

THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY

# advances

WALES

## A greener approach to cultured meat

A Welsh innovation that could provide an alternative source of protein to traditional meat products



**7** Understanding long COVID 'brain fog'



**13** Power to the electric car user and charge point operator



Llywodraeth Cymru  
Welsh Government

## 3 News

## 6 Medicine

Development in understanding of blood clots linked to COVID-19 adenovirus vaccines

Understanding long COVID 'brain fog'

## 8 Agriculture & Food

A greener approach to cultured meat

New technology to prevent octopus over-fishing

Cutting the dependency on antibiotic use in swine production

## 13 Information Technology

Power to the electric car user and charge point operator

AI pathologist used to help diagnosis of prostate cancer

Artificial Intelligence could accurately predict tsunamis

## 16 Engineering & Materials

Safer packaging for car batteries

From Graphene to gold

Turning UK's electronic waste into gold

## 20 Environment & Energy

Brewing up solutions for a sustainable future

Advances Wales showcases the latest news, research and developments in Welsh science, engineering and technology. This edition and past editions can all be viewed online.

## Advances Wales highlights groundbreaking innovations in science, engineering and technology across Wales.

The winter/spring issue of Advances Wales features diverse examples of innovation in science and technology from across Wales. Our lead story explores the new world of cultured meat production and the introduction of bioreactor technology that will help to make this new food source more widely available to consumers (page 8). Keeping an eye on the continuing battle to beat the challenges faced by Covid-19 we report on two research projects. A team at Bangor University are seeking to understand and address the problem of 'brain fog', a recognised side effect associated with long Covid (page 7), while work at Cardiff University has helped scientists to understand the link between adenovirus vaccines and the very rare occurrence of blood clots (page 6).

Our look at innovation in agriculture focusses on two very different projects. One looks at the team analysing bioactive ingredients to reduce the need for antibiotics in swine feed (page 12) and the other looks at work being done in Aberystwyth to prevent octopus over-fishing (page 10). The growing use of Artificial Intelligence (AI) is examined in two applications. In North Wales AI is now being used to help diagnosis of prostate cancer (page 14), while researchers in Cardiff are using artificial intelligence to more accurately predict tsunamis (page 15). Transport innovation highlighted in this issue looks to support the expanding use of electric vehicles. We look at the management of charge points and the infrastructure required (page 13) and a project addressing the need for safe effective packaging solutions for Lithium batteries (page 16).

Keep a look out for our Summer issue which will be the 100th edition of Advances Wales.

**Gwyn Tudor**  
Editor

Why not move your subscription online by signing up to receive a digital copy of Advances Wales

To subscribe or change your mailing details contact:  
Jennifer Clark (innovation@gov.wales). T: 03000 61 6040.

Advances Wales is available online at:  
[www.businesswales.gov.wales/innovation/advances-wales](http://www.businesswales.gov.wales/innovation/advances-wales)

AGRICULTURE & FOOD

EARTH SCIENCES

ENGINEERING & MATERIALS

INFORMATION TECHNOLOGY

BIOTECHNOLOGY

ELECTRONICS & OPTOELECTRONICS

ENVIRONMENT & ENERGY

MEDICINE

### Advances Wales Magazine Privacy Notice

The following Privacy Notice covers information collected to receive Advances Wales magazine. Upon receipt of this information the Welsh Government becomes the data controller for it.

### Personal information that will be collected and held includes:

Personal details such as name, position, address and email address.

### What do we do with your information?

In our remit as the data controller, the Welsh Government uses the information received to provide you with copies of Advances Wales and your details will be securely stored.

### Who do we share your information with?

We will not pass your information on to third parties other than for mailing Advances Wales. This list will be deleted by the mail company following dispatch.

### How long will we keep your information?

We will retain your details as long as you want to receive Advances Wales. If you request to be removed from the mailing list your details will be removed within 10 working days.

### Your rights in relation to your information

You have the right to:

- Access to the personal data that we are processing about you;
- Require us to rectify inaccuracies in that data;
- The right (in certain circumstances) to object to processing;
- The right for your data to be 'erased';
- Lodge a complaint with the Information Commissioner's Office (ICO) who is our independent regulator for data protection;
- The right to withdraw consent at any time.

For further details about the information which Welsh Government holds and its use, or if you wish to exercise your rights under GDPR, please see contact details below:

Data Protection Officer, Welsh Government, Cathays Park, Cardiff CF10 3NQ  
Email: [Data.ProtectionOfficer@gov.wales](mailto:Data.ProtectionOfficer@gov.wales)

The contact details for the Information Commissioner's Office are:

Wycliffe House, Water Lane, Wilmslow, Cheshire SK9 5AF  
Telephone: 01625 or 0303 123 1113  
Website: [www.ico.org.uk](http://www.ico.org.uk)

### If you do not wish to continue to receive Advances Wales

You can unsubscribe by emailing [Innovation@gov.wales](mailto:Innovation@gov.wales) or contact us at: Innovation team, Welsh Government, Crown Building, Cathays Park, Cardiff CF10 3NQ



Llywodraeth Cymru  
Welsh Government

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



Advances Wales is a quarterly technology journal produced by Welsh Government to showcase new developments in science, engineering and technology from 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.

**Editorial Board:** Delyth Morgan, Lucas Brown, Sarah Brajer-Hughes, Simon Cooper, Gareth Browning, Marcia Jones, Clive Thomas, Richard Johnston.

**For information on how to contribute features contact the editor,**  
tel 029 2047 3455  
email: [advances@teamworkdesign.com](mailto:advances@teamworkdesign.com)

Advances Wales is designed and published on behalf of Welsh Government by Teamworks Design, The Maltings, East Tyndall Street, Cardiff CF24 5EA.  
Creative Design: Lee Gillum.

Opinions expressed in this magazine are not necessarily those of Welsh Government or its employees. Welsh Government is not responsible for third-party sources cited such as web sites or reports. ISSN 0968-7920. Printed in

If you have created a new technology or carried out research in Wales? If so, we'd love to hear from you...

[www.teamworkdesign.com/clients/advances/](http://www.teamworkdesign.com/clients/advances/)

## Green light for Wales' first sustainable ocean farm

**Plans to establish a sustainable 3D ocean farm capable of producing up to 15 tonnes of seaweed and shellfish per year are currently in development for a site off the West Wales coast.**

It is known that land-based agriculture contributes 24% of global greenhouse gas emissions. Regenerative ocean farming is a "polyculture farming system", where multiple species such as seaweed and shellfish grow side by side. This provides a way to help restore marine ecosystems and absorb carbon from the atmosphere, making it a sustainable form of food production.

Seaweed, which refers to the different species of marine algae and plants that grow in water bodies, absorbs CO2 more effectively than trees and is considered a key weapon in fighting climate change. It helps to buffer against the ocean's acidification and provides ideal conditions for marine life. Native oysters offer significant benefits to coastal waters by helping to clean the seas and acting as an important habitat for marine wildlife. However, native oyster populations have declined by 95 per cent due to human activities.



Community Benefit Society Câr-Y-Môr (For the Love of the Sea) is leading a project to bring to life a three-hectare 3D ocean farm which will cultivate a variety of seaweeds and shellfish. The farm is the first of its kind in Wales. Sitting just below the surface of the sea, this

type of ocean farming requires no fertiliser, fresh water, feed or land. It harnesses the ocean's potential to feed humanity, while providing significant environmental benefits.



[www.carymor.wales](http://www.carymor.wales)

## Robotic Assisted Surgery Programme for Wales

**A National Robotic Assisted Surgery Programme allowing surgeons to perform complex procedures with more precision and control is being introduced in Wales. The All-Wales Robotic Assisted Surgery Network will provide less invasive surgery for thousands of cancer patients across the country.**

Robotic assisted surgery involves the use of highly advanced robotic instruments under the control of a surgeon. It will initially be used in Wales for some Colorectal, Upper Gastrointestinal, Urological and Gynaecological cancers. The service will first be provided in North Wales with other regions across Wales to follow soon after.

The programme will be delivered in partnership with medical technology company, CMR Surgical,

who will provide the equipment, maintenance and training, as well as supporting research into the adoption of robotic-assisted procedures.

Robotic-surgery has many advantages for patients compared to open surgery, including a smaller wound, less blood loss, a shorter hospital stay and faster recovery allowing the patient to return to work sooner.



"Technological advancements have had a profound effect on surgery over the last few decades, minimising the invasiveness of procedures, improving outcomes, and reducing hospital stays. With the progression of robotic assisted surgery, the next 20 years will see even more radical change, bringing with it the promise of a future where healthcare is even less invasive and better able to fit the individual needs of patients."

**Jared Torkington**  
The All-Wales Robotic Assisted Surgery Network



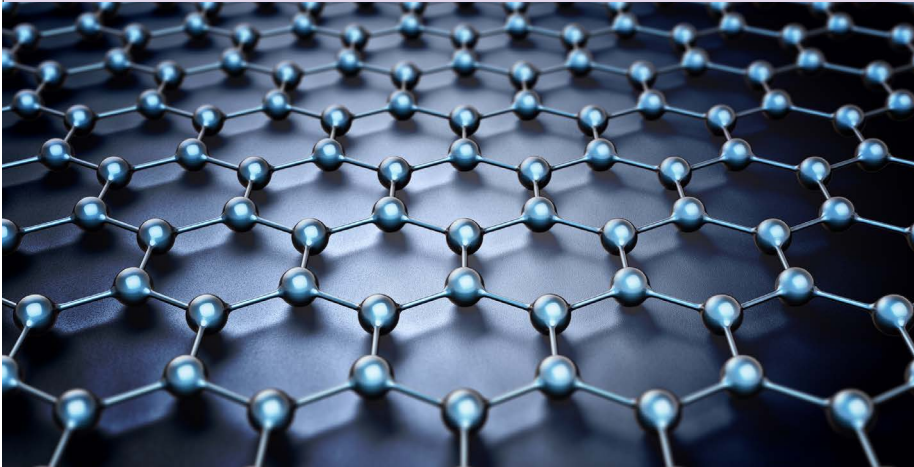
[www.lshubwales.com](http://www.lshubwales.com)

# Pioneering energy-efficient membrane technology

## Swansea University has made significant advancements in demonstrating the viability of membrane technology

Synthetic membranes are used extensively in various processes, as diverse as water treatment, dialysis, and cheese-making. However, the separation process, which uses pressure to separate particles based on size through a porous membrane, is energy demanding.

Research shows these processes are responsible for 7% of all energy consumed globally. The work demonstrates how the process can be optimised to reduce energy consumption, making it more environmentally sustainable.



Inspiring this project are the techniques that have pioneered the use of atomic force microscopy (AFM), a relatively new technology that offers a powerful tool enabling researchers to study the forces that governs separation across membranes at the nanometer level. Using these techniques as a blueprint, the team has also developed techniques for electrospinning novel membranes. Electrospinning is a polymer fabrication technology used to produce membranes with desirable characteristics, enabling optimum performance in membrane separation.

This research has now been applied extensively at scale. In medical applications membrane technology has been used in tissue engineering, wound dressing, as well as to control drug delivery, and blood oxygenation in artificial lungs. It has also been applied successfully in other industries. The British farmer cooperative First Milk, has replaced its evaporators with membrane technology resulting in energy savings of over £3.5m over a six-year period, while also delivering a reduction in their carbon footprint.



[www.swansea.ac.uk](http://www.swansea.ac.uk)

## IN BRIEF

### Using T-cells to design more effective vaccines

T-cells play a key role in how the body responds to infection. Over the last few months, scientists at Cardiff University have been investigating how they work to protect us against diseases such as COVID-19. New research has revealed a way to harness the potential of T-cells in "fine-tuning" the body's ability to fight off viral infections. This study highlights the unique role of the CD8 T-cells, allowing individual T-cells to focus on specific disease targets without driving autoimmunity, which causes the body to attack healthy cells. To achieve this, the researchers set different targets and modified CD8 T-cells while monitoring the immune responses produced. It is hoped that the work will help in efforts to create more effective T-cell-mediated vaccines which offer just the right strength of immune response, not too weak and so ineffective, but also not so strong that they do harm to the body.

### Inspiring Wales' next generation of robotics engineers

A specialist robotics workshop is being established to help inspire the next generation of engineers who will work in this fast growing, global industry. The £600,000 workshop will be set up at Coleg Gwent, in South West Wales, with a pilot hub at a local school. It will provide students with access to equipment and training to help develop their skills and support their careers working in this emerging industry sector. With the increasing use of robotics and automation in most industries, the workshop will help students to benefit from new opportunities as part of the workforce of the future. This initiative is part of the Tech Valleys programme.

### Delivering safe, sustainable access to drinking water

Welsh start-up Deploy Tech Ltd has developed a novel, sustainable and affordable alternative to conventional concrete water storage. The company has created a flat-pack, air-deployed, ready-to-use concrete water tank. When folded and packed, the tank can be transported on a standard logistics pallet and be assembled and ready to use in 24-hours. When in use the tank can store up to 40,000 litres of water. Manufactured with a concrete-filled fabric material, the product transforms into a unified concrete vessel when hydrated and will generate 70% less CO<sub>2</sub> emissions compared to conventional concrete tank manufacturing. The company is now working to develop and implement a production line to carry out prototyping and testing of their product. Globally, an estimated 2.2 billion people lack access to safely managed drinking water. This innovation will contribute to providing these rural communities with access to water and will also provide water infrastructure to other sectors like agriculture and fire mitigation required due to the changing climate.

### Pushing the frontiers of biomedical research

Welsh company Copner Biotech has established a new research facility at Tata Steel's Ebbw Vale Innovation Centre. The aim is to establish a foothold in the fast-growing bioprinting market by utilising their novel technology and forming innovative collaborations with other businesses and research centres. The company has developed new 3D printing technology for the production of 3D cell culture scaffolds based on concentric shape constructs. There is evidence that 3D cell culturing techniques provide more valuable insights for research in a variety of fields compared to traditional two-dimensional environments. The company has recently filed patents for their new scaffold and Negative Space Inkjet Printer technology and have formed partnerships with Swansea University and Welsh biotech company Jellagen, who are pioneering the use of jellyfish collagen for cell culture and medical applications.

### Glucose Republic to build the first app focused on the impact of food

Cardiff based health tech firm, Glucose Republic, has raised £500,000 from investors to build the world's first system focused on the impact of food. The new platform, which will use five unique algorithms, will measure and analyse how a user's body is reacting to the foods they eat and their activity by directly monitoring and tracking the glucose in their bloodstream. Understanding the impact of glucose enables the user to adapt their eating plans to their own individual needs and lifestyles and help them to develop sustainable strategies moving forward. The company's founders were previously involved in developing the world's first mobile-connected diabetes management platform. Co-founder David Haines explains: "Every person has a unique food fingerprint, which shows how we react to foods. We can access that fingerprint via tracking our own glucose levels. This can be utilised to provide personalised feedback to users on the metabolic impact of the food they have eaten, enabling them to make meal choices with greater confidence."

# Harnessing innovation to support healthy flocks

**Welsh company Pruex has won an award for innovation for its automated spraying system which reduces ammonia levels in poultry sheds.**

The system has been shown to improve conditions in poultry farming at a demonstration site in Wern in Mid Wales. The company has been working with the farm to evaluate and control ammonia emissions by applying noninfective bacteria sourced from soil and, in doing so, replacing the harmful bacteria found in animal faeces.

Ammonia is a gas that is present in the atmosphere of every poultry house and results from the chemical decomposition of uric acid in droppings by bacteria in the litter. Studies show that exposure to high levels of ammonia has adverse effects on the health of birds. It can damage their immune system and



respiratory health, affect the efficacy of vaccines, and increase mortality rates. Treating diseases induced by ammonia exposure requires the use

of antibiotics. The increasing use of antibiotics in intensive animal production has been linked to the emergence of antibiotic resistance.



[www.pruex.co.uk](http://www.pruex.co.uk)

## New initiative to promote sustainable tourism in Ireland and Wales

Academics from Aberystwyth University will lead a new €3 million European project to boost tourism in rural areas of Wales and Ireland, in partnership with University College Dublin and the Dyfed Archaeological Trust. The project uses technology to enhance the visitor experience and work with schools and others to record local cultural histories. This will operate for a period of two years in the four coastal upland areas of the Cambrian Mountains and Preseli Hills in Wales and the Wicklow Mountains and Blackstairs Mountains in Ireland.

## International recognition for Swansea University's circular economy

Swansea University has won major international recognition courtesy of the Ellen McArthur Foundation for its commitment in promoting a circular economy. The principles of the circular economy promote the elimination of waste. As a model for production and consumption, it works towards products being kept in circulation for as long as possible, rather than used and discarded. By reducing waste, the aim is to significantly reduce pressure on the environment. The Foundation has recognised the number of million-pound funded research programmes led by the University. This includes the SUSTAIN (Strategic University Steel Technology and Innovation Network) project, which aims to transform the carbon intensity of the process of producing the world's most widely used advanced material, steel. Led by Swansea University and partnered with the Universities of Sheffield and Warwick, the project is supporting the development of new, more environmentally friendly options for steel production.

## Funding boost supports rising demand for diagnostics

Chepstow based medical technology company IQ Endoscope has successfully raised over £4m to support its vision to increase access to flexible endoscopy. The funds will allow the company to achieve regulatory approval for its single use flexible gastroscope and accelerate the product development of its single use colonoscope. The products have been developed to help to transform endoscopy services by eliminating the challenges and risks presented by traditional reusable endoscopes. The new technology provides a single use platform which, while replicating the physical handling and ergonomic performance of re-useable endoscopic technologies, provides a cost-effective, sustainable alternative. With the number of endoscopy procedures expected to reach 130 million by 2026, this single-use solution has been designed to reduce the risk of cross-infection and free health organisations from the ongoing costs of cleaning and maintaining traditional scopes, helping to increase capacity to meet rising demand for this essential diagnostic procedure.

## Peatlands: raising hope for the planet

Research from UK Centre for Ecology & Hydrology in North Wales suggests that raising water in agricultural peatlands could lead to substantial cuts in global CO<sub>2</sub> emissions. Although peatlands only cover 3% of the world's land surface, they store twice as much carbon as the world's forests. These ecosystems are known to play a vital role in mitigating the effects of climate change. However, about 15% of the world's peatlands have been drained. When drained, they release huge amounts of carbon, stored over centuries, into the atmosphere – around 1.5 billion tonnes of CO<sub>2</sub> per year. Because large populations rely on these areas for their livelihoods, it would be impossible to fully rewet and restore all agricultural peatlands, so the scientists have considered practical alternatives. They have looked at the effects of halving current draining depths. The study shows that this alone could cut emissions by around 500 million tonnes of CO<sub>2</sub> a year, around 1% of all global greenhouse gas emissions caused by human activities.

## Virgin Orbit to launch first Welsh satellite

Leading launch company Virgin Orbit and Cardiff based start-up Space Forge have announced an agreement to launch the first satellite developed in Wales in summer 2022. The project is focused on delivering a shift to more environmentally beneficial space practice, including sustainable on the ground operations, horizontal lower impact launch technologies and in-orbit services that minimise the environmental impacts of manufacturing. Dedicated in-space manufacturing will allow Space Forge to harness the benefits of the space environment including; microgravity, vacuum, and temperature, to create products impossible to manufacture on Earth. Their focus is on producing materials and products that offer "game-changing" levels of manufacturing performance and efficiency and in doing so reduce the environmental impact of production processes. Research suggests that manufacturing certain materials in space could reduce CO<sub>2</sub> emissions by 75% or the equivalent of removing all petrol cars from UK roads.

# Development in understanding of blood clots linked to COVID-19 adenovirus vaccines

An international team of scientists believe they may have found a molecular mechanism behind the extremely rare blood clots linked to COVID-19 adenovirus vaccines.

Scientists from Cardiff University and Arizona State University worked with AstraZeneca to investigate vaccine-induced immune thrombotic thrombocytopenia (VITT), also known as thrombosis with thrombocytopenia syndrome (TTS), a life-threatening condition seen in a very small number of people after receiving the Oxford-AstraZeneca or Johnson & Johnson vaccines.

The team used state-of-the-art technology to analyse the vaccine in minute detail to understand whether the ultra-rare side effect could be linked to the viral vector. Viral vectors are commonly used by molecular biologists to deliver genetic material into cells.

The team's findings suggest it is the viral vector – in this case an adenovirus used to shuttle the coronavirus' genetic material into cells – and the way that this adenovirus binds to platelet factor 4

(PF4), a protein in the blood that promotes clotting that could be the potential mechanism.

In very rare cases, the scientists suggest that, when the viral vector enters the bloodstream and binds to PF4 the immune system views this complex as foreign. They believe this misplaced immune reaction could result in the release of antibodies against PF4, which bind to and activate platelets, causing them to cluster together and triggering blood clots in a very small number of people.

The research team are hopeful that armed with a better understanding of what may be causing rare VITT they can provide further insights into how vaccines and other therapies, which rely on the same technology, might be altered in the development of the next generation vaccines and therapies. With a better understanding of the mechanism by which PF4 and adenoviruses interact there is an opportunity to engineer the capsid, or outer shell of the vaccine, to prevent this interaction occurring.



“VITT only happens in extremely rare cases because a chain of complex events needs to take place to trigger this ultra-rare side effect. Our data confirms PF4 can bind to adenoviruses, an important step in unravelling the mechanism underlying VITT. Although very rare, it is critical we fully investigate vector-host interactions of the vaccine at a mechanistic level to help us understand both how the vaccine generates immunity – and how it may lead to any rare adverse events, such as VITT. Establishing a mechanism could help to prevent and treat this disorder. We hope our findings can be used to better understand the rare side effects of these new vaccines – and potentially to design new and improved vaccines to turn the tide on this global pandemic.”

**Professor Alan Parker**

Expert in the use of adenoviruses for medical applications  
School of Medicine  
Cardiff University

**Contact:**

**Professor Alan Parker**

**Cardiff University**

**w:** [www.cardiff.ac.uk](http://www.cardiff.ac.uk)

**e:** [ParkerAL@cardiff.ac.uk](mailto:ParkerAL@cardiff.ac.uk)



**Cardiff**



# Understanding long COVID 'brain fog'

UK study to help people suffering from the effects of long COVID.



**For some people COVID-19 can cause symptoms that last weeks or months after the infection has gone. This is sometimes called post-COVID-19 syndrome or long COVID. 'brain fog' or cognitive impairment is increasingly recognised as a major component of long COVID and estimates suggest that a quarter to two thirds of all people who experience long COVID suffer some form of 'brain fog'.**

This impairment impacts on these individuals' quality of life, and they can experience a range of symptoms. Decisions as simple as choosing tea or coffee to drink can cause confusion, while other patients report difficulties with short or long-term memory. The loss of functional ability can have major consequences for people who are affected, their families and even the wider economy if sufferers are unable to return to work.

A new UK study will help to describe how 'brain fog' is experienced by people suffering from long COVID and will evaluate a Cognitive Rehabilitation Therapy (CRT) adapted for this group. CRT refers

to treatment strategies designed to improve problems with memory, attention, perception, learning, planning and judgement.

The study, led by University College London, is being delivered in partnership with Bangor University's Clinical Trials Unit, the North Wales Organisation for Randomised Trials in Health and Social Care (NORTH) and the University's Centre for Health Economics and Medicines Evaluation (CHEME).

The project will also develop a manual for clinicians, which will describe a step-by-step approach to treating this group, helping to identify methods or strategies that can be put in place to manage the symptoms people are experiencing as part of their 'brain fog'. Any new support measure or treatment proposed for the health service needs to be assessed for its effectiveness and value.

The research is one of 15 major studies just announced by The National Institute of Clinical Research (NIHR) and UK Research and Innovation (UKRI), which will draw on the experience and insights of patients and healthcare workers to investigate treatments, service delivery and diagnostics for long COVID.



"The sheer scale of the pandemic makes addressing long COVID one of the top priorities facing healthcare worldwide. The aim is to help people to regain a better quality of life and return to their former activities. The aim of this study is to meet this need and to deliver a treatment plan for affected people which will help them return to normal life and working ability."

**Dr Nathan Bray**  
Lead for Applied Learning  
Preventative Health Academy

**Contact:**  
**Bangor University**  
w: [www.bangor.ac.uk](http://www.bangor.ac.uk)  
e: [press@bangor.ac.uk](mailto:press@bangor.ac.uk)



**Bangor**

# A greener approach to cultured meat

Developing a high-density hollow fibre membrane bioreactor for cultured meat production.

**Cultured meat is animal meat that is produced by cultivating animal cells directly. A series of nutrients are fed to cells in a machine called a bioreactor which eliminates the need to farm animals for food. The resulting grouping of cultured cells can be turned into a range of traditional meat products (including organs and fish) by the food industry. The process takes between two and eight weeks, depending on what kind of meat is being cultivated.**

West Wales based Cellular Agriculture Limited have developed a production process that uses hollow fibre membrane bioreactor technology. Current cultured meat production predominantly uses stirred tank reactor technology (STR) which has been commonplace in the brewing industry for centuries and has been used in food ingredient and biopharma industries to industrialise fermentation methods since the early 20th century. Whereas Cellular Agriculture's process mimics the human body's vascular system, allowing nutrients to be targeted

directly at cells, offering the largest theoretical cell densities of any bioreactor system.

With significant reductions in carbon footprint and lower utility and labour costs compared to traditional meat production, the company's technology platform has applications for the culturing of meat, fish, shellfish, insects and milk. So far their work forecasts a 90% reduction in greenhouse gas emissions, a 90% reduction in land use and a 50% reduction in water use, compared to livestock production.



“We are not food manufacturers, we're engineers. What we are focused on is providing a solution to support this consumer-facing industry to reach price parity with traditional meat production. We can already reduce capital costs by 50% and operational costs by up to 70%. When we consider the further efficiencies that can be gained, from recycling and waste reduction, we forecast operational cost reduction of up to 98% which ultimately will see cultured meat become a reality on the shelves of our local stores.”

**Ilftud Dunsford**  
CEO & Co-Founder  
Cellular Agriculture





As the global population increases towards 10 billion, food production will need to adapt and change to meet increasing demands. Cultured meat represents a biological innovation that can provide an alternative, nutritious source of protein that can be indistinguishable to traditional meat products.



- Cultured meat is made of the same cell types as animal tissues and so replicating the sensory and nutritional profiles of conventional meat.
- Commercial production of cultured meat is done without the need for antibiotics and is likely to result in fewer incidences of food borne illnesses because it is not exposed to pathogens.



**Contact:**  
**Illtud Dunsford**  
**Cellular Agriculture Ltd**  
w: [www.cellularagriculture.co.uk](http://www.cellularagriculture.co.uk)  
e: [illtud@cellularagriculture.co.uk](mailto:illtud@cellularagriculture.co.uk)



Llanelli

# New technology to prevent octopus over-fishing

Creating a seafood traceability network to ensure the sustainability of octopus fisheries.

The volume of fishing of octopuses, squid, and other cephalopods, which are also known as ink fish because they can all squirt ink, has increased significantly over the past 60 years.

Octopus species are often misidentified, and their catch numbers and locations inaccurately reported. This is prompting fears that a lack of data could lead to overfishing, threatening the conservation of octopus populations and the future of an important source of protein-rich food for the world population.

A multidisciplinary research team including academics in Aberystwyth aims to address this knowledge gap by using environmental DNA, machine learning and artificial intelligence tools to create a seafood traceability network to improve

stock management and ensure the sustainability of octopus fisheries.

Professor Paul Shaw, from Aberystwyth University will be developing the global octopus genetic database on which the tracking of fishery products will depend.

The team's objectives are to develop a prototype traceability system allowing for affordable identification of species and area of capture for wild octopus fisheries in the U.S. and from across the world.



“Tracking and sharing information about where our seafood comes from is an essential part of efforts to prevent over-fishing. Tracing seafood origins can help people from across the supply chain make informed choices to fish sustainably. The aim is to provide a proof-of-concept that can be rolled out to the fishing industry in general. So, while the team will focus on cephalopods, the longer-term aim is to provide a comprehensive system to enable any seafood item to be harvested, distributed and processed through to the consumer in a clearly identifiable and sustainable way.”

**Professor Paul Shaw**  
Aberystwyth University



They will also bring together a citizen-science network to gather new data on octopus populations from portable environmental DNA kits. Environmental DNA is free DNA that persists in the

environment, in this case in seawater, providing an indication of which organisms are prevalent or in the vicinity.

The 15 member team includes experts from seven countries, including the United States, Wales, South Africa, Japan and Mexico. In addition, industry partners will help to inform and test the design of the traceability tool for real-world use.



“Working with a range of partners and leading-edge technology, we plan to produce a traceability tool that will allow for a better understanding of the species caught, the source of the product, and confirmation of its legitimate path from fishery to fork.”

**Demian Willette**  
Project Lead  
Loyola Marymount University



**Contact:**  
**Colin Nosworthy**  
**Aberystwyth University**  
w: [www.aber.ac.uk](http://www.aber.ac.uk)  
t: 07496 914301  
e: [ctn1@aber.ac.uk](mailto:ctn1@aber.ac.uk)



**Aberystwyth**



# Cutting the dependency on antibiotic use in swine production

## Which bioactive feed ingredients can help in the battle against antibiotic resistance?

**Scientists at the University of South Wales have been working in partnership with Hay-on-Wye-based Feed, Food & Future, on a research project to address the challenge of increased antibiotic resistance in pigs. Antibiotic resistance is one of the most pressing current threats to global health. Since the health of humans, animals and the environment are closely linked, this study helps to make advances towards an overall reduction in antibiotic use and slow the development of resistant organisms. Cutting the use of antibiotics in the food chain is one way to address part of the problem.**

The researchers, led by Dr Cerith Jones, compared the antimicrobial activity of a wide range of non-antibiotic feed additives and their active ingredients. More than 30 compounds were compared for their ability to act against a diverse group of pig pathogens. The researchers were able to identify those which showed the most promising bioactivity against specific disease-causing bacteria. They identified

additives that could focus on a specific set of pathogens, and others that could have a broad impact on a wider range of bacteria. As a result, a solid base of evidence was built to advise farmers on which products to use to help cut dependency on antibiotic use in swine production.

The researchers also show which ingredients have little or no antimicrobial activity, so that the industry can focus on those compounds that are going to have a measurable impact. By combining microbiology and animal studies, they are developing a good understanding of antimicrobial resistance mechanisms in pig farming.

The benefits of this research for animal health in the food chain are linked to human health, as we aim to reduce the burden of antibiotic resistance in humans. Use of bioactive feed supplements could improve the health of animals, and reduce the requirement for antibiotic interventions. Ultimately the use of antibiotics in the food chain could be substantially reduced.



“Our research was all about getting evidence to drive reduction in antibiotic use by guiding the industry to choose alternatives based on a credible, science-based approach, so that pig producers have more confidence in the likely impact of the products when making that choice. We found that some products will work, some not as expected, and others have a narrow spectrum of activity against certain bacteria that could be developed further.”

**Charlotte Neath**  
PhD student research conductor  
Energist

**Contact:**  
**Feed, Food and Future**  
w: [www.feedfoodfuture.com](http://www.feedfoodfuture.com)  
t: 01497 820907



**Hay-on-Wye**

# Power to the electric car user and charge point operator

Using an application programme interface (API) to benefit electric car users and charge point operators.



**Electronic vehicles (EVs) have significantly lower running costs compared to petrol or diesel vehicles. South Wales based electric vehicle infrastructure and software company, Clenergy EV, has developed a cloud based electric vehicle management platform. The new platform communicates with charge points, using Open Charge Point Protocol (OCPP) regardless of provider or manufacturer.**

The system allows car owners to manage their charge point usage. A Google Map Interface helps users to locate the nearest charge point, check availability and plan a journey with reference to charge point locations, and the system is cloud based so no specialist software or hardware is required by users.



For operators, the platform provides a complete EV charge point management system. Operators can analyse data, including charge point usage, number of sessions, income and group, or individual CO2 data. Using a secure payment gateway they can set charging fees based on time, usage or number of sessions and set up groups with different charging rates.

An Application Programming Interface, or API, allows operators to integrate with systems they are already using and can show network information on their own websites. The platform can be used to create new payment gateways and



- Around 90% EV owners charge their car at home. Charging a car at home is cheaper than using a public charging point, but electricity bills can increase significantly. To keep costs down EV owners can switch electricity supplier or choose a specialist EV energy tariff, which will typically have lower costs during the night when there is less strain on the national grid.
- The UK has several networks of public chargers owned by different companies. The price of using public charging points is not the same from one provider to the next.
- Rapid chargers are usually found at motorway service stations for a quick top-up.
- Many workplaces are now implementing workplace charging points which are often free to use while an employee is at work.

link to building management, hotel reservation or parking management systems. The platform can also control and update charge point software remotely and continually monitor each charge point's status.

#### Contact:

**Michael Nixon**

**w:** [www.clenergy-ev.com](http://www.clenergy-ev.com)

**e:** [michael.nixon@clenergy-ev.com](mailto:michael.nixon@clenergy-ev.com)



**Pencoed**

# AI pathologist used to help diagnosis of prostate cancer

A consultant pathologist in Wales is using the first Artificial Intelligence (AI) application cleared for clinical use in the UK for the diagnosis of prostate cancer.

**There are around 52,300 new prostate cancer cases in the UK every year and around 11,900 deaths from the condition. As the appropriate clinical expertise is in high demand this technology, which can reduce the time taken to diagnose cancer and improve the accuracy of the diagnosis, could support an important priority for the NHS in Wales.**

The platform, from medical analytics firm Ibex, is being used in North Wales to check digital slides of biopsies taken from patients suspected of having prostate cancer. Slides containing biopsy samples are scanned using a digital scanning machine and then AI software analyses the scan data for potential signs of cancer. The software then grades the sample using a traffic light system. A high probability of cancer triggers a red marker, those needing investigation amber and benign samples are marked green. At the same time, the software also identifies other characteristics that help to evaluate the

progress of a disease (prognostic markers). It highlights these markers so that a clinical consultant can assess the severity of the case and take the appropriate action.

So far 340 samples have been tested by the platform and it has returned no errors in diagnosis, even though it is recognised that, due to the need to screen very small tissue samples at higher magnification, these cancers can be easy to miss.

The accuracy of the technology is likely to reduce the need for patients to repeat the biopsy process which can be painful and distressing. There is also reduced need for more than one consultant to review and check individual cases. The AI application also learns as it is used. The observations made in this study will inform future diagnosis, making it more accurate as time goes on.

Similar technology will soon be used to assess and target appropriate treatments for colorectal cancers. There is also a project being developed to use AI technology to help to diagnose breast cancers.



“This process of checking slides usually takes 50 to 60 minutes. With this tool, I can see the cancers and measure them in just a few minutes. However, I’m not so focused on the time saved, it’s the quality of the work. The AI platform is like another consultant doing all the work and bringing the results to me. We should call it assisted intelligence, as it’s assisting us to get the best for our patients, as quickly as possible. This is not reducing the need for consultants, it’s helping us to target the patients most in need.”

**Dr Muhammad Aslam**  
Consultant Pathologist  
Betsi Cadwaladr University Health Board

**Contact:**  
**Dr Muhammad Aslam**  
w: [www.bcuhb.nhs.wales](http://www.bcuhb.nhs.wales)  
e: [Muhammad.Aslam3@wales.nhs.uk](mailto:Muhammad.Aslam3@wales.nhs.uk)



**Wrexham**

# Artificial Intelligence could accurately predict tsunamis

Researchers from Cardiff University have trained Artificial Intelligence algorithms to help recognise when tsunamis might hit.

Tsunamis have a devastating impact on communities, so developing accurate methods of detecting them quickly is key to saving lives. Analysis of ocean sound waves triggered by underwater earthquakes has enabled researchers at Cardiff University to develop Artificial Intelligence (AI) that allows prediction of when a tsunami might occur.

Some earthquakes have higher capability to generate tsunamis than others. Tsunamis often occur after vertical earthquakes, where tectonic plates on the earth's surface move effectively up and down rather than side to side. This motion causes the displacement of a large amount of water, creating very long waves that can cause widespread damage onshore.

The vertical motion that results from the earthquake compresses the body of water above it which then sends specific sound signals that carry information on the dynamics and geometry of the fault.



“Our findings show we are able to classify the type of earthquake and retrieve its main properties from acoustic signals, in near real-time. These methods will complement existing technology for real-time tsunami analysis and provide another tool for experts working to detect them.”

**Dr Usama Kadri**  
School of Mathematics  
Cardiff University



Tsunamis damage, Fukushima, Japan 2011

The research team have used this information to train Artificial Intelligence (AI) algorithms to recognise when a vertical earthquake has occurred and to classify the type of earthquake and its magnitude. This is a significant step for a reliable early tsunami warning system since the

type of earthquake can dictate if a tsunami will be generated at all.

It is hoped this technology could assist experts in gaining accurate real-time assessments of geological events and could be used to pinpoint future tsunamis in real-time.

**Contact:**  
**Dr Usama Kadri**  
**Cardiff University**  
w: [www.cardiff.ac.uk](http://www.cardiff.ac.uk)  
t: 029 208 75863  
e: [kadriu@cardiff.ac.uk](mailto:kadriu@cardiff.ac.uk)



Cardiff

# Safer packaging for car batteries

Research collaboration delivers packaging solutions for automotive electrification market.

Global packaging company, Tri-Wall, are using the outputs from a major collaborative research project, undertaken with the LIBRIS (Lithium-Ion Battery Research In Safety) partnership, to create new technical packaging solutions that meet the growing automotive electrification market.



The company, headquartered in South East Wales, manufactures high performance, heavy-duty corrugated fibreboard and converts the finished board into transport packaging suitable for high volume manufacturing.

This project explores packaging solutions for batteries used in electric vehicles and has resulted in new data around the composition, manufacture and safety of packaging for lithium-ion cells. The company has used these findings to inform the manufacturing processes and materials used in the development of safer battery solutions. The project partners include; Jaguar Land-Rover, 3M, UK HSE, WMG, Denchi, Potenza, Lifeline and UK BIC.



As a result of this work the company now offers a range of packaging solutions specially designed and tested for lithium-ion cells, modules and full vehicle battery packs. The packaging consists of a heavy-duty corrugated outer with foam internals and integrated pallet. Tri-Wall has tested the new packaging with the UK Health and Safety Executive using live cells to ensure they exceed current regulatory requirements and are able to contain a thermal runaway event.

Within the packaging a thermal runaway mitigation wrap can be included. When heated above 90°C the wrap releases a cooling medium that spreads throughout the box preventing thermal runaway by displacing energy and rapid heat dissipation. The wrap has been developed specifically to suppress the spread of fire and smoke emanating from lithium-ion.

**Contact:**  
**Nathan Carter**  
**Tri-Wall**  
 w: [www.tri-wall.co.uk](http://www.tri-wall.co.uk)  
 t: 0160077 2222  
 e: [Nathan.carter@tri-wall.co.uk](mailto:Nathan.carter@tri-wall.co.uk)



Monmouth



# From Graphene to gold

Improving athletic performance using a carbon-based stretchable graphene garment.

**A graphene enabled heated garment with technology, invented, designed and developed at the Welsh Centre for Printing and Coating at Swansea University, has been used by medal winning British athletes in Tokyo, including top medal winners, to help to maintain muscle temperature before competing.**

The team collaborated with the Applied Sports, Technology Exercise and Medicine (A-STEM) group at Swansea University and the English Institute of Sport (EIS) where research has shown the benefits of maintaining muscle temperature on performance. Industry partners included Haydale, Screentec and Newbury Electronics.

Research by the A-STEM team has shown that maintaining muscle temperature at a constant level on the day of competition can improve an athlete's performance. At the level of elite sport, where the margins are so fine, the slightest boost in performance can mean the difference between winning and losing.

The challenge was how to keep an athlete's muscles warm right up until they were ready to compete.

The team invented a printed flexible heater using carbon-based stretchable graphene and silver ink that can be directly attached to the stretchable fabrics in the garment. The heating panel can stretch to 300% of its normal size and will function even when punctured or folded.

Despite these challenges, the team, along with the other collaborators, succeeded in developing a working heated garment.

Dr Matt Parker, Director of Performance Innovation for EIS, said:

“It is great to see the dedication and hard work of the whole team bring to reality garments that have been used by British athletes. This is something we will look to build on for future events.”



**Dr James Claypole**

Swansea University, explains some of the technical challenges involved:

“The stretchable garments had to be lightweight enough not to impede movement, machine washable, waterproof, and run from a small battery. This required custom electronics and control systems, a method of integrating the panels into the garment, and a means of connecting the soft, flat printed heaters to conventional electronics.”



**Contact:**  
**Kevin Sullivan**  
**w:** [www.swansea.ac.uk](http://www.swansea.ac.uk)  
**e:** [k.g.sullivan@swansea.ac.uk](mailto:k.g.sullivan@swansea.ac.uk)



Swansea

# Turning UK's electronic waste into gold

The Royal Mint to build 'world first' plant to turn UK's electronic waste into gold.

**The Royal Mint is using pioneering technology to enable them to recover precious metals from discarded electronic devices such as mobile phones and laptops.**

The Royal Mint is the largest and most technically advanced minting facility in the world. More than 3.3 billion coins and blanks are produced on the 30 acre site in Llantrisant, South Wales, every year. Although it has been located in Wales for

the past 50 years, it was located within the walls of the Tower of London for many centuries.

This new venture will help to address a growing environmental issue, whilst also creating a new source of precious metals for the business. Each year, more than 50 million tonnes of electronic waste is produced globally, with less than 20% currently being recycled. This is forecast to reach 74 million tonnes by

2030. The team estimates that 99% of the UK's waste circuit boards are currently being shipped overseas to be processed using environmentally damaging high temperature smelters.

This new process uses patented chemistry to recover over 99% of the precious metals contained within the circuit boards of laptops and mobile phones at room temperature. Instead of electronic waste leaving UK shores to be processed at high temperatures, processing can be done at the South Wales plant. Embracing the principles of a circular economy, the plant will be able to process the entire circuit board; preserving natural resources for longer and helping to reduce the





“We are transforming our business for the future - expanding into areas which complement our expertise in precious metals, champion sustainability and support employment. Our investment in a new plant will see The Royal Mint deliver sustainably sourced precious metals and provide the UK with a much-needed domestic solution to the growing problem of electronic waste.”

**Anne Jessopp**  
Chief Executive  
The Royal Mint



environmental impact of electronic waste. When fully operational, the plant will be processing up to 90 tonnes of UK-sourced circuit boards per week, generating hundreds of kilograms of gold each year.

Construction of the plant begins in Spring 2022. The new business venture will support around 40 jobs, helping existing employees to reskill, as well as requiring new chemists and engineers.



**Contact:**  
**The Royal Mint**  
**w:** [www.royalmint.com](http://www.royalmint.com)  
**t:** 0845 6005018  
**e:** [press.office@royalmint.com](mailto:press.office@royalmint.com)



**Llantrisant**

# Brewing up solutions for a sustainable future

**Bluestone Brewery is joining forces with Swansea University and Phytoquest to reduce CO<sub>2</sub> emissions and develop new products.**

**Bluestone Brewery, the ethical and sustainable brewery, based in Pembrokeshire, West Wales, are always on the lookout for ways to reduce their carbon footprint and have won several awards for their efforts at sustainable production.**

Their most ambitious project to date, working with Swansea University and Phytoquest Ltd of Aberystwyth is to capture CO<sub>2</sub> naturally produced by the action of yeast in the brewing process. The CO<sub>2</sub> will be used to create valuable biomass, in the form of microalgae, that can be used in the production of foods and medicines. The global market for microalgae is estimated at US\$3.4 Billion.

Dr Alla Silkina, Swansea University Centre of Sustainable Aquatic Research, explains:

“This is the first application of its kind in Wales. It is currently only being trialled in one place in Australia. We will use 1,000L raceway and 400L PBR for the remediation process and algal biomass production.”

Phytoquest, a pharmaceutical discovery company, is looking for new and improved medicines from compounds found in plants and through chemical synthesis. Increasingly they have also been interested in developing food supplement and cosmetic ingredients using plant based pharmaceutical discoveries.



“We have done a small amount of work on algae with Swansea University and found some new compounds that have potential as neuroprotectants or anti-ageing components for cosmetics. In this project we will focus on potentially high value chemicals such as these new compounds. Our skills are in finding new chemicals and we are very excited to have the chance to work with the larger amounts of the algae produced as part of this project.”

**Robert Nash**  
CEO  
Phytoquest

The partners have worked together to come up with an innovative solution to reducing CO<sub>2</sub> waste and environmental impact at the same time as producing microalgae biomass that can be used as a product itself or can be developed further into other higher value products.

Ultimately the challenge for this project is to make the whole process effective at reducing CO<sub>2</sub> emissions and creating value from the algal product. The more effective the CO<sub>2</sub> reduction and the greater the value, the higher chance the technology will be adopted world-wide and implemented at scale.

The project is currently in the research phase but the team plan to move to commercialisation if the outcomes are successful.

**Contact:**

**Alla Silkina**

w: [www.swansea.ac.uk](http://www.swansea.ac.uk)

e: [a.silkina@swansea.ac.uk](mailto:a.silkina@swansea.ac.uk)



**Newport, Pembrokeshire**