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THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY

advances WALES

Sterling security

New secure GB Pound designed and produced in Wales

Llywodraeth Cymru
Welsh Government

THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY
advances WALES

Contents & Editorial

Wales will be at the centre of the world stage this autumn when it hosts the largest gathering of international leaders ever to take place in Britain for this year's NATO summit.

It is no stranger to publicity and has already taken to the podium this year-winning gold at the Commonwealth Games with the help of Blizzard Protection Systems' Reflexcell technology (page 20). Gold is proving to be a precious metal in more ways than one, as vital research at Cardiff University has shown (page 14) and is not to be taken at face-value with the familiar £1 coin receiving a facelift using the Royal Mint's new technology to reduce the risk of counterfeit (page 18).

This issue's Special Feature focuses on SPECIFIC (The Sustainable Product Engineering Centre for Innovative Functional Industrial Coatings) which is an Innovation Knowledge Centre at the forefront of emerging technologies striving to channel natural energy, change the way we power our lives and effectively turn buildings into power stations (page 10). Truly inspiring!

Once again, Advances provides a showcase for many of Wales' companies and universities alike and great research has led to many new and innovative technologies and ideas. A BioBag for 'Larval Debridement Therapy (page 26) and the development of a life changing vaccine by Cardiff University's School of Medicine (page 16) are just some of those featured.

Lucinda Dargavel,
Editor

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Buildings as power stations: Changing the way we power our lives

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COVER IMAGE An artist's impression of the new GB Pound coin. Courtesy of the Royal Mint.

PHOTOGRAPHY Sourced from organisations featured, their representatives, Shutterstock and istock.

75% wedi'i ailgylchu recycled

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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£34m boost for 'made in Wales' anti-cancer medicines

The prospect of four new 'made in Wales' cancer medicines becoming a reality for patients has taken a huge step forward with the announcement that Edinburgh based biopharmaceutical company, NuCana, has made a new £34m investment to develop its portfolio of anti-cancer medicines based on ProTide technology.

ProTides is a platform developed by Professor Chris McGuigan and his team at Cardiff University's School of Pharmacy and Pharmaceutical Sciences and it is specifically designed to bypass key cancer cell resistance pathways that limit the efficacy of so many of today's anti-cancer drugs.

This represents the largest healthcare investment by a European private biotech company in over a year and the funds will be used to advance and expand the clinical programme for NuCana's lead product, Acelarin, which has shown exceptional results in patients with a broad range of advanced and progressive cancers that were resistant to all conventional therapies.

Acelarin will be developed initially for patients with pancreatic, biliary, lung and ovarian cancers. In addition, the funding means the company plans to bring a second ProTide (NUC-3373) into the clinic later this year, with two further ProTides scheduled for 2015. NuCana has exclusive worldwide rights to the pioneering ProTide technology in cancer. This technology creates compounds that bypass key resistance mechanisms associated with anti-cancer drugs.

"It is very exciting to watch a new medicine emerge, from a theoretical idea, through chemical synthesis in our laboratory here in Cardiff and now as a new treatment for patients with cancer," according to Professor McGuigan, who developed the ProTide technology.

Professor Chris McGuigan ,
Cardiff University School of Pharmacy

"This £34m investment is extremely satisfying and an endorsement of our work with NuCana. Over the last decade this represents the 14th largest private biotech round globally and the largest ever in the UK," he added.

www.cardiff.ac.uk/phrmy/

Welsh unmanned air systems selected by MIT

Small remote-controlled unmanned air systems developed in Wales are to be used in a research programme by the world renowned Massachusetts Institute of Technology (MIT).

The remote controlled systems - developed by Cardiff based BCB International can land on water with a 'fly and dip' system - will be used in a research programme by MIT's SENSEable City Lab to collect water samples for analysis.

The linkup between BCB and MIT came through Welsh Government's membership of MIT's International Liaison Programme as BCB was one of the businesses on the Welsh Government's April mission to MIT. Discussions were initiated with the SENSEable City Lab which is developing new uses for unmanned systems.

Measuring a metre across, The BCB systems are made from a superlight and super strong carbon fibre and weighing just 430 grammes, they were originally developed to carry canisters containing essential survival equipment that could be dropped in the ocean to help survivors of shipping disasters.

BCB has had three systems developed specifically for the SENSEable City Lab research group which are now en route to Boston.

Barry Davies BEM, Robotics Director with BCB International, said:" BCB prides itself on its own R&D programme and continually reinvests profits into research and this is an amazing opportunity to be involved with such a prestigious institution.

"The unmanned system we have designed and developed – which was built by a Formula 1 racing car manufacturer – is the only one we know of that can land on water which was what interested SENSEable City Lab.

"Our vision of the future is to design and develop in Wales a range of unmanned systems with the support of Welsh Government and this link opens up a raft of exciting potential opportunities and I hope it marks the start of a long term relationship with MIT."

"This is an excellent result and I am delighted to hear that BCB International is forging links with one of the world's top technology institutions.

"BCB is a highly innovative company whose expertise has been recognised by winning two Queen's Awards for Enterprise as well as various technology and innovation awards. It's great to hear that technology developed in Wales is being used for research undertaken by MIT which certainly helps put Wales on the international map."

Edwina Hart AM
The Minister for Economy, Science and Transport, Welsh Government

www.bcbin.com

Metformin helps diabetics to live longer than non-diabetics

A large-scale study involving over 180,000 people has shown that patients treated with a drug widely prescribed for type 2 diabetes can live longer than people without the condition.

Type 2 diabetes affects approximately 6% of the UK population and the findings indicate that a drug known as metformin, used to control glucose levels in the body and already known to exhibit anticancer properties, could offer prognostic and prophylactic benefits to people without diabetes.

Published in a leading diabetes journal, Diabetes, Obesity and Metabolism by scientists from Cardiff University, the study compared the survival of diabetes patients prescribed with metformin with patients prescribed with another common diabetes drug called sulphonylurea. Importantly, the life expectancy of these cohorts was also compared against non-diabetics who were matched based on criteria that included age, gender, same general practice, smoking status and clinical status. "What we found was illuminating," said lead author Professor Craig Currie from Cardiff University's School of Medicine.

The results showed that the patients treated with metformin had a small but statistically significant improvement in survival compared with the cohort of non-diabetics, whereas those treated with sulphonylureas had a consistently reduced survival compared with non-diabetic patients.

"Surprisingly, the findings indicate that this cheap and widely prescribed diabetic drug may have beneficial effects not only on patients with diabetes but also for people without, and interestingly, people with type 1 diabetes. Metformin has been shown to have anti-cancer and anti-cardiovascular disease benefits. It can also reduce pre-diabetics' chances of developing the disease by a third.

This does not mean that people with type 2 diabetes get off Scott free. Their disease will progress and they will be typically switched to more aggressive treatments. People lose on average around eight years from their life expectancy after developing diabetes. The best way to avoid the condition altogether is by keeping moderately lean and taking some regular light exercise."

In the next phase of the research, Professor Currie plans to investigate how patients prescribed with metformin as a first line therapy can best be treated thereafter to ensure that their life expectancy can be brought closer in line with the national average.

www.medicine.cf.ac.uk

Cardiff leads new £16m dementia fight

The Medical Research Council's new UK Dementias Research Platform (UKDP) is to be headed by Dr John Gallacher from Cardiff University's School of Medicine. This £16 million public- private partnership has been set up to speed up research into dementias and its new approach will explore not only what is going wrong in the brain, but look at the brain in the context of the whole body.

The UKDP brings together industry expertise and investigator teams from eight UK universities and teaming them with what will be the world's largest group of participants in dementias research (more than two million people).

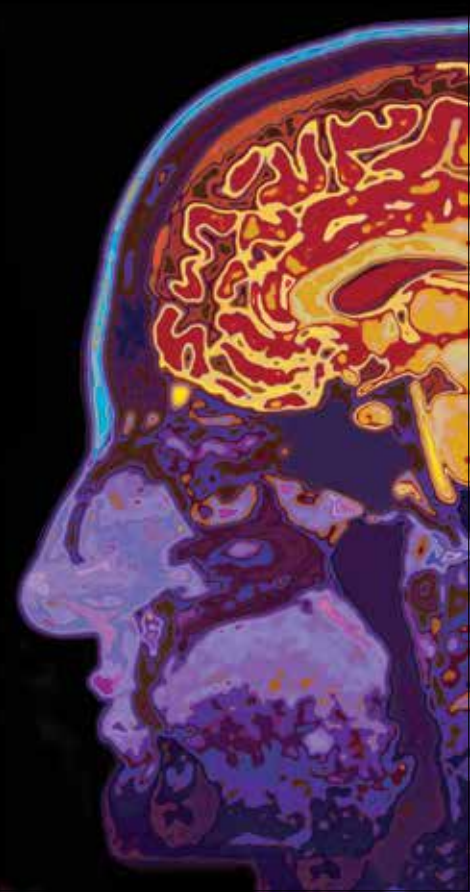
The Platform's combination of skills and resources, and its focus on looking at the whole body in order to understand neurodegenerative disease, aims to unearth completely new approaches for intervention, including new drug treatments. The Platform will investigate the causes of dementia across a range of different neurodegenerative conditions, such as Alzheimer's, Parkinson's and motor neurone disease.

Science Minister David Willetts said: "This new £16 million UK Dementia Platform will create the world's largest ever study group for research into dementia, ensuring that data is freely available to support the work of international scientists in this very important area.

"The collaborative approach demonstrated by the Medical Research Council and its business partners through this platform is critical in helping us to achieve our target of doubling dementia research funding and making the UK the best place in the world to do life sciences."

"By looking at the links between development of the disease and other factors – such as diet or illness – we hope to unearth targets for new drugs or new uses for existing drugs."

Dr John Gallacher,
Cardiff University School of Medicine and Director of the UKDP



Aberystwyth technology captures invaluable data

An Aberystwyth University scientist has helped to capture images of Greenland glaciers that will assist with building digital elevation maps and gathering glaciology data for research.

Dr Neal Snooke, a lecturer at the Department of Computer Science, has been working on unmanned aerial vehicle (UAV) technology, commonly known as drones, for the past three years and in June, six of these new UAVs were sent to Greenland. The drones were fully equipped with Sony Alpha 14 megapixel cameras to capture high quality photographic data of Store and Lille glacier, which flows into the sea off Greenland.

Dr Snooke explains, "The mission was a great success. We were able to capture thousands of high quality digital images that can be processed to produce high resolution 3D models of the glacier. The images showed and monitored the movement and calving of the glacier on a frequent basis.

"The idea came in the spring of 2013 when talking to Professor Alun Hubbard from the Department of Geography and Earth Sciences to use inexpensive UAV technology hardware to capture high quality digital images for research purposes."

"In the future, the UAV technology should allow investigation of the effects of large calving events, sub-glacial lake drainage or ice mélange breakup on the Store and Lille glacier."

Dr Neal Snooke
Department of Computer Science, Aberystwyth University

The aim was to create an autonomous UAV that could fly 7 kilometres along a glacier front and a couple of kilometres from the launch site. A typical mission would last about an hour and would cover a distance of around 60km, travelling at 55kph and carrying 700g worth of camera equipment.

Called the Skywalker X8, the drone has a 2 meter wingspan, weighs around than 2.5Kg, and is constructed from expanded polypropylene foam, making the frame quite robust and easy to repair. Improvements were made to the UAVs which went to Greenland and these included electric brushless motors, software improvements and modifications to the airframes to reduce the potential for damage caused by the need to land on rough terrain or ice.

Additional sensors such as a pyranometer are now being integrated by Dr Snooke and his team to enhance the scientific value of the data capture and in the future, they will look to increase mission endurance as this will provide a number of opportunities to routinely collect data from more inaccessible areas.

www.aber.ac.uk/en/cs

HP and Swansea University build sustainable cities

Hewlett Packard (HP) has announced a three-year collaboration program with Swansea University to explore the development of sustainable next-generation cities, communities and campuses using HP technology.

Taking advantage of sensor data management technology built at HPLabs and HP's Smart Grid Solutions for transforming utility infrastructure, the project will leverage technology such as smart metering, intelligent cities, situational awareness, data analytics and security threat detection.

"Working with global enterprises like HP as well as academia and local small and medium businesses is a fundamental part of ensuring a sustainable community," says Professor Javier Bonet, head of Swansea University's College of Engineering, and the program's strategic director. "This program will have direct economic benefits for Wales in terms of knowledge creation, innovation and exploitation, as well as the development of a highly-skilled work force".

The first phase of the project will address the Welsh Government's objective of reducing greenhouse gas emissions by 80 percent before 2050. As part of this, a testbed will be established to ultimately contribute to the creation of a permanent environment for the development of next-generation digital economy products and services.

The initial proof of concept at Swansea University's existing campus will be followed by an expansion into the new 65 acre Bay Campus, a £500m project and one of the top five knowledge economy-based projects in Europe. Construction alone will generate approximately 4,000 direct as well as indirect jobs. With the first phase due to be fully operational by September 2015, the campus will eventually be used by around 5,000 students and up to 900 staff, with facilities for use by local subject matter experts and new start-ups.

"We have long held that the future of our cities will require operating at the intersection of people, planet, profit and peta-data. This program demonstrates yet another step on our journey towards city-scale resource management."

Chandrakant Patel
HP Senior Fellow and Chief Engineer
HP Labs

www.swansea.ac.uk/engineering

Medical testing and training centre for the Cynon Valley

A state-of-the-art centre bringing the design and testing of medical equipment and the training of tomorrow's doctors together under one roof for the benefit of patients has been opened in South Wales.

The Bill Mapleson Centre is a partnership between Cardiff University and the global medical products company Flexicare and will help train doctors and dentists, acting as a focus for undergraduate and post-graduate teaching and continuous professional development.

The Centre, in Mountain Ash, is named in honour of Professor William ('Bill') Mapleson, who has worked in academic anaesthesia at Cardiff University for over 60 years. The Health Minister Mark Drakeford was joined by Bill Mapleson to officially open the Centre earlier this year and he said, "The new state of the art laboratory at The Bill Mapleson Centre at Flexicare will not only offer a cutting-edge focus for equipment development and testing, but will also offer Cardiff University students the opportunity to develop and refresh their skills using simulators in a clinical environment. This forward-looking approach to innovation fits in with Welsh Government's aims of developing new ideas and innovation as specified in our Science for Wales strategy."

Professor Judith Hall, from Cardiff University School of Medicine, added "It will help the medical community and industry for years to come – a fitting tribute to the work of Bill Mapleson."

Famous for writing a paper describing breathing systems in 1954, Professor Bill Mapleson said: "It's really quite something to have a Centre named after you. I've had a fine medal from the Association of Anaesthetists for innovation, but to have a whole centre for innovation named after you is really quite extraordinary."

Life science hub launched in Cardiff Bay

A new Life Science Hub for Wales has recently been opened in Cardiff Bay, South Wales. The nerve centre at No 3 Assembly Square will be at the heart of all activity within the sector in Wales and is expected to inject £1bn into the economy by 2022.

Together with a £100m Wales Life Sciences Investment Fund, it is hoped that the hub will boost the life sciences sector in Wales by at least £1bn by 2022. In Wales, this sector currently employs 10,000 people working for 350 companies, with a combined annual turnover in the region of £2bn a year.

The hub, in Cardiff Bay, was officially unveiled by Economy Minister Edwina Hart, life sciences serial entrepreneur and investor Sir Chris Evans and Dragons' Den star Theo Paphitis.

The hub's chairman Professor Chris McGuigan said it will act as a central resource for the whole of the sector in Wales, including academia, business, clinical and funding organisations.

Prof McGuigan, who at Cardiff University has overseen the development of pioneering drugs, said the hub was the ideal location.

> "The hub will connect and concentrate life sciences in Wales and it has been designed to ensure that people collide into each other to fertilise good ideas. There really isn't anything like this anywhere in the world."
>
> **Professor Chris McGuigan,**
> **Chairman, Life Science Hub for Wales**

As well as housing the team of Arthurian Life Sciences, which manages on a discretionary basis the £100m Wales Life Sciences Investment Fund, Prof McGuigan said the plan was for other investors to also have a presence in the hub, so allowing companies to pitch for finance in an environment which he described as being the "true Dragon's Den."

business.wales.gov.uk/lifescienceshubwales/home

Research fellowships awarded to Swansea academics

Swansea University academics have received two of only seven prestigious fellowships awarded this year by The Royal Society, the UK's national academy of science.

Both the College of Science Professor Tavi Murray and Dr Sophie Schirmer have been awarded Royal Society Leverhulme Trust Senior Research Fellowships.

The fellowships scheme allows scientists to make major progress in their area of study by undertaking full-time research. Professor Murray received her fellowship to research the interactions between ice and ocean at the margins of glaciers in southeast Greenland and Dr Schirmer is researching new paradigms for magnetic resonance molecular imaging via quantum control.

Professor Murray said, "I am really excited to be able to concentrate on research for the coming year: I'm going to be working on iceberg calving especially in south-east Greenland. Glaciers that calve icebergs are a primary control on how much water the Greenland ice sheet contributes to global sea level rise. It is a key time to work on this area - our group has just shown a new calving process operates in Greenland which isn't included in models as yet. I'm particularly excited to be collaborating with oceanographers for this project."

In response to receiving the Fellowship, Dr Schirmer said, "I'm very excited to be able to devote myself fully to applying my expertise in quantum control to my recently acquired interest in magnetic resonance imaging and spectroscopy. This is a field with many potential applications including in the early detection of biomarkers for diseases from cancer to dementia, and I hope that this fellowship will enable myself and our medical imaging team to make a significant contribution to this field."

Bangor University collaborates in world-wide ocean health check

Scientists at Bangor University have joined forces with marine scientists across the world to take part in an ambitious global research project – Ocean Sampling Day.

On 21 June, scientists from over 150 research organisations across the globe took samples of seawater on mid-summer's day to form the biggest marine research initiative ever to take place on a single day and Professor Peter Golyshin's team at the School of Biological Sciences sampled the Menai Strait in North Wales.

The precious data bank gathered from the collection of samples will allow future generations of marine scientists to understand and benchmark changes in the marine environment.

80% of all life on Earth comes from the World Ocean which covers more than 70% of the Earth surface. Marine microorganisms are responsible for a smooth functioning of global elements' cycles, however less than 1% of them are known.

> "The research findings will help us to better understand the sea at the microbial level, to determine the composition of microbial communities, their diversity and their contribution in maintaining marine environment health."
>
> **Professor Peter Golyshin**
> **School of Biological Sciences**
> **Bangor University**

The sample taken from the Menai Strait will, along with all other samples, be sent to the lead research partner Professor Frank Oliver Gloeckner at the Jacobs University in Bremen (Germany). Bulk microbial DNA will be extracted from all samples, sequenced and analysed, forming the biggest standardised reference data set in the world which can be used by generations to follow.

Samples will also be sent to the world famous Smithsonian's Institution Natural History Museum in Washington DC, USA which will keep up to 10,000 samples, collected every 21st June, in a time-capsule so that they can be used as a clear indicator of change.

As part of a large pan-European project "MicroB3" Bangor University's research team will also be using these samples to analyse the DNA contained within the microbes to demonstrate the microbial biodiversity of the oceans and therefore their potential for biotechnology. Bangor University's role is to reveal those genes in microbial communities which could be developed into novel enzymes which may be of industrial importance.

www.bangor.ac.uk/biology

Ultravision is the People's Choice

A ground-breaking invention, as featured in Advances 71, which clears smoke created during keyhole surgery won the inaugural 'People's Choice' Award at this year's Cardiff University Innovation and Impact Awards.

Voted for by the public, the win makes up a hat trick of honours for Ultravision in 2014, including the Royal College of Surgeons Cutlers' Surgical Prize and a Business Impact (Aspiring) award from PraxisUnico – a UK network that drives the commercialisation of academic and public sector research.

Edwina Hart AM, Minister for Economy, Science and Transport, presented the People's Choice Award to Dr Neil Warren, Chief Technology Officer at Asalus Medical Instruments – the spin-out company behind Ultravision.

"We are delighted Ultravision has been recognised as an excellent example of collaborative commercialisation. The University instantly recognised the potential value of Ultravision and provided translational funding to create prototypes. The commercialisation team then secured funding to create a spinout company. Four years later we have a launched product and are attracting distribution partners worldwide."

Dr Neil Warren
Chief Technology Officer
Asalus Medical Instruments

The product, conceived by Dr Warren, also picked up the University's New Ventures Award. The device is based around 'electrostatic precipitation', technology used in industrial applications to remove airborne particles from waste gases. It silently and unobtrusively clears the visual field of surgical smoke and prevents its release in to the operating theatre during laparoscopic (or keyhole) surgery.

Dominic Griffiths, Managing Director of Asalus, said, "We are honoured that Ultravision has won the New Ventures Award at a time when we're bringing Ultravision to market. The overwhelming interest we are receiving from the surgical community and global distributors makes it all worthwhile. There are around six million laparoscopic procedures performed each year globally. Smoke is an issue in the vast majority of these procedures and so we are confident that we have developed a totally unique product in a huge market."

www.asalus.com

IN BRIEF

Canadian tech firm to set up Caerphilly base

Up to 25 jobs are set to be created in Caerphilly after a Canadian mobile technology company announced it is to invest £2.6m in a new research and development centre.

Vancouver-headquartered Appnovation Technologies, understood to be one of Canada's fastest growing businesses, announced the move during a meeting between its president and chief executive Arnold Leung and First Minister of Wales, Carwyn Jones.

Leung also outlined plans to make Caerphilly Appnovation's European headquarters, with ambitions to create up to 100 high-quality jobs and said, "With Wales' close proximity to Europe and vast business resources, it was an easy decision to move forward."

Diurnal boosted with £6m

Pioneering Cardiff drug development firm, Diurnal, has been boosted with a £6m funding round led by IP Group providing finance to take its products to commercialisation.

Its lead product Chronocort was recently the subject of a positive phase 2 trial in the treatment of congenital adrenal hyperplasia. It is now due to enter pivotal phase 3 studies in the first half of 2015.

IP Group has committed up to £4.1m of the £6m and Finance Wales has invested £1.76m in the latest round.

Egypt Centre meets computer science

The Egypt Centre, Museum of Egyptian Antiquities at Swansea University has been working with Dr Rita Borgo and her student Lewis Hancock from the University's Computer Science Department on a project to enhance visitor experience.

The aim was to devise a fun, but educational, application which could enhance interaction with the collection. The application developed allows users to interact with a 3D image of the object using a hand held tablet programmed to read the QR codes placed next to the cases where the physical objects are displayed.

EKF Diagnostics wins distribution contract in China

With headquarters in Penarth, the point-of-care equipment manufacturer has announced that it has signed a distribution contract for its glucose and lactate analyser Biosen C-Line with Tianjin Multiclone Trading Company.

The initial contract for 1,900 analysers is expected to be worth €4m (£3.2m) over two-and-a-half years. Tianjin will also need to purchase consumables for the analysers, which is predicted to generate a further £1.6m of revenues over the same timeframe. EKF has also revealed that its German partner has received regulatory approval in China and Japan for its CompoLab haemoglobin instrument.

Plan for North Wales-Liverpool airport hovercraft route

Plans for a hovercraft service between North Wales and Liverpool John Lennon Airport have been revealed – and could be running as early as spring 2015. Up to 85 passengers per trip could be transported from North Wales to John Lennon Airport in Liverpool for just £15.

Wirral-based firm Hoverlink Ltd wants to make the route the world's only existing airport hovercraft link and director Simon Clitheroe said, "Our services would run a community link where you can hop on and off like a bus schedule."

Celebrating the impact of great research

The impact made by outstanding and varied research carried out at Swansea University was celebrated on 19 June. Guests from academia, industry and the public sector attended the first Swansea University Impact Awards.

Six awards were given to projects as varied as the Research as Art initiative which has reached more than 50 million people and looked at innovative ways to use satellite data to improve weather forecasts.

Professor Ian Cluckie, Pro-Vice-Chancellor (Science and Engineering), said, "Our research delivers academic impact through papers and publications but also in countless other ways - from innovation and commercialisation, to informing public policy and improving health and wellbeing; from enriching cultures and sustaining environments to educating and inspiring future generations."

"These inaugural Impact Awards give us the ideal opportunity to celebrate some of the people and projects making an incalculable difference to our society."

Some of the 2014 Swansea University Impact Award winning projects are:

The TATA Steel Award for Outstanding Impact in Commerce and Industry

Winner: Improved Aerodynamic Design Process for the Aerospace Industry through the Application of Unstructured Mesh Technology

The GE Healthcare Award for Outstanding Impact in Health and Wellbeing

Winner: Contribution to Improvements in Patient Safety through Computer-Human Interaction for Medical Devices

The BLOODHOUND SSC Award for Outstanding Breakthrough in Research

Winner: Using land-surface satellite data to improve weather forecasts and climate predictions

IDEOBA creates 100 hi-tech jobs

A hi-tech firm is creating 100 new jobs in Bridgend developing specialist web services for the financial sector.

Using data mining and profiling technologies, the powerful search engine will have the capacity to map the total global knowledge base of an estimated 300 million professionals. Ideoba is run by former Plaid Cymru MP Adam Price and American financial expert Andrew Auerbach, who met at Harvard university in the USA.

Support comes from Harvard professor Harry Lewis, who taught billionaires Bill Gates of Microsoft and Facebook chief Mark Zuckerberg. Mr Price said Wales was "moving from coal mining to data mining."

Port Talbot company acquired as part of a $100m deal

Environmental consultancy Resource & Environmental Consultants Limited has been acquired as part a $100m deal. The firm, which has an operation in Port Talbot, is one of three businesses acquired by Concept Life Sciences, a newly formed international scientific laboratory and consultancy business, in a swoop with a combined enterprise value approaching $100m, following backing from Equistone Partners Europe.

This investment is the 21st from Equistone's £1.5bn Fund IV, which sees the mid-market private equity firm secure a majority stake in the newly formed business.

Trojan to almost double workforce with £2m investment

Trojan Electronics has revealed plans to almost double its workforce in Swansea as part of an investment worth more than £2m.

Welsh Government is providing a property development grant for the refurbishment of an un-used building and business finance towards the fitting out of a new headquarters within the property. Trojan provides a repair and refurbishment service for products returned under warranty to major retailers. It said the investment would create 138 jobs. "We look forward to reuniting all our operations and staff into one location and gearing up to meet the growing demand for our services in the UK and Europe," said Trojan's finance director Malcolm Rash.

Space port for North Wales

Confirmation that an airfield in North Wales is a potential location for the UK's first space port has been welcomed by Welsh Government. Llanbedr Airport, located within Snowdonia Enterprise Zone, is one of eight sites under consideration by the UK Government.

UK Government ministers want to establish a UK space sport by 2018, which will serve as a facility to enable satellite launches. All sites will have to meet strict criteria, including being a safe distance from densely populated areas and a runway that can be extended to more than 3,000m (9,842ft).

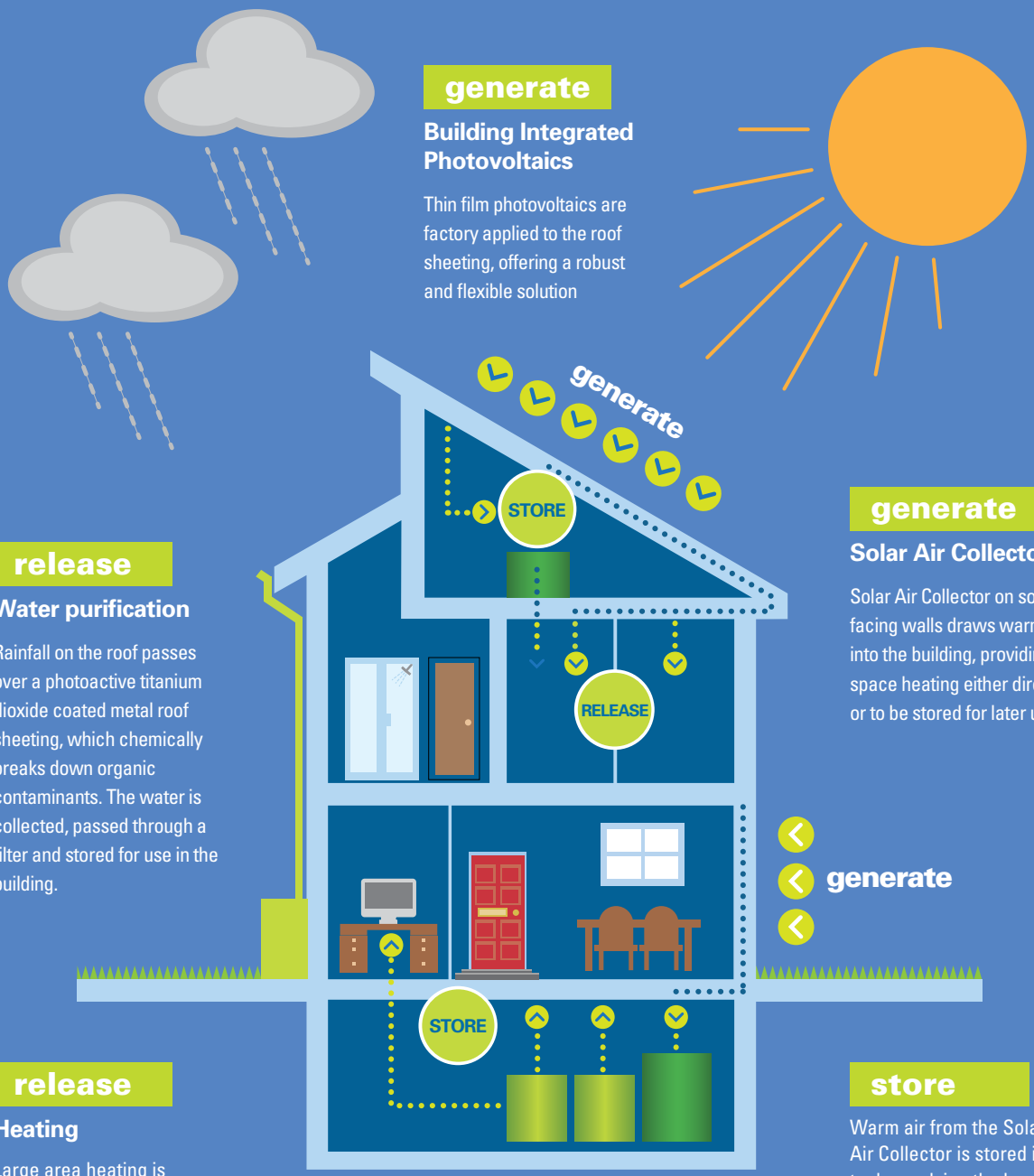
The aim is to use the spaceport to launch tourists into space as well as commercial satellites from 2018.

Glyndŵr University signs major international deals

The Welsh university and MBDA – Europe's largest missile company – have agreed to develop a series of technology and management programmes to train the next generation of world-class engineers with the cooperation of the Malaysian government agency Majlis Amanh Rakyat, known as MARA.

Glyndŵr University Vice Chancellor, Professor Michael Scott, explained that the union with MBDA and MARA will launch a new era for engineering at the Wrexham institution and that the University is "absolutely thrilled to be working alongside MBDA and MARA, two giants of defence, education and engineering."

generate › store › release



generate

Building Integrated Photovoltaics

Thin film photovoltaics are factory applied to the roof sheeting, offering a robust and flexible solution

generate

Solar Air Collector

Solar Air Collector on south facing walls draws warm air into the building, providing space heating either directly or to be stored for later use.

release

Water purification

Rainfall on the roof passes over a photoactive titanium dioxide coated metal roof sheeting, which chemically breaks down organic contaminants. The water is collected, passed through a filter and stored for use in the building.

release

Heating

Large area heating is provided by a coating applied to floor tiles, walls or other surfaces. It can also provide controlled localised heating, maximising efficiency and generating cost savings.

release

Energy generated by the building envelope is released throughout via heating, lighting, electrical equipment and water use.

store

Warm air from the Solar Air Collector is stored in a tank supplying the heating system.

Electricity generated by the photovoltaics is stored in batteries

Buildings as power stations

"I'd put my money on the sun and solar energy ...

I hope we don't have to wait til oil and coal run out before we tackle that."

Thomas A. Edison

SPECIFIC is channelling natural energy, to change the way we power our lives and effectively turn buildings into power stations. This will be achieved by accelerating the industrial scale up of academic concepts to develop practical, economic coating technologies to capture, store and release solar energy at the point of use, for both new and retrofit buildings.

SPECIFIC

Set up in 2011, the Sustainable Product Engineering Centre for Innovative Functional Industrial Coatings (SPECIFIC) is one of seven Innovation and Knowledge Centres (IKCs) in the UK, backed by funding from the Engineering and Physical Sciences Research Council (EPSRC) and the Technology Strategy Board, with Welsh Government support. SPECIFIC is led by Swansea University in collaboration with a number of Welsh and UK based academic and industrial partners, including Imperial College London, Bangor, Cardiff, Glyndwr, Bath and Sheffield Universities, and multi-nationals including Tata Steel, BASF, and NSG Pilkington.

The centre is working to speed up the commercialisation of innovative, energy generating, industrial coatings within the construction industry through its pilot production facility. These coatings will revolutionise building construction and make a major contribution to renewable energy targets. "There isn't another place in the world where you can coat sheet, coil, plastic, steel and glass all under one roof."

The generation of high technology jobs and the creation of wealth in the green manufacturing sector as well as the staged development and release of new technology means that there is a constant buzz at the innovation centre. There is always something new on the cards, an appetite for discovery and the commitment to carry ideas through.

Here is where concepts are transferred from the scientist's notebook to the real world; where true innovation is inspired, and where it begins to make its mark.

www.specific.eu.com

Project SUPER

As part of SPECIFIC's unique pilot production facility, Project SUPER seeks to accelerate the scale up of functional coatings by creating a new engineering resource that is dedicated to demonstrating and improving manufacturing techniques. It incorporates a technical laboratory, a re-engineered reel to reel line, which can process flexible steel materials up to 300mm wide and 2km long, and an open innovation space that helps to broaden the industrial engagement needed to develop commercialisation outputs.

This enhanced facility is set to deliver manufacturable solutions to industry partners, create new products and services to benefit supply chains in Wales and generate valuable IP.

The benefits from the additional capability and industry engagement resulting from Project SUPER will be commercially developed through a range of exploitation routes contributing to economic growth in sectors such as Energy and Environment, Construction and a range of Advanced Manufacturing and Materials segments.

Smart coatings for a sustainable future

Every day we get enough energy from the sun to power our planet for 27 years. Yet nearly all of that energy goes to waste.

Imagine if the buildings in every town and city, in every country across the World, could capture that solar energy for us to use in our daily lives.

The commercial exploitation of innovation and knowledge is a key enabler for sustained economic growth and wealth creation and to make that vision a reality, SPECIFIC is developing ground-breaking coatings for building materials that can be manufactured on an industrial scale in the UK. Once developed, these glass and steel-based products will be fitted to the roofs, walls and windows of new and existing buildings to generate, store and release safe, clean, renewable energy.

The concept is simple. When sunlight interacts with a coated roof or window, energy is generated and that energy can then be transferred to the National Grid or stored within the building as electricity or heat.

There are over 4 billion square metres of roofs and facades in the UK alone and transforming buildings into power stations could create a new one-billion pound industry by 2020 – one which could generate thousands of jobs, cut greenhouse gas emissions, and contribute towards a diverse energy mix to help achieve energy security which can be released as required, for heating, lighting or cooling.

A range of applications are in development and SPECIFIC's partners are working with architects, designers, developers, building owners and occupiers to ensure that they meet the specific low-carbon energy requirements.

"As a market leader in premium pre-painted steel products that go on the roofs and walls of buildings, tata is interested in extending that position by incorporating smart coated products into smart building components.

Mr Mark Collinson
Former Head of Strategy Building Envelope Sector, Tata Steel Europe

It is an ambitious vision, but the partners in this unique collaboration are committed to making 'buildings as power stations' a commercial reality by developing the next generation of cost-effective renewable energy products and creating this new one-billion pound industry that will generate jobs, cut carbon and contribute towards the security of the UK's energy supply.

From lab bench to factory floor

At SPECIFIC, innovative ideas are taken from the lab bench to the factory floor and from the factory floor to the built environment.

At the centre, this has been achieved with investment in state-of-the-art equipment and the co-location of a collaborative multidisciplinary and multi-functional team. Key to SPECIFIC's success is the identification of emerging and applied technologies and the sourcing of non-toxic earth- abundant materials which can be manufactured cost-effectively at industrial scale.

> *"a discovery is said to be an accident meeting a prepared mind."*
>
> **Albert Szent-Györgyi**

CASE STUDY

Large-scale adoption of the technologies being developed at SPECIFIC is expected to begin in the next 10 to 15 years. In the meantime, the team is busy mixing and matching its deliverables, producing smaller-scale advancements which deliver value to its industrial partners as well as progressing the longer-term projects. SPECIFIC's first spinout company, BIPVCo, has just launched with a range of integrated photovoltaic roof panels and the commercialisation of other SPECIFIC products will follow.

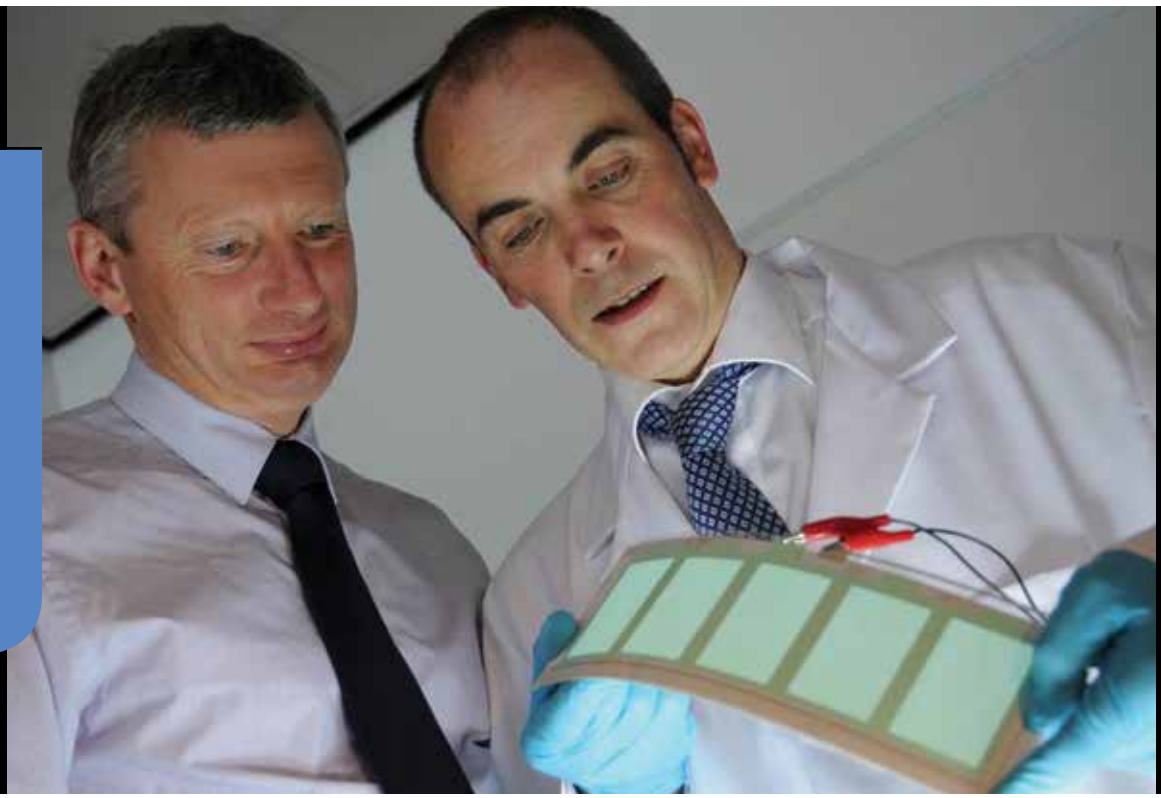
www.specific.eu.com

The speed of this transfer is especially important in the area of photovoltaics and the centre works with the most promising photovoltaic technologies to find ways to manufacture them at scale. These include Perovskites, CZTS (Copper, Zinc, Tin, Sulphur), Organic Photovoltaics and Dye Sensitised Solar Cells.

SPECIFIC is an exemplar of how co-location, collaboration and open innovation allow universities to work with industry to develop and commercialise pioneering research into emerging technologies.

Learning by doing

SPECIFIC's ethos is one of 'learning by doing'. For example, the centre's scientists and technologists use tailor-made equipment designed 'in-house' to assess product concept, performance, marketability and scale. Similarly, if new technologies are required, they are developed and assessed in the laboratories, then tested further using the modular pilot manufacturing line.



"BASF, as the worlds' largest chemical company, has long established relationships with both Swansea University and Tata and welcomes the opportunity to work collaboratively, under one roof, on the development of sustainable coated products for the construction sector.

Dr Nick Brown
Commercial Director
BASF Coatings

The centre also designs and builds small-scale 'proof-of-concept' demonstrators at an early stage in the research. These help to stimulate conversations with people around the many ways in which ideas can deliver value. One of these is of SPECIFIC's heated coating function.

Heated Coating

SPECIFIC's heated coating functions according to the long-established principle of resistive electrical heating, in which electrical energy is converted into heat energy. It has been designed for the smart buildings of the future, powered by a DC supply such as that from photovoltaics, but it can also be powered by a standard AC supply.

One of its many applications is zoned temperature control which is perfect for shared office spaces where individuals' ideal room temperatures vary and the range of products based on this technology include a heated floor tile, a foot warmer and heated wall components.

Additionally, to enable the rapid commercialisation of each concept, these demonstrators can be quickly converted into functionally-coated sheets or panels. These are then made into product prototypes and retrofitted to buildings.

Throughout the pilot production process, scientists and technologists work within a controlled 'filtered air' room. This allows the team to determine the degree to which pollutants could impact on the applied technologies.

This experimental environment is crucial to the success of SPECIFIC. It allows for the development and refining of processes as well as ensuring that all products can be manufactured at industrial scale in atmospheric conditions.

It is this end-to-end R&D capability, combined with the commercial expertise of the collaboration partners, which gives SPECIFIC a competitive edge.

Revolutionary and affordable

SPECIFIC is currently building a portfolio of affordable products, based on integrated renewable technologies, which can be easily adopted by a number of energy users and will generate more than one third of the UK's renewable energy requirement by the end of the 2020s.

These revolutionary products will be suitable for both new and existing buildings – including retail outlets, warehouses and corporate offices – where metal and glass predominate the structure.

By drawing on combined experience and expertise in both traditional and emerging industries, including plastic electronics, SPECIFIC ensures the adoption of tried and tested methodologies as well as the pioneering of new production methods.

The centre works with multiple substrates – including glass, steel and plastic polymers – to develop its innovative product concepts. Printing and coating techniques are combined for product optimisation and the development of low-cost manufacturing processes.

Through collective strengths in each of these areas, the centre is able to develop commercially-viable products within a short amount of time, by working closely with Swansea University's Welsh Centre for Printing and Coating (WCPC), and other research and development centres, to further accelerate progress by gaining a deeper understanding of the many challenges faced by businesses in this dynamic and growing market.

Scientists discover gold's hidden value

Gold as a catalyst with great potential

Scientists from Cardiff are discovering new and unexpected uses for gold – a noble metal traditionally regarded as being chemically uninteresting due to its poor ability to react with other substances.

Researchers at the School of Chemistry are pioneering new ways to exploit the revolutionary potential of gold to accelerate and optimise chemical processes in a range of industries from producing the plastics that modern life depends on to environmentally friendly energy production. Studies show that the main advantages of gold as a catalyst are its long lifetime, unusually high reactivity and high specificity to the desired product.

> "Gold has been a subject of human fascination for millennia, largely because of its resistance to corrosion and its resulting sustained beauty. However, when broken down into nanoparticles, which contain just a few hundred atoms, it not only changes colour; it also becomes incredibly reactive, so contrary to the old adage; not even all that is gold glitters. Our research into the effect of gold nanoparticles on chemical and biological processes shows that in its nanoparticle form, gold's reactions are faster, easier and energetically more efficient than many other catalysts."
>
> **Professor Graham Hutchings**
> **FRS Director of the Cardiff Catalysis Institute (CCI)**

Catalysis is an enabling technology that underpins an estimated 80-90% of all manufactured goods. The phenomenon involves a material, which is not one of the reactants, speeding up a desired chemical reaction without the need for an increase in temperature. Commonly used catalysts such as those containing mercury have proven wasteful, environmentally hazardous and even harmful to human health. Gold, scientists have discovered, is not only a viable alternative catalyst but sometimes, the best possible catalyst.

Professor Hutchings believes that gold has the potential to save lives, improve human health and clean up the environment: "Too many processes create too much waste and not enough product. By introducing a gold catalyst we can reduce the amount of waste and increase the productivity for the benefit of a number of processes. The more we learn about this precious metal, the more I feel that society is ascribing the wrong kind of value to gold."

He adds: "One of the initial discoveries we made is that gold is the best catalyst for the formation of vinyl chloride, the main ingredient for the production of PVC and has the potential to replace an environmentally harmful mercury catalyst, this would be a major benefit to society. Gold is also used as a catalyst to oxidise carbon monoxide to carbon dioxide. This has potential to be used in natural disasters where people are trapped in an enclosed space, such as mine shafts, and poisonous carbon monoxide (CO) needs to be removed from the air - but also in domestic settings where people live alongside equipment that has a risk of CO production from incomplete combustion e.g. gas heaters, cookers, petrol engines."

Catalysts are under continual development to achieve new levels of activity and selectivity to society's desired chemical products. Using gold in catalysis could enable society to make better use of precious raw materials and to exploit new, greener sources by generating fuels, plastics and other chemicals from renewables such as corn starch, glycerol and recycled waste. Smarter use of catalysis will also lower our energy consumption and help in the decentralisation of activities such as water purification and small scale electrical power generation.

Research at Cardiff Catalysis Institute (CCI) is currently exploring the possibility of using gold as a "cold start" catalyst in car exhaust systems to reduce carbon emissions. The current catalysts depend on the heat of the exhaust to become active. This means that the first few minutes of any journey produce the most emissions of CO and NOx (nitrogen oxide). As gold can work at lower temperatures than conventional catalysts, it could be used in this early stage.

Profile

Product
Gold

Applications
Catalyst

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White blood cell is key to protection

New vaccine hope for leading viral cause of birth defects

Experts in infection and immunity at Cardiff University, South Wales, have made a path-finding discovery that could lead to the development of a vaccine for a health-ravaging virus that affects around 50% of adults in the UK.

Cytomegalovirus (CMV) is the leading viral cause of congenital birth defects, with 1 in 750 babies in the UK being born with permanent disabilities - these include blindness, deafness and brain damage - as a result of infection within the womb.

These Cardiff scientists have uncovered a novel defence mechanism to control this disease, using the most common form of white blood cell – neutrophils.

Although it has long been known that neutrophils are important in killing bacterial infections, it was largely thought that they were specifically designed for this cause; the fact that they can also fight a viral attack is a major breakthrough according to Dr Ian Humphreys from the University's School of Medicine:

"Our study shows that neutrophils protect our organs from CMV by producing a protein called TRAIL that can directly kill virus-infected cells. Our body attracts the neutrophils to where the virus is replicating by producing the protein IL-22, which acts as a homing signal.

"Disease may actually be prevented if we can teach the immune system to quickly send antiviral neutrophils to the first site of infection. We are now developing a vaccine that may protect the body against CMV. Our findings may also have implications for other destructive viruses such as flu, hepatitis and even HIV."

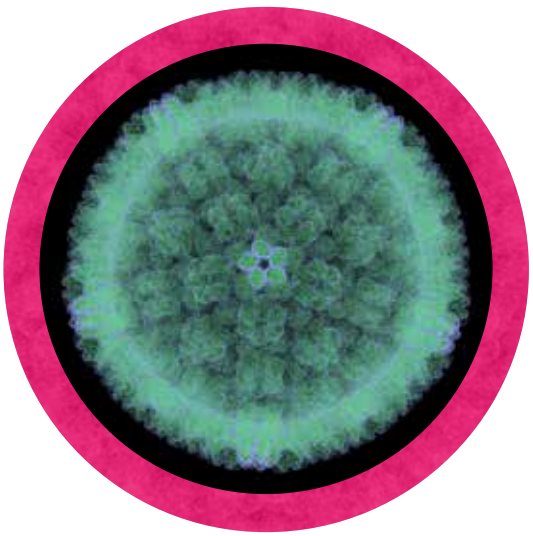
Currently there is no known treatment for CMV. Given that the virus spreads via bodily secretions such as urine, saliva and breast milk, scientists at Cardiff sought to understand how to protect mucosal sites from infection, and how to prevent the virus taking its grip in other important organs such as the liver.

The virus is also a major reason behind life-threatening diseases in bone marrow and organ transplant recipients and is known to have a major impact on the immune system of even the healthiest of adults.

The research was conducted as part of a collaboration between Cardiff University, The Wellcome Trust, Sanger Institute (Cambridge), the University of Oxford and La Jolla Institute for Allergy and Immunology in California.

The paper was recently published in the journal Cell Host & Microbe.

Illustration of a white blood cell



Cytomegalovirus (CMV) virion

"Neutrophils are the rapid-response arm of the immune system's war against infection. The discovery of a new molecular mechanism for neutrophil mobilization and execution in the fight against CMV is very exciting, and provides key insights for developing more effective vaccines and therapies to combat this little-known viral pathogen."

Dr Chris Benedict
La Jolla Institute for Allergy and Immunology (San Diego, California)

Profile

Product
Disease defence mechanism

Applications
Prevention of CMV

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Welsh study serves up sweet solution

Bees set to help combat hospital superbugs

A major piece of research led by Professor Rose Cooper, Professor of Microbiology at Cardiff School of Health Sciences (CSHS) based at Cardiff Metropolitan University in South Wales has demonstrated that honey can be used as a natural remedy to hospital infection "superbugs" which are resistant to strong antibiotics.

Medical grade honey became licensed on prescription in the UK in 2004 and approved in Canada and the USA since 2007. It is available in many forms, including tubes and as medicinal dressings or in ribbons, which are useful for inserting into a wound.

Manuka honey, which is predominantly produced in New Zealand and Australia, has the benefits of being antimicrobial, deodorising, anti-inflammatory and an antioxidant and is effective in treating traumatic wounds, surgical incision sites,

burns, sloughy wounds, and pressure ulcers.

Professor Cooper, who was the first in the UK to work with manuka honey, said: "The majority of chronic wounds have bacteria in a biofilm, which makes them much less susceptible to antibiotics, and therefore, much more difficult to treat. Manuka honey can inhibit the growth of these biofilms in the laboratory, giving it the potential to control superbug infections such as MRSA. It will inhibit MRSA by stopping cells from dividing, which makes it such an interesting product to work with." Her research, which investigated the effects of honey on gene expression in MRSA and its effects on other bacteria that cause wound infection, won the Infection and Biofilm Award at the prestigious Journal of Wound Care (JWC) Awards 2014.

Over two years, tests were conducted on bacteria gathered from infected patients and from hospitals, which proved highly resistant to antibiotics. Working with the University of Waikato in New Zealand, the research team from Cardiff Metropolitan University discovered that honey's high sugar content actually slowed bacterial growth and its syrupy texture acted as a seal against outside infection of wounds and provided a natural barrier to bacteria.

This discovery would not have been news to the ancient Greeks and Romans, who were aware of honey's health-giving properties however, with the emergence of antibiotics in the 1950s as a means of killing off infection, centuries of knowledge were overridden by the need for modern drugs to tackle infections.

In its undiluted form, honey has the effect of killing off bacteria, which researchers believe could be linked to enzymes in the bees themselves or present in pollen.

In recent years, the medical profession has become alarmed at the resistance of bugs to even the strongest antibiotics and the results of this research will have a major impact on the way hospitals tackle outbreaks of bugs, such as MRSA, which have infected 3,000 patients so far this year.

The effect of manuka honey on bacterial growth

Profile

Product
Manuka Honey

Applications
Natural remedy to hospital infection

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Sterling security

Welsh created GB Pound gives counterfeiters the slip

The Royal Mint, in Llantrisant, South Wales, has developed world-leading, anti-counterfeiting technology which will enable Her Majesty's Treasury to modernise the United Kingdom's circulating currency with the production of a brand new £1 coin.

George Osborne, the Chancellor of the Exchequer, revealed that HM Treasury believes there is a strong case for introducing a new £1 coin to help reduce counterfeiting and ensure the integrity of the UK's currency.

The Royal Mint's prototype coin utilises multiple layers of cutting-edge technology and will allow the UK to reduce the rate of counterfeit coins entering general circulation, making it the most secure coin in the world, whilst costs will be reduced by replacing homogeneous metal with a more affordable full-plated option.

This innovative technology will be made available around the world and will revolutionise global coin security, whilst reducing costs for Governments and Central Banks.

The Royal Mint – which delivers more than two billion coins and blanks, tooling and other services to 50-60 countries around the world each year – is working closely with key industry stakeholders in order to understand the potential impact, whilst a public consultation will be completed before a final decision is made on the precise specification of the new coin. A public design competition will produce the design for the reverse, or 'tails', of the coin which will be introduced in 2017 the design of which will be 'distinctly British'.

The new £1 coin will have a twelve-sided shape which evokes memories of the pre-decimalisation threepenny bit. It will be constructed from two different coloured metals and contain a special security feature – a revolutionary new high security coinage currency system developed by The Royal Mint – which will not wear off over time and will generate lifetime cost savings through unmatched durability, lasting up to 30 times longer than an equivalent value banknote.

Known as 'Integrated Secure Identification Systems', it enables not just coins but the whole cash cycle to be more secure, protecting the public, vending machine operators, retailers, and the wider banking system.

This project is the work of The Royal Mint's in-house technical team and involves the application of an existing security technology that has been proven over decades in banknotes. It is the first time that this feature has been successfully embedded into coins, bringing with it forensic level security. The incorporation of the feature throughout The Royal Mint's industry leading aRMour® plating process ensures no loss of validity throughout the lifetime of the coin, making it as secure after 25 years as it was on release. The Royal Mint has also worked with key partners to develop high speed, sophisticated optical detectors for the feature which enables it to be detected at industry standard speeds of up to 4,000 coins per minute. This detection capability ensures all levels of the cash cycle can be secured with no loss in performance.

> "After thirty years loyal service, the time is right to retire the current £1 coin, and replace it with the most secure coin in the world. With advances in technology making high value coins like the £1 ever more vulnerable to counterfeiters, it's vital that we keep several paces ahead of the criminals to maintain the integrity of our currency. I am particularly pleased that the coin will take a giant leap into the future, using cutting edge British technology while at the same time, paying tribute to the past in the 12-sided design of the iconic threepenny bit."
>
> **George Osborne**
> **Chancellor of the Exchequer**

Adam Lawrence, Chief Executive of The Royal Mint said, "We are thrilled to have the opportunity to work with Her Majesty's Treasury on such an exciting project, which could change the way that coins are made in the future. It is our aim to produce a pioneering new coin which helps to reduce the opportunities for counterfeiting, helping to boost public confidence in the UK's circulating coins."

"We are very proud to be recognised nationally in terms of providing innovative solutions on an international scale. We are already the world's leading export mint, but this new system confirms our place as leaders within our industry, expanding the boundaries of minting technology".

Andrew Mills, The Royal Mint's Director of Circulating Coin, said, "The development of our project has enabled us to develop a new generation of low cost, high security, plated coin with multiple levels of banknote-strength security built in. It will enable enhanced security throughout the cash cycle, from vending, parking, retail, and banking."

This project received the 2013 Innovation Award from The Wales Quality Centre and is the culmination of a period of intense research and development by The Royal Mint's in-house team. It has seen an investment of more than £2m to date, with a significant amount more planned as the technology is commercialised.

Profile

Product
Anti-counterfeit technology

Applications
Currency

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Blizzard keeps athletes warm

Special jackets made in Wales helped keep Welsh athletes stay warm when the competition heated up in Glasgow recently

Welsh-based company Blizzard Protection Systems Ltd has teamed up with Sport Wales and the Welsh Elite Performance Sport Innovation Network (WEPSIN) to provide Welsh athletes with new hi-tech Blizzard jackets, which have been designed to keep their muscles and body at the optimum temperature for competition.

While a warm-up is a staple part of an athlete's routine, the time before an event starts can see a significant loss of heat and Blizzard's jacket is the solution to that problem. The hi-tech material was originally designed by Derek Ryden, who was a keen mountaineer, as he wanted something that was light weight but also highly effective for use as an emergency bag. Blizzard's unique material, Reflexcell™ reflects radiated heat and the cells create insulation which trap the warm air. Its outer later is 100% windproof and waterproof and the material used by Sports Wales has a Tog rating of approximately 8.

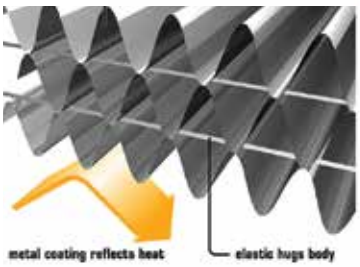
> "We know a high muscle temperature is vital to allow the athlete to produce high levels of power. In addition, a high muscle temperature helps minimise the risk of injury. This product allows the athletes to maintain muscle temperature during these potential heat loss windows."
>
> **Dr Liam Kilduff**
> **Swansea University**

As part of WEPSIN, and with Welsh Government funding, a research study was carried out by Dr Liam Kilduff of Swansea University and Professor Christian Cook of Bangor University, which has demonstrated the effectiveness of the jacket in improving athlete performance.

"The rationale for the use of this product is that there are significant periods of time, between when the athletes complete their warm-up and the beginning of competition, when an athlete can lose muscle temperature," says Professor Kilduff.

Sports such as swimming, athletics and shooting will use the jackets at the Commonwealth Games and Jackie Webb, Business Development Manager, commented, "We have made many bespoke products for the athletes to meet their individual requirements and sports.

"The Reflexcell™ material in the product for the Welsh athletes was originally designed and used as survival bags by climbers and walkers, and it has developed over the years to be widely used by the US and British military for the treatment of hypothermia in trauma casualties. It is now used extensively by the emergency services, including fire and rescue, ambulance, search and rescue and air ambulances.



Jazz Carlin wearing a Blizzard jacket before her victory in the 800m swimming event at the Glasgow Commonwealth Games (above) and after receiving her gold medal (right).

@JazzCarlin

"Recently, our jackets and trousers were used by Amy Williams and Lizzie Yarnold when they won their gold medals in the skeleton."

The technology and use of the jackets was a significant addition to preparation in Glasgow for some of our sporting stars.

"The physiological benefits of heat maintenance are now well reported and, as we are always looking for the additional one percent advantage in our own performance over our opposition, the use of the Blizzard garments was a no brainer.

"Athletes using the garments in both training and competition have noticed a significant performance gain. In competition there is also the added benefit of the psychological edge gained by having something that assists performance that the opposition do not.

"All in all it has been a great partnership and one that we are keen to continue moving forward."

Scott Simpson
National performance coach for Welsh Athletics

Profile

Product
Insulating material

Applications
Clothing for elite athletes

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Into outer colour space & beyond!

Makeover for South Wales print company

A company from South Wales which manufactures polyurethane coated vinyl labels has developed a bespoke colour matching system for the cosmetic industry which will allow charts and products to identically match each other.

Having started out by supplying products into the trophy and awards industry and now specialising in applying resin to printed vinyl branding products, DecTek, based in Pontypridd, has addressed complex issues in the industry through its own research and development. Its new bespoke LAB based colour matching system places the company at the forefront of colour matching techniques.

Driven by demand from the cosmetics industry, DecTek's new system enables cosmetic companies, to exactly match printed domed colour guides, for point-of-sale purposes, with actual product colour for the huge colour array surrounding the ever-changing cosmetic ranges used by women.

LAB Colour mode is an alternative colour space which allows for the manipulation of luminosity and colour far more flexibly than working in RGB (Red-Green-Blue) or CMYK (Cyan-Magenta-Yellow-Black) and allows for exact and pinpointed colour matching. This is a vehicle hardly used within the print industry because of the lack of understanding of three dimensional modelling and subsequent print output.

LAB colours cover all perceivable colours by the human eye and they are absolute which means that ironically, although not purposely used for printing, images converted from RGB to CMYK or back again, will pass through LAB in the process.

To help put the breakthrough into some kind of context, Mike adds "Using Pantone, RGB or CMYK colour helps you define the geographical landscape - LAB gives the Post Code."

> "Using our internally developed system of colour matching, we are not only able to match exactly but also very quickly turning enquiries into orders immediately and with a greater degree of colour accuracy and consistency, this is absolutely vital when dealing with large worldwide contracts".
>
> **Dave Beese**
> **Marketing Director**

Profile

Product
Colour matching system

Applications
Cosmetics industry colour guides

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Breakthrough for Wi-Fi services

Welsh developed Streetwise™ gives remote view of Wi-Fi quality

Cardiff-based Epitiro, which specialises in wireless quality measurement solutions, has launched its world-leading Streetwise™ software which allows for the remote monitoring of Wi-Fi network performance and improves a user's quality of experience (QoE).

Streetwise is a Wi-Fi Service Assurance Solution which uses discreet, on-site test probes to measure service beyond the user's own access point. It successfully bridges the gap between centralised network management information and actual subscriber experience by delivering cloud-hosted, real-time analytics to quality stakeholders. This remote monitoring system also significantly reduces the number of vehicles and specialists on the road i.e. it reduces 'truck roll.'

Issues that affect subscriber quality, like service accessibility, local interference and app performance can now be monitored and managed centrally. Consumers only need to download Epitiro's software which will then independently test speeds and the other technical measurements that affect consumer experience of broadband services. All of the test results will be forwarded to Epitiro's data centre for cumulative analysis while each participant will be able to view their own test results online.

"The challenge for Wi-Fi service providers is to meet quality expectations without wasting resources." said Jon Curley, CEO, Epitiro. "The ROI (Return on Investment) for Streetwise is very clear – it saves time and money by automatically reporting issues that erode subscriber confidence and, more significantly, reduces truck roll by confirming when systems are in fact working to specification."

Streetwise 4150 probes behave just like consumers, logging on via WPA/WAP2 and/or captive portal splash screen and testing apps such as YouTube, Facebook, Spotify, Twitter and others. Network metrics include throughput, latency, local RF quality and channel interference to provide comprehensive quality of service (QoS) and QoE insight.

To make the system even more accessible, Epitiro has also launched an app version of the core software which enables field testing from smartphones on trains and airplanes, and wherever crowds gather – airports, concerts and sporting events.

> "Whether it's Wi-Fi offload or hotspots, by going beyond the AP we're helping Wi-Fi operators instantly discover coverage, registration, configuration and channel conflict and other subscriber-affecting issues. Now service providers can park the trucks and drive quality."
>
> **Jon Curley**
> **CEO, Epitiro**

The Streetwise Wi-Fi Service Assurance solution scales commercially to thousands of probes for regional or national deployments. These probes are easily installed by non-technical personnel and auto-configure so that they can be up and running in minutes.

Their solution features include:

- Remote, on-line views of real-time Wi-Fi analytics
- QoE metrics: App, Access, Network Performance
- Low cost, easy-to-install data probes
- Cloud-hosted model for fast trials and deployment

Co-founder and chief executive of Epitiro, John Curley, said, "The solution we've designed is certainly world-leading and we're proud that it has been fully developed with Welsh talent."

Epitiro has undertaken projects for Ofcom and telecoms regulators in Ireland, Singapore, New Zealand, Tunisia, Bahrain and other countries. The BBC previously partnered with Epitiro to map 3G mobile coverage across the UK.

Mr Curley said: "Government regulators around the globe require the analysis technology and expertise Epitiro has uniquely developed.

"As the expected demand grows we'll continue with our strategy to recruit locally but think globally."

Profile

Product
Wi-Fi solution

Applications
Remote monitoring

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Staying switched on with iViTi ON

Innovative Welsh lighting company develops safety product

iViTi Lighting from South Wales has incorporated technology developed by a Mid Wales company (Litonics Ltd) to create three new ground-breaking products. Set to revolutionise the lighting industry, the first of these new products to be launched is called iViTi ON.

Resulting from a collaboration between design partners One Nine Design, and manufacturing partners Samsung and The Sony UK Technology Centre, in South Wales, iViTi ON represents the very highest standards of design, quality and practicality.

The product's automatic switching ensures that users are not left in the dark should the electricity supply fail and initially the iViTi ON technology will be introduced into a domestic GLS lamp, which is fully interchangeable.

The patented iViTi ON Automatic Switching Safety Lamp operates like any standard LED GLS (General Lighting Service) lamp until the lamp detects that the power has been cut. When this occurs, instantly, and undetectably, the lamp will switch to battery operation. This safety lamp can differentiate between a break in its power supply caused by manual switching and being extinguished due to a power cut.

Whilst operating under battery power the lamp functions as a normal GLS and can be switched on and off as required and when fully charged, the battery supplies enough power to keep the light on for up to 3 hours. As soon as the electricity supply is reconnected, the lamp returns to 'normal' operation and the battery is re-charged.

The uniquely designed 9.5w Automatic Switching iViTi ON GLS LED Lamp will deliver 850 lumens; with 2700k warm white colour temperature designed for the home and hospitality markets. This innovative new product is set to take its place among other 'standard' safety products within the home such as smoke detectors, CO detectors and intruder alarms.

Bill Welch, Managing Director of iViTi Lighting said, "We are very excited about the massive opportunities offered by the iViTi ON technology and are delighted to partner Litonics in its development. In addition, the experience and technical expertise of Samsung and The Sony UK Technology Centre at Pencoed within the semiconductor, LED and battery sectors, give us complete confidence in the technology and integrity of the product range. Placing this product within the most vulnerable locations within the home provides security, safety and could save lives. The added benefits of this lamp are that being LED, it is far cheaper to run as well as being environmentally friendly."

> "iViTi Lighting Limited has taken a highly responsible approach to entry into the LED market by fully testing all their products in our accredited test laboratory before placing them on the market. The introduction of their new iViTi ON range is a hugely exciting development and we have been working closely with Litonics and iViTi over the past 2 years on the project.
>
> **Peter Hunt**
> **Chief Operating Officer,**
> **Lighting Industry Association**

Profile

Product
Safety lighting

Applications
Emergency lighting

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CARS drives new microscopy technique

Welsh researchers find a new way to capture the quantitative chemical structure of cells

Cardiff researchers have developed a new microscopy technique to image the chemical composition of transparent structures such as cells with three-dimensional sub-micron (less than one millionth of a metre) resolution. The development was delivered by an interdisciplinary team including researchers from the Schools of Physics and Astronomy, Biosciences, Dentistry and Medicine studying stem cell differentiation and related imaging techniques. This breakthrough will enable researchers to create an image from living cells very quickly.

The technique is based on the nonlinear optical effect of coherent anti-Stokes Raman scattering (CARS), which uses the high-frequency vibrations of the molecules making up the material. These vibrations have a period of about 10 femtoseconds which is one hundred billion times faster than audible sound. The vibrations consist of the individual atoms in the molecules swinging against each other, with a frequency increasing with the decreasing mass of the atoms, and also with the increasing strength of the molecular bond. A hydrogen atom for example is about 12 times lighter than a carbon atom, and so it vibrates much faster. The resulting 'sound' of the molecules reflects their chemical structure, and can be used to identify them.

To hear this sound, the molecules are 'pushed' using light which is modulated at the vibration frequency, and the researchers then listen to the resulting light scattering which changes in colour towards the blue- having a frequency up-shifted by the vibration. To do this, very short light pulses are used with a duration similar to the decay time of the molecular vibration.

Without this push, molecules vibrate only due to thermal excitation which means that the resulting light scattering is much weaker because the molecules are not synchronised. This is similar to the difference between the effect of the precipitation of many random snowflakes and that of a single large hailstone.

This technique allows the researchers to "hear" the vibrations much faster, and it create images more rapidly which means that an image of living cells can be taken in a matter of seconds.

In order to determine the chemical composition of the material in a quantitative way from the scattered light, Cardiff researchers have developed an unsupervised analysis using both the causality of the vibration response (i.e. how it oscillates after it is hit) and the positive values of the concentrations. It extracts from these images taken for many different vibration frequencies, the chemical components, their 'sound' and their absolute concentration.

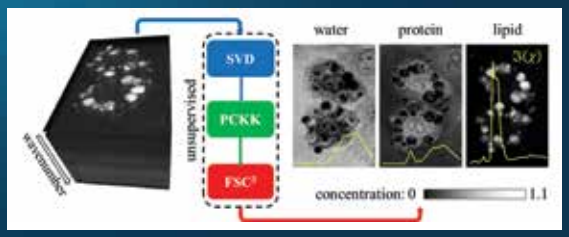

Figure 1

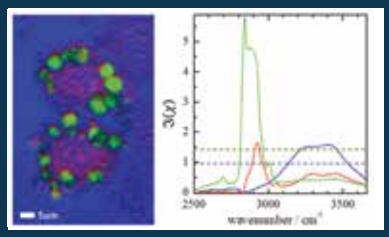

Figure 2

The workflow of the method is given in Fig.1 and an example of such an analysis on cells is shown in Fig.2, clearly identifying the different components of water, lipid droplets, as well as cytosol and nucleus.

Prof Wolfgang Langbein who headed the research said "This development is a milestone in the applicability of CARS microscopy. The quantitative nature of the imaging afforded by the method can be used to model and understand processes in biology and material sciences, for example lipid metabolism important for obesity research, and reaction kinetics in fluids important for microfluidic chemical synthesis."

The results were recently published in Analytical Chemistry - Dr Francesco Masia who acquired the data and co-developed and implemented the method said "The development and implementation of the algorithm took a few months but it was definitely worth it. I was impressed how the method was able to distinguish even subtle differences in the chemical composition of different subcellular structures, which could not be revealed by looking at the raw data."

Profile

Product
Microscopy technique

Applications
Cell imaging through vibration

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BioMonde has it in the bag

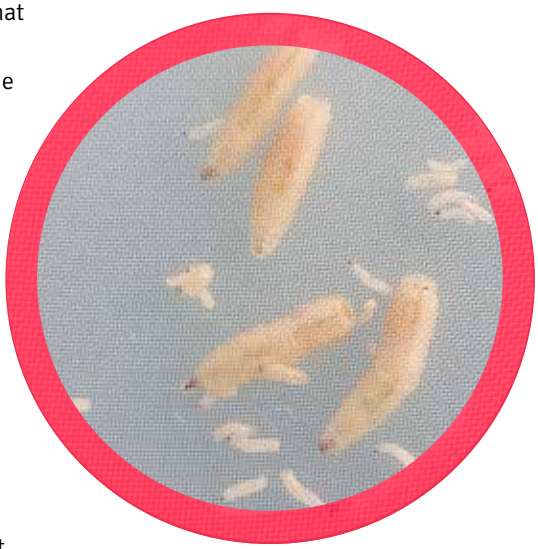
BioMonde's BioBag carries maggots for Larval Debridement Therapy

Initially formed as a spin out company from the NHS in 2005, BioMonde in South Wales specialises in 'Larval Debridement Therapy' (LDT) and has developed and patented BioBag.

The term 'Larval Debridement Therapy' (LDT) describes the use of maggots, precisely the larvae of the green bottle blowfly Lucilia sericata, for the removal of dead tissue and slough from the wound surface (debridement).

The maggots inject salivary enzymes onto rotting tissue to break it down and then suck it back up in a piston-like action. In addition, maggots feed on the bacteria that cause wound infection and, as they are photophobic, they naturally migrate to the dark depths of a wound, the area that is most difficult for surgeons to reach. It is this 'double whammy' of beneficial effects that accounts for the speed and effectiveness of maggot therapy. Effective debridement is a key step in the wound healing process and because of its selectivity for dead tissue, it is also known as biosurgery.

Larval debridement therapy is shown to have a direct effect on at least three elements of the wound healing process: it removes non-viable tissue effectively, it helps combat infection by reducing the bio-burden, and it helps normalise the wound closure by facilitating the remodelling process. An indirect effect of LDT is that moisture balance may also be normalised. Too much or the "wrong" wound fluid is often caused by infection, slough and dead tissue on the wound surface, and inflammation.



Debridement is achieved by the action of proteolytic enzymes, which are secreted by larvae. These enzymes liquefy proteinaceous material on the wound surface, which is subsequently ingested by the larvae as nutrition. The action of larval enzymes is restricted to dead tissue and

Larvae of this species have been used since ancient times, and more recently during the 1920's to clean chronic, non-healing wounds in an attempt to start the healing process. Today, LDT is increasingly used in response to the rising challenges posed by multi-resistant bacteria, which may be present in chronic wounds which are a significant drain on the resources of healthcare systems.

living tissue in the wound bed, including granulation tissue, is left unaffected. This selective process is one of the major advantages of LDT as it spares the healthy tissue necessary for healing.

The bacteria contained in this material are taken up at the same time by larvae, meaning the bio-burden is reduced and the antibacterial effect of LDT is further enhanced by the secretion of bactericidal factors, which consist of small, heat-stable peptides. In addition, larval secretions can prevent the formation of and reduce preformed biofilms which can be another barrier to effective wound healing.

The unique patented technology of BioBag uses larvae contained in a pouch-like device for ease of application and removal of the larvae by the clinician and acceptability to the patient. Larvae are placed in BioBags of different sizes, which consist of a polyester net and a cube of PVA (Polyvinyl Alcohol) foam that acts as a spacer. Larval secretions penetrate through the net and liquefied, proteinaceous material is taken back by the larvae. BioBags are placed on the wound areas that need to be debrided and covered with an appropriate secondary dressing. These BioBags can be left on the wound for up to four days and investigations have demonstrated that free and bagged larvae are equally efficacious in terms of debriding the wound. BioBag is available as BB50, BB100, BB200 & BB300. The number denotes the minimum number of larvae per bag at a dose rate 5-7 larvae per sq. cm found to be the optimum. Frequently, only one or two treatments, each lasting 2–3 days, are required.

In contrast, with conventional treatments, it can take months to achieve a successful outcome. This makes maggots a very cost-effective alternative to conventional therapies, substantially reducing hospitalisation costs. Often, maggot therapy is the only alternative to continuing pain, disfigurement, repeated surgery or even amputation.

A number of clinical trials have already been completed and BioMonde has active scientific research partnerships with both Swansea University and the University of Nottingham. A recent report commissioned from Swansea University's department of Health economics found that LDT was the most cost effective debridement method in terms of being both less expensive and more clinically effective to achieve the outcome of a successful debridement.

BioMonde is the only provider of bagged larvae in Europe and BioMonde LDT products have been used to treat over 18,000 patients across Europe, primarily in the UK and Germany. Following recent approval in the US, the company is in the process of establishing a manufacturing and distribution base in Gainesville Florida and will begin supplying the therapy to customers in the US later this year.

Profile

Product
BioBag- bagged larvae

Applications
Larval debridement therapy

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