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CHALLENGECARDIFF

THE RESEARCH MAGAZINE FOR CARDIFF UNIVERSITY

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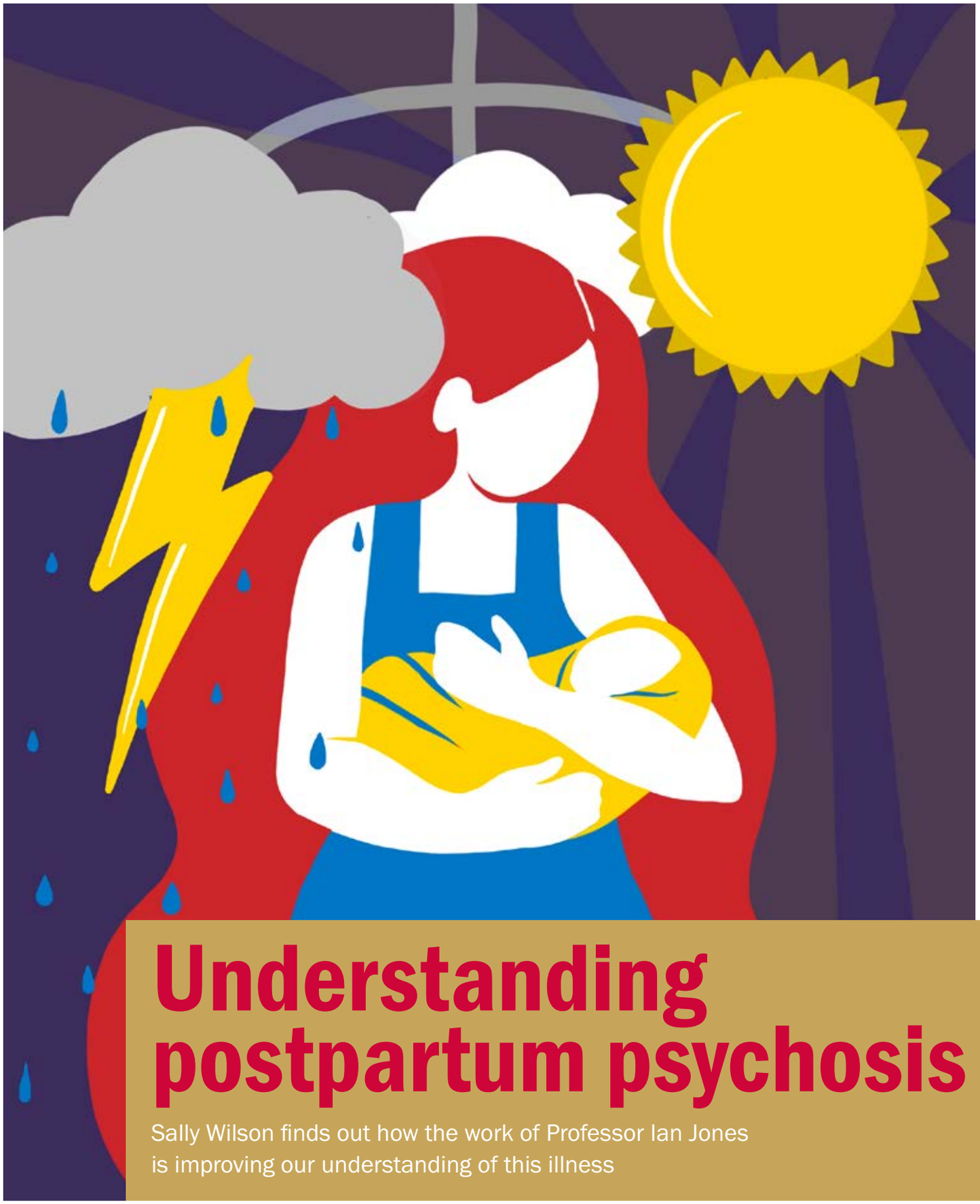
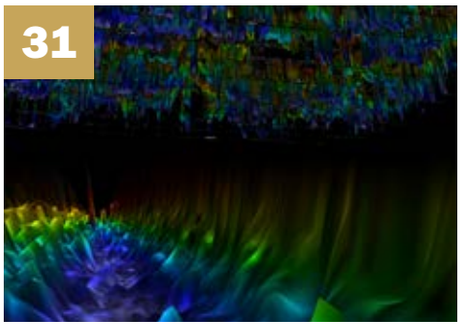


Understanding postpartum psychosis

Sally Wilson finds out how the work of Professor Ian Jones is improving our understanding of this illness



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Challenge Cardiff Autumn 18

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Welcome to Challenge Cardiff

EARLIER THIS YEAR, Universities UK launched its #MadeAtUni campaign which highlights the "100+ ways that universities are saving lives and keeping us healthy". Our contribution to this campaign is the work of Dr Margaret Woodhouse OBE and the Down Syndrome Vision Research Unit. Dr Woodhouse's research featured in the first issue of Challenge Cardiff, and in this issue, we showcase some more of the excellent work our researchers are doing to improve the health and wellbeing of communities in Wales, the United Kingdom and the world.

Professor Ian Jones is a leading expert in postpartum psychosis (PP). This severe illness can occur suddenly and unexpectedly. Professor Jones' research is seeking to better understand the illness, provide more targeted treatments and improve the lives of women affected by it. He speaks to Sally Wilson, who had PP, about his work and the importance of involving those with the condition in research.

The Cardiff University/Cardiff Half Marathon is the second largest half marathon in the United Kingdom. Understanding the economic and environmental impacts of such large events is key for organisers. Research undertaken by Dr Andrea Collins and Professor Max Munday has informed Run4Wales' green action plan. Chief Executive of Run4Wales Matt Newman spoke to Dr Collins and Professor Munday about the importance of their work to the Cardiff University Cardiff Half Marathon and other key UK and international sporting events.

Dr Timothy Easun is a Royal Society Fellow based in our School of Chemistry. His work in metal organic frameworks is applying fundamental science to create simple and effective solutions that will provide clean water to small communities in developing countries. Working with colleagues in our Water Research Institute and the GW4 Water Security Alliance, his project is an excellent example of how working together across disciplines is crucial to solving some of the world's biggest challenges.

The Cardiff University Research Opportunities Programme (CUROP) provides our undergraduates with paid opportunities to work on live research projects for four to eight weeks over the summer holidays. Since it was established in 2008, it has supported 800 research projects and has been of great benefit to the experience of our students as well as enriching our research environment and helping us to identify researchers of the future.

To find out more about the work featured in this issue, please go to our website **www.cardiff.ac.uk**

PROFESSOR COLIN RIORDAN
VICE-CHANCELLOR

Understanding the society-wide transformations urgently required to bring about a sustainable, low-carbon future

The University has been selected as the main hub for a £5m research centre to explore how we can live differently to achieve the rapid and far-reaching emissions cuts required to address climate change.

A collaboration between Cardiff, Manchester, York and East Anglia universities, and charity Climate Outreach, the Centre for Climate Change and Social Transformations (CAST) will work closely with industry, local/national governments, and charities to tackle climate change. It is funded by the Economic and Social Research Council.

The Centre will focus on four challenging areas of everyday life that contribute substantially to climate change, but which have proven stubbornly resistant to change. These include consumption of goods and physical products; food and diet; travel; and heating/cooling in buildings.

As well as looking to the future, the Centre sets out to learn lessons from past and ongoing changes that have occurred across societies.

The Centre will also have a strong practical focus and will experiment with approaches to bringing about change at all levels of society, applying behaviour-change techniques designed to break people's habits and encourage more active travel. Working with charities, the team will trial practical interventions at the community level to reduce household emissions, and with industry partners to shape sustainable workplace practices.

The researchers will work closely with Welsh Government and city councils to develop and apply approaches designed to bring down emissions, and better engage the public in tackling climate change. They will also work with politicians and policy-makers in the UK and internationally to press for research findings to be implemented in ways that lead to real change.

NEW APPROACHES FOR TREATING PSYCHIATRIC DISORDERS

Cardiff University has formed a drug discovery collaboration with Takeda Pharmaceutical Company Limited (Takeda) to identify new approaches for treating schizophrenia and other psychiatric disorders.

The collaboration will combine the University's large-scale genomic data, and world-class expertise in psychiatric genetics, genomics and neuroscience, with Takeda's extensive drug discovery and clinical development capabilities.

The collaboration will allow Takeda access to world-leading biological psychiatry research and the related infrastructure across the University, including the MRC Centre for Neuropsychiatric Genetic and Genomics, the Neuroscience and Mental Health Research Institute, National Centre for Mental Health, and the Brain Repair and Intracranial Neurotherapeutics Unit.

Major psychiatric disorders, including depression, schizophrenia, autism and bipolar disorder, collectively represent an enormous unmet health need, accounting for approximately 20% of all years lost to disability globally, according to the World Health Organization.

BRINGING A NEW GENERATION OF DRUGS TO PATIENTS

The University is stepping up the development of new drugs for mental health and central nervous system conditions, with the launch of the Medicines Discovery Institute.

Focusing on areas of unmet clinical need, the new Institute will develop novel medications to improve the lives of people across the world.

Part-funded by the Welsh Government, the Higher Education Funding Council for Wales and the European Regional Development Fund, the £14m centre aims to put Wales at the forefront of medical innovation.

The Institute, which is located within the highly successful School of Biosciences, will also provide an excellent opportunity for training and inspiring the next generation of medicines discovery scientists.

One of the Institute's first big projects will focus on improving anxiety medications – an area of research where there have been no major advances since 1960. Thanks to a major investment of £3.5m from the Medical Research Council (MRC), the team will focus on the development of drugs that reduce the side effects associated with the benzodiazepine class of anxiolytic drugs.

Another new grant from the MRC will allow the team to develop improved medication options for people with Fragile X syndrome – the most common inherited cause of learning disabilities. Focusing on a protein known to regulate the connections between nerve cells, the team aims to develop a novel medication that will make a difference to the lives of individuals and their families living with the condition.

CARDIFF UNIVERSITY BECOMES LATEST PARTNER IN GLOBAL NEUROSCIENCE RESEARCH INITIATIVE

Cardiff University has become the latest global partner in Western University's BrainsCAN, a $66m neuroscience research investment from the Government of Canada provided through the Canada First Research Excellence Fund.

Through a Memorandum of Understanding (MOU), BrainsCAN and Cardiff researchers will build collaborative, high-impact neuroscience research projects to develop and deliver evidence-based assessments for the diagnosis and treatment of brain disorders.

As a part of this partnership, Cardiff researchers will have the opportunity to work closely with BrainsCAN researchers to share expertise and resources. Postdoctoral fellows and students from both institutions will also benefit from access to world-renowned principal investigators from Western and Cardiff.

BRAZILIAN BOOST FOR RESEARCH

The University has signed a strategic partnership agreement with one of Brazil's leading universities in a bid to boost research and educational opportunities for staff and students.

The new partnership will see the University partner with The Universidade Estadual de Campinas, commonly known as Unicamp.

Established in 1966, Unicamp is one of Brazil's primary medical and scientific research centres. Based in the São Paulo state region, it has affiliate campuses in both Limeira and Paulínia.

The partnership commits the two universities to collaborate in areas of joint research activity. It is hoped the partnership could also pave the way to joint PhD programmes and further student exchanges.

HR EXCELLENCE IN RESEARCH AWARD

The University was successful in retaining the European Commission's HR Excellence in Research Award following an external review of the ways in which it supports its research staff.

The HR Excellence in Research Award demonstrates an organisation's commitment to the implementation of the Concordat to Support the Career Development of Researchers.

The Concordat is based on the principle that improving development opportunities and career management for researchers will improve the quantity, quality and impact of research for the benefit of UK society and the economy.

Cardiff University is one of eight UK universities that has retained the award after its eight-year review. The external review requires institutions to highlight key achievements and the progress they have made in the last four years, and to outline their strategy and success measures for the next review period. In retaining the award, the University has demonstrated its long-term commitment to the career development of researchers.

CARDIFF AND BREMEN UNIVERSITIES SIGN PARTNERSHIP

The University has entered into a partnership with the University of Bremen in a bid to strengthen European relations.

The two universities will come together to form the Bremen-Cardiff Alliance, aimed at increasing the movement of both staff and students between institutions and providing better access to research funding.

A unique aspect of the alliance will be the affiliation of academic staff members from one university to the other. This will enable staff to take part in long-term collaborative research projects, to supervise PhD students and, most significantly, apply for external funding through the respective national systems of the partner institution.

The University of Bremen is one of Germany's leading 'young universities', with around 20,000 students and 2,300 academics. Its teaching and research activities span a wide range of disciplines in the natural sciences, engineering, social sciences and the humanities. From 2012, it has received funding as one of the 11 top universities in the German Excellence Initiative.

The University has long-established research links with the University of Bremen, including through the School of Earth and Ocean Sciences and the University of Bremen's Centre for Marine Environmental Sciences (MARUM), and the cross-disciplinary Science Humanities initiative at Cardiff University and the University of Bremen's Fiction Meets Science group.

The Bremen-Cardiff Alliance, although open to all areas to develop new collaborations, will initially focus on complementary research strengths in three specific areas: media and communication sciences; marine and environmental sciences; and literary, social and historical studies. A further promising area to bring into the alliance is semiconductor physics.

A dedicated collaborative fund will be open for the development of joint research between the two institutions in all disciplines, as well as the mobility of teaching, technical and professional services staff to share best practice.

€4M FUNDING AWARDED TO DRIVE SKILLS IN STEEL INDUSTRY

Researchers at the University have been tasked with developing training and skills strategies to ensure the European steel industry remains globally competitive for years to come.

The European Steel Sector Agenda (ESSA), which has been awarded €4m, is co-managed by Dr Dean Stroud of the School of Social Sciences, in partnership with the Technical University of Dortmund. The project encompasses a consortium of 24 organisations from 10 European Union countries, complemented by seven additional associated partners from member state countries. These include steel companies, education and training providers, steel associations and social partners and research institutions.

Working together, they will develop a blueprint for a sustainable steel industry in Europe, along with a strategy for fulfilling the skills demands of its workforce.

A database will be produced to document the existing and emerging occupations in the sector, as well as the skills and qualifications they require. This will then be used to deliver new vocational training. It is hoped the work will help maintain a competitive industry, which is environmentally responsible and promotes sustainable growth, innovation and the creation of highly skilled jobs.

SUPERCOMPUTING PROGRAMME LAUNCHES IN WALES

The University is leading a £15m project aimed at making Wales a leader in high-performance computing and big data. Supercomputing Wales, which also involves the universities of Swansea, Bangor and Aberystwyth will develop cutting-edge research projects using state-of-the-art computing facilities.

The project has been funded with £9m through the European Regional Development Fund (ERDF) through the Welsh Government, which has been matched by a multi-million-pound investment from the university partners.

The money will fund two supercomputing hubs based in Cardiff and Swansea which will be fitted with a full suite of the latest high-performance computing equipment and software, provided by Atos and Dell EMC.

The partnership between Supercomputing Wales, Atos and Dell EMC will create a world-first Supercomputing Centre of Excellence.

Research Software Engineers will work with researchers from across the consortium to develop algorithms and customised software that harnesses the power of the supercomputing facilities, to perform multiple computational tasks simultaneously at very high speeds.

PARTNERSHIP WITH THE OFFICE FOR NATIONAL STATISTICS

A strategic partnership has been launched between the University and the Office for National Statistics (ONS). Benefits include new data science skills through a summer school scheme, a new senior academic position and extra master's degrees and PhD programmes.

The partnership will have broader regional impact, including a focus on data and data science, identified as a priority by UK Government, Welsh Government and Cardiff Capital City Deal. The University and the ONS are committed to bringing their collective capacity and expertise to enhancing the data ecosystem in South East Wales.

It builds on many years of close working between the University and the ONS which has already seen students taking part in developing new data science techniques that aim to inform top government decisions. The new partnership places a strong emphasis on developing skills, career pathways and creating graduate opportunities.

The scope of the five-year partnership will continue to evolve over time, but will include closer sharing of facilities, resources and expertise, co-developing events and activities to promote data use as part of decision making in public policy, and new research collaborations that improve understanding on topics such as healthy ageing, economic intelligence and education and skills.

Pioneering professor wins Eddington Medal

A Cardiff University professor who discovered how to measure the expansion of the universe has been honoured by the Royal Astronomical Society (RAS).

Bernard Schutz received the Eddington Medal for 'an investigation of outstanding merit in theoretical astrophysics.'

His pioneering work paved the way for analysis pipelines that are now at the heart of searches for gravitational waves through the Laser Interferometer Gravitational Wave Observatory (LIGO) and the Virgo interferometer.

In a 1986 paper, Professor Schutz, School of Physics and Astronomy, showed how gravitational waves can be used to measure the cosmic expansion rate.

He argued that gravitational waves from collisions (mergers) of two neutron stars or black holes are "standard sirens", carrying information about their distance to Earth.

Thirty years later, his theory was realised when both gravitational and electromagnetic waves were detected by LIGO. In 2017, Professor Schutz travelled to Stockholm to watch his former PhD supervisor and mentor, Kip Thorne, share a Nobel Prize for his work on LIGO.

The landmark discovery was made possible thanks to the significant contribution of a team of researchers at the University's School of Physics and Astronomy.

Professor Schutz joins an illustrious body of astrophysicists including Professors Stephen Hawking and Roger Penrose (1975) in receiving the accolade, named after English astronomer and mathematician Sir Arthur Eddington who made the first empirical test of Einstein's theory. It was first awarded in 1953 to the cosmologist Georges Lemaître who proposed the expansion of the Universe on theoretical grounds.

Professor Schutz received the award at the National Astronomical Meeting in July.

Improving relationship and sexuality education

Professor Emma Renold (BA 1994, PhD 1999) of the School of Social Sciences discusses her research focusing on relationships and sexuality education with parent Barbara Lovesey and teacher Rhiannon Davies.

Mum Barbara Lovesey is learning valuable lessons from daughter Hanna, aged ten.

A pupil at Ysgol Gymraeg Casnewydd in Newport, she has fully embraced its philosophy programme covering issues such as gender stereotyping, feelings and emotions, friendships and relationships, gender and sexuality equality and rights.

Using interactive and creative methods to open discussion and debate, relationships and sexuality education (RSE) has been woven into every element of the school curriculum. The school's approach has been commended by the Children's Commissioner for Wales as a model of best practice.

Barbara, also mum to Lidia, aged seven, is extremely proud of the way in which Hanna has taken inspiration and empowerment from these lessons.

"Once we went to the park and she asked, 'I wonder if this dog, which is wearing a pink collar, is a boy or a girl'. I said, 'it's obvious – it's wearing a pink collar so it must be a girl'. She looked at me really strangely and said, 'you are gender stereotyping'. I realised how much even young children are aware now of what can be hurtful to someone. Even though I see myself as quite a progressive person, I think everyone can become set in certain mindsets."

Teacher Rhiannon Davies said that Hanna and her classmates had been galvanised into making positive changes throughout the school. The discussion on gender stereotyping has prompted them to call for changes to how the school fete's lucky dip box is organised. Pink and blue boxes – with supposed girls' and boys' gifts arranged separately – have been replaced with one box of presents for everyone.

"We have a school display in the foyer which says, 'being different is the only thing we have in common'," Rhiannon said. "That's something we really do think is important, that children understand that they can be themselves and that we should embrace difference. I think it's something so many adults struggle with. But if you can teach them at a young age how to discuss these issues and give them an environment where they feel comfortable, that's going to affect how well they do in school and in the future."

Professor Emma Renold, who specialises in childhood studies, commended the school's work to nurture the children's voices and opinions.

"Listening to children and young people is vital in the area of RSE because there is a huge gap between what children are learning and experiencing and the content of RSE lessons," she said.

Professor Renold's world-leading expertise has been instrumental in an overhaul of the RSE curriculum in Wales.

As Chair of the Wales Minister for Education's expert panel, The future of the SRE curriculum in Wales, Professor Renold's report concluded that sex and relationships education (SRE) in schools is too biological and too negative, with insufficient attention given to rights, gender equity, emotions and relationships. Professor Renold's research in Wales informed the vision for a new holistic, creative, empowering and inclusive relationships and sexuality education curriculum.

These findings have led to the changes we see today. From 2022, this area of study will become relationships and sexuality education (RSE) – a statutory part of Wales' new curriculum.

RSE represents a major departure from traditional approaches; it broadens this area of study and places an emphasis on developing a relevant and empowering curriculum with children, parents, carers and communities that can learn from, respond to and support all children and young people's needs.

"Our vision is a sexuality and relationship education for lifelong learning and experience," said Professor Renold.

Her AGENDA resource, for schools preparing to deliver this new curriculum, focuses on helping teachers to safely and creatively discover what children and young people want to learn about. Initially aimed at secondary-age pupils, the resource has now been adapted to cater for primary children too. Its success has also led to it being launched in England.

Barbara agreed the changes were positive. "I'm so pleased this programme is being rolled out in schools," she said. "Working as a mental health professional, I cannot say how many times I've heard, 'No one ever taught me what a healthy relationship looks like'. When I was in school, it was certainly something you had to make your own mind about. Now, children can ask the question in a safe space before forming their own opinions."

Professor Renold said: "That's a really important part of AGENDA. All the research suggests that if you use interactive methods, you will be creating a learning environment that is developmentally appropriate because you start from children's own learning and experience. It's about tuning in to their understandings, allowing them to explore ideas and issues at their own pace, while of course providing them with accurate information at the same time."

Barbara felt that, as a parent, there were often misconceptions about what relationships education means.

"I think a lot of work could be done to demystify the role of teachers," she said. "It's not about placing views into their minds. It's about giving

children a voice and letting them know it's ok to bring their questions into the open rather than brushing them under the carpet and feeling ashamed about difference. From the parent point of view and my ethnic background I'm aware there are a lot of assumptions."

She wondered if Professor Renold had come up against this sort of resistance.

Professor Renold agreed it was a sensitive issue. "Childhood innocence is often used to avoid areas which adults think children are too young to explore. My research has shown that children learn about sexuality and relationships long before they start school. And when we give children the opportunity to ask questions, we are sometimes surprised about what they already know, the language that they use, the issues that they are aware of. Their questions are glimpses into their worlds. They show us what they already know, as well as what they don't.

"What we are advocating in Wales is what I have called a living curriculum; which is basically a curriculum that is relevant and responsive to children and young people's lives and real-world issues."

A teacher at Ysgol Gymraeg Casnewydd for 10 years, Rhiannon said their methods had been met with positive reactions and feedback from the community.

"We're very open with the parents about what we do," she said. "We always inform them of the types of things that will be discussed during philosophy. It's about giving the parents a voice as well. Once a month we send a question home where they have to discuss the topic with a child. There's a section for the child to put their opinion and there's a part for the parent to put their opinion. We're always here if they've got anything they want to ask. Generally, we've found the parents to be very supportive."

> "No one ever taught me what a healthy relationship looks like. When I was in school, it was certainly something you had to make your own mind about. Now, children can ask the question in a safe space before forming their own opinions."

Professor Renold praised this approach. "Looking at it from the research base, the ongoing dialogue that Rhiannon is describing is best practice. Effective RSE builds a curriculum with children, with teachers, with governors, with the community, with families. If there are concerns along the way you address them together."

Rhiannon Davies, Professor Emma Renold and Barbara Lovesey

The AGENDA resource is full of ideas, information and stories to help teachers build supportive and engaging environments for children and young people to speak out and share what matters to them. Case studies from schools offering examples of best practice, along with suggested classroom and whole-school activities, give teachers a springboard from which to develop their own lessons.

"There are so few resources on relationships and sexuality education, especially bilingual resources, that invite teachers to explore a diverse range of often challenging topics in a positive way," Professor Renold said.

Professor Renold said the resource was purposely non-prescriptive – so that teachers can work flexibly and adapt the activities to their own practice – and Rhiannon agreed AGENDA had complemented the preparations they had made for lessons.

"I would much rather this approach than lots of lesson plans where you're following a set thing, because every school setting is different," said Rhiannon. "I think Primary AGENDA gives you the opportunity to dip in and out. As a teacher that's what you're doing when you're making lesson plans. The basic work is there for you to build upon and I found it to be really useful."

Professor Renold said: "That's spot on. AGENDA has been written as ideas for teachers to build on creatively. And creativity can encourage children to explore new responses to familiar or unfamiliar ideas, feelings and situations."

Barbara said the lessons were benefitting Hanna but also their family.

"I've learned how much our minds can be stuck in certain ways of thinking about things. I'm pleased to see how confident Hanna is in talking about the topics. She doesn't feel it's inappropriate to open up."

Professor Renold concurred: "Too often, children learn about relationships and sexuality through negative stereotypes. AGENDA takes an affirmative approach to RSE. It does this by giving children a range of creative ways to express feelings and ideas, and by learning about often difficult issues, such as discrimination or violence, through how others have raised awareness of them, and sometimes changed them. This can be empowering. As one child from Rhiannon's class said about the school's RSE lessons: 'It's important to learn about how other people have changed the world because it inspires other people. I feel so proud when doing this.'" ■

The enormous social challenge of achieving the UK's carbon targets

Most of us want a green future, but how will we achieve it and who will pay for it? Professor of Psychology, Nick Pidgeon has been delving into the tricky business of transforming a whole energy system.

▲ Nick Pidgeon, Professor of Psychology

Psychology might not be the discipline that springs to mind when considering the UK's looming carbon targets, but, to achieve the scale of change needed to meet them, around 30 million households need to be on-board, meaning there is a vital task in understanding public values and attitudes.

That's where Professor Nick Pidgeon and his team at the University's School of Psychology come in. In 2013, on behalf of the UK Energy Research Centre (UKERC), in collaboration with colleagues in the Welsh School of Architecture and the School of Engineering, they published the world's first survey of public attitudes to whole energy system change.

Since then, they've expanded that work, looking more closely at public attitudes to everyday energy consumption, providing novel insights, and influencing both UK policy makers and international guidelines on climate change action.

"The UK's energy system must radically alter over the next 40 years if we want to meet our carbon targets and seriously tackle climate change," says Professor Pidgeon. "But moving to greener systems is not just about engineering and economics; energy system change is a massive social challenge too.

"When we started our research in 2010, it became clear there was a gap. While there were many scenarios of how to reach carbon targets through energy system transformations, there was no real agreement on what direction the change should take, and no real evidence of what was acceptable to the public.

"What we discovered was that the majority of the British public do see the bigger picture of energy system transformation, and are overwhelmingly committed to moving away from fossil fuels. They want a new system that is affordable but modern and safe."

Looking beyond public preferences, the work uncovers the underlying social values that come in to play: an important factor when considering that preferences are likely to change depending on context.

Efficiency and minimisation of waste; protection of the environment and nature; reliability and affordability; autonomy; fairness; and improvement of quality is the main values that public acceptability are conditional upon.

Professor Pidgeon says: “People are rarely just for or against, it’s all down to particular circumstances, and our research is about informing the public debate and identifying what those circumstances are.

“It’s actually quite hard to find a genuine nimby (not in my back yard), in a sense of someone who supports something nationally but not locally. There are often very good reasons why people won’t support something, such as a company irritating local communities by making last minute change with no early consultation. And this is why this social research is so important. You can get people’s opinions and gauge feeling before making decisions.

“The idea is to use social intelligence for the policy makers and energy companies. You do this deliberative work, give people scenarios and find out what they are conditionally for or against and what the conditions are. For example, with wind turbines it’s conditional upon the landscapes they are placed in.”

The research also throws up interesting questions around who should pay for energy transition and reveals the extent of the public’s low trust in energy companies. While 79% want to see a reduction in the use of fossil fuels over the next few decades, and 81% express a desire to reduce their energy use, there is concern about how much they will have to pay. Within this is also a desire for a system that is fair and not unduly disbenefitting the poor. For example, people being offered cheap electricity as an incentive to switch to an electric car but those on lower incomes not being able to take advantage of this because they can’t afford such a car.

“People are prepared to pay some transition costs on their bills, or from taxes, for a fair and sustainable energy transition, but they are also very sceptical as to the motives of government and industry and don’t believe that the energy transition will be delivered in the way they want,” comments Professor Pidgeon. “It’s quite sobering news, especially for the energy companies. People see reports about their high profits and believe it to be unfair that the consumer is then charged for energy transition. They also believe that the government isn’t regulating the energy sector properly and suspect collusion.”

> People are rarely just for or against, it’s all down to particular circumstances, and our research is about informing the public debate and identifying what those circumstances are.

This low trust and perception of excess profit could prove a major hurdle for both energy companies and government when it comes to meeting targets, with the UK Climate Change Committee estimating that around 15% of energy transformation costs need to go on bills by 2030.

Professor Pidgeon believes that any such proposal could be met with very high kickback, and not just from individual consumers but through the media too. “The public wants policy makers to clarify how current changes to the energy system will fit with longer-term plans, and to develop an intelligible and coherent strategy for this,” he says. “If you move ahead with something that is very unacceptable to the public you can end up spending a lot of money but not getting anywhere.”

So, what does our energy future look like? Scenarios include on-shore/off-shore wind, solar power, nuclear energy, low-carbon technologies for the home, or a mixture of these. But the changes don’t end there; it’s not just about the type of energy we receive, it’s the way in which we receive it too. “There are two sides to energy system change: supply and demand,” says Professor Pigeon. “On the demand side, we will need to heat our homes differently and travel differently. When it comes to supply, public preference is for renewable forms of energy. So, you’re reducing use of energy and changing the way you’re making it.”

One of the very high renewable scenarios is lots of wind, wave and solar energy but one of the trade-offs is the need for a lot of demand-side management in the home, as some of these sources of power are variable and don’t meet the peaks that the current system does, such as during the early evening when we are all heating our homes and making dinner.

If we're offered a more high-tech solution, with some fossil fuels and some carbon capture storage, there is less of a problem with demand management but there are other implications such as negative public perception of nuclear power.

Whist overall there is support for changes on the consumer side, there is also some scepticism around particular aspects. For example, proposed electric heating systems and vehicles are not perceived as matching the performance of current models.

In terms of demand-side management, the team found that people were broadly willing to share their energy-use data, although many wanted conditions placed on this, so that they still had some level of control.

Professor Pidgeon says: "In our first study we asked participants if it was okay for an external party to control their lights, so that when there was nobody in the room the lights would switch off. The response to this was quite positive but the moment we proposed a refrigerator that could be delayed from coming on but still keep food cold and fresh, people weren't so keen to hand over control. They didn't believe that this could be done without any health implications. The safety value was very important to them.

"So, people are willing to change but there are definite caveats and they also feel that the changes that industry can make should come first."

Whatever approach government and industry decide to go with, it's going to be a tough job. Future carbon targets are now so strict (net-zero) that anytime we burn some carbon, say by flying somewhere or producing materials that are difficult to substitute, such as steel, we would have to balance it with a negative emission process. That could be planting trees or artificially taking carbon out of the atmosphere, which isn't yet a deployable technology.

"Our economy runs on fossil fuels, so removing them isn't going to be easy," says Professor Pidgeon. "Some things will change more easily; electricity we know is going to

decarbonise, and is already happening, but most houses run on gas. So, heat is a big issue as it probably requires a huge technical transformation somewhere along the line. And even this change won't be enough. At some point, people will have to make larger changes to lifestyle and more seriously consider emissions produced by our travel habits, our diets, and the goods we consume. These areas are currently proving stubbornly resistant to change.

"When it comes to diet, there is a need for a drastic reduction in meat consumption. But this is a prime example of a national habit that is difficult to change. Food choices are very personal and often tied to tradition."

Professor Pidgeon added, "To achieve real and significant change we need everyone on board. It's about working together to decide what a sustainable system is and then having an ongoing conversation about that."

Professor Pidgeon is currently working with colleagues in Social Sciences and Engineering on the FLEXIS project to understand the social and human dimensions of novel future energy systems for South Wales, with a particular focus upon the Neath Port Talbot area. He is also a co-investigator in the new £36m Active Building Centre funded by EPSRC and the Industrial Strategy Challenge fund to develop 'buildings as power stations'. ■

Undergraduate research scheme celebrates 10 years

Tom Knight MChem student

Cardiff University Undergraduate Research Programme (CUROP) celebrated its tenth anniversary in 2018. Established in 2008, the scheme has grown over the past decade and now provides over 200 students with an opportunity to get involved in research each summer.

During the summer of 2008, the programme supported 15 research projects across the University. It has now supported more than 1,000 projects.

Undergraduate students work on live research projects under the supervision of academic staff over a four to eight-week period during the summer holidays. At the end of their placements, students are asked to produce a research poster to display the outcomes of their research at a celebratory poster exhibition.

The students receive additional training and support during this period organised by the Centre for Education Support and Innovation, such as skills development workshops, research poster design and communication sessions.

The scheme is also a vital platform for early career researchers (ECRs) in the University to develop in their role, offering opportunities to engage in and facilitate interdisciplinary research while developing broader transferrable skills.

CUROP is funded by the University and since 2018 has received £10,000 from Santander towards the funding of projects.

Challenge Cardiff spoke to some of the scheme's alumni and academic supervisors to find out what makes this scheme such a success and how it is not only enhancing the student experience but also contributing to the University's vibrant research community.

Thirty years ago, Professor Phil Davies (PhD 1989), School of Chemistry, was being put off science by the way that chemistry was taught at that time. His research project reignited his love of the subject and he has championed providing undergraduates with the chance to do research ever since.

"I used the Royal Society of Chemistry's scheme to employ a student over the summer, when I was asked to manage the pilot programme to CUROP in Chemistry, dreamt up by my colleagues Mike Hewlins and Peter Edwards. It was brilliantly successful, and I promoted the idea around the University whenever I could, until it was finally taken up and became the excellent scheme we have today."

Today he uses CUROP to test out speculative ideas, gather initial data and provide a launch pad for new projects. "A great example of

how useful the scheme can be is the project undertaken by Emir Bouleghlimat looking at acid treatment of graphite surfaces. Emir's work over eight weeks generated a publication and led to a research project that has involved several other CUROP studentships and resulted in three further publications with another two in preparation. Emir subsequently went on to study for a PhD under my supervision and now works as a development scientist."

Another School of Chemistry CUROP success story is MChem student Tom Knight. His eight-week CUROP placement in 2018 was in synthetic chemistry. He started an industry placement with a large pharmaceutical company to work on the research and development of new anti-cancer drugs at the end of the 2018/19 academic year.

"I gained a lot from CUROP and it definitely helped me to secure my industrial placement. I got experience of techniques that are not available in my undergraduate research. They told me at the interview that it really made my CV stand out. As part of the scheme I had to give a talk on my project, which was really fun and gave me confidence in public speaking and helped me with my interview."

Post-doctoral research fellow Dr Emma Yhnell (BSc 2012, PhD 2015) credits the CUROP scheme with her decision to do a PhD. While an undergraduate in the School of Biosciences, she saw an opportunity to spend the summer improving her statistical skills through a CUROP placement with Dr Andrew Shore, her then personal tutor. Her placement involved working with Professor Chris Taylor in the Wales Institute for Social & Economic Research, Data & Methods (WISERD) to look at the way in which the Welsh Baccalaureate was assessed. It was a completely different subject area from her undergraduate degree but provided Emma with the opportunity to improve her research skills. Her research was selected for presentation at the British Educational Research Association conference and led to a peer reviewed research publication in the International Journal of Science Education. As an academic, Emma continues to be an advocate for the scheme.

During her graduate training in the US, Dr Sarah Gerson (School of Psychology) supervised and managed dozens of undergraduate students as part of an active laboratory. She said: "I thought it was unfortunate that most undergraduate students in the UK didn't have those kinds of opportunities (e.g., gaining course credit for working in a laboratory). A source of funding from the University is incredibly helpful to make the internship accessible to students who would otherwise need to find other work over the summer."

"In my field (developmental psychology), a large team is needed to carry out research. A full-time student for eight weeks allowed us to train the student appropriately to be a full and active member of our research group. This meant the student could interact directly with participants, code data, and engage in conversations about the research that opened our eyes to new perspectives."

Dr Kerry Moore's (PhD 2010) (School of Journalism, Media and Culture) first involvement with CUROP was in 2013. She collaborated with Dr Katy Greenland in Social Sciences on an interdisciplinary research project examining the social construction of racism, *The Meaning of 'Racism' in the UK Press 20 Years After the death of Stephen Lawrence.*

> I gained a lot from CUROP and it definitely helped me to secure my industrial placement. I got experience of techniques that are not available in my undergraduate research.

"It was a real bonus that students could gain valuable practical experience working with us, and further advance research skills in ways that could help them in their future academic and working lives.

"Having a research assistant involved in a focused project for a couple of months makes a huge difference to what it is possible to achieve during that period, most obviously in terms of data collection and analysis.

"It also provides ECRs a valuable opportunity to develop supervisory experience. Although I worked as a Principal Investigator on other projects, I learned a lot from my involvement with CUROP about supervising a small research team. The focus on training and developing a researcher and really considering the experience of the role you are defining for them, is positive. Considering things like designing the scope of a small team project realistically, managing timeframes for objectives, and communication require careful thought for a successful CUROP."

Dr Sion Jones (BScEcon 2012, MSc 2016, PhD 2018) (School of Social Sciences) already knew he wanted to pursue a career in research when he graduated and saw the CUROP scheme as an opportunity to gain more experience to help his PhD application.

"I studied several modules on research methods on my undergraduate degree. I enjoyed the experience of carrying out research because I liked collecting data and making discoveries regarding our social world. I was applying for a Coleg Cymraeg Cenedlaethol scholarship to do a PhD in the School of Social Sciences and I felt that gaining more experience through a CUROP placement would help."

He worked with the research team in the Cardiff Unit for Research and Evaluation in Medical and Dental Education (CUREMeDE) exploring trainee doctors' use of a mobile application, which enabled them to search across 17 medical textbooks for reliable information relevant to their practices. The project examined how, when and why the trainee doctors were using the application and the impact it had on knowledge and practice.

"I enjoyed my placement, it provided me with the opportunity to develop several research skills such as using different software to input and analyse quantitative and qualitative data. I presented some of the initial findings at a conference. I was successful in getting the scholarship from the Coleg Cymraeg Cenedlaethol. I believe that the CUROP placement strengthened my application for the PhD. The skills that I developed through CUROP helped me with my PhD research as well as the research projects I've been involved with since."

Professor Amanda Coffey (PhD 1993), Pro-Vice Chancellor for Student Experience and Academic Standards said: "It's great to see how CUROP has benefited both our students and staff over the past ten years. The scheme is an excellent opportunity for students to develop their knowledge and skills through engagement with real-world concerns and contexts as well as helping them to develop their employability skills. Last year we had 100% student satisfaction with the scheme, and this is a result of the fantastic work of our research community who work so hard to provide our students with such an excellent experience during their CUROP placements. Over the years, CUROP projects have not only led to the publication of papers, reports and conference papers but have also been instrumental in finding future research talent and helping to grow the thriving research culture we have here at the University." ■

Understanding postpartum psychosis

Before giving birth to her daughter, Ella, Sally Wilson was totally unaware of a condition that would soon change her life.

Sally wasn't surprised that her labour was painful but, as time went by, she became confused until she lost her grasp on time entirely. She hardly slept and she began to hallucinate.

Sally was experiencing **postpartum psychosis (PP)**.

Now that Sally has recovered, she works as a training coordinator for Action on Postpartum Psychosis (APP), a national charity for women and families affected by PP. She met up with Professor Ian Jones to learn more about PP and the research taking place at the University.

Sally: I first became unwell a few days after giving birth. Is this typical for most women who experience PP?

Ian Jones: Yes, it's a typical situation that the first signs of any problems come very quickly after the baby's born.

When we asked women during our research, about 85% said in the first week. Of those, the vast majority were within the first three days. We are dealing with an illness that has a rapid onset.

Sally: In terms of those first few days, could you describe the first symptoms leading up to psychosis?

Ian: They vary hugely from woman to woman, there's no typical pattern. For many women they may start to experience some difficulties sleeping.

Mood symptoms are common, these can be mixed between low mood and high mood of elation or irritability. Other symptoms include increased energy and psychotic symptoms such as hallucinations and delusions.

Really, the lesson for clinical teams is that something significant happening at that time must be taken seriously. Even if the immediate assessment of the women may be reassuring, things can change quickly.

Sally: Is it difficult to spot those early signs?

Ian: People talk about baby blues and we know that many women, 50% or more, have experience of mood symptoms around that first postpartum week.

'Blues' probably isn't the best way to describe it, as high or changeable mood is just as common as low mood itself.

It's always difficult because for anyone who's gone through labour, delivery, the joy of seeing the new baby, the exhaustion, these symptoms are not uncommon.

Two important things to consider are firstly, how long do symptoms go on for? If it's more than a few days, that's a sign to get help. And secondly, whether symptoms become more severe very quickly.

Sally: I had a long traumatic labour but before that I was well. I had no major history of psychiatric disorders and I was well throughout my pregnancy. Are there any early warning signs or triggers for postpartum psychosis?

Ian: We know that previous experience of mental illness is a big risk factor – women at highest risk are women who've had PP in a previous pregnancy (40-50%).

This shouldn't stop them trying for another baby – it's a decision they need to make with all the information.

Women with previous episodes of bipolar disorder are also at very high risk of PP (around 20%).

Part of the task of services is to make sure women are aware of the high risk and that everyone involved in their care knows this, so as much can be done as possible to keep women well and spot signs that they may be becoming ill.

In about 50% of cases of PP however, like with you, there is no history of psychiatric illness. In these cases, it's a matter of being aware of the symptoms of PP as we discussed – and taking it seriously if these symptoms start in the first few weeks following having a baby.

Sally: In my current role at Action on Postpartum Psychosis, people often ask me, 'Is it because it was a traumatic birth? Is it because they didn't want the baby in the first place? Is it because they have other socio-economic things going on?' Is there any evidence for predictions based on that?

> The important message, though, is women should not be blaming themselves for PP – it's not their or anybody else's fault.

Ian: For lots of health conditions and psychiatric disorders there's evidence that things like social deprivation and life difficulties play a role and can increase risk. When it comes to PP, the role of these issues seems to be much less of a factor than for other conditions.

It seems to be an illness where bad things that may have happened in your life don't play a major role, and it affects women from all backgrounds.

It's common though, for people who've experienced this devastating condition, that can be really severe and can come out of the blue, to try to find reasons for what accounted for it.

But usually there's no obvious cause people can find. It's not anything that's happened in childhood, not something they or their partners have done, no wrong choices.

Often when I'm asked these questions in clinic, I have to say going down that line is not usually very helpful. I can understand why people want to ask these questions though – we want to find reasons for why this happened. The important message, though, is women should not be blaming themselves for PP – it's not their or anybody else's fault.

Sally: I took a long time to get better. I tried different drugs and eventually had electro-convulsive therapy (ECT). What's the evidence for ECT in mood disorders?

Ian: For most women with PP, medication in that early part of the episode can be the important factor in helping them get well.

The difficulty we have is we can't predict which woman is going to respond to which medication – often it's a case of trying different combinations until we find something that suits that individual.

I think what we know about ECT is that it can be really effective. I feel very strongly that, despite its image, it wouldn't be wrong to say it can be lifesaving for some women.

In the long run we need better treatments, that are better able to be targeted so we know what combination will work for individual women. That's why research is so important.

We know from speaking to women through APP that they feel the psychological part of their treatment wasn't done particularly well. Many women feel they needed more help to come

to terms with this illness and the effects it can have on women's guilt and their self-image as mothers.

This is where peer-support is so vital – it's part of the holistic jigsaw to give women the support they need. You found APP support very helpful in your recovery?

Sally: Yes, definitely. I had the peer support, being able to talk to women who'd been through it before offered me hope that I'd get better.

I could see other women having come through it and I guess it makes you feel less isolated. It offered support which was a big part of my recovery.

Ian: That word you used is really important – hope. It's so important.

Such a severe illness coming out of the blue with no warning can mean women and their families can worry that this is how it's always going to be, whereas actually, the really positive news about PP is that although it's severe, for the vast majority of women it has really good outcomes – women do get better.

I think hearing that message from somebody who's been ill themselves and is now doing well is so much more powerful than a doctor or nurse telling you that. I think instilling hope is one of the most important things we can do as clinicians.

Sally: You mention the need to find better treatments, what research are you doing in this area?

Ian: Bipolar disorder is a big area of work for us, and we're recruiting people with experience of this condition to help through the National Centre for Mental Health and our Bipolar Disorder Research Network (BDRN). One area we're trying to understand better is why childbirth can be such a strong trigger for women with bipolar.

I think hearing that message from somebody who's been ill themselves and is now doing well is so much more powerful than a doctor or nurse telling you that. I think instilling hope is one of the most important things we can do as clinicians.

To do this, we need more women with experience of bipolar disorder and PP. About 600-700 women have helped us but we need to push it into the thousands. We'll be launching a new project soon to try and increase those numbers.

We're also running a study with women who are at high risk of PP and are either thinking about pregnancy or currently pregnant. We follow women through their pregnancy to try and understand what particular factors may help us individualise that assessment of risk.

I can only massively thank people who've helped to date and in the future, because without their help we wouldn't be able to do any of this work.

Sally: We've mentioned predicting risk – those with bipolar or previous mental health conditions. Do you believe it can be totally out of the blue? Is there anything underlying?

Ian: I think for somebody to have a severe episode of mood disorder, it probably says there's some underlying vulnerability that's been triggered.

Part of it is understanding what determines that vulnerability, what makes some women very vulnerable at this time. We know this is a complex combination of genes and environment. Probably many thousands of genes that nudge risk up and down, all in combination with things that happen in our lives, our experiences, our personality.

Unravelling this complex mystery is exciting and gives us the prospect of research bringing real benefits to women with PP in the years to come.

My question to you, given the experiences you've had – what do you think is the most important message for clinicians to hear? What would you want clinicians to do or take into account?

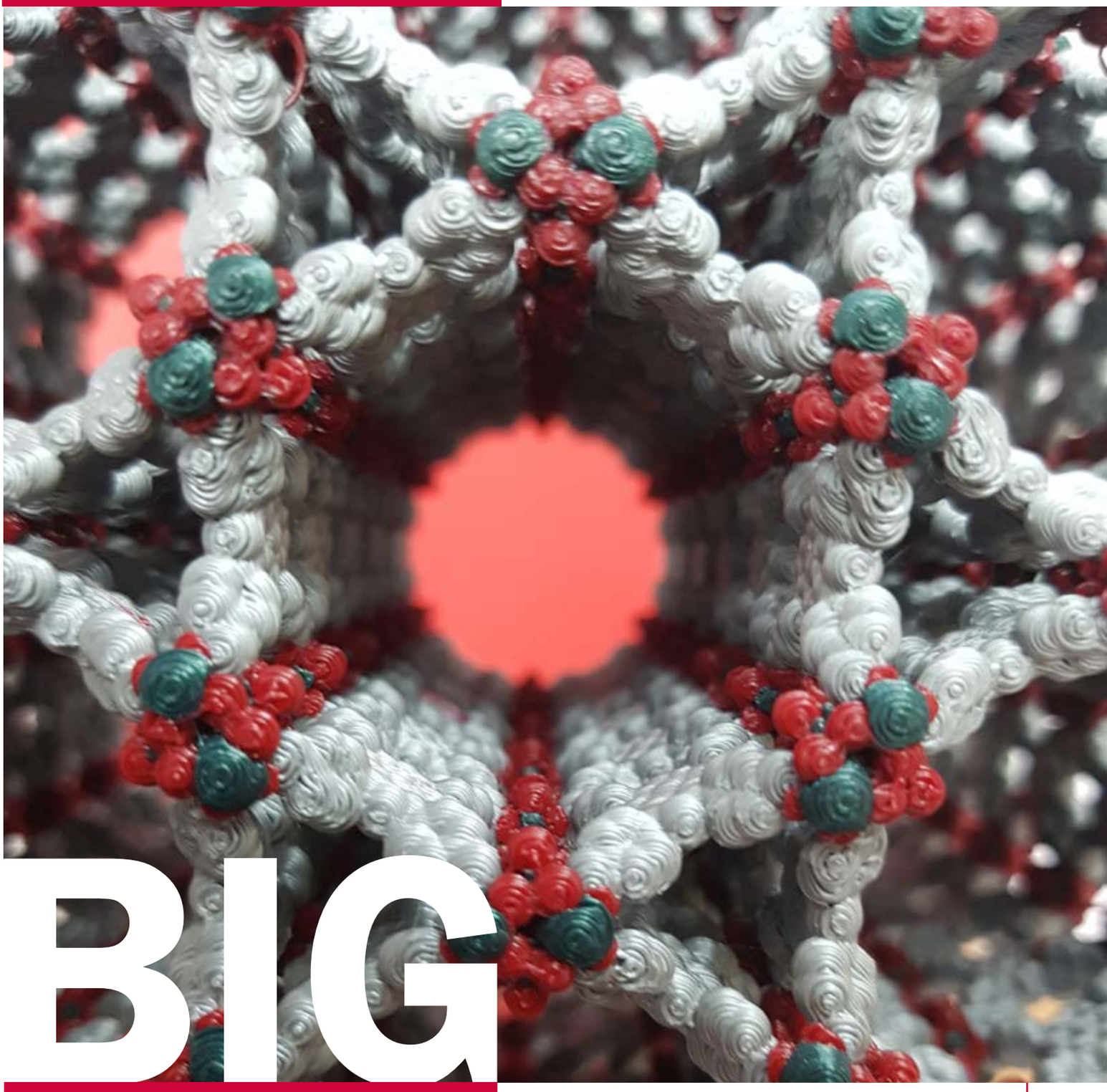
Sally: Lots of things have changed since I was ill, new perinatal teams and specialists. But when I was ill it was the lack of information that was a big problem. Being informed as a patient and a family about the illness and the evidence for treatment and getting better would have helped a lot in the acute phases.

Also, the continuity of care – explaining my story to many different health care professionals, so that meant nobody could really track my progress of getting better or worse.

And maybe, just knowing that these women do get better, so you'll be seeing us when we're very poorly, but we do get better, and to have that in mind.

Ian: Thanks, Sally. This illustrates the importance of having women with lived experience to help set the agenda and help us make decisions when it comes to setting research questions. ■

SMALL SOLUTION



BIG DIFFERENCE

In conversation with Dr Timothy Easun

Challenge Cardiff spoke to Dr Timothy Easun about how his work in materials chemistry is helping to make the world's water cleaner and safer.

Dr Timothy Easun is a Royal Society University Research Fellow in the School of Chemistry and is also a member of the University's Water Research Institute. His work has led to the development of a simple but effective water filtration system that has the potential to provide clean water for small communities in some of the least developed parts of the world.

He said: "My group studies porous solid materials known as metal-organic frameworks (MOFs). MOFs are made up of clusters of metal ions and linkers of organic molecules. We are interested in how you can design and make these MOFs and how the materials behave."

The study of metal-organic frameworks has been going strong for about 20 years in research labs around the world. There are only 15-20 frameworks commercially available and currently there are only four or five products that have MOFs in them. They were originally proposed for applications of gas storage and separation.

MOFs are now being developed for a range of uses such as stopping bananas from going brown when they are being transported, and in wound healing technology. Or in the case of Dr Easun's work, water purification.

They can take up fuel gases like hydrogen and methane, trap carbon dioxide out of the atmosphere, and can be used to separate gases from each other. For example, if you are storing a gas such as methane you don't want carbon dioxide and water in it as the combination can corrode your steel pipes. You want a material that takes out the water and carbon dioxide but leaves the methane behind. Similar processes could also be used in shipping to trap out toxic gases such as sulphur dioxide and nitrogen oxides from engine exhausts.

The work that Dr Easun does began with fundamental science, funded by the Royal Society.

"My fellowship gives me freedom to do research that is interesting but also relatively high risk, and the Royal Society is very good at supporting this type of research.

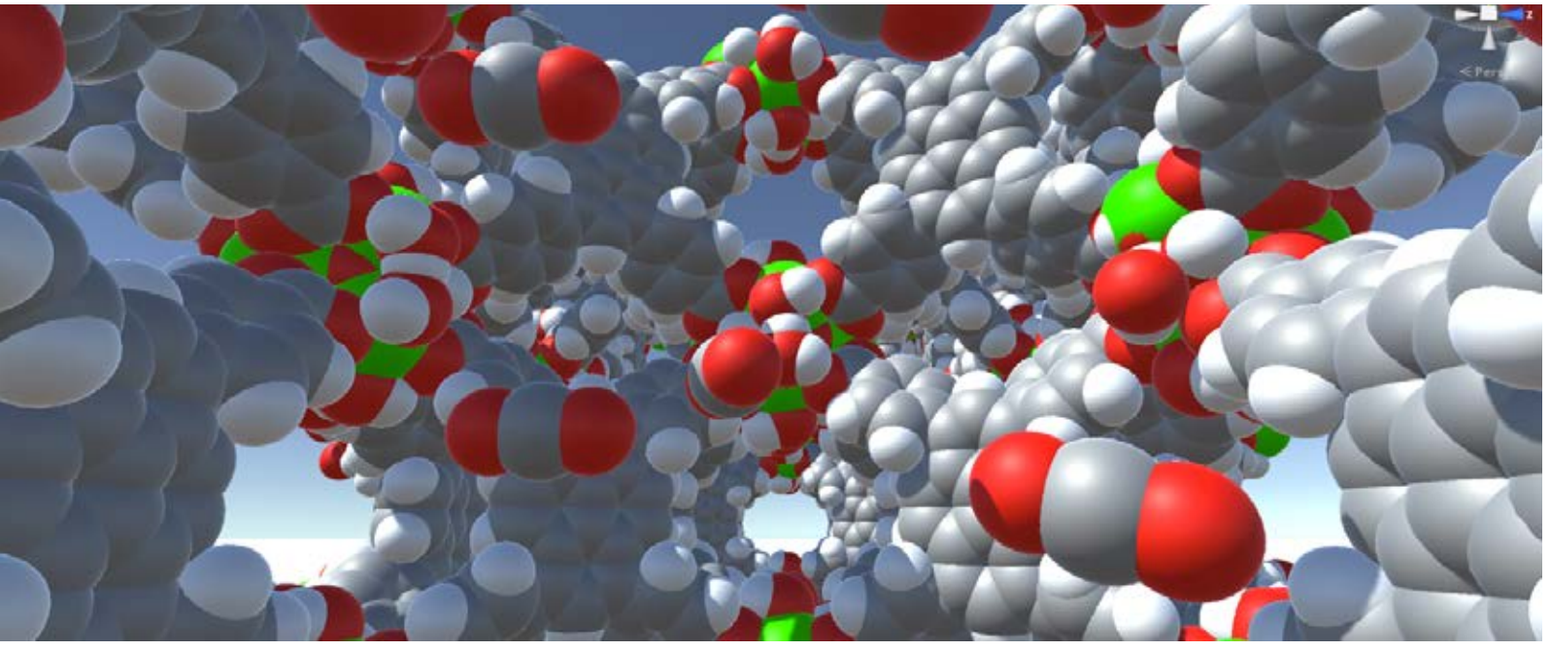
> We hope our system will be used in local distributed networks for houses or villages on a small scale and we could spread lots of small kits around rather than develop one central station that does the job.

"Our work looks at how the small molecules and gases you put inside MOFs move and flow around that network. If you understand the nanofluidic behaviour of molecules, how they are flowing and what the structures are doing, you can understand and then change and control what the frameworks do and what the molecules do. Think of it like squeezing a sponge: you can soak up something useful, like water, but you also want to be able to wring it out as if the water's trapped permanently, the sponge is no use. Ideally, our sponges trap out unwanted contaminants from the water during the process."

Dr Easun is using photochemistry to extract these unwanted contaminants. "We use light as a stimulus to extract the unwanted materials as you can do this without having to add any extra chemicals, anything that could destroy the framework or could make re-use of the MOFs difficult," he said.

"The photochemistry we are doing involves structure change. We use sunlight as a free energy source. We shine a light on the MOFs so they absorb energy and change structure; this can make the pores close or open more. This can change the porosity and voids and the channels down which molecules can go, but we can also change the chemistry of the MOFs including which molecules are trapped by them and what will react with them.

"This gets us on to water. When I started in Cardiff four years ago, in addition to the fundamental science we were going to do, I had a vague idea we could do something with water purification as one of several possible ideas for applications. Then, a couple of years ago, an opportunity came up with the Royal Society to apply for a Global Challenges Research Fund (GCRF) Challenge grant for a one-year post-doctoral researcher (Dr Adam Nevin) to do something practical with the work. He spent a year making new materials, scaling them up and optimising them. He also spent time with a collaborator of mine, Dr Richard Bourne at the Institute of Process Research and Development



at Leeds University. Within the space of a year, we'd gone from 'these are materials we could do something with' to a lab-scale working prototype where we can desalinate a small amount of salty water and then regenerate the material using light."

Dr Easun is working with the University's Water Research Institute to translate his fundamental science to real-world applications.

"We can use our work to trap toxic ions or salt out of sea water, for desalination, or to trap charged ions of value such as gold out of sea water. Once we've trapped it, we also need to get it back out. There is no use having a sponge that soaks something up but doesn't let it go. That's why we are using photochemistry. We are using UV or blue light stimuli to trap ions and red light to make our 'sponges' release them.

"We flow saltwater through the material under the blue light, which we can get from the sun, and we use the MOF filter to trap out salt. Once it's saturated we change the light colour using a cheap filter (or cover with black cloth if it's a hot day) and get a release of ions that are trapped into a waste stream so we get alternating streams of desalinated water and extra salty waste water."

Dr Easun is on the management board of the University's Water Research Institute and this has had a significant impact on his research. "I am a materials chemist and we had technical ideas about water purification, but we just didn't have the context to understand the global problems of water pollutants. Our role is to start with fundamental science and see how it can be applied.

"What's dissolved in water spans an enormous amount of chemistry, with many ions as well as sodium chloride. We also don't want to take all the salt out of the water as if it's completely deionised it's not good for you. We were not fully aware of the challenges. We also weren't aware of what was in groundwater around the world. As a result of the Cardiff University Water Research Institute we have access to expertise and understanding that means, for example, now we know we could target manganese and arsenic in places such as Bangladesh where the geology is such that there are these toxic species in the water.

"The other thing I am much more aware of and hadn't really appreciated is the people. You need contacts in the water industry in the United Kingdom and further afield. With the Water URI, we are also part of the GW4 Water Security Alliance, which gives us access to a broader range of expertise and which has helped us to understand the sociological and geopolitical challenges related to water. It turns out how you deploy equipment isn't just a technological problem, and as pure scientists we maybe don't consider this as much as we should.

"Our new contacts are good at saying 'if you do that no one's going to use it', or 'the challenge isn't what you think it is, it's this…'. For example, in some parts of the world people are drilling private bore holes and this contaminates the water. What they contaminate it with depends on how they do the drilling, and this has consequences for everyone else using that water. Geology and local industry impact on water and the issues are not quite the same in any two places. That makes any new technology development complicated."

Challenge Cardiff asked Dr Easun if having a better sense of the geopolitical and sociological context helps him to improve his research and focus and understand more about the context of how the fundamental science can be applied. He said, "With the MOFs, there is an infinite scope of what we could make. It's good to have guidance on what's needed and necessary, and what's of interest so we can reduce that to a manageable nature. There are lots of metals in the periodic table we could use for MOFs for water purification, but some might be toxic to human health. For example, if we made a MOF from chromium, even a small amount of leaching could make the situation worse. So, we wouldn't use a MOF made from that."

◄ **Dr Timothy Easun**

The goal is to make his system completely sunlight driven. "We pour water into a packed bed, put it out in the sun, and the water filter operates from using sunlight. It's extremely simple and wouldn't even need moving parts (other than buckets!).

"We are not ever going to compete with purifying hundreds or thousands of gallons at a time like they do in thermal desalination plants. These are often great for people near the coast but not people further in land. We hope our system will be used in local distributed networks for houses or villages on a small scale and we could spread lots of small kits around rather than develop one central station that does the job."

Potentially, the filtration system they are developing could be life-changing, but he says they also need to think about who will be using this equipment. "In countries which have a skilled and educated workforce and population this isn't an issue, but if a region has low skills or education levels, these are things we need to consider. We need a system that is robust, easy to use, low cost and doesn't contain a lot of moving parts that need replacing. You often find that a pump or drill will be sent to a community and when it breaks nobody locally knows how to fix it and so they go back to what they were using before. We need to provide something that is simple, straightforward, recyclable or easily fixed and won't fail in the medium to long-term."

He concluded: "We now have a PhD student funded by the Royal Society, who started by reproducing what Adam did. He is already making new materials based on our initial work. I'm very excited to see what happens. We are talking to water companies and collaborators. We are developing materials first, starting with what we know, working out what we can do, with the goal of deployment in the longer term." ■

Wales' first multi-disease biobank opens in Cardiff

The University has opened a new facility with the capacity to hold up to a million biological samples for medical research.

The Cardiff University Biobank, launched in October 2018, is situated in a new, purpose-built facility at the University Hospital of Wales, and offers high-quality human biosamples for academic and commercial research.

Led by Professor Phil Stephens, the Biobank provides a large storage space for nearly one million biological samples including blood, urine, tissue and saliva. Patients and healthy volunteers kindly donate these samples to enable researchers to gain a deeper understanding of diseases. The samples are crucial in allowing researchers to find better ways to diagnose, prevent, and treat a wide range of serious and life-threatening illnesses.

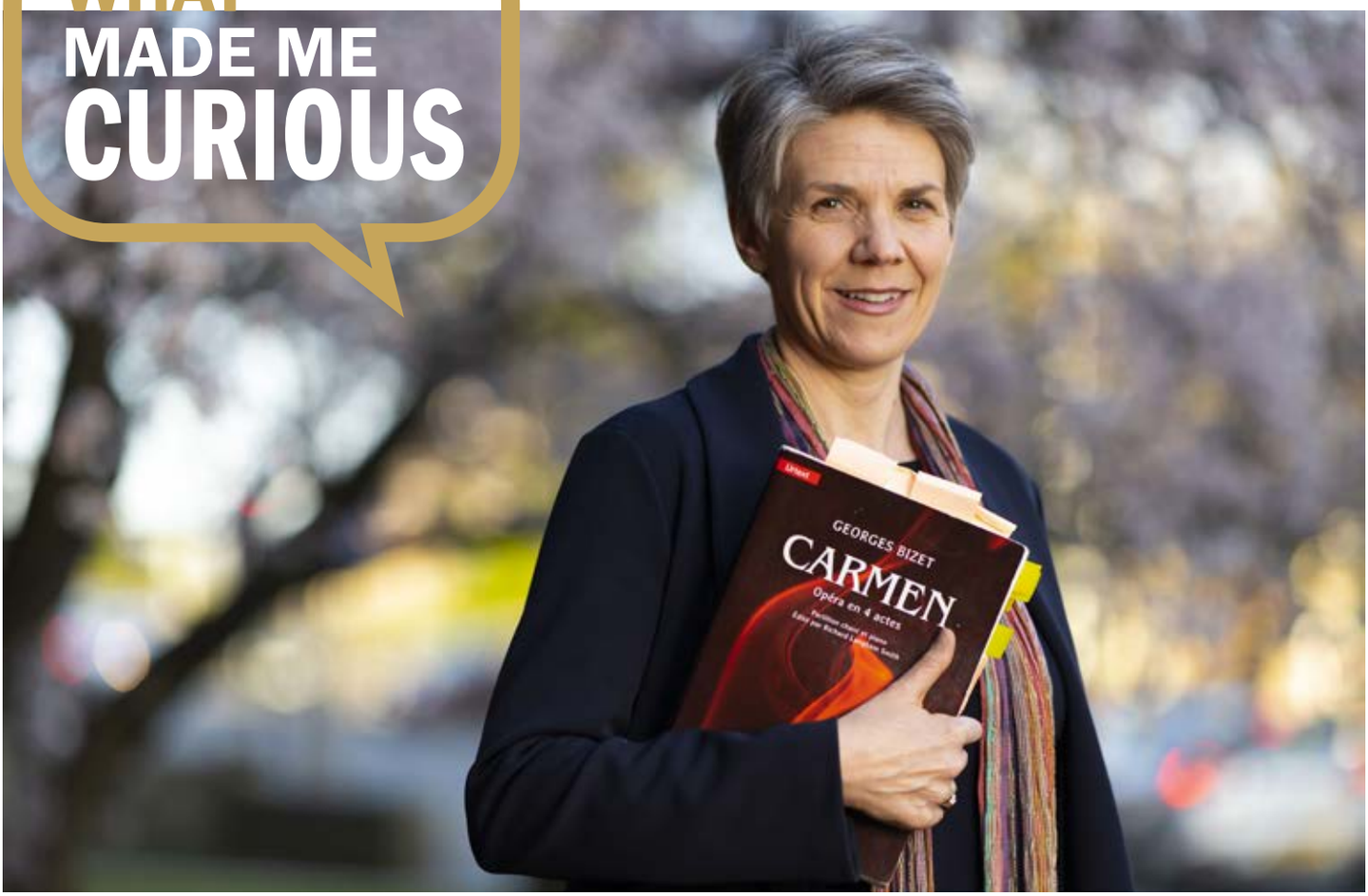
Once the samples have been collected (after fully informed consent from the individual), they are then stored in the Biobank until they are later accessed for use in medical research. The Biobank is fully equipped with a range of storage facilities, including ultra-low minus 80-degree freezers and vapour-phase liquid nitrogen, to keep samples at the required temperature. Samples are then provided to researchers in fresh, frozen or processed format. The Biobank also offers dedicated lab space for sample processing and a phlebotomy suite for blood sample collection.

The Biobank will allow researchers from the University and across Wales, the UK and beyond to have access to high quality biological samples. Crucially, samples can only be used for scientific research that is for patient and public benefit. All applications from researchers to access the samples will be approved by an experienced independent committee, to ensure that they are used in high quality medical research with far-reaching impact.

As with all other biobanks, Cardiff University Biobank has robust procedures and policies in place for all activities which it undertakes. The facility adheres to relevant biobanking standards and has recently been awarded certification to ISO 9001:2015 for its quality management system.

It is hoped that the Biobank will eventually form part of an all-Wales biobanking infrastructure. Currently, the University hosts eight separate research tissue banks including the Wales Cancer Bank and Wales Kidney Research Tissue Bank. The new facility provides an umbrella support structure for each of these, ensuring their long-term sustainability and the continuation of robust governance procedures. It will also boost access for researchers to new bio-samples in other disease areas. ■

WHAT MADE ME CURIOUS



Inspiring the next generation of musicians is what drives Dr Clair Rowden. A reader in musicology at the School of Music, she specialises in opera and 19th-century France.

"I am a singer and I think the human voice touches me in a way that other musical performance doesn't," said Dr Rowden, who has coached the University's operatic society in their production of Carmen. "Conveying the complexities of opera to students is hugely enjoyable. This art form is a spectacle. It's the coming together of many elements – music, drama and art – and that throws up its own unique challenges."

At Cardiff University, Dr Rowden has focused on Bizet's *Carmen*, exploring the ways it developed from its very first performance to the modern day. A 'performance urtext' edition of the *Carmen* vocal score, which she edited in collaboration with Professor Richard Langham Smith, has led to a number of creative and musicological projects, one being the conference, *Carmen Singer of the World* in 2017, where academics from around the world met to exchange on a multitude of performance traditions.

"People are always trying to find new ways of 'dealing with' *Carmen*," she said. "Our aim was to develop a working score based on the first performances, one that could be used by directors and performing groups to help them find new and informed ways of telling this much-loved story.

"An opera will always be changed in performance. Because of the material conditions, financial constraints, the cultural backdrop against which it is made. Each production has an opportunity to reinvigorate it and present it in an engaging way."

A further project, **www.CarmenAbroad.org**, follows the digital turn in the humanities to present information and archival sources about performances of *Carmen* worldwide up to 1945 in an interactive online map and timeline. A British Academy/Leverhulme research grant was awarded in March to develop the site further.

"CarmenAbroad.org is designed to complement the forthcoming book of the same name and the score, and reveals the wealth of creativity that has come out of the telling of this compelling story."

"An opera is continually evolving. It travels across borders, is translated and adapted. The journey this art form takes and has in turn, taken me on, has been absolutely thrilling."

She may be recognised as a leader in her field, but Dr Rowden is quick to acknowledge the huge influence key mentors have had on her.

"Other people have always seen my potential before I have," she said. "I was lucky to have teachers who encouraged me. A lot of young people, often women, lack confidence and unless those around them lay it on the line they will never know."

"It's something that has remained with me in my teaching today. It's up to all of us to make sure those who show promise are aware of it and that it's nurtured."

Dr Rowden's interest in music started at a young age, when, as a seven-year-old, she asked her mother if she could have some piano lessons.

> "An opera is continually evolving. It travels across borders, is translated and adapted. The journey this art form takes and has in turn, taken me on, has been absolutely thrilling."

"I lived in a tiny village where all the kids knew how to play something, and I didn't," she said. "I also always wanted to sing. My mum wasn't a churchgoer but took me to church every Sunday so I could sing in the choir. It grew from there."

It was when she started her A-levels that this interest became a vocation.

"I had a teacher, Deborah Mawer (now a Professor at the Royal Birmingham Conservatoire), who was finishing her PhD. She was inspirational for music history," said Dr Rowden.

"I was tasked with writing an essay and just given a title to work from. This was the first time I'd been sent to the library to do my own research."

A degree in Music at Goldsmith's College, University of London, followed. Once she graduated, she took a year out to work as an au pair in Paris.

"I was working for two professional singers. I was able to sit in on their rehearsals while the baby was asleep in the dressing room. Away from my studies, it threw me into the world of professional performance and provided me with insider knowledge."

It was also there that she met her husband Pierre-Maurice Barlier, a vocal coach with whom she regularly collaborates.

Intent on pursuing an academic career, Dr Rowden returned to London to study a master's degree at City University. But a chance phone call from the prestigious National Opera Studio delayed her start.

"I'd sent them a CV as an undergraduate and they got in touch as they were looking for administrative support. So, I deferred my master's degree to go and work as a PA to its then director, the hugely influential and much regretted Richard Van Allan."

The work gave Dr Rowden first-hand experience of dealing with logistical challenges behind the operatic scenes. "The National Opera Studio is the last training school for opera singers before they take to the international stage. I was responsible for scheduling meetings and rehearsals, looking after the library, writing any correspondence for the director. It turned my focus to the practical tasks of opera rehearsal and production which underpin the performance seen by an audience."

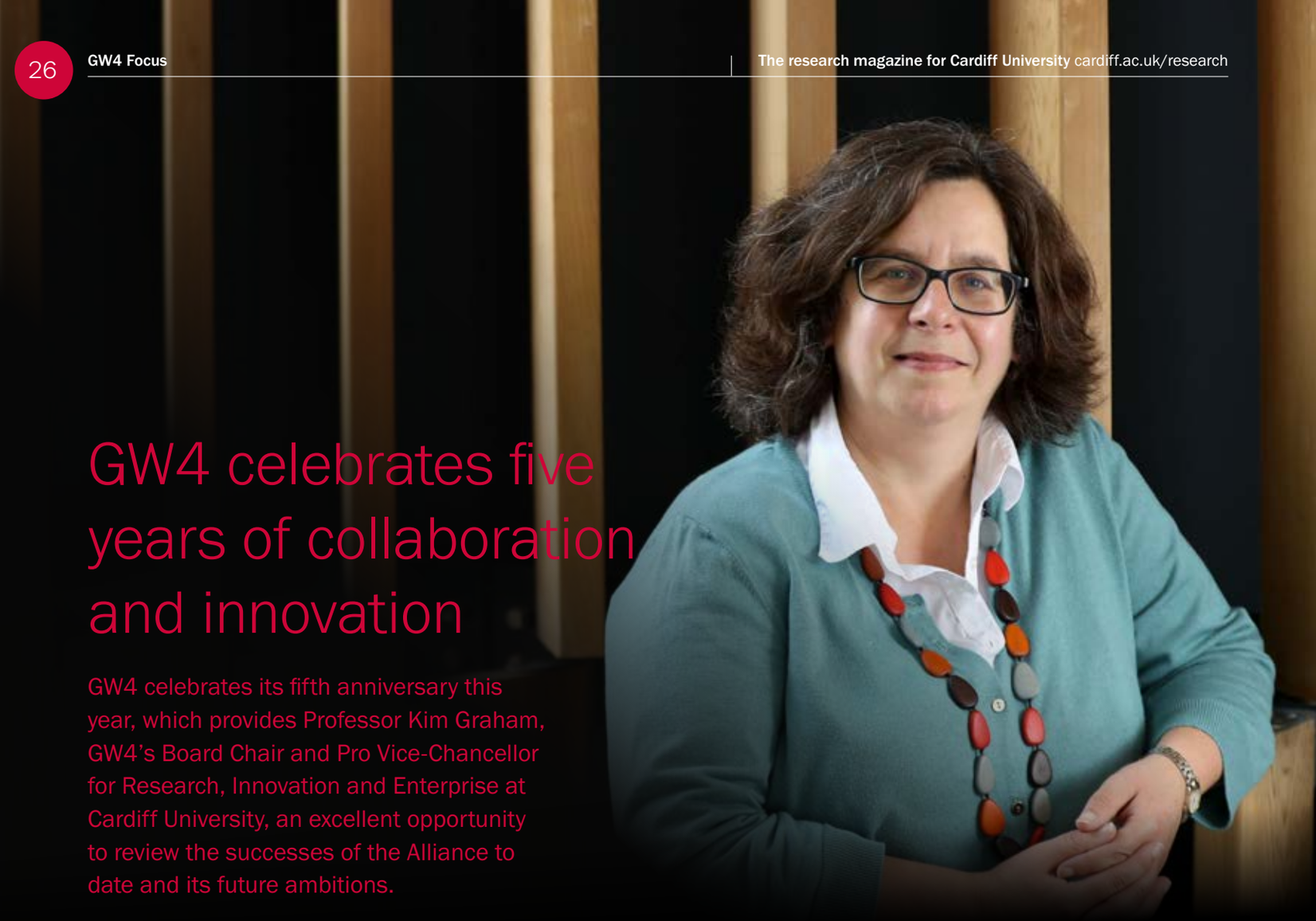
Dr Rowden went on to study an MA (Performance) at City University. It was later at City, when working on her PhD, that her supervisor Professor Annegret Fauser helped consolidate Dr Rowden's future ambitions and gave her the support needed for her thesis, *Massenet, Marianne and Mary: Republican Morality and Catholic Tradition at the Opera*.

"She was truly inspirational," said Dr Rowden. "You'd go into a supervision and she'd throw everything at it. But she always left the direction to follow up to me – she was never prescriptive. She was quite clear she could see my potential and she helped me enormously with my confidence.

"She pushed me to present at conferences and encouraged me to create my own networks of scholars with whom exchange was possible.

"The first time I gave a paper at a conference I was nervous, but afterwards I realised my strengths lay in communicating my research to others."

She added: "It's quite a solitary pursuit and you have to be pretty single minded. But I get excited every time I walk into a library and find a new piece of the archive. It's not necessarily the narrative you planned on at the start but that's what makes it so fascinating." ■



GW4 celebrates five years of collaboration and innovation

GW4 celebrates its fifth anniversary this year, which provides Professor Kim Graham, GW4's Board Chair and Pro Vice-Chancellor for Research, Innovation and Enterprise at Cardiff University, an excellent opportunity to review the successes of the Alliance to date and its future ambitions.

Since joining GW4 as Chair of the Board in September 2018, I have really enjoyed working with colleagues across the Alliance to champion research and innovation in our region. This is an exciting time for GW4, with considerable opportunity and proven success in obtaining large-scale investment supporting delivery of innovative cross-institutional programmes which have the potential to be world-leading.

The GW4 Alliance brings together four of the most research-intensive and innovative universities in the UK: Bath, Bristol, Cardiff and Exeter. The Alliance allows us to identify areas of complementary expertise across the universities and develop research communities at scale able to address major global and industrial challenges.

GW4 has seven research foundations, based on our regional strengths and expertise. These are Aerospace and Advanced Engineering; New Energy Systems; Next Generation Microelectronics; Resilience, Environment and Sustainability; Creative and Cultural Economy; Living Well; and Digital Innovation.

GW4 has seen major successes in each of these areas and is able to draw on previous successful initiatives and existing partnerships as well as developing new collaborations to engage with the Government's Industrial Strategy Grand Challenges.

For example, in the industrial challenge area, Future of Mobility, the Institute for Advanced Automotive Propulsion Systems (IAAPS) is set to open in 2020 and will be a new research and innovation facility based at the Bristol and Bath Science Park. In the Ageing Society challenge area, GW4 benefited from two large MRC Dementia Institute Momentum Awards, to Bristol and Cardiff, with a further £20m funding into the Dementia Research Institute Centre at Cardiff University. Funding from Alzheimer's Society to Exeter, also involving Cardiff, on living well with dementia further cements our region's considerable strength in aging research.

Our region's creative industries are also going from strength to strength, receiving two Creative Clusters awards for Cardiff and Bath/Bristol, with the universities working with a range of partners across the South West. Channel 4 also announced Bristol as one of their creative hub locations, enabling them to work closely in partnership with Cardiff and its production sector, further cementing our region's creative research and development potential.

This demonstrates how our universities are important drivers of regional economic growth and innovation in the Great West region. The strength and scale of our network is such that we can mobilise businesses, industry, government and third sector organisations, acting as a regional connector to deliver sustained investment via a coordinated response to the UK Government's Industrial Strategy.

For example, Cardiff University's partnership with microelectronics manufacturer IQE, formed the basis of the world's first compound semiconductor cluster, CSconnected. Compound semiconductors are the technology of the future, and this foundational investment is now helping the region engage in other industrial challenge areas, such as the 'driving the electric revolution' challenge. . The economic importance of this sector was highlighted in The South West England and South East Wales Science and Innovation Audit (SWW-SIA). The Audit was undertaken by UK government and a consortium of organisations and businesses from the region including GW4. The SWW-SIA also found that our region is home to the strongest aerospace sector in the UK, the most productive digital economy in the UK outside London, and has more climate

expertise than any other area worldwide. The latter includes the Met Office headquarters located in Exeter, and the Water Research Institute at Cardiff University. Further realising the opportunities identified in the Audit, Research England recently announced funding for the £100m Bristol Digital Futures Institute at the University of Bristol and The Centre for Resilience in Environment, Water and Waste at the University of Exeter. These research centres will be at the forefront of developing innovative solutions that benefit the environment, global societies and the economy. The Bristol Digital Futures Institute based at the University of Bristol's new Temple Quarter Enterprise Campus will bring together researchers from different disciplines to create new approaches to digital innovation and social change, placing people and society at the heart of innovation. The Centre for Resilience in Environment, Water and Waste – a joint venture between the University of Exeter and South West Water – will conduct world-leading research into the provision of safe and resilient water services in the UK and overseas.

GW4 is committed to developing new and exciting collaborations. In February we announced funding for 12 new collaborative research communities, bringing GW4's investment in research communities to over £2.8m, realising a return on investment of £12 for every £1 spent. The GW4 Board approved significant funding to the GW4 Water Security Alliance, one of the largest collaborative water security research endeavours in Europe. This demonstrates GW4's aim to further develop research at scale leveraging our considerable research capabilities and external partnerships to make a real difference to society.

One of our previously funded GW4 research communities led to the development of VSimulators, a world class national research facility currently under construction at the universities of Bath and Exeter. VSimulators provides a unique capability to physically and virtually recreate different environments, such as tall buildings, offices and stadiums to measure the impact of motion on people's health and well-being. The GW4 community aimed to change the way that structures are designed and operated within the built environment and included researchers from across the Alliance. The community received GW4 funding, and support to catalyse the project and scale up their research. This led to a £4.8m Engineering and Physical Sciences Research Council (EPSRC) grant along with significant co-creation funds from the universities of Exeter and Bath, to bring total funding to £7.2m.

In the most recent funding round of GW4 Building Communities, I was delighted to see a strong level of interest from our early career researchers, demonstrating their engagement in working across the region from early on in their academic careers. The sustainability of GW4 will be delivered by these future leaders, in whom collaboration comes naturally, going beyond traditional disciplines, institutions, and even in GW4's case, countries. Our GW4 Crucible programme provides hands-on training and mentoring to help develop these collaborative research leaders of the future. This year's theme was digital innovation – a broad topic and one ripe for interdisciplinary research, so very fitting as a GW4 Crucible topic. Digital Innovation is one of GW4's priority areas as outlined in our Vision and at the heart of the UK government's industrial strategy. As a group of universities and a region, we take a leading role in developing digital technologies including our deep-tech digital excellence in microelectronics, high value design, quantum engineering, cyber security and virtual and augmented reality. And it is core to many of the universities' exciting developments, from Bristol's new Temple Quarter Enterprise Campus and the University of Bath's Institute for Advanced Automotive Propulsion Systems (IAAPS).

Finally, the successes of GW4 would be incomplete without mentioning our highly sought-after PhD training programmes. Our programmes are highly collaborative, involving a range of academic and non-academic partners. For example, the AHRC South, West and Wales Doctoral Training Partnership is a consortium of nine universities and other organisations, including museums, providing postgraduate studentships and training to develop talent and creativity. The GW4 Alliance recently received more EPSRC funded Centres for Doctoral Training (CDTs) than any other regional alliance, despite other consortiums consisting of more universities. These include a new CDT in Advanced Automotive Propulsion Systems at the University of Bath where students will have the opportunity to develop invaluable skills through intensive research projects within its new £60m automotive propulsion research facility, IAAPS. At Cardiff University a new CDT in Compound Semi-conductor Manufacturing will provide excellent PhD training aligned with the needs of the UK industry. This CDT is a partnership of four universities and 24 companies, many already working closely together via the EPSRC Future CS Manufacturing Hub, based at Cardiff University. The University of Bristol received funding from EPSRC for nine CDTs – the highest number awarded to any university in the country. These centres will train and equip our talented engineering and science students with the skills needed to tackle global challenges such as sustainable energy and cyber security. GW4 universities also received funding for CDTs in Artificial Intelligence, including the University of Exeter's new centre which will lead pioneering research into using AI to increase society's resilience to changes in our environment.

GW4 has much to celebrate as it reaches its fifth birthday, and as universities we should be proud of what we have achieved in such a short time. This success has been delivered by a small core team, with representatives at each university leading on different GW4 themes, including sharing research infrastructure; building capacity and developing people; communications and connectivity; and building communities.

The ability, passion and innovation of this team have been truly impressive; they have brought together researchers to work collaboratively, showcased the very best of our region, and developed GW4 into a world-leading research and innovation hub across our seven Foundation areas. What an extraordinary start; if this is what we can achieve, together, in only five years, imagine what we can do in the next five! ■

GW4 five year anniversary

GW4 officially celebrates its fifth anniversary this year, following the GW4 launch event at the House of Commons in October 2014.

The GW4 Roadshow visited each university with Dr Sarah Perkins, GW4 Director, presenting GW4's achievements and future aspirations to the Senior Management Teams.

In October 2019, GW4 will host a research showcase and networking event in London, to celebrate our considerable achievements and collaborations to date, and set out our exciting plans for the future with our partners and key stakeholders.

Keep up to date with GW4 with our newsletter and on Twitter to find out more

Follow us **@GW4Alliance**

Subscribe to our newsletter via our website: **http://gw4.ac.uk/**

Research helps race to go green

Cardiff University has been carrying out research with thousands of runners as part of its title sponsorship of the Cardiff University Cardiff Half Marathon. This impactful research is helping shape the way the event is organised, including reducing any negative environmental impact. Researchers Dr Andrea Collins and Professor Max Munday discussed their latest findings with Matt Newman, Chief Executive of race organisers Run 4 Wales.

The figures are large. The Cardiff University/ Cardiff Half Marathon's 20,000 runners travel millions of kilometres to complete 13.1 miles – spending £2.3m in the process.

Organisers know this detail about runners' travel and spending habits because Dr Andrea Collins and Professor Max Munday have painstakingly researched the event during the past two years.

Run 4 Wales, which also organises other running events in Wales, including the Newport Marathon, is using the data to inform its decision-making and further develop what is now the second largest half marathon in the United Kingdom.

The research is broad, covering many aspects of the race-day experience.

Besides travel and spending, the research considers participant age, race satisfaction, recycling habits, previous half marathons and even whether runners achieved that all-important personal best.

Findings from the 2017 research were used by Run 4 Wales Chief Executive Matt Newman and his team to inform planning of the 2018 race.

The research has particularly supported Run 4 Wales in one of its key aims – to make the event more environmentally friendly, a major challenge for a mass participation race.

Thanks to the partnership between the not-for-profit organisation and the University, real progress is being made.

Dr Collins, from the University's School of Geography and Planning, explained: "As a result of what Run 4 Wales has done encouraging runners to travel in a more sustainable way, there was a very positive impact in terms of being able to reduce the environmental impact of runner travel in 2018.

"There was an increase in walking (8%), cycling (2%) and using the bus (5%), and a decrease in car use (2%) and air travel (12%).

"We used these figures to calculate what the reduction in CO2 travel emissions would be and found there was a 49% reduction in runners' travel footprint.

"A substantial portion of the 49% reduction was due to a fall in runner air travel, but there was a definite shift by runners to use more sustainable transport which had a positive effect on CO_2 emissions."

This progress is important for Run 4 Wales, which has drawn up a green action plan for the first time, informed by the research.

Professor Max Munday, Matt Newman and Dr Andrea Collins

Mr Newman said: "We were delighted that people were taking more environmentally friendly forms of transport to get to the event.

"After 2017, we improved our communications about the travel options for runners to get to the event on race day and there has now been an impact on the CO2 emissions.

"One of the longer-term benefits of this research is that we can sit down and have a conversation with bodies such as Transport for Wales and present them with our evidence.

"We've also created a green action plan for the first time, partly because of the culture of Run 4 Wales and the fact that we feel it's the right thing to do, but also with a steer from the research of the University.

"We're already changing the way we do things, so for example the goodie bags that we give to runners at the end of the race have always been the supermarket-type bags, but we've now moved to biodegradable bags."

As a not-for-profit organisation, Run 4 Wales is able to put social and environmental goals at the heart of its work. But it must still deliver profits to be reinvested in running in Wales.

A successful business understands its strengths and, thanks to the University research, Run 4 Wales now knows exactly how much Cardiff Half Marathon runners contribute to the economy.

Professor Munday, of Cardiff Business School, told Mr Newman that in 2018 the runners alone spent more than £2.3m, but the amount the event generated was likely to be several times that figure.

"It's an event at a quiet time on a Sunday, however figures suggest some £2.3m to £2.4m is being put into the Welsh economy by the runners," said Professor Munday.

"Much of that is in Cardiff but some of it is elsewhere in Wales.

"And this is not taking into account the trickle-through effects or the spending of the spectators, so it's likely to be some multiple of that.

"It's on a Sunday so some of that may be deemed additional spend because people might otherwise be at home on a Sunday morning."

Mr Newman added that he could not overstate the importance of having this type of information about the event's impact.

"When we're meeting stakeholders like Cardiff Council and Welsh Government, this allows us to have an evidence-based conversation about it," he said.

"We have to be able to demonstrate the positive impact that the race has."

The Cardiff University/Cardiff Half Marathon is the latest major event that Dr Collins and Professor Munday have researched going back many years.

Starting with the FA Cup Final of 2004, they have looked at the impact of sporting events

including Six Nations rugby, the Tour de France Grand Depart and the UEFA Champions League Final, and also cultural events such as the Hay Festival, Swn Festival and National Eisteddfod.

Their work has contributed to the development of UK Sport's eventIMPACTS toolkit which provides organisers of events with guidance and good practice principles for evaluating the economic, social, environmental and media-related impacts of their event.

Professor Munday said that their research covered a diverse set of events, but the Cardiff Half Marathon differed from others because it was research with participants, rather than spectators.

"It's much easier to get data at the Cardiff Half Marathon than for the football and rugby events because we have great access thanks to our excellent relationship with Run 4 Wales," he said.

"We have a lot of data from a lot of participants – almost 5,000 runners took part in the 2018 survey, a huge sample size.

"That gives us a great level of confidence in the findings because we have such a good sample size."

This allows Run 4 Wales to know, for example, that 93% of runners said they were likely or very likely to run the event the following year, and that the race medal in 2018 was rated as good or excellent by 97% of runners.

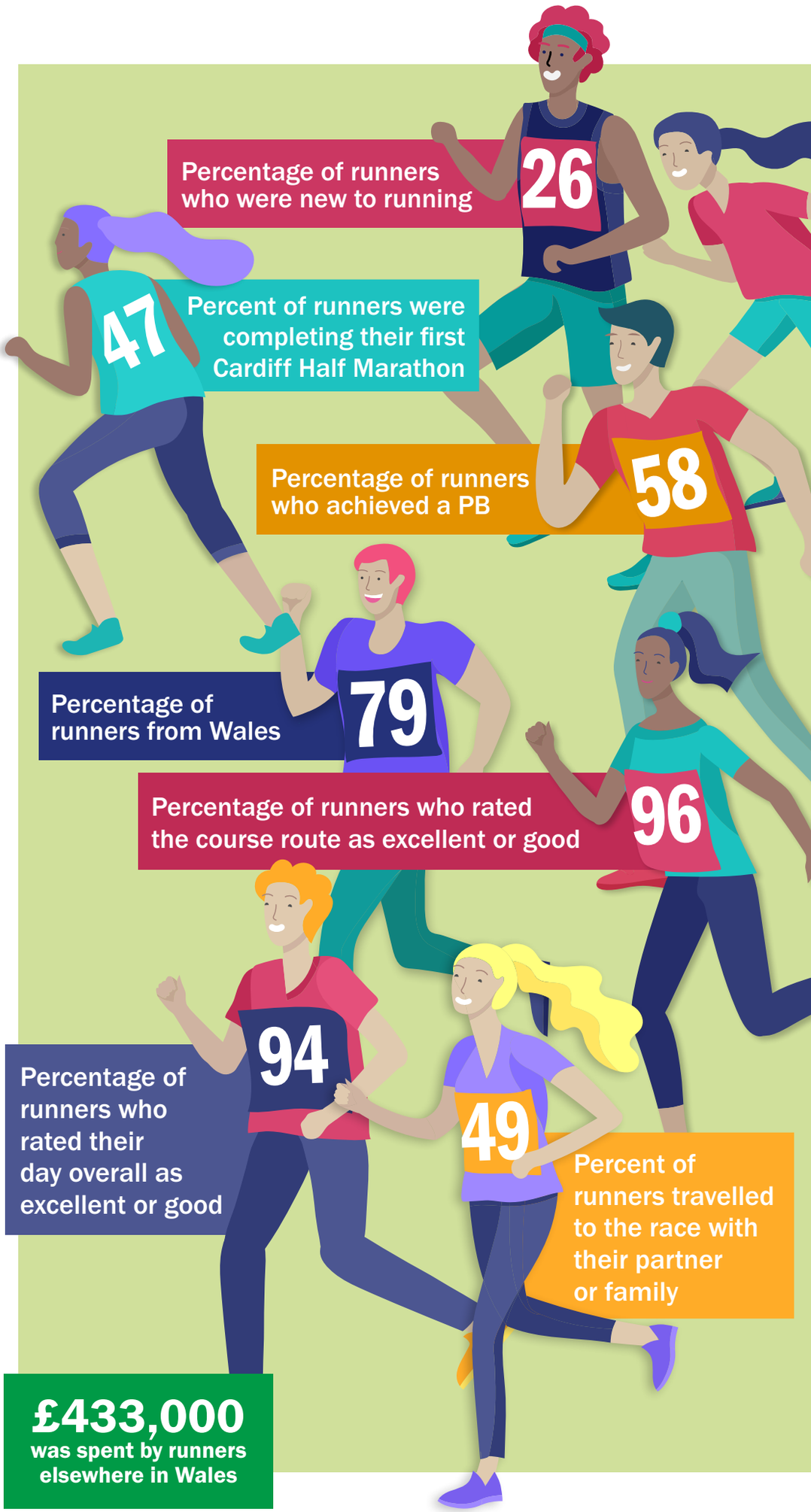
This level of detail is important to race organisers as they seek to offer a better race experience year after year.

Mr Newman added: "The research is helping on many fronts and it's helping the organisation to evolve.

"Not least there's the customer experience because the runners know that we will do something with their feedback to make the event even better.

"Our green action plan is real and tangible and we're also capturing some of the social benefits that we talk about as well as the economic benefits.

"All of that helps us to evolve so I want to say a big thank you to Andrea and Max for the work that you have done." ■



IMAGES OF RESEARCH

On 11 December 2018, over 150 people gathered for the Doctoral Academy's fifth Images of Research event. Images of Research is one of the Doctoral Academy's most popular annual events, and attracts a wide audience of researchers, Cardiff University students and staff, and the general public.

Earlier in the year postgraduate research students from across the University were invited to submit an image that encapsulated their PhD, along with a short description. A record number of entries were received and 40 were shortlisted. These images were displayed in an exhibition in the Hadyn Ellis Building atrium.

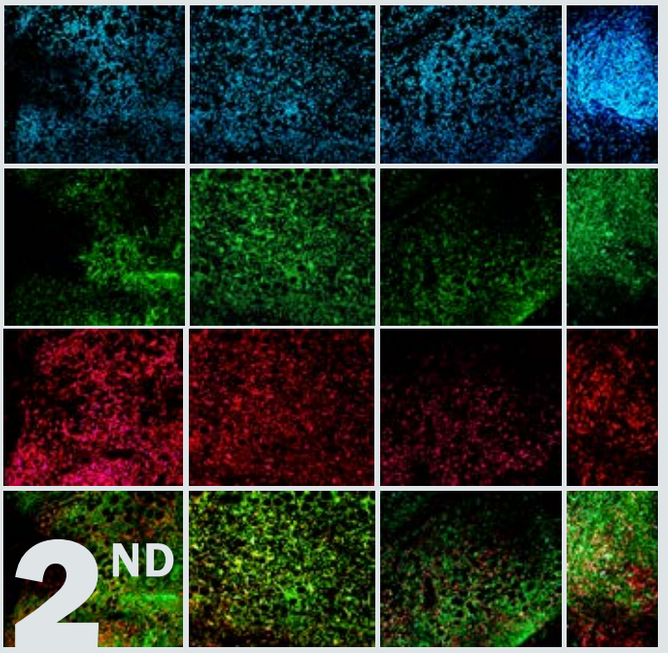
Attendees were invited to vote for their three favourite images, and the most popular image received the People's Choice Award. Three other winners were picked by a selection of judges from across the University.

Doing Daughterhood in Pakistani Families

Henna Nisa, School of Social Sciences

Henna's research aims to explore how family values and practices continue or change for Pakistani women across three generations as they 'do daughterhood'. By exploring how grandmothers, mothers and granddaughters contest and negotiate family relationships, duties and values, her research will highlight how Pakistani family cultures mediate the views and practices of women who are seen as the carriers of family honour and respect.

The image shows three generations of women who are each wearing gold bangles. There is a common practice in Pakistani families for daughters to be gifted gold bangles at birth and at marriage. These bangles are often a gift from mothers to their daughters, their daughter-in-laws and their granddaughters. It is expected that each generation will pass on this tradition.

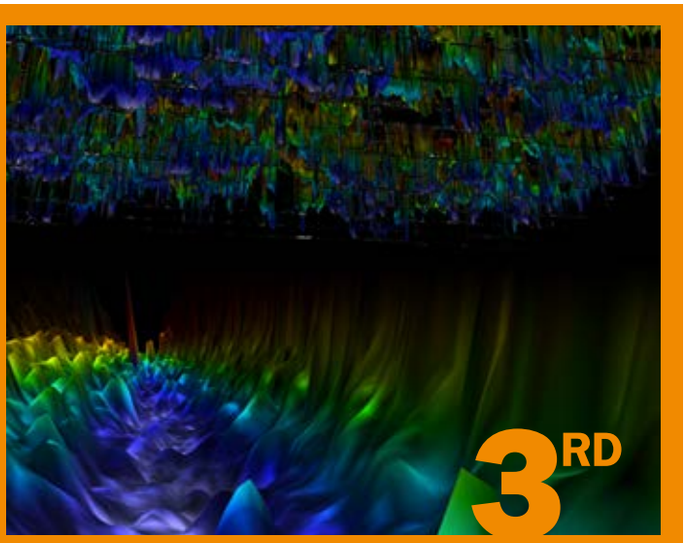


Andy Warhol Style Mouse Knee Joints

Alicia Derrac Soria, School of Medicine

This is an immunofluorescence image of mouse knee joints with Rheumatoid Arthritis (RA). Hundreds of thousands of individuals in the UK are affected by autoimmunity, and more than 80 autoimmune diseases have so far been identified. RA, one of the most common, causes painful stiffness, swelling and damage in the joints. We really don't know why the body attacks itself, however, we know cytokines play a major role in autoimmune diseases.

Cytokines allow immune cells to deliver information to each other, binding to receptors on target cells and activating a complex cascade of intercellular signals. Alicia's PhD focuses on testing novel therapies that target these signals in mice with RA. By injecting these therapeutic substances into the inflamed joint, we are able to switch on and off the molecules responsible for this inflammation, and hopefully reduce the signs and symptoms of this condition, improve physical functioning and reduce mortality.



The Spectacle of the Microstructure Borealis

Haydee Martinez Zavala, School of Engineering

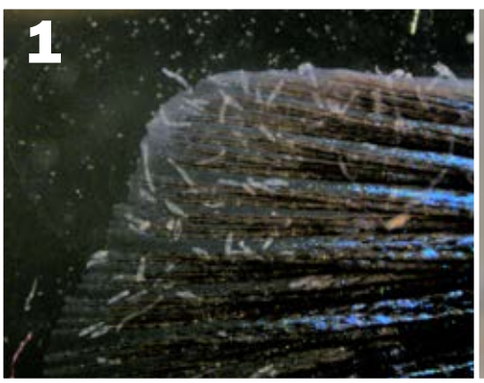
Complex engineering problems can be solved by imitating nature through biomimetics. Microstructures which form the main part of Haydee's PhD study occur abundantly in nature, like on shark's skin allowing the shark to swim faster and on lotus plants allowing them to repel substances and absorb sunlight. Studying microstructures in this way can effectively solve engineering calculations such as drag reduction and energy consumption. The Northern Lights, also known as Aurora Borealis, are one of the most spectacular natural phenomena that gave Haydee powerful inspiration to go from macro to micro. This image is a 3D scan of the microstructures that she has been using for her research in energy recovery systems. This image to Haydee, signifies the importance and effectiveness of microstructures for all the elements of nature from the land to the sky.

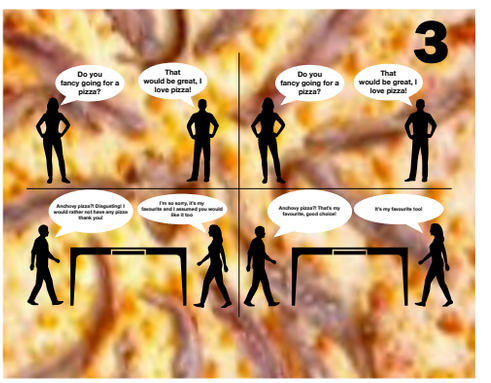
PEOPLE'S CHOICE WINNER

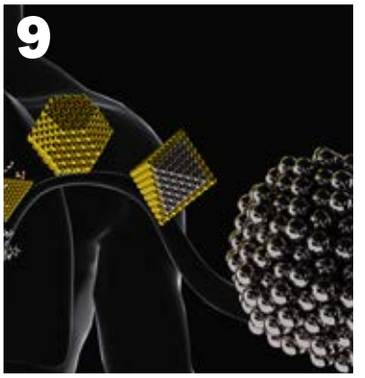
Bodily Restraint is Imperative

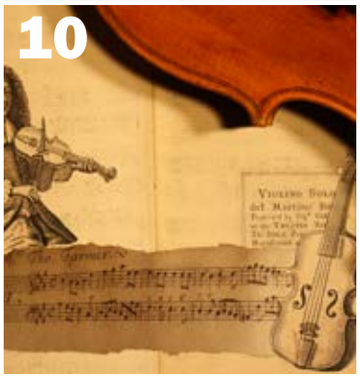
Cerys Knighton, School of English, Communication and Philosophy

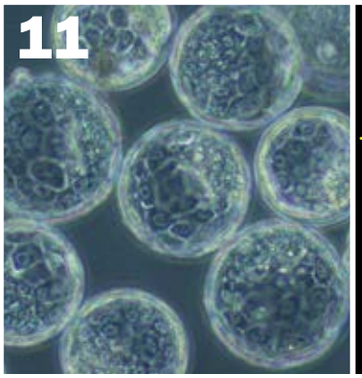
Cerys' research examines how mood disorders became a category for diagnosis by analysing medical cases and literature from 1830-1930. This artwork depicts a medical article published in The Lancet in 1841, which contributes to an ongoing debate about whether restraint is effective when treating mania. The author argues that the use of chains and manacles is imperative, showing contempt towards manic patients with language such as 'wretched' and 'corrupt', but agreeing to compromise if the power to use restraint is disallowed for all staff except medical attendants – such as himself. To visually depict this discussion, she wanted to tie a figure together with nothing but pen and ink. She wound together line detail to create a sense of being tightly bound down to muscle texture. Extending this to eyes and lips to remove a sense of identity, Cerys aimed to portray the mechanical treatment of patients in the early-nineteenth century.

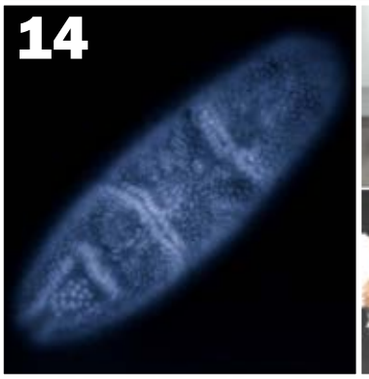


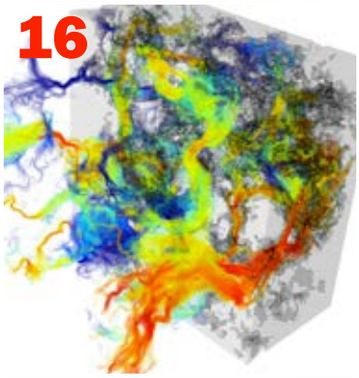


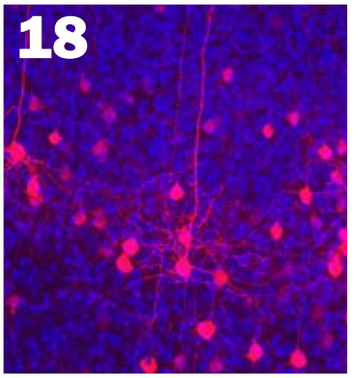


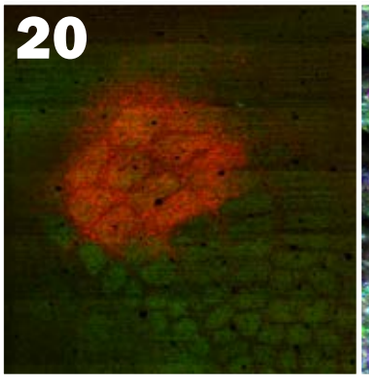


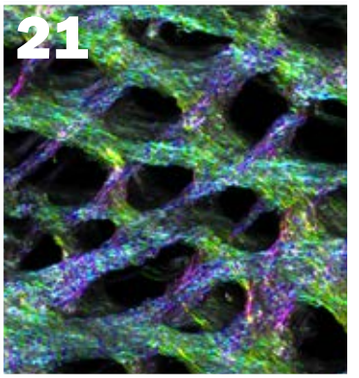




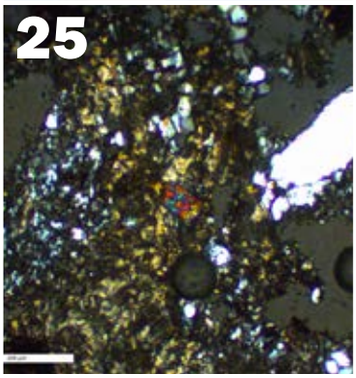


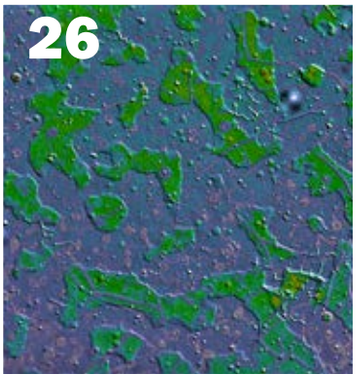


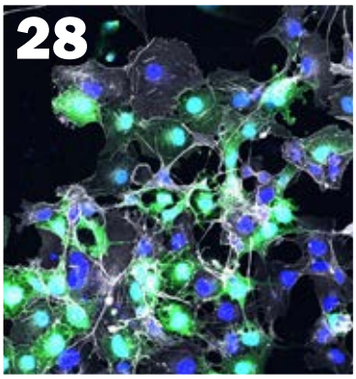


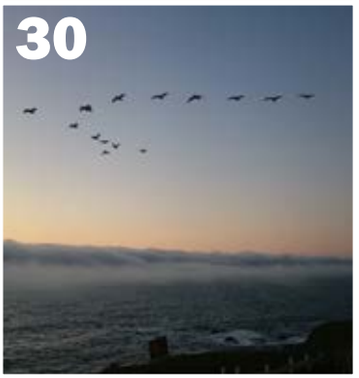


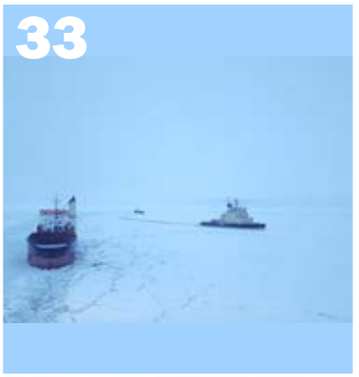
1. Weeds of Aquaculture **- Elissavet Arapi**
2. Transition from Foster Care to Adoption: is a 'Clean Break' Really Best? **– Jenny Blackmore**
3. Pizza, Like Clinical Supervision, is Generally Perceived to be a Good Thing **– Rebecca Bullingham**
4. Farm or Factory? **– Alison Caffyn**
5. All You Need is Glove (Box) **– Jamie Carden**
6. A Desert of Written Desires – **Javier Cortés Ortuño**
7. Let's Eat Together and Live Together! **– Siyu Duan**
8. I'm Sticking to You **– Katherine Dunkley**
9. A Nanoparticle Walks into a Tumour: Heroes Come in All Shapes and Sizes **– Barbara Farkaš**
10. An Admirable Solo **– Annika Gray**
11. Droplets of Life **– Jessica Griffiths**
12. Poly Come Dancing **– Hassan Izanloo**
13. Sleeping Soundly **– Holly Kings**
14. When Does Sperm Start? **– Fiona Messer**
15. Mae Darlun yn Adrodd Cyfrolau / A Picture Paints a Thousand Words **– Megan Haf Morgans**
16. Examining Fluid Flow in Landfills at the Pore–Scale **– Syed Muaaz–Us–Salam**
17. Silaturrahim **– Azian Binti Muhamad Adzmi**
18. A Nervous Journey **– Sylvia Adriana Newbold**
19. The Issue with Tissue Culture **– Olivia Ogle**
20. Not all Viruses are Nasty **– Nicole Pacchiarini**
21. The Rainbow Nature of Collagen **– Laura Paletto**











22. “Ett, Två, Tre, Fyra, Yes! A Toi!”
– Kaisa Pankakoski

23. Persistent Luminescence: Batteries Not Included
– Kaitlin Phillips

24. Labels with Lives of their Own
– Jack Pickering

25, Ancient Speed Dating
– Jamie Price

26. Phase Transition in a Supported Lipid Bilayer
– David Regan

27. Equality in Partnership
– Amy Sanders

28. The Scaffolding of the Cell
– Monika Sledziowska

29. Altered States on ICU
– Martyn Stones, Cardiff Delirium Study

30. Fog & Pelicans
– Lyndsey Stoodley

31. “I Went to Primary School in this Temple!”
– Lui Tam

32. A Statue of Liberty?
– Charlotte Taras

33. Opening up the Northeast Passage
– Dimitrios Theocharis

34. Locked up with Rapists
– Faye Vanstone

35. Vision without the Brain
– Melissa Emily Wright

36. Computers Can Help As Well
– Aleksandar Živković

New creative industries initiative Clwstwr opens for business

A multi-million-pound programme to drive innovation in the screen industries is operational.

Led by Cardiff University, in partnership with the University of South Wales and Cardiff Metropolitan University, Clwstwr is an ambitious five-year research and development (R&D) programme which aims to create new products, services and experiences to boost the sector in South Wales.

The full Clwstwr delivery team is now in place at its new home at Cardiff's City Hall. This includes four producers who will set up, curate and oversee a range of R&D programmes.

Clwstwr Director Professor Justin Lewis said: "Cardiff is now one of the UK's biggest media production centres outside London. But if we're to thrive in an industry dominated by big global players, we need to find ways to foster collaboration. The Clwstwr team is very much looking forward to putting innovation at the heart of the city, so that we can address some of these key challenges."

Clwstwr's first open funding call attracted 134 Expressions of Interest, requesting Research and Development funding totalling £8million, which demonstrates the need for innovation funding in the South Wales cluster.

Following a highly competitive process, the first cohort of 23 businesses have been chosen and will be awarded a total of £1million to pilot their innovation projects, which include a news service for schools, remote editing facilities to grow regional post-production and a virtual reality film studio.

Clwstwr brings together all major Welsh broadcasters including BBC Cymru Wales, S4C and ITV Wales with independent film and television production companies, Wales' national companies and creative organisations, creative coworking spaces, tech start-ups, strategic agencies including Arts Council of Wales, local authorities including Cardiff Council, and Welsh Government. Clwstwr is one of nine Arts and Humanities Research Council (AHRC) Creative Clusters across the country and is the first programme of this kind to be funded by the UK Government's Industrial Strategy.

The Clwstwr team is keen to engage with academics across all three institutions to develop collaborations and co-create innovation with the screen and news sectors. Visit **www.clwstwr.org.uk** to find out more and get involved.

CARDIFF JOINS AI DOCTORAL TRAINING CENTRE

Cardiff University is joining a new Centre for Doctor Training (CDT) to help create a new generation of leaders in artificial intelligence (AI).

Led by Swansea University and funded through UK Research and Innovation (UKRI), the CDT will specialise in AI, machine learning and advanced computing, and will operate in close cooperation with Supercomputing Wales.

A total £200m UK investment will create 16 new UK centres with 1,000 PhDs to transform AI, working with partners including AstraZeneca, Google and Rolls-Royce, and NHS trusts.

Roger Whitaker, Professor of Collective Intelligence and Dean of Research in Physical Sciences and Engineering, said: "We are proud to be key partners in training the next generation of experts in AI. This involves researchers from across all our three Colleges at Cardiff, in areas where AI is already having a significant impact.

"Led by Professor Gert Aarts at Swansea University, the CDT will engage with data from large science facilities such as the Large Hadron Collider and Laser Interferometer Gravitational Wave Observatory (LIGO); biological, health and clinical sciences; and novel mathematical, physical and computer science approaches to train doctoral researchers who can make an impact across a wide range of disciplines and industries."

SUPPORTING A THRIVING TECHNICAL COMMUNITY

Across the University, hundreds of technical colleagues work to support research. Although their work is not always visible, the University could not function effectively without it.

Professor Karen Holford, Deputy Vice-Chancellor, said: "Throughout my career in industry and academia, across teaching and research, the support of technical staff has really made the difference. They bring a diverse range of knowledge and skills which enable the University community to meet their research and academic aims."

The University was one of the founding signatories of the Technician Commitment, an initiative from the Science Council to ensure visibility, recognition, career development, and sustainability for technicians working in higher education and research. Through the Commitment, it has pledged to recognise the contributions made by its technicians, and to work with them to support and improve their career development pathways.

Charlotte Lees, Laboratory Technician in the School of Biosciences, said: "The Technician Commitment gives me the chance to gain recognition for my work and have the support from Cardiff University as a founding signatory, to gain the skills I need to progress in my career."

Jennifer Arnold, Laboratory Technician in the School of Biosciences, added: "To me, the Technician Commitment has meant that I have been able to achieve qualifications more relevant to my role while continuing my work. This has led to a lot more confidence in my abilities and enabled me to pursue further training opportunities to develop my career, such as working towards further recognition by becoming RSci registered."

EPSRC FUNDS COMPOUND SEMICONDUCTOR CENTRE FOR DOCTORAL TRAINING

A new Centre for Doctoral Training (CDT) will help train tomorrow's experts in compound semiconductor technologies.

The Cardiff University-led CDT in Compound Semiconductor Manufacturing will provide outstanding PhD-level training aligned with the needs of UK industry.

It is one of 75 CDTs announced by the Engineering and Physical Sciences Research Council (EPSRC) as part of a £446m investment in skills by UK Research and Innovation.

Co-created with IQE Plc, Compound Semiconductor Centre, Newport Wafer Fab and the Compound Semiconductor Applications (CSA) Catapult, the CDT is an alliance of four universities (Cardiff, University College London, Sheffield, and Manchester) and 24 companies, many already working closely together via the EPSRC Future CS Manufacturing Hub, based at Cardiff University.

US ADOPTS UK ANTI-VIOLENCE SYSTEM

The Cardiff Model for Violence Prevention, pioneered by Professor Jonathan Shepherd, has been primed for roll out by the US Centers for Disease Control and Prevention (CDC). The model brings agencies together to prevent violence, using data collected in emergency departments (EDs) as well as police intelligence.

Prevention has been hampered because more than half of violent crime in the United States is not reported to law enforcers, according to the US Department of Justice.

By using data from EDs, the model reveals violence hotspots which are invisible to police – places where policing should be concentrated.

Now the CDC, which works to protect America from health, safety and security threats, has produced a website and toolkit to help agencies implement the model across the nation.

The CDC toolkit features a range of materials to help health professionals and agencies set up joint 'Cardiff Model' projects. It includes guidance for hospitals and law enforcement bodies, plus advice on legal issues, finance and how to build successful partnerships.

CARDIFF ACADEMIC JOINS UK'S AI COUNCIL

A leading Cardiff University academic is to join the AI Council – an independent expert committee helping to supercharge the UK's artificial intelligence sector.

Pete Burnap, Professor of Data Science & Cybersecurity, will work with a group of around 20 experts from industry, academia and data rights organisations.

They will put in place skills, data and ethics to help the UK make the most of AI technologies.

The line-up includes Professor Sir Mark Walport, Chief Executive of UK Research and Innovation; online-only retailer Ocado's Chief Technology Officer, Paul Clarke; member of the Independent Commission on Freedom of Information, Dame Patricia Hodgson; and Alan Turing Institute Chief Executive, Professor Adrian Smith. ■

New Generation Thinkers

Two researchers are among this year's New Generation Thinkers, the initiative from BBC Radio 3, BBC Arts and the Arts and Humanities Research Council (AHRC).

Historian Dr Emily Cock and archaeologist Susan Greaney, both from the School of History, Archaeology and Religion, will have the opportunity to share their research through the media, making programmes for Radio 3 and other BBC outlets, as well as taking part in the 2019 Being Human Festival and contributing to wider media through the AHRC.

Leverhulme Research Associate Dr Emily Cock is exploring changing attitudes towards facial disfigurement from the 17th century to today.

Emily said: "I'm thrilled for the opportunity to share my fascination with historical faces with the BBC audience, and perhaps to challenge people to think about how we engage with our own and others' physical differences in our daily lives."

AHRC-funded PhD candidate Susan Greaney is unearthing the attitudes of Neolithic people to the ground beneath them and the underworld. Susan said: "I'm really looking forward to working with the BBC to share my research into Neolithic monuments with new audiences, particularly introducing people to the completely different views and beliefs about the world that people may have had in prehistory. Surprisingly, these can help to challenge our modern-day perceptions about how we interact with the natural environment and about our unequal social relationships."

Professor Andrew Thompson, Executive Chair of the AHRC, said: "The New Generation Thinkers scheme is all about helping the next generation of researchers to find new and wider audiences for their research by giving them a platform to share their ideas and allowing them to have the space to challenge our thinking." ■

Energy Systems Research Institute

There are three key issues that energy systems face: availability and security, affordability and public acceptance, and environmental impact.

At a global level the demand for energy has been affected by several issues including: increasing economic and population growth in countries such as Brazil, India and China, leading to greater energy demands, climate change and concerns, and the depletion of traditional fossil fuels, which are driving research and investment into alternative energy production methods.

Nationally the issues are complicated by additional factors such as: an ageing energy infrastructure unsuitable for integration with newer, alternative energy sources, public concern over safety and environmental considerations of energy generation, like nuclear energy, and business models that need to benefit the government and yet are attractive for investment by private industry.

Led by Professor Phil Jones and Professor Phil Bowen, the Energy Systems Research Institute was established to attempt to find solutions to these challenges. Its vision is to establish a truly interdisciplinary systems-based research culture which encompasses both the physical and social sciences, drawing on existing research excellence from across the University.

In order to respond to these challenges significant innovation in energy systems is required. Any given piece of innovation cannot take place in isolation of other aspects of the energy system. For example, if there is an increase in the amount of electrical power generated from renewable sources which might be located some distance from where the power is eventually used, ways to strengthen the energy supply infrastructure and ensure it is capable of transporting the power to where it is needed, must be found.

In order to diversify the ways in which power is generated and move away from the reliance on fossil fuel imports, ways need to be found to obtain power from alternative sources in a way which is less damaging to the environment and which is acceptable for communities and countries.

Simultaneously a ‘whole systems approach’ must examine demand for and use of energy, as well as its generation and supply. Sustainable design in the built environment and better ways to monitor and manage energy consumption within buildings are key components of our future energy system.

In February this year, the Engineering and Physical Sciences Research Council (EPSRC), announced funding for 75 Centres for Doctoral Training (CDTs). The Centre for Doctoral Training in Resilient Decarbonised Fuel Energy Systems is a collaboration between the universities of Cardiff, Nottingham (lead) and Sheffield.

The CDT will carry out research into energy-intensive applications over the next eight years. It will provide training and fully funded EPSRC studentships for PhD students wishing to carry out research which is crucial to providing environmentally friendly energy for the future.

The University’s arm of the new CDT, led by Dr Richard Marsh, will be based at the Gas Turbine Research Centre (GTRC), an off-site, large-scale facility undertaking world-leading research into new low/zero carbon combustion systems and alternative fuels. The CDT will collaborate with the Research Institute’s interdisciplinary expertise through co-supervised studentships.

Researchers at the Gas Turbine Research Centre are also working alongside Siemens, the University of Oxford, and the Science and Technology Facilities Council as part of an Innovate UK project, piloting a new integrated renewable power-to-power system demonstrator that uses ammonia as an intermediate energy storage medium generated from wind power. It will test the next-generation technology with a view to creating flexible integrated energy systems which generate power when required, while efficiently storing energy in the form of ammonia when the demand for, or price of, electricity is low.

The Research Institute includes six research groups from across the University involved in the FLEXIS (Flexible Integrated Energy Systems) project. FLEXIS is a £24m research operation, part-funded by the European Regional Development Fund via the Welsh Government, which aims to develop a resilient, affordable and secure energy system across Wales with the potential for global application. Cardiff researchers are working alongside leading energy experts at the universities of Swansea and South Wales.

The Welsh School of Architecture's Low Carbon Built Environment project (LCBE), funded by a £3m Welsh European Funding Office (WEFO) programme, is demonstrating a range of low-carbon approaches to both new build and retrofitting existing buildings. The energy positive SOLCER house, designed and constructed by Low Carbon Research Institute (LCRI), continues to be the subject of investigation, with new technologies being tested. A range of energy retrofits have been applied to existing housing to reduce their energy demand and incorporate renewable energy systems and energy storage. Partners include Neath Port Talbot, Carmarthen and Swansea local authorities, Wales and the West Housing Association, and a range of supply chains' technology companies. The work has been instrumental in developing the Homes and Power Stations project, which forms part of the Swansea Bay City Deal.

The Knowledge Economy Skills Scholarships (KESS 2) announced funding to support a three-year PhD studentship to develop optimal low-carbon ventilation strategies and technologies for domestic buildings in the United Kingdom. This funding offers the opportunity to link the world-leading ventilation manufacturer Nuaire (Polypipe PLC), the Welsh School of Architecture and the Research Institute to undertake collaborative research. The PhD student will be jointly supervised by Dr Hu Du and Professor Phil Jones, and Colin Biggs, Technical Director of Nuaire.

A further strength of the Research Institute is its industrial and policy collaborations and partnerships, which it continues to develop. These all help to inform and advise the Research Institue's strategy. Partnerships include the National Grid, the Building Research Establishment (BRE) and Tata, with ongoing collaborations with energy focussed companies including Uniper, Siemens and Rolls-Royce. ■

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Athena SWAN Silver Award

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