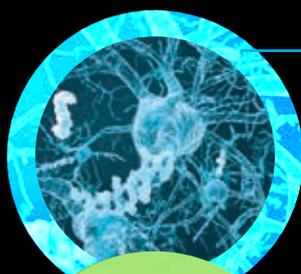
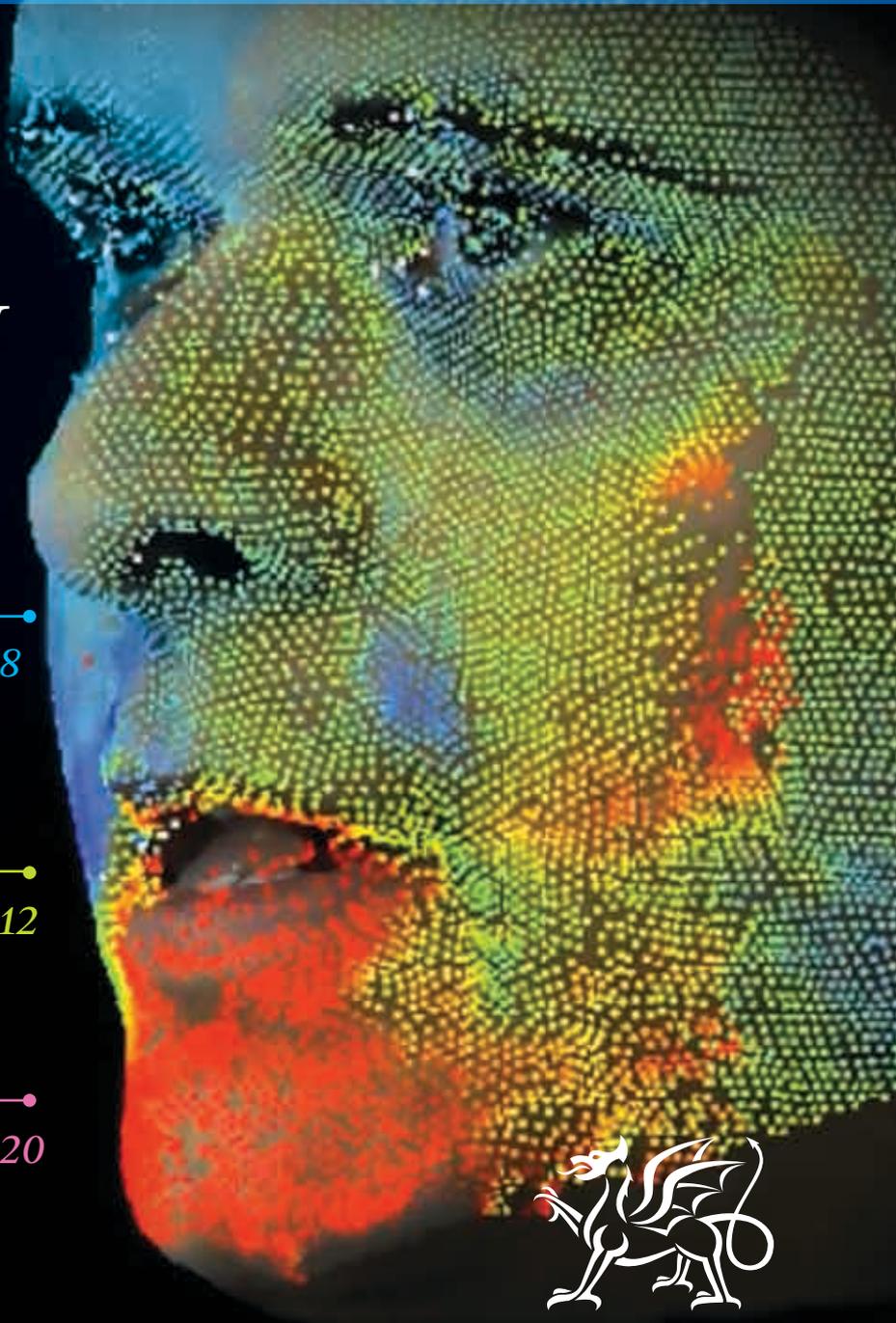


THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY

advances **WALES**

The face of 3D Technology

A New Dimension in 3D/4D Facial Imaging



Cardiff-led research discovers 11 new genes linked to Alzheimer's disease **8**



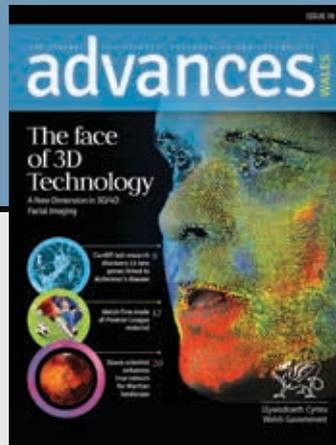
Welsh firm made of Premier League material **12**



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Llywodraeth Cymru
Welsh Government



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“Whatever you can do, or dream you can; begin it. Boldness has genius, power and magic in it.” – Goethe

Featured in this edition are Baz Dhaliwal, Founder of Rikoset, Greg Dash, Creator of the ‘Little Cyclops’, and Sara Wynne of QOL all of whom had the courage and desire to succeed and turn their ideas into commercial reality.

Great research needs to be recognised and celebrated. Our Welsh universities are at the forefront of many ground-breaking discoveries and research, such as that led by Professor Julie Williams, investigating new risk genes linked to Alzheimer's. The full article can be found on page 8. It is also fantastic to see such research being developed into products, as with the revolutionary self-healing concrete which can be seen as a “holy grail” for the building industry (page 11).

Wales holds the key to expertise in many diverse areas, the PanCam from Aberystwyth University is an example of a product developed in Wales which will potentially have a global impact when it returns from the 2018 ExoMars mission (page 20).

Our news section looks at collaborations, investments and success stories for Wales. The importance of commercialising our world-class IP is highlighted as is the need for funding to improve the country's research and resource capabilities.

You will notice that this issue of Advances has a new look and a new editor. I am always happy to work with both companies and academics to investigate new leads and develop potential features to help readers keep up-to-date with the latest news and developments in science, engineering and technology in Wales.

I hope you enjoy the new issue.

Lucinda Dargavel
Editor



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Mars 2018 mission: Colour calibration system created in Wales ensures images sent back to Earth truly represent Mars' landscape

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COVER IMAGE 3D / 4D facial imaging. Cardiff University's School of Computer Science and Informatics (see page 18).

PHOTOGRAPHY Sourced from organisations featured, their representatives and Shutterstock.



Advances Wales is a high-quality, quarterly 'transfer of technology' journal produced by the 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.

Commissioning Editor Alyson Pasch.

For information on how to contribute features contact the editor, Lucinda Dargavel (tel +44 (0)29 20473456, email advances@teamworkdesign.com).

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Stemming risk in stem cell therapies

Biotec Services International has announced a new joint venture to develop a technology to increase the efficiency and reduce the risk in stem cell therapies.

Biotec, which is already a leader in clinical trials supply chain management, is teaming up with AwenID- a Swansea University life sciences spin-out company to form TrakCel in a new joint venture.

This new joint venture company is looking to develop tracking technology for the full lifecycle of stem cell based therapies, in order to ensure that patients receive the correct treatment at both the right time and the right location.

Efficient and controlled delivery of stem cells is critical as the cells have a very short lifespan and need to be transported, manufactured and re-introduced to the patients in a safe, controlled and scalable way (as featured in Advances Wales issue 68).

TrakCel's new technology aims to provide physicians with the ability to track the movements and temperatures of cell-based

therapies and therefore ensure that the cells have the best opportunity of being successfully re-introduced to patients. The spin-out has announced that live 'named patient' stem cell trials will commence with international pharmaceutical company GlaxoSmithKline early in 2014.

Kevin Smith, a director of AwenID and newly appointed chief executive officer of the joint venture, said: "We're all hugely excited at the opportunities that lie ahead for Trakcel. Biotec's heritage in clinical supply chain management, allied to AwenID's proven capability and patent-pool in automation and tracking, will solve some key challenges for the nascent cell therapy industry as it prepares to scale-up and scale-out globally."

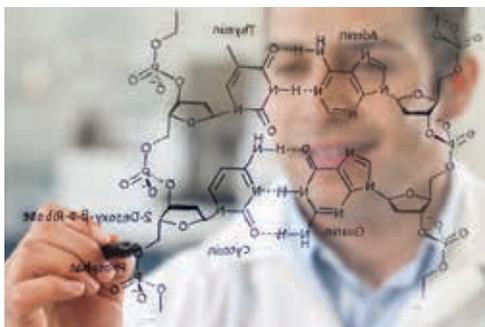
”

We're committed to leading the world in supply chain management. The technology and solutions we envisage for the future will be made possible through innovation and focus at TrakCel.

Keren Winmill
Chief Executive Officer
Biotec Services



www.biotec-uk.com



Finance Wales and Fusion collaborate to help commercialise world-class IP

The current economic climate is challenging for any entrepreneur seeking to finance a new start-up. University spin-outs are no exception. It is therefore very welcome news to two Welsh Universities, Cardiff and Swansea, that Finance Wales and Fusion IP, have agreed to collaborate in supporting the commercialisation of emerging technology led companies.

Building on an agreement made in 2007 this outlines a co-investment strategy to support the opportunities arising from Fusion's intellectual property pipeline agreements with Welsh Universities. The company signed an agreement with Cardiff University in 2007 and another with Swansea University in April 2013.

Fusion IP's CEO, David Baynes says, "We're ambitious to create successful businesses from the world-class IP created at the universities we work with. Both Cardiff and Swansea University have a number of excellent research departments with an interesting pipeline of potential commercialisation opportunities.

Welcoming the agreement, Steve Smith, Finance Wales' Director of Technology Venture investments, said, "Young technology ventures can often require a number of funding rounds before they become commercially viable and the availability of seed and series A capital is limited at the moment. Having the backing of long-term investors with capital to invest over a number of rounds can make all the difference."

Finance Wales has invested £9m in Welsh technology businesses over the last financial year. This investment capital has attracted a number of high-growth ventures such as Clinithink and Creo Medical to Wales.



www.financewales.co.uk

Wales to share in ESRC's £64m Big Data funding investment

Swansea University, in partnership with Cardiff University, is among five grant recipients in the first phase of a £64 million funding investment by the Economic and Social Research Council (ESRC) to support the development of a UK-wide network of innovative centres to strengthen the UK's competitive advantage in Big Data.

The announcement of the new Administrative Data Research Network (ADRN), which will form the core of the ESRC Big Data family, was made by Rt Hon David Willetts MP, Minister for Universities and Science, during the Mountbatten Memorial Lecture at The Royal Institution in London.

Mr Willetts said: "Every day the world creates 2.5 quintillion bytes of data – equivalent to over 150,000 iPads worth of information. The power of computing in analysis of massive and mixed datasets will transform science and industry in the UK and through the creation of the Big Data Network and the ADRNs; we hope to be well placed to take competitive advantage of this great technology."

The ADRN, was established on 1st October and will run for an initial period of five years. It is a partnership between Government departments, research funders, national statistical authorities and the research community, which will reach across the UK to facilitate research based upon linked, routinely collected administrative data.

This network will be led by the Universities of Edinburgh, Queens University Belfast, Southampton, and Swansea, with the Administrative Data Service (ADS) to be based at the University of Essex.

The ADRN Wales will be led by Swansea University, in partnership with Cardiff University, under the direction of Professor David Ford, Institute of Life Science, College of Medicine, Swansea University.

Commenting on the announcement, Professor David Ford said: "ADRN Wales is a truly exciting development. The new Centre will share a brand new purpose-designed building at Swansea University, designed specifically to house ADRN Wales and its sister Centre – the Medical Research Council's Farr Institute – both working together to unleash the potential of large scale data to conduct powerful new research."



www.esrc.ac.uk

£14m to support 'drug hunters' in Wales

New drugs to fight a range of diseases could be discovered and developed in South Wales with the backing of a £14m cash injection designed to support the world's best 'drug hunters'.

The funding has been given for a new pioneering network focusing on drug discovery and development for unmet clinical needs.

The new National Research Network (NRN) in Life Sciences and Health, led by Cardiff University Professors Chris McGuigan and Malcolm Mason, is part of wider plans to concentrate, connect and boost the Life Sciences sector in Wales.

The NRN is backed by £7.3m from Welsh Government's Sêr Cymru programme and will be matched by industry, academia and charities to create a fund worth £14m. Over the next five years, this resource will not only allow four Welsh universities to support over one hundred PhD students and researchers but it will also mean that it will be able to attract and retain the world's leading experts to oversee their pioneering work.

According to Professor McGuigan, "The scientific challenge of developing new drugs to help treat conditions like cancer has never been greater. Discovering new drugs will help address some of society's major current needs – especially with an ageing population.

"The potential for this work is huge. It will help increase world-leading activity in this priority area in Wales, lead to an increase in competitive research funding and help foster industrial engagement and knowledge transfer.

"The focus could be on any therapeutic area – in areas like cancer, infectious diseases and Alzheimer's disease. The best research proposals will be considered by some of the world's experts in their field. We hope this unique funding opportunity will attract some of the world's leading 'drug-hunters' and help put Wales firmly on the map for drug discovery," he adds.



www.wales.gov.uk

Aerospace firm Testia aims to train 1,400 in Newport

The next generation of expert aerospace engineers are to be trained in South Wales after a global company launched a new UK business.

EADS, which owns Airbus in Flintshire, hopes to recruit school leavers to join Testia, which will be based at the EADS Newport campus in South Wales, and will specialise in non-destructive testing and training in aerospace. Following Welsh Government investment, within six years the new venture hopes to be training 1,400 students a year who will each receive National Aerospace Board qualifications as well as creating around 60 jobs.

The new site expects to train engineers from hundreds of suppliers and customers including GE, Rolls Royce, global engineering group GKN, Airbus and the space company Astrium with regulations dictating that big aerospace companies have to send their staff to outside organisations for training.

Denis Gardin, head of EADS New Technology Ventures and President of Testia, said: "By opening a Testia company in the UK we are addressing a potentially serious problem in



the global aerospace industry by replacing an ageing population of engineers with young, highly-skilled persons who will progress to fill those expert roles in the future."

What is important for Wales is that this investment is recognition that the country has a significant aerospace industry.

The reality is that there are 20,000 people working across aerospace manufacturing, maintenance, repair and overhaul as well as support services in Wales and together they are worth around £1.2bn.



www.testia.com

New Chief Scientific Adviser for Wales

Professor Julie Williams CBE has been appointed as the new Chief Scientific Adviser for Wales.

The Chief Scientific Adviser for Wales (CSAW) is responsible for providing independent and top quality scientific advice to the First Minister and his administration across a broad spectrum of topics to support both decision and policy making.

Professor of Neuropsychological Genetics and Dean of Research at the University's School of Medicine, Julie Williams said: "I am honoured and delighted to have been offered this great opportunity to help shape, develop and champion the role that science plays in our society here in Wales and especially to follow in the footsteps of

Professor John Harries who did so much work to support science and scientific research in Wales.

Professor Williams takes over from Professor John Harries who retired earlier this year and was responsible for developing the Science for Wales strategy and introducing a number of initiatives to increase Wales' science capabilities. Professor Williams will build on this, placing a particular emphasis on enhancing the provision of scientific advice in Welsh Government decision making across all its business areas.

Announcing her appointment, First Minister for Wales, Carwyn Jones said: "Professor Julie Williams is an outstanding research scientist and her contribution to Alzheimer's research is recognised worldwide. She

is also an able communicator and is an excellent choice as Chief Scientific Adviser for Wales.

”

I am delighted that one of our leading Professors from a Welsh University will hold this position at a time when the role of science in society and the economy is growing in importance. I am confident that she will take us to the next level in terms of our ambition to create a strong and vibrant science base in Wales.

Carwyn Jones,
First Minister for Wales

IN BRIEF

Funding for Excellence

Swansea University has been recognised as one of the UK's leading academic centres of excellence in the UK by the Engineering and Physical Research Council (EPSRC).

The EPSRC has announced funding for four new centres for innovative manufacturing that will develop ways of manufacturing in the fields of electronics, laser use in production processes, medical devices and food production.

Swansea University's Printing and Coating and Complex Fluids Centre will form part of the new Centre for Innovative Manufacturing in Large-Area Electronics (LAE). This centre will bring together leading academics from Swansea University, the University of Cambridge, Imperial College London and the University of Manchester.

Swansea University is already held by the EU as an example of how structural funds can be used in combination with research council funding. It will receive its share (about £1.4m) of the £5.6m awarded by the EPSRC to the Large-Area Electronics Centre.

From Bangor to Brazil

Bangor University has announced that the first three research projects funded under a recent co-operation programme are in the fields of Marine Sciences and Marine Ecology. These projects link researchers from Bangor and Universidade de São Paulo in the State of São Paulo, Brazil and follow on from a research co-operation agreement with the São Paulo Research Foundation (FAPESP). Bangor was the first Welsh University to establish a research partnership with FAPESP.

Concrete Canvas pours into South America

Following on from securing its £2m deal selling geo-composite fabric to Chilean gold mines, Concrete Canvas (featured in Advances issue 58) is making serious inroads into South America and plans to penetrate the lucrative Russian market. Exports now account for 85% of Concrete Canvas' turnover as it already sells its highly innovative products to forty countries around the world.

Joint venture for Cell Therapy

Cardiff-based biotech company Cell Therapy Limited (CTL) has entered into a new joint-venture agreement with a Chinese firm Zhongyuan Union Stem Cell Bio-engineering Corporation (Union). The new deal will see CTL establishing the joint venture with Union in multiple cities across China and developing large operational hubs near Shanghai and Beijing, with CTL holding nearly half of the shares in the new company.

Queen's Awards for Enterprise

Six companies in Wales are among 152 across the UK that have been recognised for their achievements by winning Queen's Awards for Enterprise this year.

The Queen's Awards for Enterprise acknowledge businesses with outstanding performance in three categories – international trade, innovation and sustainable development.

Four received awards in the international trade category and one for innovation. The sixth, Reid Lifting, won awards in both categories and is one of only three companies in the UK to win two awards this year – they were recognised in both the International Trade and Innovation categories. Reid Lifting previously won a Queen's Award for Innovation in 2006.



It is the third time that SRK Consulting (UK) Limited has won an award and the second time for Just Rollers from Cwmbran.

First time winners from Wales include Bon Bon Buddies Ltd of Blackwood, SPTS Technologies UK Ltd, of Newport, and Airbond, of Pontnewynydd, Pontypool.

Ground Breaking Grant

Professor Dyson is just one of two Swansea University based recipients of the Grand Challenges Explorations grant - a grant given for ground breaking research in Global Health and Development. The Grand Challenges Explorations is an initiative funded by the Bill & Melinda Gates Foundation and the initiative fosters innovation in global health research. Professor Paul Dyson's idea, developed at Swansea University Institute of Life Science, comes under the heading of RNA Interference in Insects and looks at developing specific technology that could ultimately eliminate some of the world's most damaging food crop pests, without the use of environmentally damaging chemicals.

Welsh KTP Success

The Knowledge Transfer Partnerships (KTP) programme has recently hosted its Welsh awards. The awards celebrate the success of partnerships developed through the KTP between businesses and universities.

G.L.Jones Playgrounds Limited and Grwp Llandrillo Menai were the winners of the overall prize, receiving the KTP Award Trophy and a £3,000 cheque in recognition of their work on a new design process which allows products to be manufactured more cost effectively and efficiently. As a result of the collaboration, the company's output has increased by 19% and its market share by 7%.

The runner up was Biocatalysts Limited partnered by the University of Nottingham. This project was recognised for its work in developing different enzymes for commercial use. This resulted in the company developing their own in-house facilities which have cut costs and doubled their profits.

Demand for Pure Wafer

Welsh computer chip recycling firm Pure Wafer sees record levels of demand and is increasing capacity at its manufacturing base as the market continues to grow for its products.

A spokesman for the business said: "Pure Wafer has continued to see increased demand for its wafer reclaim services, mainly from the Asian markets and particularly from the foundry sector, but also from the stable US and European regions, and is currently running at record levels of production.

"The semiconductor market continues to show positive signs of further growth for the remainder of 2013 and beyond, which gives confidence that current levels of business will be sustainable into the next financial year."

Industry analysts are now forecasting growth for the next two years in computer chip recycling based on an increasing demand for hand held devices from emerging economies.

Record number of Alzheimer’s risk genes discovered in largest ever study

Research has revealed 11 new genes linked to Alzheimer’s disease

In the largest ever study of its kind, an international collaboration of scientists, jointly led by Cardiff University, has uncovered 11 new susceptibility genes linked with Alzheimer’s disease.

This major breakthrough will significantly advance scientists’ knowledge of Alzheimer’s. It throws open new research avenues and enables a better understanding of the disease’s disordered functional processes.

Published by Nature Genetics and undertaken by the International Genomics Project (IGAP), the

work details 11 new regions of the genome involved in the onset of this neurodegenerative condition. The research, part-funded by the Medical Research Council, the Welsh Government and Alzheimer’s Research UK, builds on the genome-wide association analysis study that has, since 2009, discovered 10 genes known to be associated with Alzheimer’s.

“This discovery will pinpoint new mechanisms underlying Alzheimer’s disease,” said Professor Julie Williams, Head of Neurodegeneration at the Cardiff University School of Medicine’s Medical Research Council (MRC) Centre on Neuropsychiatric Genetics and Genomics, who led one of four global research consortia.

”

By combining the expertise and resources of geneticists across the globe, we have been able to overcome our natural competitive instincts to achieve a real breakthrough in identifying the genetic architecture that significantly contributes to our mapping of the disease.

**Professor Julie Williams,
Head of Neurodegeneration at
Cardiff University School of
Medicine**



“What surprised us most about the findings was the very strong pattern that showed several genes implicating the body’s immune response in causing dementia,” she added.

There are a total of 21 published genes known to increase the risk of developing Alzheimer’s, though a large portion of the genetic risk for the disease remains unexplained. Further research is still needed to locate the other genes involved before we can get a complete picture.”

Since February 2011, the leaders of the four largest international research consortiums on the genetics of Alzheimer’s have joined forces to accelerate the discovery of new genes. In less than three years the IGAP scientists have been able to identify more susceptibility genes than was achieved in the last 20 years.



Genetic data was collected from 74,076 individuals from 15 countries across the globe yielding 11 new gene discoveries.

One of the most significant discoveries was found in the HLA-DRB5/DRB1 major histocompatibility complex region of the brain, which confirms the involvement of the immune system in the disease. The same region is also associated with two other neurodegenerative disorders: multiple sclerosis and Parkinson’s disease.

Professor Julie Williams explained that the next phase of research will turn its attention to people with early onset Alzheimer’s – these are people in their 40s and 50s who are afflicted with more severe forms of the condition. It is believed that their genetic architecture may hold the key to finding even more genes involved in Alzheimer’s. This is because they carry a heavier genetic load than people who develop the condition in later life and so will yield clues about what genetic markers we should be looking out for.

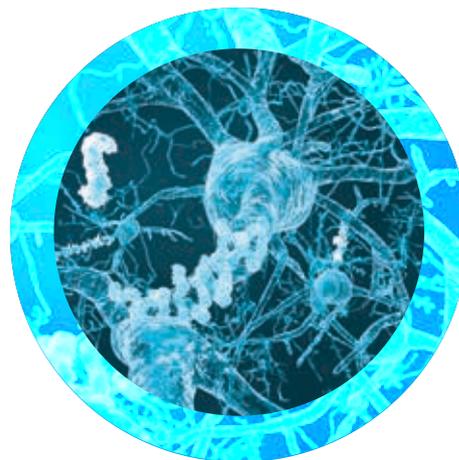
The findings of a series of major studies will also be compiled exploring the role environmental factors play in the development of Alzheimer’s, looking at what increases the risk and, conversely, what lessens it. It is hoped that these insights will give people an opportunity to change their risk for the better, setting them on a safer course through life.

Professor Williams added, “Our work demonstrates that, given the complexity of such a disease, only a global collaboration will quickly find solutions to tackle this major threat. It would be greatly encouraging to also see the world’s molecular biologists all pulling together, breaking out of their silos and uniting in their aim of unravelling disease and developing the treatments to tackle it.”

Mike Owen, Director of Cardiff University’s MRC Centre for Neuropsychiatric Genetics and Genomics described the work as another big step towards understanding the causes of Alzheimer’s disease. He explained that the major role taken by the MRC Centre team in this work which has also involved groups from around the world clearly shows the value of collaboration in studies of this kind and opens up a number of important new avenues for research. The MRC Centre has already begun a new study aiming to understand how genes contribute to early onset forms of Alzheimer’s and this will also increasingly focus on the interplay between genetic and environmental factors in large population studies.

This landmark study further strengthens the role of the immune response in the development of Alzheimer’s and is testament to investing in projects that foster first-class global collaborations to combat dementia.

Dr Eric Karran, Director of Research at Alzheimer’s Research UK, the UK’s leading dementia research charity, said: “By mapping the genetics of the most common, late-onset form of Alzheimer’s, these findings highlight new biological



processes that could significantly advance our understanding of this devastating disease. Alzheimer’s is a complex disease that requires a multi-faceted research approach and this important study shows the progress that can come through collaboration. Advances in technology have accelerated genetic research in recent years and Alzheimer’s Research UK is pleased to be supporting scientists at the cutting edge of this progress.

While this new discovery holds real potential, its true value will come from pinpointing the exact genes involved, how they contribute to Alzheimer’s, and how this information can be translated into benefits for people living with the disease.

Profile

Product

Alzheimer’s risk genes

Applications

Advancement of knowledge concerning Alzheimer’s disease

Contact

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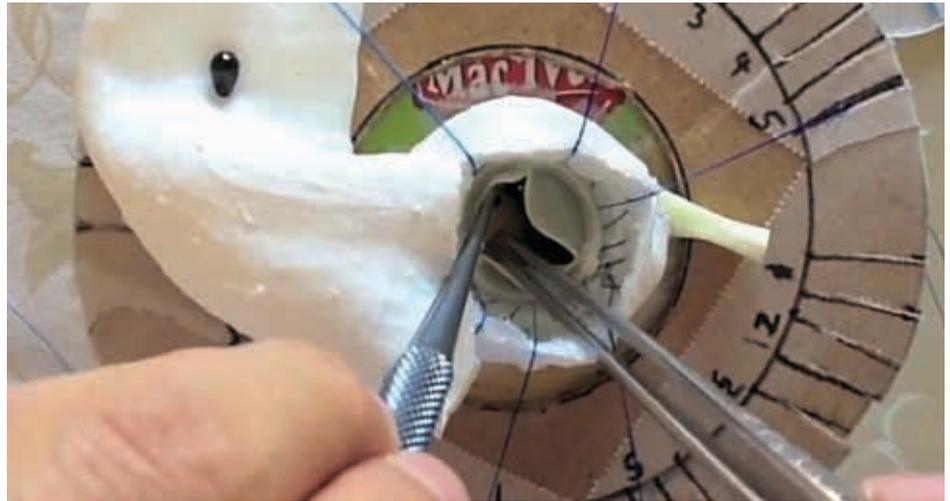
Surgeon's cost-cutting invention cost less than £1 to create

A new portable training device for heart surgery

A heart surgeon at Morriston hospital, South Wales, has won an award for a medical invention that cost him less than £1 to create. It seems unbelievable but Dr Abdullrazak Hossien actually made his surgery training simulator out of a sweet tin.

Dr Hossien is senior clinical research fellow in the cardiothoracic department at Morriston Hospital. His award winning portable device can be used anywhere for training for surgery of the aortic root, which carries blood from the left side of the heart to the arteries of the limbs and organs and it is now being manufactured for use globally.

Dr Hossien first created his training device for a competition which was run as part of the European Association for Cardiothoracic Surgery (EACTS) Conference 2013 in Vienna.



“I designed a portable trainer, which you can keep in your pocket. You can practice on the train, on an aeroplane, at home, wherever you are.”

Dr Hossien said that if trainees used this simulator then they would be completely familiar with the procedures by the time they came to carry out supervised aortic root surgery on patients.

Dr Hossien developed the aortic root simulator and was declared the joint winner along with a candidate from Italy. His simulator will now be manufactured for the global market by the award sponsor Ethicon, a Johnson & Johnson company, which develops innovative medical devices.

Mr Saeed Ashraf, consultant cardiothoracic surgeon and honorary senior lecturer at Swansea University said: “Dr Hossien is a very talented academic surgeon with an excellent pair of surgical hands.”



The training device is

- Portable - meaning the trainee can practice in the train, on an aeroplane, home, hospital etc
- Effective - the trainee can master the surgical procedure and consequently improve surgical performance
- Reusable - allowing the trainee unrestricted usage.

“The trainer was developed from a sweet tin which can be fixed to a table, and Dr Hossien created an aorta using synthetic material.

”

to invent you need a good imagination and a pile of junk.

Thomas Edison

“They will have mastered the procedure before they operate on the patient.”

This trainer allows qualified surgeons and any doctor with an interest in the specialty to improve their skills.

The criteria of the EACTS award challenged applicants to create a low-tech training simulator for aortic root surgery and the ideas forwarded were then judged by a panel of eight top surgeons from Europe and the USA.

Profile

Product
Heart surgery training simulator

Applications
Training for aortic root surgery

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For more information please circle 7002 on the reader reply card

Concrete which can heal its own cracks

Self healing concrete aims to become building industry's holy grail

Cardiff University researcher Dr Diane Gardner is working as part of a team that has developed award winning self-healing concrete.

Dr Gardner from the School of Engineering is part of a research group which is involved in an exciting "Materials for Life" project along with Cambridge and Bath Universities which aims to produce the building industry's holy grail – "self healing concrete".

The group is working towards giving concrete the ability to sense and respond to damage within its own infrastructure. This discovery has the potential to make huge impacts on concrete installations in the UK and beyond, dramatically cutting repair costs and reducing their carbon footprint.

The researchers have developed a system using microbes embedded in the concrete which spark into life once water enters a crack. The water triggers the microbes to produce limestone deposits plugging the

crack before water and oxygen can corrode steel reinforcements inside.

At the same time, the newly developed concrete will use specially developed polymer tendons, like conventional steel rods, which can then be activated to shrink and close any gaps.

Construction giant Costain is now planning to trial the prototype self-healing concrete as part of a project to create an in-built "concrete immune system" which reacts to repair cracks. This experimental concrete will be fitted with special bacteria contained in protective microcapsules which can be added to the original mix.

The university researchers will work with Costain, the Welsh company Alun Griffiths (Contractors) Ltd. and other stakeholders,

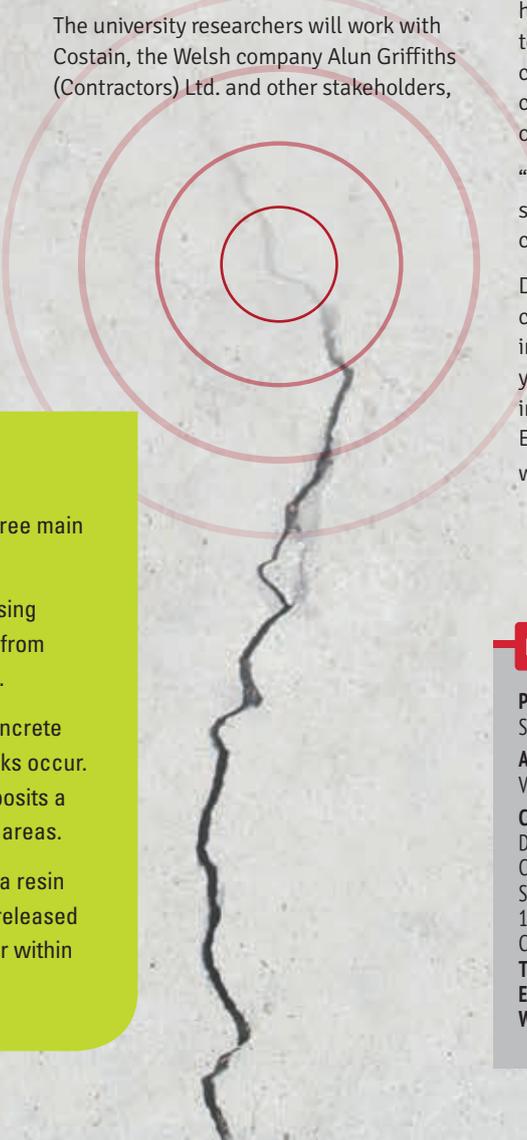
including BRE, Highways Agency, the Welsh Government and Atkins to test and develop the idea and the products developed will be trialled at several construction sites from spring 2015 once the technology is fine-tuned.

Andrea Green, project manager, said: "Self-healing concrete could be a game changer for the industry, with the potential to enhance durability, improve safety and dramatically reduce maintenance costs."

Oliver Teall, a Costain graduate civil engineer, is researching how "shape memory polymers" can be used to help heal cracks in concrete. He said: "Polymer tendons are incorporated into the concrete. If a crack occurs, these tendons can currently be activated by either heat or an electrical supply.

"They then spring back to their original shape, compressing the concrete and closing the crack."

Dr Gardner hopes that self-healing concrete could start to be introduced into non-critical structures within 2-3 years. From then on, the aim will be to introduce this technology across the Civil Engineering industry and increase and widen its use.



- The self-healing concrete works in three main ways:
- The opening of cracks is controlled using fibres which can potentially be made from recycled plastic materials like bottles.
- A bacteria is incorporated into the concrete which starts to rejuvenate when cracks occur. Once damage starts, the bacteria deposits a biological cement which fills in these areas.
- Nano and micro capsules containing a resin or glue healing agent which again is released when damage or cracks start to occur within the concrete structure.

Profile

Product
Self-healing concrete

Applications
Various construction uses

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For more information please circle 7003 on the reader reply card

Welsh company Rikoset is

Toughest ever shin guard created in Wales

A University of South Wales spin out company, Rikoset, recently hit national headlines when its super strong shin pads for sport launched into the marketplace.

British company Rikoset has been working with a number of Premier League players and club physiotherapists on the shin pads for two seasons and their feedback has resulted in the development of one of the thinnest yet toughest shin guards available.



The Rikoset shin guard with visible V-zone (patent pending)

Their incredible strength is not only down to Aramid – the material usually associated with bullet proof vests, (however that could all change with the launch of the ‘toughest football shin guard ever created’) but these shin guards also boast a state of the art shell which absorbs the force of an impact by spreading it over their entire surface (in the same way as a bullet proof vest) and they have the highest strength to weight ratio of any shin guard on the market, hence providing the most protection.



Specially engineered contours drastically improve the impact absorbing capabilities whilst also significantly increasing the strength and structural integrity of the shell.

The product was four years in the making and took countless hours of testing. It resulted in a Welsh design award in 2012 and more recently, Manchester United’s physiotherapist, Tom Hughes, endorsed the pads saying, “The shin guards are manufactured from exceptionally tough and durable materials, and therefore provide players with a great deal of protection which can be very important, especially when returning from significant injury.”

The Rikoset shin guard was originally conceived by Baz Dhaliwal as an undergraduate product design project. The aim of the project was to identify an inadequate product currently on the market and to then redesign it to improve its functionality. After conducting scientific tests on existing shin guards it was ascertained that the level of protection they

offer was well below what was required. Four years were spent testing a range of tough, impact absorbing materials for the shell and energy dispersing foams for the padding until a combination was found that worked together to provide the maximum level of protection. Under the guidance of his lecturer Dr Gareth Loudon, Baz Dhaliwal developed a revolutionary new design that seriously outperformed all other competitor products.

Following graduation, Dr Gareth Loudon, felt that there was significant commercial potential in the idea to develop it into a spinout business and after recruiting Professor Peter McCarthy from the University of Glamorgan for his knowledge of sports injury, Rikoset Ltd was officially formed in 2009.

Poor legislation and misconceptions regarding the impact forces generated in football had led to inadequate shin guard designs which offered little or no protection from high impact challenges and serious injury. This has resulted in the importance of shin guards being overlooked and misunderstood by many players, professional and amateur alike. The company worked closely with the physiotherapists at top professional clubs as it sees shin guards as a medical device to prevent injury.

Previously, very little work had been done in the scientific community to explore this and Rikoset’s investigations showed that these forces can exceed that of a bullet and its V-zone (patent pending) was developed as a result of extensive impact testing. These specially engineered contours drastically improve the impact absorbing capabilities whilst also significantly increasing the strength and structural integrity of the shell.

Premier League material



The product was fine-tuned with help from first team Swansea City Football Club players, and after building an impressive client list consisting of some of the biggest names in world football Rikoset looked to enter the more lucrative consumer market with a view to becoming a global sports brand.

Using the strong premium brand already developed through working with its Premier League clients, the Rikoset team collaborated with a number of professional

players and developed a range of revolutionary shin guard designs, the likes of which have never been seen in an industry which has been stagnant of innovation for decades.

”

We have revolutionised the science of body protection in sport and developed the world's best football shin guards. These shin guards are the toughest, most protective and technologically advanced shin guards in the world.

Baz Dhaliwal
Managing Director, Rikoset

The result was a limited edition consumer shin guard which went on sale in August 2013 with endorsement from Manchester United Football Club and it received national media coverage within 24 hours of launch.

Profile

Product

Rikoset shin guard

Applications

Extra tough shin-guards for sports use

Contact

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Buddy improves quality

Unique waterproof bandage and cast covers created by a South Wales company

Based near Cardiff, South Wales, QOL has created unique waterproof bandage and cast covers. These covers are enabling patients to utilise the healing properties of water either by simply showering or by undergoing hydrotherapy rehabilitation and improving Quality of Life.

QOL founder Sara Wynne is a trained nurse in wound healing and when her daughter Beth broke her arm shortly before a family holiday, Sara discovered that the products on the market to keep her daughter's cast dry were limited to showering and a quick dip in the pool. These products also had the added problems of either being made of latex or that the seal was restrictive and too tight to be comfortable.

The market niche was identified for a product which was both soft and stretchy and, crucially was also latex free in its composition. After



The QOL Buddy in action

extensive research, such a material was developed to a unique 'recipe' and tested on people suffering from broken bones, leg ulcers and post-operative wounds.

Joanna Winslade decided to invest in QOL after realising that the product would provide a solution for people suffering with diabetic ulcers.

The Buddy range now includes five different products to cover any adult or child's limb. The cover has a unique, gentle seal that will not put pressure on sensitive or afflicted skin, fits snugly to the limb and remains watertight, protecting any wounds, bandages or casts and improving Quality of Life.

The unique special 'recipe' material is infused with SteriTouch, (as featured in AW51 - Spring 2007), which provides anti-microbial qualities, as well as being both anti-allergenic and latex-free. A fresh vanilla scent was added to the material to ensure that the Buddy was not associated

of life during healing



with the typically ‘plastic’ or ‘medical’ feel of other products. The material being of non-allergenic composition is significant for the intended topical application for wounds.

After receiving encouragement from Sir Richard Branson, the Buddy has become an innovative yet simple answer to improving Quality of Life and has generated interest from a number of sources.

”

“At QOL, we feel that individuals can realise the benefit in being able to shower every day and the opportunity for improving their Quality of Life through a sense of freedom that the Buddy gives by way of swimming, relaxing in water and even partaking in hydrotherapy. By providing simple, functional and comfortable support the Buddy can be used by any individual with wounded limbs ranging from as simple as verruca treatments, to leg ulcers and broken limbs”.

Sarah Wynne
Buddy

Profile

Product
Buddy waterproof bandage and cast cover

Applications
Protection for wounds, bandages or casts

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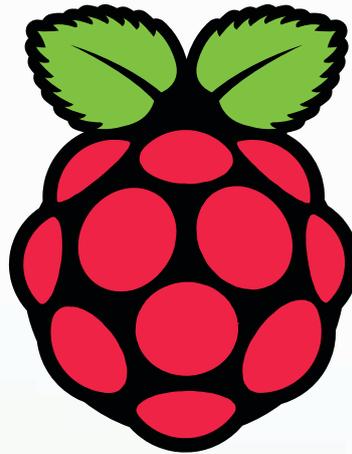
Sony pops out Pi's

Sony UK Technology Centre (UK TEC) has made one million Raspberry Pi's using PoP technology

S South Wales-based Sony UK Technology Centre (UK TEC), has just produced one million Raspberry Pi's, a unique credit-card sized mini computer whose manufacture includes package-on-package (PoP) technology.

Over the last year, the South Wales-based business has seen the success of the Pi grow from strength to strength and has had to extend its manufacturing process capability to include the new package-on-package (PoP) level of technology. The PoP enables the processor and memory to be stacked on top of each other, reducing the printed circuit board (PCB) footprint and the distance that high-speed signals need to travel, improving overall reliability. Steve Dalton OBE, Managing Director of Sony UK Technology Centre commented: "As an organisation we are continually committed to developing the site's offering. This is shown from our diverse product portfolio through to the investment we make in machinery and the development of the processes we use."

The Raspberry Pi is designed to stimulate young people's interest in computer programming and electronics, but it has been hugely popular with hobbyists and developers.



Its design is what is termed double sided SMT and single sided PTH. Translated, this means it has surface mount components (SMT) mounted on both sides of the PCB and through hole (PTH) components just on the top side, with the pins pushing out of the bottom.

The PCBs are actually mounted in a panel of six and the manufacturing line is made up of four key processes, bottom SMT, top SMT, PTH, test and pack, but the skill of the Sony UK TEC team goes much further

than that, into production engineering and component procurement.

The majority of the Pi's components are mounted on a couple of SMT machines, and the panel of boards is then passed to a special placement machine which carries out the PoP. The main processor is placed as any normal part, but the memory has to be placed on top of it. Solder paste is not printed on the top of the processor. Instead a solder paste tray has been developed into which the memory chip is dipped gently, to coat the solder balls on the underside of the part. This is then placed on top of the processor. The tray is constantly rotating and has a scraper bar which sets the exact depth of the paste as well as an automatic dispenser control system which adds more paste as required. This is the best solution from Sony UK TEC and the result is phenomenal yields in the volumes required. The Pi's production rate is one every 4.3 - 2.7 seconds (depending on the volume produced at a given time) and involves three machines, one building the underside and two for the topside.

Steve Dalton OBE, Managing Director of Sony UK Technology Centre commented: "The Raspberry Pi, is a fantastic example of UK innovation, design and engineering, at its best. From the day the product launched we knew the Raspberry Pi would be a success and we wanted to be part of it. We've been delighted and staggered by the continuous demand of the Pi across the world and there are no signs of this decreasing anytime soon.





”

The Raspberry Pi is testament that if you have the right product, manufacturer, distribution channels and customer demand any idea can be a huge success. We look forward to continuing our work with element 14 and The Foundation and we're excited about what the future holds for this innovative product.

Steve Dalton OBE
 Managing Director, Sony UK Technology

“In a little under a year we have created one million units and the work done by all parties has acted as a significant milestone in the UK manufacturing industry, which ultimately helps to support and grow the UK economy.

“The Raspberry Pi shows that with some innovation, the right product, manufacturing, distribution channels and customer demand any idea can be a huge success.”

Profile

Product
 Raspberry Pi PoP technology

Applications
 Mini computer suitable for various electronic devices

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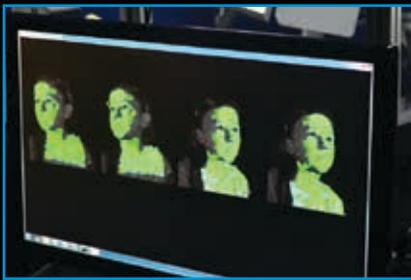


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The face of 3D technology

Cardiff scientists and 3dMD enter a new dimension in 3D/4D facial imaging

Cardiff University academics have helped 3dMD, a leading company in the field, to develop the latest commercial system capable of recording moving human images in 3D. This same team of clinicians and computer scientists can now, for the first time, carry out facial movement research and transform the way patients needing facial surgery are assessed and monitored.



The system works on the principle of active stereo. Each system actually has two stereo pods, one to capture a 3D image of each side of the face (which are stitched together in software). Active stereo essentially operates by imparting a speckle pattern into the scene to make the dense stereo correspondence of the many thousands of points, necessary for the stereo reconstruction. The texture (photographic element) is then captured by a separate camera and the stereo and texture cameras are synchronised to capture images at short time intervals apart so that the speckle does not contaminate the texture. Specialist software performs reconstruction of all points and a 3D model is then assembled using these.



”

Research into facial movement has important applications in patients whose facial movement is affected by conditions such as a cleft lip, neurological conditions such as Parkinson's disease or someone who has experienced a stroke.

Videos have generally been the preferred method for recording facial movements – unfortunately, they are only two dimensional so when analysing how the face moves, important data is lost

Dr Hashmat Popatl
Consultant Orthodontist

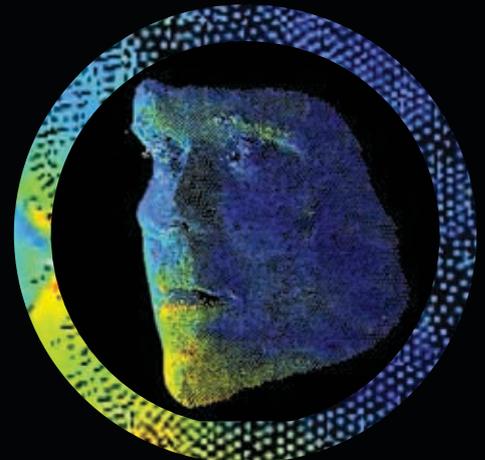
In 2005, the Cardiff team commissioned the 3dMD's first commercial scanner capable of recording moving human images in 3D and have had an important influence in its continued development. Cardiff procured two new 2013 generation high-speed, high-precision 3dMDdynamic systems to further their research.

This enabled Cardiff University to move from 2D to 3D video in order to measure with precision the dynamic aspects of facial soft tissue movement and expression.

“Even today, videos are the most widely used method for recording facial movements, however a 2D video is unable to support true measurements of 3D shape and how this changes with facial expressions,” according to Professor David Marshall from Cardiff University's Computer Science & Informatics.

Their research into more general 3D dynamic facial expression analysis and its application to biometric identification, expression recognition, like a smile, and computer graphics and animation has also been productive, including joint work with psychologists.

As Cardiff has two of these systems available the team has been pioneering work in Conversational Expressions where they have been able to record and analyse the 3D facial dynamics of two people engaged in a conversation.



Working closely with 3dMD Professor Stephen Richmond and Dr Hashmat Popat from Cardiff University's School of Dentistry and Professor David Marshall and Professor Paul Rosin from the School of Computer Science & Informatics have pioneered the use of 3D video analysis.

"As 3dMD continued to progress its next-generation technology there was no question that we would work closely with the team who has had the most published research experience to date in the field of dynamic 3D applications," according to 3dMD's Co-Founder and EVP Kelly Duncan.

The team at Cardiff University has pushed 3dMD to make many breakthroughs such as their 60fps 3D capture frame rate and more recently an enhanced non-intrusive lighting and texture capability to open up the possibility of a very dense optical tracking capability in order to understand and quantify the subtleties of soft tissue deformation during facial movement in babies, children and adult subjects.

These developments also mean that it will be possible to objectively assess a patient's functional outcome and how others in the community react to that outcome, and the team will be able to start advancing computerized simulation models to replicate facial expression and functional behaviour for patients undergoing treatment.

Profile

Product

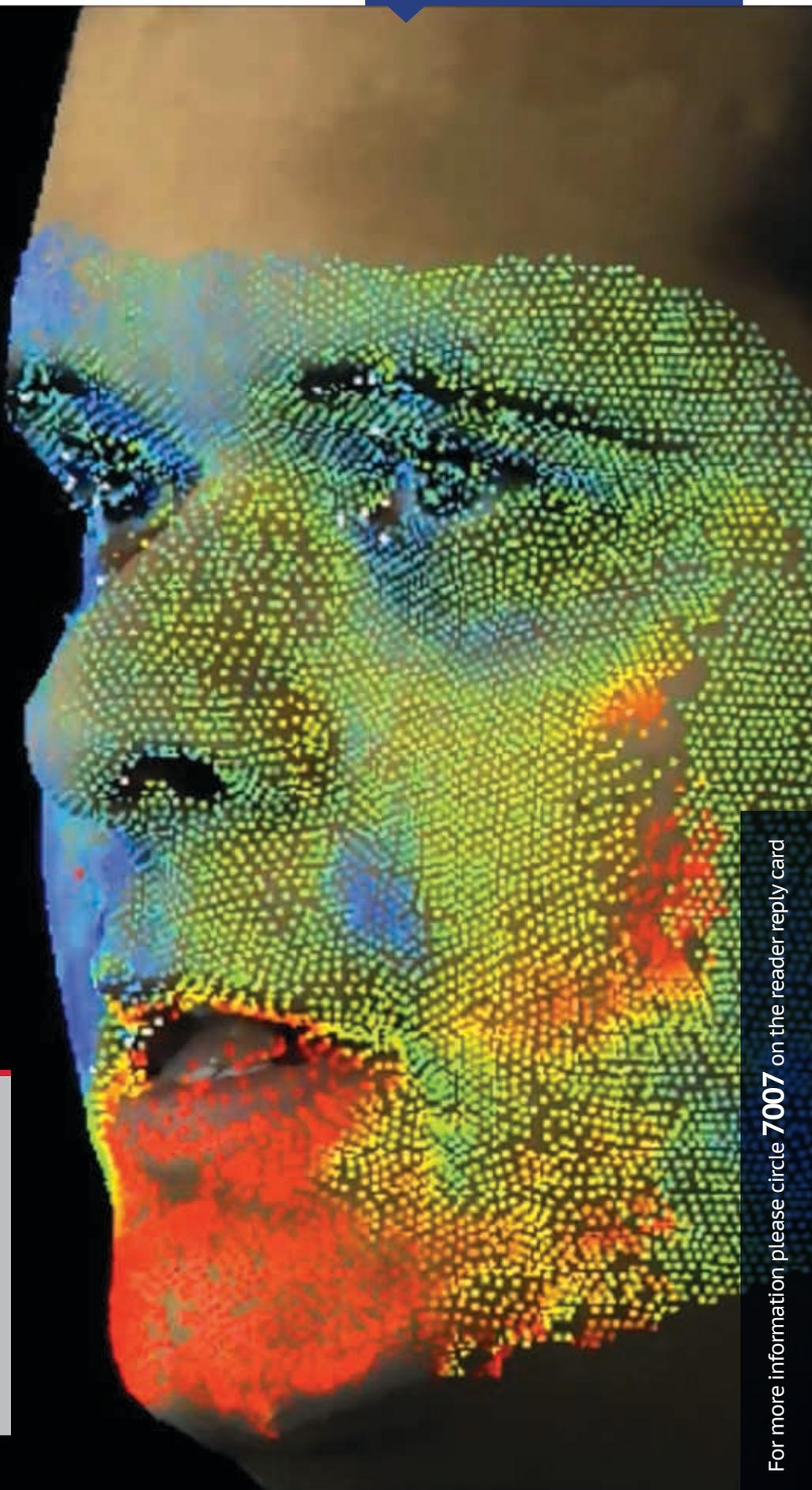
3D/4D facial imaging research

Applications

Increase understanding of conditions that affect facial movement

Contact

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True colours for Martian

Novel colour calibration system created in Wales ensures images sent back to earth truly represent Mars' landscape

A space scientist from Aberystwyth University has travelled to Chile's Atacama desert as part of the preparation for the 2018 ExoMars mission to Mars to test the university's PanCam.

Dr Stephen Pugh from the Institute of Mathematics, Physics and Computer Science (IMPACS) worked on the ExoMars Panoramic Camera Instrument (PanCam) during a seven day field trial in early October.

PanCam will be the science 'eyes' for the mission and will feature a novel colour correction system to ensure that images sent back to earth truly represent the colours on Mars.

Featuring small stained-glass coloured chips manufactured using a process similar to that used in medieval times, the PanCam colour calibration target

measures just 50 mm × 50 mm, 18 mm high and weighs no more than 25 grams.

The Aberystwyth PanCam work is led by Professor Dave Barnes, who was based at mission control at the Rutherford



landscape

”

Learning how to operate the PanCam instrument on Mars will be vital to the success of the mission, and this field trial in the Atacama desert in Chile was a significant step in its development.

This was the first time that the instrument prototypes were integrated with an ExoMars development rover and tested in such an environment.

Professor Dave Barnes
 Professor of Space and Planetary Robotics,
 Aberystwyth University,



Appleton Laboratories during the trial, along with other PanCam team members.

“Mars has little to no ozone in the atmosphere and this means that the high ultra violet radiation can cause colours to fade when exposed to sunlight. The stained-glass idea comes from observing the many stained-glass windows in churches, many of which date back to medieval times. These have been exposed to sunlight for centuries and show little to no colour degradation.

“Scientists want the returned images to be colour corrected (as if they were being viewed by a human) to help them in identifying potential science targets for further investigation”, added Professor Barnes.

To do this a PanCam Calibration Target (PCT) must be mounted on to the ExoMars rover and every time a sequence of images is captured, images of the PCT are also taken.

The PanCam is a monochrome multi-spectral instrument. Using the images taken with the available filters, in combination with the data obtained from the images of the PCT, it is possible to generate true colour images of the Martian terrain.

The space robotics team is working with colleagues from the Institute



of Mathematics & Physics who have the necessary glass expertise and they will be responsible for processing the images taken by PanCam using a variety of computer vision techniques and algorithms developed at Aberystwyth.

Although the PanCam Calibration Target is tiny, its contribution to the quest for life on Mars may yet be enormous.

Profile

Product
 PanCam colour calibration target

Applications
 Imaging colour correction system

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Welsh student develops “world’s

High-tech special effect photography and video at an affordable price

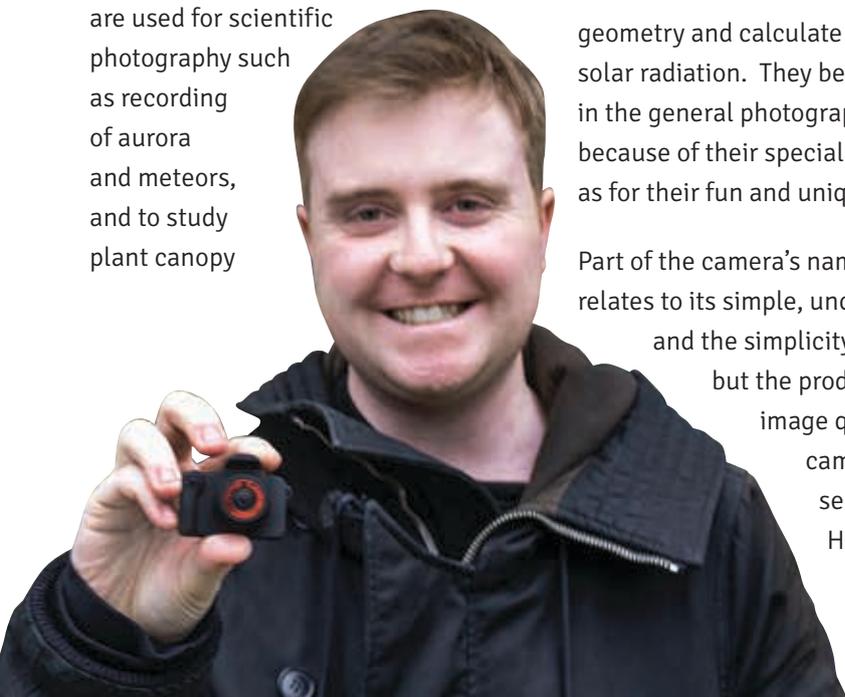
Aberystwyth University student, Greg Dash, has developed the world’s first miniature fisheye camera available at an affordable price.

Used for special effect photography and video, the Lofi-Fisheye Digicam is a high-tech, low cost product which shoots HD video with no LCD screen. With a major brand’s most extreme fisheye lens selling for around £100,000, the Lofi-Fisheye Digicam is available to a wider market at just £65.

The desirable 170-degree glass fisheye lens contains an ultra wide-angle lens which produces strong visual distortion intended to create a wide panoramic or hemispherical image. The first practical use of these lenses was in the 1920s for use in meteorology to study cloud formation giving them the name “whole-sky lenses” and today they are used for scientific photography such as recording of aurora and meteors, and to study plant canopy



Images captured by Greg Dash illustrating the capabilities of the ‘Little Cyclops’



geometry and calculate near-ground solar radiation. They became popular in the general photography field because of their special effect as well as for their fun and unique uses.

Part of the camera’s name itself (Lofi) relates to its simple, uncluttered style and the simplicity of the design— but the product maintains image quality. The camera’s onboard sensor records HD video and

captures images at up to 12 megapixels but unlike most digital cameras, this one has no viewfinder or screen to view photos.

Greg said that this element reminds him of the way people work with film cameras.

“One of the things I first loved about it is that it doesn’t have an LCD screen to preview images - so you have that element of surprise when you come to look at the photos you have taken for the first time.

first' miniature fisheye camera



The 'Little Cyclops' is around 4cm long and 2cm high - less than the length of the average thumb

”

“One of the things I first loved about it is that it doesn't have an LCD screen to preview images - so you have that element of surprise when you come to look at the photos you have taken for the first time.

“That's something I love about using film cameras, but being a hard-up student I couldn't always afford to develop rolls.

“So that's where the idea about making it digital came in.”

camera, dubbed the 'Little Cyclops' which sold out and were shipped all over the world.

A second version of the camera was released recently in time for Christmas and they sold out in just over a week with only social media as a way of promotion; Greg says that he cannot make enough of them and receives two or three emails daily from potential customers.

With funding from web-based crowdfunding company Indiegogo, Greg produced 1,000 units of the fisheye

Profile

Product

Cyclops camera

Applications

Fish-eye still image and HD video

Contact

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