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THE RESEARCH MAGAZINE FOR CARDIFF UNIVERSITY

CHALLENGE

CARDIFF



British Heart Foundation's
Jo Oliver talks to Professor
Valerie O'Donnell

Getting to the fat of the matter

Judas

The Archbishop of Wales talks
poetry with Professor Damian
Walford Davies

Ecohomes – the solution to the housing crisis?

Steve Morgan OBE challenges
Ester Coma Bassas on affordable
low carbon housing

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We'd like to hear from you

Your feedback is incredibly valuable to us here at Challenge Cardiff. We welcome your comments - please email them to challengecardiff@cardiff.ac.uk

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Welcome to the third issue of Challenge Cardiff, the research magazine for Cardiff University.

The magazine places the users of our research at its heart. We hope that Challenge Cardiff in its first year of publication has provided a good insight into the research we undertake at Cardiff, and its impact in Wales, nationally and internationally.

Our cover story on understanding lipids is a great example of how Cardiff is using interdisciplinary research to tackle the number one cause of death globally. The work forms part of the newly established Systems Immunity Research Institute, one of five new Research Institutes that we have created.

Cardiovascular disease (CVD) is the leading cause of death worldwide. Professor Valerie O'Donnell and her team of immunologists are working to improve the understanding of lipids and their role in the disease. Joanne Oliver, a former nurse and Area Development Manager for the British Heart Foundation in South Wales, spoke to Professor O'Donnell to find out more about her work and what it means for people living with the disease.

Sustainable living is an area where Cardiff is at the forefront. The Solcer House project, which attracted widespread media interest, is Wales' first low cost energy smart house. Built and designed by our Welsh School of Architecture, it demonstrates that zero carbon targets can be met in an innovative and

affordable way. In this issue, Steve Morgan OBE, chair and founder of Redrow plc quizzes Ester Coma Bassas on the challenges of designing and building such houses, and the feasibility of building them in great numbers.

We feature the Cardiff University Research Opportunities Programme (CUROP) which gives our undergraduates the valuable opportunity to gain research experience. We find out about the experience of one of its participants who is now working with government and industry on a project to help keep our streets safe.

At Cardiff we acknowledge that the global challenges we face are not discipline specific. Our nine University Research Institutes bring together

academics from a number of fields, who by working together are discovering ground-breaking solutions to these issues. We feature the work of the Cardiff Catalysis Institute, while Professor Martin Innes (Director of the Crime and Security Institute) tells Chief Constable Peter Vaughan, QPM what sparked his interest in policing and criminology. We hope that you will be encouraged to find out more about our research. Further information about the work featured in this issue can be found on our website as well as a series of films and podcasts that accompany the magazine. (www.cardiff.ac.uk/research/news/challenge-cardiff).

Please contact challengecardiff@cardiff.ac.uk if you would like to challenge our academics on an issue that matters to you.

Research news

University launches five new flagship Research Institutes



The University is reinvigorating its commitment to solving some of the most pressing problems facing humanity with the establishment of five new flagship Research Institutes.

World-leading experts from a variety of disciplines are pooling their expertise to develop new and innovative solutions to intractable world issues that have a lasting impact. As well as creating opportunities for existing researchers, the Institutes will serve to attract the best international talent to Cardiff.

Their establishment more than doubles the number of

Cardiff's Research Institutes, bringing the number to nine in total – the first four of which became active in 2011. In the four years since their formation, the original Research Institutes have made huge strides in their respective fields.

The new Institutes which include Data Innovation Research Institute, Systems Immunity Research Institute,

Water Research Institute, Crime and Security Research Institute and the Energy Systems Research Institute – will be instrumental in building on the success of the 2014 Research Excellence Framework (REF) which propelled Cardiff to fifth in the UK for the quality of its research, and second for impact.

It is hoped that these new research activities will help carry forward the University's strategic aim of breaking into the QS World University top-100 rankings by 2017.

Cardiff's Vice-Chancellor, Professor Colin Riordan, said: "We want our new Institutes to send a clear message that we

have the critical mass and the academic excellence to make a difference to major problems facing humanity, and in these fields we intend to be world leaders.

In the short time since the original Institutes were formed in 2011, their pioneering work in areas ranging from drug discovery to neurological disease has already signalled to the world Cardiff's strengths and intentions as a global university.

It is important that our research continues to offer answers to the biggest challenges that threaten our future, and I'm confident that by focusing our energies on these new areas we can succeed."

£1.8m for online resource of contemporary Welsh language

Cardiff University is to play a key role in developing the first ever large-scale corpus of the Welsh language, compiling an initial data set of 10 million Welsh words.



The University's School of English, Communication and Philosophy has secured £1.8m in funding from the Economic and Social Research Council (ESRC) and the Arts and Humanities Research Council (AHRC) for an interdisciplinary, collaborative project, entitled The National Corpus of

Contemporary Welsh, or Corpws Cenedlaethol Cymraeg Cyfoes (CorCenCC).

Starting in March 2016, the project will run for three and a half years. It will draw on expertise from Swansea, Bangor and Lancaster Universities.

The corpus - a large collection of texts, or a body of written or spoken material for linguistic analysis - will represent Welsh language use across all communication types. This will include spoken, written and digital language, encompassing different genres, language varieties (regional and social) and contexts.

Participants will be drawn from the 562,000 Welsh speakers in the UK, who will contribute via crowdsourcing digital technologies and community collaboration.

Further detail about the project and the ways in which users will be able to participate will be shared once it is live in 2016.

Dr Dawn Knight, from the School of English, Communication and Philosophy, who is leading the project, said: "What we hope to achieve is the development of

the first large-scale living and evolving corpus, representing the Welsh language across communication types and informed by users of the language.

The project will have a positive impact on the work of translators, publishers, policy-makers, language technology developers and academics, and a bespoke toolkit will be constructed for teachers and learners, integrating basic corpus functionalities for the exploration of language use."

The range of stakeholders involved in the project includes the Welsh Government, Welsh Joint Education Committee, Welsh for Adults, Gwasg y Lolfa and University of Wales Dictionary, which indicates the linguistic, cultural and social relevance of the project.

Top honour awarded to Professor Karen Holford

Professor Karen Holford, Cardiff University's Pro Vice-Chancellor, College of Physical Sciences and Engineering, has been elected a Fellow of the Royal Academy of Engineering.

The admission, one of the highest national honours an engineer can receive, recognises Professor Holford's distinguished research career in industry and academia, as well as her commitment to outreach activities and promoting engineering as a career.

Professor Holford joined Cardiff University's School of Engineering as a lecturer in 1990, and became the School's director in 2010. In September 2012, Professor Holford was appointed Pro Vice-Chancellor for the College of Physical Sciences and Engineering.

Her current research focuses on acoustic emission, and how high frequency sensors can be developed to monitor damage in a number of different structures and systems, such as bridges, buildings and aircraft landing gears.

In addition to her research, she is a proud advocate of engineering and is a member of a number of committees and organisations that actively encourage young people to consider a career in the field.

As a Fellow of the Royal Academy of Engineering, Professor Holford will be



engaged in a variety of activities on behalf of the Academy, supporting engineering research, policy formation, education, entrepreneurship and public engagement.

The Academy's Fellowship represents the nation's best engineering researchers,

innovators, entrepreneurs, business and industry leaders. The Fellowship currently stands at over 1,500 engineers from across the sectors and disciplines, who lead, guide and contribute to the Academy's work and provide expertise.

Jo Johnson announces new funding for lightning lab



L to R: Vice-Chancellor Professor Colin Riordan, Universities and Science Minister, Jo Johnson MP and Professor Manu Haddad.

The Universities and Science Minister, Jo Johnson, committed £2.6m to a Cardiff University-led project to develop new ways of protecting modern aircraft from lightning strikes.

The PROTEST research project, which is also being led by Airbus, will take place at the newly redesigned Morgan-Botti Lightning Laboratory and will aim to understand the phenomena and physics of mechanisms involved in aircraft joints when built from carbon composite materials.

Whereas previous aircraft were made mainly of aluminium, which is a very good conductor of electricity and therefore a better protector against lightning, modern aircraft are made from stronger and lighter carbon composite materials, which are poorer conductors of electricity in comparison.

Researchers at the lightning laboratory will study the mechanisms involved when lightning strikes these carbon composite materials and devise ways of making the materials safer and more reliable.

The information will also be used to make overall aircraft design more efficient and economical and keep the UK at the cutting edge of innovation in aerospace.

Currently, the Morgan-Botti Lightning Laboratory is the only university-based lightning laboratory worldwide which is dedicated to aerospace research and testing.

The PROTEST project has been funded by Innovate UK, through the Aerospace Technology Institute (ATI). The other industrial partners involved in the project are Airbus Group in Filton, HEXCEL, a manufacturer of carbon composites based near Cambridge, and the National Composite Centre (NCC catapult).

The new funding was announced during Mr Johnson's visit to Cardiff University, where he was also shown the world-leading Cardiff Catalysis Institute and the Cardiff University Brain Imaging Centre.

Mr Johnson said: "As a One Nation Government we are backing science and innovation across the UK. We want to be the best place in Europe to innovate which is why we are investing in Cardiff University's unique project to create new ideas for developing Wales' world-class aerospace sector.

This is the kind of expertise we are supporting to safeguard the future success of the nation and its economy."

Wales's most powerful MRI scanner arrives



Professor Derek Jones

A giant £6m MRI scanner with superior power to detect disease inside the human brain has arrived at the University.

The MRI scanner is referred to as a 7T system, as the magnet inside is 7 Tesla (Tesla = unit of magnetic field strength). It will help researchers at Cardiff University Brain Research Imaging Centre study a range of neurodegenerative and psychiatric disorders including dementia, schizophrenia and depression.

The 7T weighs in at 40 tonnes and is the third of its kind in the UK. Supplied by Siemens Healthcare, it will aid the early detection of disease and the development and monitoring of new therapies.

Professor Derek Jones, Director of Cardiff University Brain Research Imaging Centre, said:

"The arrival of the 7T scanner is the next big step in the evolution of Cardiff University Brain Research Imaging Centre. It will enhance our capability for high quality research, helping us understand mechanisms of disorders such as dementia, autism and learning disabilities. Working with NHS Wales and industry helps bring advanced technology closer to patients."

The secret of 7T scanning technology lies in the strength of its giant magnet, which helps create more finely detailed images of the human brain, and can reduce scanning times for patients. The 7T magnet is around seven times stronger than magnets used to pick up cars in junk yards, producing very high resolution images.

MRI – or Magnetic Resonance Imaging – is a technique that shows internal body structures. It can distinguish soft tissues, and is often used to image the brain, muscles, and heart. A non-invasive technique, it is now the most

used imaging method in neuroscience.

The delivery of the new scanner marks another milestone in the completion of the new Cardiff University Brain Research Imaging Centre research facility on the Cardiff Innovation Campus at Maindy Road. It is due to open in Spring 2016.

The project is supported by the Welsh Government, the European Regional Development Fund and other significant funding agencies.



Cardiff named 'Excellence Centre' in Precision Medicine Catapult

Cardiff has been named a 'Centre of Excellence' in a network of hubs to develop precision medicine across the UK.

Cardiff University's expertise in researching and developing innovative technologies for the UK healthcare sector will support the Precision Medicine Catapult's Cardiff Centre. It is one of six centres named in the £50m Precision Medicine Catapult project funded by Innovate UK, the UK Government's innovation agency.

Led by a consortium headed by Welsh Government, NHS

Wales and the University, the Centre will work on local programmes, building expert teams across the city.

Professor Colin Riordan, Vice-Chancellor of Cardiff University, said: "The announcement highlights both the city's expertise in precision medicine, and the University's reputation for outstanding UK research. The Cardiff Centre will support major UK clinical and data programmes, such as testing of

new clinical trial models and the development of NHS adoption routes. Bringing Cardiff inside the UK Catapult Network will also bring wider benefits to the Welsh economy."

The centre, which will also be supported by Swansea University, will collaborate with local, national and global partners to identify and resolve barriers to building a leading UK precision medicine industry.

Professor Julie Williams, Chief Scientific Officer for Wales and Dean of Research at Cardiff's Institute of Psychological Medicine and Clinical Neurosciences, said: "Precision medicine uses diagnostic tests and data-based insights to understand a patient's disease more precisely and so helps develop treatments with more predictable, safer, and cost-effective outcomes. The Cardiff

Centre will work with UK and Welsh Government initiatives, industry and regulators to build the sector."

First Minister of Wales, Carwyn Jones, said: "Wales has a thriving life sciences sector and a worldwide reputation for excellence in research. Today's announcement of Cardiff as one of the centres of excellence to develop precision medicine is a further boost to the sector."

Universities and Science Minister Jo Johnson said: "The UK is a world leader in the life sciences and we are committed to strengthening our capability in this crucial industry. These centres of excellence will support researchers across the country in developing precision medicine technologies that will save lives and help grow the sector."



Judas: Arch-betrayer or necessary instrument of salvation?

To call someone 'Judas' is not exactly a compliment. The Christian gospels tell how he betrayed Jesus with a kiss, for money. Professor Damian Walford Davies has written a volume of poetry which questions who Judas was and explores the paradoxes that have built up around him.

The Archbishop of Wales, Dr Barry Morgan, challenged Professor Damian Walford Davies about the theological and literary choices that underpin the book.

BM: Most poets write one or two poems about Judas; you've written a whole volume. Why did you decide to do that?

DWD: Talk about a man caught in a cleft stick. Judas is the man with the dark halo – the fiendish betrayer of Christ and yet the necessary agent of salvation. One remembers poet Brendan Kennelly's description of him also as just 'another ordinary appalled man'. I like that. I wanted to explore the paradox, the problem, that is Judas.

BM: And where do you stand personally on Judas, because of those two sides? He's the man who betrayed Jesus and yet the gospels hint that without him Christ's work wouldn't have been fulfilled.

DWD: I approached him as a creative writer rather than as a dogmatic theologian or historian or believer (though that's in there somewhere). My Judas can't be pinned down. If, of course, he existed at all: the accepted historical view is that he was the necessary invention of a young faith that wanted to put clear blue water between itself and its Jewish roots. A political scapegoat. There's a lot of theological politics bound up with the construction of Judas, developed and magnified over the last 2,000 years.

BM: He's not the most appealing character – if as you say he existed at all (and some Christians would be horrified to hear you and me say that). You paint a fairly bleak picture of our world. Is that your perception of the world in which we live?

DWD: I think that's more my perception of that cleft stick that Judas, had he existed, would have found himself in. Here was a man craving release from Roman occupation, craving a certain kind of deliverance, but not knowing quite what the shape of that was to be. Jewish apocalyptic desire and Jewish political thought help to illuminate the Judas predicament.

BM: There are deep theological questions in your book. Are you religious yourself, and are you by writing poetry exploring questions of faith?

DWD: I think that's an entirely fair question,

since Jesus comes in and out of the frame in this volume, which is spoken entirely by Judas, of course. This is Jesus as seen by (my) Judas, and the portrait we get is complex, biased, contradictory, unfixed. I guess the ambiguity that's at the heart of the volume is at the heart of my own faith. I was brought up a nonconformist but was baptised into the Church in Wales in my early 20s. I would say that my reading of the history and politics of first-century Palestine, and also my reading of bodies of poetry such as that of R. S. Thomas, have inflected my faith.

I'm probably closer now to a late R. S. Thomas position that God is precisely that which we can't know. Writing this volume has swerved my idea of God as a personal deity towards that dark but echoing unknowability.

BM: But that's perfectly orthodox isn't it, because none of us can know God. The ultimate unknowability of God is highlighted in Holy Scripture and in the writings of the mystics. It's not just R. S. Thomas, and therefore it's main-line theological thinking.

Going back to R. S. Thomas: he said that sometimes the poem just came, and sometimes he wrestled with it for days. I remember him telling me once there was lots of paper wrinkled up and thrown in the waste paper bin. How do you write poetry – does it come easily?

DWD: I think it tends to come relatively easily. It's not the day job in the sense that the academic job is, although poetry is now a crucial part of the research-based academy. Poetry isn't just plucked out of the air; it has a stringent underpinning.

I've got the gospels as a model here, of course; I can intervene, I can choose an angle of entry into something that is already there. That always helps to kick-start a poem.

BM: There are hints in parts of the volume that Judas has a love-hate relationship with Jesus that is almost homoerotic at times.

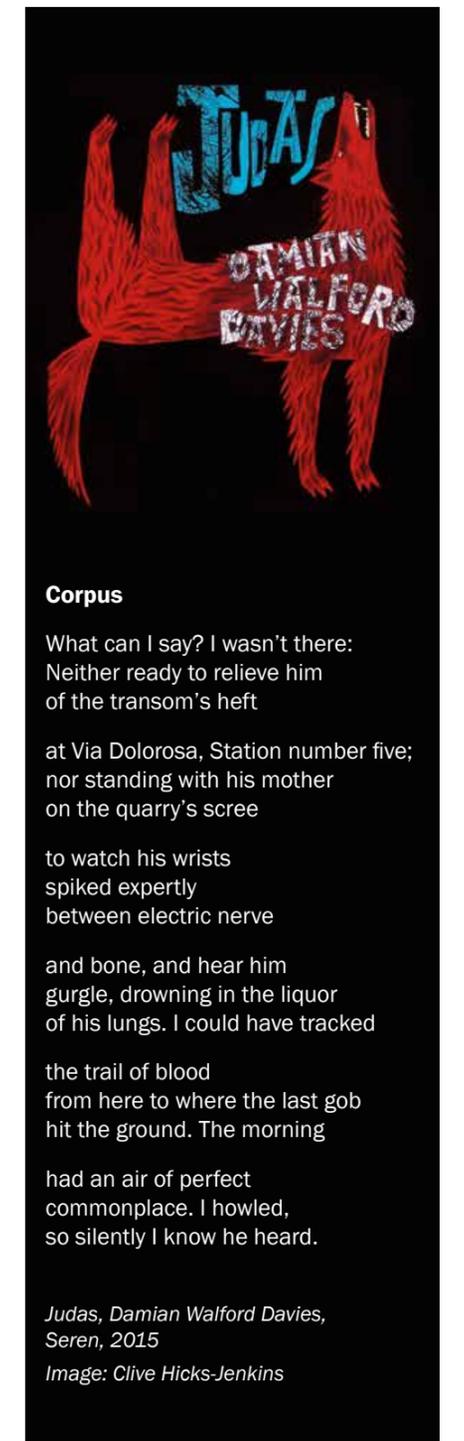
DWD: It is, and that's something we've inherited from 2,000 years of representing Judas. Back in the early '90s, the rock band U2 produced a very insightful song about Judas; the lyrics run:

*In the garden I was playing the tart –
I kissed your lips and broke your heart...*

('Until the End of the World', Achtung Baby, U2; Island Records, 1991)

That kiss. It's central, isn't it? It's the way in which Judas identified Christ in the darkness of that garden with those flickering torches all around. It's a curious act, that paradoxical act of love. I think love is central to Judas, central to his tragedy.

Grief and love are the challenging ways into Judas, far more than cynicism, demonisation and the charges of betrayal that have crystallised around him. What do we mean when we call someone 'Judas' nowadays? (We remember the 'Judas!' shout from the audience when Bob Dylan turned electric in 1966 in the Manchester Free Trade Hall.) In a way, it's a complex act of sympathy – an acknowledgement that a Judas has been forced by circumstances into a certain position.



Corpus

What can I say? I wasn't there:
Neither ready to relieve him
of the transom's heft

at Via Dolorosa, Station number five;
nor standing with his mother
on the quarry's scree

to watch his wrists
spiked expertly
between electric nerve

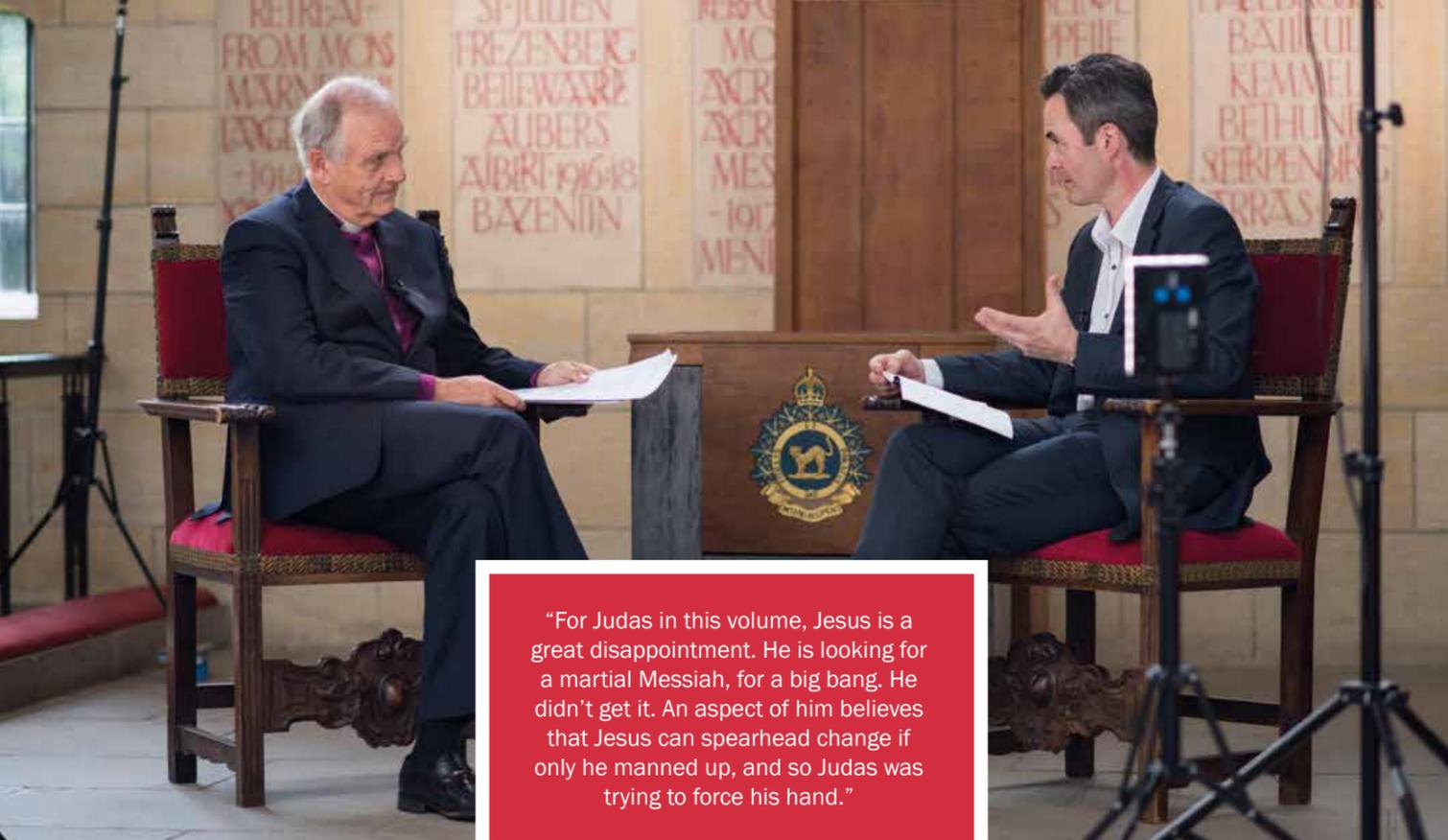
and bone, and hear him
gurgle, drowning in the liquor
of his lungs. I could have tracked

the trail of blood
from here to where the last gob
hit the ground. The morning

had an air of perfect
commonplace. I howled,
so silently I know he heard.

*Judas, Damian Walford Davies,
Seren, 2015*

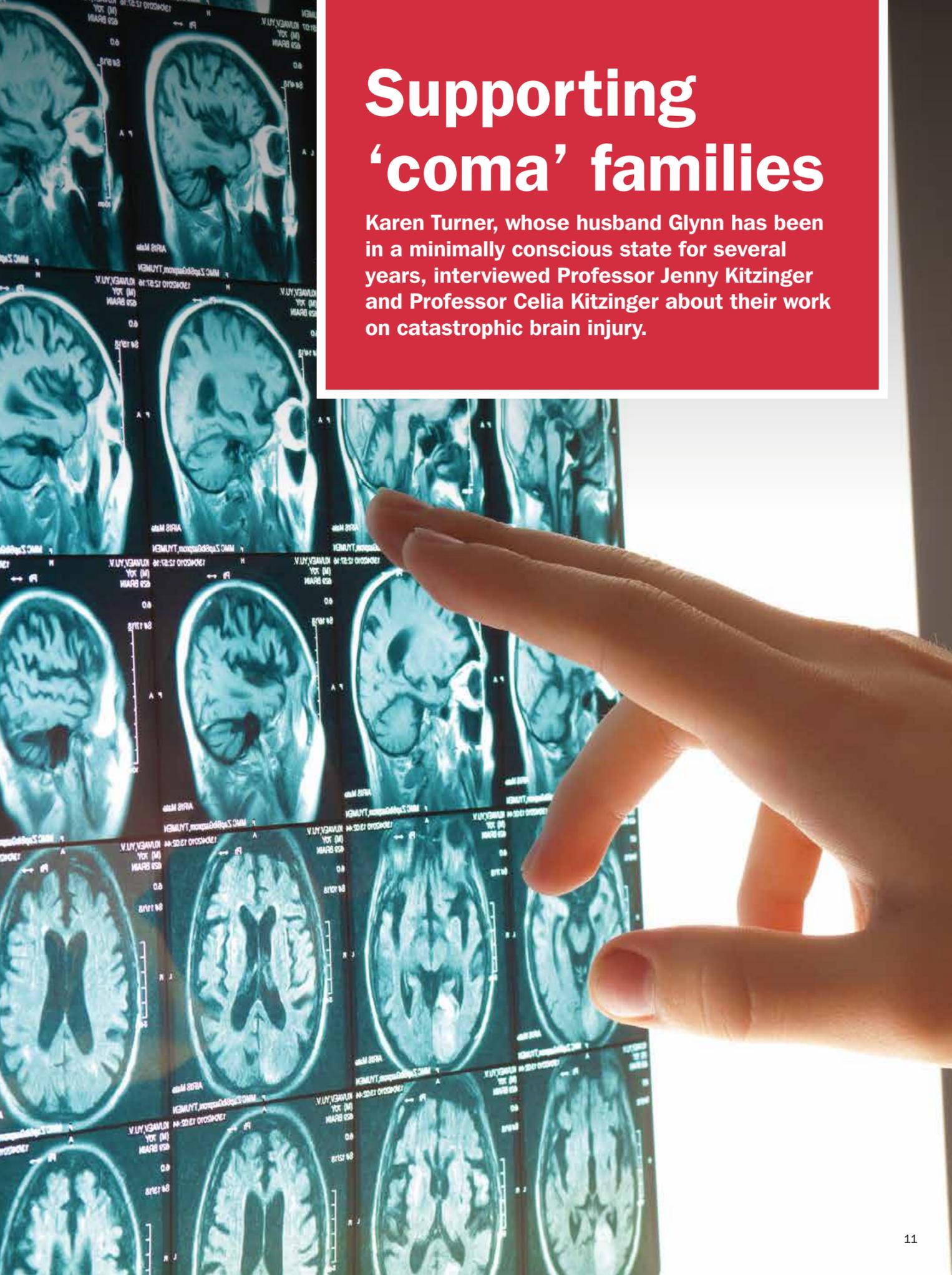
Image: Clive Hicks-Jenkins



“For Judas in this volume, Jesus is a great disappointment. He is looking for a martial Messiah, for a big bang. He didn’t get it. An aspect of him believes that Jesus can spearhead change if only he manned up, and so Judas was trying to force his hand.”

Supporting ‘coma’ families

Karen Turner, whose husband Glynn has been in a minimally conscious state for several years, interviewed Professor Jenny Kitzinger and Professor Celia Kitzinger about their work on catastrophic brain injury.



BM: There are only 22 references to Judas in the whole of the New Testament, although he’s had a profound effect on Christian history. Some people say that the character of Judas is responsible for much anti-Semitism.

DWD: Yes, and there have been spikes of Judas-centric anti-Semitism from the medieval period to the Nazi era, right through to our own time. Judas is our contemporary; my volume tries to reflect that.

My Judas – whom I’ve made the sole dramatic speaker – inhabits a strange dual universe in the book. He skirts around first century Jerusalem in a kind of historical stereo in which the future, and the Arab-Israeli War for example, are as alive to him as the tensions between Romans and Jews. I wanted to bring out those anachronisms to underline his relevance. So he’ll see two women air-kissing in the lobby of the Sheraton; he’ll see teenage Israeli soldiers – as I did when I went to Jerusalem to research this book – with their fingers on the safety catch of their automatic weapons; and he’ll respond to those things. Figures from history and fable need to be reanimated by poets and brought into contemporary contexts.

I wonder if I could ask you a question. What did you make of the volume from a theological perspective?

BM: I’m sure that some people will be shocked by it and will wonder whether you know what you are talking about, whether you’ve studied the Scriptures. For others

of us, the book is exploring very interesting questions, the theological conundrum at the heart of Judas’s character in a sense. He betrays Jesus and yet he’s the necessary tool for the salvation of the world in the Christian scheme. You feel the inner agony of Judas in this volume.

Theologians have suggested Judas was trying to push Jesus in a particular direction and Jesus wasn’t responding. He hoped that by pushing Christ in a revolutionary direction, change would happen. Then he lives to regret his betrayal when it all goes wrong.

DWD: For Judas in this volume, Jesus is a great disappointment. He is looking for a martial Messiah, for a big bang. He didn’t get it. An aspect of him believes that Jesus can spearhead change if only he manned up, and so Judas was trying to force his hand.

BM: I haven’t been there but there is a convent on the site where Judas is alleged to have hanged himself. Have you been there?

DWD: No, I didn’t go to that convent. I went to the Garden of Gethsemane, of course, during my 2009 research trip.

BM: The author Peter Stanford, who like you has just published a book on Judas, went to the convent I referred to, and said there were no traces of Judas – almost as if the nuns were embarrassed that he even existed. So we come full circle in a sense: did he or did he not exist?

DWD: That wiping out of Judas’s trace is very interesting. In some parts of the world he’s venerated as a saint and in the gnostic

Gospel of Judas he is the only disciple who finally and fully understands Christ’s message.

BM: The cover of your volume is very striking – red being the colour of wickedness traditionally associated with Judas. And here he appears almost a sheep in wolf’s clothing. That’s a paradox too.

DWD: Yes, here’s the wolf howling. This is a wonderful disturbing image by one of Wales’s most accomplished artists, Clive Hicks-Jenkins. What Clive remembered from the book is Judas’s (silent) howl at the moment of Christ’s crucifixion. The cover taps into that real connection between Judas and Jesus that has to do with jealousy, love, hurt.

I didn’t want dogma to take hold; I wanted to swerve the reader out of that and put him/her into a rather more difficult space, the space of paradox and irony. So this is not a book that offers definitive, non-negotiable positions.

BM: And is that what you’d like to leave your readers with?

DWD: In the final lines in the book, Judas turns to address the reader, the world, the future, and describes himself as ‘*the dark conductor of your lightning strikes*’. If this collection of poems is anything, it’s what I’d like to call ‘gospel noir’.

To see the interview in full visit: www.cardiff.ac.uk/research/news/challenge-cardiff



Karen Turner talks to Professor Celia Kitzinger about how the work of the Coma and Disorders of Consciousness Research Centre is helping the families of coma patients.

Professor Jenny Kitzinger and her colleague (and sister) Professor Celia Kitzinger are co-Directors of the Coma and Disorders of Consciousness Research Centre (CDoC), a joint initiative they set up between Cardiff and York universities, involving colleagues across law, philosophy, history, sociology, health sciences and other disciplines. The Centre explores the social, legal and ethical challenges of the vegetative and minimally conscious states.

The two sisters set up the research centre after their own experiences of what happened to their sister, Polly, who was catastrophically injured in a car crash near Brecon in 2009.

They went on to do interviews with over 65 family members with experiences of having a relative in a coma, vegetative or minimally conscious state and have used their research to inform over a dozen co-authored, peer-reviewed publications and also to create an online resource. The resource is on the healthtalk.org platform (<http://bit.ly/1HchkbX>); it summarises their research findings, alongside showing filmed interviews, to provide support for families and training for professionals.

When Cardiff University awarded this initiative the 2015 Innovation and Impact Award, Karen Turner, from Ipswich, wrote in highlighting how the Kitzingers' research had been invaluable for her: "As the wife of someone who is in a minimally conscious state, and has been for the last five years, I know that this is a very lonely experience for myself and my children. This research is giving families the opportunity to speak

out, tell it like it is, and feel that they have a voice. We are surrounded by experts who care for our relatives but they haven't got the lived experience we have and don't really 'know' what we go through emotionally and practically. Research like this not only helps the families but gives the professionals the opportunity to look beyond the patient to the whole family."

Karen spoke to the sisters about their ground-breaking work.

KT: Why did you start doing research on coma and disorders of consciousness?

CK: After Polly was injured in 2009 she was first in a vegetative and then in a minimally conscious state. During that time, and still now that she's regained consciousness but with profound multiple neurological disabilities, there were real problems with her care. Occasionally it was individuals who we felt acted inappropriately, but mostly it wasn't any one individual's fault. Mostly it was the system. Doctors seemed ignorant about the law and even lawyers that we consulted did not seem to be clear about what could be done. We were left in limbo without any way of advocating for Polly's clear values and beliefs. We knew as a family what Polly would have wanted but because this didn't fit with what the doctors were doing, we were ignored when we tried to get Polly's voice heard. We hadn't fully appreciated before that next-of-kin have no rights to make treatment decisions in this situation and it was a bit of a shock.

JK: A few months after Polly's accident I applied for, and was eventually appointed as, a Welfare Deputy by the Court of Protection.



Professor Celia Kitzinger asks Karen Turner about her experience.



Professor Jenny Kitzinger films the research interviews for the project (clips available on healthtalk.org.uk)

This is an official role that was created by the Mental Capacity Act 2005. This meant that I could make some decisions on Polly's behalf, however I still could not refuse some of the treatments I believed she would have wanted to refuse. Even with decisions that were within my legal powers I continued to be overruled by people who didn't understand what a Welfare Deputy was. We've since had an official apology about this, but it's too late to make a difference to Polly.

We hope our analysis of the situation, and research we went on to do with a wide range of families, can make a difference to other people, and we have fed our findings into policy documents such as the House of Lords' scrutiny of how the Mental Capacity Act is working in practice.

KT: How can the online resource support families?

CK: We wanted to give families accurate information about their role in medical decision-making, which is telling medics what the patient would have said in this situation if they could. The online resource explains how families can ask for Best Interests meetings, and how they can make sure that their relatives' wishes, values and beliefs from before the accident are taken into account.

JK: Alongside this we wanted to communicate some accurate information about coma to replace media emphasis on miracle recoveries so we've included discussion of what recovery from a prolonged coma usually means and videos with leading professionals in the area. We've

also gone on to work with artists to develop some creative representations of long term 'coma' in art, music, poetry, even a puppet show. (www.buff.ly/1VgbvSW)

KT: What happened to Glynn led me to make a living will, an advance decision, to protect myself and my family in the future. What can be done to encourage other people to do this before disaster strikes?

CK: Living wills, now known as advance decisions to refuse treatment, are a way in which you can refuse in advance any treatment you don't want to have in the future when you might not be able to refuse it. I co-founded a charity, Advance Decisions Assistance (ADassistance.org.uk) to help people write them. If Glynn or Polly had written one they could now be at peace. All that is needed is to write something like "If I am diagnosed as being in a vegetative or minimally conscious state by two appropriately qualified clinicians X weeks after the precipitating incident I refuse all treatment aimed at prolonging my life". Signed, dated, witnessed, and with a statement saying "I maintain this refusal of treatment even if my life is at risk as a result", this is a legally binding document.

The problem is that although the law permits this, there's been very little government support promoting advance decisions. They're not for everyone, but those who do

want them are being denied the opportunity to write them. We covered advance decisions in our online resource (see section on end of life wishes on our healthtalk.org resource) and we're trying to spread the word, via the charity and also through the Before I Die Festivals we organised both in Cardiff and York. It is very important that people feel more able to talk about dying and death.

KT: Your work has helped the Royal College of Physicians (RCP) develop new guidelines on prolonged disorders of consciousness. How are they helping medical practitioners and families work closer together in deciding treatment options?

JK: The guidelines are available online via the RCP and can be invaluable because they provide a map, with signposts and directions as to what should happen and to what timescale, after a person is in a prolonged disorder of consciousness. For families who've felt lost in the wilderness, alone without a compass, that's really important. And for doctors, who may themselves be unsure of some of the issues, it's a crucial reference document. Working with the RCP we ensured that there was clear information in the guidelines about doctors' duties to consult with families. We have also created some additional booklets based on the guidelines to make them more accessible to families, and help them hold doctors

to account – they are all available on our research centre website at www.cdcc.org.uk.

KT: Does the Coma and Disorders of Consciousness Research Centre work have any implications for considering whether the law concerning permanent vegetative state (PVS) and minimally conscious state (MCS) patients need to be changed?

CK: Yes, and we're trying to change it! The main problem we're addressing right now is that the law says that artificial nutrition and hydration cannot be withdrawn from a patient in a permanent vegetative state without a court hearing even if everyone, all the family and all the doctors, believe it is in the patient's best interests to withdraw such treatment and the patient had been clear they would not want to be sustained in PVS.

Nobody wants to go to court, not the clinical commissioning group or trust, not the doctors, not the family. The process of applying and getting to court can be intimidating and is time-consuming and costly. This means that patients go on receiving treatment for months or (usually) years after family members have come to believe that this is not what the patient would want. We are working with a multi-disciplinary team of lawyers, doctors, and other experts to find a way of streamlining the court application process and making it less stressful for everyone concerned.

The healthtalk.org resource about vegetative and minimally conscious states topped the Information on Ethical Issues category in the 2015 BMA Patient Information Awards.

The reviewer for the BMA praised the team for creating: "a profoundly honest and singular resource which will offer wisdom, empathy, insight and support to others... of great value to both families and clinicians." They added: "In over five years of reviewing for the awards this is the best resource I have seen."

The resource was used by over 4,000 people within months of launch and has also won awards for its impact on policy and society.



L to R: Margaret Kellas (Patient/Family Representative member of the Advisory Group), Professor Jenny Kitzinger, Professor Celia Kitzinger and Gunars Libeks (Patient/Family Representative member of the Advisory Group) at the BMA Patient Information Awards



Getting to the fat of the matter

“Thanks to advances in mass spectrometry, we’ve estimated that around half of the lipids in our cells remain unknown, so in our lab we are working to find out more about these new lipids...”

Professor Valerie O'Donnell

According to the British Heart Foundation, cardiovascular disease (CVD) is the leading cause of death worldwide. Scientists working within Cardiff University's newly established Systems Immunity Research Institute believe that tiny molecules known as lipids (or “fats”) lie at the root of this epidemic.

To fully understand what lipids do and the role they play in CVD would require a herculean effort. There are tens of thousands of these unique molecules in our bodies – even within a single cell – with an untold number yet to be discovered.

This is the challenge faced by Professor Valerie O'Donnell and her team, made up of biochemists and immunologists. Their fundamental research seeks to unpick the biology of lipids and how they contribute to life-threatening conditions such as blood clots, fat accumulation and hardening of the arteries.

Earlier this year, Joanne Oliver, a former nurse and Area Development Manager for

the British Heart Foundation in South Wales, visited Valerie in her lab to find out more about her work and what it means for people living with CVD.

JO: Can you tell me a little bit about your research?

VO: My research is mainly concerned with lipids and how they're involved in regulating inflammation in cardiovascular disease. We traditionally think of lipids as the bad guys that navigate through our circulation and do bad things to our vessel walls, leading to heart disease. But that's a really simplistic view and not entirely correct.

Our team is identifying new lipids made by circulating blood cells, and aims to

understand how they regulate normal healthy processes, and what they do when this goes wrong and blood vessels become diseased in CVD.

Lipids perform many important functions. For example, the structure of your cells – your cell membrane – is made of lipids. They're an important energy source and also act as signalling molecules. If you were to cut or injure yourself, a number of different blood cells go to the site of injury to stop you bleeding and prevent bacteria from getting in. A big part of how the cells do this is by using lipids to signal to each other. This is called inflammation. But when inflammation happens in the wrong place, then lipids become a major part of the problem. If

these lipids are produced deep in the vessel rather than out where the cut site is, they start setting up inflammatory reactions in the wrong place and that can then be the start of atherosclerosis (a condition in which an artery wall thickens as a result of fatty plaque deposits).

The work of my group is about discovering new lipids in human cells using mass spectrometry, and then making the new lipids through chemical synthesis so we can understand how they are involved in causing cardiovascular disease and how they regulate inflammation as well as normal healing processes.

JO: How is your research unique compared to the work of other cardiovascular researchers?

VO: Lots of scientists are interested in the role that lipids play in cardiovascular disease and normal health. But most people tend to research lipids we already know about, that have been discovered in the past, and whether they may become a useful therapy

or target for treatment of inflammatory diseases.

Thanks to advances in mass spectrometry, we've estimated that around half of the lipids in our cells remain unknown, so in our lab we are working to find out more about these new lipids – ones that people have never seen before. We mainly study immune cells that circulate in our bloodstream. These are the cells that fight infection and stop you bleeding, and they make lots of interesting lipids that have the potential to cause problems relating to cardiovascular disease. We've found over 100 new lipids made by blood cells called platelets, and many of them stimulate blood clotting, something you definitely don't want to happen in your bloodstream as it can be the major cause of a heart attack.

JO: Is understanding the immune system crucial to our understanding of heart disease?

VO: Definitely. Over the last 20 years there has been an enormous appreciation of the

fact that the immune system is a major player in causing cardiovascular disease. We also know that people with chronic immune/inflammatory disorders including dementia, diabetes and arthritis are at higher risk of getting heart disease, so the same people tend to get all these diseases. This means that our major inflammatory disorders are all caused by similar processes. We know that inflammation and over-active immune cells are a big part of this and that lipids are centrally involved.

There is still a huge amount we don't know about how immune cells actually cause heart disease, and the consequences of inflammation occurring in the wrong place at the wrong time. Our work is about understanding how signalling by lipids contributes to this.

It might seem to be a small part, but lipids do a lot. One good example of this is aspirin, and a tiny lipid called thromboxane. This is made by platelets in very small amounts and they use it to communicate and tell other platelets to stick together to form a clot.



Jo Oliver



Professor Valerie O'Donnell

British Heart Foundation's Jo Oliver and Professor Valerie O'Donnell in a Cardiff University laboratory

Aspirin prevents platelets from making this lipid which is why it is given to people at risk of heart attack. Aspirin is one of the most widely used drugs in the world and it works by preventing lipids from being made.

Of course, the problem is that aspirin can lead to increased bleeding because if you have no thromboxane it makes it harder for your blood to clot when it really needs to. People generally think about lipids and heart disease in the context of high cholesterol or high triglycerides, but it's so much more complicated than this.

JO: If BHF supporters asked why we're funding your research, what can you tell us about the advances you've made and the difference it's made so far?

VO: Our research is very much at the basic science end, so it takes many years to lead to potential benefits for patients. Understanding what these lipids do is only the beginning. We have to understand the biology of our vascular system before we can hope to develop new treatments for disease.

It isn't simply a case that eating too much fat causes heart disease. It's more about the lipids we make in our bodies and how they respond to infection, exercise, smoking, our genes and our lifestyle choices.

At this stage, we are working out what the new lipids we have discovered are doing during development of heart disease. On the other hand, some of our recent work being done with haematologists is aiming to develop new drugs that could promote blood clotting because too much bleeding is a major problem in trauma injury, surgery and inherited bleeding disorders.

Other lipids we have worked on with colleagues in the US are in clinical trials now for inflammatory disorders but still are a way off from becoming actual drugs available for patients. But this is the ultimate aim.

JO: You're now the co-director of the Systems Immunity Research Institute. How will the new research strategy of the Institute benefit your research area?

VO: The new approach we have taken in the Institute is around applying mathematics and computer sciences approaches to our research - something we increasingly need to do - because these days we generate a huge amount of data and it is a huge challenge to analyse and understand it. The new Institute is allowing us to showcase the work at Cardiff, and put us on the global stage of immunity research.

For my own research it's been amazing. We have joint projects with researchers in the School of Computer Sciences and Informatics who are helping to write software and automate our processes so we can handle the large amounts of data our mass spectrometers are generating. This is allowing us to discover more new lipids and is making it easier and quicker to work out which lipids are worth researching in more detailed studies. It's also allowing us to compare lipids in people with various genetic mutations associated with cardiovascular disease and dementia.

JO: What would you like to achieve in the next five years, with regards to your research?

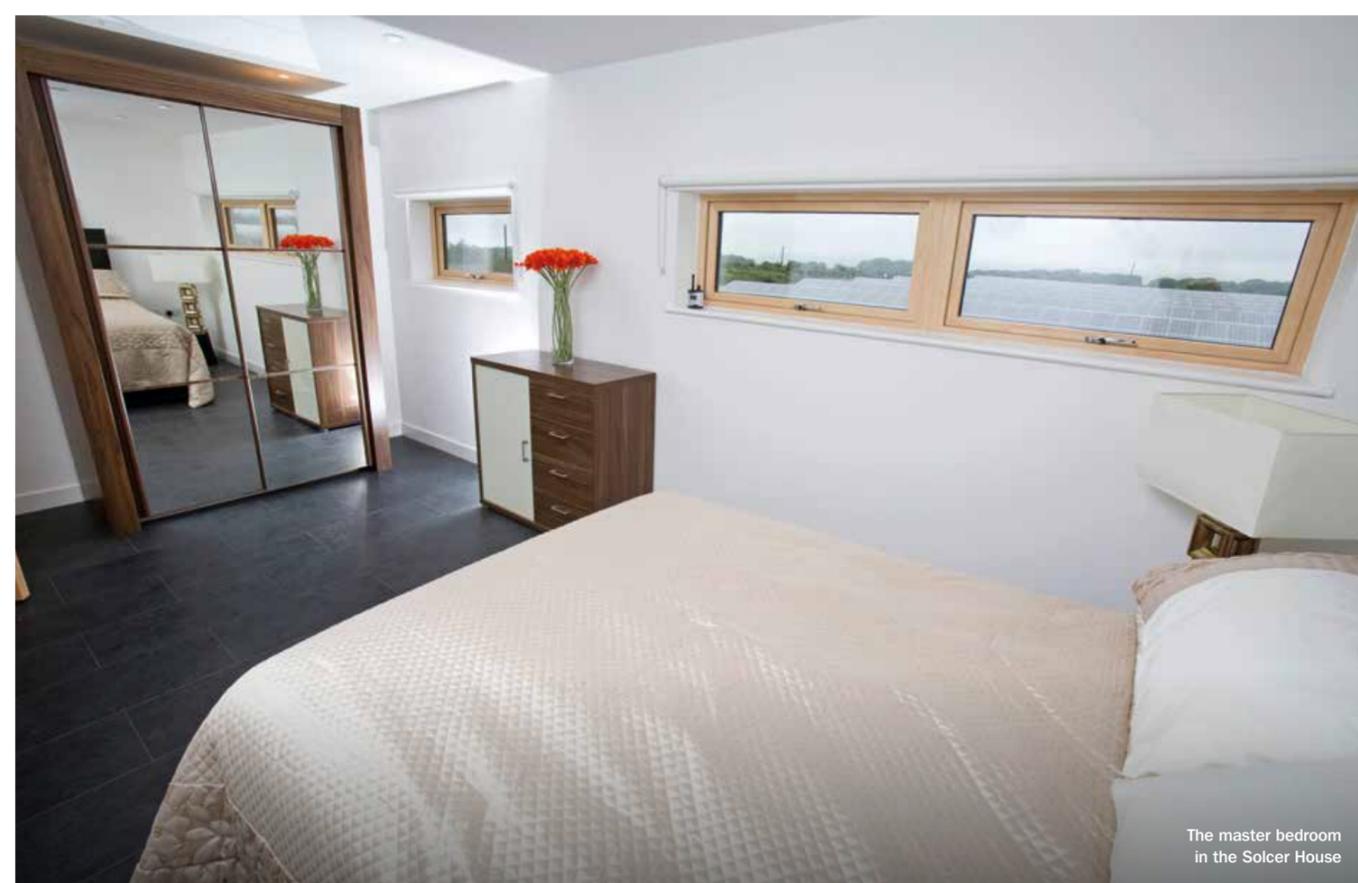
VO: We have an awful lot to do, including discovering more lipids, working out what they do and then translating them into new ways to diagnose or treat cardiovascular disease and other similar inflammatory disorders. We believe that a single cell type contains about 5,500 unique lipids of which about half are totally new. It's more than enough to keep us busy for many years to come. We work as an interdisciplinary team, including chemists, computer scientists, cell biologists and clinicians. It's down to the hard work of the entire group that we are managing to get this work done at all.

Homes for the future



"Solcer House demonstrated that zero carbon targets could be met in an innovative and affordable way."

Photography of the Solcer House courtesy of BASF



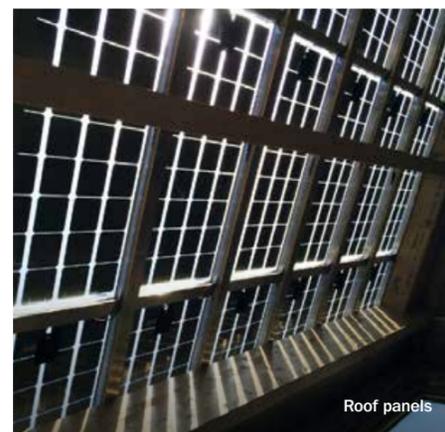
The master bedroom in the Solcer House



For every 1 kWh of energy the Solcer House takes from the national grid, it is able to generate and transfer 1.75 kWh of energy back into it.



Ester Coma Bassas outside the Solcer House



Roof panels



Steve Morgan OBE



Solcer House taken from rear aspect

To the dismay of many in the construction, property and renewable energy industries, the Chancellor George Osborne has scrapped plans to make all new UK homes carbon neutral by 2016.

Shortly after his announcement, a team led by Cardiff University's Welsh School of Architecture unveiled the UK's first carbon positive house, capable of exporting more electricity to the national grid than it uses.

Built in just 16 weeks at a cost well within the social housing budget, the three-bedroom 'Solcer House' demonstrated that zero carbon targets could be met in an innovative and affordable way, creating long-term benefits for both the economy and the environment.

As one of the UK's most successful house builders, Steve Morgan OBE, chairman and founder of Redrow plc, appreciates the vital role that innovation plays in providing affordable homes.

Steve is interested in the challenges associated with designing and building a carbon positive house, and curious as to how it can be rolled out more widely across the country.

He spoke to Ester Coma Bassas, the project architect of the Solcer House, to find out more.

SM: Where did the idea of building a carbon positive house come from?

ECB: The idea to build the house came about through the University's involvement with the Low Carbon Research Institute (LCRI) – a body that was set up in Wales in 2008 to link academic research with industry and

government, specifically in the development of low-carbon technologies.

The Welsh School of Architecture has been involved in a programme looking at the built environment, and how carbon dioxide emissions can be reduced through the development of individual building components and buildings themselves.

Up until recently, it was UK government policy to make all new homes carbon neutral by 2016, so it was a natural progression for us to bring together all of the latest technologies and demonstrate to builders that this target could be met at an affordable price.

SM: As you say, shortly before the house was unveiled, the UK government scrapped plans to make all new homes carbon neutral from 2016, stating that this couldn't be achieved cost-effectively. Has your project proved otherwise?

ECB: There are a number of ways of getting to this zero carbon target. Some feel that you can't achieve zero carbon housing with on-site energy generation alone and, therefore, at certain times of the year – specifically in the winter months – energy will need to be drawn in from the national grid.

Mass house builders in particular have been resisting the move to zero carbon housing, saying that the target is difficult to reach, costly to implement and brings risks in applying relatively unfamiliar technologies.

What we have shown is that over a whole year, it is quite feasible for a zero carbon building to achieve energy positive performance. For every 1kWh of energy the Solcer House takes from

the national grid, it is able to generate and transfer 1.75kWh of energy back into it.

We're still analysing the final cost of replicating the house, but we believe that a single house could be built at a cost of around £1,000 per square metre. If you were to build a number of these houses at the same time, the cost could be reduced by around 10 to 15%. The costs would then be well within the standard housing benchmark, which is currently £800 to £1,000 per square metre.

SM: What makes this project unique?

ECB: The house is unique in that it's not only energy positive over the entire year – exporting more energy to the grid than it takes away – but is also built using low-carbon materials from the local supply chain. For example, the cement used in the foundations was a special low-carbon variety developed by a local company in Bridgend, whilst the extremely efficient insulating panels were provided by a company in Llandovery.

Furthermore, the off-the-shelf technologies that are used to generate, store and transfer electricity are integrated together to form one complete flexible system rather than several different 'bolt-ons'. Nothing like this has been done before in the UK, and it really does position Wales as a trailblazer of low-carbon technology.

SM: What were some of the biggest challenges you faced when designing and building the house?

ECB: The biggest challenge was applying what we call the systems approach. To make the Solcer House as efficient and easy to use as

possible, we had to ensure that each of the technologies could essentially 'talk' to each other.

In the past, technology has often been 'bolted' onto buildings, which can make things over-complicated and unintelligible for the building user. A smart house should be simple to use.

In the Solcer House, the energy-generating solar panels were intrinsically linked to the energy-storing batteries, which were further linked to the heating, lighting, ventilation and small power systems. Furthermore, the technologies were integrated into the architecture of the house itself, so the solar panels became the actual roof of the house and the solar thermal air collector was the façade.

As an architect, this was challenging as I had to think like an engineer throughout the whole design process.

SM: How did you go about sourcing the low-carbon materials and technologies to build the house, and how did you manage to keep costs to a minimum?

ECB: One of our main aims when designing and building the house was to not only show that zero carbon targets could be met, but also to showcase the technologies that are currently being developed in Wales. Through our involvement with the LCRI, we were able to source most of the building components, as far as reasonably practical, from Welsh manufacturers and installers.

This was an enormous learning experience for everyone, as it was the first time that some of the local contractors had installed their

components. Many of them are now applying this experience to other buildings.

This did, however, have implications for me as an architect, because if you want to make the most of local suppliers you have to look at what technologies are out there first and adapt the design accordingly.

SM: If the aesthetics of the house are unacceptable, how can this be improved without compromising the carbon positive principles?

ECB: Beauty, or aestheticism, is a subjective value to me. Looking at the Solcer House it is quite obvious that we did not follow a traditional approach in which the architect uses a conventional design methodology focused mainly on the aesthetics and on a building's space and form. Instead, we have proposed a 'performance-driven' architectural design, that takes a holistic approach towards energy and thermal performances of buildings, while ensuring that the use and aesthetic of the design are not dismissed.

I believe that in the 21st century, with so many world-wide issues such as fuel poverty and global warming, the housing sector must have a much bigger responsibility. We want to convert UK households into power stations, and to me that is the real beauty.

SM: Now that you've successfully built a prototype, how will you go about encouraging house-builders like myself to take up this concept?

ECB: Our key task now is to ensure that all the technologies we've put in place are continually monitored to assess how the house is using

and generating energy. The house is currently home to a local business, which helps us monitor the continual use of energy.

When we finished building the house earlier this year, we held a launch event at the site which was attended by a range of stakeholders as well as the national media. This generated an extraordinary amount of exposure and subsequently led to a number of organisations and officials visiting the house to see how it could be replicated more widely. These stakeholders have included SMEs, councils, Welsh Government, building owners, landlords, national housing developers and, remarkably, the Vice Premier of China during her visit to the University.

We are continuing to engage with each of these stakeholders, informing them of how the house is performing and the projects that we have lined up for the future.

It is our vision to see this type of house built not only in Wales and the UK, but also all around the world.

SM: What are the next steps of the project?

ECB: We are now looking at how we can replicate this concept at scale, extending our work to larger housing projects and other building types.

Our next move at a building level will be to design and construct a row of interconnected carbon positive houses, with each house acting as an individual power station with the potential to share energy with other houses.



Researchers of the future

Jessica Antell, School of Social Sciences with her poster at the CUROP exhibition

Cardiff University is ranked fifth in the UK for the quality of its research and second nationally for the impact of its research.

It recognises that to maintain this excellence, encouraging and investing in researchers of the future needs to start at an early stage. In 2008 it established Cardiff University Research Opportunities Programme (known as CUROP), giving undergraduates from across the University valuable research experience and a chance to be involved with the University's contribution to the grand challenges of our time.

The programme provides paid summer placements of up to eight weeks for undergraduates. Students are supervised on staff-defined research projects. This year, projects reflected the diverse range of research undertaken at Cardiff, from tackling rural poverty to helping with the development of a medical tool for the diagnosis of obstructive sleep apnoea.

Professor Patricia Price, Pro-Vice Chancellor, Student Experience & Academic Standards, is responsible for Cardiff University's programmes of study, academic standards and quality of the student experience. She explained: "The opportunity to work on a live research project brings a real sense of achievement and allows our undergraduates to make a highly valued contribution to real

world problems. The fact that 43% of CUROP participants progress to postgraduate study at Cardiff, with a further 35% taking up postgraduate study elsewhere, demonstrates the importance of the scheme in helping our undergraduates to decide if research is the right next step for them. I am delighted to report that in April 2015, University Executive

Board agreed to expand the CUROP scheme over the next five years in recognition of its fantastic success and the important benefits it brings to both students and staff."

One of the most recent CUROP success stories is Perry Smith. The third-year student is currently working in the University labs on placement, having completed his CUROP



L to R: Toby Mott and Elliot Hayes students in School of Journalism, Media and Cultural Studies

project in the School of Biosciences this summer. Perry said: "My CUROP project focused on using mathematical modelling to analyse academic performance. Although it initially looked at how Access students performed, my ideas quickly evolved into new ventures I started working on independently. I'm now writing a paper on what I found, which I hope to publish in the future."

As a Molecular Biologist, I found that this project gave me the opportunity to work in a completely different field, and gain skills such as statistics that will help me as I continue my degree. It's also a different way of earning money over the summer, and of course something productive to put on my CV - which resonates with the majority of students!"

Offering another perspective is Sara MacBride-Stewart. The Sociology lecturer has extensive experience as a mentor for such students, "The CUROP scheme is a wonderful opportunity to assist a student to develop research skills, such as literature reviews, interviewing, qualitative data analysis and report writing, in a work environment. I have seen students develop in confidence, using their academic skills to contribute to a project that is often a pilot for seeking further funding or as a publication. The students certainly help me maximise my summer research activities. The showcase event at the end of summer is a reflection of the diverse activities, disciplines and students that CUROP has supported over the years", she said.



Nathan Roberts is Head of Education Support at Cardiff University, and responsible for CUROP, both creating and managing the project. He summarises the advantages that CUROP so widely provides:

"From its inception in 2008, the CUROP programme has aimed to deliver unique research placements for undergraduate students. Now one of the largest schemes in the UK, and set to grow even further, it has become a distinct part of the Cardiff experience. Each year, over 100 undergraduate students work in laboratories and archives, in schools and the community, working through the summer alongside leading academic researchers on innovative and challenging projects.

When researchers across the University submit proposals for potential projects to the academic panel that allocates the stipends, the overriding concern is that projects should give students

the opportunity to make genuine and meaningful contributions to research. The aim is to ensure that students experience research in as 'real' a way as possible - with all its trials and tribulations as well as its rewards and successes. Some will find themselves really switched on to a research career and there is a well-worn path from CUROP to postgraduate study. Others may decide that research is not for them - that's a useful outcome in itself, as it allows students to make an important decision based on genuine evidence. In both cases, over 98% of participants report satisfaction with the scheme and would recommend it to their peers.

Students find that CUROP projects help develop their academic skills and self-assurance in ways that stand them in great stead for their futures, whether in education or the world of work. For them, it's a really engaging and proactive way to spend their summer. What has exceeded our expectations too are the benefits the scheme has brought to academic staff. As well as the obvious extra pair of hands for their research, it has allowed staff to explore new avenues; work collaboratively across disciplines in experimental pilot projects; develop their own experience of supervision and proposal writing; and improve teaching materials and approaches that benefit whole cohorts of students on their courses."

Mapping Cardiff's creativity

The Creative Cardiff project based in the College of Arts, Humanities and Social Sciences, aims to motivate and support working relationships as they develop across the city's creative outlets and hopes to build the first city network for creative practitioners.

It hosted two CUROP placements this summer, with the goal of mapping Cardiff's creativity, incorporating a mix of individuals and organisations. Many stakeholders expressed a keen interest in involvement, including the Arts Council of Wales and Cardiff City Council.

Toby Mott and Elliot Hayes, second-year students in the School of Journalism, Media and Cultural Studies were the placement recipients. They worked alongside the Director of Creative Economy, Sara Pepper and Alice Taylor, Project Officer. They interviewed and liaised with a range of contacts, from

Cardiff's vibrant and burgeoning creative sector. Their work was further overseen by Professor Justin Lewis and Professor Ian Hargreaves.

Sara Pepper commented: "Our experience of working with two CUROP students was equally interesting and rewarding on a number of levels. The students contributed a significant amount to the research project that we were undertaking - not only in terms of work input, but also in new ideas, suggestions and different ways of thinking about the research that we were doing and the people we were engaging with. They took on every task that was



in the original brief and also rose to the challenge of doing additional work that came about as the project developed, e.g. running additional events and making videos to capture what happened that could be shared with the participants online. We were very impressed with the way the students engaged with everyone that they came into contact with and the maturity they brought to their work."



Keeping the streets safer

Kaelon Lloyd started his CUROP project at the end of the second year of his computer science with visual computing degree, it has now evolved into a million pound project involving the University, industry and Welsh Government.

Having enjoyed the independent research aspect of his second year group project, Kaelon was keen to do more. When Professor Dave Marshall told him about the CUROP opportunities coming up that summer, Kaelon didn't hesitate to apply.

The project involved looking at CCTV footage from South Wales Police and the goal was

to see whether it could be used to predict where violence could occur. Was it possible that computers could determine violent and nonviolent scenes?

Kaelon said: "I really enjoyed my CUROP project. In the lab we had international exchange students, PhD students, research associates and CUROP students. It was a

nice hive of activity. If you want to go on to postgraduate study, it's a good way of finding out if you're cut out for research."

CUROP helped Kaelon to decide that he was cut out for research. He found that the eight week project wasn't enough, so he decided to continue with the work for his undergraduate dissertation. He was then

awarded a scholarship from the School to undertake a PhD, and is now working on a million pound project, a partnership between the University, Airbus and the Welsh Government, (and supported by the Association of Chief Police Officers) which is developing software to help CCTV cameras to interpret what they see and predict when and where violence will erupt. The project is designed to help the police and councils to keep our streets safe.

Professor Dave Marshall who supervised the CUROP project and is now Kaelon's PhD supervisor underlined the value of CUROP to the University: "It's important that we support students and give them a taste of what

research is like. You need to commit a lot of effort to it, but you get bright people working hard and producing really good work that makes a contribution to the research.

It's also a good way of identifying potential PhD students. In our School, over the last two to three years we've had five out of our ten CUROP students go on to do PhDs."

More information on the CUROP project can be found on our website www.cardiff.ac.uk/research/news/challenge-cardiff

"I really enjoyed my CUROP project. In the lab we had international exchange students, PhD students, Research Associates and CUROP students. It was a nice hive of activity. If you want to go on to postgraduate study, it's a good way of finding out if you're cut out for research."

Kaelon Lloyd



What made me curious?

Peter Vaughan QPM, Chief Constable for South Wales Police questions Professor Martin Innes, Director of the Crime and Security Research Institute, about what sparked his interest in criminology and policing.



I went and interviewed some kids engaged in low level crimes. They weren't talking about that, they were talking about the buzz and the excitement. I thought it was really interesting. It was enough to make me want to continue.

PV: You did your first degree. What next?

MI: I did a criminology masters at LSE. My dissertation was supervised by Robert Reiner, and he asked what I was going to do? I went back and talked to my Dad. He was working in the murder squad at the time and he said why don't you come and see what we do?

I went back and said can I do something on murder squads? At that time nobody had ever really got into that world, I was able to get in there and talk to people. Rob Reiner said to me if you can do this again you ought to do a PhD. So I did.

My PhD was explicitly on police murder squads. Nothing had ever been done on this. At LSE at the time we had Paul Rock, David Downes, Robert Reiner and Stan Cohen. Four huge names in criminology and it was a remarkable atmosphere. In the first three weeks of doing my PhD, all the new students had to stand up and present in front of their peers and those academics. There was I thinking I was doing something no one else had done, feeling really good about myself, and after my presentation they completely took me apart. Not in a nasty way but in a very methodical, rigorous and scholarly way. It was really important learning for me.

I always say to my PhD students that was probably the most important experience for me academically, because I thought 'I'm never going to let that happen to me again'.

PV: What challenges have you faced and how have you learnt from those?

MI: Almost all of the big research projects we've been involved in from murder investigations, through to neighbourhood policing to the counter terrorism work I'm doing at the moment, we've always got pushback.

When we're really good as researchers we're two to three years ahead of the game. One of the things I've learned is just because you have resistance at the moment doesn't mean you're wrong. If you've done good research, been rigorous and independent, not been swayed by other people's agendas and your evidence is good, stick to it because you probably are right and things will come around.

PV: What are the aims of the Crime and Security Research Institute?

MI: The purpose is to broaden the research we do. Crime and security is a global challenge and we need new approaches. We need to be genuinely interdisciplinary and collaborative.

There is a model of science where you do basic science and try and apply it to the real world. What we're trying to do is change that round and start with the real world. Do lots of applied research and from that we can distil out the fundamentals and the key principles.

I've worked for the past five years with colleagues who are from very different backgrounds and disciplines and it's a great way to work. We're trying to enable other people to do that and by working together we can tackle the challenges that are out there.

PV: You mentioned some names that resonated with me and you're amongst them now. How did you get there?

MI: I've been very lucky. I came across some really interesting problems at the right time. I've never really had much of a plan, but when I do decide to work on an area or problem, I know I'm going to work on it for an extended period of time to take it apart and really understand it.

The other element is protecting your independence and not being swayed by political agendas and currents of thoughts that are out there. Working with South Wales Police that's quite important. I've always said to my team if you think something's wrong say it is, if you think something's good, say it's good. That way, people can have a degree of confidence in us because if we say you're doing well then you probably are. Equally if we say that something needs looking at, we're not doing it to get attention or a media story. It's because we think there's something here that could be done better.

PV: What about the future?

MI: We've had a work stream for the past few years on counter terrorism and I'd like to keep working on that for the next five years.

It goes back to almost where we started in this interview, some of things the police have to deal with are really difficult, and there's not always a right answer or a clear solution. Sometimes all we can hope to do is to help produce an evidence base and a degree of understanding and insight that means perhaps things aren't as bad as they could have been if you didn't have that available. That's what I'm hoping for the future.



Professor Martin Innes

PV: Tell me a bit about your background and where you grew up?

MI: I grew up in Chichester on the south coast of England. My Dad was a cop and that's how I guess I got interested in policing. I never had any plans to be an academic and certainly not to do anything on the police, I just kind of drifted into it and have kept going.

PV: You watched your Dad coming back and forth from work and something flickered your interest?

MI: I think so. When you're around cops a lot you realise they are ordinary people who sometimes have to do extraordinary things. I think that's really important. Growing up in a police family you also saw what people bring home. It doesn't always stop when you come

home and take the uniform off. Appreciating that was really important.

PV: Did that have an impact on you, how did that affect you at school?

MI: In my secondary school there were only one or two of us from police families. You get the things like "don't talk to him, his Dad's a cop, it will get back to him." I didn't mind that. You find your own way. I was never the best student at school, I preferred to play rugby and football. I played for the county. That was my thing.

PV: What did you do after school?

MI: A-Levels were a difficult time for me and I didn't do very well. I had to make a decision; did I go back and do it again and do it better, (which is what I decided to do)

or did I just coast? That was an important moment for me.

I did well enough to get in to university. I got to the third year and did a module in criminology led by Professor Frances Heidensohn at Goldsmiths. She was great. That's where the switch flicked on and the two worlds came together.

The other thing that happened of course was the style of learning changed. As soon as it became about my project and something I was interested in, rather than just reading stuff in books, that really made a difference.

PV: Can you remember what the project was?

MI: I did something on motivations for youth crime. At the time there was a lot of stuff around rational opportunity frameworks.

Cardiff Catalysis Institute

Catalysis, part of the chemical sector, is an immensely important part of the overall UK economy. In recent years, UK output related to catalysis has totalled over £50bn and is ranked seventh in the world, despite competition from developing nations.



L to R: Rt Hon Stephen Crabb MP, Secretary of State for Wales, Baroness Randerson of Roath Park, Dr Ewa Nowicka and Professor Colin Riordan at the University Research Institutes' Event at the Houses of Parliament. Dr Nowicka spoke at the event about her work at Cardiff Catalysis Institute.



L to R: Minister for Universities and Science, Jo Johnson MP, Professor Colin Riordan, Alun Cairns MP, Parliamentary Under-Secretary of State for Wales hear from Catherine Davies (postdoctoral research associate) about the work of the Cardiff Catalysis Institute.



Members of Cardiff Catalysis Institute with Professor Nora de Leeuw (Pro Vice-Chancellor International and Europe) and Professor Karen Holford (Pro Vice-Chancellor College of Physical Sciences and Engineering) at the University Research Institutes' Event at the Houses of Parliament.

Catalysis enables chemical reactions to go faster, with better selectivity and at a lower energy cost resulting in cleaner, more economical and more sustainable processes. These attributes put catalysis at the heart of most industrial and biological processes.

Cardiff Catalysis Institute was founded in 2008 with three main aims:

- To improve the understanding of catalysis
- To work with industry to develop new catalytic processes

- To promote the use of catalysis as a sustainable 21st century technology

Led by Professor Graham Hutchings FRS, it is the premier academic catalysis facility in the UK, and one of the top five in the world.

Home to 70 researchers, the Research Institute has generated grant income totalling more than £23m since its establishment and continues to build an international reputation, winning major international prizes and awards.

Over 3,200 UK companies are involved in catalysis, with SMEs playing a substantial role. The sector produces a £5.5bn positive trade balance, and over 80% of its output is exported. In addition, the sector earns around £1bn in royalty income by exploiting its knowledge base internationally.

As well as playing an important part in the economy, catalysis is also an essential element in the radical solutions required to meet societal needs such as adequate worldwide food provision, clean energy and clean water.

Key projects

The Research Institute has innovative research programmes that focus on the provision of clean water and air, as well as designing new approaches to using renewable energy and feed stocks to ensure future sustainability.

Gold catalysis

The Research Institute is leading the way in how gold is used in heterogeneous catalysis, and investigating how the interaction between gold and other precious and transition metals can be controlled. Professor Hutchings, is one of the world's pre-eminent authorities on heterogeneous catalysis, pioneering the innovative catalytic use of gold nanoparticles. This newly identified catalyst has the potential to save lives, improve health and clean up the environment.

Reducing water consumption

Most of the water used in homes is discharged as greywater from showers, sinks and washing machines. If treated to remove contaminants and bacteria it could be reused for some applications that currently use drinking water. This project aims to engineer and develop a novel water disinfection system that enables around 40% of water from the average household to be recycled and reused, instead of discharging it to sewers.

The Research Institute is developing catalysts to generate hydrogen peroxide to disinfect the greywater, an engineering company is investigating the design of the greywater system, and building companies are looking at how we can implement this technology into homes and businesses in conjunction with utility companies.

Vehicle emission control

With the introduction of ever more stringent emission controls and the diversification of transport fuels, such as bioderived fuels, the demands on improving vehicle catalysis performance are continually increasing. Through collaboration with Jaguar Land Rover, Scania, Toyota and General Motors, the Research Institute has worked on several projects, including reducing emissions of soot particles, developing catalysts more efficient on *cold start* and investigating catalyst components as alternatives to precious metals.

Transforming waste into fuel

Biofuels can be greenhouse neutral if efficient methods for their production are developed. Within the NOVACAM project, the Research Institute is developing the fundamental catalytic reactions required for the processing of biomass into useful chemicals and fuels. The processing of biomass, such as cellulose, involves significantly different chemistry to that applied to traditional fossil-based carbon sources; notably the oxygen content must be reduced while retaining carbon and hydrogen if these resources are to be upgraded.

Catalytic Routes to Intermediates for Sustainable Processes (CRISP)

CRISP is an Engineering and Physical Sciences Research Council (EPSRC) funded project in collaboration with the University of Liverpool, Aston University and Imperial College London, which seeks to identify and develop new heterogeneous catalysts for the conversion of plant waste into useful chemicals. Specific targets are the sustainable production of key chemicals which are used to make a wide range of polymers. The project aims to replace the currently used starting materials derived from crude oil with the plant waste. To achieve this, new heterogeneous catalysts and new reaction pathways need to be identified.

Photocatalysis

Professor Phil Davies, has put together a cross-disciplinary team of scientists and engineers from teams based in Britain, Germany, Spain, Turkey, Vietnam, Malaysia and Thailand. They have secured approximately €3.9m of EU funding to develop a cost effective and sustainable, solar powered method for treating organic pollutants that biological methods cannot currently remove from the waste water produced in agricultural industries.

Key collaborations

Professor Graham Hutchings FRS, is working with Professor Robert Schlögl of the Fritz Haber Institute of the Max Planck Society. Their teams of researchers are developing a new programme of catalysis research as part of the Society's Maxnet Energy Network.

Cardiff Catalysis Institute leads a consortium consisting of Cardiff, Bath and Bristol universities that hosts an EPSRC funded Centre for Doctoral Training (CDT) in Catalysis. The CDT is providing PhD places for a minimum of 12 students a year between 2014 and 2019.

Productive working relationships with a wide range of UK and international businesses, including research projects with ExxonMobil, Jaguar Land Rover, Johnson Matthey, Invista, Solvay, Henkel, Sabic, Sasol, Molecular Products, BASF and Haldor Topsoe, Selden.

Collaborating with many leading universities including Tokyo Metropolitan in Japan, Victoria in New Zealand, Witwatersrand in South Africa, Alicante, Bilbao, Valencia and Zaragoza in Spain, Louisiana and Lehigh in the USA.

Working with an international committee, the Research Institute hosted the 7th International Gold Conference (Gold 2015) at Cardiff City Hall in July, which allowed experts and industry specialists to discuss the growing field of applications for gold as a catalyst in a range of chemical reactions.



Professor Graham Hutchings: "Catalysis is crucially important for everyday life and one aim of the Cardiff Catalysis Institute is to discover new catalysts that will be of immense benefit to society".

Hadyn Ellis Building - a hub for major research into cancer biology and mental health conditions.

To find out more about the impact of our research go to
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