A new wave of astronomy

Lord Martin Rees, Astronomer Royal, discusses Cardiff’s role in one of the greatest scientific discoveries of the decade

Social Work
How research into social work practice is helping to improve the lives of children and their families

Dementia
It’s not just about the dementia
Improving general hospital care for dementia patients
Earlier this year, perhaps one of the greatest scientific breakthroughs of this century was announced in Washington. The detection of the first gravitational wave, involving 1000 scientists from 15 countries, and I am very proud that this included our Gravitational Physics Group, based in the School of Physics & Astronomy. The group is led by Professor B.S. Sathyaprakash who in this edition speaks to Astronomer Royal Lord Martin Rees, about Cardiff’s role in discovering the first gravitational wave.

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Scientists have demonstrated a method for generating several key types of eye tissue from human stem cells in a way that mirrors whole eye development.

When transplanted to an animal model of corneal blindness, these tissues are shown to repair the front of the eye and restore lost or damaged vision. A collaborative team comprising researchers from Cardiff and Osaka University in Japan described their findings in Nature.

Previous studies demonstrated that particular cell types, such as those that constitute the retina or cornea, can be created in the laboratory from pluripotent stem cells. However, these studies do not represent the complexity of whole eye development. These latest experiments report the generation of multiple cell lineages of the eye, including the lens, cornea, and conjunctiva, using human induced pluripotent stem cells.

The scientists have been able to show that the corneal epithelial cells can be cultured and transplanted onto the eyes of rabbits with experimentally induced blindness to surgically repair the front of the eye.

Study co-author, Professor Andrew Quinlan from the School of Optometry and Vision Sciences, said: “This research shows that various types of human stem cells are able to take on the characteristics of the cornea, lens and retina.

Importantly, it demonstrates that one cell type - the corneal epithelium - could be further grown in the lab and then transplanted on to a rabbit’s eye where it was functional, achieving recovered vision.

“Our work not only holds potential for developing cells for treatment of other areas of the eye, but could set the stage for future human clinical trials of anterior eye transplantation to restore lost or damaged vision.

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Around 4,000 corneal grafts are performed by the NHS annually, which rely on human organ donation.

Cardiff University’s world-leading mental health research facility has been awarded the UK’s most prestigious academic award - the Queen’s Anniversary Prize.

On behalf of the University’s MRC Centre for Neuropsychiatric Genetics and Genomics, Professor Sir Michael Owen was presented with the award at a ceremony in Buckingham Palace. The prize is awarded every two years by the Queen in recognition of an academic or vocational institution, and falls within the UK’s national honours system.

Professor Owen said: “I am extremely proud of all the staff in the Centre for winning this award. It is a reflection of the amazing achievements made possible by an excellent team of scientific, technical and administrative staff which sits at the forefront of mental health research.

“Therapists have succeeded in casting light into some of the darkest corners of mental illness and place us in strong position to make further advances that will lead to substantial benefit to patients.

“Over the next five to ten years, the focus of the Centre will be to put our genetic discoveries to work to better understand disease mechanisms, develop improved diagnostic approaches and treatments; and become a leading centre of translational neuroscience.

“Centre scientists are also increasingly applying genetic findings in epidemiological settings in order to study the impact of genes at a population level, improve prediction and diagnoses, and understand how environmental and social factors interact with genetic predisposition to cause mental illness.

“I am very grateful to the MRC for their sustained support for our research over many years, and to Health and Care Research Wales as well as many other funders. I am also immensely grateful to Cardiff University for backing us so strongly and for nominating us for this award.”

Among the Centre’s landmark discoveries are the identification of a genetic link between intellectual disability, autism, Attention Deficit Hyperactivity Disorder (ADHD) and schizophrenia; the discovery of the first specific genetic risk factors for schizophrenia, bipolar disorder and ADHD; and the discovery of the first new Alzheimer’s disease risk genes for over 17 years. As well as their fundamental genetic discoveries, the work of Centre researchers has directly influenced policy and practice.

Since 2000, the University has won six Queen’s Anniversary Prizes for research ranging from geo-environmental engineering and violence prevention to medical genetics and clinical diagnosis.
A quick, cheap and highly efficient method for producing a water-purifying chemical has been developed by researchers at Cardiff University.

The team, from Cardiff Catalysis Institute, Lehigh University and the Department of Energy’s Oak Ridge National Laboratory, have developed a new catalyst that can produce hydrogen peroxide (H₂O₂) on-demand in a quick, one-step process, opening up the possibility of manufacturing the chemical in some of the poorest, remote and disaster-stricken areas of the world. Their results have been published in the journal Science.

“Using our new catalyst, we’ve created a method of efficiently producing H₂O₂ on-demand in a quick, one-step process,” said co-author of the study, Dr Simon Freakley from Cardiff Catalysis Institute. “Being able to produce H₂O₂ directly opens up a whole host of possibilities, most notably in the field of water purification where it would be indispensable to be able to produce the chemical on-site where safe and clean drinking water is at a premium.”

Current uses of H₂O₂ include paper bleaching, disinfecting and water treatment and in the chemical synthesis industry.

Though centralised systems adequately supply clean water to billions of households around the world, many people still do not have access to these large-scale water supplies. For them, the team’s method of producing H₂O₂ on-demand could be a simple one-step protocol.

Over four million tonnes of H₂O₂ are produced by industry each year, predominantly through a large, multi-step process, which requires highly concentrated solutions of H₂O₂ to be transported before dilution at the point of use. Current uses of H₂O₂ include paper bleaching, disinfecting and water treatment and in the chemical synthesis industry.

Now the team has shown that gold can be replaced with five different readily available metals, including tin, zinc and cobalt, to form a much cheaper and more efficient group of catalysts for this specific reaction.

“Using our new catalyst, we’ve created a method of efficiently producing H₂O₂ on-demand in a quick, one-step process.”

Dr Simon Freakley

Cardiff-led £24m project to meet energy challenges of the future

Cardiff University will lead a £24m project aimed at developing more intelligent ways of managing future energy systems.

The FLEXIS project, which also includes Swansea University and the University of South Wales, will set out to meet the diverse, complex and inter-dependent challenges that arise when new sources of energy are integrated into the grid by suppliers.

The challenges include: accommodating power supply from multiple, somewhat random, places; storing energy when it is not needed; coping with extreme flows of energy into the system; accommodating an ageing infrastructure; and making sure all challenges are met in a socially acceptable, affordable way.

As part of the project a demonstration site will be established to act as a test bed for new ideas and to show new technology and solutions being developed. Leading researchers from the UK and Europe will be recruited to Welsh universities as part of the project, helping to strengthen Wales’ position as a leader in research and innovation within the energy industry.

Former Finance and Government Business Minister Jane Hutt AM, Professor Colin Riordan, Vice-Chancellor, Professor Hywel Thomas, Pro-Vice-Chancellor for Research, Innovation and Engagement, with the project’s Principal Investigators

British media coverage of 'migrant crisis' among the most aggressive in EU

Significant differences in the way media organisations in different EU countries reported the migrant crisis in 2014 and early 2015 have been identified in new research by Cardiff University. The report, by a team from the School of Journalism, Media and Cultural Studies, examined 2000 news stories across five different European countries: Spain, Italy, Germany, Sweden and Britain.

The research identified striking differences in patterns of source access, terminology (‘migrant’, ‘refugee’ and ‘illegal’), news angles, as well as the explanations and proposed solutions to the crisis.

Domestic politicians, who were found to be the most accessed source category in news accounts, were most prominent in Sweden, followed by Germany, Italy, Britain and Spain. In all countries in the sample, except Germany and Spain, the main opposition to government policy came from the anti-immigrant right.

Media also differed widely in terms of the predominant themes to their coverage.

Humanitarian themes were most common in Italian press coverage (50.6% of articles) and rarest in the right of centre British tabloids (Daily Mail 13.2%, Sun 7.6%, EU average 41.8%).

In contrast, the British right-wing press was found to feature accounts which stressed the threat that refugees and migrants posed to domestic welfare and health systems at a much higher level than the other countries in the sample (Daily Telegraph 15.8%, Daily Mail 41.9%, Sun 26.2%, EU average 8.9%).

British television news reporting, which often focused on the plight of refugees and migrants at Calais or on the Mediterranean, was found to feature some of the most empathetic coverage in the sample. However broadcast reports tended to frame the crisis as a problem of ‘illegal migration’ or ‘illegal immigration’ rather than one which partly involved the resettlement of refugees. This meant when discussing potential responses to the crisis, BBC and ITV reports focused on discussing the need to strengthen UK or EU borders.

The research was funded by the United Nations High Commission for Refugees (UNHCR).
It’s not just about the dementia

At least one in four acute hospital beds is now occupied by someone diagnosed with dementia and thousands more are admitted into hospital with undiagnosed dementia or some form of cognitive impairment.

These people are often admitted to general surgical wards with conditions unrelated to their dementia, and where often the staff are not trained to deal with such patients.

Dr Katie Featherstone, a medical sociologist based in the School of Healthcare Sciences, has been awarded £447,000 by the NHS National Institute for Health Research to conduct research into dementia care in hospitals. She is focusing particularly on the behavioural aspects of people with dementia when they are in an hospital.

Dr Featherstone has taken an ethnographic approach to her research and Jackie wanted to match the questions. What are people doing and why? I observe them in their everyday settings. What are the everyday routines and rituals and the mundane work.

KF: When someone with dementia is in hospital they often have something else wrong with them, they may have fractured their hip, they may have a chest infection or pneumonia. The behavioural aspects of dementia can really be exacerbated by being in a different and unusual environment and they can go downhill rapidly in that setting.

A lot of people with dementia die in hospital or have very extended lengths of stay. I’m a medical sociologist, I’m interested in how medicine works, classification of medicine, diagnosis, and family experiences as well. My previous work looked at genetics and genetic conditions. I was looking for a new challenge and had read about growing rates of dementia and that it was rising on the public and policy agenda.

JF: How do you think your research is going to help?

KF: When I went to quite a few meetings to decide what research we could do and what struck me was that everyone was asking for an intervention. Although I could see the urgency, there isn’t the evidence base yet to inform those sorts of interventions. I think we’ve both got a vision of what needs to happen but we need to take certain steps before we get there.

What are the challenges being faced by hospital staff, what are the experiences of people in wards, what’s the experience of people in hospital with dementia? What’s the experience of their carers? Until we understand what’s happening now, we can’t move on to the next phase of developing interventions and changing things. We need the fundamentals first.

JF: I would agree with you there. What did you do next?

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Dr Katie Featherstone

“Dementia can really overshadow the person and everything else and that becomes a barrier to care.”

Sir Isaac Newton famously said, “If I have seen further, it is by standing on the shoulder of giants.”

These poignant words were in reference to the collaborative effort that underpins scientific endeavour, so it was therefore fitting that on Monday 14 September 2015 a collaboration of over 1000 scientists from 15 different countries finally added the missing piece of the jigsaw to our current understanding of gravity – a theory that Newton initially proposed. At 9:51am GMT on that Monday morning, the LIGO (Laser Interferometer Gravitational-wave Observatory) Scientific Collaboration detected a gravitational wave for the very first time.

The implications were profound. Not only did the detection confirm a key prediction made by Albert Einstein – another pioneer of gravitational physics – exactly 100 years ago, but kick-started a brand new era of astronomy.

Described as tiny ripples in space-time, that are emitted as a result of violent cosmic events in the Universe, gravitational waves are the final confirmation of Einstein’s spectacular theory of general relativity and will allow scientists to observe stars, galaxies and the Universe’s most exotic objects in ways that have never been possible before. The detection would not have been possible without the key contribution of scientists working at Cardiff University’s School of Physics & Astronomy, whose knowledge and expertise enabled scientists to pick out the signal from a cacophony of background noise and decipher where in the Universe, as well as the precise time, the gravitational waves were emitted.

Since the LIGO Scientific Collaboration formed over 15 years ago, Cardiff University’s

are feeding these into hospitals straightaway. We’ve had a good response. They recognise they need help, an evidence base and direction. They are incredibly keen to take this on at ward level and at hospital and trust level too. I found that a great thing.

Those general surgical wards need the training and the support so that they can eventually know what good care for someone with dementia looks like. Dementia can really overshadow the person and everything else and that becomes a barrier to care.

JA: It doesn’t need millions of pounds just a change in attitude, and training.

KF: It’s those small targeted interventions I’m aiming for. By doing them in our early sites and testing and refining them, we can find out what works and why. Also by talking to the population we’re doing it for, to the carers’ networks and groups.

JA: You’ve come to our group and we don’t hold back.

KF: It’s both invigorating and terrifying going to meet the groups of carers.

JA: We will give you a grilling.

KF: I’m doing it for you. It’s got to be something you feel is worthwhile.

JA: Anyone who does anything to improve dementia awareness and treatment care in hospitals, it’s going to be more than worthwhile. We all feel the same. Have you got other projects in mind for the future?

KF: I’m already working on the next one, continence and incontinence issues for people with dementia in hospital. I always come to you guys first and say could this be a project. Until you say it’s got merit it’s not going forward.

JA: They said my husband was incontinent. He wasn’t totally continent, but being in hospital they didn’t have enough staff to take him to and from toilet or anyone on hand to see him try and get up to go to the toilet. People with dementia can’t always remember to ring for the nurse. Which is pretty vital.

KF: It struck me as such a fundamental issue. So much mundane work, taking people to the toilet, catheterisation but people were not talking about it. If someone gets catheterised for far too long that’s when they can get infections and die. It’s not just a dignity issue but it’s also a fundamental issue around survival and mortality.

JA: We have to change the lot of people with dementia.

KF: There’s lots to be done it’s just chipping away and we can get there.


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Professor B.S. Sathyaprakash, who is part of the Gravitational Physics Group (see page 13), has been studying sources of gravitational waves and developing ways to detect them.

The detection made by Professor Sathyaprakash and the rest of the collaboration has been hailed as one of the greatest scientific discoveries of the decade, a statement that has been echoed by Astronomer Royal Lord Martin Rees.

Lord Rees is one of the world’s leading astrophysicists as well as a senior figure in UK science, and knows too well the significance of this landmark discovery. He has conducted influential theoretical work on subjects as diverse as black hole formation and extragalactic radio sources, and was one of the first to predict the uneven distribution of matter in the Universe.

Lord Rees (LR) speaks to Professor Sathyaprakash (BS) about the history of gravitational waves, the efforts to detect them, and the implications for the field of astronomy now that they’ve finally been found.

LR: For me, Albert Einstein’s theory of general relativity, which he put forward in 1915, is one of the most remarkable intellectual achievements in scientific history – a triumph of pure thought and insight.

Einstein’s theory told us how space and time are intrinsically linked, and that space tells the story of pure thought and insight. Achievements in scientific history – a triumph of pure thought and insight.

Our specialty here at the University is developing algorithms to search for gravitational wave signals buried in the noisy data that is collected by the detectors. Without the aid of such an algorithm, it would have been impossible to carry out the search in a timely manner. Algorithms formed the basis of the discovery.

Furthermore, we also study the dynamics of two circling black holes, known as a binary system, and the shape of the gravitational waves they emit. These models have helped us measure the properties of the black hole binary system that LIGO has observed.

LR: Astronomers have long realised that if we were to detect gravitational waves it would have to involve much stronger gravity than in ordinary stars and planets. The strongest predicted events are those caused by neutron stars, supernovae and two black holes crashing together. As experts in the modelling of binary black holes, it must have been very exciting for your group to get the first signal from such an event?

BS: Indeed, it was very exciting for us. In 2002 we published a paper with some colleagues that predicted that the first sources we would detect would be from binary black holes and there was a very good reason for us to believe so. However, for a number of years now we thought that the first sources we would detect would be two neutron stars merging together. In fact, from the late nineties until a few years ago, binary black holes were thought to be uninteresting for LIGO. It was therefore very surprising to some that the very first sources we detected were binary black holes.

LR: Up until now, there has never been any firm evidence that gravitational waves exist. The problem is that their detection requires an amazingly sensitive instruments to detect the extremely small jitters in space-time as a wave passes. The Earth’s two LIGO detectors, one in Washington State and the other in Louisiana, consist of intense laser beams that are projected in different directions by 4-km-long pipes and reflected by mirrors at each end. By analysing these beams of light, it is possible to detect gravitational waves by observing very small changes in the distance stretching and compressing of space and detected a gravitational wave for the very first time.

BS: After two decades of searching for these elusive signals, this was a very special moment for us. Thanks to the pioneering work performed here at Cardiff University, we were able to determine that this particular gravitational wave originated from two black holes that were circling each other. The result was nothing short of a groundbreaking discovery – which is why the detectors must be extremely sensitive. The experimenters and engineers deserve immense credit for these amazing instruments, as do the theorists such as those at Cardiff University, who calculated what would be observed when two black holes merged.

BS: I am not an experimentalist and what I say is the perspective of someone who marvels at the achievement of his experimental colleagues from a safe distance. The LIGO detectors have to deal with a cacophony of noise both inside and outside of the detector. LIGO have to deal with noise from the ground, from the weather and the ambient environment. The detectors have to combat this noise with the aid of an algorithm.

LR: The LIGO detectors recently went through a major upgrade, increasing the ultimate sensitivity of the instruments by a factor of 20 which was enough to detect at least one convincing chirp of a gravitational wave almost instantly. Unless the detector team had extraordinary luck in detecting this event so soon, there is no way we might expect more in the near future.

BS: We certainly hope that this wasn’t extraordinary luck. In addition to this detection, which we have little doubt about its reality, we also detected a less significant event that looks like a binary black hole merger. I personally think that this event is genuine, and not down to any external noise, and here at Cardiff University we are currently developing data cleaning techniques that may well increase the significance. It is important to note that so far we’ve only announced results taken from a month’s worth of data taken between September and October last year. We still have another three months’ worth of data to analyse and have speculated that there is an 80% chance that this data should contain a binary black hole event similar to the one we have already detected.

BS: Two European detectors, Virgo and GEO/EOB, are joining the search for gravitational waves, and I’m sure this initial step will stimulate wider efforts to exploit this new kind of astronomy.

LR: The recently announced LIGO-India detector will be an important part of this search. We certainly hope that this wasn’t extraordinary luck. In addition to this detection, which we have little doubt about its reality, we also detected a less significant event that looks like a binary black hole merger. I personally think that this event is genuine, and not down to any external noise.

BS: Field of scientific astronomy became by exploiting visible light with optical telescopes to observe the stars and planets in the skies above us. Over the last century we have used radio waves, microwaves, x-rays and gamma rays to explore parts of the Universe that are hidden to optical telescopes. Without these new windows of observation, we wouldn’t have learnt about quasars and radio galaxies, neutrons stars, pulsars and black holes.

Gravitational waves will open a brand new window for us to observe the Universe. They will allow us to probe regions of extremely high density and gravity, such as the deep interiors of supernovae, the central engines of gamma ray bursts and the dense cores of neutron stars.

Furthermore, gravitational waves will help us to test Einstein’s theory of general relativity with ultimate precision.

But ultimately, gravitational waves are the ideal tools to explore the state of the Universe just a tiny fraction of a second after the Big Bang. It is something we can ever hope to learn about the physical conditions at the birth of our Universe. Nothing could be more illuminating.

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THE RESEARCH MAGAZINE FOR CARDIFF UNIVERSITY

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American football’s league, the National Football League (NFL), is currently embroiled in one of the most controversial periods in its 96-year history.

Considerable questions have been raised about the NFL’s ability to control the sheer brutality of the sport, as well as its role in protecting professional players from developing potentially life threatening brain injuries.

Just last year, the NFL was ordered to pay $756m to over 4,000 ex-players who had sued the organisation on the grounds that it had failed to protect them against concussion and brain injuries.

In 2009, a study showed that NFL players were 19 times more likely to suffer from early onset Alzheimer’s disease than the general public. These bleak findings have been compounded by several incidences of NFL players committing suicide in recent years, with their autopsies showing brain damage consistent with routine sports equipment.

In response to this burdening issue, the NFL has implemented several new rules to try and protect players on the pitch and is investing a significant amount of money in research and development to protect against, treat and diagnose brain injuries.

One such initiative is the Head Health Challenge, a $20m initiative created in conjunction with Under Armour, GE Healthcare and the National Institute of Standards and Technology, that has invited researchers to submit their own ideas on how brain protection can be improved. Dr Peter Theobald (PhD 2006, PgCert 2010), from the School of Engineering, is part of a collaboration that has successfully secured funding through a grant of the Head Health Challenge to further develop a material that they have designed and built to protect the head in a number of different sports.

Manufactured using the latest 3D printing technology, the novel material has the potential to be rolled out not only in American football, but in a wide-range of other sports, including horse riding, cycling, motorcycling and rugby. High-impact collisions are part of the daily grind for the Welsh rugby international Jamie Roberts (MRCGP 2013), The Harlequins FC star has acquired a reputation for playing fast, aggressive, direct rugby and has been lauded for putting his body on the line every time he steps onto the pitch.

This all-or-nothing attitude has resulted in a glittering career for Jamie, clocking up over 70 international caps for Wales and touring twice with the British and Irish Lions.

In spite of this, Jamie is acutely aware of the physical strain that sport can impart on the body, principally because he is a qualified doctor, having obtained a medical degree from the University’s School of Medicine in 2013. Below, Jamie (JR) talks to Peter (PT) about the heightened awareness of brain injuries in sports, the role that 3D-printed materials can play in protecting players, and the likelihood of the materials being integrated into various sports equipment.

JR: Head injuries in sports have recently drawn a lot of attention in the media and have become a hot topic for debate. How are you working to address the issue of head injuries?

PT: Our work is looking to develop new materials that will be more effective at absorbing energy during impact in a wide range of scenarios. Specifically, we are aiming to develop materials that can be used to protect the head, so our new materials need to have a range of properties suited for this application, including being light weight.

JR: Do you think head injuries have become more prevalent as sports have become more and more competitive, or have we just got better at detecting them?

PT: When a head injury occurs because of an impact, it broadly happens via one or two mechanisms. The first type is caused by a high-energy, single impact that typically results in a relatively quick injury. The second type of injury is caused by the cumulative effect of multiple lower energy impacts, over an extended time period, in sports where there is a risk of a high-energy impact, for example falling at high speed.

JR: How closely do you work with people in the medical profession to define the different types of head injuries, and develop ways to prevent them?

PT: Our work designing new materials predominantly focuses on out-performing contemporary products when tested against established, international standards that govern all safety helmets. These standards are routinely reviewed by committees of leading experts from a range of specialities, including medicine, to ensure that they consider the latest scientific evidence. Furthermore, we are constantly engaging with a wide range of medical-related professionals to ensure that our research is focussed on establishing new materials that are optimised for a particular application.
a cycling road race, helmets are commonplace; hence, the wearer is protected from a high energy impact, while also being protected from lower energy impacts. Where the impact forces are likely to be less severe than this, for example in rugby union, head protection is not typically mandatory; however, this may mean that players are exposed to injury as a cumulative consequence of multiple, lower energy impacts. It would seem reasonable to assume that this long-term injury risk is probably increasing where collisions are occurring between increasingly stronger players, and therefore increasing impact energies, with rugby union being a prime example.

In addition to this, the wider understanding of head injuries has changed significantly in recent years, driven in part by a recently established correlation linking American football participation, which subjects its player to multiple, lower energy impacts, with an increased risk of players developing a degenerative brain disorder called chronic traumatic encephalopathy. This correlation, and the subsequent $756m dollar litigation case, may have encouraged similar sports and the subsequent mandatory; however, this may mean that participants of sports such as these will ultimately be safer, whether pursuing their hobby or their profession. And of course, if rugby union, head protection is not typically mandatory; however, this may mean that players are exposed to injury as a cumulative consequence of multiple, lower energy impacts.

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It: Congratulations on your new appointment as Professor of Child and Family Social Work at Cardiff University and the Research Centre for Practice and Policy. I want to tell you about your new role and what CASCADE is?

DF: I took up the role in January this year. CASCADE was set up by Professor Sally Holland who’s now the Children’s Commissioner for Wales. It’s a relatively new centre. It has a specific focus on children’s social care, giving their voice greater prominence and trying to improve services for them. I think it’s achieved a lot in two years and I’m looking forward to developing it further.

IT: Tell us about your background and how you came to be in this fantastic role?

DF: I qualified as a social worker in 1992. I worked in Southwark until the end of 90% in frontline practice. I was drawn into academic life for lots of reasons. I worked with parents who had substance and alcohol misuse problems. It seemed a high proportion of my caseload was families with drug and alcohol issues. It provided whole family preservation service. It worked with families where there was a likelihood that children might come into care and where there were drug and alcohol issues. It provided whole family interventions and both of my evaluations were for other people. So I became interested more generally in what works in children’s services.

IT: What’s your current hypothesis on what does change practice and really impacts on families?

DF: The quality of practice and intensity of service they receive are crucial. Whether they have significant problems is also crucial. Key elements of good practice are empathetic collaborative relationships that marry a sense of purposefulness, and the ability to use authority well.

IT: What’s going to be your main aim in this new role? What do you want to achieve in the next five years for children and families?

DF: I want to build the centre so academics can thrive and do good work that makes a difference within the Centre. For instance, we are developing expertise in child sexual exploitation. We already have a track record of involving children and young people and giving them a voice.

One of the great things about Cardiff is that it has a PhD programme and other things that will allow you to bring academics through. I’m particularly interested in how you create changes in practice and exploring different approaches to that. I think we can describe the key elements of really good practice. It’s worth recognising that if you want to see really good practice you need to have some sort of vision of practice for effective leadership.

IT: I went to Holland a couple of weeks ago to visit Buurtzorg. It was wonderful to see how those who found themselves in the same situation make in the different environments. Social workers find themselves in huge bureaucracy, not much practice, being told what to do by other people, very little use of professional autonomy or use of professional judgement. So he set up this organisation which has 8,000 practitioners working in community nursing and child and family community work. No managers or supervisors, just 16 coaches. They have intravision (small group reflection and challenge). They work in small units of 10-12 people and are self-managing. So why do you think a supervisory relationship is so important?

IT: Using motivational interviewing?

DF: Yes, it is a core feature in my studies. My first study found that social workers couldn’t work with the denial and minimisation they were experiencing. So I went to the world of substance misuse to try to get answers. Both methodologically and for effective ways of working with people. Motivational interviewing is a state of counselling and communication. It pays a lot of attention to understanding that resistance is understandable. In child protection you need to be able to understand to do this work. It teaches you how to overcome that and develop more effective healthy relationships.

So most of my studies have looked at that.

IT: What’s your current hypothesis on how does change practice and really impacts on families?

DF: The quality of practice and intensity of service they receive are crucial. Whether they have significant problems is also crucial. Key elements of good practice are empathetic collaborative relationships that marry a sense of purposefulness, and the ability to use authority well.
A celebration
of innovation

For 18 months, the University has been building an innovation system which will unlock the power of research.

Combining new facilities and staff with an increased focus on ‘work ready’ courses and skills for graduates, Cardiff Innovation System brings together campus investment, new partnerships and cultural change to drive prosperity.

The aim is to make Cardiff an innovation capital for Wales by harnessing research to create prosperity, better connecting businesses with academics, and translating innovations into new products and technologies, services, and start-ups.

Devised by the Vice-Chancellor, Professor Colin Riordan, this pioneering approach permeates all aspects of University life - from teaching and research through to student work placements and industry-focused degrees.

The University is recruiting leading international researchers, building a £300m innovation campus to drive growth, and putting student entrepreneurship at the heart of education.

Major capital investment on the University’s Innovation Campus, including Cardiff Business School’s £13m Postgraduate Teaching Centre; a £44m Cardiff University Brain Research Imaging Centre; a Translational Research Facility for Catalysis and Compound Semiconductors (£77m), and the development of Innovation Central – a £49m collaborative space.

In 2014-2015, new partnerships helped Cardiff exceed its objectives: £77m in Semiconductors, services, and start-ups.

The launch of Compound Semiconductor Centre Ltd – a joint venture between IQE Plc and the University to develop Compound Semiconductor technologies - helped attract a £50m UK Innovation Catapult in Advanced Compound Semiconductor Applications. CIS also helped secure a partnership role for Cardiff in a £50m catapult for UK Precision Medicine. We have also launched Creative Cardiff – supporting the city’s creative industries and economy.

This year, a Clinical Innovation Partnership has been forged with Cardiff and Vale University Health Board to turn clinical research into cutting-edge products and services.

To celebrate our innovation success, Summer of Innovation aims to strengthen our innovative partnerships and showcase our work to the wider world.

Positioning Cardiff at the forefront of innovation, growth and enterprise in Wales, Summer of Innovation will provide a platform for academics, business, government and other external stakeholders to exchange ideas on innovation and think about ways of solving current issues.

The celebration starts in early June with the opening of the state-of-the-art Cardiff University Brain Research Imaging Centre, and includes our Innovation and Impact Awards in mid-June. We will showcase our innovative work around graduation in mid-July, and feed into events including the National Eisteddfod in late July and early August.

The intention is to close the programme with a high-profile public lecture which will launch a series of Innovation Public Lecture Briefings for 2016/17.

Events

We are currently working on a full programme of events which will be listed on our website, www.cardiff.ac.uk/summer-of-innovation

Confirmed events are detailed below:

Staff fair and workshops – Tuesday 6 June
Celebrating innovation and providing an opportunity for staff to engage with elements of the Innovation System from the new Innovation Buildings to our collaborative partnerships.

Opening of Cardiff University Brain Research Imaging Centre – Tuesday 7 June
Inaugurating the new state-of-the-art building which is set to become one of Europe’s top facilities for brain imaging. (see page 22 for more details).

Digital 2016 – Tuesday 6 - Wednesday 7 June
We will be involved with this annual festival of digital inspiration and innovation which takes place at the Celtic Manor Resort in Newport.

Cardiff University Innovation and Impact Awards – Wednesday 22 June
Our Innovation and Impact Awards celebrate our successful collaborations and links with business. Winners are carefully selected based on the innovation, impact and added value arising from the collaboration, and can be large businesses or small companies, social enterprises or government organisations, charities or public bodies.

Venturefest – Wednesday 28 September
Bringing together entrepreneurs, investors and innovative companies to inspire business growth.

Contact us
To find out more about the Summer of Innovation, please email innovationsystem@cardiff.ac.uk

www.cardiff.ac.uk
The Cardiff University Brain Research Imaging Centre (CUBRIC) is a state-of-the-art research-dedicated neuroimaging facility housing a combination of equipment and expertise that is truly unique within Europe.

It houses Europe’s most powerful MRI scanner, the Siemens 3 Tesla Connectom, a specially adapted MRI scanner of which there is only one other in the world at Harvard University in the USA. It will enable researchers to study tissue microstructure in incredibly fine detail. The scanner’s power is such that it has been described as the Hubble space telescope of neuroscience.

Scientists at the Centre will seek to provide unprecedented insights into the causes of neurological and psychiatric conditions such as dementia, schizophrenia and multiple sclerosis, as well as understanding the workings of the normal, healthy brain.

The new facility has been part-funded by the Engineering and Physical Sciences Research Council (EPSRC), the European Regional Development Fund through the Welsh Government, the Medical Research Council (MRC), the Wellcome Trust, the Welsh Government and the Wolfson Foundation. Together, these investments are supporting innovation in world-class brain imaging research, including the creation of highly-skilled research jobs in Wales. More than £27m of the cost has been provided by funders.

http://sites.cardiff.ac.uk/cubric

Cardiff University
Brain Research Imaging Centre
What made me curious?

Writer, broadcaster and geographer, Nicholas Crane spoke to Professor Paul Milbourne about what sparked his passion for human geography.

NC: Where did you grow up?
PMM: I grew up in Whitefield, a small industrial town about five miles north of Manchester. This was a place of social contrasts, containing three large council estates and one of the most affluent suburbs in North West England.

It was also a place of considerable change, council estates swallowing up swathes of green space and bringing with them several thousand people, and a motorway driving six lanes of tarmac through farmland barely 400 yards from our house. Even with such change, nature remained an important part of the rugged hills providing an important visual backdrop, footpaths still taking us through open farmland, and the largest municipal park in Europe only a 15 minute walk away.

NC: How did your interest in geography develop?
PMM: Most probably from these early experiences of place and landscape. I also had a wonderful geography teacher at school, who was able to bring the subject alive. Moving away to study human geography at Aberystwyth University developed my geographical imagination in other ways. The academic context of the course broadened and deepened my understanding of the subject, enabling me to make connections between academic themes and personal experience: urban and social geography emphasised the interconnectedness of social and spatial inequalities and injustices in the urban environment, while a module on landscape and nature opened my eyes to how ‘natural’ spaces are socially and politically constructed to reflect the interests of particular (powerful) groups.

Moving away from Manchester also made me realise how regions and places matter to our sense of identity. Living in a small Welsh-speaking town in rural Wales broadened my understanding of the ways in which landscape, culture and language shape people’s sense of place and identity.

NC: What is your research about?
PMM: It’s largely positioned within social and environmental geography, exploring the interplay between social and spatial processes of inequality and injustice. My work has examined the geographies of welfare, particularly poverty, homelessness and welfare reform, in relation to urban and rural places in the UK and US, especially on how social problems become ‘spatialised’, that is, associated with and concentrated in some places but not others. More recently, I have focused on social and environmental forms of injustice across a range of themes and settings, including community growing projects in disadvantaged urban neighbourhoods involving 20 cities in the UK, North America and Australia. This research has shown how community groups have been able to transform neglected spaces in their neighbourhoods – in physical, environmental, socio-cultural and political terms - through collective forms of gardening. These projects have not only created new spaces of place but also new forms of sociality, conviviality and empowerment among residents. While the scope of this research is global, it is very much concerned with what can be achieved locally. A local component to this work has involved community growing projects in Cardiff as part of the University’s Grangetown Community Gateway engagement project.

My research seeks to extend the community growing agenda in a couple of ways. First, it engages with austerity politics to think critically about the management of public green spaces in the city. With public sector cuts forcing local authorities to evaluate spending priorities and community growing groups seeking out additional land, it is possible that more public green spaces could be transformed into growing spaces, providing locally sourced fruit and vegetables in the heart of the city.

The bigger agenda for me is to bring agriculture back into the city – moving from aesthetical to productive plantings and creating more of what we might call ‘ edible spaces’ in our cities. Second, working with colleagues in the School’s Sustainable Urban and Regional Food Research Centre, I am making connections between food poverty, food justice and healthy eating within the city. We are asking how we could develop more holistic approaches to urban food as a way to produce more equitable foodscapes in the city, and address the twin problems of hunger and obesity.

NC: So tell me why you think human geography is important?
PMM: It shapes our lives in a variety of ways – through everyday interactions with place and environment, movements through physical and virtual space, and the influence of global economic, socio-cultural and environmental processes on our lives. Geography is concerned with how we make sense of our place in a changing world. It examines the ways in which the physical and human environments are mutually dependent – how we continue to shape our natural worlds, and how nature impacts on our everyday lives. Geography also has an important part to play in addressing what we might refer to as the ‘grand challenges’ of our time, providing socio-cultural understandings of climate change and the future security of natural resources.

In other ways, geography is concerned with spatial differences and processes: the uneven distribution of population, jobs, wealth, poverty, services and natural resources across space. It seeks to make sense of these differences and processes at a variety of spatial scales – from the global to the local.

NC: Looking beyond the academic, do you think human geography has broader relevance?
PMM: Geography is particularly relevant to some of the big political, economic, social and environmental issues facing us today. The migration of large numbers of people from war zones to Europe is raising important questions about national borders and our capacity for integration within European cities.

Political devolution within the UK has introduced important policy differences between the four home countries, particularly in terms of welfare, health and education. Political debates about

What made me curious?

**Nicholas Crane**
Presenter of BBC Two's *Coast*

The future of energy, natural resources and the environment connect with geography’s concerns with the interconnectedness of the social and natural worlds.

NC: And do you think geography has more popular appeal?
PMM: I have noticed increasing media coverage of geographical themes over the last few years. While geography may not be used as a descriptor in a way that the term history is used to label articles and programmes on television, I think it’s clear that the media has become much more interested in the interactions between people, place and environment. In terms of TV, your excellent programme, *Coast*, which has been running for more than a decade, presents a fascinating account of socio-natural relations at the interface between land and sea. I also read recently that the BBC programme, *Countryfile* attracted a larger viewing audience than the finale of *War and Peace*, with 9.5m viewers tuning in.

NC: Could you say something about the changing student demand for human geography?
PMM: Geography is becoming a more popular academic subject. In August last year an editorial in *The Guardian* referred to student numbers having risen from 30 to 255. A key reason for this growth is the high quality of our research. The School is currently 44th in the QS World Rankings of Geography, I’m pleased that the QS measure of citations per paper positions us third of the top 10 UK universities for geography, ahead of both Oxford and Cambridge. The School employs the largest number of human geography staff of any UK university with a research footprint that extends to four continents and covers the full range of human geography.

Another reason for the popularity of geography at Cardiff is the way we teach the subject, encouraging critical thinking and development of analytical skills, and the applications of the knowledge to real world issues.

NC: I understand it’s the 50th Anniversary of the School of Geography and Planning in 2016. Could you tell me how you are celebrating this milestone?
PMM: It’s an important year for the School, with a series of high profile events to bring together researchers from the School, other universities, and the worlds of policy and practice to discuss research themes. The first was on homelessness, co-organised with Shelter, also celebrating its 50th year in 2016. Future events cover the changing city-region, food planning, produce more equitable foodscapes in the city, and address the twin problems of hunger and obesity.

Further details of these events can be found on our website ([www.cardiff.ac.uk/cplan](http://www.cardiff.ac.uk/cplan)).

The research magazine for Cardiff University

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The research magazine for Cardiff University
Neuroscience and Mental Health Research Institute

Mental illness is one of the greatest remaining health challenges facing our society. Mental health disorders, which span dementia, epilepsy and the psychiatric conditions, affect one in six people in the UK population at a cost of over £100bn per year to the economy.

Cardiff University’s researchers are global leaders in unravelling the genetic basis of mental disorders, and this accumulating genetic knowledge has initiated a new era of mental health research. The challenge now is to use neuroscience to translate genetic discoveries into major improvements in the diagnosis and treatment of mental illnesses.

The Neuroscience and Mental Health Research Institute, established in 2010, brings together research expertise in psychiatry, neuroscience and psychology from across the College of Biomedical and Life Sciences, to apply recent advances in understanding the biological basis of mental illness. It has already achieved major successes in funding and recruitment, establishing strong foundations from which to now build a world-leading mental health institute recognised for its research, innovation and impact.

The Research Institute’s research is principally undertaken through the following four themes:

Neurodevelopment

The Research Institute is interested in how genetic and environmental factors acting on brain development alter risk for mental illness, and study this process in a variety of ways, including using cellular assays, model systems and clinical, cognitive and imaging studies. These are applied to patient and developmental groups, including carriers of rarer high penetrance genetic risk factors.

Neuroplasticity

The Research Institute is interested in both the basic and clinical processes underpinning learning, prediction and plasticity in the brain, and in their relevance to the understanding and treatment of neuropsychiatric disorders. It addresses these issues using studies which span from cellular approaches to human brain imaging studies in patients.

Neuroexcitation

The Research Institute is involved in research from cellular to clinical studies uncovering the basis of these disorders and looking for new routes to therapy including cellular transplantation in Huntington’s disease and new approaches such as immune modulation in Alzheimer’s disease.

In August 2015 the Research Institute gained funding for a further five years, its ambition now is to bring psychiatric genetics and neuroscience researchers together to form the basis of a new MRC / Wellcome Trust Unit embedded in Cardiff University – the first such Unit in Wales.

Example achievements

The study that is the focus of Professor David Linden’s paper, Multimodal brain imaging reveals structural differences in Alzheimer’s disease polygenic risk carriers: A study in healthy young adults (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4460187/) identifies specific sets of genes contributing to excitatory signalling complexes in schizophrenia that could lead to better therapeutics delivery into the human brain.

Defining Endophenotypes from Integrated Neurosciences (DEFINE). This £5.2m Wellcome Trust Strategic Award involves nine Principal Investigators from the Schools of Medicine, Psychology and Biosciences, led by Professor Mike Owen. Twelve new posts have been created with this award. It is the first Wellcome Trust Strategic Award for Cardiff. The aim of the study is to understand how genetic risk factors impact on brain function in psychiatric disorders such as schizophrenia, ADHD and autism. By studying cells, animals and patients all carrying the same genetic risk factors researchers will be able to link abnormalities in brain function and behaviour seen in patients to abnormalities in cells and brain circuits. This will pave the way for further investigation into the effects of Alzheimer’s disease risk variants and may become useful for efforts to combine data for risk prediction and to enhance future prevention trials of the disease.

Key research programmes

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Key research programmes

1) To develop new and refine existing systems for therapeutics delivery into the human brain
2) To develop the appropriate infrastructure for capturing relevant high-quality patient data to measure real clinical and social impact, as well and continuing to support ongoing mechanistic translational research
3) To build our clinical and health economic outcome, social care and service delivery research portfolio.

£495,000 donation from the Jane Hodge Foundation to support two research rising stars. This donation was to support the brightest and best researchers to the Research Institute to benefit from the environment we have built and to translate our findings into benefits for patients and their families. It is with this human capital that we are able to make a difference and allow us to make rapid progress in understanding and treating these devastating conditions. Two research fellowships have been appointed, one in translational neuroscience – Dr Nichola Brydges and one in translational neurophysiology – Dr Adam Errington.

£1.2m NISCHR Brain Unit - The Brain Repair and Intracranial Neurotherapeutics (BRAIN) Unit directed by Professor William Gray is a Welsh and UK National Centre of Excellence for delivering novel cell drug growth factor therapies to patients with currently untreatable neurological and neurodegenerative diseases. The Unit has three main themes:

1) To develop new and refine existing systems for therapeutics delivery into the human brain
2) To develop the appropriate infrastructure for capturing relevant high-quality patient data to measure real clinical and social impact, as well and continuing to support ongoing mechanistic translational research
3) To build our clinical and health economic outcome, social care and service delivery research portfolio.

Public Engagement

Funding is available to engage with the public and professionals. This is achieved through a series of open lectures and conferences, increasing engagement, and also through the appointment of a genetic and biological counsellor in mental health.

Supporting talented young researchers

This programme supports talented young researchers to develop beyond their PhD research to the point that they can attract their own independent funding.

Responding rapidly to new innovation

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Hady 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 www.cardiff.ac.uk/research