# the journal for science, engineering and technology

#### SPECIAL BIOSCIENCE EDITION

## Targeting the tsetse

Welsh scientist fine-tunes visual baits for effective trapping of disease-spreading tsetse flies



Llywodraeth Cymru Welsh Government

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Targeting the tsetse

"To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science." Albert Einstein

As Editor, I am delighted to introduce you to this Bioscience special edition of Advances-launched in time for BioWales 2015.

As one of the most vibrant life sciences events in the UK, BioWales will attract over 600 individuals to Wales' capital to hear from a line-up of high-profile speakers from across the world. The Cardiff event provides an opportunity for businesses and investors to network and develop commercial opportunities, to partner with like-minded organisations in one-to-one meetings, and to investigate access to investment and new business.

The outstanding REF (Research Excellence Framework) results achieved by our Welsh universities are testament to the recognition of our great research. In this edition, this includes the identification of a special gene to prevent the onset of cancer from Cardiff University (page 10) and Swansea University's discovery of a hunger hormone linked to cognitive decline (page 12). Aberystwyth University's fight against the tsetse fly and sleeping sickness is also highlighted (page 18).

Our news section looks at collaborations, investments and success stories for Wales- including our part to play in Rosetta and the comet landing (page 6) and Aberystwyth's 'robotic orchestra' playing at the Royal Institution Christmas Lectures (page 7).

I hope that you enjoy reading this issue which highlights both the extensive range of research and development as well as the breadth of expertise which we have here in Wales.

Lucinda Scott-Morgan (née Dargavel) Editor

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

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## Wolfson Foundation support for new laboratory

Swansea University has been awarded £200K by The Wolfson Foundation to equip a state-of-the-art laboratory at its new Bay Campus, which will be dedicated to facilitating a wide range of research in the field of power electronics and power systems.

The equipment will enable ground-breaking energy related research through the new Wolfson Power Electronics and Power Systems (PEPS) Laboratory, which will be located within the College of Engineering's Engineering Manufacturing Centre (EMC) at the Bay Campus, which opens in September 2015.

The Wolfson PEPS Laboratory will primarily support the work of the University's Electronic Systems Design Centre (ESDC), a research group in Electrical and Electronics Engineering (EEE) in the College of Engineering, which is recognised internationally for its excellence in power electronics and nanoelectronics research.

The ESDC, led by Dr Petar Igic, has a significant track record in supporting industry through activity ranging from large research projects with leading multi-nationals to working on smaller projects with SMEs and the centre's major industrial sponsors include BT, Siemens, Plessey, GE Lighting, IBM,



"The area of power electronics and power systems is becoming immensely important globally as a vital part of energy research capable of delivering optimal energy production and distribution. The laboratory will facilitate ground-breaking research and will be instrumental in delivering research programmes in a critical area for Swansea."

Professor Richard Davies Vice Chancellor, Swansea University TSMC, Schlumberger, COGSYS, SILICONIX, Morganite, Newbridge Networks, Alstom, City Technology, BNR Europe, Philips, SWALEC, DERA, BTG, Toyota and Hitachi.

Research activities supported through the new Wolfson PEPS Laboratory will include power electronics devices and power integrated circuits development, including next generation electronic devices based on novel architectures, or new materials like Gallium Nitride (GaN).

www.swansea.ac.uk/esdc

## World's first 'intelligent' artificial lung a step closer

Swansea University's College of Engineering is now a step closer to developing 'intelligent' respiratory aids which mimic the performance of healthy lungs, allowing immobile patients with lung disease to enjoy a better quality of life, following Welsh Government funding.

The innovative project entitled 'Development of responsive control systems for an artificial lung', brought together Swansea University's College of Engineering with Swansea-based companies Haemair Ltd, Haemaflow Ltd, DTR Medical Ltd, and Staffordshire-based EGS Technologies Ltd.

This project builds on previous successful work which established the feasibility of an artificial lung and it addresses two problems which emerged from that research namely the need to better understand the dynamic response of natural lungs according to metabolic demand, and the need to understand the effect of residence-time distribution on blood clotting in respiratory aids. Both of these issues have been fundamentally addressed though the design of novel experimental work and the acquisition of a large database of empirical physiological data.

A spokesman for Haemair said, "The project has provided a much improved understanding of how the body controls respiration rate in response to mental and physical exercise; it has enabled us to refine a control system for our lung-assist device that responds in a way that mimics the body's own natural control systems. The research has generated a unique large-scale database of physiological data which will have great value for future developmental work. Equally importantly, we have gained a deeper understanding of the factors that determine the risks of blood clots arising in such respiratory aids".

As a result of this research, Haemair has developed an improved design of an Extracorporeal Membrane Oxygenation (ECMO) device, or artificial lung, with reduced risk of blood clots.

www.haemair.com

## Aberystwyth space scientists help discover Beagle 2 on Mars

scientists at Aberystwyth have played an important role in iscovery of the remains of the le 2 Mars Lander which was lost on Christmas Day 2003.

The UK-led Beagle 2 Mars Lander, which hitched a ride on the ESA Mars Express mission, has been found partially deployed on the surface of Mars. This find shows that the 'Entry, Descent and Landing' sequence for Beagle 2 worked and the craft successfully landed.

The team searching for Beagle 2 approached Dr Laurence Tyler and Dr Matt Gunn at the Institute of Mathematics, Physics and Computer Science

at Aberystwyth University to provide detailed 3D images of the area where it was believed to have landed. Using powerful computer software developed by the Space Robotics Group at Aberystwyth University, Dr Tyler was able to provide a terrain map of the area from images taken by the HiRISE camera on NASA's Mars Reconnaissance Orbiter. Commenting on the discovery of Beagle 2, Dr Tyler said, "The team searching for Beagle 2 were interested in knowing what the slopes of the terrain were like in that region of Mars. We were able to show them that the area where the lander was supposed to have landed was very flat."

Dr Tyler hopes to use the same technique to study the proposed landing sites for the European Space Agency's 2018 ExoMars rover mission.

Beagle 2 was led by Professor Colin Pillinger from the Open University and Aberystwyth University space scientist Professor Dave Barnes played a key role in the development of one of the mission's defining features, its robotic arm. Sadly, Professor Pillinger died in May 2014 and Professor Barnes in July 2014. Professor Barnes was researching autonomous science sample acquisition methods for the ExoMars mission, and was a Co-investigator for the mission's Panoramic Camera (PanCam) science instrument (Advances 70).

www.aber.ac.uk/en/university/institutes/impacs/

## Reducing animal testing through application of supercomputers

Moleculomics, a spin-out of Swansea University has recently been awarded prestigious funding from the NC3Rs through a CRACK-IT challenge to develop technologies to identify off-target Molecular Initiation Events (MIEs). The task involves linking these to associated Adverse Outcome Pathways (AOPs) through the application of software technology developed at the university.

This first of two possible project phases, will explore the potential for developing a computational version of routine laboratory screening of the toxicity of chemical compounds to humans which is typically limited to particular in vitro panels of enzymes and receptors, or whole system toxicity testing using animals. The developed technologies will provide toxicologists with a better understanding of the molecular interactions that lead to adverse reactions and toxicity.



"This is one of 3 technologies competing in the first Phase of the competition and if successful, will reduce animal use and add real scientific and business value to a broad range of sectors, including the pharmaceutical, chemical and consumer products industries."

**Dr Cathy Vickers** Programme Manager for NC3Rs

Dr Jonathan Mullins, Chairman of Moleculomics explains, "the conventional points of use of animals in toxicity screening are becoming increasingly difficult to justify in light of the enormous computational advances of recent

years. In any case, we know that chemicals found to be toxic in animals are not necessarily toxic in human (and vice versa) meaning the results of animal trials are not always useful. There is also the impact of natural polymorphic variation in human beings to be considered. We hope that utilising the supercomputing capacity offered by HPC Wales will provide genomescale molecular information to improve the efficiency of new compound research and development."

With sponsorship from both Unilever and Dow AgroSciences, this CRACK-IT challenge is the NC3Rs' response to the changing environment in the biosciences. The aim is to accelerate the availability of technologies which will deliver benefit to the "three Rs"; the Replacement, Reduction and Refinement of the use of animals in scientific procedures. An emphasis of the funding is that the resulting technologies will be made commercially available with a view to maximising both scientific and commercial benefits of new and emerging technologies.



www.moleculomics.com

## MedaPhor takes ScanTrainer to the cloud



#### Medical technology business MedaPhor has launched the latest version of its ultrasound training system ScanTrainer in what the company has called a major development milestone.

ScanTrainer v5.0 will now have the option of running on the cloud, allowing tutors to review trainee results online, automatically upload updates and receive detailed system usage summaries.

"This is a major development milestone for the company. The first systems in the UK are now running through the cloud, which offers the potential for our systems to provide regional, national and international, standardised and objective training and examination of ultrasound scanning skills. The ability of hospitals to share training cases, remotely assess trainees' scanning skills and open up trainee access to our learning resources remotely via a tablet will dramatically expand the usability of our system.

Stuart Gall Chief Executive, MedaPhor

This is the first phase of MedaPhor's cloud-based development programme and the company is now working on phase two, which will expand the system's cloud capability in 2015.

MedaPhor is a Cardiff University spin-out business and raised £4.7m in August after publicly listing on AIM (Alternative Investment Market) which is a sub-market of the London Stock Exchange.



www.medaphor.com

## 25 years in the field for Magstim

Carmarthenshire-based medical device manufacturer The Magstim Company Ltd is celebrating 25 years of business. The company produces a range of one the most widely used TMS (Transcranial Magnetic Stimulation) Stimulators in the world. These stimulators are used by neuroscience researchers to investigate the connectivity of the brain, with results which have implications for the diagnosis and treatment of Multiple Sclerosis, Central Motor Disorders, Motor Neurone Disease and Spinal Injury.

In addition to the research market, Magstim provides solutions for mental health professionals, utilising its innovative rTMS (Repetitive Transcranial Magnetic Stimulation) technology, for the treatment of drug resistant depression. The clinical traction of this technology has grown Internationally and Magstim are supplying the NHS with rTMS Therapy systems for depressed patients who have failed, or are unable to respond to traditional medication.

The company is also responsible for the Neurosign range of intra-operative monitors and accessories, which are routinely used by ENT (Ear, Nose and Throat) surgeons to protect vital facial nerves during complex surgery. Over the course of its 25 years in the Neuroscience industry, Magstim has been a pivotal tool in the advances of Transcranial Magnetic Stimulation for researchers across the globe. To this day, Magstim is cited in approximately 79% of TMS research papers.

Managing Director Robin Davies states, "Magstim has played a crucial role in supporting researchers and clinicians in neurostimulation and nerve monitoring for 25 years. Built on a commitment to innovate and adapt, the quality of Magstim's medical devices has positioned us as a world leader in our industry. In the coming 25 years, the role of Magstim will be to retain its position as a leader at the forefront of Neuroscience technology and continue to support the local economy in West Wales".

Magstim serves customers in over 50 countries and has grown to employ more than 100 staff from its manufacturing facilities in Whitland, West Wales. Increased investment in R&D and Engineering has seen the company expand into additional facilities within the area in line with new product development projects. Through funding support from Welsh Government, Magstim has ambitious plans to expand its premises in 2015, as the popularity of Transcranial Magnetic Stimulation increases worldwide. State of the art facilities will aid Magstim's objectives for growth internationally and provide innovative facilities for its skilled workforce.

) www.magstim.com



## Research collaboration for Cell Therapy

The Cell Therapy Catapult, which is focused on the development of the UK cell therapy industry to increase the nation's health and wealth, and TrakCel, a provider of supply chain integration management technology for cell therapies, have announced a research collaboration agreement to explore the utility of TrakCel's technology in missioncritical situations.

To test Trakcel's solution in a GMP (Good Manufacturing Practice)-compliant environment, over the next three years each company will provide resources, facilities and personnel to form a project team. The Cell Therapy Catapult will provide advisory feedback and product enhancement input throughout the duration of the project for the benefit of TrakCel's solution development in cell therapy planning, manufacturing, regulatory and clinical affairs. TrakCel technology improves cell therapy process success by proactively instructing professionals within the supply chain whilst providing real-time visibility to stakeholders. As well as reducing the implementation risks associated with paper-based systems the information collected by TrakCel technology enables greater insight into clinical trial data and provides a foundation for regulatory audits.

TrakCel will install a system at the Cell Therapy Catapult for the purpose of stress testing and

"TrakCel is striving to improve the success of cell therapy processes by introducing an innovative approach to cell tracking and control technology that overcomes limitations of the existing industry methodology. Through providing access to our experts and facilities, we're looking forward to jointly exploring its potential."

Keith Thompson CEO, Cell Therapy Catapult



analysis in a series of mission-critical situations including inbound/outbound logistics. The project will command a full cell process mapping exercise as well as training for Catapult analysts and experts. The Cell Therapy Catapult will publish its initial findings as to the applicability of the TrakCel solution in the autumn of 2015.

www.trakcel.com

## North Wales space firm that helped Rosetta land on a comet

After a 10-year journey through the Solar System, the Rosetta mission finally achieved its ambitious aim of landing the Philae probe on a comet and among those watching the landmark event were staff at Qioptiq, based in Bodelwyddan, who supplied the ultra-robust coverglass components on board (as featured in Advances 72 for their work with Glyndŵr University).

"We are one of the only facilities in the world producing this type of glass specifically for the space industry, supplying all of the West's satellites."

Craig Taylor Head of Communication Qioptiq Qioptiq CMG 100 Coverglass is as thin as a human hair yet so robust that it can be bent double without breaking. These coverglasses are used in their hundreds, to cover the photovoltaic cells, which provide the satellite with its power, and protect them from the harsh extremes of space. Rosetta relies solely on solar cells for power generation and its 14 metre long solar panels allow the craft to operate with only 4% of the sunlight levels on Earth.

Craig said, "Qioptiq has a long history with these satellites and a heritage that goes back to the early days of space exploration. We have been supplying the space industry for well over four decades and continue to be world leaders, supplying ultra-thin coated coverglass which protects the solar cells in the harsh environment of space and OSRs (Optical Solar Reflectors) for the thermal management of space craft for a myriad of programs. Our unique expertise is recognised by industry and academia alike as we supply the vast majority of satellite programs with our highly specialised products." Over the years Qioptiq products have been used on a substantial number of major satellite programs including Huygens - designed to explore the surface of Saturn's moon Titan and Orion – for crewed missions to the Moon, asteroids, and Mars.



www.qioptiq.com

## Research shows barrel jellyfish aren't just drifters

**Researchers at Swansea University** have found that free-ranging barreljellyfish have a remarkable ability to detect the direction of ocean currents and to swim strongly against them.

"Detecting ocean currents without fixed visual reference points is thought to be close to impossible and is not seen, for example, in lots of migrating vertebrates including birds and turtles," said Swansea University Biosciences Professor Graeme Hays who is currently with Deakin University in Australia.

Professor Hays along with his Swansea University colleague Dr Sabrina Fossette tracked the movements of the jellyfish with GPS loggers

"Jellyfish are not just bags of jelly drifting passively in the oceans, they are incredibly advanced in their orientation abilities."

**Prof Graeme Hays Department of Biosciences** Swansea University

(as featured in Advances 69) and used GPStracked floats to record the current flows. They also directly observed the swimming direction of large numbers of jellyfish at the surface of the ocean.

Published in the Cell Press journal Current Biology, this data shows that jellyfish can actively swim at counter-current in response to drift and their model of the jellyfishes' behaviour and ocean currents helps to explain how jellyfish are able to form blooms including hundreds to millions of individuals for periods up to several months.

While jellyfish do play an important role in ocean ecosystems as prey for leatherback sea turtles and other animals, Hays noted, they can also clog fishing nets and sting beachgoers and so understanding the distribution of jellyfish in the open ocean may be practically useful for predicting and avoiding troublesome jellyfish blooms.

"Now that we have shown this remarkable behaviour by one species, we need to see how broadly it applies to other species of jellyfish," Hays said. "This will allow improved management of jellyfish blooms."



www.swansea.ac.uk/biosci/

## Welsh robotic orchestra performs at The Royal Institution

A 'robotic orchestra' built by staff at Aberystwyth University's Department of Computer Science was invited to take part in the Royal Institution **Christmas Lectures which were** started by Michael Faraday in 1825.

Featured in the finale of the Christmas Lectures, Aberystwyth's robotic orchestra consists of three instruments: a pipe organ which includes scrap components from a vacuum cleaner and various plumbing components; a child's glockenspiel modified to be played automatically and an electronic keyboard.

The pipe organ and the glockenspiel joined a host of other robotic instruments and four human musicians for the performance and Dave Price, Teaching Fellow and Computer Officer at the Department of Computer Science, spent three days at the Royal Institution working on the production and coaxing the best from his robotic creation.

"Our robotic instruments worked beautifully and didn't miss a beat during the rehearsals. It has been a real pleasure to take part in the production of the Christmas Lectures and to work for a few days at the Royal Institution which is steeped in scientific history; this should be a real highlight of the festive season."

**Dave Price Department of Computer Science** Aberystwyth University

The human and robotic orchestra in the Christmas Lecture 'A new revolution' was made possible thanks to a fantastic collaboration of robotics and engineering experts and musicians from all over the UK and even Spain.

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



Nu Instruments Ltd in Wrexham has made more than £500,000 of equipment available to Glyndŵr University in a bid to forge closer links with the institution's engineering and forensic departments

The company is one of only two organisations in the world designing and constructing high performance inorganic magnetic sector mass spectrometers and accessories which are installed and used in universities, industry and research laboratories across the globe.

Its CEO, Alan McCall, is a Glyndŵr alumnus who returned to North Wales and Nu Instruments in 2010, to embark on an ambitious expansion plan. Under his leadership the company soared to almost £20million revenue in 2014 and is poised for further growth in 2015, which is why Alan wants Glyndŵr University to capitalise on this opportunity and give its students a head start on other graduates when the time comes to enter the work arena.

He said, "I want to see the next generation of engineers and scientists come out of Glyndŵr with the skills, knowledge and competence to do great things, whatever industry they find themselves in. I'm sure that the university will utilise what we have here and it will be of major value to their students and degree programmes as the relationship develops."



"Advanced mass spectrometers at Nu Instruments are wonderful tools in the isotopic analysis for materials chemistry and forensic science. We are so delighted to be able to access the machines and collaborate with the researchers from the company."

Dr Jixin Yang, Senior Lecturer Chemistry/Analytical Chemistry, Glyndŵr University



## N BRIEF

#### Q Chip acquired by Midatech Pharma

Q Chip, a pharmaceutical company which specialises in the development of cancer therapy and opthalamology products has been acquired by a Europe-wide nanomedicine business.

Oxford-based Midatech Pharma announced the completion of the acquisition of Q Chip, based in Cardiff, following its admission to trading on AIM.

Midatech said it has acquired Q Chip to support "novel delivery platforms and product developments in cancer, diabetes and ophthalmology."

Q Chip has developed a complementary technology and products that allow the sustained release of substances over extended periods of time and will provide a platform to incorporate Midatech's gold nanoparticle (GNP) compounds for sustained and extended release.

#### Green light for Aberystwyth

Welsh Government's Finance and Government Business Minister, Jane Hutt, has announced that Aberystwyth University will be the first multi-million pound project to receive the green light through the new £2 billion EU funding programmes 2014-2020.

The project at the Gogerddan Campus, with an estimated value of more than £35m, will see the construction of a new state-of-the-art, internationally recognised facility to attract further research funding so that companies and researchers can undertake collaborative research projects to boost the bio-economy. These will generate innovative new products, services and spin-out companies in sustainable food, health, biotechnology and renewable energy sectors.

#### Stateside investment for Chromogenex

Carmarthenshire-based Chromogenex Holdings has raised money from a US medical technology investor to execute the next stage in its growth plan.

The Llanelli developer and manufacturer of laser and intense pulse light systems received the funding from Squadron Capital, a US investment vehicle headquartered in Connecticut and funded by a Chicago-based trust. Gambit Corporate Finance advised Chromogenex Holdings and in partnership with US firm P&M Corporate Finance, originated the transaction and sourced Squadron Capital.

## University project shortlisted for prestigious award

A Swansea University project based at Baglan has been shortlisted for a prestigious award that celebrates the best of British engineering.

The College of Engineering's Materials Education Training and Learning Project (METaL) has been shortlisted in the Semta Skills Award Training Partner of the Year category for its work with Tata Steel.

Project Manager David Warren said, "I am delighted to have been shortlisted as a finalist in this year's awards. Its great recognition for all the hard work put in by the team and also the delegates attending the training."

## Swansea University's Centre for NanoHealth supports Welsh packaging company

Swansea University academics Dr Chris Wright and Dr Nafiseh Badiei from the Centre for NanoHealth have been working with Welshpoolbased WIPAK Ltd to review its newly developed antimicrobial medical packaging.

WIPAK UK is a packaging company predominantly operating within the food sector. However a proportion of its business also focuses on the medical sector with a number of products providing safe and reliable sterile barrier systems for medical devices, pharmaceutical solutions and other healthcare products. The company is looking to expand its medical product range and has developed a new range of antimicrobial treated films, papers and pouches for the medical sector. The Centre for NanoHealth (CNH) has been working with WIPAK to review these products' antimicrobial substrate packaging capabilities. The CNH review involved a series of activities which included the identification and analysis of bacteria species most commonly present in packaging associated with home and hospital – examining the kinds of bacteria found on package services, storage and handling of products, the process of bacterial colonisation of sterile packages from package to hand and air to package etc.

Dr Wright presented the findings from the review at the recent international medical packaging conference hosted by WIPAK held at the Williams Martini Formula 1 Grand Prix Collection and factory, near Oxford. "Every day we are hearing of the increase in hospital acquired infections and the threat of antimicrobial resistant bacteria. Medical packaging is the first line of defence against bacterial contamination of medical devices such as catheters, implants and wound dressings, which can lead to severe problems for the treatment of patients. Thus, our review was extremely timely and seeks to examine the arguments for and against the use of antimicrobials in medical packaging."

Dr Chris Wright Centre for NanoHealth Swansea University



## Biotec Services International completes its rebrand into PCI Group

PCI has announced that further to the acquisition of Biotec Services International, the company has rebranded as part of the PCI group.

This rebrand brings together the expertise of two world class organisations and significantly expands PCI's capability to deliver an integrated pharmaceutical service for global studies of investigational medicinal products.

Dr Fiona Withey, Managing Director, UK Clinical Services, stated, "We are very excited about the investments PCI has undertaken of late, the acquisition of Biotec and Penn Pharma along with the construction of a new North American Storage, Distribution and Returns Management site, increases the breadth of the PCI service offering and provides our clients significant opportunity to engage with a truly global pharmaceutical services organsation."

## Moneypenny launches in the US

Having revolutionised the face of telephone answering and outsourced switchboards in the UK, Moneypenny, based in Wrexham, North Wales (as featured in Advances 72) has opened for business in the US with a new base in Charleston, South Carolina.

The company, founded by brother and sister Ed Reeves and Rachel Clacher in 2000 has gone from a £10,000 start-up to the biggest business of its kind in the world. Moneypenny answers more than 9 million telephone calls a year for over 7,000 businesses, either on an overflow or fully outsourced basis.

## Green technology creates 30 jobs for Gwent packaging company

A €6.4m investment by Klöckner Pentaplast to increase capacity and introduce new green technology into its manufacturing process in South Wales has created 30 new jobs in the past 12 months with Welsh Government support.

The investment has seen a new state-of-the-art extrusion line installed for the production of polyester films, primarily used in food and consumer packaging applications. Now in full production, this line introduces new clean, greener technology with lower energy consumption and is capable of using a higher quantity of recycled materials to meet the growing demand from customers in the UK and Ireland.

#### Swansea University experts' important work published in esteemed journal

Four academics from The Centre for Water Advanced Technologies and Environmental Research (CWATER) at Swansea University have had four 'state of the art reviews' published in a special issue of the international journal Desalination.

With pressure increasing on our limited water resources and more people requiring clean water, effective solutions need to come from reusing water in the most efficient way. CWATER benefits from world-leading expertise in the areas of desalination and membrane technologies for water treatment and Professor Nidal Hilal, Dr Darren Oatley-Radcliffe, Dr Daniel Johnson and Dr Victor Kochkodan of Swansea University have investigated using membranes as filtration devices.

# Key piece to cancer cell survival puzzle found

#### Collaboration brings about discovery of vital role for gene

team of researchers from Cardiff University, South Wales have identified a special gene which human cells require in order to survive chromosomal defects.

Scientists have long known that chromosomal defects occur as cells repeatedly divide and that over time, these defects are linked to the onset of cancer.

#### "

"We have found a gene that appears to be crucial for the evolutionary processes that can drive cancer. This is a new role for this gene, making it a potential therapeutic target."

Professor Baird Institute of Cancer and Genetics Cardiff University

As cells in the body divide their telomeres — the DNA "caps" which protect the ends of chromosomes from damage — shorten, leaving the chromosomes vulnerable to sticking to each other. In normal cells, this chromosome stickiness is a death knell — a signal to trigger the defective-cell clean-up process to move in and help finish them off. Malignant cells, however, are somehow able to evade this clean-up process.

This current research, published in the journal Cell Reports, identifies an essential component which allows the older cells to evade death. By using sophisticated genetargeting techniques, to disable particular genes in human cells and then studying the impact on telomere fusion, the researchers found that the cells escaped death only when the gene Ligase 3 was active but not when its action, which appears to promote fusion within like chromosomes rather than between different chromosomes, was blocked.

"Telomere dysfunction has been identified in many human cancers, and as we have shown previously, short telomeres can predict the outcome of patients with the condition (chronic lymphocytic leukaemia) and probably many other tumour types," stated Professor Baird.

"Thus, the discovery that Ligase 3 is required for this process is fundamentally important," he added.

This research was made possible by a chance meeting between Cardiff's Professor Baird and Professor Eric Hendrickson from the University of Minnesota at an international conference as once the pair discovered that they were both looking at the role of Ligase 3 in cancer, they decided to collaborate. "The collaboration paid off as we were able to uncover something that neither one of us could have done on our own," Professor Hendrickson said.

Additional studies are already underway and in particular, the reliance on Ligase 3 appears, in turn, to be dependent upon the activity of another key DNA repair gene, p53. "Since p53 is the most commonly mutated gene in human cancer, it now behoves us to discover how these two genes are interacting and to see if we can't use that information to develop synergistic treatment modalities," added Professor Hendrickson.

Professor Baird and colleagues from the Cardiff School of Medicine are in the process of commercialising their telomere testing technology, to provide high resolution prognostic information for cancer patients, healthcare providers and the pharmaceutical industry.



#### Profile

**Product** Cell construction

Applications Chronic illness prediction

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## Hunger hormone helps memory

Research finds 'hunger hormone' may help combat cognitive decline

Ν

ew research, co-led by Dr Jeff Davies of Swansea University's College of Medicine, in South Wales, and Dr Lisa Saksida of the University of Cambridge, shows that a hunger hormone, generated in the stomach, promotes stem cells to form new neurones in the learning centre of the brain. These new cells are involved with promoting a specific form of memory which is impaired in ageing and neurodegenerative disease. the hormone could trigger brain stem cells (cells that have the ability to become any cell type) to turn into nerve cells and whether it also affected memory function.

Their findings showed that daily injections of ghrelin triggered stem cells to form new nerve cells in the learning centre of the adult brain – the hippocampus. These new nerve cells became involved with controlling the specific form of memory which is impaired in ageing and neurodegenerative disease. Through the testing, they showed that those which had been treated with this hormone had significant improvements in this 'pattern-separation' memory.

In short, this hormone may prove useful to combat both agerelated cognitive decline and dementia which are predicted to increase significantly in the coming years. Current drugs are lacking and recent attempts to develop new therapies for Alzheimer's disease have stalled. Therefore, it has become vitally important to look at new ways to tackle the disease. This most recent finding is particularly interesting as it suggests that finding ways to increase ghrelin in the blood, rather than in the brain, may have a therapeutic benefit. Dr Davies added that, "From a drug-discovery perspective, identifying a valid peripheral target to combat a brain disorder would have significant benefits for the development of new drugs."

The researchers will now test whether the hormone is protective in pre-clinical models of Alzheimer's and Parkinson's disease and they are also analysing the levels of ghrelin in the blood of people suffering from mild cognitive impairment and dementia.

## "

Our data show that systemic injections of physiological levels of ghrelin can produce long-lasting improvements in spatial memory that persist following the end of treatment. As ghrelin is potentially involved in regulating the relationship between metabolic and cognitive dysfunction in ageing and neurodegenerative disease, throwing light on the underlying mechanisms of this holds promise for identifying novel therapies and lifestyle factors that may have beneficial effects on the brain."

Dr Jeff Davies College of Medicine Swansea University

The research – 'The orexigenic hormone acyl-ghrelin increases adult hippocampal neurogenesis and enhances pattern separation'– is published in the journal Psychoneuroendocrinology, the Official Journal of the International Society of Psychoneuroendocrinology.

To view the paper visit http://www. psyneuen-journal.com/article/S0306-4530(14)00399-0/abstract.

#### Profile

Product Ghrelin Applications Treating memory-related disease Contact Dr Jeffrey Davies Associate Professor College of Medicine Swansea University Singleton Park Swansea SA2 8PP. UK T: +44 (0)1792 602209 E: jeff.s.davies@swansea.ac.uk W: www.swansea.ac.uk/medicine/

The stomach hormone, ghrelin, was identified in 1999 as an important factor released from an empty stomach to trigger hunger. As mild calorie restriction has a beneficial effect on brain function, including improving memory and reducing the incidence of brain disease such as dementia, the researchers questioned whether this hunger hormone may be responsible for some of these beneficial effects. They tested whether administering

## Taking the bite out of venom

New understanding of venom could open door to more effective antivenoms

ew research from Bangor University, in North Wales, which disproves the theory that venom evolved just once in reptiles could also lead to new medical treatments to counteract snakebite.

The "Toxicofera hypothesis", which proposed that venom evolved and that the majority of reptile species alive today descended from a common venomous ancestor was first put forward nearly a decade ago. At the time this was a radical proposition, as traditionally venom was believed to have multiple origins, but the Toxicofera hypothesis became widely accepted and had never actually been tested, until now.

Researchers in the School of Biological Sciences at Bangor University used cuttingedge DNA sequencing technology to study gene expression in the venom and the salivary glands, as well as several other body tissues, from a range of venomous and non-venomous reptiles in order to test the robustness of this Toxicofera hypothesis.

The research of Bangor PhD student Adam Hargreaves and his supervisor Dr John Mulley, together with colleagues at the Wellcome Trust Sanger Institute and the Institute of Biological, Environmental and Rural Sciences at Aberystwyth University, found that the Toxicofera hypothesis is not supported by this new data, prompting a return to the traditional hypothesis that venom evolved at least twice in reptiles.

"We are very interested in the evolution of venom, which everyone thought had evolved only a single time early on in reptile evolution", explains Adam Hargreaves. "However, when we started looking at the data, we found no evidence to back this up. Instead it looks like many genes used in support of the Toxicofera hypothesis are normal maintenance or "housekeeping" genes, and not toxins. Taking that into account, the inevitable conclusion is that venom has evolved more than once in reptiles, and that previous studies were overreaching in their claims." This discovery has profound implications for how the evolution of venom is understood, and also for the design of new medical treatments to counteract snakebite. Dr John Mulley explains, "Ruling out so many of the proposed toxins as actual components of venom means that snake venom is far simpler than was previously suggested, with the majority of venom complexity limited to just a few gene families. It seems likely therefore that we can develop more effective antivenom treatments which focus on combatting the effects of just these families."

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Fundamentally, this new research demonstrates the power of advanced DNA sequencing technologies to shed new light on old questions, and in this case to overturn well established hypotheses regarding the evolution of venom in reptiles.

The research was supported by the Royal Society, the Wellcome Trust and the Biosciences, Environment and Agriculture Alliance between Bangor and Aberystwyth universities, with analyses carried out using High Performance Computing (HPC) Wales infrastructure.

#### Profile

Product Science of venom Applications Development of antivenoms

#### Contact

Dr John Mulley Research Lecturer School of Biological Sciences Bangor University, Deiniol Road Bangor, Gwynedd LL57 2UW. UK T: +44 (0)1248 383492 E: j.mulley@bangor.ac.uk W: www.bangor.ac.uk/biology/

# For more information please circle **7505** on the reader reply card

## Your cell is marked

New method to 'barcode' human cells will help identify and track cancer cells



#### esearchers at Swansea University's Centre for NanoHealth in the College of Engineering have led an international collaboration to develop a new method to 'barcode' individual human cells. This method can be used to identify and track rare cell types, such as cancer cells, in large populations.

Working in collaboration with colleagues from the Broad Institute of MIT and Harvard (Cambridge, Massachusetts, USA), the Institute for Materials Research at Leeds University, and GE Healthcare, The Maynard Centre, Cardiff, the team found one of the key advantages of their method is that the cells 'choose' their own barcode depending on their physical state and therefore cancer cell barcodes appear different from healthy cells when examined through high-throughput microscope imaging.



The team have demonstrated this unique method of labelling cells by colour-coding and generating a large number of unique digital codes, which enables them to immediately see a cell's identity and allows for the tracking of single human cells.

The new method works because cells absorb nanoparticles as they take up nutrients from any surrounding fluid and then encapsulate them in a protective membrane, which means they do not appear to alter the cells' behaviour.

By introducing three different colours of nanoparticle to the cell population the colour pattern generated is unique enough to act as a barcode allowing



"Uniquely identifying and tracking individual cells within a population is incredibly powerful. Cell-tracking software is notoriously error-prone and yet tracking cells by eye in long movies is incredibly tedious. The approach developed here allows the cells to physically carry a barcode as they move around, making the tracking problem much more feasible. It takes a lot of pressure off image analysts and enables long-term examination of cancer cell populations."

Dr Anne Carpenter Director, Imaging Platform The Broad Institute

researchers to distinguish each individual cell in a large population. Also as the number of nanoparticles in the cell does not change, the same cell can be identified after much longer time periods than has previously been possible.

The team's paper, entitled Nanoparticle Vesicle Encoding for Imaging and Tracking Cell Populations, is published in the leading life sciences journal Nature Methods.

As the number of nanoparticles that a cell takes up is dependent on the cell state this method allows the identification of mutated cells in a large population because the barcode of these cells will have a different pattern than healthy cells.

This is a significant step in the development of tools to study the evolution of large cell populations. Looking ahead, this method will allow researchers to observe the progression of individual cells to a cancerous state or to study the evolution of stem cells into the mature cells that make up the human body.

#### Profile

Product Method of coding cells Applications Tracking rare cell types

Contact Professor Paul Rees College of Engineering Swansea University Singleton Park Swansea SA2 8PP. UK T: +44 (0)1970 823200 E: P.Rees@swansea.ac.uk W: www.swansea.ac.uk/engineering/



#### MEDICINE

## **Rolling out safer material**

New development set to cut factory fire risk

Cwmbran-based manufacturing company has created a new material which could make the packaging and print industry markedly safer.

Supported by Welsh Government, KV Rollers has developed Kalexite; a roller covering with superior anti-static properties, which is believed to slash the risk of factory fires by reducing the risk of sparking and ignition, while boosting productivity for its users.

With print, paper and packaging rollers operating at increasingly high speeds, possibly in contact with static generating substrates, the risk of VOC (Volatile Organic Compounds) ignition due to sparking, and of subsequent factory fires in the industry sector, has become significantly increased.

Kalexite's anti-static properties reduce this risk of sparking and subsequent ignition and in developing the product, technologists used a recently introduced grade of base-polymer to produce a formulation matching the Eltex GNN75 requirement for printing efficiency which measures resistance of a material to penetration of a spring loaded needle-like indenter and connectivity. Achieving these targets took 44 formulatory evolutions and attaining the required electrical specification within the framework of a manufacturing-friendly, financially viable product proved to be challenging. This was due to the fact that the maximum possible electrical conductivity of the base polymer was required and so blending with any quantities of non-conductive additives was unacceptable.

Traditionally, High-hardness implies higher filler and curative loadings as well as an associated increase in material sg (specific gravity). These factors would work to diminish a polymer compound's electrical viability whilst also acting to increase the overall weight of the final product. Added to these conventional concerns, the Kalexite material needed to be unusually resilient, as it would be expected to perform faultlessly in both mechanically and chemically arduous environments.

Navigating these, and other design obstacles, in search of an optimum product solution proved a worthy challenge for the company asthe resulting material has the potential for a multitude of uses within a wide range of printing, mechanical handling, and film packaging-based applications and is considered to be the next generation of multipurpose, multifunctional, future-ready rubber compounds.

The material is an exemplary example of KV Rollers' ability to reverse engineer and create precisely formulated matches for technically advanced applications and the Kalexite-based roll coatings have already been adopted by industry giants such as 3M. KV Rollers' Director Kevin Lower said the material, which was the result of hundreds of man hours in the lab and in production, has "the potential to revolutionise the print and packaging industries."

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"As well as being a potential boon to safety Kalexite is proving its worth as far as performance quality and longevity too, which has an impact upon manufacturing costs and, importantly, upon profit margins. We believe this product will, in time, become the standard and dominant solution for many demanding applications."

Kevin Lower Director, KV Rollers

#### Profile

Product Anti-static material Applications For packaging and print Contact Andrew Glanville Director and Polymer Technologist **KV Rollers** Unit 1-3 Claenwern Avondale Ind Est Cwmbran NP44 1TY. UK T: +44 (0)1633 871919 E: a.glanville@kvrollers.com W: www.kvrollers.com



## **Platform for success**

New in silico platform for antimicrobial development to meet the UK's defence and security needs

oleculomics, based in Swansea, in South Wales, has collaborated with the Defence Science and Technology Laboratory (Dstl) to produce an innovative new platform to assist in the development of novel antimicrobials.

This collaboration has led to the computational prediction of structures of entire bacterial genomes and the identification of homologous antimicrobial targets across a number of different organisms. The resulting computational platform, the first of its kind in the world, facilitates faster and more reliable antimicrobial development programmes.

The technology is based upon the ability of Moleculomics to accurately predict the 3D structure of the proteins of multiple bacterial genomes, including variant proteins (also known as resistance mutations). The resulting protein models are then applied to a High Throughput Screening process whereby each and every protein is screened against a set of 25,000 chemical compounds (which could be later developed into drugs) to assess the binding affinity between the protein and the drug.

This process was assisted by 1024 compute cores of HPC Wales, allowing for over 3 million affinity dockings with specific sets of biologically important and structurally notable proteins to be undertaken in a matter of weeks. Developed with input from Dstl, the resulting technology platform facilitates the addressing of questions driven by the scientific interests of the end users themselves. A significant capacity of this new technology is the ability to identify targets across a range of bacterial organisms for the potential development of broad spectrum antibacterials, as well as to identify common structural sites encoded by different genes in the same organism which will reduce the prospects of future antimicrobial resistance.

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"The application of this novel tool advances the field of drug development through improved knowledge of protein-ligand interactions at enormous scale"

Dr Richard Saint Technical Partner, Dstl

The project was originally funded by the Centre for Defence Enterprise (CDE - www. gov.uk/dstl/cde) to facilitate the early stages of antimicrobial drug development and Dr Jonathan Mullins, Chairman of Moleculomics commented, "We are very fortunate to have secured this type of funding and to collaborate closely with exceptionally good and clear thinking scientists at Dstl."

Moleculomics are currently translating the project's core technology into a series of products aimed at both the pharma and bio-pharma markets. Dr Will Krawszik, Head of Operations at Moleculomics explained, "We are currently developing tools which will enable protein-ligand molecular interactions to be better understood for applications in both lead discovery and toxicity studies to assist the drug development process with higher quality targets whilst simultaneously identifying and eliminating problem compounds earlier in the R&D cycle." It is expected that these tools will be available in the summer of 2015.

#### Profile

Product In silico platform Applications Antimicrobial development Contact Dr Will Krawszik Moleculomics Institute of Life Science Swansea University Singleton Swansea SA2 8PP.UK T: +44(0)1792 606761 E: will@moleculomics.com

## **Targeting the tsetse**

New visual baits may help in the fight against sleeping sickness

esearch carried out by a scientist from Aberystwyth University, in Mid Wales, will help fine-tune visual baits for the more effective trapping of tsetse flies, and the control of the tropical disease which they spread.

Tsetse flies transmit human African trypanosomiasis or 'Sleeping Sickness' in sub-Saharan Africa. This potentially fatal disease is spread by the bite of an infected tsetse fly, eventually causing the victim to suffer a parasitic infection of the brain and the meninges (the covering of the brain and spinal cord).

Currently, the treatment of the disease is difficult, and there are no vaccines or prophylactic drugs which work against sleeping sickness. Therefore controlling the tsetse flies that spread it is considered the best approach. Coloured baits and traps are used to kill or catch these flies, and are one of the





most effective ways of controlling the spread of the disease however, further optimising these devices is crucial in the fight against sleeping sickness.

Dr Roger Santer is a scientist and lecturer in Zoology at the Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University, and he has taken a novel approach to understanding how the tsetse flies see coloured visual baits, and why they are attracted to different colours.

Previous studies have tried to determine the best colour for visual baits by relating their light reflectance properties to their attractiveness to tsetse. However, as Dr Santer explains, "the key to optimising these visual baits may be to look at them through the eyes of a tsetse fly." The eyes of flies and

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"By understanding the mechanism that causes tsetse flies to be attracted to visual baits, we can select colours for visual baits that most strongly activate that mechanism. By doing that, we should be able to catch more tsetse and better control the spread of sleeping sickness."

Dr Roger Santer the Institute of Biological, Environmental and Rural Sciences (IBERS) Aberystwyth University

humans have different types and numbers of photoreceptors (sensory cells which respond to different wavelengths of light reflected from an object like a visual bait), and this means that they do not perceive colours in the same way.

Published findings, in the journal PLOS Neglected Tropical Diseases

PHOTO CREDIT: GEOFFREY M. ATTARDO, RESEARCH SCIENTIST AT THE YALE SCHOOL OF PUBLIC HEALTH

A fly's eye contains five different types of photoreceptor which each respond most strongly to a different wavelength of light. Colour perceptions are based upon the relative responses of these photoreceptors. Humans, meanwhile, perceive colour based upon the responses of only three different kinds of photoreceptor.

The novelty in Dr Santer's work was that he calculated the excitation of each fly photoreceptor type by the visual baits used to catch tsetse flies in three previous field studies. Effectively, he worked out the fly's eve view of these visual baits and he then used these calculated photoreceptor excitations to work out what attracted tsetse flies to visual baits. He found that tsetse fly attraction could be explained by a simple mechanism in the fly's nervous system that compares the relative excitations of three different photoreceptor types.

#### Profile

Product Coloured bait Applications Control of tsetse flies and other insects Contact Dr Roger Santer Lecturer in Zoology Institute of Biological, Environmental & Rural Sciences (IBERS) 1.16 New IBERS Building Penglais Campus, Aberystwyth Ceredigion SY23 3FG. UK T: +44 (0)1970 628776 E: rds5@aber.ac.uk W: www.aber.ac.uk/en/ibers/

## Can an embryo learn?

#### Learning shown to be possible even during this very early developmental stage

esearchers at Aberystwyth University, in Mid Wales, have shown that when snails are exposed to the smell of a predator as an embryo they are better able to avoid predatory fish once they hatch.

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These findings have shown that pond snails are able to sense chemicals released by their predators whilst they are still embryos in the egg and then alter their behaviour accordingly. This 'pre-programmed' response proves extremely important for snails to be able to survive just after hatching when they are very small and at their most vulnerable. Pond snails are central to freshwater environments, helping to control the growth of plants which can clog up our rivers and they are also under threat from invasive predators including the killer shrimp and signal crayfish. Understanding how these snails are able to learn about predators at different life stages, from embryo to adult, gives a good indication about how capable they may be of surviving under these increasingly risky conditions.

In order to get an idea of how snails respond to predators, the team at Aberystwyth looked at how pond snails, Lymnaea stagnalis, responded to the smell from a predatory fish, tench.

The snails were exposed to the smell of this predator throughout their embryonic development in egg capsules and once they hatched out, they were kept in a predatorfree environment for a week, and then tested for how they respond to the predator smell. Those snails which had been exposed to the predator smell as embryos strongly responded to the smell when they re-encountered it as juveniles, reacting by crawling out of the water to escape the potential predator.

Dr Sarah Dalesman, Leverhulme Trust Early Career Fellow at Aberystwyth University, said, "We were quite surprised at how well the snails were able to learn during this very early phase of development."

The ability to respond to potential predators while still in the egg may be extremely important in allowing the young vulnerable snails to survive and Dr Dalesman added, "We also found embryos exposed to the predator smell hatched out at a smaller size than those kept in predator-free conditions." This discovery mirrors the effects of stress on development in mammals, including humans, where foetuses of stressed mothers are often smaller at birth than their non-stressed counterparts.

Teams from the University of Exeter and University of Plymouth were also involved in the research and Dr Simon Rundle (University of Plymouth) stated that, "One of the most important findings in this study was that there appeared to be a genetic component to the snails' behaviour, with those animals whose grandparents had experienced fish predators in the wild showing the biggest response."

#### Profile

Product Embryo research Applications Pre-programmed response Contact Dr Sarah Dalesman Lecturer in Freshwater Biology Institute of Biological, Environmental & Rural Sciences (IBERS) Room 0.18, New IBERS Building Penglais Campus, Aberystwyth Ceredigion SY23 3FL, UK T: +44 (0)1970 622344 E: sad31@aber.ac.uk W: www.aber.ac.uk/en/ibers/



This research work was funded by a Leverhulme Trust Early Career Fellowship (Dr. Dalesman) and an undergraduate student scholarship from the Association for the Study of Animal Behaviour (Angharad Thomas). The findings are published online in the journal Freshwater Biology.

## "And breathe"

advances

#### The diagnostic tool which anyone can use, anywhere

mspex Diagnostics based in Abercynon, South Wales, has designed an innovative diagnostic tool with multiple uses across different industries.

This tool uses a combination of gas chromatography (GC) and ion mobility spectrometry (IMS) to detect contaminants in the gases produced from waste products in order to analyse the sample effectively. When combined with gas chromatography, IMS has a number of technical and operational advantages over the standard techniques of GC-MS (mass spectrometry) and one of these is



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Gas chromatography (GC) is a common type of chromatography used in analytical chemistry for separating and analysing compounds that can be vaporised without decomposition.

Ion-mobility spectrometry (IMS) is an analytical technique used to separate and identify ionised molecules in the gas phase based on their mobility in a carrier buffer gas. that IMS uses air or nitrogen as a carrier gas instead of helium which is rare and very expensive. Furthermore, the IMS system is much smaller and much less costly than that of GC-MS, as well as being highly sensitive, which means that it can detect volatile organic compounds down to concentrations of a few parts per billion.

One of the variations of this tool is Breathspecdeveloped in-house this is a clinically applicable breath analyser which has the ability to classify disease states in patients and has specifically

been designed for the analysis of VOC (volatile organic compounds) metabolic profiles in human breath. Sample preparation with this tool is very easy, and in the case of taking breath samples using the BreathSpec no actual preparation is required at all - the user simply breathes into a disposable mouthpiece and in less than ten minutes the machine will have automatically analysed the breath sample using GC-IMS. One of the BreathSpec's unique features is that its operation does not require the skills of specialist laboratory staff and, in addition, its portability means that it has the capability of analysing either direct or intubated exhaled breath at the point of care; this is proving particularly useful in the early detection of lung cancer. The instrument will be used for clinical applications where non-invasive patient screening valuably aids the clinician decision making process by both determining different treatments and monitoring the various paths and outcomes.

With support from Welsh Government and Finance Wales, Imspex has been able to develop different varieties of this diagnostic tool. FlavourSpec is a gas analyser which is typically used in food markets for flavour testing, beer brewing, the detection of waste products and artificial odours in natural gas, perfumes and flavouring as well as other applications. The tool is also used as an analyser for the GC-IMS detection of contaminants in the gas produced from waste processes such as

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"Providing reliable screening and early detection for a number of health conditions, the BreathSpec could greatly improve the outcomes to hundreds of thousands of patients in the UK and save billions of pounds to the health service."

Santiago Dominguez Chairman and CEO Imspex Diagnostics

for the presence of siloxanes which cause severe damage to mechanisms such as engines and turbines.

#### Profile

**Product** Diagnostic tool **Applications** Breath analyser

Contact Santiago Dominguez Chairman and CEO Imspex Diagnostics Ltd Tŷ Menter, Navigation Park Abercynon Rhondda Cynon Taf CF45 4SN. UK T: +44 (0)1443 740217 E: santi@imspex.com W: www.imspex.com

## The tomato that will fight blight

#### Commercially available blight-resistant tomato

light-resistant tomatoes which will grow outside have been developed by Bangor University in North Wales as part of a collaborative project.

Blight is a fungus-like organism which can affect tomato and potato plants and thrives in warm wet weather. The wet summers of recent years have seen all attempts to grow tasty tomatoes outdoors in the UK decimated and with the spores being carried on the wind, tomato blight can spread for many miles. The infected plants begin to rot, starting with the leaves and stems and then spreading into the fruits. The disease can be treated by chemicals but these are not available to the amateur gardener to use and although some blight resistant tomatoes are already available, until now none have been able to fight off all strains of the disease.

Bangor University has been working with the Sárvári Research Trust and experienced tomato breeder, Simon Crawford and his company, Burpee Europe to develop the new hardy variety under a Knowledge Economy Skills Scholarships (KESS) Programme.

The research involved identifying the exact genes responsible for making the tomato plants blight resistant and then making crosses to transfer them using non-GM selection methods. The Ph-2 and *Ph-3* genes, which originate from wild tomato plants, confer resistance to the pathogen Phytophthora infestans, better known as blight, so the strains of the disease that each of the genes confer resistance to do not have an effect on the plant. Identifying and selecting the molecular markers responsible for the traits sought has speeded up the selection and development of the new plant, to

produce a commercially viable new variety of hardy tomato which produces good quality fruit but has natural resistance to blight.

The successful results have led to the creation of this new tomato, Crimson Crush, which is available now. As well as being able to survive even the worst attack of blight, Crimson Crush is claimed to produce exceptionally fine tasting, large round tomatoes- each weighing up to 200g.

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"Outdoor grown tomatoes, when you can grow them, are delicious and tasty as they've grown in direct sunlight. This new hardy variety of blight-resistant tomato can be grown locally by gardeners, allotment holders and market gardeners even in our wet climate. They tick all the boxes for high quality, sustainable, low- input and locally grown food."

David Shaw Director, Sárvári Research Trust Henfaes Research Centre Bangor University

Under the KESS scheme, James Stroud has been working with the Trust and a University academic supervisor, Dr Katherine Steele of the University's School of Environment, Natural Resources & Geography, while also gaining valuable research & development skills.



## "

"This project will help us to better understand blight-resistance in tomatoes, allowing breeders to produce better outdoor varieties for gardeners and growers. This project is one example of our work to provide a scientific basis for sustainable agriculture, forestry and the conservation of natural resources."

Dr Katherine Steele School of Environment, Natural Resources & Geography Bangor University

David Shaw commented, "Working with Katherine Steele has allowed us to tap into her cutting edge, crop breeding skills. She is training James in the latest molecular techniques to identify genes and to fingerprint the blight organism. This has been paramount to the success of the project."

#### Profile

Product
Blight resistant tomato variety
Applications
Improved outdoor growing capabilities
Contact
Dr Katherine Steele

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## Homegrown housing solution

#### High performance affordable housing in a night

oed Cymru, based in Newtown, Mid-Wales, has coordinated a team drawn from industry and academia which has developed a system of high performance affordable housing using new structures. Based on the properties of homegrown timber this is an adaptable manufacturing process ideal for the intermediate labour market or small enterprise. The Countryside Council for Wales (CCW), now Natural Resources Wales, sponsored the original study by Coed Cymru, The Welsh School of Architecture and University of Wales Bangor to develop a system of high performance affordable housing capable of using spruce and other species of softwood grown in Wales. This original partnership grew as the system attracted interest from architects, manufacturers and developers.

Typical Tŷ Unnos structures are formed from one or two storey frames spanning up to approximately 6m between columns. These frames are typically at centres of

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The new Tŷ Unnos system is a highly adaptable, additive, modular system which can create a range of house types and sizes. The system is a simplified and standardised kit, made up of component parts, which uses a 600mm basic layout grid and the locally sourced timber is used in standard, readily available lengths to create a simple housing system which is suitable for a self or an assisted build.



approximately 3m and can be arranged in a variety of configurations to give different building sizes and shapes. The Tŷ Unnos system is formed from two principal components; box beams and ladder beams. In addition to these standard timber joists, plywood or OSB (Oriented Strand Board) sheathing and connections are used.

The Tŷ Unnos box beam is a rectangular hollow section formed from four solid timber sections jointed with glued joints. These solid timber sections can be jointed in the length of the beam to create beams longer than standard timber sizes and the web pieces can also be jointed along the length of the beam to create deeper beams. The hollow section is very light and strong, comparing favourably with solid timber and glulam (glued laminated timber).

The name  $T\hat{y}$  Unnos, or house in a night, stems from an old Welsh tradition which has parallels in other folk traditions in other areas of the British Isles. Going

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"Welsh Grown softwood is a challenging raw material to work with but we do have a lot of it. By accepting that it is very different and working from the first principles of design the team has achieved all its original aspirations and much more. I am very grateful to all the team members and our sponsors."

David Jenkins, Director, Coed Cymru

back to the seventeenth century, it was believed by some that if a person could build a house on common land in one night then the land belonged to them as a freehold. Other variations on this tradition were that the test was to have a fire burning in the hearth by the following morning or that the squatter could extend the land around the building by the distance that they could throw an axe from the four corners of the house. Wales has 150,000 hectares of coniferous plantations which produce around a million tonnes of softwood in the round per annum. Over 70% of current production is Sitka spruce, a native of the Pacific coast of North America which suits Wales' mild, wet climate and peaty upland soils.

In its native range, Sitka spruce grows slowly to a great age. Welsh spruce grows much faster producing timber of lower density with heavier branching and larger knots. It is seldom used in modern timber frame construction which normally utilises higher grades of imported C24 or TR26 softwood. Although Welsh spruce has poorer structural properties than imported softwoods, it is its tendency to twist during drying that timber frame manufacturers cite as their reason for not using it but this system overcomes that.

The Tŷ Unnos system has been tested, developed and refined through a series of real design projects which consider parameters such as economic and environmental performance. In all, thirty buildings have been completed and a number are in the pipeline. Initial interest in the Tŷ Unnos system yielded a number of challenging projects including an Environmental Research Classroom at Ebbw Vale, a Tŷ Unnos based on a traditional Welsh longhouse in Ebbw Vale and a studio at The Old Sawmill, Tregynon. The first commercial application was a group of four 3-bed houses built by Elements Europe Ltd at Dolwyddelan in Snowdonia in 2010. These were delivered to site as fully fitted volumetric units. They were designed to meet the highest performance standards at the time but subsequent monitoring of energy and water use has shown that their actual performance far exceeds that design.

These projects provided a wide range of learning outcomes to aid in the development and refinement of this commercially applicable construction system. The portfolio of completed projects is varied and impressive though the engineers and architects working with the system have identified further capacity in the system to achieve longer spans.

#### Profile

Product New housing construction method Applications High performance affordable housing Contact David Jenkins Director Coed Cymru Cyf The Old Sawmill Tregynon, Newtown Powys SY16 3PL. UK T: +44 (0)1686 650 777 E: davidj@coedcymru.org.uk W: www.coedcymru.org.uk

## Keeping the focus on winning on the go

Complete athlete management made simple

ased in Pembrokeshire, West Wales, software development company Writemedia has created SportZone which is a unique athlete management system that enables athletes and coaches to prepare effectively. This is a fully-fledged online system which has been designed to be utilised by both individual sportsmen and women and entire teams.

SportZone has been developed around the complex and varying needs of athletes at the elite level. An athlete's life is a demanding mix of planning, training and performing and the aim of this system is to minimise the strain placed on the athletes to respond to these key factors by creating a comprehensive, easy to use suite of tools which communicates effectively.

Developed in-house, with Welsh Government support, the unique SportZone software comprises of two primary dashboards; the first provides a 'Sports Science' view where the coaching groups are able to plan the development of individual athletes or of squads. The second of these dashboards displays the athlete's view where each individual sees and examines only the data and images which relate directly to themselves.

Features in Writemedia's management system include a coaching module and strength & conditioning, nutrition, psychology, physiology, physiotherapy and medical (injuries/sickness reporting) sections as well as notational video analysis and daily data (daily monitoring).









The SportZone system is supported by a mobile app, which is compatible with both the iPhone and the iPad, and provides a performance plan for player feedback, includes video analysis clips and synchronises with both iCal and Google calendars. This system also incorporates a messenger service and sends push notifications to the user; for the coaching teams this function is further developed with the squad status feature notifying them of any updates from their medical teams 24/7.

SportZone's online notational analysis system has the capability to upload complete events or matches along with their accompanying analysis data so that coaching teams, regardless of their location, can share the information. The sophisticated software is able to upload from the main notational analysis programs currently in the market.

Writemedia develops in three specific areas, corporate, tourism and sport and has designed other leading edge software solutions for sport specific organisations in the UK. The SportZone product is currently being introduced into schools in Wales to promote young athlete development, and by providing this technology Writemedia hopes to assist the schools in their sports development programs. When used in schools, SportZone's feature list is tailored and adapted to suit the educational environment.

#### Profile



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