Queen's University Belfast

THE DNA OF INNOVATION

THE IMPACT OF WORLD-CLASS RESEARCH AT QUEEN'S

VOLUME TWO

CONTENTS

> The pioneering spirit of our staff provides answers to some of the world's major issues.

FOREWORD

PROFESSOR SIR PETER GREGSON
PRESIDENT AND VICE-CHANCELLOR OF QUEEN'S UNIVERSITY BELFAST

One of the proudest moments in the recent history of our University came at Buckingham Palace early in 2012 when Her Majesty the Queen presented us with a Diamond Jubilee Queen's Anniversary Prize, the UK's most prestigious form of national recognition for a Higher or Further Education Institution.

The award was a particular tribute to the University's work in creating the Comprehensive Cancer Services programme which is providing innovative new treatments and improved cancer care throughout Northern Ireland. It also acknowledges what can be achieved through collaboration – in this instance a partnership involving Queen's, the Department of Health and our five Health Trusts.

That spirit of collaboration is also at the heart of the ground-breaking research which we explore in this new publication.

Being a member of the Russell Group, which bands together the leading research-intensive universities in the UK, brings responsibility. It demands both excellence and impact. In times of economic difficulty, universities such as ours are seen as drivers of growth, providing innovative solutions to global challenges. On these pages, you will see how those challenges are being met.

Through every part of Queen's, research work is being conducted in partnership with other academic staff, with universities at home and abroad and with international agencies and industries. These partnerships allow us to expand our horizons and enhance our international reputation, as we attract an increasing number of researchers from all over the world to share in the Queen's experience.

The pioneering spirit of our staff provides answers to some of the world's major issues. Our role as an institution is to provide a supportive environment where they can develop their ideas and where their work can flourish.

In these case studies you will read about the people, their projects and the contribution they are making to society. You will learn about the enormous range of research activity taking place at Queen's and why it is recognised as a world-leading institution, a university making a global impact from the heart of Northern Ireland.

> ... research of extraordinary diversity, advancing and exchanging knowledge, delivering impact and benefit to Northern Ireland and to the wider world.

INTRODUCTION

SCOTT RUTHERFORD
DIRECTOR OF RESEARCH AND ENTERPRISE

A rich heritage of discovery shines out from the case studies in this publication. They tell the story of a university and its people involved in research of extraordinary diversity, advancing and exchanging knowledge, delivering impact and benefit to Northern Ireland and to the wider world.

It is the story of a university engaged with the major challenges of modern times but also aware of the part which history, both distant and recent, plays in all our lives.

In the previous volume of *The DNA of Innovation*, we turned the spotlight on the achievements of academics working on projects funded by the Engineering and Physical Sciences Research Council. Scientific innovation is celebrated in this publication, too, but we also wanted to consider the successes of a broader research base and how it benefits society in terms of policy, culture and business.

Our work in health and life sciences is providing remarkable new results and therapies in the treatment of many serious illnesses, including cancer. Our researchers are also finding new ways to combat viruses, to track the causes of major eye diseases or to help the lives of people suffering from debilitating conditions such as Parkinson's.

Technology, ever advancing, plays its part in areas of research beyond traditional fields of medicine, engineering and sciences. An electronic database provides scholars with access to rare medieval texts as never before; state-of-the-art communication allows musicians at our Sonic Arts Lab to engage in simultaneous performances with collaborators in Brazil and California; while elsewhere, the University's wave tank facilities provide a fluid platform for work on new sources of energy.

Several of the case studies emphasise the distinctive role and important responsibility which Queen's has within the community it serves. Our Pro-Vice-Chancellor for Academic Planning, Staffing and External Relations, Professor Tony Gallagher, looks at our children and our schools and talks of 'creating the architecture of a new society.' His work on the development of shared education is a significant building block.

Queen's is a university at the heart of a post-conflict society. Our academics study and influence how communities deal with the legacy of violence and division, both in Northern Ireland and in the wider world. Their vision is truly global. They also cast light on issues ranging from poverty and social exclusion in the UK to community business enterprise in Africa. Even the world economic crisis is a vivid backdrop to the exciting activity at the Queen's Management School and our Leadership Institute.

Queen's is a powerhouse of knowledge and enterprise. It is our purpose in this publication to emphasise the breadth of the impact of the inspirational work being carried out at one of the most research-intensive universities in the UK – work that is truly exceptional.

A SOLUTION TO GLOBAL SWINE DISEASE FROM A LAB IN BELFAST

> It's been the most successful research to date into swine disease.

Professor Gordon Allan
School of Biological Sciences

Many scientists dream of finding a way to combat a virus successfully, but Gordon Allan and his colleagues have actually done it.

Professor Allan's expertise, known all over the world, is in pig diseases. He retired in 2009 as Principal Scientific Officer with the Agri-Food and Biosciences Institute (AFBI), formerly the Science Service of the Northern Ireland Department of Agriculture, where he had worked for 40 years, but in addition he has had a long association with Queen's as an honorary Professor, working with the University on a range of successful research projects. In 2011 he was appointed as a 'World Leading Expert' Professor of Porcine Virology in the School of Biological Sciences.

'I believe I was the first technician from the Veterinary Sciences Division of the Department of Agriculture to register at Queen's for a PhD. This was on the characterisation, epidemiology and pathogenesis of porcine circovirus.

'I was working on a virus which we now know as PCV1 when I was contacted by people at the University of Saskatoon in Canada who had found an unusual new wasting disease in pigs in Canada. It was emerging at the same time in France.

'They thought it might be a pig circovirus which was why they came to me for help. We sent these colleagues in Canada a lot of reagents and expertise and they sent us material. Together we worked in the labs in Belfast and Canada and we recovered a new circovirus out of the material from the diseased pigs which was different from PCV1. I designated it PCV2.'

The disease caused by this virus quickly spread around the world and became the most important global swine disease of the 'noughties.' Substantial grant funding to study the new disease was obtained through the University's contracts with the European Union and commercial companies and work began in 1997 involving Queen's, the Department of Agriculture, the University of Saskatoon and Merial, the multi-national animal health company.

Vaccines and diagnostics were developed and they are now being sold globally. PCV2 vaccine is the biggest-selling veterinary vaccine in the world, generating something in the region of 400m US dollars a year in revenue, from which Queen's and the AFBI receive a substantial royalty.

The successful outcome of this research was driven forward by more than 10 years of international collaborative research, co-ordinated by Professor Allan through Queen's, resulting in a vaccine that is probably the most efficient ever produced.

The animals no longer get the disease. 'But nature abhors a vacuum and there are, and always will be, new emerging infectious agents and new diseases to fill it.'

He sees today's funding landscape as being very different from that of 15 years ago. 'When this disease emerged we were in the position – through serendipity – where we had the expertise on this virus group, but somebody, somewhere on the globe, needs to maintain the expertise in these new small viruses. It's not easy now to get money from commercial and non-commercial sources for horizon scanning and emerging diseases.

'The legacy of the work? It's the most successful research to date into swine disease, in terms of identifying and then solving the problem, and all of the multinational contract research that resulted in this success was coordinated through Queen's. I make sure I fly that flag wherever I go, helping to generate good PR and perhaps future income for the University.

'Nowadays I spend a lot of my time reviewing papers and grant applications, attending meetings, networking and advising people about grant applications and if my name helps, that's fine. Because of my PCV2 research coordination activities I have friends and associates in a lot of laboratories and research institutes around the world, and I still check in with them to find out what they're doing, what's new and if I can help.

'At the moment, among other things, I'm talking to people I know in the pig business about PCV2 disease in sub-Saharan Africa. Nobody's looked for it there.'

TEMPUS G: WHAT HAPPENS WHEN WE LOSE CONTROL OF HOW WE MOVE?

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What happens when our control breaks down – as in Parkinson’s?

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Cathy Craig’s research space at the Queen’s Physical Education Centre is a long gallery known as the Movement Innovation Lab. But it used to have another purpose.

‘Originally, it was to be a rifle range,’ Cathy says, ‘but there was never a shot fired here.’

Not a surprise in the Northern Ireland of the 70s. But these days there are different targets. Cathy, a Professor in the School of Psychology, is engaged in a unique research project which looks at how we move, why we move and why sometimes we can’t.

She studied psychology at Edinburgh University. ‘I really enjoyed research. I was particularly interested in movement and perception and action – things like how we can hit a golf ball, how we can walk across the street between cars, how the brain decodes that information and allows us to guide our actions.’

For her PhD she focused on the problems of pre-term infants, devising a method of monitoring their sucking actions as a way of identifying future coordination difficulties.

After university she spent eight years working at a movement and perception lab at the University of the Mediterranean in Marseille. ‘We did all sorts of experiments – parabolic flights where you can actually experience zero gravity – and I got into virtual reality as a resource. It was there that I discovered the power of virtual reality technology as a way of probing the complexities of the visual system.’

She was also able to combine her work with her love of sport. ‘I was always fascinated by the curved free kick but especially what it meant for the goalkeeper. I worked with experts from Adidas on the design of their ball and I got to carry out research with some of the world’s greatest players, at Marseille and AC Milan.’

Cathy’s latest project is called Tempus G, a five-year study being funded by the European Research Council. ‘It stands for the Temporal Enhancement of Motor Performance Using Sensory Guides. We control our movements all the time – directing our eyes to read text, using a pen, picking up a cup. But what happens when temporal control of movement breaks down, as in Parkinson’s Disease?’

Professor Cathy Craig
School of Psychology

Her Movement Innovation Lab is equipped with an array of technological equipment but there is one curious construction. In the middle is a balance board, embedded in a foam platform, with a zimmer frame ‘which we got from Argos.’ And there’s a video screen.

Cathy explains, ‘We’ve created our own game specifically for adults over 65 who have difficulty controlling their balance. They’ve really taken to it. When they get a good score their balance confidence improves. The competitive edge is very valuable.’

Other research concerns people with Parkinson’s Disease. ‘Parkinson’s attacks the gearbox of the motor system of the brain, that part which allows you to initiate movement and to control it smoothly. We found that if you provide people with a cue, it makes a difference and they can actually move much better. We’re using the sound that’s made when someone walks on gravel. You can tell how big they are, how fast they’re moving, that sort of thing. We’re trying to see if people can use those sounds in order to walk better and so far the results are very promising. The next step will be to see how we can take this outside the lab.’

To measure human movement precisely, Cathy uses very sophisticated infrared cameras that record the motion of reflective markers placed all over the body. This is the same technology that is used for computer animation.

‘We’re trying to understand how someone moves and, if there’s something wrong, how you can improve things. We’re trying to make a difference to people’s lives.’

GIVING OUR FOOD AN EVEN HIGHER GLOBAL REPUTATION FOR SAFETY

For Professor Chris Elliott, dioxin is a dirty word – and one he would like to hear a lot less in future. Indeed, that ambition is at the heart of an international research project he is driving, funded by 3m Euro from the European Commission's Framework 7 Programme.

Dioxins are highly toxic, persistent environmental pollutants. Chris, Director of Queen's Institute of Agri-Food and Land Use, says, 'If you think about the large number of food scares right across the world in the last 20 or 30 years – things like dioxins, BSE, salmonella outbreaks – they all have a common denominator: contaminated animal feed. Here at the Institute we thought that if you're trying to make food safer, the first port of call should be the animal food supply chain.'

Along with several European colleagues, Professor Elliott and his team produced a large research proposal which they presented to the European Commission. In it, they explained their concept – QSAFFE, standing for Quality and SAfety Feeds and Food for Europe. The EU evaluated it along with multiple other research proposals and ranked it number one of those submitted.

The four-year project is under way. 'We're linked up with a lot of excellent researchers in Europe but also further afield, through a partnership with a leading university in China. We're looking at ways of trying to find contamination episodes much quicker than is currently the case. We're trying to find out how those contaminations happened and to try to provide strategies for preventing them happening in the future.'

Chris was recruited by Queen's in 2005, after 25 years in the Department of Agriculture Science Service, to head up the Institute which had just been created.

'It was a great opportunity to link up with many highly-ranked international organisations, food production and biotechnology companies, and to collaborate with them on research of importance globally, but also with substantial importance to our local agri-food sector and consumers.

'My brief from the University was to try to reinvigorate both teaching and research in agriculture and food, to try to move them forward with new and cutting-edge dimensions. The student intake then was low but now, for every place Queen's has, we're getting eight applicants. Not only that, but when we introduced a new Food Safety Masters programme, within a few weeks of advertising, we had enough international students to fill the course.'

After years when agriculture in Northern Ireland was in poor shape, Chris now sees an agri-food economy which is doing extremely well and out-performing just about every other sector.

But food scares are often big news. Chris works with the Science Media Centre, an independent, London-based team which aims to get to the facts behind the headline.

'They will contact me and ask me if I want to comment about a scare. Often there's nothing in it to alarm the public about - or no-one's going to get ill from what happened. But sometimes there's the other extreme – like a very bad case of E. coli in Germany where 35 people died. What was the true source of that contaminated food?

'Food traceability is one of our big research themes. Think of cars. If there's a fault, a manufacturer will know within a short time who owns the cars and where in the world they are. You can't do that with food.

'If our research goes the way we want it, you won't actually see the successful impact because there should be no food scares. We work with a lot of local companies which import feed materials and they're trying to prevent the next dioxin scare. If there are no more dioxin scares in Ireland we can take some of the credit for that. The success will ultimately show impact with Northern Ireland food produce gaining an even higher world-wide reputation for being safe.

'It's not that we're going to produce some wonderful molecule or the cure for cancer. Our research is about trying to prevent things from happening. The world has cottoned on to the fact that cheap food isn't everything, but safe and high quality food is of great importance.'

CREATING THE ARCHITECTURE OF A NEW SOCIETY – BASED ON PEACE

Professor Tony Gallagher
Pro-Vice-Chancellor for Academic Planning, Staffing and External Relations

Professor Tony Gallagher seems surprised by the suggestion that he might be described as a visionary. Yet there is no doubt that his unique perspective is what is behind an imaginative programme of research which could have a lasting impact on learning in Northern Ireland.

His brainchild, the Shared Education Programme, is about forming bonds between schools – 'creating networks of trust and friendship which will change the nature of relationships between communities. People from outside Northern Ireland are amazed at the system here and the institutional barriers that exist. Our research is trying to find ways of making those barriers more porous, of getting teachers and pupils to move between schools – all part of creating the architecture of a new society that's based on peace.'

Funding has been provided by the International Fund for Ireland and Atlantic Philanthropies, with additional support from the Economic and Social Research Council.

Tony has vivid memories of a time when things in Northern Ireland were different. He was educated at St. Malachy's College in North Belfast during the 70s, 'a period when the violence was just awful. That really shaped and informed my teenage years.'

He went to Queen's where he became fascinated by social psychology 'because of the way it helps us understand relationships between people.' A psychology degree was followed by a masters, then a PhD.

After university he worked in educational research and at the Centre for the Study of Conflict. He returned to Queen's as a lecturer in education, followed by a gradual process of promotion that led to his becoming Head of the School of Education, a role he fulfilled for five years before becoming Pro Vice-Chancellor with responsibility for academic planning, staffing and external relations.

He explains the background to his research. 'Over the past 30 years there have been three approaches to bringing young people together – through the curriculum, through contact programmes, such as joint holidays, or through integrated schools. There has been inspirational work in all these areas but the scale was limited and slow.

'The Peace Process provided new opportunities for research and funding. We wanted to achieve broader systemic effects more quickly, with schools being seen as a network, rather than as a collection of individual places. Currently they're autonomous, competitive, with kids cut off from one another, so would it be possible to change that relationship?'

In 2006, 12 schools were approached and all agreed to take part. By the end of the first three years of the programme, 5,000 pupils from more than 60 schools were involved.

The Shared Education Programme has also had influence beyond Northern Ireland. 'They're very excited about it in Macedonia where there are separate schools for Macedonians and Albanians – sometimes different shifts in the one school.'

It has been genuinely innovative. 'We had no template. We depended on the expertise of the teachers and we were prepared to let them try things. Some of them didn't work but you can still learn from that.

'It's been wonderful to see kids in the one classroom and wearing two or three different school uniforms. But we want to create a situation where this isn't extraordinary.

'We're measuring the longer-term consequences of sustained regular contact and interchange. One of the striking facts in the first survey carried out was that 40 per cent of the pupils involved had never met someone from the other community before – and this was 15 years after peace. To me that was an extraordinary illustration of just how divided our society still is.'

Queen's itself has also played a part. 'I see what we're doing as part of the great civic tradition on which Queen's was founded. The support of the university has added a sense of legitimacy to the project. It has also been an opportunity for some secondary school pupils who didn't have a relationship with us to get a look at what it's like.'

As for the future of the Shared Education Programme, he says, 'The longer-term aim is to promote processes that aid reconciliation through ideas that are new. We don't use the term best practice. We talk about next practice. It's about looking over the horizon, rather than looking over your shoulder.'

> "I see what we're doing as part of the great civic tradition on which Queen's was founded."

INVISIBILITY AND BEYOND: NEW HORIZONS IN TECHNOLOGY

Dr George Goussetis
School of Electronics, Electrical Engineering and Computer Science

George Goussetis is one of a team of scientists pushing the boundaries of innovation, dealing in concepts and applications in technology that would have been unimaginable not so many years ago.

Dr Goussetis is a reader in Electronics, Electrical Engineering and Computer Science at the Queen's Institute of Electronics, Communications and Information Technology (ECIT) where thinking outside the box is encouraged. 'This exciting environment,' he says, 'is very much the reason I'm here.'

Born in Greece, he came to the UK in 1998 on an Erasmus exchange for three months 'and ended up staying 14 years.' He did his PhD at the University of Westminster in microwaves and microwave filters. From there he obtained a postdoctoral position at Loughborough University before moving to Heriot-Watt in Edinburgh and then Queen's in 2006. In that year he was awarded a five-year research fellowship by the Royal Academy of Engineering.

His research interests at ECIT include numerical electromagnetics, microwave filters, antennas, frequency-selective surfaces and microwave heating.

'The cluster in which I work deals with high frequency electronics and in that field we sit comfortably among the best in the UK, both in terms of our size and facilities, but also and more importantly the output.'

Specific projects include – research into systems which operate as ultra-fast high speed wireless connections for the home environment. 'Rather than connecting your dvd or Blueray in the conventional manner, we've developed a way of doing this through a wireless link.'

Sources of funding for the research are diverse and include support from the EPSRC, from the EU, from industry – including a recent grant from Samsung – and from the European Space Agency.

Dr Goussetis believes in the advantages of spending time with commercial firms. 'Last year I was seconded to one in Dublin which manufactures its own chipsets – integrated circuits for use with microprocessors – which it then sells to electronic companies. And I'm also scheduled to go on secondment to a company in Austria, one of the big European chip manufacturers.

'It's very important to get to know what's needed in industry so that you can direct your research to areas that are relevant. You get to know how industry works, you make valuable contacts. As an academic, you may come up with ideas but you need the pathway to capitalise on them so it's helpful to know people who can make things happen.'

The ECIT philosophy of blue skies, as well as strategic and industrial research projects, is one that Dr Goussetis is happy to embrace. 'My PhD was very much focused on applied mathematics and since then I have been heavily involved in a field of engineering and physics called metamaterials. These are artificial materials which are engineered to have properties that may not be found in nature. It's the topic for which I received my research fellowship – a field that really started no more than 10 or 12 years ago so it's very much blue sky.

'The main concept is considering whether we can actually reproduce the electronic properties of real materials – such as in refraction...the straw bending in the glass...but also producing properties that are not otherwise available naturally. Through this we are pursuing something of a holy grail – the concept of cloaking – how you can dress something like a building with something else – like a kind of film of light - in order to render it invisible.

'There are potential applications in defence, of course, but lately people have been wondering if you could make this work in other areas. Could you actually cloak buildings from earthquakes or a tsunami?'

He is constantly scanning new horizons. He is involved in a knowledge transfer project funded by the Royal Society looking at selective shielding of buildings from cyber attack.

'It's relevant to banks, for example, which want to maintain a wireless network which is physically secure and confined within the building, but they also want to have wireless access to the outside world by mobile. I use the example of the microwave oven: the grid behind the glass has apertures large enough to let light go through but small enough to keep the radiation inside. We're looking at the idea of conductive paint or a stencil to achieve the same result.'

He says, 'In general, we're looking into components, concepts and approaches for systems that are one or two generations ahead. It might be in the area of telecommunication, of sensing, or there may be medical applications. But we're also keeping in touch with the needs of industry now as well as in the next five years. The impact, in terms of wealth creation, policy-making and general benefits to society, is immense.'

> "The main concept is considering whether we can actually reproduce the electronic properties of real materials."

TAILORING A UNIQUE APPROACH TO CANCER CARE

Paul Harkin and Richard Kennedy are at the heart of an imaginative research partnership that is delivering dramatic results for Queen's University, for a top pharmaceutical company and, above all, for the care of cancer patients.

Paul is Professor of Molecular Oncology at Queen's, but he is also President and Managing Director of Craigavon-based Almac Diagnostics. Richard is Vice President and Medical Director of the company. He holds the additional post at Queen's of McClay Professor of Experimental Cancer Medicine.

The initiative is based at the Centre for Cancer Research and Cell Biology. More than £4.4m has been invested through InvestNI and Almac in a three-year programme to help develop more effective tests for certain forms of cancer.

Both men are graduates of Queen's. After gaining his PhD in the genetics of ovarian cancer, Paul went to Harvard Medical School and did a postdoctoral placement at Massachusetts General Hospital. Four years later, he returned to Queen's where he would eventually become a professor. Along the way he and the Dean of Medicine, Professor Paddy Johnston, formed a spin-out company that was taken over by Almac in 2004 and became Almac Diagnostics.

Richard's PhD is in molecular biology and he became a specialist registrar in medical oncology. He also spent a period at Harvard, working as an instructor in medicine, focussing on predictive tests. His foremost research interest is in personalised medicine, and he returned to Northern Ireland as Head of Research for Almac Diagnostics because they were interested in getting into that field.

He says, 'People with advanced disease are treated with chemotherapy but the response rates are low – 20 or 30 per cent - so the majority of people who receive chemotherapy aren't benefitting from it. It seems there are certain patients who benefit from certain drugs but we don't generally know that beforehand. We give what seems to work for the majority.

'But cancer medicine has changed over the last five to ten years. Increasingly we're trying to target the drugs to specific people. The idea is that a cancer that has a specific problem with its DNA may be sensitive to a particular drug and resistant to another drug. So if you know that abnormality exists, then you may tailor the treatment to the patient.'

Another exciting development is in the treatment of stage two colon cancer where new tests have been devised which can detect the likelihood of recurrence of disease in patients who have undergone surgery.

Richard explains, 'Stage two colon cancer can be cured but 25 per cent of people develop recurrent disease within five years. Now there's good evidence that if you analyse the DNA of the tumour at the time of presentation you can predict where this is likely to be the case and give that patient additional treatment to try to prevent it from happening.'

This molecular test has been validated and published in the journal of the American Society of Clinical Oncology. But more than that, as Paul points out, 'the test has been licensed to a USA diagnostics company with the intent of releasing it in the USA. We are also thinking about how we'll develop this in Europe. It all means that it's a commercial success for a project that originated and was driven here in Northern Ireland through this collaboration between Almac and Queen's.'

There is already a significant relationship between Almac and Queen's. The late founder of the company, Sir Allen McClay, was a significant benefactor of the University – the McClay Library is striking evidence – and the link remains with the McClay Foundation, the charitable trust.

Paul sees the relationship being strengthened still further. 'The intent would be to continue this collaboration long term. We would expect this programme to be successful so we would see it running in three-year cycles. The success of the programme will provide mutual benefits. Almac will have certain things that it wants to do with the output of the research but a lot of the data being generated can be utilised here and can lead to funding for the University from additional sources, leading to new programmes.

'All of it means additional valuable investment for Northern Ireland. We definitely see this as the beginning of a long journey.'

Professor Paul Harkin (right) and
Professor Richard Kennedy
School of Medicine, Dentistry and Biomedical Sciences

> "It's a commercial success for a product driven in Northern Ireland by Almac and Queen's."

DEVELOPMENT THROUGH ENTERPRISE IN SOUTHERN AND EASTERN AFRICA

Dr Diane Holt
Queen's University Management School

> Our goal is to showcase transformative, truly innovative business models.

Africa is like a second home to Dr Diane Holt.

She was brought up in the West Midlands where her father had a car repair business and her mother ran a shop. This early understanding and experience of local enterprise is something which has stayed with her throughout her academic career and which she is now using in a major project in the 19 countries of Southern and Eastern Africa.

Diane, a lecturer at Queen's Management School, has been travelling to Africa since she was a student at Stirling University in 1991. Now she has launched an imaginative and hugely ambitious research programme, funded by the Economic and Social Research Council First Grants Scheme, which she calls the 'Trickle Out Africa Project.' It aims to identify examples of social and environmental enterprises in the region and to explore and evaluate the role that these enterprises may play as a way of spreading social, environmental and economic benefits from within local communities.

It was from studying a group of small 'green' businesses in the United States that she developed an interest in the intersection between the environmental and social objectives of business. She read that social and environmental enterprises are considered the key to sustainable development in Africa, underlined by the words of the former UN Secretary General Kofi Annan that 'trade, not aid, is the long-term route out of poverty.'

She says, 'Our research proposal was unique. One of the biggest problems in Africa is that the usual way of conducting academic research is parachuting in, collecting data and then you go again, leaving nothing behind. I thought we could make more of a contribution than that so I came up with the idea of a directory.'

She describes this as being like 'a big online telephone book. The ambition is that if you want a partner in solar power technology in, say, Kenya, you can click and find one. In addition, many of the enterprises we're dealing with don't have a web presence of their own so this is a way of providing them with one.'

The directory will contain examples of social or environmental enterprises that produce, retail, manufacture or offer services, along with donor agencies, voluntary associations and assurance schemes that support them.

One problem she has encountered is – what constitutes a social enterprise? 'That's a big issue because they self-designate. The nature of these enterprises is radically different and so what we might think of as a social enterprise here – where, for example, a certain percentage of profit is reinvested – those things don't work so well in Africa. Some of the enterprises aren't even registered, they're not part of the formal economy, they don't pay tax.'

She explains,'There is a gaping hole in knowledge in this area. Our goal is to showcase the transformative, home-grown, truly innovative business models that form the bedrock of the region.

'The directory is making an impact already. It's early days yet but it's already becoming a very valuable resource for those who need it. It has the potential to become very powerful. It's growing constantly. The website and the data collection instruments are in five languages and that will increase too, and through individual case studies, we'll come up with a more rigorous evidence-led framework for the future.

'We hope that what we come up with will influence policy-makers and also shape how social and "environmental enterprise" is considered by those of us in the west looking at Africa. We're already making our mark. If you Google the words "environmental enterprise" and "Africa", you'll see that we're all over the internet.'

“We’re talking about the heartbeat of world culture.”

Professor David Johnston
School of Modern Languages

TRANSLATION: WHERE CULTURES COME TOGETHER

Mounted on the wall outside the Brian Friel Theatre at Queen’s is a poster which reveals one man’s artistic passion - a production of Lorca’s *Blood Wedding* ‘in a new version by David Johnston.’

David is Professor of Hispanic Studies at the University and a translation studies scholar of international reputation whose work is noted for its emphasis on creative engagement and ethical responsibility. He is frequently invited to deliver keynote lectures both at academic conferences around the world and at symposia organised by a wide range of cultural bodies, including the National Theatre in London, The Mexican Ministry of Culture, and the Nobel Academy in Stockholm. ‘My work is both theoretical and practical,’ he explains, ‘and a key part of that practice is translation for performance.’

It is this practical side to his work that has created immense international cultural impact. He has become a multi-award-winning translator who, in the last three years alone, has had over twenty professional and thirty amateur productions of his work in eight different countries. In Ireland he has worked with the Lyric and the Abbey, and has had national tours with Galloglass and Bruiser theatre companies. But his translations have been performed by some of the leading companies around the world – from the BBC to the Royal Court to the Washington Shakespeare Company. Furthermore, he has been commissioned three times by the Royal Shakespeare Company.

‘Like all subjects in the Humanities, translation studies is about thinking, about critical analysis and response - but translation is also deeply involved with the making of culture in a very real way’, he explains.

Much of this involvement has been with Spanish Golden Age theatre. Of the twenty-five professional productions of the great Lope de Vega on the British stage since 1900, fourteen of them have come from David, picking up a number of prestigious international awards along the way. ‘Translation for me is a way of understanding the complex processes at play in any moment of cultural encounter, but it is also an opportunity to introduce English-speaking audiences and practitioners to the huge riches of the Spanish and Latin-American theatre world’. And such audiences have turned up in numbers - his recent Washington production of Lope de Vega’s *The Dog in the Manger*, for example, played to over 26,000 spectators and was nominated for five Helen Hayes awards (including best play of the year).

His emphasis on translation as dialogue, an encounter, between two different cultures and languages has also led to success in securing external research funding. He is currently working with colleagues from Oxford and King’s College, London on a £1m grant from the Arts and Humanities Research Council.

‘We’ve set up an interactive website – Out of the Wings – that functions as a virtual theatre environment, providing the English-language theatre professional – critic, historian, practitioner – with a range and quality of access to Spanish-language theatre that is fit for professional purpose’.

The breadth of translation studies is evident in the range of innovative projects in which his PhD students are engaged. One is translating the Irish playwright Marina Carr into Brazilian Portuguese, one is working on the Latin comedies of Plautus for contemporary performance, while another is developing a new practice in film subtitling ‘so that subtitles are seen not as a necessary evil, as blemishes on the screen, but as a way of enhancing the aesthetic impact of the film as a whole.’

David says, ‘There’s also someone working on images of Polynesia in 19th-century French writing, another student who’s looking at translation and public policy in Northern Ireland, and another who’s examining how located communities imagine – translate – unmapped communities, such as the travellers in Ireland or the favelas in Brazil. All of this is translation in the sense of cultural encounter. It’s translation in the way that Brian Friel uses it when he talks about the importance of looking outwards from your own cultural homeland and beginning to engage with the alternatives’.

For David, this is what translation is about: ‘It’s the heartbeat of culture, the establishing of connections of thought and feeling across the divides of time and space.’

HELPING COMMUNITY HEALTH CAN BE A WALK IN THE PARK

> We're trying to tilt the balance away from only looking at the causes of things – looking instead at what interventions will make things better.

Professor Frank Kee
The UKCRC Centre of Excellence for Public Health NI

When Professor Frank Kee decided to become a doctor, he did not have general practice in mind.

'Public health was a career choice from very early on, when I was a student. I was interested in the basic science of epidemiology. I was interested in being able to intervene in terms of whole populations rather than just single patients.'

Now, as Director of The UKCRC (UK Clinical Research Collaboration) Centre of Excellence for Public Health NI, he has that capacity. He explains, 'There are five UKCRC Centres of Excellence across the UK and they were established in 2008 through multi-partner funding from a consortium of Research Councils and major charities – the Economic and Social Research Council, Medical Research Council (MRC) and the Wellcome Foundation among the biggest. We were set up to build capacity in public health research - but research that has an outward face and can have translational impact, so we have been engaged with practitioners and policy-makers from the start.'

Much of the impact is through specific projects. One of the biggest is known as the PARC study – Physical Activity Rejuvenating Connswater.

'We're in collaboration with the East Belfast Partnership who were awarded a Big Lottery grant to build the Connswater Community Greenway. We made an independent grant application to the MRC to evaluate its impact and were awarded almost £1m over a five-year period to do that.

'So far the partnership with our stakeholders has been a real success. As we've been producing our early findings we've been able to relate them back to local people. For example, we recently carried out our first household survey and have been able to present the results to representatives of the local community. It's good to have that direct link. In fact, in 2011 the Joseph Rowntree Foundation produced a report on the impact of local research and they chose the PARC study as one of their examples of good practice.'

Another workstream in the Centre involves the development of public health infrastructure. 'That doesn't mean bricks and mortar. It can be a resource such as record linkage of public health data. One of our researchers is leading many projects associated with the Northern Ireland longitudinal study based on the 2001 census. What's emerging is quite powerful – such as how social circumstances affect mortality.'

As Professor Kee explains, the work of the Centre is carefully and closely managed by the Research Councils.

'They look at the engagement we have with decision-makers and how our work influences policy and practice. Ultimately, our impact will be in the wellbeing of the community but senior researchers sit on a variety of regional policy advisory committees, such as those devising obesity prevention strategies and the multi-sectoral group updating the Investing for Health strategy.'

He believes in strengthening intervention research. 'We're trying to tilt the balance away from only looking at the causes of things – looking instead at what interventions will make things better. In the PARC study, it's changing the built Environment. For example we have experimented with physical activity loyalty cards and carried out a trial with 400 civil servants at Stormont. When the civil servants went for a walk around the grounds at lunchtime they could swipe the card at sensors we'd set up at various locations around the estate. They could build up "points" according to how much walking they did and get rewarded with retail vouchers. This trial has gone well and so interventions like this will be part of our focus in the future.

'The Government talks about trying to change what it calls the choice architecture of our lives. However, behavioural change isn't solely down to personal decisions. People are affected by their circumstances. So I welcome things like the minimum price of alcohol and the smoking ban. Government and society as a whole have to complement individual choices.'

THE UNIQUE TEST BRINGING HOPE TO CHILDLESS COUPLES

Sheena Lewis chalked up a remarkable first with the January 2012 edition of *Focus on Reproduction*, the quarterly periodical of the European Society of Human Reproduction and Embryology.

'Not only was my work the main story,' she says, 'but it was the first time they'd ever had a picture of a sperm on the cover.'

While the feature was undoubtedly a highlight in her professional sphere – she is Professor of Reproductive Medicine at Queen's and leads the University's research group in that field – her work has been attracting attention literally from Albuquerque to Azerbaijan, making an impact on the people who need it most: couples who are struggling to have children.

As she explains, 'One in six couples will have difficulty having a family and 40 per cent of these problems relate to the man. The only test for a man up until now has been semen analysis – basically just looking down the microscope at the sperm, seeing how many, how fast they're moving. It's a very blunt instrument.'

Over the last 20 years her research has focused on the molecular structure of the sperm's DNA instead. Funding has included grants from the European Framework 7 Programme, National Institute of Health Research, the Wellcome Trust and the Research and Development Office in Belfast.

'The only thing that is really important in any sperm is its DNA. That's what combines with the egg to form the embryo. Nothing else matters. So we've been looking at it at a very advanced molecular level. Then in 2010 our research group published four papers in the best journals in the UK and the US and suddenly Reuters took an interest and infertile couples started emailing me, asking – how can we have this test?'

It gave Professor Lewis pause for thought. 'I was thinking – I'm an academic. We're not selling to the public. And then I thought – we have a responsibility to do this. Here we have a process from bench to bedside. Quite simply - we've developed a test which could be useful in giving better diagnoses and prognoses for men who've got fertility problems. Why shouldn't we go ahead?'

The result is the spin-out company Lewis Fertility Testing Ltd, of which she is Managing Director, which was launched with the help of QUBIS.

'This is a local business with a global market. What happens is that fertility clinics sign contracts with us and then they send us their samples for testing. Some of the clinics in the UK have satellite clinics in India and China. We can test those too. Samples can easily be couriered to us from anywhere. It doesn't matter what corner of the world the men are attending for fertility treatment.'

What is unique about the Lewis method is that it is the first quantitative test – looking at the amount of broken DNA in individual sperm, counting it up and giving a measure of the amount of damage. Then there are clinical thresholds.

'We can guide clinics and couples to the right treatment. But what we provide is not a treatment itself – it is a diagnostic test – and we are going to want to keep the intellectual property rights for that here in Belfast. We can have partners in other countries, we can have clinics working in collaboration with us, but we want to do the work here and keep it local. We also have other tests in the pipeline which will add to our portfolio.'

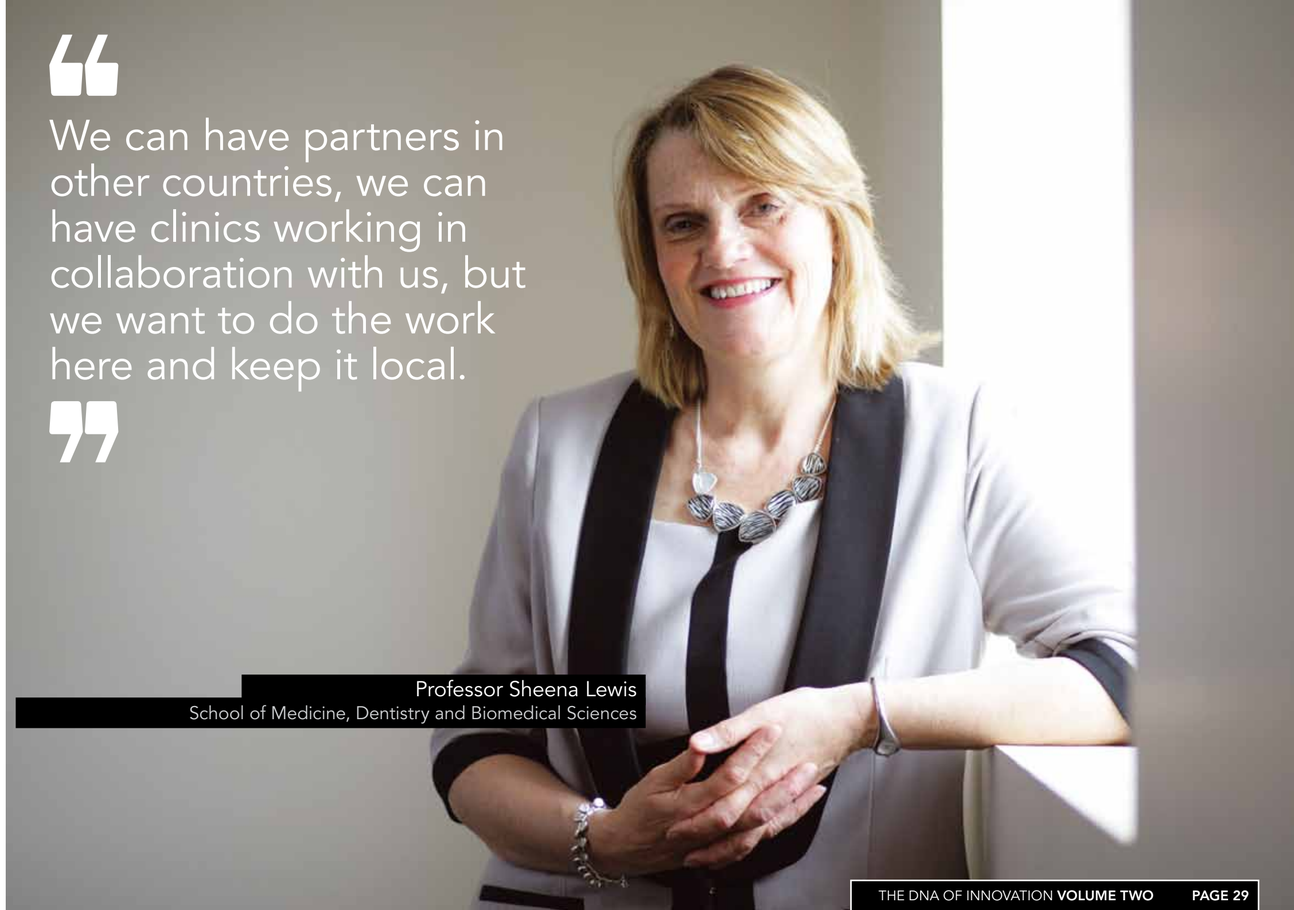
Male fertility problems produce a central issue – how does the man involved feel?

Professor Lewis says, 'The psychological barriers are huge and have to be overcome. It can be difficult for men because they're inclined to think that infertility is associated with a lack of virility – and it's not.'

In her role as chair of the andrology section of the European Society of Human Reproduction and Embryology she has been running workshops, including one in Seville. 'We called it *The Whole Man*. We had counsellors, psychologists, clinicians all coming together to discuss how to talk to men about their fertility problems.'

And problems can be cured. 'We have testimonials from people who have been helped. People are so grateful and we're always delighted to hear of success. That's real impact.

'Next to the human desire for survival is the desire to reproduce. Everyone wants to have their own child. They want to have that little bit of themselves in the next generation and when they find they can't have that, it breaks their hearts.'



REACHING THE GOLD STANDARD IN THE CARE OF CHILDREN

Professor Geraldine Macdonald
Institute of Child Care Research

> “Our research aims to give children a voice.”

Professor Geraldine Macdonald has spent her career seeking to improve outcomes for people who use social work services. Yet the direction she chose came more by chance than design.

She says, ‘I read Philosophy and Theology at Oxford. I wasn’t sure exactly what I wanted to do, and took a job as a residential social worker in the London Borough of Barnet.

‘I found myself looking after adolescent girls who were not much younger than me – 16 to 18 years old. Looking back, I’m not sure that in the two years I was there I understood very much about the lives of those young women, and how they’d come to be where they were; and I certainly didn’t know very much about the social workers who were responsible for them and how they came to be involved. But it made me eager to learn more.’

She returned to Oxford to train as a social worker, and worked for Oxfordshire Social Services for a number of years. Academia followed: first, Royal Holloway, University of London and then the University of Bristol, where she held the Chair in Social Work from 1997. But the outside world would beckon again and in 2004 she was recruited to a major post with the national social care inspectorate and regulator in England, then the Commission for Social Care Inspection.

In 2006, an opportunity arose at Queen’s. She was appointed as Professor in Social Work and a year later took over as Director of the Institute of Child Care Research (ICCR).

Established in 1995, the ICCR provides policy-makers and practitioners with the knowledge and evidence they need to improve outcomes for children and young people. Professor Macdonald says, ‘Our research aims to give children a voice, to shed light on the social problems that impact on their lives, and assist in the development of effective interventions by rigorous evaluation.’ Funders of the research include the Economic and Social Research Council (ESRC), National Institute for Health Research, Office of the First Minister and Deputy First Minister, Atlantic Philanthropies, Joseph Rowntree Foundation, Alcohol Research UK and a number of charities such as Barnardo’s, Parenting NI and Brook.

Professor Macdonald says, ‘ICCR is well-embedded in the systems it is designed to influence. We work with a wide range of external bodies from all sectors. We have two very strong advisory groups – one a scientific group and the other a professional liaison group made up of people who are at the cutting edge of policy and practice.’

The research portfolio is varied and innovative. ‘To give some examples – The Belfast Youth Development Study is a longitudinal study of adolescent development, and the largest study of its kind in the UK. We have followed some 4,000 young people from 42 schools since they were 11. We have an enormous amount of information, including – uniquely – data on young people’s friendship networks. This provides a rare opportunity to explore the impact of peer-influences relative to other factors known to be associated with the use and misuse of substances, including cigarettes, alcohol and drugs.

‘We also do excellent qualitative research. One of the studies funded by the Public Health Agency (NI) is currently looking at the emotional health and well-being of disabled adolescents, a study prioritised by disabled young people themselves, who felt this important issue was ignored by professionals.’

Evaluations include randomised trials of a parenting programme for parents of adolescents and of an after-school literacy programme for primary school children. These are funded by Parenting NI and Barnardo’s respectively.

‘Good intentions are not enough. History confirms that well-intentioned, well-trained and well-resourced professionals sometimes do more harm than good.’ That is why Professor Macdonald established the Cochrane Developmental, Psychosocial and Learning Problems Review Group in 1997. The group, now based in the ICCR, works with over 750 authors across the world to produce ‘gold standard’ systematic reviews of health, social and educational interventions aimed at improving outcomes for children and adolescents.

‘PhD students are tomorrow’s researchers, managers, and policy-makers. One of my students is exploring the potential of computer games as a therapeutic tool for use by residential child care social workers. The project is in collaboration with the Southern Health and Social Care Trust and funded by the ESRC.

‘Looked-after children have poor mental health but most don’t like the idea of “therapy.” The research uses a computer game that simulates the daily lives of characters. The person playing is responsible for working out what they need and how they are feeling, and responding appropriately. This provides the residential worker with a chance to talk about things that might be difficult to talk about “formally”, such as how to recognise when someone is feeling angry or upset, and how best to manage situations.’

Further afield, ICCR is a key partner in Childwatch International, a prestigious consortium of research centres, and has links with policy research centres in countries including the US, Norway, Spain, Brazil, South Africa, Israel and Jordan.

As Professor Macdonald says, ‘There’s nothing parochial about the work we do here.’

THE MODEL APPROACH THAT'S MAKING A DIFFERENCE TO HEALTH CARE

Professor Adele Marshall
School of Mathematics and Physics

Professor Adele Marshall's analytical skills are in growing demand in areas where they can make a difference to how we live our lives – in education, road safety, finance, security, government and particularly in health.

Professor Marshall is Director of Research at the Queen's Centre for Statistical Science and Operational Research (CenSSOR) in the School of Mathematics and Physics. She says, 'There's a great interest in statistics and analytics. Industry is tapping in with everyone collecting data now, and there's a demand for graduates in statistics. Take the banks, for example – they realise that some clever modelling, using sophisticated analysis, can make a lot of difference in the economic crisis.'

Professor Marshall has a particular interest in health. Since 2008 she has been a key member of the Centre of Excellence for Public Health Northern Ireland, a partnership between Queen's and the Institute of Public Health. Its team of investigators has concentrated on major issues such as obesity, diet and smoking, with a focus on nutrition and physical activity, and her research continues to play an important part.

Professor Marshall is also playing a crucial role in the analysis of health care provision. In particular she has developed a statistical model looking at how long elderly patients are liable to stay in hospital.

'The proportion of the elderly in the population is increasing. Governments right across Europe are finding it more difficult to balance resources and to fund health care. But if you're able to predict, when patients come into hospital, how long they're going to stay, how much it's going to cost, the amount of resources they need – all of this based on factors such as the size of the population and the information you have about the patient on admission – then that can help determine financial patterns. It's got to the stage where we can actually create a check list and chart of all the key variables.'

Adele's initial research in this area was with St George's Hospital in London, but she also collaborates with health and social care services in Northern Ireland, and she's now helping health care providers in Milan and the Lombardy region of Italy. 'That came about through some EPSRC funding that allowed us to employ a postdoctoral research assistant who happened to be Italian. Now we're trying to broaden that out into a bigger European project.'

Adele's group has gained international renown for their ground-breaking work. 'Right across the world we're recognised for health care modelling. It has now expanded into a family of models which I call Discrete Conditional Phase-type Models. I recently collaborated with Cardiff University to model a neo-natal unit in Cardiff. We predicted resource need, how long mothers would be in labour, based on information about them during their pregnancy.'

She is a key member of the Cumberland Initiative, a group of academics who are keen to push forward modelling to help in health care. 'We believe we can save £20bn if this is adopted properly.'

But wider application is growing. 'Financial markets, for example – predicting trader collusion. We also have some people working on road traffic flow modelling, the occurrence of accidents, where the hot spots are, identifying those and the road network around them.'

'One of our PhD students is funded by the Strategic Investment Board, which provides support to the Northern Ireland Executive. He is currently working with DEL and the FE Colleges to analyse demand patterns across the FE sector in ways that will help in the continual drive to improve services and productivity. We're providing careful modelling to inform strategic planning and decisions about future investment in the college estate that underpins a high quality learning environment for students across the region. And once that's done for the FE colleges, it can be done for any service.'

Adele hates to see statistics being misused. 'That often happens. But there is now the UK Statistics Authority who have quite a bit of influence with Government and will point out when something is wrong – like statistics on knife crime, which were misreported.'

She is also a member of council of the Royal Statistical Society, a member of the Statistics Advisory Committee for Northern Ireland Statistics Research Agency and President of the Irish Statistical Association. 'We keep an eye on things. Accuracy is crucial.'

> "Everyone's collecting data now and there's a demand for graduates in statistics."

THE SILENCE OF THE GENE: NEW TACTICS IN DISEASE CONTROL

Professor Aaron Maule and his team spend their time trying to understand parasites, infectious organisms that even today have a powerful grip on the health and economy of the world.

He says, 'Even though they undermine human and animal health and welfare, as well as agricultural productivity and food security, we can only marvel at their success, their remarkable resilience and their unique biology.'

Professor of Molecular Parasitology at the Queen's School of Biological Sciences, he is also Director of Research for Molecular Biosciences, working to develop novel strategies for the control of parasitic worms that infect people, plants and animals, particularly, although not exclusively, in developing countries.

He says, 'Many human diseases caused by parasites are designated as neglected tropical diseases (NTDs) which are pervasive among the poorest and most underprivileged people on the planet. These are people who are unable to help themselves. They don't have financial power or a political voice and so these diseases attract low health priority status.

'Most of the drugs used to control these worms were generated from veterinary medicine pipelines because of the economic consequences of these diseases among farm animals. Later these same drugs often become translated for human medicine. However there are serious gaps in our portfolio of anti-parasitic drugs and these shortfalls drive much of the research we do.'

For the past ten years, Professor Maule has been involved in a collaborative project run by the US National Institute of Health looking at the blood fluke, a parasite that causes a chronic disease that affects 200m people and is especially prevalent among children.

'Our remit is figuring how the worm thinks, how it coordinates its behaviours, discovering the chemicals that control that, with a view to making drugs that will disrupt their ability to survive and cause disease.'

He and his Queen's colleagues are also the co-ordinators of a collaborative international project centred in India. Funded by the UK Biotechnology and Biological Sciences Research Council (BBSRC), it is tackling liver fluke, a huge problem to global livestock producers and an emerging human NTD.

'The consortium includes researchers from the University of Aberystwyth and two universities in India: Madras Veterinary College and Aligarh Muslim University, who collectively are identifying, validating and testing new vaccine targets for the control of liver fluke.

'Our specific contribution is the development and application of gene silencing platforms which allow us to selectively switch off a gene in the parasite and so identify which genes cause worm death or paralysis. These could then have value as drug or vaccine targets for fluke control.

'We validate the drug targets in the tropical form of liver fluke and our Indian partners run these through vaccine trials. If successful, this could also resonate at home, as liver fluke is the most common disease seen in local abattoirs. Indeed, recently published models on liver fluke spread with climate change have predicted an epidemic in the UK by 2020.

'We're being encouraged by the Biotechnology and Biological Sciences Research Council to take this reverse genetics technology we've developed to India for the benefit of poor farming communities. To this end, in visits to Chennai, Erode and the Ooty region in Tamil Nadu, we went to farm areas where liver fluke disease is rife and we ran workshops for field veterinarians, gathering data and providing advice on approaches. This is a key part of the impact we're making.

Spreading the knowledge is crucial. 'Animal health pharmaceutical companies in the US are showing keen interest in applying these technologies in parasites in order to aid their selection of new drug targets.

'Parasites are remarkable, resilient animals. They can endure complex and torturous life cycles, manipulate the behaviour of their host, evade the host immune system, genetically modify the host cells to their own advantage and resist control by chemotherapy and vaccines. That's what we're up against.

But his outlook is positive and optimistic. 'Researchers from labs working in this field right throughout Europe have been here at Queen's to learn about these technologies. More and more researchers are using these platforms to exploit the genome data that's accumulating, and this will undoubtedly lead to advances in the development of next generation drugs and vaccines.'

THE OBJECTIVE VOICE MAKING AN IMPACT ON MIDDLE EAST POLICY

Beverley Milton-Edwards has a deep understanding of the politics of the Middle East which has made her a unique source of influence in dealing with the problems of that troubled region.

Professor Milton-Edwards has been an academic at Queen's for 20 years and is Director of the MA programme in Violence, Terrorism and Security. Her particular focus is on radical Islam, with funding for her research coming from the Arts and Humanities Research Council. She has written nine books on the subject, most recently a co-authored study of Hamas which has been well received – notably by those who have a close interest in that organisation.

Her fascination with the subject began when she was a student at the University of Exeter. 'I'd signed up for a module on the politics of Eastern Europe but after about the second lecture, where we were looking at the chief exports of Hungary being rose petals for the perfume industry, I decided this wasn't for me. Instead I found a course on the international history and politics of the Middle East and something clicked.'

She went on an internship to Jerusalem and was there when the first Intifada broke out in 1987. 'These were extraordinary events, such as I'd never witnessed before - globally a historic, transforming moment.'

Out of that uprising came Hamas. 'I proposed that I would study this group. People pooh-poohed the idea, saying they were upstarts, here today and gone tomorrow, radical fundamentalist terrorists who'd never talk to me – and especially because I'm a woman. But I got the funding to do it and I joined the school of scholarship based on sheer determination in proving that it could be done.

'I became the first western researcher to engage with Hamas at that early point of their establishment. I was unique in gaining access to them, and I was never refused.

'That established my credibility as an objective academic researcher. As a result, over the years I have been able to interact with the Israeli intelligence community, the western intelligence community, various other Islamist groups, other Israeli and Palestinian actors. That credibility and integrity of research has been extremely important in terms of creating impact in areas of policy-making and policy influence.'

She has acted as an advisor to, among others, the UK Governments, the Governments of Norway and the Netherlands, and to the EU Foreign Policy and Security Chief. She has played a direct role in ceasefire negotiations in the Middle East and in 1999, at the request of the British Government, held second-track peace negotiations in Belfast with senior Israeli and Palestinian negotiators on Jerusalem.

Towards the end of 2011 she was in Gaza, assisting the Norwegian Government. 'The smallest thing matters at these meetings, and if they break down there can be serious consequences. An issue came up, almost a social slight, but I was able to calm everybody, put things into context, because the people I'm interacting with know that I know what I'm talking about.

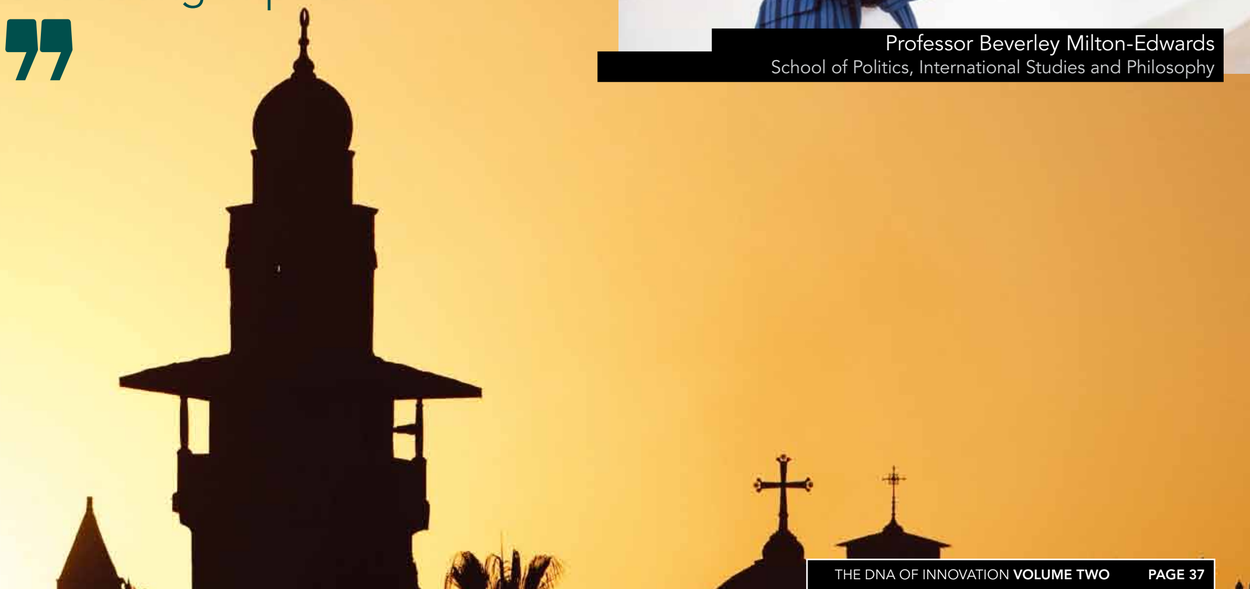
'Academics aren't diplomats, but we can bring some perspective. Being able to talk and use language in a way that people in the region understand is very important.'

And now there is the Arab Spring. She has spoken on this to the Foreign and Commonwealth Office and to the Governments of Norway, Finland, Denmark and Holland. 'Much of my work focuses on the democracy deficit in the Middle East. What's taking place in the region is very much something that scholars like myself had predicted.'

She says, 'In one sense the Arab Spring is a rejection of Jihadi ideologies. We did not see the banner of Jihad raised in Tahrir Square, but political Islam is still part of the movement in the shape of the Muslim Brotherhood. That presents a huge challenge for the west – whether organisations like that can be considered to be the new interlocutors with Islam after so many decades. It's an incredibly important turning point for the region, and it's not over by any stretch of the imagination.'

> "That credibility and integrity of research has been extremely important in terms of creating impact."

Professor Beverley Milton-Edwards
School of Politics, International Studies and Philosophy



THE SEARCH FOR ANSWERS TO THE BIGGEST PUZZLES IN FINANCE

From the window of his office in the refurbished Riddel Hall, site of the newly-opened Queen's Postgraduate and Executive Education Centre, Michael Moore has a commanding view right across Belfast to Parliament Buildings at Stormont. But his professional horizons stretch a lot further.

He is the University's Professor of Finance. His field is international economics and he has extensive experience both inside academia and out, including periods spent with the Central Bank of Ireland and the Irish investment body, the IDA.

His current research focus is on European sovereign bonds. He is mid-way through a three-year project, funded by the Economic and Social Research Council, examining dealer behaviour in that market.

'This particular piece of research began with the question – under what circumstances would bond markets break down? As you can imagine, it's very relevant because that's exactly what occured.

'We were concerned because we found a peculiar feature in the data which was that customers seemed to get a much better deal from dealers than dealers gave each other. Customers got better spreads. We had to develop a model to try to explain this. One of its predictions was that if this type of issue became very acute, then the market would break down completely – and that's what did happen.'

As he explains, 'The euro is the world's largest bond market, and it's in crisis because many people would not accept the bonds of individual countries, and so the entire euro system has been put at risk.'

He has clear views on the issues. 'The design flaw in the euro was that banking supervision and regulation was left to the national central banks instead of being brought in with the rest of the European Central Bank functions. When a bank is in great difficulties, the national central bank which is responsible for it has no means to actually rescue it other than to go to the Treasury and ask for money. We need centralised banking supervision, centralised deposit insurance and centralised bank resolution. Then when banks get into difficulties that rescue has to be funded by printing money. That element is completely missing.

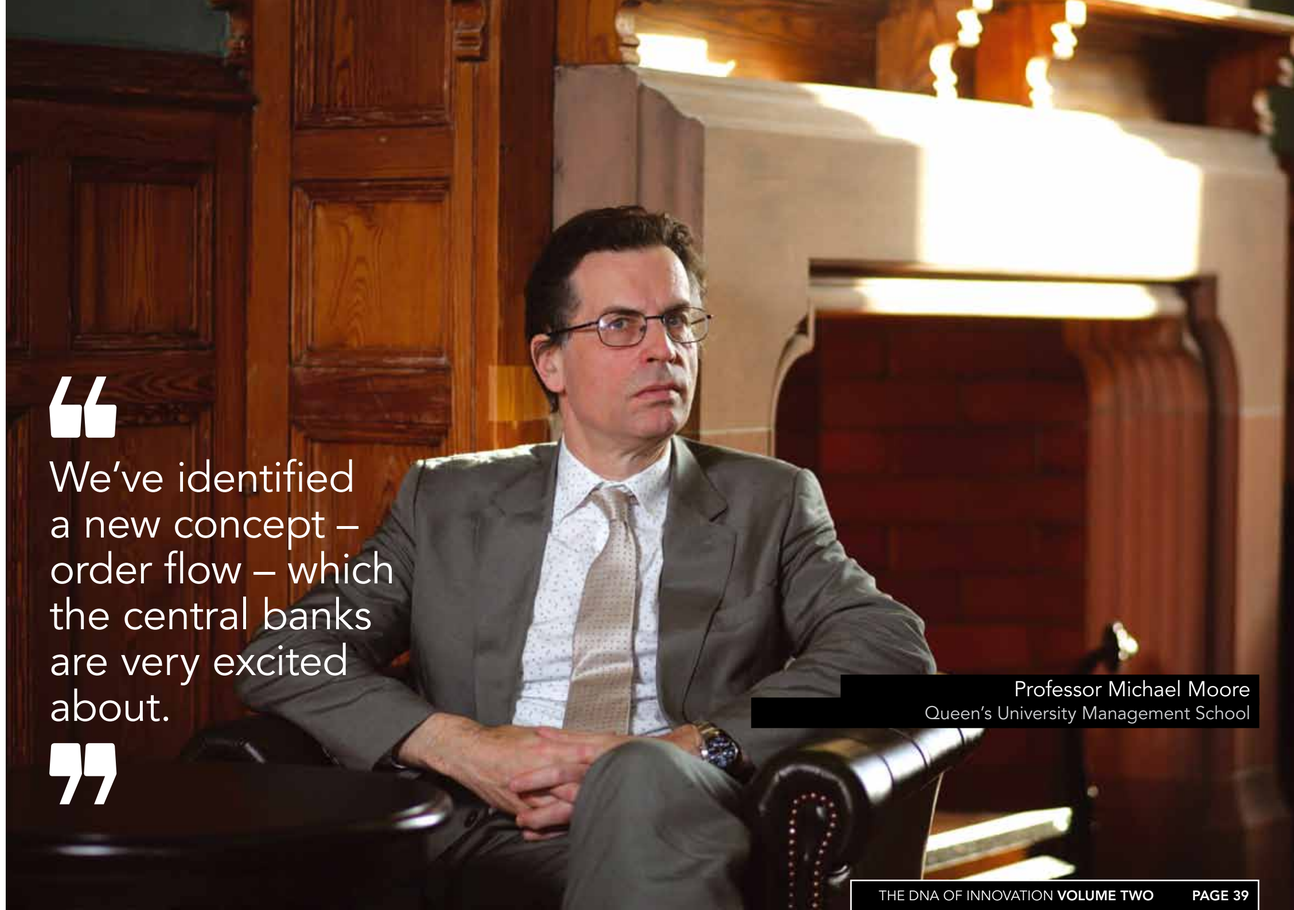
'There is a belief that what we have in Europe is a sovereign bond crisis. We don't. We have a banking crisis. Ireland had the most secure public finances in the western world in 2007 and now it's bankrupt. What happened was that many of the banks went insolvent and had to be rescued and the public debt shot to unsustainable levels. This was a banking crisis that became a sovereign debt crisis and the conventional means of printing money wasn't available.'

Professor Moore works closely with a group of international academics and a large number of major central banks, including the European Central Bank, the Federal Reserve and the Bank of Canada. They are turning their attention to the question of how to forecast exchange rates.

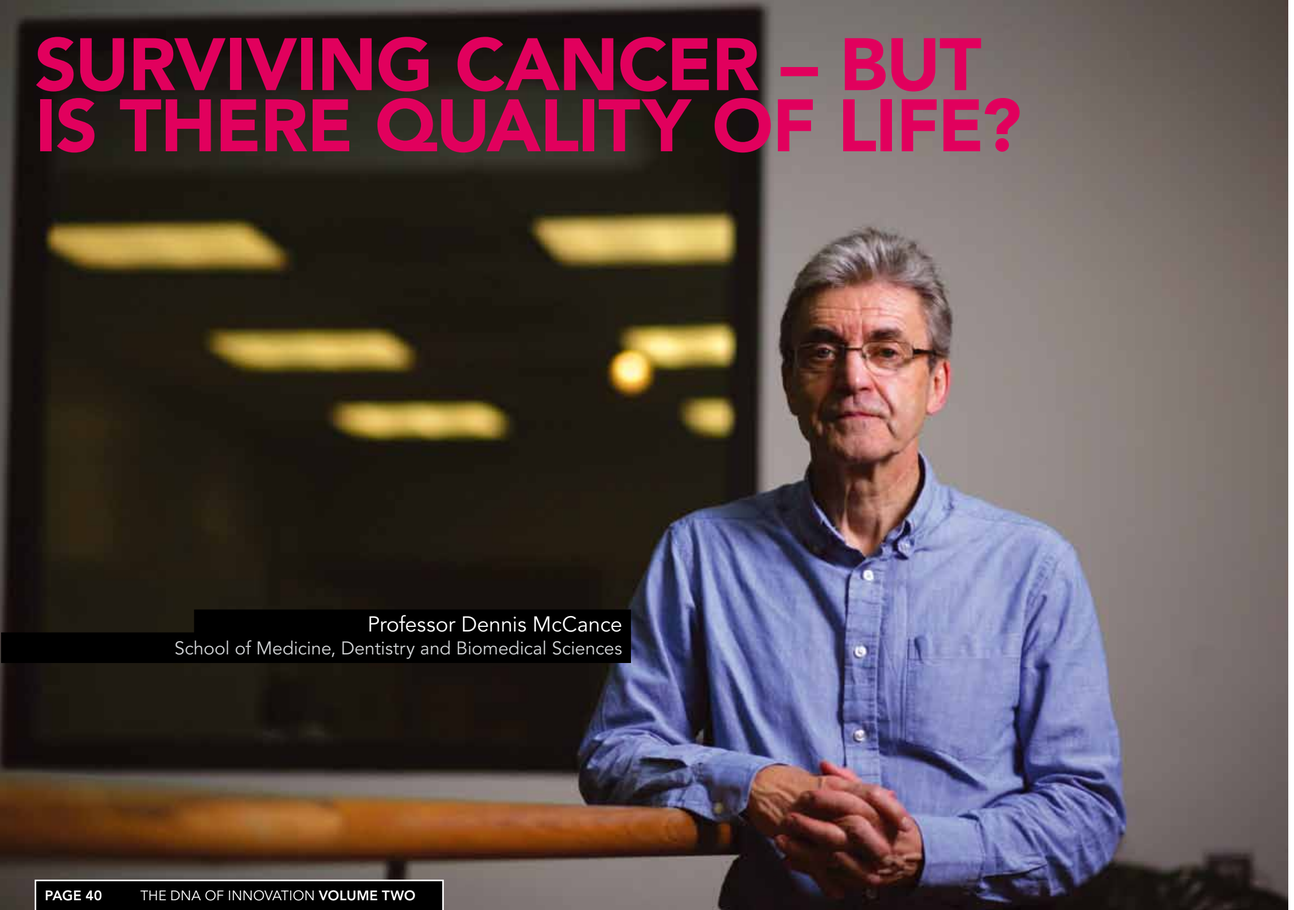
'This is a real puzzle, one of the biggest in finance. In general the current methods of forecasting aren't good but we've identified a new concept – order flow – which the central banks are very excited about.' A consortium has been formed for the purpose, involving researchers and central banks.

And there is Riddel Hall. He is excited about the work that will be carried out there. 'We see ourselves as providing very high quality executive education. Finance is one of the key areas in the Queen's University Management School and with the support of First Derivatives and Invest NI, we have a mock trading room where our students can come in and experience the trading environment directly. First Derivatives are also using it for their own training purposes.

'My area is international finance but we also have groups working on financial institutions and financial history. That is very important because the sort of things we're seeing now have happened before. So we need to look at how we got ourselves into a particular situation – but, more importantly, how we managed to solve these problems in the past.'



SURVIVING CANCER – BUT IS THERE QUALITY OF LIFE?



Professor Dennis McCance
School of Medicine, Dentistry and Biomedical Sciences

> We want to improve the long-term outcome.

Dennis McCance is striving to cure people suffering from certain types of cancer. But he also wonders – afterwards, what sort of life will they have?

Professor McCance, Director of Cancer Research and Cell Biology at the Queen's School of Medicine, Dentistry and Biomedical Sciences, is engaged in major research, with £800,000 in funding by the Medical Research Council, into head and neck cancer.

He explains, 'Traditionally, this type of cancer occurs in people over 60 who've abused alcohol and have been lifelong smokers. But over the last ten years there's been a rise in a type of cancer called oropharyngeal cancer, which is at the back of the tongue and the area around the tonsils, and people in a younger age group are being affected.

'The human papillomavirus (HPV) is thought to cause a percentage of these cancers, although not all, but we have found that those cancers which are HPV positive tend to respond to treatment much better than those which are HPV negative. Our research is aimed at determining why this is.'

He says, 'The treatment for both types is usually radiation plus chemotherapy. However with this treatment normal tissue can be destroyed as well as the tumour. A patient can be left with no saliva, difficulty in swallowing and perhaps no speech. So their quality of life can be really diminished, even though they might be cured.

'But if we can show why HPV positive cancers are more responsive, we may be able to use this information to treat HPV negative patients more moderately and that will improve their long-term outcome.'

Dennis studied zoology and microbiology at Queen's, followed by a PhD at Birmingham in mycology, the study of fungi. He joined the staff of Guy's Hospital in London where he spent 15 years before being recruited to the University of Rochester in up-state New York, where he stayed for seventeen years until he took up his current post in 2006.

'At Rochester it was much more difficult to do clinical research than it is here. It's something to do with the personnel we have. At Queen's we're much more clinically orientated.

'We have a big radiation sciences group, involved in all facets of radiation, working with the Physics Department. They're interested in new ways of treating people, new methodology, using proton beams rather than x-rays. They're interested in the biological consequences of radiation, studying ways to protect healthy tissue. If it is protected, then the dose can be increased. We have people from the Schools of Pharmacy, Chemistry and Chemical Engineering and Physics and Mathematics involved. We're multi-disciplinary.

'We are the only place in the UK where this kind of work is being done. We have the infrastructure in place with radiation research, young clinicians and surgeons coming into labs to carry out research and state of the art facilities in the Clinical Cancer Centre in the City Hospital.'

The work being carried out in the Centre is of global importance and has attracted talented specialists to Belfast. 'There are 60 PhDs in the Centre as we speak. They come from India, China, Poland, Belgium, Italy and from all over the UK.'

The Centre is also in partnership with the Belfast Health Trust. 'The relationship has been greatly helped by the management of the Trust who are very research-orientated and appreciate the need for it within Trusts. In fact, it's a Government directive that Trusts have to show that they're improving the quality of life of their patients through research.

'And that is our aim. The potential impact of this work for patients is immense.'

WORLD-LEADING NEW TECHNOLOGY IN BELFAST'S HISTORIC HEART

Professor John McCanny
School of Electronics, Electrical Engineering and Computer Science

> "... the idea was born of a research and enterprise park which would attract and develop hi-tech business."

As the seagull flies, the new iconic Titanic Belfast is only a few hundred yards from ECIT, Queen's University's Institute of Electronics, Communications and Information Technology, yet Professor John McCanny, ECIT's Director, thinks the two buildings are closer in other ways.

They may represent achievements in engineering that are separated by 100 years, but he says, 'When you look at Titanic and think of what those guys were accomplishing in that era – they were at the forefront of the world. They were pushing the envelope of innovation with everything they were doing. And that's what we're trying to do. The engineering may be different but the drive is the same.'

ECIT was built for impact. In the surroundings of the School of Electrical and Electronic Engineering, Professor McCanny had found himself riding a wave of fast-flowing new digital technology, working on developments such as audio compression, which would be used to create the quality of sound in Jurassic Park and is still being used widely, such as in the iPhone and the iPad.

'InvestNI would bring companies to see us, companies looking for solutions, but we couldn't provide results within their timescale in a research lab with a PhD student. We needed professional engineers.' So to achieve what they wanted, they set up two companies - Audio Processing Technology Ltd and Amphion Semiconductor Ltd, now part of NXP, working in video compression. Amphion's video chip designs have since been used in an estimated one third of all the world's Set-Tox boxes and are also the video hardware acceleration engines used in the Intel C2100 Media Processor chips used extensively in PCs and laptop computers.

'After that, we started to think.... in Taiwan, in Silicon Valley, they have their own science parks. Could we not do that?'

And so the idea was born of a research and enterprise park which would attract and develop hi-tech business, 'taking the research out of the ivory tower and putting it in a much more business orientatated environment.'

With initial funding from EPSRC, TSB, InvestNI and the Department of Education, ECIT opened in 2004 and became the anchor tenant in the new Northern Ireland Science Park. 'Eight years on from that, when the new building next to us is filled, there will be about 2,000 people working here – involving about 110 companies, including global giants like IBM and Microsoft, and around £80m-£100m a year just in salaries alone for the local economy.'

On top of that there is space and encouragement at ECIT for 'spin-out' and 'spin-in' companies (high tech companies created outside the University). 'You might have three or four people who meet in a coffee shop and have this great idea but they don't have a whole lot of money and they certainly can't afford to sign ten-year leases. So we facilitate people like that as well.'

The year 2009 saw another exciting development. 'EPSRC and the Technology Strategy Board created an initiative to form innovation knowledge centres. We saw an opportunity here so we bid to become a centre for cyber security and won.'

And so CSIT, the Centre for Secure Information Technologies, came into being with initial five-year funding of £30m. It has rapidly achieved a global reputation for innovation and expertise in this important field. It hosts an annual World Cyber Security Technology Summit and is now being recognised as an Academic Centre of Excellence in Cyber Security Research by GCHQ in partnership with Research Councils UK and the Department for Business Innovation and Skills.

Professor McCanny says, 'Our vision is to be a world leader in cyber security technologies by linking with industry, academia and government to combat emerging cyber threats. The wellbeing of the individual and society as a whole is at the heart of all of this.'

He adds, 'We have our challenges. We keep growing. We need to replenish the funding. We may not be in this game as long as some institutions but we've established a reputation as a place where things get done. Hi-tech companies are always nervous about working with universities but they realise they have to because of the access they get to bright young people. However some universities are not very business-savvy.

'There are 175 people in ECIT – it's a sizeable operation – and we've overlaid the research base with a business layer. Traditionally, universities have researchers and PhD students on three-year contracts and they end up leaving when things are getting to a crucial point. We created a new type of contract, based on the hi-tech business model, to employ engineering staff with extensive industry experience, with well-defined career paths and salary scales.

'We want to create the sort of environment you have in Silicon Valley. We recruit can-do, will-do people. Can't-do, won't-do? Forget it.'

> I maintain that children should have access to evidence-based medicine.

Professor James McElnay
Pro-Vice-Chancellor for Research and Postgraduates

THE PHARMACY RESEARCH THAT IS SAFEGUARDING THE RIGHTS OF CHILDREN

When children – many of them just born – need to be given medicine, how can its safe and effective use be guaranteed?

That is the question at the heart of a research programme being headed by James McElnay, Professor of Pharmacy Practice at the School of Pharmacy at Queen's, where he is also Pro-Vice-Chancellor for Research and Postgraduates.

His main professional interest is in the area of clinical pharmacy – where the pharmacist becomes much more involved in clinical decision-making around the use of medicines in patients. This was just becoming an important new aspect of pharmacy when he was completing his PhD at Queen's in 1979. As a postdoctoral researcher at the University of Iowa, he further explored the new developments, then began to pursue them in a research programme at Queen's when he joined as a lecturer.

He says, 'The reason I have become interested in children in particular is because the whole use of medicine in children, especially premature infants and babies, is often without an evidence base. Medicines are often not tested or licensed for use in children. The reasons for that are obvious – there can be significant ethical issues around children participating in dose ranging clinical trials – so many of the medicines are used in an unlicensed fashion, with no labelled instructions as to what dose would be appropriate.

'This creates a dilemma for doctors. They know a medicine may help, but dosing becomes a bit of a guestimate.'

But now more evidence is being gathered and Professor McElnay and his group are a key part of that process. 'We started looking at children who were already prescribed medicines of interest. We've developed techniques to measure medicines in a single drop of blood applied to filter paper when a sample is being taken for another clinical purpose. By measuring the amount of medicine in the 'blood spot' we can begin to build up a pattern. Working collaboratively with neonatologists and paediatricians, we receive samples from a range of different children at our lab and we're able mathematically to construct the kind of profile you would normally obtain from a traditional clinical trial.'

The research programme has been running for ten years. Other aspects include adherence of children to medicine – are parents giving medicine to a child in the way it has been prescribed? A complimentary stream of the work also involves the excipients which are used in medicines.

'It's common for drug companies to use excipients, for example a preservative, when they're manufacturing a medicine but there's increasing evidence that these agents can have adverse effects, particularly in premature babies.'

Now Professor McElnay is carrying out a study in partnership with the Universities of Liverpool and Leicester, and with groups in France and Estonia looking at how newborn infants are able to handle excipients. 'With a premature baby there is premature liver and kidney development so you can imagine that if a child like that is being given medicine every day and the body isn't able to get rid of the excipient, then there is the risk of toxicity.'

Funding for the research programme over the years has come from Action Medical Research, The Health and Social Care Research and Development Office, the British Council, Arthritis Research UK, Atlantic Philanthropies and the Medical Research Council.

'I also have had a stream of international PhD students who are funded by their own governments or universities. They want to come and have experience in our lab with the kind of clinical pharmacy work I'm doing.'

Professor McElnay says, 'This is a long-term project with significant scope for influential publications. We have evidence that our publications are having an impact on how paediatric medicine is practised. We are providing evidence that can be incorporated into the British National Formulary for Children, a publication that didn't exist when we started this work.

'The project is linked into the Improving Children's Lives initiative at Queen's. The latter is a fantastic initiative which involves a number of Schools across the University, partially funded by the Atlantic Philanthropies and the Health and Social Care Research and Development Office. It focuses on children's rights. I maintain that children should have access to evidence-based medicine in the same way you or I have. That's a basic human right of a child.'

GUIDING COMMUNITIES ON THE JOURNEY FROM CONFLICT TO PEACE

> We're not on the sidelines – we're in the middle of the game.

Kieran McEvoy doesn't believe in standing on the sidelines.

Professor McEvoy is Professor of Law and Transitional Justice at Queen's and Director of Research in the School of Law. He is recognised internationally as an authority on conflict-related issues such as prisoners, truth, amnesties, lawyers and community justice.

As he sees it, 'Our job is to make a difference. Queen's is unique. It's a Russell Group university which was in the middle of a conflict and is now playing an important role in the transition from conflict. It isn't just a question of the University reacting to that transformation. People here have been crucial in leading or contributing significantly to different aspects of the transition.

'This field of study is a particular strength of Queen's. We have the organisational and institutional power to carry out some very high end research. The University is a player, rather than an observer. We're not on the sidelines – we're in the middle of the game.'

One of his current projects (with Professor Gordon Anthony and Dr Louise Mallinder from the University of Ulster), has been funded by the Arts and Humanities Research Council (AHRC). It is looking at the question of prosecutions and the public interest in the Northern Ireland transition.

This project grew out of a previous comparative project he led on Amnesties also funded by the AHRC. In other societies, just like here, conversations about this issue tend to be dominated by lawyers and technical legal matters on whether there is a duty to prosecute. While such issues are important, the question of granting an amnesty affects all walks of life. It's hugely significant for victims, civil society, ex-combatants and a whole range of actors other than lawyers.

We try to locate debates on amnesties into the much more interesting areas of politics, community attitudes, how victims felt about amnesties – moving beyond narrow, technical, dry, legal conversations and into the bigger social and political context.'

The original research began in 2007, with grant funding to conduct comparisons in five jurisdictions emerging from conflict – Uganda, South Africa, Bosnia, Uruguay and Argentina.

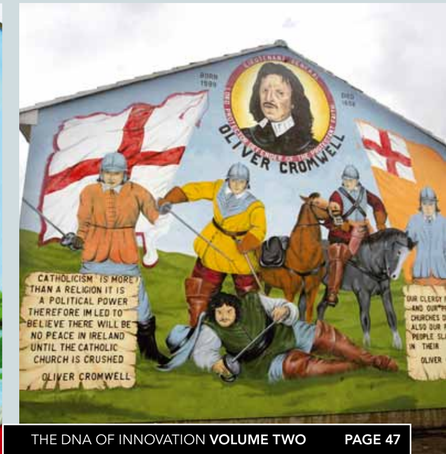
'As a result we produced a range of academic material as well as accessible reports and so forth of use to the local communities affected. Now our focus is on Northern Ireland.

Here we have seen a heated debate on dealing with the past and a range of initiatives have been established. 'The Historical Enquiries Team is probably the best known. The police officers involved are working their way through conflict-related deaths. While the quality of investigations varied over the years, some evidence is being produced which may lead to prosecutions. The reality is however, for pre-1998 murders, no-one is going to serve more than two years. If they were held on remand for a period, they may leave the court on the same day as they are found guilty. We have to ask ourselves – is this in the public interest?

There has to be a very public conversation around this issue. 'Some people will say that we should always prosecute. Others, some victims, for example, say that what they really want is truth – the truth about what happened to a loved one and why – rather than prosecute. Both views need to be respected but we need to have a grown-up conversation about this, one that is informed by international experience, law and politics.

'Our role as academics is to inform contentious, difficult, complicated debates like this in ways that let people make up their own minds, albeit from a position of knowledge. We narrow the space for permissible lies – that's our job.'

Professor Kieran McEvoy
School of Law



MARRIAGE IN IRELAND: THE HIDDEN HISTORY

Since the 1970s, Mary O'Dowd has been casting light on areas of Irish history which have been obscured. Her current research project, looking at marriage in Ireland from 1660 to 1925, is a shining example.

But, as she says, when she came to Queen's in 1978, much of Irish history as a whole was unexplored in the educational curriculum.

'I think there were two courses in Irish history and most of the students hadn't done any Irish history before. You would have imagined that all the Catholic grammar or secondary schools might have been teaching it but many were not.'

It was after Irish history was 'up and running' at the University that she began to get interested in women's history. She went on to become a founding member of the Women's History Association of Ireland and later served as President of the International Federation for Research in Women's History. She has written widely on this theme, including a history of women in Ireland between 1500 and 1800, published in 2005.

She is now Professor of Gender History. She says, 'Marriage seemed like a good theme to follow, looking at the experience of men as well as women.'

The research project is funded by the Arts and Humanities Research Council and she co-directs it with a colleague of long standing, Professor Maria Luddy of Warwick University. The time frame begins with the Restoration of Charles II as King of Ireland and ends with the prohibition of divorce in the Irish Free State. It will conclude with the publication of a book.

She says, 'We're looking at trends, but we want this to be a readable book and we're very keen to tell the stories of individuals as well. We're also creating a website for those stories.' And she teaches the subject to her students.

She says, 'There has been very little research undertaken in this whole area before and for a very good reason. The Public Records Office in Dublin was destroyed by fire in 1922 and many of the sorts of documents we use for social history were burnt. So we had two researchers searching archives throughout Ireland for records relating to marriage. They looked, for example, at church records, both Protestant and Catholic. But the Catholic Church is now quite sensitive about letting people look at their archives. So some dioceses refused access. Most, however, did not and we were allowed to see a lot of material that few, if any, researchers have looked at before.'

The research has turned up some interesting new perspectives on marriage in the past. Divorce was rare and difficult to get, but couples made their own separation arrangements. 'We explore, for example, notices placed in the *Belfast Newsletter* from the 1760s by men saying they're separated from their wives and are no longer responsible for their debts. In one case the wife ran off with a wandering schoolmaster. In another it was with a cobbler who came to visit.' Bigamy was also surprisingly common.

She says, 'A certain amount has already been written about marriage in the aristocracy so we are focussing on the middle and lower classes. One of the main themes that emerges is that the law on marriage was very lax up until at least the 1850s. Before then, most people got married in their own home. No witnesses were necessary and you could get married in secret. It's not until the middle of the 19th century that the State introduces laws, saying you had to marry in a church and you had to have banns announcing it in advance. Even then the civil law was not compulsory for couples marrying in a Catholic church.

'We go through the whole process – the law, courtship, seduction, abduction and elopements, relations between husband and wife, problems in the marriage, adultery, how you get a divorce or separation.

'We look at mixed marriages, the attitudes of the Catholic Church and its relationship with the State, the Presbyterian Church and the problems it had in getting marriages recognised. Class is another significant theme. There were differences in attitudes between the larger tenant farming families and the landless labourers with little material wealth to invest in dowries for their daughters.

'This is a huge and important part of Irish history.'

Professor Mary O'Dowd
School of History

> "We've been allowed to see material that few researchers have looked at before."

PERFORMANCE WITHOUT BOUNDARIES – A GLOBAL STAGE

As Dr Franziska Schroeder says, you can't be in several places at once. But that's a technical detail that she and her collaborator Professor Pedro Rebelo are trying to overcome.

Through an imaginative concept known as Distributed Performance, they have developed a dynamic international collaboration and a new way of bringing music to audiences. And it is another achievement in innovation for the Sonic Arts Research Centre (SARC) where Pedro is Director of Research.

At the heart of the research project are multi-site concerts involving performers at SARC and in other parts of the world – including Stanford University in California, the University of São Paulo in Brazil, New York University and the Institute for Electronic Music and Acoustics at Graz in Austria.

A recent European Union-funded Culture 2007 project, CoMeDia, was a prestigious grant which allowed them to develop work in this area over four years, along with leading players in Europe, such as IRCAM in Paris.

As part of the Sonorities Festival of Contemporary Music in Belfast in 2010, a showcase event consisted of three concerts involving Belfast, Graz and the Hamburg University of Music and Theatre.

Franziska describes another concert, this time with São Paulo. 'Not only did we have musicians in different places but we had one of our students walking down one of the main roads in Brazil and his interventions, running a stick along railings, for example, directed what the musicians in Belfast were playing.'

Pedro says, 'SARC is important as an infrastructure, both in terms of facilities and people, and the fact that it was created as a way of bringing together synergies. The Sonic Lab allows us to rethink in practical ways what the role of the audience member is in relation to the stage or the performer in relation to a group of other performers.

Both acoustically and visually we can re-configure the space fairly easily and that opens up doors to explore different ways of performing in a space and, in our case, spaces that are outside SARC, bringing in other concert venues.'

Franziska is a saxophonist and theorist and has written widely on performance. She trained at a conservatoire in Australia and later in Bordeaux. With a PhD in performance and theory from the University of Edinburgh, where her colleague also studied, she is currently an Academic Fellow and lecturer at SARC.

She says, 'Distributed performance needs both the technology and the people. I think that was partly the reason I received an AHRC Fellowship from 2007 - 2009. There were composers and engineers at SARC but I was one of the first performers to come on board.'

Pedro is a composer/digital artist and performer. His music has been published, recorded and performed at international festivals. A pianist and improviser, his work has been released by Creative Source Recordings and he has performed with Chris Brown, Mark Applebaum, Carlos Zingaro and Evan Parker. He has also contributed sound installations at Belfast's newest arts venue, the MAC.

Franziska points to practical issues which have to be resolved with Distributed Performance. What sort of experience is it for both performer and audience? What kind of performance language has to be developed?

'It was an eye-opener in the beginning – people in different spaces texting questions on social platforms during our performance about who's playing and where. It's important to engage with new ideas about what it is to listen in a space.'

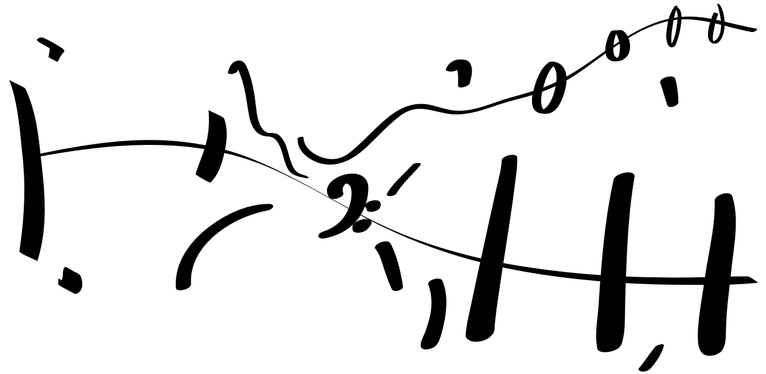
Pedro says, 'If you look historically, there are a number of critical moments in music in which the link between new performance practices and spaces and new musical language are tied together.

In large cathedrals, for example, certain kinds of music are possible and some are not. Smaller churches allow you to create more intricate music, such as Bach's counterpoint.

We're at the stage where we're experimenting with different types of music and performance strategies, the main hope being that out of this new environment we can conceive music that wouldn't be possible otherwise.'

In order to bring together resources created all over the world, SARC is releasing an international online archive for distributed performance repertoire.

For more information visit www.somasa.qub.ac.uk/~comedia/



Cipher #1
Pedro Rebelo, 2010

> "Out of this new environment we can conceive music that wouldn't be possible otherwise."

Professor Pedro Rebelo and Dr Franziska Schroeder
School of Creative Arts

THE GREEN LIGHT THAT TRACKS A VIRUS

Professor Bert Rima and Professor Paul Duprex
School of Medicine, Dentistry and Biomedical Sciences

> Our USP is the ability to generate viruses that we track easily.

Bert Rima and Paul Duprex believe in the power of vaccines. As Paul says, 'Few products have done more to alleviate disease.'

He points to chickenpox and shingles, severe diarrhoea, cervical cancer, meningitis – a range of diseases which affect young and old, rich and poor, in both the developed and developing world. 'What unites these various conditions is that in the last couple of years several major pharmaceutical companies have released new vaccines to fight these diseases. Vaccines deliver. Moreover, they provide a steady source of income for the pharmaceutical companies since other manufacturers who rely on selling low cost generic drugs find them harder to replicate.'

Dr Duprex's expertise is in bioimaging and he has had a long-standing interest in how viruses infect us and spread. He and Professor Rima have formed a unique research partnership and are currently working on a £1m grant project, funded by the Medical Research Council, on Animal Models of Disease.

Bert says, 'We have a set of compatible skills – more classical virology from my side and the molecular aspect of the virus from Paul.'

Paul puts it, 'Bert has this huge overall understanding of viruses as agents of disease. I brought the tools and the ability to genetically engineer them.'

The aim of the project is to understand how respiratory viruses cause disease. Bert says, 'Our USP is the ability to generate viruses that we can track easily.'

To do this, with an animal model, they are using a genetically modified virus which glows bright green when it infects a cell. It allows them to light up a disease in a way that was never possible before.

Paul explains, 'As well as seeing these illuminated manifestations of disease with the eye, high-powered microscopes can be used to identify individually infected cells with supreme levels of sensitivity. And since this model has been so beneficial in measles research, we plan to use it to study how other respiratory viruses establish infections.'

Bert is one of the world's most esteemed virologists. He is an authority on measles and mumps and he was called on for his expert advice by the US during the controversy over the MMR vaccine.

Paul says, 'For this project, we got the best viruses, the best cells and the best animal models. We got viruses which are real, which cause real disease in real people. We grow them in real cells. If it's a respiratory virus we grow it in a respiratory cell. Then you look for the best animal model which copies the disease and that's as near to the real context as you can possibly get. That's what makes this research unique. The funding agencies looked at this and saw classical virology, molecular virology and animal models all wrapped up.'

He adds, 'It's only by understanding the real disease that you can say intelligently – this is the way to develop the vaccine.'

Of the measles virus, Bert says views have changed. 'It was always considered a respiratory virus but now we look on it more as a virus like HIV because it focuses very strongly on the immune system.

'At the end of the day, although the measles virus is no longer a real killer, like HIV is, we'll have to continue vaccinating against it. There are a number of other viruses in that family that are like canine distemper, like some of the viruses that killed seals in the past, that are potentially more dangerous for us.

'Measles has come into the human population and established a sort of relationship with us. But it's always possible that some of the other viruses from that group will jump into the human population and cause a major pandemic. We see plenty of opportunities for us to exploit some of our molecular trickery in the development of other vaccines.'

Professor William Scanlon
School of Electronics, Electrical Engineering and Computer Science

> We do the science here at ECIT, but in a way that is clearly linked to a commercial need.

SMART PEOPLE – THE FUTURE OF MOBILE COMMUNICATION

William Scanlon's interest in communication has been lifelong. 'When I was primary school age, I used to sit in my granny's kitchen fiddling with ham radios, building little electronic circuits, trying to write clever code for my own microcomputer, that type of thing.'

He has been on a long professional journey since then. Now he holds a Professorship at Queen's and is Director of Research into Digital Communications at the University's Institute of Electronics, Communications and Information Technology (ECIT).

As a student, he obtained his PhD on the subject of wearable antennas. 'If you want to put an electronic medical device on the body you can't have an aerial sticking out so you have to miniaturise it and you have to take account of the fact that human body tissue has properties which distort electromagnetic waves. That's what this work was all about.

'One of the things I pioneered during that research was the concept of medical implant telemetry – sending signals to and from devices inside the body – using UHF radio. With these high frequencies you can send more data.'

And that concept is still driving his research today. In a project with colleague Dr Simon Cotton he is looking at how to satisfy the modern demand for high rate data communication for people on the move. His solution – a body-to-body network that would function over a short range and use high frequencies. As they see it, this would make an important social impact - complementing and extending existing infrastructure networks by supporting network capacity, improving data rates and promoting green spectrum usage.

Funding for the research has come from EPSRC, the Royal Academy of Engineering and the Leverhulme Trust – the latter two specifically for Dr Cotton's work.

Professor Scanlon says, 'You hear of the rise of the smart phone, the tablet. You hear the cry – we're going to run out of mobile data, we're going to run out of spectrum. This is a way to address that issue.

'If you think about it, a man with a walkie-talkie is a form of body-to-body communication but here we're not talking about a device which you hold but a device that you wear or one that you're not explicitly using.'

He envisages this new form of 'smart' device being worn on the body or integrated into clothing, creating a generation of 'smart people.'

'Cities are where this is needed most. We're calling this a co-operative body-to-body network, in effect using people themselves, using their movements over short ranges to increase the amount of data. You can really achieve any-time, anywhere connectivity. In fact, I also have a grant from the Ministry of Defence to work on a soldier-to-soldier network and the security advantages there are obvious.

'But to give a very localised, social example. If you go to the Odyssey to see Lady Gaga and you take a picture with your mobile to send to a friend, you currently have to upload it to the network in order to send it. With our concept, you just send it person-to-person. We become our own base stations.'

He sees huge potential applications in areas like sport, too. 'If you take a team sport like rugby, we're experimenting with devices being embedded in the shirts in a project with Imperial College. The coach can stand at the side of the pitch with a tablet device, watch and analyse the game, and later show players where their movements went wrong or whatever.

'Teams of cyclists can also take advantage. With these built-in devices they can sense each other's fatigue levels and respond accordingly.'

This person-to-person localisation work has led to an ECIT spin-out company, ACT Wireless Ltd, in which Professor Scanlon and Dr Cotton are key figures. 'We're commercialising the technology in different ways - looking at tracking patients through A&E, time and motion in a factory, health and safety on an oil rig, student attendance at a university – there are many applications.

'We do the science here at ECIT, but in a way that is clearly linked to a commercial need and we have the mechanisms here for spinning out new companies.'

Professor Scanlon is now a world-renowned figure in next-generation communications and in Spring 2012 gave a series of NATO lectures in Finland, Norway and Canada.

He says, 'I give a talk with a title which sums up what I believe – You are at the centre of your wireless future. There is no doubt about it. The future of communications is personal.'

> We're investigating this actively now as a means of treating solid cancers.

Professor Chris Shaw
School of Pharmacy

GOING BACK TO ANCIENT ROOTS IN THE BATTLE AGAINST DISEASE

Chris Shaw is getting used to being known as 'the frog man.' And he is happy about it.

It means that he is being noticed, that he and his team at Queen's are being recognised for their innovative research into natural resources and how this can help in the treatment of major diseases.

Chris is Professor in Drug Discovery at the School of Pharmacy. His exciting work involves the discovery and characterisation of biologically active agents within nature, in particular from the venoms of amphibians such as frogs and toads. In 2011 this brought a commendation at the Medical Futures Innovation Awards in London.

At the heart of the research are two peptides – as Chris explains, 'short proteins which are in effect the vocabulary of how cells talk to one another.'

One of these peptides is a powerful inhibitor, the other a powerful stimulant of blood vessel growth.

A protein from the waxy monkey leaf frog, found in South America, can inhibit the growth of blood vessels and could be used to kill tumours. Chris says, 'We're investigating this actively now as a means of treating solid cancers. Cancers need a blood supply if they are to grow. Our hope with these molecules is to make cancer a chronic disease.

'Insulin, for example, is one of the oldest and most successful drugs used by the pharmaceutical industry. It is a peptide which was extracted initially from cow and pig pancreas. Our vision is to be able to treat the cancers in much the same way as diabetics are treated, so that although not cured, people can live an almost normal life.'

Another potential resource is the giant fire-bellied toad. It produces a peptide protein which can stimulate blood vessel growth. It is thus of potential use in clinical situations where blood supply has been damaged or is in need of replacement. There is an array of potential applications in wound-healing, organ transplants, diabetic ulcers and damage caused by strokes or heart conditions.

Chris says, 'Some years ago figures produced by the World Health Organisation showed that 85 per cent of humanity use traditional medicines as the sole means of health care. This means that the drugs with which we are familiar are available to just 15 per cent of people on the planet. That is astonishing.

'If you examine some of the major traditional medicine cultures, such as those found in India, China and most of South America, you will find a huge resource that remains, even today, largely untapped. Colleagues who have studied these medicines are gaining some incredible insights into their functionality. And in our own work we're going back to those roots, back to what are unique sources of knowledge about unique molecules.'

He adds, 'In drug discovery today, even with the billions being invested in systematic logical screening of compounds, many major drugs have been discovered either by accident or trial and error and that's exactly how the medicinal concoctions and potions have been developed traditionally over many millenia.'

But Chris is concerned about the threat to many of the amphibians which are his resource. 'At the present time they're undergoing mass extinction. Once a species becomes extinct, its DNA and its proteins/peptides essentially become extinct too and in each case we lose hundreds of millions of years of accumulated and naturally-selected molecular knowledge. This is a one-way street.'

Funding the work is crucial but it is being helped by important international links. 'Over the years we have developed interactions with six Chinese universities. We have a post-graduate training programme for Masters and PhD students and we have now reached a steady state with 32 full fee-paying students from China each year in our pharmaceutical biotechnology programme. They are highly-motivated and happy to be here and in turn we are happy to host them. The amount of data they generate is colossal but even with that we're still just skimming the surface of a very deep pond.'

THE WORLD-LEADING TEAM SEARCHING FOR ANSWERS IN SPACE

Stephen Smartt's ambitions are far-reaching. He wants to find the earliest supernova in the universe.

Professor Smartt, Director of the Astrophysics Research Centre at Queen's, is leading a team of 12 international scientists who are engaged in a five-year project made possible by funding of 2.3m euro awarded by the European Research Council (ERC).

He says, 'This is evidence of the global reputation which Queen's has in this field. There was very high competition for this grant. Typically the success rate for funding of this kind is less than one in ten so this was quite an achievement. The ERC want to fund a project that might be risky – there are no guarantees - but there is the prospect of a very exciting scientific pay-off.

'We're hoping to gain a new understanding of the origin of chemical elements. We have found explosions in the last few years that are much brighter than anything we expected to see. The brighter something is, the further away it is. We're able to look back and see the universe when it was younger than it is today. In effect, we're looking back in time.'

Stephen Smartt studied at Queen's where he did his PhD in astrophysics. He then spent three years as an astronomer at the UK-run observatory in the Canaries before becoming a research fellow at Cambridge. He is also a former holder of a European Young Investigator award and returned to Queen's as a lecturer in 2004, rapidly building up a team to study supernova explosions.

He says, 'What helped our bid was the track record which our group at Queen's has developed. We've been very successful and we've started to compete with some of the best groups in the world in this field. We've joined a telescope project in Hawaii called Pan-STARRS – it's the world's biggest camera, sweeping and surveying the sky – and we've started to find very interesting things. We've now got a leadership role within that project. We get the data in Hawaii and then analyse it on our computers here in Belfast.'

The team has a truly international basis. 'We have people from Italy, a lecturer here who's originally from Kenya, a postdoctoral researcher from Sweden, people from right across the UK. In the Astrophysics Research Centre we have Americans, Portuguese, Germans. Most nationalities in Europe have been through here at some stage.

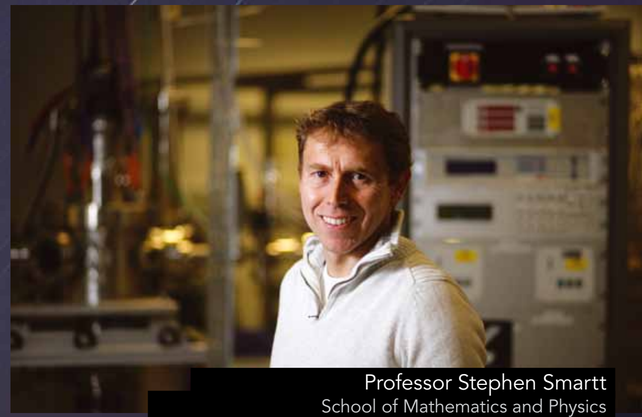
'In the Pan-STARRS project, we're involved with the University of Hawaii, Harvard, John Hopkins University and the Max Planck Society in Germany. Then we have a more European-focused collaboration with most of the universities in Europe who are involved in supernova research.'

Professor Smartt sees the project making an impact in several ways. 'There are benefits for the economy here. It will involve around £2m in salaries – people living and working here in Belfast. Then there's the educational impact – the outreach to schools. And on top of that there's the enormous scientific impact.'

> "We're able to look back and see the universe when it was younger than it is today. In effect, we're looking back in time."

He acknowledges that the focus of research can change. 'That can happen over time. You tend to make discoveries along the way which can change your views and that's very exciting. What we do over the next five years will probably be slightly different from what we're planning at the start. Something always surprises you in the universe. What I'm certain about is – we'll find something new but I don't know what it is yet.'

Astrophysics is renowned as one of the most competitive areas of scientific study. 'Is there an urge to get there first? There absolutely is. This type of science is about discovery. That's one of the things I've instilled into the group. If you're second, nobody cares. You don't get the money, you don't get the papers, you don't get the recognition. And in science that's really what it's about. No-one remembers the second person who split the atom.'



Professor Stephen Smartt
School of Mathematics and Physics

ONE MAN'S VISION: A NEW THERAPY THAT IS DESPERATELY NEEDED

Professor Alan Stitt
School of Medicine, Dentistry and Biomedical Sciences

Alan Stitt, McCauley Chair of Experimental Ophthalmology, is aiming to use his research to help people suffering from one of the major sight-threatening diseases - diabetic retinopathy. He also helps them cope with their fear.

'People are frightened of going blind. I talk to patient groups about my research. I tell them what causes diabetic retinopathy and the new strategies we're developing to treat it.

'At an event in W5 I spoke to the parents of kids who had just been diagnosed with diabetes. That's a difficult thing to pitch. The parents are scared but they also want to hear what the progress is. They wonder – is there going to be better treatment for their son or daughter when they get older and retinopathy becomes a risk?'

And that is Professor Stitt's goal. As Director of the Centre for Vision and Vascular Science at Queen's, he and his colleagues are engaged in world class laboratory and clinic-based research with the goal of understanding the causes of diseases and improving outcomes for patients.

'The two main pillars in our unit, in terms of eye research, are diabetes and age-related macular degeneration - AMD. These are leading causes of vision loss but current treatments for both are limited. This affects quality of life for individuals and there are enormous economic costs for the Health Service. So there's a push towards understanding what causes these diseases and to improving treatments.'

Professor Stitt's group is in the early stages of an ambitious research project using vascular stem cells to treat retinopathy. His funding base is impressive with major awards from the Medical Research Council, the US-based Juvenile Diabetes Research Foundation, Fight for Sight, and the Sir Jules Thorn Charitable Trust.

'This research is exciting because it harnesses stem cells, which we all have. They're not embryo-derived stem cells so there isn't any ethical issue around foetal tissue. The strategy is simple. You isolate the cells from blood, expand them in a laboratory setting and re-deliver to the donor where they help to repair damaged blood vessels. With some patients, their vascular stem cells might not be working so well so we also have this opportunity to fix this defect prior to delivery.

For this 'cell therapy' the focus is on retinal diseases where blood vessels are progressively damaged over a period of time.

'We have demonstrated that these stem cells can repair blood vessels in the damaged retina and this approach is being further developed for use in patients.

'It's exhilarating to be involved in this research. When I talk to patients they easily grasp the concept. What we're doing is offering a novel approach and a new therapy in an area where it is desperately needed.'

The work being carried out by the Centre has brought international renown and has attracted research students, post-doctoral scientists and academic leaders from all over the world.

'We have many really talented researchers from across the globe. They come here to embrace new challenges, learn new skills and advance their career. Some stay in Northern Ireland, others move on to partner labs in the US, Europe or Australia. It is truly an international research programme.

'We're recognised around the world for what we do and we have a focused, strategic plan. Northern Ireland is a small place. Research-wise, we are competitive on the world stage. As our Centre grows and develops even further I fully expect our impact to be even bigger – which has major benefit for Northern Ireland.'

"We're offering a new approach where it is desperately needed."

HELPING POLICY-MAKERS LEARN HOW COMMUNITIES ARE CHANGING

Aileen Stockdale is fascinated by people and how they live – but, more especially, where they live.

She says, 'Growing up in Tyrone, I was acutely aware of the processes of change in rural life. When I was a student, the dominant view was that people were leaving the countryside and going to the cities. My research found that young people were leaving but older people were moving back. That discovery started a research journey that continues to this day.'

Based at the Institute of Spatial and Environmental Planning, Professor Stockdale is an established authority on internal migration patterns and processes and their consequences for rural communities. She has published widely in international scientific journals and has presented many papers at national and international conferences.

Her most recent research project examined mobility trends and migrant and rural community wellbeing in three areas of the 'celtic fringe' – the Glens of Antrim, the Isle of Bute in Scotland and Radnorshire in Wales – focussing on people aged between 50 and 64 who moved into these areas.

'A lot is known about retirement migration but what about people in that window just before they retire? Are they making decisions based on an expectation that they're going to retire in ten years or whatever? This is a generation that's living longer and, leaving aside the recession and things like changes to pensions, are in general as affluent as they've ever been. Because they have the means, they're able to plan ahead.'

The research exposed differences in the three areas. People moving to the Isle of Bute tended to be highly-qualified professionals, some of them English. In the Welsh area migrants were more blue collar, moving from the Midlands. Part of the area is even called 'little Birmingham.'

'And in the Glens we found something quite distinctive. There was a certain amount of return migration but there were also people who had never lived there. However, one or other of their parents had. This was second generation return migration – a desire to return based on childhood memories of visits with their parents.'

The study also addressed attitudes. 'You always think that when people move somewhere, they adopt a nimby – not in my back yard – attitude and prevent further development taking place, for example; or they take over the running of things, house prices go up – all the negative things come to mind. But there's a positive side. New people offer an opportunity for the rural economy. They may set up a business themselves or bring skills, knowledge, expertise, and the ability to help a local young person start a business, for example. They have an extensive network of contacts. I don't think we tap into enough of these potential opportunities. There's a real resource here that isn't being used.'

But there is another extreme. 'New people get involved in local community events and activities. There's the potential, especially within the voluntary sector, that they become overly relied-on. And so you may end up with an ageing population becoming increasingly dependent on ageing people.'

The project was funded by the Economic and Social Research Council. 'Part of their requirement is that the results are disseminated, not just in the academic world but to policy-makers and people on the ground. We ran evening seminars in each area and were taken aback by the sheer numbers of people who came along.'

Through this kind of community contact, the research is proving of enormous interest to policy-makers and may have a long-term impact on strategic decision-making at local and government level.

Aileen emphasises, 'All you can do is present the findings. We can't dictate policy but we can make sure we reach every relevant government department and organisation.' One such is the Homes and Communities Agency in London that has shown particular interest in the Welsh study and potential housing consequences.

'We've known for a long time that demographic ageing will happen, yet it's only in the last few years that we've started to really think about it. At the moment the issues being considered relate to pensions and health care but my argument is that there are other aspects which we need to be pro-active about.

'Twenty years down the line – what types of society do we want for our ageing communities?'

Professor Aileen Stockdale
School of Planning, Architecture and Civil Engineering

> "Demographic ageing – it's only in the last few years we've started to really think about it."

21ST CENTURY MAGIC BRINGING MEDIEVAL TEXTS TO LIFE

When Professor John Thompson examines an early manuscript, he is studying more than the text. He is fascinated by who read it originally and the impact it had on them.

John says, 'I'm interested in the way textual cultures can be identified that reflect on how we understand our own identities. Textual study is a very venerable aspect of English studies. However I'm interested not just in textual studies per se but in the readers and reading practices, the way the texts have been received, both in the period in which they were written and then hundreds of years later by us or by collectors.'

John is Chair of English Textual Cultures at Queen's. He has recently finished leading a project, funded by the Arts and Humanities Research Council, called Geographies of Orthodoxy, a collaboration with the University of St Andrews. The project uses 21st century technology to bring medieval writings to a broader readership. An electronic database has been created which is opening up a whole body of manuscripts to the scholarly community and to wider critical debate.

It has also led to new funding, this time from the Joint Information Systems Committee, which is driving innovation in UK education and research, in which Queen's is linking with several other universities to create a database called Medieval Manuscripts Online.

And there is a further project, a collaboration with colleagues in France and Germany which is the biggest yet attempted in terms of looking at historical and cultural transitions between 'medieval' and 'renaissance' and the pre- and post-Reformation period across Europe.

John says, 'I'm interested in the way writings in the Middle English period, from 1066 to 1600, have influenced what we understand by religious identity and national identity. With Geographies of Orthodoxy we looked at how texts which have an orthodox feel about them, or veneer, were actually circulated and how they were received by readers. We call this cultural mapping.'

The texts on which the research focussed were *Lives of Christ*, based on the Gospel treatments, and one in particular, Nicholas Love's *Mirror of the Blessed Life of Jesus Christ*, translated from the Latin.

'We investigated the survival of those manuscripts that belonged to the same tradition as Nicholas Love. We learned about reading practices – evidence in the books of marginalia and underlinings. We studied collectors – who they were, how they were collecting them, what other materials they were assembling alongside them.

'Often we found that marginalia was just in the opening pages, showing the reader running out of history or patience. On other occasions we found that readers were profoundly influenced by the text and named it in their own subsequent writing.

'The way a text is copied – mise en page – is also important. It reveals something of the way it was intended to be read. The writers often left instructions. There were also alterations through the generations. For example, some readers who had experienced the Reformation went back into these texts and expunged words like the Pope and also added their own commentary.'

John notes that there are two approaches in the manuscript culture of the Middle Ages. 'You either get a huge emphasis and priority on transcribing the text exactly – with some translations looking almost as if they've been factory-produced – or, on the other hand, you have texts that are more romanticised retellings of Biblical stories where the scribes had enormous freedom and would adjust the texts in all kinds of ways.'

He is delighted with what the work is delivering. 'The handmade books belonging to this tradition, that were copied, owned and read in the period, have never before been systematically analysed. We have high prestige projects here at Queen's that link with other high prestige projects elsewhere in the UK and Europe. The impact is huge in terms of how our work will relate to major archives which are a repository of heritage. We are making openly and freely accessible highly specialised information that allows us to rewrite how we understand the history of English literature and printing.'

Professor John Thompson
School of English

> "The impact is huge in how our work will relate to the repositories of heritage."

TRULY INNOVATIVE METHODS OF SOCIAL DATA COLLECTION

Professor Mike Tomlinson
School of Sociology, Social Policy and Social Work

> We're trying to capture the everyday experience of poverty and social exclusion.

Mike Tomlinson is engaged in a major research project on living standards which could have profound implications on the way the disadvantaged are viewed.

With £3.8m funding from the Economic and Social Research Council, Poverty and Social Exclusion in the UK is a collaboration with six universities across the UK. Two major surveys are involved, followed by an analysis phase.

As Professor of Social Policy at Queen's, Mike is acknowledged as an authoritative voice on economic and social marginalization. Much of his research and published work has focused on this area and he was a key member of the team which completed the first-ever Poverty and Social Exclusion study in Northern Ireland, funded by the Treasury and the Office of the First and Deputy First Minister ten years ago.

He says, 'The importance of doing a piece of work like this at the present time should be clear. For many in the UK living standards are declining under the twin pressures of high inflation and public policy responses to sovereign debt management. Whether it's the billions of pounds taken out of the welfare system, the rise in unemployment or blocked opportunities for young people – all are taking their toll. We're trying to capture the everyday experience of poverty and social exclusion.

'The surveys are large-scale quantitative work but in addition we're doing supplementary work involving in-depth interviews with people in low income households. In the Northern Ireland context we're interested in family life. Many believe the family is stronger here than in other parts of the UK, enabling people to cope better with the recession. We're looking at patterns of family life to see what family resources, if any, people have to draw on when they're under pressure.

'It's important to know how financial and social stress impact on the way families behave. We think we're a very sociable community – but is it true? Do current pressures bring families together or push them apart?'

He explains, 'The main objectives of the study are to improve the measurement of living standards, deprivation and social exclusion, and to use the data we collect to carry out policy-relevant analysis.

'A defined income isn't the only measure of poverty. We need to consider the extent to which people are in deprivation. But who defines deprivation? Our approach is to research what people say are the basic necessities of life and to use this consensus to establish which items and activities are critical for the measurement of disadvantage. We believe that the science we're developing from this particular approach has the potential to influence the way the poverty line is drawn across the European Union.'

Mike came to Queen's in the late 70s. 'Before going to university I had a gap year working with street homeless people in Birmingham which opened my eyes to the private issue of humiliation and to the public issue of failing welfare systems.'

Of Northern Ireland today, he says, 'We need to understand that violent conflicts are imprinted on the social fabric, from patterns of physical and mental health to participation in the labour market and a whole range of social activities. Peace-building is as much about social and economic reconstruction as it is about workable political institutions.'

Mike believes the current project 'will illustrate and define where the squeeze is really being felt and what the significant issues are. One of those we know already – the complex policy question of people keeping warm. The problem in this instance is three-fold – income, lack of insulated homes and energy costs.'

He says, 'We've established a Northern Ireland network of organizations and people who are concerned with what's being researched. We're also working with local communities to discuss the questions and findings and to discuss policies and locally-relevant strategies.

'People on low incomes, people on fixed incomes, people who aren't working are often the scapegoats of politicians who need to turn attention away from their own difficulties in managing economic and political realities by blaming the victims. My task is to produce evidence that counters some of the wilder claims that are made and to illuminate what life is really like for the quarter of the population of Northern Ireland living below the EU income poverty threshold.'

THE CYCLE OF CRISIS – CAN IT BE PREVENTED?

Sally Wheeler makes a prediction. 'The next problem will be mass actions over the mis-selling of financial products. People are realising how little their retirement pot has assembled since they went into a private pension scheme. Lloyds have already been fined a vast amount for selling care packages which turned out to be inappropriate. There'll be more of this.'

It is the kind of issue which Professor Wheeler watches keenly. She has spent her whole career working in the area of commercial law and has been at Queen's since 2004 as Chair of Law, Business and Society.

She says, 'A lot of people think commercial law is very dry and obscure. But it's really interesting and often very simple, using simple concepts and simple devices to order the commercial world. I look at why people design the devices they do, whether they work or not. I spend a lot of time talking to lawyers who design them, to bankers and to regulators who are always trying to play catch-up.'

Her most recent area of research, funded by the Economic and Social Research Council, has centred on developments in the United States where there has been an increase in prosecutions being negotiated between corporations and the Department of Justice and the Securities and Exchange Commission.

'An example would be a company that hasn't declared its correct balance sheet on its accounts because if it did its stock market price would be affected. The American regulator is saying – that's very naughty. We're going to put an independent monitor into your firm to watch what you do. They're going to tell you to comply with certain regulations for a certain period of time and if you do, then this will be written off.

'We wanted to look at how consistent the arrangements were, whether corporations would sign up to this or would they say – sue us. We were also interested in the transfer of personnel – whether firms were keen to take on people who had worked in a regulator's office and so would know how these arrangements worked and how to avoid them. We found a lot of gamekeepers turned poacher.'

There has been no sign of similar developments in the UK. 'We wondered if this idea would take off here and it hasn't. I suspect that the corporate culture accounts for a lot of that. We found that the American firms didn't seem to mind having these corporate monitors dropped on them and they saw that as more viable than the alternative. Here, enforcement is lower. Far fewer firms are ever sued in the UK or pursued by the regulator. Consequently there isn't the same incentive to sign up for those sorts of arrangements and UK firms are not used to that degree of interference.'

The research followed a previous project looking at new US legislation to deal with corporate collapse like Enron. Could such an event happen again?

'These things never go away. Look at the cycle. In the early 90s in the UK you had Polly Peck and Robert Maxwell and they resulted in a raft of new legislation. By the time you get to 2000 you see a lot more with the bursting of the Dot Com bubble and now we have various Treasury reports into things like Northern Rock and the running of RBS.

'These business models were never financially sound. Whose fault is that? Who was supposed to monitor them? How do we stop it happening again? So we close a few more gates. But my guess is that in ten years time exactly the same thing will happen.

'People like me have been saying for years that it would all end in tears but when it does, do you feel pleased? You don't get a platform for saying things will go wrong, not when a government and people themselves are in full swing, but it doesn't mean you can't help shape the alternatives.'

Professor Sally Wheeler
School of Law

> "I talk to lawyers, bankers and regulators who are always trying to play catch-up."

MAKING WAVES IN THE WORLD OF ENERGY

Professor Trevor Whittaker
School of Planning, Architecture and Civil Engineering

> We were recognised from an early stage as people who meant business.

In 1976 Trevor Whittaker had just finished his degree at Queen's and found himself being offered a job. It was as a research assistant at the University, helping to work on wave energy.

He is in no doubt about why he was chosen. 'Alan Wells was Head of School. He had his eye on me because while I was an undergraduate I also had my own powerboat-building business. Apart from being a civil engineer, I'm also a naval architect. He reckoned these interests would work well.'

These days Trevor is Professor of Coastal Engineering and has become a leading international figure in the world of wave energy.

As he points out, in those early years, Queen's was not at the forefront. Wells was having some initial ideas. He would go on to create the Wells Turbine which always rotates one way, despite the direction of the air flow. Trevor even has a mini version on his desk and will happily blow into it to demonstrate.

'The whole enterprise has really grown since then, as has the University's reputation in this field. There are two wave tanks, one in Belfast and one in Portaferry. To date I have supervised 24 PhD students, with another seven on the books at various stages of completion. The team itself is bigger. Within Queen's and affiliated to the group there are 24 people involved.

'But our main claim to fame is the number of working prototypes we have around the world. This is a unique form of applied research.

'We were recognised from an early stage as people who meant business in this field, being part of the UK wave energy programme in the late 70s and early 80s. We got some very big grants and we made our mark as one of seven teams designing a power station for the Western Isles of Scotland.'

Other commercial applications included wave-powered navigation buoys. Then came Limpet, a shoreline energy converter, in partnership with the company Wavegen, and currently the Oyster project, a collaboration with marine energy firm Aquamarine Power.

'The Oyster concept started because I was having ideas about alternative ways of generating electricity with shoreline devices, working directly with the movement of a body in the waves instead of with oscillating water columns driving an air turbine. So we looked at doing away with all the structure and interacting directly with the surging water in the near-shore zone.

'We applied to EPSRC and got two back-to-back grants, working along with staff at Manchester Metropolitan University who are experts in numerical modelling of coastal processes. In 2005, a Scottish entrepreneur came to me with a proposal for developing Oyster commercially. And so he founded Aquamarine purely for that purpose.

'We're going from strength to strength. This year alone we have another three big research grants. Aquamarine employs two staff at Queen's and a lot of the work done in the tank here is development work for the company. It suits everyone.'

Trevor is constantly asked for his views on world energy problems. 'There is no single panacea. What you need is diversity of supply. Wave is a part of the mix – a very big part. The amount of energy available off the western coast of Europe is 17 per cent of its total energy demand. You could never extract the full 17 per cent but if you produce a proportion of it, then that's a huge industry making a valuable contribution to reducing carbon emissions.

'Educating students is our primary business. But here they can work on real projects. There's nothing hypothetical about it. I'm not a pure out-and-out academic. I'm an applied academic. My strap line – research excellence towards commercial development. That sums us up. That's what we do.'