest year on record. So what's going to happen in 70 years' time when we have drier summers and wetter winters? The embankments will shrink and swell to a greater extent during dry and wet periods respectively, causing more problems.'

Seismic geophysical methods had not been used previously to assess fluid-induced changes in slopes or earthworks.

Shane says, 'The EPSRC first grant was a feasibility study. Can we do this? Are these seismic waves sensitive to fluid-induced changes? Over time, what properties in the ground change?'

'We found that they're sensitive to soil moisture and pore pressure which have a direct influence on the stability of the structure.'

'The next stage is to see if we can start to make our embankments and earthworks more resilient. We don't want to wait for failure to occur. We need to do advance assessment and do it rapidly along large stretches to predict failure.'

Shane is seeking new EPSRC funding to take the work further over the next three years during which the scope will be UK-wide with further potential benefits to roads and waterways. As well as Network Rail other relevant agencies and organisations likely to become involved include TransportNI and Translink.

'There's a major opportunity here. The impact of our research is that it will save money, it will avoid disruption of services and it will potentially save lives.'

“ We're developing techniques which produce 2D and 3D images of the geotechnical properties affecting [earthworks] stability... The impact of our research is that it will save money, it will avoid disruption of services and it will potentially save lives. ”

Dr Shane Donohue
School of Planning, Architecture
and Civil Engineering

EXPANDING THE DIALOGUE THAT WILL SHAPE CULTURAL POLICY

“ There’s a lot of opportunity for greater learning, for growth and exchange... That’s very much part of the ethos I’m shaping here – transferring that knowledge, having a dialogue. ”

Dr Victoria Durrer is bringing international experience to a new post at Queen’s where she is helping to educate and influence a future generation of arts managers.

As a lecturer at the School of Creative Arts she is working with Dr Dave Robb in leading the MA in Arts Management and Cultural Policy which was begun in 2012.

Victoria has a BA in Art History from the University of Maryland and a Masters from Washington University in St. Louis. After university, she worked for three years in an art museum in China. ‘That broadened my mind about the capacity of the arts to facilitate exchange amongst people.’

Coming to the UK, she studied at the University of Liverpool for a PhD in sociology which focused on the arts and social inclusion. Before joining Queen’s in 2014 she was Youth Arts Co-ordinator for a local authority in Dublin.

She says, ‘There’s a lot of opportunity for greater learning, for growth and exchange. When I arrived at Queen’s the students were researching their dissertations so we worked with four of them to present their research back to the sector. That’s very much part of the ethos I’m shaping here – transferring that knowledge, having a dialogue.’

She has quickly made her mark where it matters – with Belfast City Council and other local authority areas, with small theatre companies and larger organisations like the MAC and the Lyric Theatre – ‘talking to them about the MA, trying to understand our relationship with the sector and how it can be built upon.’

She is also listening to the students. ‘There’s an increasing interest from international students in arts management. This gives us a rich opportunity to develop intercultural strategies that allow local and international students to learn from each other.’

And she sees opportunities for more research and exchange between practitioners and

academics. ‘There’s a wealth of research on arts and cultural participation, planning and development right across the island. I’m also aware of a growing desire in the sector to engage more, to learn more.’

With funding from the Irish Research Council she is working with Kerry McCall of the Institute of Art and Technology in Dun Laoghaire on a major innovation – setting up an All-Island Cultural Policy Research Network.

‘This island is not in the conversation the way it should be in terms of cultural policy. There is so much cross-discipline expertise available. We can all learn from each other, drawing on our distinctive social and structural similarities and differences, as well as our geographical proximity. There are skills that are just a bus or a train ride away.’

The first phase of the network will bring academics together to collate existing research and develop plans for exchanging ideas with arts producers, practitioners and policy-makers.’

Victoria is also working to develop research methodologies that promote learning and exchange. With Professor Peter Shirlow, now Blair Chair and Director of the Institute of Irish Studies at the University of Liverpool, and colleagues in Drama and Film in her own School, including Mr David Grant and Dr Des O’Rawe, she is developing research on the role of the arts in reconciliation.

‘I want to see an open and reflective dialogue involving funders, commissioners, policymakers, artists and arts managers about the lived experience of projects and to allow people engaged in them to determine what the outcomes are.’

‘I’m also interested in how the local context shapes arts provision. For instance, where will the arts sit in the new super council structures? The answer to that will say a lot about how local government places value on its arts and culture and how it might work locally to support and grow its cultural infrastructure.’

Dr Victoria Durrer
School of Creative Arts

SELF-HEALING MATERIALS AND THE LESSONS FROM NATURE

When Dr Andrew Hamilton admires the beauty of nature, he not only appreciates its art but its ingenuity. And he is learning from that. His research focus is on self-healing and adaptive materials – trying through science to mimic the achievements of the natural world in making itself better and stronger.

A graduate of the University of Buffalo in both Philosophy and Civil Engineering, Andrew also studied at the University of Illinois at Urbana-Champaign for a Masters degree in Theoretical and Applied Mechanics and a PhD on the subject of 'the development and characterisation of vascularised polymers for the autonomous repair of fracture and fatigue damage.'

He says, 'All around us in nature there are examples of self-healing – trees, for instance, or the human body – materials that, when they fracture, when they're damaged mechanically, they have this inherent ability to redress that somehow without external intervention.'

'One way we can copy that is to make micro-vascular networks, like our blood vessels, in a synthetic material. We circulate adhesives and when a crack opens the adhesives are released and the crack is healed. But our blood vessels do much more than heal. They distribute nutrients, manage temperature and these are things that other materials can benefit from as well.'

After his PhD, Andrew travelled to Europe and became a post-doctoral researcher at Aalborg University in Denmark. 'I'd been in a small town in the Mid-West and I wanted to go somewhere really different, with more people. But when I got to Aalborg I discovered it had exactly the same size population as the place I'd just left!'

At Aalborg, he embarked on a new but similar area of research, characterising materials that are used in wind turbines, a big strength in Denmark. And then came the opportunity to come to Belfast and to Queen's.

'Right away, I felt very comfortable. I found it easy to interact with all the academics I met, plus this is a Russell Group university engaged in leading research.'

Since joining Queen's he has been working closely on expanding the potential for materials that mimic nature with his Director of Research, Dr Nicholas Dunne, 'He is a very supportive presence. His area is bio-materials, which are used in medical applications such as orthopaedics. Previously I would have been focused on big structural applications, like wind turbine blades or aerospace materials, but I've started looking at other possibilities relating to the human body.'

'Natural materials can adapt. A prime example of that is bone. A lot of engineers hold it up as an ideal material to emulate because it has many unique properties, one of which is that the micro-structure follows the direction of the greatest load. I'm trying to do that synthetically by developing ways of placing material spatially where mechanical stresses and deformations are the highest. Potentially that allows a very efficient material allocation at a time when material resources are becoming more and more precious and we're trying to reduce waste.'

To further this work, two PhD projects are under way with the support of a

Marie Curie Fellowship. 'We've opened up a whole new seam of research.'

Andrew sees substantial benefit from the work. 'If we can improve the functionality of implants, for example, if we can improve patient outcomes, then that's a benefit to health and wellbeing.'

'Another benefit is the efficient allocation of materials where they will do the most good – and that applies whether you're talking about the human body or massive structures like aircraft.'

“ All around us in nature there are examples of self-healing... One way we can copy that is to make micro-vascular networks, like our blood vessels, in a synthetic material. ”

Dr Andrew Hamilton
School of Mechanical and Aerospace Engineering



“ It is said that our eyes are the window to our souls but they are also the window to our health. ”

IMAGES GUIDING US TO A HEALTHIER TOMORROW

Dr Ruth Hogg from the Queen’s Centre for Experimental Medicine is leading one of the teams working on one of the most far-reaching research projects ever conducted in Northern Ireland – the NICOLA study.

Its full title is the Northern Ireland Cohort for the Longitudinal Study of Ageing and it carries the message – *understanding today for a healthier tomorrow.*

It will involve 8,500 participants over the age of 50 and Ruth is heading the eye component of the study. She says, ‘It is said that our eyes are the window to our souls but they are also the window to our health.’

It was when she was studying optometry at Ulster University that Ruth got her first taste of research – a summer project at Queen’s with Professor Usha Chakravarthy, a global leader in

ophthalmology. After graduating, she went on to obtain a PhD at Queen’s, travelled to Australia on a Bicentennial Scholarship at the University of Melbourne, and worked as a postdoctorate at Cambridge. Then an opportunity arose to return to Belfast as a lecturer.

‘My core research focus is age-related macular degeneration – AMD – but my main role at the moment is the NICOLA study. I was responsible for designing the eye component of the study. I’m devoting a lot of time to the project but I can see that the dividends will be huge.’

A key tool in the research work is imaging. ‘What’s exciting for us is that we are able to use really cutting-edge retinal imaging that hasn’t been included in studies of this type before so there is the potential to gain a lot of new information.

‘Most of the epidemiology studies to date have relied on what is known as the fundus photograph of the retina, which is widely used in eye examinations. But that only

shows the surface. The retina is multi-layered and there is a lot going on beneath.’

The new techniques, optical coherence tomography and wide-field imaging, are being spearheaded by two international companies, Heidelberg Engineering and Optos.

‘We’re seeing all sorts of interesting things. It’s a steep learning curve but we’re already gaining far more from this study than we thought we would. This kind of imaging has transformed ophthalmology in the past 10 to 15 years and there is more transformative technology to come.’

Ruth is also supervising the progress of six PhD students, four of whom are involved in NICOLA. ‘During my own PhD I was supervised by Usha Chakravarthy and I hope I’m translating some of that experience. Most successful scientists are able to point to someone along the way who helped and mentored them and Usha has provided valuable advice and encouragement throughout my career.’

Of the NICOLA research she says, ‘From a public policy perspective it’s important to know the prevalence of eye diseases but it’s more important to know why people get them and if there are ways of prevention. Through imaging we may be able to pick up the disease process much earlier than before.

‘I take an optimistic approach. We’re looking at disease at an early stage, carrying out research that’s going to influence the health of future society and that’s a real privilege.’

Dr Ruth Hogg
Centre for Experimental Medicine,
School of Medicine, Dentistry
and Biomedical Sciences

CULTURAL MEMORY: A JOURNEY TOWARDS UNDERSTANDING

Memory... migration... multiculturalism – these themes are central to the work of Dr Isabel Hollis, Research Fellow at the Queen's Institute for Collaborative Research in the Humanities.

Teaming up with colleagues from different disciplines across the University, she is seeking to establish greater clarity in our understanding of how memory functions within society, particularly in relation to recognition and validation of minority cultures.

Isabel's dedication to this area of research began with her fascination for languages. 'I really wanted to travel, meet other people and live in other countries.'

She graduated from the University of St Andrews with a Single Honours French degree and later studied at the Sorbonne. But by that time, 'I'd become very interested in issues relating to people living abroad, people coming from different countries to live

in Europe, why they might come, what their motivations were, what their experience was.

'So I studied for a Masters in Cultural Memory. Then I was funded for a PhD at King's College London which looked at representations of immigration in literature and film, specifically North Africans living in France and how they were represented.'

Following a temporary lectureship in French at the University of London Institute in Paris, she came to Queen's as one of five junior Research Fellows funded by the University.

She sees positive examples in Northern Ireland of how memory is addressed. 'There's a real movement to validate the contribution of each society that's been involved in the conflict here, to make sure that memories – whoever's memories they are – are shown to be worthwhile. I think that's an important model.'

'Whether people are considered as discriminated against, whether they're considered as minorities, whatever their

situation, when you come to look at their heritage and their memory they become equal.'

She is building an exciting research portfolio. With funding from the British Academy, she is working with a colleague in France on a project examining the development of the new Institute of Islamic Cultures in Paris.

'We're looking at how this came about, under what circumstances the State – which is meant to be secular – decided it was necessary to fund a public institution that had a religious dimension to it and how the site functions within the community in which it's housed.'

She is also teamed with a senior colleague from the School of Modern Languages, Professor Margaret Topping – 'an inspiration' – who is now Dean of the Queen's Graduate School, in a bid for a £4m grant from the Arts and Humanities Research Council for a project that focuses on language.

'Languages are a human right. Our project has two perspectives – why it's a human

right as a school pupil in the UK to learn foreign languages, but why it's also a human right as a minority within the UK to have one's language validated.'

Isabel says, 'The broader vision for all my work is – if anything I can do as a researcher helps to promote tolerance within society then that is a positive benefit.'

She is grateful for the support of senior colleagues – including Professor Janice Carruthers, Head of the School of Modern Languages, and Professor John Thompson, Head of the Institute. 'He is a very positive figure. He has created an environment in which it's always possible to think outside the box and consider new possibilities.'

Margaret Topping says, 'People like Isabel are the future. They are not constrained by boundaries. They are an innovative, energetic new generation of researchers whose work shows ethical responsibility and ethical commitment.'

“ If anything I can do as a researcher helps to promote tolerance within society then that is a positive benefit. ”



Dr Isabel Hollis
Institute for Collaborative Research in the Humanities

BUILDING BRIDGES BETWEEN BELFAST AND BRAZIL

“Brazil is a very exciting place for digital technology. I'm challenging the stereotypes. It's not all football and samba.”



Dr Tori Holmes
School of Modern Languages

Dr Tori Holmes is one of a number of leading academics helping Queen's to widen its international horizons. The focus of her teaching and research is on Brazil – and, in particular, the culture of Rio de Janeiro's famous favelas.

The growth of her interest in South America began when she was studying Spanish and French at the University of Cambridge. The Modern Languages course involved a compulsory year abroad, for which she chose Peru – 'partly because of Paddington Bear but also because of the writing of Mario Vargas Llosa.'

After gaining her BA (Hons) she studied at the University of London for an MA in Latin American studies, writing a final dissertation on Peru's internet cafes. 'Peru was becoming known for being innovative in terms of shared spaces providing public internet access for lower income populations but there wasn't much research on this at the time.'

After completing her MA, she was working in the NGO sector in London when professional and personal circumstance led her back to South America – this time to Brazil where she worked as a freelance consultant, researcher and translator, always connected to information technology and digital communications.

'I found that some very innovative and insightful work in digital culture was emerging. Then I saw funding at the University of Liverpool for a PhD in Latin American cyberculture.'

It was the perfect fit. Her doctoral thesis, completed in 2011, examined the use of blogs and other internet platforms by Brazilian favela residents. 'It picked up the theme of how digital communications can allow people to have a voice where they perhaps have not had their voice amplified before.'

Tori joined the staff of Queen's in 2012. She acknowledges the support of all her colleagues in Spanish and Portuguese in the School of Modern Languages, but in particular her mentor Professor Isabel Torres, 'a sounding board for my questions and doubts.'

She says, 'I'm widening the focus to look at digital culture in urban Brazil more broadly and to connect to the agenda of urban change, which is very striking in the build-up to the World Cup and the Olympics.'

'I'm looking at the way digital technologies are being used by people in Rio, not only favela residents, to put forward opinions and engage in debate about these processes of change, some of which have been controversial.'

'The use of social media sites like Facebook has expanded a lot. There's documentary on the internet. I'm also interested in a new strand – mapping – how organisations and individuals are using digital technology to map favelas, using that to give visibility to cultural activities removed from the common perception of poverty and violence.'

Tori is involved in the University's Latin American Studies Forum. She is also playing a key role in forging fresh links between Queen's and Brazil that provide bridges for students to gain new experience. She was part of a delegation led by Professor Shane O'Neill that strengthened

existing connections and made new ones and she has led the negotiations on a new agreement with PUC, a private university in Rio.

In October 2015, she is due to present her work at SOCINE, the Brazilian Society for Cinema and Audiovisual Studies. She has also secured DEL funding for a PhD project on documentary, digital technologies and urban change in Brazil, to be jointly supervised with Professor Cahal McLaughlin from the School of Creative Arts.

'Not a lot of people know that Brazil is a very exciting place for digital technology. Here at Queen's I'm able to explore this area in my teaching and research. Through that, I'm challenging some of the stereotypes about Brazil. It's not all football and samba.'

FINDING GLOBAL BENEFITS THROUGH SOLAR IMAGING

On a computer screen on his desk Dr David Jess runs a video and immediately there is a violent blaze of colour – the turmoil of the surface of the sun. But David points to a small black spot. ‘That’s where my research interest lies.’

David is adding a new layer to the work of the Solar Physics Group at Queen’s. ‘I’m looking at these faint structures. I want to see what impact they have on mass and energy flowing through the sun’s atmosphere but they move quickly, they migrate and evolve, and you have to take very rapid images.’

To do so, he has been working with Andor Technology (now an Oxford Instruments company), the global instrument company that has its origins at Queen’s, to build his own imaging system. That has led to further success because it has now been commissioned as a common-user instrument in major facilities such as the Dunn Solar Telescope in New Mexico.

‘Being able to build my own imaging system in order to answer my own specific questions means I can put the emphasis on the things we really need to look for. The images we’re getting are sensational and it’s also encouraging that research groups throughout the world see the potential of our system. That is good for Queen’s.’

‘These small-scale structures are the building blocks of the larger solar features. If we understand how they release their energy we can understand bigger events better. Solar flares send vast amounts of charged particles across space. If one of these is directed towards earth it can have huge implications and with so many satellites in space providing our communications, we’re now more vulnerable.’

A Queen’s graduate, David now holds an advanced STFC Ernest Rutherford Fellowship. For his PhD in 2005 he was sponsored jointly by Queen’s and the NASA Goddard Space Flight Center near Washington. Subsequently he was employed as instrument scientist for ROSA – Rapid Oscillations in the Solar Atmosphere – at the US National

Solar Observatory at Sacramento Peak. He has previously been an STFC Post-Doctoral Fellow at Queen’s and a Marie Curie Fellow at Leuven in Belgium.

‘Queen’s is a leader in the acquisition and analysis of data while Leuven is a big player in theoretical understanding. That’s why I wanted to go there.’

Of his personal progress, he says, ‘I’ve been nurtured by Queen’s. During my PhD I had two supervisors from NASA and two from Queen’s – Professor Francis Keenan and Professor Mihalis Mathioudakis – and they are still important colleagues. I’ve been very fortunate.’

‘Thanks to my current Fellowship I now have a five-year independent research programme with funding that allows me to hire my own postdoctoral researchers. My goal was not to come back to Queen’s and continue with research that other members of the group are doing, but to use my new-found knowledge and theory, as well as the expertise in instrumentation that I gained at NASA, to take us in a slightly different direction.’

And there have been unexpected benefits – in a more down-to-earth way – through new links with another successful local enterprise, Radox Laboratories, the world-leading diagnostics company.

‘They use chemiluminescence on patient samples but sometimes they’re dealing with very faint sources. We’re looking at the possibility of employing our research, not only in the astrophysics environment, but in the world of public health to help maximise the amount of detail they can extract from these faint signatures.’

‘This may have important implications for patient benefit and it is a truly multidisciplinary approach, bringing astrophysics, biomedical sciences and chemistry together.’

“ We're looking at how we can employ our research, not only in the astrophysics environment, but in the world of public health. ”

Dr David Jess
Astrophysics Research Centre,
School of Mathematics and Physics

“ My research is very connected to the way I teach. It’s about bringing the real world into the class – global politics, who matters and why... ”



Dr Heather Johnson
School of Politics, International Studies and Philosophy

THE VOICE OF THE MIGRANT AND HOW TO MAKE IT HEARD

When Dr Heather Johnson watches television news pictures showing boatloads of desperate migrants on the Mediterranean, she is more than a concerned observer. Their plight is at the core of her research.

She says, ‘My focus is refugees and asylum seekers and the way people understand who they are, why they’re coming. Tropes and stereotypes play such a huge role in the way people think about migration. The dominant discourse is – oh, they’re coming to steal our jobs, or to take advantage of the NHS, or they might be terrorists. All of this is empirically unfounded but it’s incredibly damaging.’

Educated at Queen’s University in Kingston, Ontario, and with a Masters at McMaster University, Hamilton, in what was then a new programme – Globalisation and the Human Condition – her PhD was on practices of resistance of asylum seekers and irregular migrants in various key border spaces around the world. ‘I did fieldwork in refugee camps in Tanzania,

at the border between Spain and Morocco and in detention centres in Australia. I worked with migrants themselves, asking them about their experiences and perspective, trying to counter the dominant narrative that we have about migration.’

Heather joined the staff of Queen’s in 2012. ‘An interdisciplinary environment is very important to me and Politics, International Studies and Philosophy are a really good mix.’ She praises the support of colleagues – Head of School Professor David Phinnemore, Professor Yvonne Galligan and Dr Debbie Lisle, amongst many others. ‘They’ve never made me feel that I’m the junior scholar.’

Her research examines the journeys and routes of migration to and from global border sites.

One project which ended in 2014 was funded by the Defence Science and Technology Laboratory and was a collaboration with colleagues from International Studies, Sociology and Engineering. It looked at detection technology and how the technologists and

scientists involved understand practices of border security when they’re working in the lab.

A current project, with colleagues in International Studies, Philosophy and Law and funded by AHRC and ESRC, looks at how people are treated as they cross borders and how the regulations and practices that manage the movement of goods are conflated with those that manage the mobility of people. In addition, Heather is involved in an individual project on asylum and the access to it, looking at boat arrivals globally.

‘My research is very connected to the way I teach. It’s about bringing the real world into the class – global politics, who matters and why, instead of starting with the normal understanding of world politics which is about how the elites manage these things.’

But what are her observations on migration and Belfast? ‘Belfast is going through a period of really rapid change. It’s in the diversity you see just walking down the street. This is a positive change but there are

negative consequences too. But difference is something that should be valued and encouraged. It’s productive and exciting.’

Some of her students work with actual cases of asylum-seekers. They present recommendations to the rest of the class and then discuss what actually happened in each case.

This also relates to what she sees as the vital element missing in the global debate on migration – the voice of migrants themselves. ‘It’s completely absent. We’ve got to a place where they’re thought of as a huddled mass, faceless, voiceless, dehumanised, and if they do have a story, it’s suspicious and threatening.’

‘We need to reframe the way we look at society – who counts. How do we engage in a politics that takes non-citizenship seriously, that sees it not just as an absence of citizenship, but a real thing that people are living through?’

CREATING A NEW SCHOOL FOR SCIENCE IN THE GREAT OUTDOORS

It was through the impact of her PhD at Queen's that Dr Karen Kerr found the theme that has been the focus of her research work ever since.

'The decline in children's attitudes to science had already been uncovered. People thought it was happening around Primary 7 but I was able to show that it was happening much younger – at the ages of six or seven. Children were disengaged from science. They didn't really understand what it was.'

Her study was conducted and completed in 2007-8. Eight years on, things are changing. Since 2014 she has been helping to lead an ambitious project that is altering perceptions and providing new experiences of what science is.

Led by Imperial College London, OPAL – Open Air Laboratories – has been

working with communities in England since 2007. Now it is operating across the UK, funded by the Big Lottery, with Queen's as the lead partner in Northern Ireland, alongside the Field Studies Council.

Karen says, 'It's a citizen science project, a very focused initiative with a specific emphasis on hard-to-reach and disadvantaged communities. We have a target of 8,500 children and young people and schools are approaching us all the time. I've been overwhelmed by the feedback.'

'The knowledge and the skills that are gained through learning in the outdoors are invaluable. It's vital to promote science for children at primary level so that we can develop Northern Ireland's scientists of the future. At the heart of this is the message – science isn't only something for the clever people, it's for everybody.'

'The effect on children's health and wellbeing from being outdoors can't be over-estimated. But it's not just a day out of the classroom.'

It's about opening minds to possibilities and then sustaining that interest, bedding it into what schools are doing. We're building a legacy because the funding we're enjoying now isn't going to last forever.'

Along with her colleague Dr Gretta McCarron, the OPAL Outreach and Training Officer – 'without her, this project wouldn't be happening' – the message is being spread far and wide through events such as the first NI Science Festival, held at the beginning of 2015, and the Balmoral Show.

'We're working with so many other people – Eco-Schools, Landscape Partnerships, local councils, NIEA – and here at Queen's we're involved with the Widening Participation Unit and we're designing a module for the Degree Plus programme.'

Karen's research always keeps her close to the classroom – whether indoor or outdoor. 'I had seen myself as a teacher from the year dot. I did my undergraduate degree at St Mary's

University College, then I was a primary school teacher, working in Northern Ireland, England and Spain. Even when I was here at Queen's doing my PhD, I taught one day a week.'

And she is helping to train the teachers of the future. At Queen's she has been instrumental in developing an International Postgraduate Certificate in Education (PGCEi) involving a partnership with Stranmillis University College and Tenby Schools in Malaysia.

'The Director of the Tenby schools is Lim Si Boon, a Queen's alumnus. A relationship already existed with colleagues here and at Stranmillis, but this is an important development. We've built a new course and we're working closely with our International Office on ways to adapt it for other markets.'

'There were a lot of long hours and sleepless nights to get this going but it's exciting to be able to use my teaching experience in new ways. I love to be constantly challenged.'

“ It's vital to promote science at primary level so that we can develop Northern Ireland's scientists of the future. ”



Dr Karen Kerr
School of Education

“ Like civil conflict, a debt crisis leaves no-one unaffected and there is a popular demand for truth, justice and accountability. ”

THE ECONOMIC CRISIS AND THE LESSONS NOT BEING LEARNED

Just before the Greek elections in January 2015, the influential Wall Street Journal published a feature on the country's deep political crisis and the problems that exist with the structure of the electoral system.

Well-informed and analytical, it was written by two academics who are leading voices on the subject – Dr Iosif Kovras of Queen's Institute for the Study of Conflict Transformation and Social Justice and Dr Neophytos Loizides, formerly of Queen's and now at the University of Kent – and it was based on their joint research into the Greek debt crisis and its consequences.

Now the two colleagues are collaborating again, this time along with Professor Sally Wheeler, Head of Queen's School of Law, and Kieran McEvoy, Professor of Law and Transitional Justice, in a major ESRC-funded research project – *Truth, Accountability or Impunity? Transitional Justice and the Economic Crisis*.

The project is applying concepts of dealing with the past to an investigation into how six European countries – Spain, Portugal, Greece, Ireland, Cyprus and Iceland – have come to terms with the origins and consequences of the post-2008 financial crisis.

Iosif says, 'Like civil conflict, a crisis like the debt crisis leaves no-one unaffected and there is a popular demand for truth, justice, accountability and to ask – what went wrong?'

Iosif's relationship with Queen's dates back to 2007 when he came from Greece to Belfast to do a PhD which was supervised by Dr Loizides and another colleague Professor Adrian Guelke. 'I wanted to do research on the politics of memory, on societies emerging from conflict and trauma. This was a perfect place because you can see the politics of memory on the streets here every day.'

With his PhD completed, he took up a postdoctoral position in Athens in 2011. 'It was not a pleasant experience to be back home amidst such a deep crisis.'

Then he was offered a Fellowship in the Seeger Institute for Hellenic Studies at Princeton in the USA. 'It was a dream come true. It gave me the opportunity not only to further my research but to start thinking about how to expand it.' Now he is doing so at the Institute for the Study of Conflict Transformation and Social Justice.

The new research project in which he is involved argues that significant political and legal lessons can be learned from the economic crisis but that these are being missed because it is being seen solely through an economic lens.

'You have the situation where there is a political need to have some kind of stability, to take decisions, to have consensus, but to pursue that you have to collaborate with the political elite who probably have a vested interest in obstructing accountability measures.'

'We look at the different responses of different countries. Spain and Portugal took minimal steps to address the causes. But there's a truth commission in Cyprus, another one in

Iceland. And in Ireland and Greece we have prosecutions of bankers and politicians.'

Iosif acknowledges the support and encouragement he has been given by the Institute Director, Professor Hastings Donnan, and by Professor McEvoy.

He says, 'I'm very lucky to be working in this type of environment, with this level of collaboration. We try to engage with contemporary events and contemporary debate but our research has to be grounded. If not, there is the risk that because everything changes so rapidly it's like quicksand and you don't have solid empirical evidence on which to base your research.'

Dr Iosif Kovras
Institute for the Study of Conflict
Transformation and Social Justice

UNDERSTANDING STEM CELLS AND THEIR IMPACT IN LUNG DISEASE

Dr Anna Krasnodembskaya's research at Queen's University's Centre for Infection and Immunity (CII) is focused on the devastating condition that is acute lung injury, more properly known as acute respiratory distress syndrome (ARDS).

She says, 'It is the major cause of death in intensive care units, about 40 per cent mortality, and despite decades of research there is currently no cure.'

Anna is focused on changing that situation through stem cell research that is bringing us closer to an understanding of the mechanisms that occur in an injured lung.

A graduate of Saint Petersburg State University in Russia, she is a trained biochemist. Her PhD was in immunology with the specific topic of antimicrobial peptides.

It was at a conference where she was giving a presentation that she met Professor Michael Matthay, a world leader in lung disease research. They realised there was a connection between her work and his developing interest in the potential of mesenchymal stem cells – MSC – the most widely-used in cell therapy.

The result - she became a postdoc at his lab at the University of California, San Francisco. 'I came from a totally different background. I didn't know anything about stem cells or animal research, physiology, lung diseases. But I think that actually helped because I was able to look at the problem from a different angle.'

Over the next four years, her expertise would expand. During that time she also found herself side by side and making friends with two researchers, Professor Danny McAuley and Dr Cecilia O'Kane, who were on sabbatical from their home university – Queen's in Belfast.

Encouraged by them, she applied for a position as lecturer at Queen's and joined the staff in January 2013. 'From the start I was amazed by

the academic freedom here and how supportive the environment is.'

Of her research she says, 'I believe MSC are good candidates for therapy for ARDS but for the translational development of stem cell-based therapy we need to know more about their mechanism of action and that is poorly understood.'

ARDS is characterised by dysregulated inflammation in the lung. Although inflammation is usually a method by which the body copes with infection, when it is dysregulated it can lead to severe damage.

Immune cells known as macrophages control inflammatory reactions. Anna has received £450,000 Medical Research Council funding, allowing her to take on her own postdoc and two PhD students, to investigate whether MSC can affect the stimulation of the macrophages and promote the state in which they will suppress the inflammation.

'We've already obtained some really exciting

data on how MSC can exert their effect. Our goal is to pursue the potential of new mechanisms that will finally result in the development of stem cell therapy for this condition.'

Anna is also part of two other collaborative research groups at CII. One focuses on the role of the immune system in the processes of lung regeneration. The other looks at the different structures of lipopolysaccharides, potent immunostimulatory molecules which activate the innate immune system.

There is also a collaboration with Professor Dan Weiss of the University of Vermont on lung regeneration – and the ultimate possibility of creating an entirely new organ.

'All of this work is enormously exciting. But we never lose sight of the fact that there is a patient at the end of the process. We are so close to real people, to their lives and their health, and I am privileged to be at the heart of so much important research.'

“ All of this work is enormously exciting. But we never lose sight of the fact that we are so close to real people, to their lives and their health. ”



Dr Anna Krasnodembskaya
Centre for Infection and Immunity,
School of Medicine, Dentistry and Biomedical Sciences

THE GROUND-BREAKING SURVEY ON THE MATERNITY EXPERIENCE

“We’ll get a better understanding of which maternity services are working well and where they could be enhanced. It’s the kind of public and patient involvement that the Health Service is crying out for.”



Dr Fiona Lynn
School of Nursing and Midwifery

It was while working on her dissertation for a Masters in Finance at Queen’s, that Dr Fiona Lynn realised she had developed a thirst for research. ‘That started me thinking about doing it as a career. But I knew it had to be something that would have a real impact, something that matters to the person in the street.’

She has fulfilled that aspiration since then – most notably in a project funded by the Public Health Agency in which she was co-investigator on the first-ever comprehensive survey in Northern Ireland of women’s experiences of maternity services.

Her path to this point took her from a degree in Business Finance at Leeds Metropolitan University and University of Granada, Spain, via the Masters at Queen’s, and then – ‘Maternal child health was something of

great interest to me, partly because I’d just had a child myself, so I was delighted to get an opportunity to do a PhD in Health Economics at the School of Pharmacy.’

She also took up a research assistant post at the School of Nursing and Midwifery, working part time on her PhD with its related theme – women’s preferences for ultrasound scans in the third trimester of pregnancy. After graduation she became a post-doctoral research fellow within the Improving Children’s Lives initiative at the School where she is currently a lecturer.

The recent maternity care study partnered Queen’s with the National Perinatal Epidemiology Unit at the University of Oxford and the Northern Ireland Statistics and Research Agency. It involved sending surveys to all women who gave birth in Northern Ireland between October 1 and December 31 2014.

‘There’s a survey like this every four years in England and a similar study in Scotland but this is the first population-based survey of its kind in Northern Ireland. We’ve been giving

women an opportunity to tell us about their experiences of maternity services, as well as asking about their partners’ experiences.

‘We’ll get a better understanding of which maternity services are working well and where they could be enhanced. It’s the kind of public and patient involvement that the Health Service is crying out for. It’s a really strong method of being able to influence policy and make changes to practice.’

Fiona acknowledges the career support of Professor Fiona Alderdice – ‘my line manager for the past ten years, keeping me focused’ – and of Professor James McElnay, her PhD supervisor. ‘I take my lead from him in how I supervise my own students. It’s about understanding their capabilities.’

Other collaborations in which she is involved include a randomised controlled trial, funded by the Big Lottery, with the Northern Ireland Music Therapy Trust, looking at the cost-effectiveness of music therapy for young people accessing mental health services.

She is also working with TinyLife, Northern Ireland’s premature and vulnerable baby charity, to assess the impact of new support services for families. And with the School of Education there is a cluster-randomised controlled trial on Nurture Group provision for children with social, emotional and behavioural difficulties.

She is particularly excited about a relationship with the Federal University of Santa Catarina in Brazil. ‘I travelled there in autumn 2014 to collaborate on maternal and child health-related projects and to help build research capacity. I plan to go back soon to strengthen that relationship.’

Fiona says, ‘My particular strength is in health economics but I couldn’t do my research without working closely with other researchers and experts in a multidisciplinary team with an interdisciplinary approach. And all of that leads to the most important part for me – making a positive and real impact on the health and wellbeing of families.’

RECOVERING VITAL RESOURCES BEING LOST THROUGH WASTE

Molecularly Imprinted Polymers – MIPs – ‘are like footprints in wet cement,’ says Dr Panagiotis Manesiotis. Lecturer in Analytical Chemistry at Queen’s, he is establishing a leading reputation in the technique and is driving forward research which is making a difference in diverse areas ranging from healthcare to environmental protection and clean-up.

Molecular imprinting creates template-shaped cavities in polymer matrices, allowing the formation of specific recognition and catalytic sites. Panagiotis became fascinated by the process and applications of these ‘plastic antibodies’ while studying for his undergraduate degree at the Aristotle University of Thessaloniki in Greece in 2000.

Later, as a postgraduate student at the University of Dortmund, he worked with one

of the leading figures in MIPs, Professor Börje Sellergren. More recently, before joining Queen’s, he was Senior Researcher at the Pharmaceutical and Molecular Biotechnology Research Centre at the Waterford Institute of Technology.

He says, ‘This is a new pocket of research within Queen’s and we’re attracting a lot of interest from many different fields – medicine, pharmacy, biological and food sciences, chemistry and chemical engineering’.

His collaborative research with Dr John McGrath from the School of Biological Sciences was recently awarded over £1m from the Environmental Protection Agency, Science Foundation Ireland and the Department for Employment and Learning for joint projects between Queen’s and NUI Galway.

‘In simple terms, instead of using synthetic materials, we convert waste biopolymers, polymers that we get from nature, into molecular sponges that enable us to capture and recycle valuable resources, including the least abundant of the essential elements of life – phosphorous.

‘Phosphorous has been identified by the EU as one of the top 20 critical resources. It’s very important for food security, so we are looking to take back and recycle the phosphorous that farmers use and release it back into the environment.

‘Our design starts from anaerobic digestion of waste and water treatment all the way to the removal of phosphates and selective capture of key organic compounds that are highly valuable, for example in biofuel preparation.

‘Our research indicates that the majority of lakes and water streams within Europe and globally contain much more phosphate than they should, even following extensive – and expensive – water treatment. Apart from wasting a valuable resource, phosphorus abundance in surface waters is responsible for eutrophication, the process that fills our lakes with algae.

‘All of this involves multi-million expenditure by EU governments every year to clean this up. Our project will have a triple benefit: recycling biopolymer waste, recovering valuable resources from waste water and rectifying the problem of phosphate contamination.’

Panagiotis praises the support of his colleagues, notably Professor Steven Bell, Director of the Innovative Molecular Materials Group at the School of Chemistry and Chemical Engineering. ‘He has given me fantastic support from the beginning and we are currently working together on a number of projects combining our complementary research interests in spectroscopy and materials.

‘Working at Queen’s is very exciting. There is some very high-profile research going on and there are some very talented people to collaborate with, right across the University. The open door attitude is a very important part of the ethic. You can go and talk to anyone and people are always open to new ideas – this is how great research is born!’

Dr Panagiotis Manesiotis
School of Chemistry and Chemical Engineering.

“ Our project will have a triple benefit: recycling biopolymer waste, recovering valuable resources from waste water and rectifying the problem of phosphate contamination. ”

NEW STRATEGIES IN CANCER RESEARCH FROM A NEXT GENERATION INNOVATOR

“ We hope the strategies we’re developing will underpin stratified personalised medicine approaches. ”

Dr Simon McDade
School of Medicine, Dentistry
and Biomedical Sciences

As a student, Dr Simon McDade played top-level basketball. He even captained the last Queen’s team to win the Irish universities championship. But now he is shooting high for other goals – in cancer research.

After graduating in molecular biology, Simon was offered a PhD funded by Action Cancer and when Professor Dennis McCance joined Queen’s in 2006 Simon became the first postdoctoral researcher he recruited.

Professor McCance is now at the University of New Mexico – ‘but he became, and still is, a close friend and mentor. At that time, Professor McCance’s work had moved away from virology and into how the biology of DNA tumour viruses and the changes they invoked could be used to understand how cancer evolves. That was a seminal moment in my career.’

It led Simon to focus his research on the p53 tumour suppressor, described as the ‘guardian

of the genome.’ Increasingly, the work involves using cutting-edge next generation sequencing-based technology and protocols which he developed during a period spent at the Institute of Cancer Research.

Some of Simon’s work is focused on head and neck squamous cell carcinoma, where p53 inactivation occurs in the sixth most frequently diagnosed cancer worldwide. Current treatment is a combination of surgery, radiation and chemotherapy but the location of the tumours and the nature of the therapy result in severe side-effects and loss of quality of life. Other work focuses on understanding the role of p53 in resistance to chemotherapy in colorectal cancer.

‘We’re investigating the different mechanisms of p53 inactivation to help understand who will respond well to current therapies and to spare the side effects for patients who won’t.

‘And if we understand how cells change because of p53 loss, which happens in almost all cancers, we could identify an Achilles heel, allowing us to design drugs to

target cancer cells where this has occurred but leaving normal cells untouched.’

Work on sequencing patient samples is in collaboration with Dr Jackie James, Head of the NI Biobank, and Professor Manuel Salto-Tellez.

‘We’re also working with the Wellcome Trust Sanger Institute and Dr Ultan McDermott, a Queen’s alumnus, who leads one of the arms of their cancer genome project. We’re analysing 1,000 cell lines to try to identify different classes of mutation and we’re comparing that with a panel of over 6,000 cancers sequenced across the world to make sure the cell lines represent the cancers.

‘Ultan’s lab have screened 250 drugs across these cell models. We want to use that information, plus data we have generated here, to identify novel ways of exploiting p53 status in cancer.’

Simon’s team also works closely with Professor Patrick Johnston’s research grouping, encompassing a number of investigators focused on colorectal cancer. ‘That’s coming

at it from a stratified medicine approach, where we aim to understand why different patients with different genetic or other changes in their tumours have different responses to therapy. We want to identify patients who will benefit and those who don’t and might actually be harmed by it.’

In addition, he is keen to contribute to development of tools to underpin research of this kind at Queen’s and beyond. ‘The sequencing requires a lot of computational effort. We’re teamed up with Analytic Engines, a Queen’s spin-out company, and we’re trying to come up with novel accelerated ways to carry out some of this analysis with a view to possible commercialisation. That’s the next step – creating new sequencing tools, rather than new approaches.

‘We hope the strategies we’re developing will underpin stratified personalised medicine approaches. That’s going to happen in all disease types but cancer will be the first disease where it’s really going to impact and we’re geared up here to deliver that.’

HELPING PEOPLE ADJUST TO LIFE DURING AND AFTER CANCER

Cancer survivor – a term that’s heard a lot more often these days. But how do those who *do* survive come to terms with their experience?

‘For many, cancer is a chronic illness now and that’s where our work comes in,’ says Dr Gillian Prue from the School of Nursing and Midwifery. Cancer survival is her main research focus and she has had a special interest in men’s health, in particular prostate and testicular cancer and HPV-related cancers, since the start of her academic career.

After graduating in Physiotherapy at Ulster University, she began a PhD in the area of cancer-related fatigue, a multi-centre study sited in Belfast, Bristol and Southampton. Later she became involved in a ‘Men and Cancer’ project funded by the then Ulster Cancer Foundation, examining the different experiences of men and women with colorectal cancer.

Now she is at Queen’s supervising PhD studies which include an exploration of men’s experiences of undergoing active surveillance in prostate cancer. In this she is working closely with Joe O’Sullivan, Professor of Radiation Oncology.

She says, ‘Joe understands the importance of the psychological and social impact of a cancer diagnosis. It’s about helping patients cope, supporting them from diagnosis right through their journey.’

‘The new Prostate Specific Antigen test means a number of men are being diagnosed with the disease, but that might not mean they need treatment. We’re looking at the impact that has, how they manage the uncertainty and stresses of being told – yes, you have cancer but we don’t need to do anything about it at the minute.’

The general increase in cancer survival rates, while welcome, is leading to other pressures. ‘Survivors are coming to the cancer centres for review appointments

which they don’t necessarily need. Rarely are recurrences picked up this way. The centres are stretched to capacity so we’re working on new forms of follow-up – in the home, all done online – because we can’t maintain a system where people keep coming back for review for the next ten years.’

As Gillian says, cancer doesn’t just affect the one person – it affects the family, the care-givers, so she is now involved in a Cochrane review, led by another member of the survivorship team, Olinda Santin, of the effectiveness of targeted psycho-social interventions among this group.

She is also starting to work with the Centre for Cancer Research and Cell Biology (CCRCB) to take forward her earlier research into cancer fatigue. ‘We don’t have effective targeted treatments but in CCRCB they have the expertise to help. We’re looking at cytokines – little proteins that co-ordinate immune response – identifying those that link with fatigue, so that we may be able to develop better-targeted treatments and pharmacological therapies.’

And she is engaged in a campaign around Human Papillomavirus – HPV – which is linked to many cancers. In the UK, vaccination is available to girls but not to boys. Gillian believes this policy is misguided.

‘Australia, the USA, Austria, Israel and parts of Canada already vaccinate both boys and girls. The UK argument is based on the assumption that as this is an STD, vaccinating girls will mean they don’t have the virus and it won’t be passed to boys.’

‘That argument stands up if every single girl gets vaccinated and all boys only have sexual contact with vaccinated girls. That’s unlikely to happen.’

‘A comprehensive vaccination programme could stop five per cent of all cancers, potentially wiping out all cancers caused by HPV in a generation. There aren’t many cancers we can say that about.’

“ We're assisting patients to cope, supporting them from diagnosis right through their cancer journey. ”

Dr Gillian Prue
School of Nursing and Midwifery

“ Law doesn't exist in a vacuum. We need to understand its interactions with the social, cultural and political world. ”

Dr Alex Schwartz
School of Law



Dr Alex Schwartz | School of Law

BUILDING NEW STABILITY IN POST CONFLICT SOCIETY

Dr Alex Schwartz has a very clear view of the kind of institutions Northern Ireland needs if it is to have a stable and secure future.

‘You want institutions that are simultaneously sensitive and responsive to the hard realities of a deeply divided society, that don’t turn a blind eye to them, but you want institutions as well that have some flexibility and that don’t become just another site of conflict.’

Lecturer at the School of Law, Alex joined the staff of Queen’s in 2013 after obtaining his PhD here. Previously he was Banting Fellow and Adjunct Assistant Professor with the Department of Political Studies at Queen’s University in Kingston Ontario.

A collaboration with Professor John McGarry from that university, along with Professor Brendan O’Leary of the University of Pennsylvania and Queen’s colleague Professor Christopher McCrudden, led to a submission to

the Northern Ireland Assembly and Executive Review Committee and a publication – *Why Northern Ireland’s Institutions need Stability* – which he hopes will be influential.

Alex’s research on Northern Ireland has also fed into additional public engagement through the Knowledge Exchange Seminars at Stormont, with respect to reform of the current system of veto powers within the Assembly, in particular the Petition of Concern procedure.

‘The Petition of Concern allows members of one community to veto a proposed Bill or Motion in the Assembly by requiring that a decision be passed with cross-community support. Increasingly, there’s discontent with this procedure because there is a perception that it’s being overused on matters for which it wasn’t intended. So you have a problematic escalation in its use.

‘I’ve been working to help define the categories of decision where it makes sense to have a Petition of Concern veto

– issues to do with the legacy of conflict, issues relating to power-sharing itself.’

Alex can draw on his extensive study of another post-conflict jurisdiction. With research funding from the British Academy he has been examining structures in Bosnia-Herzegovina, in particular the work of the Constitutional Court, which he sees as having potential relevance for Northern Ireland.

‘There is a similar power-sharing arrangement in Bosnia but it is more complicated in that there are several sub-state territorial entities. The Constitutional Court adjudicates on disputes that arise. It has two Bosnian judges, two Serbs and two Croats, together with three international judges.

‘The court’s design is intended to satisfy the anxieties of different communities who may be worried about their interests being sidelined and the international judges are there to provide an ostensibly neutral perspective and break ties. I’ve

been looking at the consequences of this arrangement through a statistical analysis of hundreds of judicial decisions.’

Alex expresses gratitude for the support he has received at Queen’s from his colleagues, especially Professor Kieran McEvoy – ‘someone from whom I have learned a lot’ – and he applauds the impact which the School of Law itself is having on society.

‘The School of Law at Queen’s understands its role. Law doesn’t exist in a vacuum. We need to understand the broader context in which it exists and its interactions with the social, cultural and political world.

‘My research is very much part of that. It has an impact in all sorts of ways, not just in the sense of the evolution of legal doctrine but in how we can speak to questions of policy and reform, both here in Northern Ireland and to a broader transnational audience.’

THE AEROSPACE ENGINEER ADDING VALUE TO DESIGN

Dr Danielle – Dani – Soban always wanted to be an engineer. ‘I grew up in Simi Valley, a town north of Los Angeles. In the mountains they were developing the space shuttle engines so every few weeks we’d hear this big rumble and the windows would rattle. It was inspiring.’

Lured towards an interest in aircraft, she studied aerospace engineering at California Polytechnic State University, San Luis Obispo, stayed to do a Masters and then was recruited for a PhD at Georgia Institute of Technology where she was later invited to stay as a Research Engineer.

‘It was an applied research lab. We took problems from industry which research engineers and postgrads worked together to solve, while simultaneously advancing the state of the art of aerospace. I found myself working with NASA, Boeing and Lockheed, but during that time I also established professional contacts with the people here at Queen’s.’

It was these contacts that led her to consider an academic career and in 2010 she arrived in Belfast.

‘I came to academia through a non-traditional route. I never did a postdoc, I wrote technical reports instead of journal papers, but I had a lot of very relevant industry experience.’

This was pivotal in determining her current research area: advanced decision-making techniques for complex systems.

‘In the aircraft world, you have to bring together disparate pieces of information in order to make things work correctly. But you can’t just take the best wing and the lightest structure, the most efficient manufacturing process and try to kluge them all together. You’ll have a terrible aircraft.’

‘It’s about making decisions, making trades. You make sacrifices in one area in order to make advances in another.’

It was this skillset in decision-making that brought her to the School of Mechanical and Aerospace Engineering. ‘This School is very

good at the disciplines: structures, composites and manufacturing, aerodynamics – but now I’m trying to bring a top layer of integration into everything we do.’

Central to this is her specialisation in Value Driven Design. ‘Value is about the overall package, not just the design with the lowest cost. If you take a value-driven perspective at the beginning of your design process, you not only optimise performance but you can take into account things that are hard to quantify, like sustainability, and you’re going to end up with a better product for everyone.’

Value Driven Design can be applied to anything – buildings, cell phones, anything with a lot of complexity. Dani is applying the techniques to an Innovate UK project with the School of Planning, Architecture and Civil Engineering involving social housing.

‘This is about energy poverty. We need to live in a society where people can afford to be safe and warm in their homes. The project has wired buildings with sensors, measuring things like temperature and humidity, and is trying to find

the best combination of technology to give the best results in terms of energy efficiency and lower costs. Using a value perspective we can analyse the data and optimise not only for cost but for overall value to society.

‘In today’s world we’re generating a vast amount of data and these decision-making techniques, including surrogate modeling, probabilistic analysis and visual analytics, help us extract meaning from it.’

‘In my work I like to bring together things that are better for the environment, things like sustainability, things that we know are important to society. I’ve always been interested in doing things that are useful. I don’t think I’d be an engineer otherwise.’

“ In today's world we're generating a vast amount of data and these decision-making techniques help us extract meaning from it. ”



Dr Danielle Soban
School of Mechanical and Aerospace Engineering



“ Industry's creating so much waste that it's now seen as a resource. We're turning it into value-added material. ”

Dr Malgorzata Swadzba-Kwasny
Queen's University Ionic Liquid Laboratories (QUILL)
School of Chemistry and Chemical Engineering

OPENING UP NEW DIRECTIONS IN GREEN CHEMISTRY

Dr Małgorzata 'Gosia' Swadzba-Kwasny is a new Queen's University Research Fellow in an area for which the University is renowned – Green Chemistry. But she is not exactly a stranger to the institution or this field of research.

'I used ionic liquids when working towards my Masters in Poland but wanted to learn more. So the place to go was Queen's University Ionic Liquid Laboratories in Belfast.'

The first time she met Professor Ken Seddon, Director of QUILL, who later became her PhD supervisor, was in Austria at a conference. 'I had contacted him about a summer internship. We met and had a discussion – mainly about science fiction – but he said: "Come and do a PhD with us".'

And so she did. 'I came in 2005, convinced I would leave after three years, but there were always new opportunities and so ten years later – I'm still here.'

Gosia's PhD project, sponsored by BP, was on making engine oils using ionic liquids. 'Naturally, it was strongly applied science. But I grew interested in more fundamental aspects.'

As she explains, in the solid state, molecules have very little movement, they 'stay still'. But in complex liquids, there is a constant change – dynamic equilibrium – with bonds created and broken all the time.

'Studying the structure of such systems is challenging but this knowledge is crucial in order to use them more efficiently. Ever since my PhD, I have enjoyed combining these two aspects: fundamental studies which then help to develop applications, especially those making industrial processes greener, more sustainable.'

After graduating in 2009, Gosia was offered a postdoctoral position and an open door to develop her own line of research. 'It was really unusual to be given so much scientific freedom straight after my PhD and this is what made me stay. I started working

with people like Dr Peter Nockemann, of the Innovative Molecular Materials Group, on the synthesis of inorganic materials, and with Dr John Holbrey on the fundamental aspects.'

In parallel, she led several industrial projects, first in collaboration with the oil giant Petronas, one of QUILL's major partners, then with Evonik Industries, a German specialist chemical company.

'I thought – ionic liquids have been around for decades. We should take what we have learned from this field, and develop beyond it, to access new classes of liquid materials.'

Building on the liquid structure studies, Gosia and her team designed two families of liquid catalysts. 'One group is called liquid coordination complexes – cheaper, greener and easier to make than ionic liquids. The other group are liquid Lewis superacids – extremely powerful catalysts, also made from inexpensive components.'

With these new catalysts, two industrial projects were taken to a scale-up phase. 'And I hope they will be developed beyond that.'

In her new role, Gosia works with complex liquids to address sustainability in different branches of industry. 'I am looking at very different projects, from catalytic removal of sulfur from fuels, through limiting heavy metal emissions from the cement industry, to what is known as urban mining.'

'Industry is creating so much waste that it's now perceived as a resource in its own right. Instead of using primary resources that we're running out of, we are turning waste into value-added material.' There is interdisciplinary and inter-departmental collaboration – for example with Professor Marios Soutsos from the Geopolymer Group in Civil Engineering.

'What I like about Queen's is that I've always been given a lot of opportunity to prove myself and develop. This Fellowship gives me academic independence and, with limited teaching and administrative responsibilities, I can really focus on strengthening my own scientific reputation.'

THE CIVIC CHALLENGES FOR THE GENERATION BORN AFTER PEACE

Dr Laura Taylor believes her focus on community development stems from her own beginnings. 'I was born and raised in the Marshall Islands in a remote part of the Pacific and as a result of that I became interested very early in community indifference.'

At university in the USA, she studied medicine at first 'but when I discovered psychology I realised that was a way to really understand people. That led me into dealing with them at a community level.'

After graduation, she became involved in mental health work in remote mountain villages in Guatemala with women affected by the genocide and armed internal conflict that lasted there from 1960 to 1996. 'We supported them as they created community networks, establishing a foundation on which they could then build and work towards the future they desired.'

Back in the USA, she gained a Masters in Peace and Justice Studies and a dual PhD in Peace Studies and Psychology. That led to research examining the impact of political violence in communities in Colombia, Croatia and Northern Ireland and eventually to her current job as a Lecturer in the School of Psychology.

'When I was studying for my doctorate at the University of Notre Dame I became involved with a research team collaborating with Queen's. That early experience made me aware of what a wonderful institution Queen's was.'

'I moved from working with women to working with youth, in particular the generation born after the peace accord. My research aims to understand what challenges they face that are different or unique from those faced before.'

She is part of an interdisciplinary international team in the closing stages of the ambitious six-year Northern Ireland Project, a longitudinal study involving 1,000 mother-and-child pairs,

examining the relations between political violence and the well-being of children.

'We talk to the families over time to see how the kids think and feel, how attitudes and emotions might be changing and how they relate to family support and family stress.'

This part of the research is funded by the US National Institute of Child Health and Human Development. A follow-up qualitative phase is being funded by the Office of the First Minister and Deputy First Minister. There have been presentations at Stormont and at an event in Belfast involving community organisations.

'We want to provide some depth to the longitudinal survey. We're in the transition between basic research - trying to understand how things unfold over time and develop among young people - and moving towards informing policy and practice.'

'I focus on constructive outcomes. What are the things that might encourage young

people to engage in more positive ways with the community, such as civic engagement rather than negative behaviours like rioting?'

'In a democracy we should be able to vote and hold political leaders accountable. If we believe that system works and we can see the impact, we're going to buy into it.'

Laura says the theme of this research can apply in multiple contexts. She singles out its relevance in Croatia, to 'youth growing up amid intergroup divide.'

She is grateful for the early support she received from the late Ed Cairns and also the help of her colleague at Queen's, Professor Rhiannon Turner.

'Interdisciplinary work is very important and I find I'm working in a very natural way with people in other schools. For example, I've made important connections in the School of Education. They're fantastic collaborators.'

Dr Laura Taylor
Centre for Identity and Intergroup Relations
School of Psychology

“ I focus on constructive outcomes. What are the things that might encourage young people to engage in more positive ways with the community? ”



I'm trying to reduce the burden to the healthcare system and I'm inspired to do something excellent for patients and society.



Dr Raj Singh Thakur
School of Pharmacy

BRINGING COMFORT TO PATIENTS IN TREATMENT OF EYE DISEASES

Dr Raj Singh Thakur's aspirational research programme is developing novel methods of drug delivery which will be of global benefit in treating the world's major eye diseases.

He says, 'Age-related macular degeneration, diabetic retinopathy and diabetic macular edema – these are all very challenging to treat. Patients have to see their doctor almost monthly to get an injection into the eye. That's not patient-friendly.'

So Raj's research is looking at another way to provide treatment – through implants.

His development of this field of research began with his undergraduate degree in Pharmacy at the Jawaharlal Nehru Technological University in Hyderabad 'where I got a lot of inspiration about drug delivery systems.' Then he completed a Masters in Pharmaceutics at the University of Science Malaysia, during which time he also developed a tablet formulation which is now being marketed commercially.

When he came across the concept of microneedles and the research being carried out at Queen's, he set his sights on Belfast and in 2006 arrived as a PhD student to work with Professor Ryan Donnelly. 'That was exciting because it was a totally different area of drug delivery compared to the conventional systems of the time, like patches.'

After his PhD he worked as a postdoctoral researcher, then became a lecturer, and backed by funding from the School, headed to Nanyang Technological University in Singapore for research training.

'That was when I started to focus on something which had not been done in the School of Pharmacy before – ocular drug delivery – and when I came back I started to work on it.' With Professor David Jones as a mentor, he secured funding from InvestNI.

'Repeated injections in the eye can cause problems. There are chances of infection, of bacteria from the surface of the eye getting in. The patient needs antibiotic drugs as well as the medicine itself which is very expensive to

provide. It costs roughly £18k for 24 injections to treat one patient suffering from age-related macular degeneration in the UK.

'People need the injections just to maintain their existing state of blurred vision. If they don't get the injections they'll go blind but even so they miss appointments because they're afraid.'

Raj and his team are working on implants using liquid material which turns solid after being injected. 'If we can inject this material on the outside of the eye, it's less invasive. We can also control the drug release from two months to a year so it's one injection every four or six months, not every four weeks.'

He is also working on injectable-size solid implants composed of bio-compatible, biodegradable material. 'We administer once, it stays there and dissolves over time.'

And there is research into longer-lasting eyedrops for glaucoma. 'At the moment there are problems here too. How do you get the dosage right? And when you blink – most of the drug is gone.'

There are major global collaborators, including the Moran Eye Centre at the University of Utah, the Singapore Eye Research Institute, and with chemical engineers at the University of Loughborough.

Raj's research has led to the formation of a new Queen's spin-out company – Re-Vana – shortlisted in the top 18 UK and top 40 global healthcare/life science start-ups by Mass Challenge 2015.

'This is platform technology in which you can change the drug, change the application. Companies are interested in sustained release implants which are safe for the eye, don't cause irritation and are easily manufactured.'

'Clinicians want something better for the patient. Patients want something more convenient for them and scientists are working towards better therapy than the existing one. I'm trying to reduce the burden to the healthcare system. I'm inspired to do something excellent for the benefits of patients and society.'

BIG DATA AND BIG CHALLENGES AT THE CORE OF COMPUTER SCIENCE

The expansion of teaching and research in Computer Science is a priority for Queen's. It can be seen in the redevelopment of its home at the Bernard Crossland Building where a modern new structure is being created and it can be seen in the appointment of new academics like Dr Hans Vandierendonck who is opening up research in a fast-developing field.

A degree in Computer Engineering from Ghent University in Belgium led to a PhD which focused on Computer Architecture, 'the branch of computer science which studies how to design and organise the hardware components of computing systems.'

He spent eight years as a research fellow at the Research Foundation Flanders working on high-performance computing. During this time he also travelled to Crete for a collaboration at FORTH – the Foundation for Research and Technology Hellas – with Professor Dimitrios Nikolopoulos who would

later join the School of Electronics, Electrical Engineering and Computer Science at Queen's.

'That's how I got to know about Queen's and when an opening as a lecturer came up I applied for it.'

These are rapidly changing times in computer science, as Hans explains. 'Computers became faster and faster but there were physical restraints on how to cope with this. So round about 2004 multi-core computers were introduced.

'Now if you buy a laptop, or even a mobile phone, it doesn't have one CPU – central processing unit – it has two or perhaps four. It's like working in a restaurant where instead of one chef preparing a dish you have several working on it.

'But software that's been written for multi-core CPUs is much less reliable, more buggy and much harder to fix than the software written for a single CPU. So you have to solve the problem – how can I write software that uses multiple

cores but doesn't pose any significant problems for the programmer? That's the programme I started to work on in my postdoc years and it's what I'm working on today at Queen's.'

In addition, a research project through an ERC Marie Curie Fellowship, and with support from the international software company SAP in Belfast, relates to big data and how to manage it. It involves a new type of technology – non-volatile memory.

'Vast amounts of data are being amassed and need vast amounts of energy. Google, Facebook, Twitter, BT – most companies have data centres using tens of megawatts each. In fact, it's estimated that the data centres around the world are consuming more power than the whole of Italy.

'Companies currently store these big datasets within the main memory of the computer. Traditional DRAM-based memories consume a lot of energy because they forget quickly and the data must be rewritten before it disappears. But this new technology uses

very little energy. Reading and writing takes up energy but once you store it, it remains there, using almost none.'

Another project involving big data is being funded by the EC's Data Value Chain and is a collaboration with the National Technical University of Athens, FORTH, the University of Geneva and the Italian telecoms company Wind.

'Wind are giving us a chunk of data from customer records to be analysed. One of the things they have in mind is shared car rides. They can identify people living in the same area and travelling to the same place so they want to give them the opportunity to subscribe to a service that shares a car.

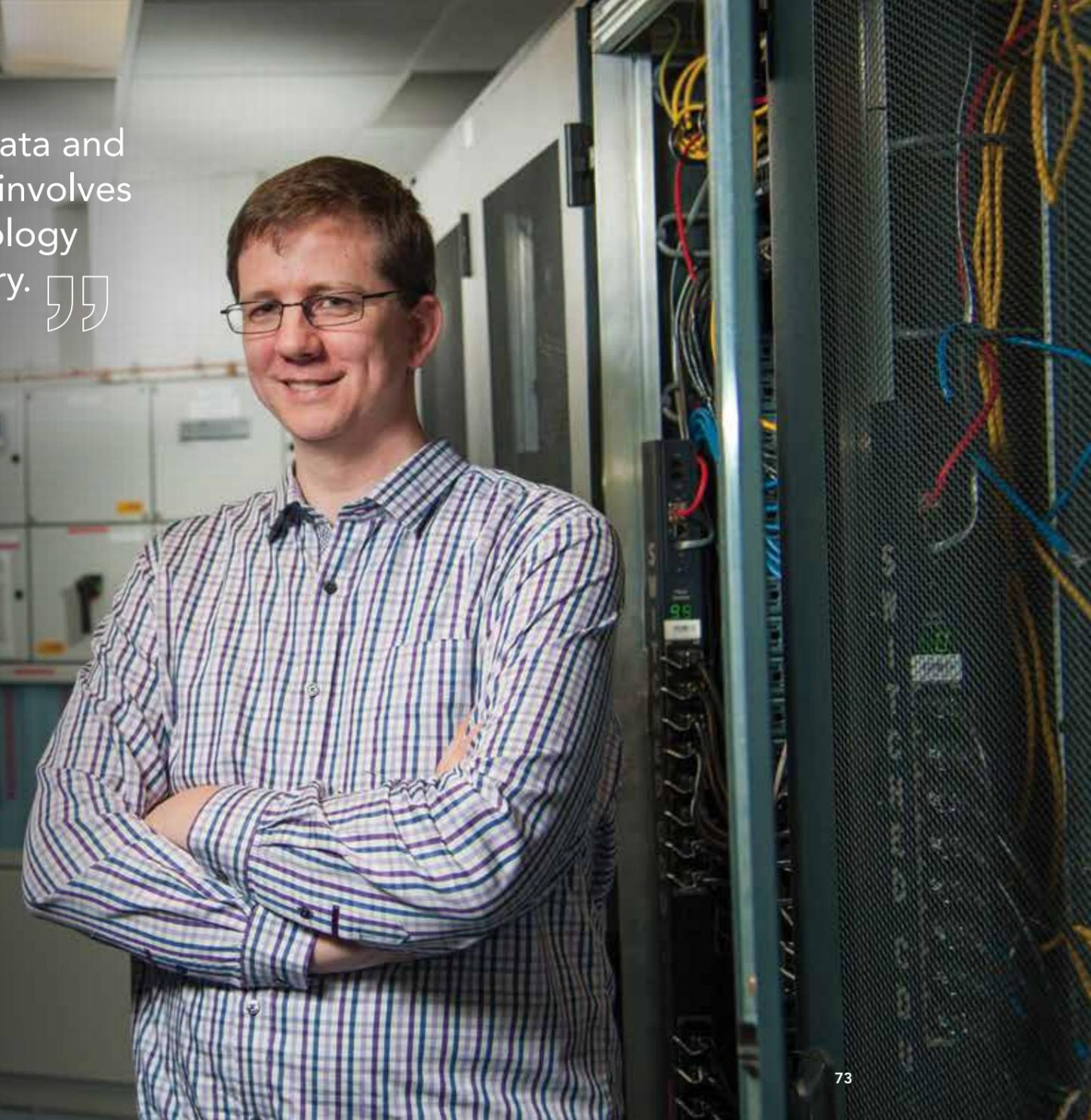
'We're living in a digital world. The gigantic amount of data being shipped around the internet is growing at an exponential rate, doubling about every year. This is hard to sustain. There's nothing in nature that grows at such a pace.'

“

I'm working on big data and how to manage it. It involves a new type of technology – non-volatile memory. ”

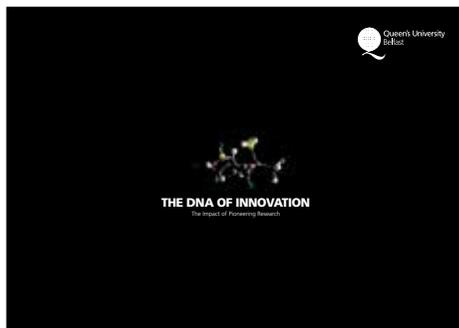
”

Dr Hans Vandierendonck
High Performance and Distributed Computing,
School of Electronics, Electrical Engineering
and Computer Science



Previous titles published in
The DNA of Innovation series are:

The DNA of Innovation: Volume I
The Impact of Pioneering Research



The DNA of Innovation: Volume II
The Impact of World-Class Research at Queen's



The DNA of Innovation: Volume III
Creative Connections



The DNA of Innovation: Volume IV
Our Global Impact on Society



For further information, or to download PDF copies of these publications, please visit the 'Impact' section of the Research and Enterprise Directorate website. Video interviews with and presentations given at events by some of the academics profiled in the *DNA of Innovation* series are also available: <http://go.qub.ac.uk/impact>

This publication was produced by the Research and Enterprise Directorate, Queen's University Belfast:
63 University Road, Belfast, BT7 1NF businessnetworks@qub.ac.uk Tel: 00 44 (28) 9097 2568

