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THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY

advances WALES

The digital revolution

Digital excellence in Wales showcased

Llywodraeth Cymru
Welsh Government

THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY
advances WALES

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Digital worlds: Fantasy meets reality with Welsh designed augmented reality apps

"In the digital world, he who hesitates is abandoned. So you have to generate 3-D excitement with as many devices as you can find."

- Sir Howard Stringer, Ex-CEO, Sony Corporation

Generating excitement in 3-D is certainly the mantra of Living Data. Bringing characters from Alice's Adventures in Wonderland to life in Llandudno with support from the Digital Tourism Business Framework on pages 10 and 11.

This issue's Special Feature focuses on the digital age in Wales. Apps that have been developed with the help of bodies such as the Centre for Excellence in Mobile Applications and Services (CEMAS) based at the University of South Wales once again highlight the on-going relationship in Wales between academia and industry and the creation of the first entirely Welsh Sony PlayStation 4 game by Wales Interactive demonstrates the strength of the talent available here.

Advances provides a showcase for many of Wales' companies and universities alike. Great research has led to many new and innovative technologies and products such as Fovography which gives us a different perspective on how we see images (pages 22 and 23), the Book of You (page 20) an app which looks to help those suffering from dementia to hold onto their memories and fight-sensing cameras aiming to make the streets safer (page 21).

Our news section looks at success stories for Wales and recognises our expertise in cyberterrorism (page 8) and robotics (page 4) as well as our capabilities across a variety of sectors.

I hope that you enjoy reading this issue, which highlights just some of the fascinating developments taking place here in Wales.

Lucinda Scott-Morgan (née Dargavel)
Editor

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Advances Wales is a high-quality, quarterly 'transfer of technology' journal produced by Welsh Government to showcase new developments in science, engineering and technology from Wales. Devoted to concise reports and commentary, it provides a broad overview of the current technology research and development scene in Wales.
Advances raises the profile of the technologies and expertise available from Wales in order to facilitate collaborative relationships between organisations and individuals interested in new technologies and innovation.

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Study finds attractive computer graphics boost task performance

A new study by researchers from Swansea and Bournemouth Universities has found that eye-catching computer graphics help people perform tasks quicker and more easily as the activity gets more demanding.

The results of the study by Dr Irene Reppa from Swansea University's Department of Psychology, and Professor Siné McDougall of Bournemouth University's School of Design, Engineering and Computing, into how the aesthetic appeal of visuals such as icons on electronic devices such as mobile phones and websites enhances performance, has been published in the journal Psychonomic Bulletin & Review.

The team used computer icons in their study, as these visuals are well-defined stimuli and part of everyday modern life. In a search-and-localisation task, the study's participants first memorised a target icon and then searched for it among an array of nine "distractor" icons. This activity was designed to reflect the kind of tasks people perform when interacting with modern electronics.

Simple and familiar icons were the easiest to find, but when the task was difficult the icons that were aesthetically appealing were found faster than their unappealing counterparts. The study concludes that appealing icons are not only pleasant to use, but also speed up people's ability to solve multi-step problems with visuals when using websites or mobile phones.

Pleasing aesthetics prove to be most important under taxing conditions, such as when users deal with complex, abstract or unfamiliar material. Investing in the design of attractive visuals with the most widespread appeal for mobiles and websites, or anything people need to interact with, will enhance the user experience, make these applications and interfaces more efficient, and be beneficial in the long run.

"Savings of even a few milliseconds at a time all add up when someone is performing multi-step interactions on a website or a mobile phone. This might make people avoid some interfaces, such as certain websites or phones, in favour of those that maximise efficient performance. Use of aesthetic visuals produces a win-win situation for all parties involved."

Dr Irene Reppa
Department of Psychology
Swansea University

www.swansea.ac.uk/psychology/

Tidal lagoon 'made in the UK, assembled in Wales'

Every major part of Swansea Tidal Lagoon project will be made in the UK and assembled in Wales.

The project's chief executive, Mark Shorrock, told members of Cardiff University Innovation Network that four proposed tidal power lagoons off the Welsh coast would bring major economic benefits.

In his 2015 Budget speech, Chancellor George Osborne said negotiations were opening on the £1bn tidal lagoon scheme.

Mr Shorrock, Chief Executive of Tidal Power Lagoon Ltd, told the Innovation Network the lagoon projects will contribute £27bn to UK GDP over the 12 year construction period. The company proposes to build six tidal lagoons: four sites are earmarked for Wales in Cardiff, Swansea, Newport and Colwyn Bay, plus Somerset and West Cumbria in England.

Mr Shorrock told the meeting, "Every major part of the lagoon is going to be made in the UK and assembled here in Wales." He said the lagoon project would deliver power equating to 4416 offshore wind turbines or 10 reactors.

www.tidallagoonswanseabay.com

"Tidal Lagoon Power's proposal would help Wales to contribute to the European Union's goal of smart, sustainable and inclusive growth. It would also be a major boost for the Cardiff Capital Region, which aims to create a more innovative regional economy in South East Wales."

Prof Kevin Morgan
Dean of Engagement
Cardiff University

Computer vision and robotics used to survey Cardigan Bay

Scientists at the Department of Computer Science at Aberystwyth University have been working with marine conservation group Friends of Cardigan Bay to develop better techniques for studying the seabed, which is vital for marine conservation and fisheries management.

Until recently the work of mapping and recording the seabed had been done using the traditional "researcher and clipboard" technique, which is costly, and time consuming. The project has been looking at how video images of the sea floor can be reviewed by utilising computer software programs and this information will then be used to assist conservationists to classify the different habitats.

The work was undertaken by postgraduate student Matt Pugh, marine expert Phil Hughes from Friends of Cardigan Bay, and Dr Bernie Tiddeman and Dr Hannah Dee from the University's Department of Computer Science. Phil Hughes said, "The initial idea was that computer vision and machine learning techniques could give a new perspective upon the analysis of undersea video."

The team are now looking at novel ways of acquiring undersea video and a kit robot, Open ROV, has been built and tested in a nearby lake. Operated from a laptop, usually from a boat on the surface, the robot can navigate its way around the seafloor, and uses lights and cameras to record the submarine world. The team hope that the robot will be ready in the summer for data collection.

"The key question we wanted to address was that of "substrate classification". Put simply, can we wave a video camera around underwater, and map the seafloor from the video we get back? Natural Resources Wales has a classification system which categorises the seafloor into a number of different classes, from fine sands to rocky areas. We wanted to create a simplified version of this using modern technology, and ensure that visually similar areas fell into the same categories. Once we had completed this phase, the next challenge was to analyse underwater video collected by Friends of Cardigan Bay and Bangor University to try to build a classification automatically."

Dr Hannah Dee
Department of Computer Science
Aberystwyth University

www.aber.ac.uk/en/cs/

TrakCel pair among winners at new awards

The founders of life sciences software start-up TrakCel were among the winners at the first Making Business Happen Awards, aimed at encouraging graduate enterprise.

Ashkay Peer and Matthew Lakelin of Cardiff-based TrakCel took the first prize in the Graduate Start-up category at the awards, which were organised by the University of South Wales. The Aspiring Entrepreneur Award went to 20-year old Bridgend College student Edward Shorney for his web-based business Go Rookie: The Apprenticeship Finder.

MAKING BUSINESS HAPPEN AWARDS 2015

University of South Wales
Prifysgol De Cymru

The awards recognise graduates of UK universities who have started businesses using the skills and knowledge gained whilst studying. Three of the awards were open to contestants from across the UK. The other, the USW Challenge Award, was open only to students of the University of South Wales. It was won by Evan Tamblyn for his app StartWrite, which helps university students to manage their projects and coursework.

Julie Lydon, vice-chancellor of the University of South Wales, said, "Our finalists represent some truly extraordinary and innovative ideas, developed by passionate people from across the UK."

The idea for TrakCel came out of academic research into a software platform for the construction industry. Akshay Peer and Matthew Lakelin set up an office in Cardiff Bay, enlisted the support of a board of directors, and developed a software platform that codes and tracks tissue and cell samples used in regenerative medicine.

trakcel.com

Welsh University study into common triad of diseases published

Academics from Swansea University's College of Medicine, have taken part in a worldwide study into the common diseases of asthma, eczema and hay fever, which has been published in the renowned Nature journal.

Atopy refers to a family tendency to develop certain allergic conditions including eczema, asthma and hay fever. If one or both parents have eczema, asthma or hay fever, it is more likely that their children will develop one or more of these conditions.

This tendency means that your body produces a certain type of antibody, called immunoglobulin E (IgE), in response to harmless allergens, such as pollen and dust mites and atopy is what links eczema, asthma and hay fever. Eczema usually appears first, often at a very young age. Babies or children with eczema are then at a high risk of developing asthma and hay fever at a later stage.

These diseases are increasing in prevalence and are a major source of disability in the modern world.

With systematic knowledge of IgE production lacking, specialist academics from institutions in Swansea, Havard, Quebec, Ontario, Denver, Montreal and Imperial College conducted the study "An Epigenome-Wide Association Study of Total Serum Immunoglobulin E Concentration".

Dr Gwyneth Davies and Professor Julian Hopkin from the College of Medicine at Swansea were involved in the study. Dr Gwyneth Davies recruited over 1600 unselected volunteers students and university staff, who were carefully phenotyped by their physical and biochemical characteristics for asthma-related characteristics and genotyped by their genetic makeup.

The Nature study used a biochemical approach to identify patterns of gene activation or inactivation in normal subjects and in those with allergy and asthma - and through that was able to identify

novel gene products (proteins) important to the allergy process. The work opens up the possibility of developing new diagnostics or therapeutics based on these protein "targets".

Further work is planned using these methods and others to examine lung tissue in asthma - with the intention of characterising subtypes of asthma including those forms which respond poorly to currently available treatments.

www.swansea.ac.uk/medicine/

Technocamps recognised by national accreditation body

Technocamps has become the only organisation within Wales accredited to deliver the Ofqual-recognised ASFI Certificate in Computing for Teachers

After a detailed scrutiny and accreditation process, Technocamps's portfolio of Technoteach teacher training modules has been formally endorsed by ASFI – Accredited Skills For Industry. Technocamps is a schools outreach programme established in 2003 by the Computer Science Department in Swansea University. It now has hubs in six further University Computer Science Departments across Wales: at Aberystwyth, Bangor, Glyndwr, Cardiff and Cardiff Metropolitan Universities and at the University of South Wales in Glamorgan. Over the past 16 months these hubs have hosted 18 Technoteach CPD modules – each typically 20 hours long delivered one evening per week over six weeks – upskilling a total of 256 teachers covering all Key Stages of education from both primary and secondary schools.

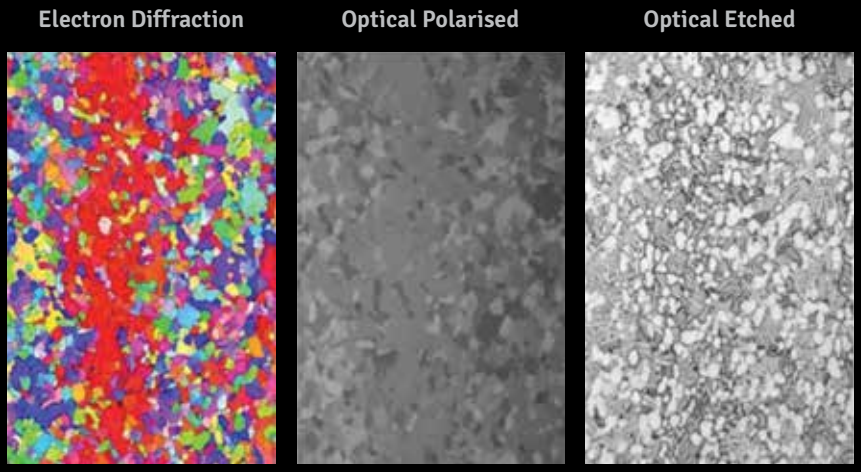
Technocamps was started as a programme to engage school kids as a means to change perceptions about computing amongst schools

and teachers. After providing fun and interactive workshops for tens of thousands of school children over the past decade and financed through a variety of private and public funding streams, the Technocamps effect is finally being felt and acted upon by schools and government.

www.technocamps.com

The ultimate zoom: £2.5 million for imaging facility to see close to atomic level

A Swansea research team has won a £2.5 million award for equipment allowing experts to examine materials right down almost to the atomic level. The new equipment would have lots of potential applications, for example improving detection of metal fatigue in aircraft materials or imaging complex architectures in the natural world.



"We're extremely happy to receive this highly competitive EPSRC funding. The new X-ray and electron microscopes will enable us to image complex micro and nano structures of advanced materials with exceptionally high resolution, and in 3 and 4 dimensions.

This will advance our imaging research portfolio in many exciting areas. The new facility will be the only one in Wales to offer an integrated imaging service, and will be open to industry and academic partners across the region."

Dr Richard Johnston
Senior Lecturer, Materials
Swansea University

The award, given to materials scientists Dr Richard Johnston and Dr Cameron Pleydell-Pearce in the University's College of Engineering, is from the Engineering and Physical Sciences Research Council (EPSRC). It will fund a micro-level CT scanner, which allows researchers to analyse objects at very small scales, and a transmission electron microscope, which means they can study tiny samples of materials at even higher magnification.

The new equipment means that Swansea will be able to offer an integrated imaging facility, where researchers can examine objects at all scales. Crucially, they will also be able to combine the data they get from looking at the same object using different techniques and equipment, building up a much fuller picture of how materials behave.

The new facility will have a broad range of applications, from materials science to bioengineering, and from medicine to archaeology. The Swansea team has already used its existing scanning and imaging equipment to reveal the contents of ancient Egyptian mummified animals and the composition of space debris.

www.swansea.ac.uk

DTR Medical celebrates 10 years of innovation in medical devices

Swansea-based medical device manufacturer, DTR Medical, is celebrating 10 years of business. The company sells and markets its own brand of sterile single-use surgical instruments, priding itself on developing new and innovative products that are used throughout ENT, Gynaecology, Vascular, Neurology, Orthopaedic, Ophthalmology and general surgery.

DTR Medical maintains a close relationship with clinicians to develop single-use instruments that are suitable for new and existing procedures. This relationship facilitates innovation and DTR Medical is responsible for the award winning Rotating Cervical Biopsy Punch, that has a unique design and uses advanced manufacturing techniques.

Great Ormond Street Hospital is the lead customer for the company's most recently launched product which is a single-use bone trephine used for cleft palate procedures where the need for first time sharpness and eliminating the risk of contamination are of utmost importance

Successful growth over the past 10 years has enabled DTR Medical to expand into the export market. As well as working with new distributors in Germany, Austria, Holland, and Saudi Arabia, in 2014 export sales for the company soared by 354%.

In delivering quality products DTR Medical has maintained a strong reputation in the industry and pride themselves on retaining their position as market leaders in the medical device market.

"Providing high quality single-use sterile products that deliver clinical value combined with exceptional levels of service is at the forefront of our mission."

Andrew Davidson
Managing Director
DTR Medical

www.dtrmedical.com

New £15m Moneypenny 'dream' headquarters set for Wrexham

Moneypenny, a North-Wales based telephone answering specialist as featured in Advances 72- has unveiled its designs for an extraordinary new £15m headquarters which aims to rival the likes of Google and Apple.

The office, which is being built in Wrexham, will boast a treehouse, a village pub, and an impressive triple height 8,000 sq ft atrium with a restaurant and stadium seating. It will also enjoy a stunning 10 acre plot with nature trails, orchards, vegetable gardens and open views over the surrounding countryside.

Ed Reeves, co-founder and director of Moneypenny, has been responsible for spearheading the flagship project. He says, "We literally sat down with a blank piece of paper and asked ourselves what we could do with these 10 acres of dream Greenfield land? The answer was to create our ideal home - somewhere exciting and innovative, yet practical. The manufacturing industry has long been building commercial premises to suit its needs, but up until now, most offices just follow a standard template. We wanted to change this and rip up the rule book."

More akin to something you would find in London or Silicon Valley, every inch of the 91,000 sq ft building has been designed to cater for the needs of Moneypenny's employees and clients. This includes creating the perfect environment for call handling and Moneypenny tasked expert engineers to create bespoke technology that will absorb sound and eliminate background noise.

> "It was our vision to create not just the best office for us, but the best office in the UK, and we are determined to achieve this."
>
> **Ed Reeves**
> **Co-Founder and Director**
> **Moneypenny**

The new campus will also be one of the most environmentally sustainable commercial projects in the country.

www.moneypenny.com

Cardiff unlocks £13m for innovative research

Cardiff University has been awarded nearly £13m (€15.8m) to develop research that benefits science and society.

The University has secured funding for 26 projects under the European Commission's Horizon 2020 programme in the first year of its operation. The money will help Cardiff develop a range of new technologies and innovations, and support young scientific researchers whose work shows 'great promise.'

The new projects include four awards from the highly prestigious European Research Council (ERC) 'Consolidator Grants' scheme. This marks the first time any Welsh university has received four such grants in one round.

The School of Physics and Astronomy was the University's most successful bidder, securing three

of the four ERC Consolidator awards to fund work by young researchers into gravitational waves, cosmic dust and nanodiamonds. Dr Haley Gomez will receive over £1.4m to probe the evolution of dust throughout cosmic time. Dr Oliver Williams, reader in experimental physics, will receive nearly £2.2m to lead research into the superconductivity of diamond films and superconducting quantum devices, and Dr Mark Hannam will receive nearly £1.6m for his team's work on mapping gravitational waves from collisions of black holes. The fourth ERC Consolidator award of £1.5m was won by Professor Chris Chambers in the School of Psychology to research cognitive control training.

Cardiff University Vice-Chancellor, Professor Colin Riordan, said, "The 26 Cardiff projects are spread across the three pillars of the Horizon 2020 programme: Excellent Science, Industrial Leadership and Societal Challenges, and underpin our mission to tackle major global issues."

"A set of awards of this magnitude for Cardiff University is an outstanding example of impact in action. It not only confirms our reputation as a world leading institution, but underscores the ground-breaking work being done by young researchers to advance our understanding of science and society."

www.cardiff.ac.uk

Swansea researcher shares expertise at NATO Advanced Training Course

Swansea University Cyberterrorism researcher David Mair has recently returned from Ankara in Turkey, where he delivered two lectures at a NATO Advanced Training Course on Terrorist Use of Cyberspace.

David who is a PhD student within the University's College of Law, was the UK representative at the course, which was organised by the NATO Centre of Excellence Defence Against Terrorism (COE-DAT) and featured 12 invited speakers from six countries.

The course was attended by participants from 18 countries, drawn from the military, intelligence services, police, government and other security bodies.

The course director, Dr Major Mehmet Nesip Ogun, of the Turkish Army, said, "In modern terrorism, almost all terrorist organisations are benefitting from the Internet to commit their activities such as message delivering to the masses in the frame of propaganda activities, facilitate communication, and recruit new members to their organisations, raising funds, or to train the new hired members. The area of concern, as a consequence of Internet exploitation, has been extended not only in the domestic realm, but also additionally to transnational and international arenas. Full cooperation and coordination of efforts are required to prevent Internet usage by terrorist organisations."

"Terrorist use of cyberspace has catapulted their propaganda into our everyday lives and it is essential that we study this phenomenon in order to understand the most effective ways to combat this threat. I am very grateful to the University and to NATO COE-DAT for giving me this opportunity to present my own research on the topic and interact with global experts from NATO partner nations."

David Mair
Swansea University

www.swansea.ac.uk

IN BRIEF

EKF launches next generation Hemo Control analyser

EKF Diagnostics has launched its next generation Hemo Control point-of-care (POC) diagnostics analyser, providing laboratory accurate haemoglobin and haematocrit results in one simple test.

Uniquely the new haemoglobin POC analyser enables full upgrade with Data Management functionality as required, giving the user complete flexibility over their future connectivity options via its bi-directional interface. In addition to delivering accuracy and reliability of results, the new Hemo Control can easily communicate with hospital and laboratory systems.

Markes International wins Queen's Award

Markes International, a manufacturer of specialist laboratory instrumentation based in Llantrisant, has had its export success recognised through receiving a Queen's Award for Enterprise. The accolade, in the International Trade category, was received for demonstrating 'outstanding achievement' in overseas earnings, sustained over a period of at least three years. Since 2005, over 85% of Markes' business has been for export . Managing Director, Alun Cole said,"It is an honour to be recognised by Her Majesty the Queen for the strength of our export business, and I believe it reflects many years of hard work and dedication from everyone at Markes."

Datakom opens Aberystwyth office

Telecomms provider Datakom is set to open a new office as part of plans to expand across Wales. Headquartered in Bridgend, Datakom has grown from five employees in 2009 to more than 20 and also has plans to open an office in North Wales in the next 18 months. Managing director Jay Ball said, "We're planning to expand across Wales. We believe that telecoms and phone system providers need to have a local focus to be effective. So many customers suffer from poor service from big suppliers - whereas we have engineers who can work day to day with our customers with faster response times."

Energy sector's innovation ambition heats up

Small business innovators, the energy industry, policy makers and academics attended the annual UK Energy Innovation Awards in Manchester, organised by the Energy Innovation Centre (EIC). Cardiff-based iViTi Lighting Limited, as featured in Advances 73,was recognised in the 'New Energy Innovation Start-up' category for an innovative LED light bulb product that continues to function normally in the event of a power cut, which will protect vulnerable customers.

Momentum Bioscience secures CE marking

Cardiff headquartered Momentum Bioscience is pleased to announce that it has CE marked Cognitor® Minus, the first in a range of products for the hospital microbiology laboratory utilising ETGA®. Cognitor® products are designed for the rapid detection/ exclusion of infection, assisting clinicians with antibiotic stewardship, improved patient outcomes and treatment costs.

Type 1 diabetes vaccine possible within a generation

Over £4.4 million of new investment for research that will be led by scientists from Cardiff University, King's College London and Imperial College London could produce the first working vaccines for Type 1 diabetes within the next 10 years.

As well as helping to delay or even prevent Type 1 diabetes in those at high risk, this will also be an important step towards a cure for the condition. It is likely that the vaccine will also work in harmony with other treatments that reduce damage to insulin producing cells in the pancreas caused by the immune system.

A fully effective Type 1 vaccine would represent a significant leap forward in diabetes research. In the first of four new studies, Professor Mark Peakman at King's College London will lead the UK's first ever trial of a prototype vaccine in children and teenagers living with or at high risk of Type 1 diabetes whilst Professor Colin Dayan from Cardiff's School of Medicine will develop a UK-wide network to enable more Type 1

'immuno-therapy' trials to take place in UK hospitals – and to train the young doctors and researchers who will lead them.

Professor Dayan said, "This funding has already led to a bold new collaboration between UK diabetes scientists and will provide an immense boost for this field as we work towards new clinical trials and a step change in our ability to halt the loss of insulin in Type 1 diabetes. Within a year or two we will see many more children and adults taking part in this research. Within four years we expect to see results from studies of more than six potential treatments and within ten years we hope to see the first vaccine therapies delivered to patients in the clinic."

Dr Alasdair Rankin, Diabetes UK's Director of Research, said, "This research, which has been made possible thanks to funding from Tesco and additional support from JDRF (the Juvenile Diabetes Research Foundation) is hugely exciting because it has the potential to transform the lives of hundreds of thousands of people living with Type 1 diabetes, as well as leading us towards a longed-for cure. Today, Type 1 diabetes is an unavoidable condition with a huge impact on the lives of more than 300,000 people in the UK. Managing diabetes is a daily struggle and too many people develop devastating health complications or die before their time. These studies will take us a long way towards changing that – bringing us closer than ever to preventing and ultimately curing the condition."

www.medicine.cf.ac.uk

GE Innovation Village launched

The first phase of GE Healthcare's Innovation Village, in Cardiff, will have labs and space for 12 growing hi-tech life science companies but 50 have expressed an interest since the idea was first announced. Life sciences – developing new drugs and health technologies – is one of the fastest-growing sectors in Wales. Kieran Murphy, chief executive, said it was about nurturing "world class science". Wales is the only country in the world to have a designated £100m fund to attract life science companies to relocate here. The campus at Forest Farm Industrial Estate is backed by £367,000 of Welsh Government and EU funding – aimed at encouraging businesses to collaborate. GE Healthcare will provide advice on turning ideas into products and to market them across the world.

Software centre logs on in Cwmbran

The new base, at Springboard Technology Centre, will specialise in robotic process automation (RPA), a software application that speeds up data entry and other IT processes. Genfour, which operates the facility, had considered locating the new centre in Cape Town. But a £350,000 investment from Welsh Government secured the project for Wales. Genfour said the new centre would allow it to support existing and new contracts, adding that it had already hired six software developers and was currently recruiting for more.

Terex Trucks halve component cleaning time thanks to Ultrawave

Cardiff-based Ultrawave, a manufacturer of ultrasonic cleaning equipment, has designed and supplied an ultrasonic cleaning system to Terex Trucks, cutting the company's processing times in half while also delivering improved cleaning results. Based in Motherwell, Terex Trucks manufacture off-highway rigid and articulated haulage trucks used in mining and quarrying applications and this partnership has increased production efficiency and eliminated the company's hire cleaning costs by 100%.

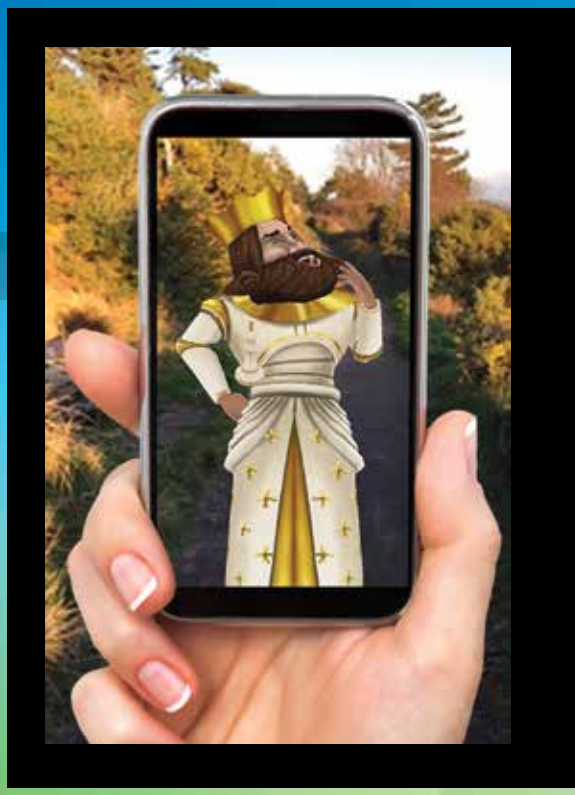
Welsh innovators set to showcase pioneering work

Businesses and organisations in Wales which develop ground-breaking products, services and processes are being urged to open their doors this summer to show off their ideas and expertise. The aim is to help embed innovation as a major engine of Welsh economic growth, with the potential to increase national earnings by hundreds of millions of pounds each year and create thousands of new jobs. Following the success of the pilot Wales Festival of Innovation in 2014, organisers have decided to host an enlarged programme of events throughout June 2015. The Festival is organised jointly by ESTnet, the Electronics and Software Technologies Network for Wales, the Knowledge Transfer Network (KTN) and Welsh Government.

Immersed in a digital world

Fantasy meets reality with LivingAR

Simon Burrows of Alice in Wonderland Ltd commissioned Living Data to develop a digital Alice trail around the town of Llandudno to celebrate the town's connection with Lewis Carroll's Alice's Adventures in Wonderland. Described as an 'Augmented Reality Experience', this is an app that entices visitors to follow the White Rabbit to numerous sites around the town meeting and interacting with modern animated 3D versions of many of the books' characters.



Living Data has been using augmented reality within its applications for some time and the Alice project proved to be its most challenging to date. Testing of the augmented reality platforms already available on the market demonstrated that none was able to provide the full range of services needed to create the exceptional user experience that the Alice project demanded.

"Augmented reality though now a common phrase is still in its early stages. LivingAR has helped us to overcome many of the problems encountered within existing platforms. We are very excited about the potential it offers and are keen to explore this."

Melinda Russell
Company Director
Living Data Labs

With support from Welsh Government and HPC Wales, the Living Data team created the characters, the animations and the scripts that would form the content of the apps. In parallel the Living Data team created its own AR platform called LivingAR.

LivingAR provided the specialist capabilities needed for the app to know, amongst other things, where the user was, where they had been and what they were looking at. The LivingAR service then dynamically determines what to display and where, enabling, in this case, the display of 3D walking, talking characters for users to interact with exactly where they want them to be.

www.livingdatalabs.com
www.alicetowntrail.co.uk

The platform has been used in 3 Alice applications so far:

Alice Origins is a free app introducing the user to the characters. Mad Hatter, March Hare and many others appear in 3D and give their biographies in their own unique ways.

The White Rabbit app provides a modern twist on the original Alice in Wonderland story and takes the opportunity to explain the link between the book and the award winning seaside town Llandudno.

The Looking Glass app uses the Alice Through the Looking Glass book as its inspiration. The app enables the visitor to see the novel's characters and also includes a 3D recreation of Alice's wonderful holiday home Penmorfa.

Download the free Alice Origins app and select 'Discover Extra' then White Rabbit Town Trail.
The app will recognise this trigger and send you to Wonderland.

The Living Data team has since used the LivingAR platform to provide the augmented reality element of an app recreating the fascinating history of Aberglasney House and Gardens. In addition to bringing the platform to market, Living Data is in consultations with companies in Malta and Cyprus to explore its use in other sectors.

Welsh digital excellence

The Centre of Excellence in Mobile Applications and Services (CEMAS) is established at the University of South Wales and part-funded by the European Regional Development Fund. The CEMAS team plays its part in Wales' digital story by helping SMEs and start-up companies develop their app ideas on a number of platforms.

CEMAS apps

Eqipad

Based in Swansea, Emily Rees the founder of ESR Sports Massage developed the idea for the 'EqiPad' riding analytics app after being actively involved in equine sports and a key member of the Commonwealth Games 2014 sports massage team.

Launched at BETA (British Equestrian Trade Association) in February 2015, the app was collaboratively developed with CEMAS to bring to market a unique solution to intelligent horse riding. The specialist app and associated weight sensing pad is aimed at horse owners/riders (able and para) market. The idea is to increase the rider's awareness of their riding style, promote a good relationship between horse and rider, promoting better riding technique through 'real-time' audio and visual feedback. In turn, the rider can make necessary corrections to posture and weight distribution, which will help enhance performance, improve application of aids (increasing accuracy), balance and co-ordination and improve horse and rider's well-being. The app also allows the data to be recorded, so that rider, trainer and therapist can support development and riding technique. The app has been designed to be easy to use, with wireless communication to the sensors, allowing the rider to perform without restrictions. It is currently available on the Google Play store and there are plans to develop an iOS version in the future.

"From the beginning CEMAS believed and supported my app concept, providing me with expertise, valuable guidance throughout the development. Working with CEMAS has helped me to achieve my app to a very high standard and produce an advanced prototype of my product. The team was very supportive, offering expert advice and allowed me to bounce my ideas creatively."

Emily Rees, Co-founder
EqiPad

Allergy Alert

Pembrokeshire Tourism Ltd is a trade association for the tourism industry with members from all sectors. It has worked with CEMAS to develop an app to support the hospitality sector.

The app will give food providers a system to input all meals they supply with a list of any of the 14 allergens they may contain. The EU has set out new regulations whereby all food providers must give clear and accurate information to consumers. Selecting the allergen will highlight the items on the menu that they are able to eat or alternatively a meal can be selected and it will show if the allergen is in the requested meal. The app is aimed at and should benefit everyone involved in the hospitality trade from hotels, b&b, guesthouses, cafés, restaurants, pubs and food suppliers. The creation of an app that makes this legislation easier to handle for small businesses will not only assist their businesses, but will also provide a profile for innovation and development for Pembrokeshire Tourism. This app will help to streamline processes and support any commerce that experiences constant change and the pressures of a seasonal business model.

This app should make life a little easier for the hospitality trade, as someone eating something that they are allergic too could be fatal. The hope is that the app can roll out to other areas of Wales.

"The CEMAS team have provided valuable support in the creation of this app – with their design and development facilities, together with the knowledge of what would work and what would not, have helped bring the app to fruition. One of the many benefits of working with the CEMAS team is access to their knowledge and guidance, it has also been a huge support knowing that the app could be produced at little cost to ourselves."

Liz Williams, Project Executive
Allergy Alert

"CEMAS has been world first in its nature and mission. We have contributed to create a focal point for mobile technology and apps development in Wales. I am proud of the team and all businesses we supported."

Professor Khalid Al-Begain
Founder and Director of CEMAS

www.cemas.mobi

In My School

Based in Swansea, the founder Michael Leach came up with the idea for 'In My School' to improve communication between schools/teachers and parents.

Winner of the Swansea Startup competition 2013, the app offers parents a quick and easy way to access what activities, when PE Kit etc is needed and general useful information about their child's school day. It became clear that the key to the success of In My School would be teachers seeing the benefits of being able to simply add events and information to the school system.

The app is much easier to use than the current method of creating and printing letters that pupils then take home in their rucksack!

It allows for the easy creation of event reminders such as "Sports day, remember PE Kit" and 'Digital Letters' replace expensive photocopying. The app also allows the school to send free & instant push alerts rather than expensive SMS messages for important events such as "School closed – Snow Day!"

CEMAS successfully project managed and built the app, working from a design and a specification defined by Michael.

"Working with the dedicated CEMAS team was a great experience that afforded us a wealth of expertise and experience. The teams hard work has meant that our In My School app has exceeded our expectations."

Michael Leach,
Director

Through the experience we gained an experienced partner who could turn our wish list of features in to reality. As a start–up our resources are very small, without this support our dedicated app for teachers would not have been made. We would have relied on a simpler web only interface that would have dramatically reduced the appeal of our service.

Muerte en El Prado

Muerte en El Prado is an interactive murder mystery game in Spanish set inside one of the most recognisable buildings in Madrid – El Prado Museum.

The user progresses through a number of different rooms at the museum picking up information in Spanish and solving clues along the way in order to work out who the murderer is. They will meet various characters along the way, and most of these will reveal clues that are relevant to solving the murder mystery and will enable the user to advance in their quest as long as the user is able to interpret them.

The objective of the app is to uncover clues about the murder whilst at the same time discovering and revising language pertinent to GCSE / A level studies.

"Our experience with CEMAS has been nothing but positive from start to finish. Martin, Eilian, Mike and the rest of the developing team are professionals and have taken my vision for a second language iPad app to new dimensions which I could only have dreamed of.

We at DX Languages Ltd, truly could not have done it without them- ¡Gracias chicos!"

Michelle Rooney
Director DX Languages

Wales' first PlayStation 4 game launched

Sony UK Technology Centre (UKTEC) has released the first game to be developed at its Business Incubation Centre in Pencoed.

Infinity Runner is a sci-fi action running game for the PlayStation 4 that has been developed and published by UKTEC tenant Wales Interactive and it is the first PS4 game to be made entirely in Wales.

David Banner, co-founder and managing director of Wales Interactive, said, "Having a studio at UKTEC's Business Incubation Centre has really helped our business grow over the past two and half years. The introductions made for our company have been invaluable to us and played a big part in our studio achieving official PlayStation developer status."

Wales Interactive forms part of Sony UKTEC's Sir Howard Stringer Foundation for Media and Technology, which aims to establish a media development hub and support the product development of the Welsh games industry.

Steve Dalton OBE, managing director of Sony UK Technology Centre, added, "The gaming industry is continuously evolving; however, more often than not many games are typically produced outside of Wales. With the launch of this game it demonstrates that there are opportunities for developers in Wales."

The game tasks players with escaping from a decaying starship, whilst battling against the ship's inhabitants and evading obstacles.

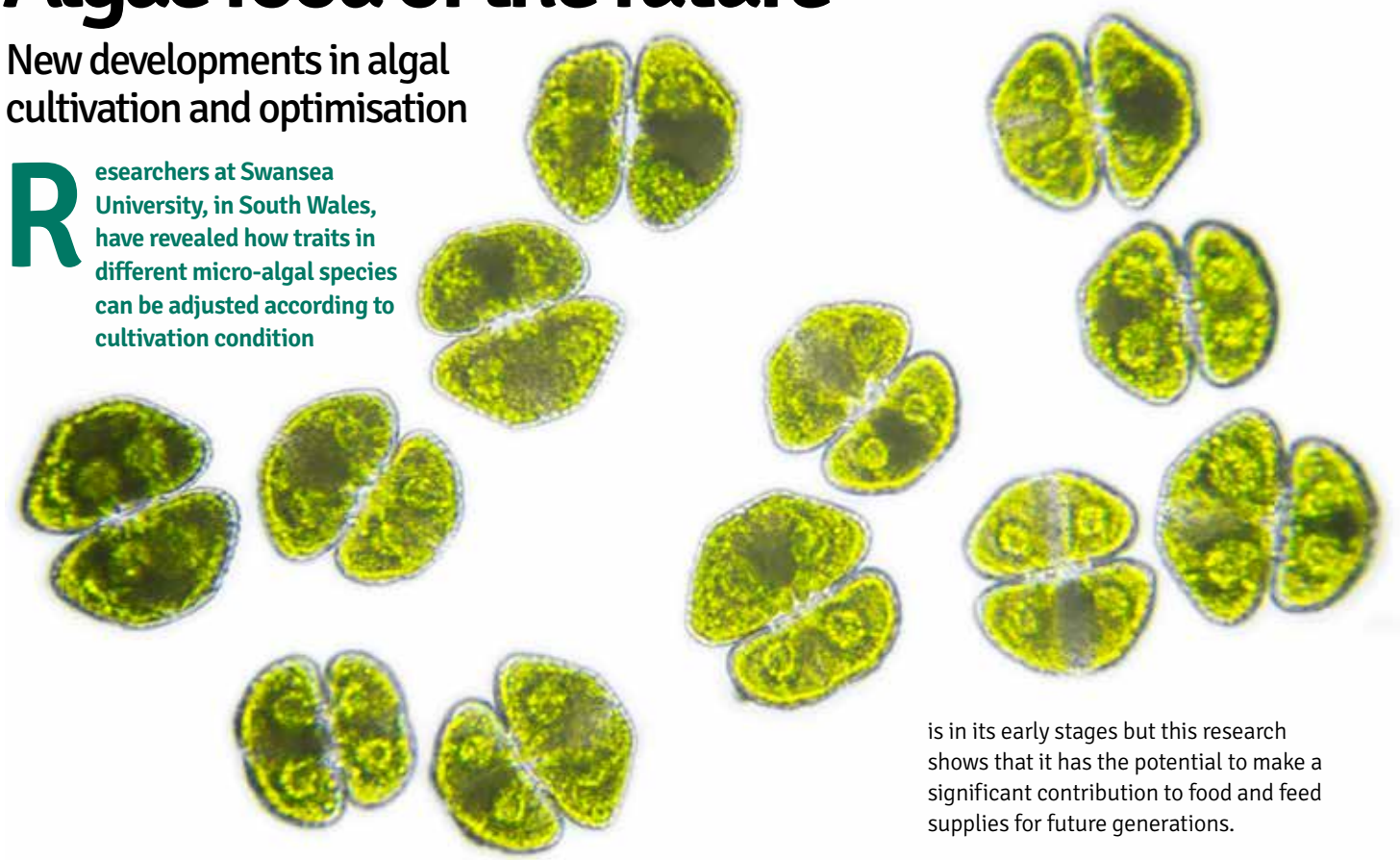
Wales Interactive is also developing its second PlayStation 4 game, Soul Axiom, scheduled for release at the end of 2015.

www.walesinteractive.com

Algae food of the future

New developments in algal cultivation and optimisation

Researchers at Swansea University, in South Wales, have revealed how traits in different micro-algal species can be adjusted according to cultivation condition



The research shows how algae could one day contribute to modern agriculture crop production and become a mainstream source of food and feed. Algae are a good source of protein, fats and carbohydrates as well as being rich in micronutrients such as vitamins and minerals. Some species are particularly rich in omega-3 oils giving the option of bypassing the need to consume the oily fish. Algae have the advantage compared to other agricultural crops in having rapid growth rates and in that they can be cultivated year round.

This research means that Swansea scientists are able to naturally adjust the metabolism of algal cells to optimise growth and the biochemical composition of the cells and hence their nutritional profile. This has been achieved by understanding and carefully controlling the light the algal cells are exposed to as well as the nutrients in the media that the algal cells grow in throughout their life cycle. Ultimately, understanding the metabolism within the cells will lead to the production of a food source containing the right combination of macro- and micro-nutrients in sufficient quantities for industry take-up.

> "The Decision Support Tool developed in EnAlgae enables interested parties to predict best types of algae and biomass production for a given location within the EU and is important in helping us take the new Algal Industry forward."
>
> **Dr Carole Llewellyn**
> **Associate Professor in Applied Aquatic Biosciences**
> **Swansea University**

It has taken thousands of years for humans to cultivate the agricultural crops grains, fruits, and vegetables with the desired traits that we take for granted. 'Algal farming' is in its early stages but this research shows that it has the potential to make a significant contribution to food and feed supplies for future generations.

The research at Swansea, supported by Welsh Government, has been enabled by the EU collaborative INTERREG EnAlgae project. The EnAlgae collaboration led by Swansea University has taken experimental results from the 19 project partners and used these for the development of a decision support tool.

Profile

Product
Controlled algal cultivation and optimisation of products.

Applications
Food, feed and healthcare

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Researchers illuminate the way to low cost solar energy

Making solar energy a more affordable solution

Researchers at the SPECIFIC Innovation and Knowledge Centre in Baglan, South Wales, are one step closer to making low cost solar energy a reality by cutting the time it takes to make a new type of solar cell from up to 90 minutes to just 3 seconds.

SPECIFIC stands for Sustainable Product Engineering Centre for Innovation in Functional Coatings, and the SPECIFIC Innovation and Knowledge Centre is a consortium of Swansea University, Tata Steel, BASF and NSG Pilkington and is backed by funding from the Engineering and Physical Sciences Research Council (EPSRC), and Innovate UK, with Welsh Government support.

SPECIFIC researchers have shown that their new production method uses a short burst of near-infrared radiation – which is the infrared radiation closest in wavelength to visible light – to stimulate the growth of perovskite crystals. This is the active ingredient that converts the sun's rays to electricity.

Over the last four years, SPECIFIC has developed this unique capability in the use of near-infrared for a range of drying and curing processes in photovoltaic manufacture and using this method, the perovskite annealing step has been reduced from 90 minutes to under 3 seconds. The crystallographic analysis, which has been carried out, has also shown a more preferentially oriented structure, which may improve stability.

Unlike conventional ovens, which cure the perovskite from the outer surface, near-infrared passes through the perovskite and titanium dioxide layers and is absorbed by the fluorine doped tin oxide (FTO) coating on the glass substrate. This acts like an instant hotplate, driving the solvent out towards the surface.

> "Every day we get enough energy from the sun to power our planet for 27 years. If we could capture just a fraction of that, we could solve the energy crisis. Perovskites are the subject of intense research at the moment because they are low cost and highly efficient at converting the sun's light into electricity, even in low-light countries like the UK"
>
> **Joel Troughton**
> **Lead scientist**
> **SPECIFIC**

Until now the perovskite has always been crystallised in a conventional oven at 100°C, which takes up to 90 minutes and consumes vast amounts of power, making the cost of manufacture too high to be commercially acceptable.

The silicon solar cells that are seen on roofs up and down the country currently reach about 25% efficiency and that is an improvement on around 23% a decade ago. By contrast, the efficiency of these perovskite cells has leapt from 5% to 17% in just two years and Dr Trystan Watson, Senior Lecturer, SPECIFIC, stated "They are much lower cost than silicon cells too, so the sooner perovskite cells can be commercialised the sooner we'll all benefit from low cost solar energy. For that to happen they need to be quick and cheap to manufacture – that is why this work to remove a major processing bottleneck is so important."

The work was published in the Journal of Materials Chemistry A by the Royal Society of Chemistry.

Profile

Product
Perovskite solar cell

Applications
Solar cell technology

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Fast forward for performance video

Unique software-based analysis system benefits trainers and players

Llanelli-based AnalysisPro has developed AP Capture which is a new form of software designed to provide a unique and high quality way of filming activity which will in turn improve performance analysis. It is a new, fit-for-purpose solution which has been developed in-house using the company's consultancy experience in the field.

AP Capture is designed to work with two high-end Axis IP Cameras and is suitable for both indoor and outdoor use. The cameras can be fixed in position or mounted on a mobile tripod, which was also developed in-house. AP Capture software enables the cameras to be controlled with free-flowing movement patterns which are not normally associated with IP Cameras.

An Internet protocol camera, or IP camera, is a type of digital video camera commonly employed for surveillance, and which, unlike analogue closed circuit television (CCTV) cameras, can send and receive data via a computer network and the Internet.

A special joystick is supplied as part of the software solution. When connected to a PC running the AP Capture software, it allows the camera to move in any direction without jerking, which provides smooth, simultaneous movements, allowing the operator to pan, tilt and zoom all at the same time. These are vital qualities for filming fast-flowing events like football, rugby and hockey matches and any change in pressure and speed applied to the joystick by the user automatically changes the speed that the camera tracks or zooms in or out.

The AP Capture software can be used to create videos in various high quality file formats (.MOV, .MP4 and .ASF), and is also able to mix that with a sound source, so it can be linked to a microphone, either within the mobile tripod itself, or to an external one such as a referee's. A separate Ethernet feed can be connected to a laptop which runs the Nacsport video analysis software for a secondary live capture and analysis of the event.

With support from Welsh Government, the development of the unique AP Capture software enables AnalysisPro to provide many services and features tailored to fit the demands of the video analysis industry. Previous IP Camera solutions were not capable of meeting the requirements of performance analysts or organisations wanting to utilise video analysis of their events.

A new development of the software enables users to take the IP Camera feed, along with additional camera feeds, saved videos, audio and pictures, and live stream a combined video to YouTube. This gives users a powerful new method of using IP Cameras and sharing live events with wider audiences.

AnalysisPro has also developed a mobile tripod solution that allows an IP Camera user to film from an elevated position; meeting the needs of sports performance coaches using grounds and training venues without fixed elevated filming positions.

The company has developed a plan for add-on functions for new versions of the software, looking to create further bespoke features for elite performance analysis.

Profile

Product
Filming software

Applications
Enhanced performance analysis

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SPOT the difference

Welsh-designed software reduces errors in medical devices

Researchers at Swansea University Computer Science Department have developed a groundbreaking prototype tool that is capable of detecting software errors in medical devices, which can lead to preventable user error and adverse consequences.

Aptly named SPOT, the tool uses novel modelling, testing and simulation methods to verify the specifications of device interfaces. Using a sophisticated graphical front end, the tool enables the user to generate and evaluate interactive devices in a realistic simulation environment.

It is estimated that 90,000 people die each year in UK hospitals due to preventable error and device regulators repeatedly report that many of these deaths are caused by poor user interface design and engineering. These design errors are usually inherited by incorrect system requirements or specifications and identifying these defects early in the development process can significantly reduce use errors, and thus save patients' lives.

SPOT can rigorously examine device behavior against specific safety and usability requirements, i.e., it verifies whether a device performs a particular function as intended by its design. It allows the user to operate the device through the simulator and observe in real time how the device responds to these user actions, e.g., by pressing a particular button on the user interface, what feedback is provided on the device displays.

These may sound like basic design safety principles that, surely, all medical devices must satisfy however, according to Jay Doyle, Business Development Officer on the research project, "many reported incidents and product recalls involving medical devices are due to software defects, either by incomplete or erroneous system requirements or design features which are chosen without due consideration of usability factors. We look beyond the design and intended functions, and examine how devices are used in the real world, and often in very intense, critical situations."

SPOT was developed by Dr Patrick Oladimeji of Swansea University, and Dr Paolo Masci of Queen Mary University of London, working on the CHI+MED (Computer-Human Interaction for Medical Devices) project. CHI+MED is a six-year, £6million project funded by the Engineering and Physical Sciences Research Council, to improve the safety of programmable medical devices.

Through research that combines advanced software engineering techniques with human factors, experimental observations, and cognitive psychology, researchers are able to examine how people carry out work tasks in real-world situations, as well as to explore the causes of user errors in the system design of devices.

What makes SPOT unique is its ability to produce results in a form that allows users to disentangle user interface defects and software design errors. The tool can be used to test existing devices and it can also be used at early phase of design, for verification and validation of design alternatives before committing to potentially expensive design decisions. Although all safety-critical systems must be verified against safety requirements before being marketed, there is a lack of technologies commercially available with the advanced capabilities of SPOT.

This rapid form of verification not only helps enhance medical device safety, it also reduces crucial time to market and the cost of expensive recalls to fix design issues after device deployment.

SPOT is also gaining attention outside of healthcare; NASA and the European Space Agency are interested in SPOT's capabilities for testing safety-critical systems such as avionics software and next generation collision avoidance systems. The US Food and Drug Administration (FDA), the world's largest medical device regulator, is currently piloting SPOT in its medical device safety testing programmes.

The researchers behind SPOT now wish to move a step closer to scaling-up the technology for commercial application. Jay Doyle said, "In terms of market need for this technology, the case is clear; what SPOT brings to the healthcare sector and beyond is a truly unique and game-changing method for robust and reliable testing that is currently missing in safety-critical domains. That this innovation is attracting such high-level interest internationally speaks to the high-level recognition of our work and the uniqueness and credibility of our research at Swansea University."

Profile

Product
Software modelling tool

Applications
Detecting software errors in medical devices

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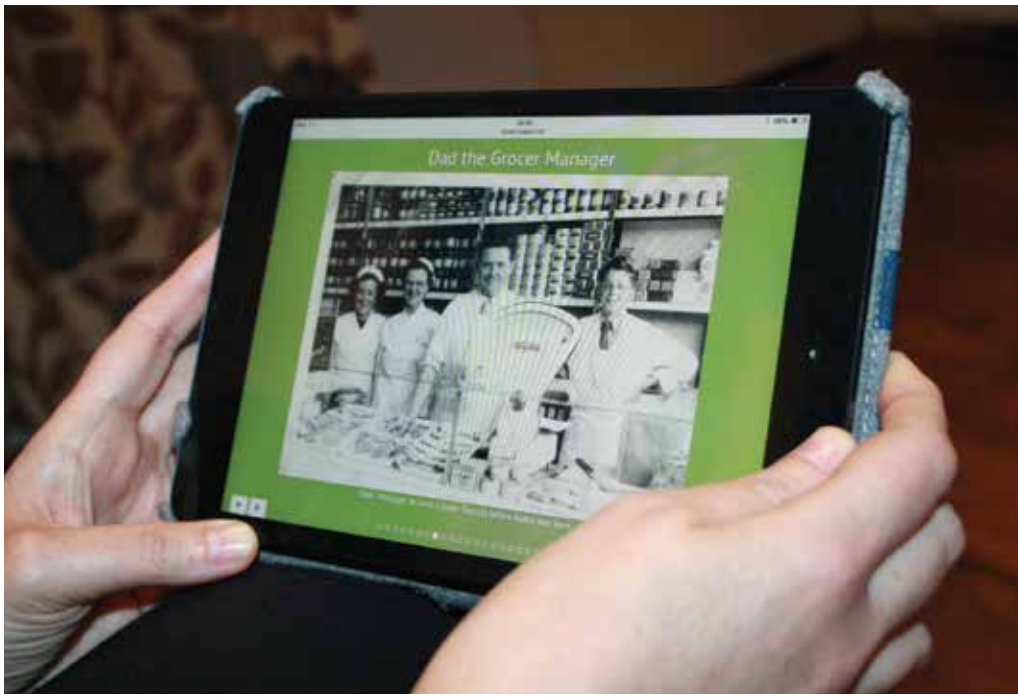
Helpful app for people with dementia

Reminiscence therapy aided by Welsh-designed app

Tom and Kathy Barham, from Denbighshire in North Wales, have developed an innovative app which aims to help people with dementia to reclaim their memories.



The device, created by their not-for-profit company Book of You CIC, uses the concept of "life story therapy" to help people with dementia capture their past experiences using photos, videos, words and music and is being welcomed as having the potential to revolutionise reminiscence therapy for people with dementia.

Reminiscence therapy is widely used with people with dementia, and involves reminiscence sessions, which use objects and photographs from the past to encourage memories and conversations, or creating books of memories and life-stories relating to each individual.

The 'Book of You' takes those sessions and individually created books onto a mobile device which has the ability to incorporate sound and moving images as well as providing an easy way to create each individual's content.

Bangor University is providing expertise to support the development and effectiveness of 'Book of You', and Professor Bob Woods of the University's Dementia Services Development Centre explains, "What this app does, is to focus on what many people with dementia can do-which is to access their long-term memories. Sharing those memories not only helps them maintain their own sense of self, it also helps family and carers looking after them, and they, in turn, can learn about the individual and have greater empathy with them, through sharing their life story. The beauty of 'Book of You' is the way it uses digital media to bring to life pictures and words that simply don't have the same power as pages in a book. When you add in film and music, you have something that is very evocative."

People with dementia often have difficulty remembering what has recently happened in their lives and so there is evidence that reminiscence therapy can improve mood, wellbeing and some mental abilities such as memory. It is also proven to help boost an individual's self-esteem by helping to make valuable connections between the past and the present.

The app was trialled in both care homes and day centres and launched earlier this year. Kathy stated, "For the users, it has helped them to recapture and share some of the things that shaped their lives, from the everyday but none-the-less important things like the music they love through to extraordinary events such as meeting royalty or travelling the world."

The app will now be used in care homes, with facilitators working with people with dementia to create their digital life stories. Professor Woods sees the app being of particular benefit to people in the early stages of dementia and added, "Our research suggests that producing a life story book results in a better quality of life for people with dementia and as reported by family, improved quality of relationships."

The app is set to benefit thousands of people with dementia, their families and carers and, as a social enterprise, all profits from the app will be reinvested into expanding the service across the UK.

850,000 people in the UK currently suffer with dementia and that number set to rise to more than a million in 2025

Profile

Product
Book of You dementia app

Applications
Aids with reminiscence therapy for people with dementia

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For more information please circle **7607** on the reader reply card

Sensing street crime

Fight-sensing cameras to cut crime on Britain's streets

Researchers from Cardiff University, in South Wales, are looking to make the streets safer with 'smart' cameras that are able to sense violence.

This project stems from earlier academic research and sees computer science and violence experts working with technology specialists from the Airbus Group to develop a system that will spot trouble brewing and guide police before anyone gets hurt.

The study focuses on the development of imaging technology that will automatically alert CCTV operators when fights are detected on city centre cameras. 'Smart' CCTV already exists which can count people and identify cars however this project goes further by analysing and recognising the complex behaviour of night-time crowds and providing 'real time' alerts, which in turn help to prevent serious injury and reduce costs to health services.

Professor Simon Moore, from Cardiff University's Violence and Society Research Group, said, "Developing 'smart' camera technology that can pinpoint violence is a really cost effective way of helping police to do their jobs. Officers cannot monitor hundreds of city centre CCTV cameras all the time."

The system is able to differentiate between violent and non-violent behaviour as it can identify how chaotic the movement is, as well as the magnitude of an action and the element of direction. When these factors are detected, if classed as so, the CCTV screen displays the word 'Violent' and the whole screen becomes tinted red, although a range of other outputs to alert people to the situation are possible.

> "By using imaging technology, officers will be alerted to violence 'hotspots' in real-time, helping to further reduce violence. It's a great way of using technology to make the streets safer for all of us."
>
> **Prof Simon Moore**
> **Violence and Society Research Group**
> **Cardiff University**

Professor David Marshall, from the University's Computer Science School, said, "This work builds on an active collaboration with the Violence and Society Research Group and research expertise in video analysis. Detecting violence from CCTV camera footage presents some interesting technical challenges due to the time of day (night time), the need to operate in all weather conditions, camera positions and recognising people's often complex activities in such footage."

The project has grown out of original research work carried out by Kaelon Lloyd, a PhD student in the University's School of Computer Science and informatics. This involved the development of software that assisted CCTV observers with the identification of violence by modelling scene dynamics and is a partnership between Cardiff University, Airbus Group (formerly EADS) and Welsh Government. Airbus is developing the technological infrastructure, whilst Welsh Government is providing funding.

Fights on the street cost the taxpayer millions of pounds each year. The Home Office estimates that an average violence incident costs more than £33,000 in NHS and criminal justice costs, lost working hours, and the impact on victims.

The Association of Chief Police Officers backs the project. Adrian Lee, Chief Constable of Northamptonshire and ACPO lead for alcohol and licensing said, "As austerity continues in policing it is important that we work together with academia to develop an evidence base of knowledge to ensure officers and resources are deployed as effectively as possible."

Profile

Product
Fight-sensing camera

Applications
Helps to provide a safer community

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Seeing a new perspective

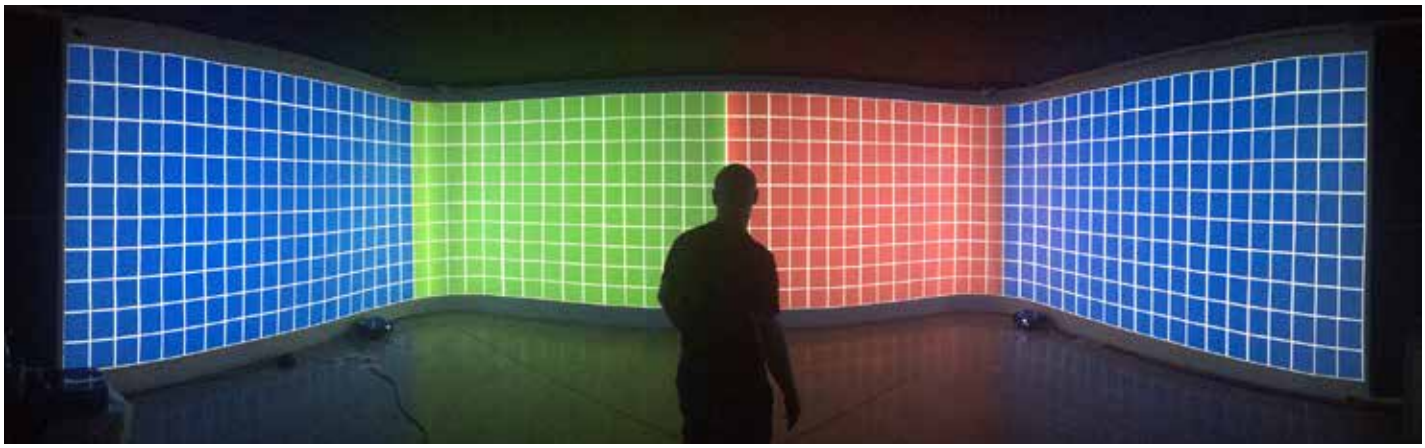
Fovography - a new generation of imaging technology

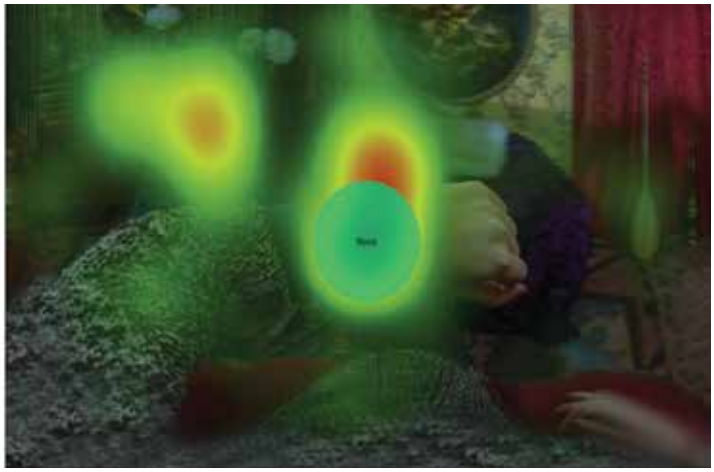
Researchers at the Cardiff School of Art & Design at Cardiff Metropolitan University, in South Wales, have developed a process that overcomes the limitations of linear perspective.

The School's research into human visual perception has led to a number of technological developments that offer improved ways of depicting visual experience. Existing imaging systems, such as cameras and computer graphics engines, are based on the geometry of linear perspective, which was developed over 500 years ago during the Italian Renaissance. Useful as linear perspective has been in allowing us to capture visual space on a flat picture plane, its many limitations have been well known ever since it was discovered. These include the fact that perspective images generally capture only a single eye point of view, and a very narrow angle of vision.

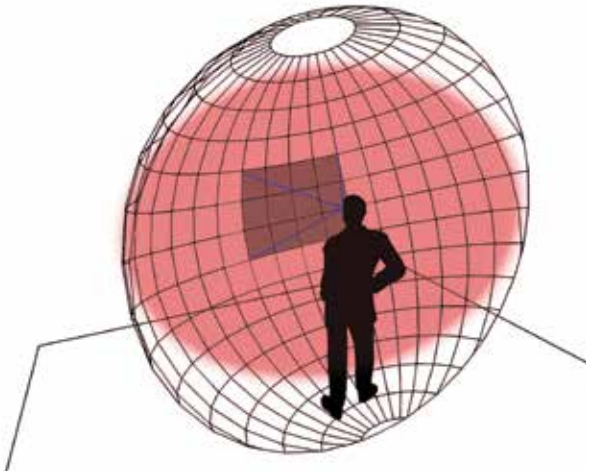
The researchers have developed a process called Fovography that overcomes these limitations as it allows the user to capture the full field of view (hence the prefix 'fov') and present it on a flat surface in a way that appears natural to human perceptions. Fovography meaning 'field of view imaging' has been developed through a unique combination of artistic and scientific research.

The traditional method of depicting the visual world, projects a linear model of 3D space onto a flat rectangular plane and is still largely employed today in photography, cinema and computer graphics. Fovography, on the other hand, is modeled on the curved structure of the human eye and the way our perceptual systems process visual information.





Left image showing eye tracking responses to a conventional photograph. The orange disc shows the area of interest. Right image shows a Fovograph and the user eye tracking responses to the same area of interest.



This diagram illustrates the difference between a conventional camera's view of a scene and what a human actually sees. The grey rectangle represents the section of the world that would typically be captured by a standard 35mm lens. The red area represents the scope of the scene that would be visible to a human with normal vision.

Fovographs produce images with greater breadth and depth than normal photographs. They capture the entire visual field, not just the cropped rectangle seen in most paintings, photographs, and movies. They can simulate how the world appears from a first person point of view, offer a much greater sense of depth and immersion than normal photographs, and can make objects seem almost tangible – as if they are floating in space, and in effect, provide 3D visual experiences – without the need for special glasses or expensive screens.

Other methods of capturing wide visual angles, such as panoramas and fisheye lenses, produce images that are either extremely long in format or highly distorted whereas fovography uses a unique process that avoids extreme aspect ratios or distortions while presenting the full scope of the visual field in a naturalistic way. As a result fovographs can accommodate much more visual space within a given picture area.

Enhanced sense of depth. Fovographs capture and present spatial information in much the same way we see it in real life. As a result the visual system is easily able to interpret the spatial cues and so you more readily see depth where none really exists. Under the right conditions the effect can be quite startling.

Realistic first-person perspective. Many people are surprised when it is pointed out how much of their own body is visible in the field of view. Our legs, hands, torsos, and even our noses, are a constant feature of everyday visual experience. Yet hardly ever do they appear in representations of that experience. Fovographs are able to convincingly depict how the world appears from a first person point of view. This opens up new narrative possibilities, allowing images to be created with a compelling sense of first-person presence.

Directed attention. In natural vision our eyes are always fixated on some part of the world in front of us, even if only momentarily. Normally the object of fixation commands our attention and interest, and is often what we are most consciously aware of at that time. Because fovographs emulate natural vision we are instinctively drawn to whatever object in the fovograph is treated as the fixation point. This allows image-makers to direct viewers' attention to specific areas within the picture far more quickly, and to hold their attention at that point for longer.

Originally developed as a means of capturing visual experience through painting and drawing by researchers at Cardiff School of Art, fovography has now been turned into a digital photographic process and is currently being applied in a number of commercial contexts, including advertising, simulation, computer gaming, and virtual reality.

> "Despite what many people think, there's a great difference between the way we see the world and how a camera captures it. This is something artists have known for many years, and it is fascinating to look back through art history and see how artists have depicted the world in ways that are much closer to actual human vision. We have been able to harness some of their discoveries and build them into a new generation of imaging technology."
>
> **Prof Robert Pepperell**
> **Cardiff School of Art**

The project was supported by the Academic Expertise for Business Scheme, run by Welsh Government and funded by the European Structural Fund.

Profile

Product
Imaging technology

Applications
Visual appreciation

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‘Stem cell’ test could identify most aggressive breast cancers

New study suggests that testing breast cancer cells for how closely they resemble stem cells could identify women with the most aggressive disease

Researchers from Cardiff University, in South Wales, have found that breast cancers with a similar pattern of gene activity to that of adult stem cells had a high chance of spreading to other parts of the body.

Assessing a breast cancer’s pattern of activity in these stem cell genes has the potential to identify women who might need intensive treatment to prevent their disease recurring or spreading, the researchers said. Adult stem cells are healthy cells within the body that have not specialised into any particular type, and so retain the ability to keep on dividing and replacing worn out cells in parts of the body such as the gut, skin or breast.

In the study, a research team from Cardiff University’s European Cancer Stem Cell Research Institute, The Institute of Cancer Research, London and King’s College London identified a set of 323 genes whose activity was turned up to high levels in normal breast stem cells in mice.

The study was funded by a range of organisations including the Medical Research Council, The Institute of Cancer Research (ICR), Breakthrough Breast Cancer and Cancer Research UK.

The scientists cross-referenced their panel of normal stem cell genes against the genetic profiles of tumours from 579 women with triple-negative breast cancer – a form of the disease which is particularly difficult to treat. They split the tumour samples into two categories based on their ‘score’ for the activity of the stem cell genes.

Women with triple-negative tumours in the highest-scoring category were much less likely to stay free of breast cancer than those with the lowest-scoring tumours. Women with tumours from the higher-scoring group had around a 10 per cent chance of avoiding relapse after 10 years, while women from the low-scoring group had a chance of around 60 per cent of avoiding relapse.

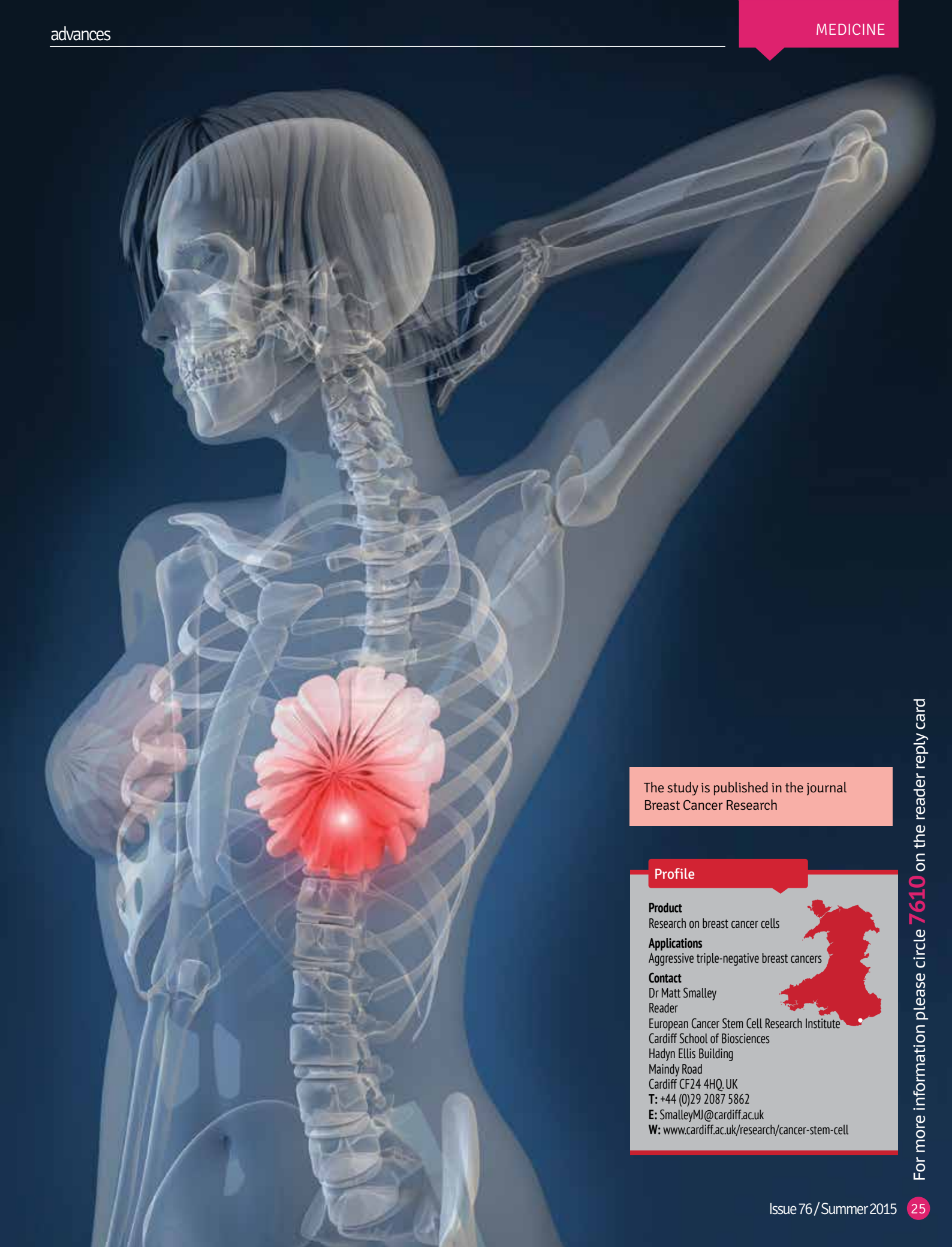
The results show that the cells of aggressive triple-negative breast cancers are particularly ‘stem-cell-like’, taking on properties of stem cells such as self-renewal to help them grow and spread. They also suggest that some of the 323 genes could be promising targets for potential cancer drugs.

Study leader Dr Matthew Smalley, Deputy Director of the University’s European Cancer Stem Cell Research Institute, said, “Triple negative breast cancer accounts for around 15 per cent of breast cancers, but is more difficult to treat than other cancer types as it is not suitable for treatments such as anti-hormonal therapy. It’s particularly important to understand the genetic factors that help it to spread around the body – and we were excited to find that a key factor seems to be the degree to which gene activity resembles that of stem cells. Our next step will be to explore which of these 323 genes are the most important drivers of the disease and to use these to develop a new genetic test.”

Dr Matthew Lam, Senior Research Officer at Breakthrough Breast Cancer, said, “Women with triple negative breast cancer tend to have higher rates of recurrence than those with other types of breast cancer. There is so much more to learn about this particularly aggressive form of the disease which is why this type of research is so important. If we can develop ways to predict who is most likely to relapse, more can be done to protect high-risk patients, such as closer monitoring or extended treatment, to help reduce the chance of their cancer coming back.”

Dr Nathan Richardson, Head of Molecular and Cellular Medicine at the Medical Research Council, said, “Triple negative breast cancers are a particularly challenging form of the disease to treat. Casting a light on to the genetic factors that are behind the recurrence and spread of cancer is crucial to understanding more about the biology of this aggressive disease. This study could be hugely important to find ways to identify those patients who are at risk of the most aggressive forms of the disease, improving the way they are monitored and cared for. Crucially, this research could lead to new treatments with the potential to make a real difference for women with this type of breast cancer.”

> “Cancer cells can behave very much like stem cells – but stem cells gone bad. They find a way to activate genes which are usually only turned up in normal stem cells, giving them characteristics – such as self-renewal and immortality – that make them more difficult to treat.”
>
> **Professor Clare Isacke**
> **Professor of Molecular Cell Biology**
> **The Institute of Cancer Research, London**



The study is published in the journal Breast Cancer Research

Profile

Product
Research on breast cancer cells

Applications
Aggressive triple-negative breast cancers

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A hidden condition

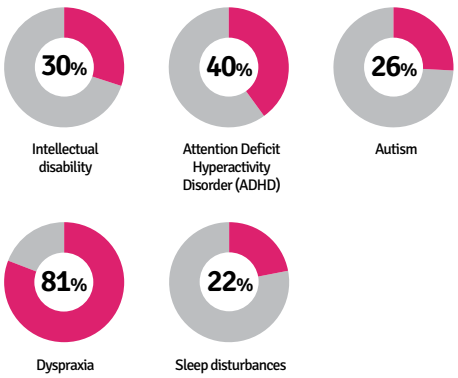
Investigating mental health issues facing children with a chromosomal disorder

Researchers from Cardiff University's ECHO research team (Experiences of people with copy number variation), in South Wales, report that children and adults living with a poorly understood chromosomal condition are 25 times more likely to develop schizophrenia than the general population.

Affecting an estimated 35,000 people in the UK, 22q11.2 Deletion Syndrome (22q11.2DS) is caused by the deletion of a small amount of DNA from a person's chromosome 22. Babies who inherit the condition are often born with serious health problems as well as issues affecting normal development.

Study leader, Professor Marianne van den Bree, from Cardiff's Institute of Psychological Medicine and Clinical Neurosciences, said, "Having interviewed parents across the UK about their children with 22q11.2DS, we have found very high rates of intellectual, developmental and a range of mental health problems, the extent of which is largely unknown by the medical community or policymakers."

Researchers found that the main issues confronting children born with 22q11.2DS include:



Furthermore, in adulthood, patients have an increased risk of developing schizophrenia (25 times more likely to be affected than people in the general population).

Cardiff PhD researcher, Samuel Chawner, said, "Our findings indicate that these risks depend to some degree on the developmental stage of the child. For example, the rate of ADHD declines somewhat when children reach adolescence, while risk of low mood increases slightly."

Parents frequently report that they do not get the support they need for their child. Prof van den Bree added, "Society, including medical and other professionals, has generally never heard of the syndrome, and this creates a barrier for accessing much needed services. Children and their parents frequently have to cope with lack of understanding in other settings, such as the school."

According to the researchers, children tend to be referred for genetic screening because of physical or developmental problems however, the ECHO study has found that there is a great variation between services in how parents are told about their child's diagnosis. Parents are often not told by clinicians about the risk their child carries of developing mental health problems. As a consequence, they tend to learn about these complicated problems when browsing the internet, rather than with the guidance of a clinical expert.

In addition, there is currently insufficient scientific information about the likely course of the condition from childhood to adolescence and into adulthood. Parents therefore do not know what lies around the corner. These important issues need to be addressed by studying patients over time.

Dorne Mitchell is mother to Ivy, aged 2, who lives with 22q11.2DS. She said: "As we reached the last two weeks of our pregnancy we received the bombshell that our little girl appeared to have abnormalities. A test confirmed that Ivy had 22Q11 – a condition we'd never heard of – along with that came the devastating news that she had a rare and complex cardiac problem which would require open heart surgery throughout her life."

The ECHO study is currently tracking the effects of 22q11.2DS on 130 families throughout the course of their lives – one of few studies to do so. By presenting their findings to politicians, clinical experts and patient support groups the Cardiff team hopes to increase awareness of the condition, gain funding for further research and discuss ways of improving support for the condition.

The researchers believe that understanding why individuals with 22q11.2DS are at increased risk of developing mental health problems can ultimately also provide important insights into these conditions in the general population.

The research was funded by Waterloo Foundation, the National Institute of Health (NIH), Wellcome Trust and The Baily Thomas Charitable Fund.

Profile

Product
Knowledge of chromosomal condition

Applications
Awareness of development of schizophrenia

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