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Secrets of the fruit fly microbiome

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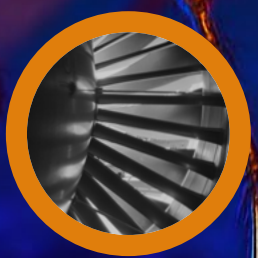

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THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY

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In Issue 107, Advances Wales continues to highlight pioneering projects that support the Welsh Government's Innovation Strategy Missions – education, economy, health and wellbeing, climate and nature. This edition showcases research and technologies that are reshaping science, public services and everyday life across Wales.

Our cover story explores new findings from Bangor University on the microbiome of wild fruit flies. Using DNA sequencing and metagenomics, researchers have uncovered a level of microbial diversity far greater than previously recognised, revealing hidden bacterial communities that influence insect health, evolution and environmental adaptation.

Welsh researchers continue to push the boundaries of discovery. Swansea University scientists have helped demonstrate that blood platelets store fragments of DNA, which opens new possibilities for earlier and less invasive cancer detection. Cardiff University's identification of eight new genes linked to schizophrenia deepens understanding of a complex condition and creates opportunities for targeted therapies. Meanwhile, spinout Draig Therapeutics is advancing a new generation of treatments for neuropsychiatric disorders.

Cardiff-based Laennec AI is transforming smartphones into intelligent digital stethoscopes, enabling continuous monitoring for people with chronic respiratory and cardiac conditions, supporting more sustainable models of care. Cardiff researchers are developing AI that interprets medical images more like a radiologist, improving diagnostic accuracy and easing pressure on clinical services .

Wales also remains at the forefront of environmental and industrial innovation. BionerG and Llysfasi Agricultural College are demonstrating how tree brash can be converted into high-quality biochar, supporting soil health while delivering verifiable carbon removals. In industry, Wall Colmonoy's advanced vacuum casting facility is accelerating aerospace innovation and strengthening the UK supply chain, while Transport for Wales is leading the UK in immersive VR-based staff training to enhance safety and operational readiness.

Gwyn Tudor
Editor

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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.

For information on how to contribute features contact the editor, tel 029 2047 3455
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Have you created a new technology or carried out research in Wales?
If so, we'd love to hear from you...
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Live rocket firing launches space innovation in North Wales

North Wales has taken a major step into the UK space sector with the opening of a state-of-the-art Space Test and Training Centre (STTC) at Llanbedr, Gwynedd. The facility, based at the former airfield in Eryri (Snowdonia), was recently unveiled with a live rocket engine firing and a high-altitude balloon launch, signalling the region's arrival on the national space stage.

The Centre offers advanced testing infrastructure to support the development of rockets, spacecraft and near space technologies. On site facilities include a centrifuge to test high-g tolerances, a multi-axis vibration table to simulate launch conditions, an aerostructures test rig, and a dedicated teaching laboratory. The centre also features a thermal vacuum chamber capable of recreating the extreme temperatures and near-vacuum of space. Propulsion and flight systems can be validated using the rocket engine test stand and two adjustable rail launchers, which support both vertical rocket launch profiles and horizontal take-off trajectories for rocket-powered aircraft.

The site also provides access to expanded Special Use Airspace over Cardigan Bay, enabling flight testing for microgravity research, re-entry systems and near space vehicles. With dedicated STEM education programmes, the STTC aims to accelerate product development while inspiring the next generation of space engineers.

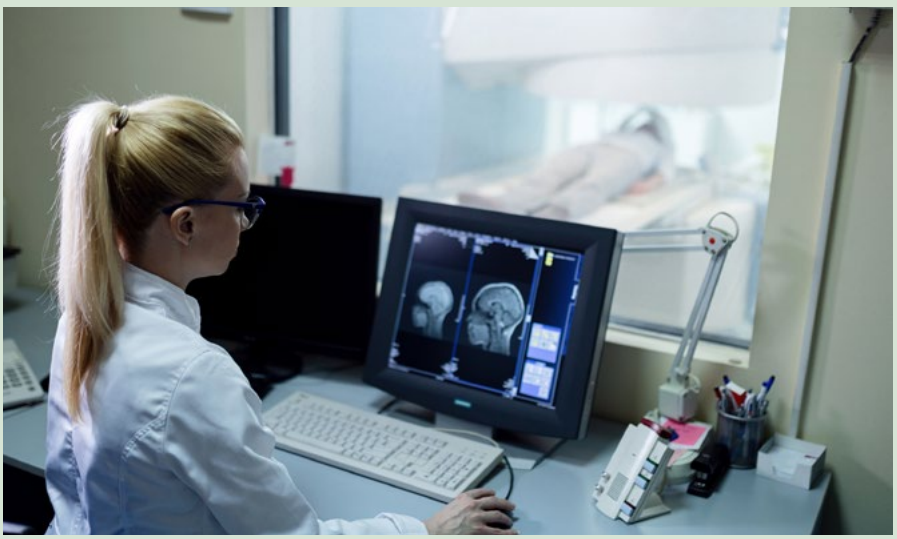
The Space Centre will shortly be opening its gates to the UK's first dedicated Space Engineering and Flight Test Training Course and is hosting the Welsh Heats of the national UKROC and CANSAT Competitions.

www.radicalmoves.co.uk

New radiopharmacy to produce vital medicines

A new £7.6m radiopharmacy facility is being established in Newport to manufacture radioactive injectable medicines for NHS patients across Southeast Wales.

The site will produce radiopharmaceuticals, specialist medicines used primarily in diagnostic imaging, including scans that detect cancer, heart disease and other serious conditions. These medicines contain precisely controlled radioactive isotopes, which emit signals that scanners use to create highly detailed images inside the body. Because radioactivity declines rapidly over time, their useful life can be measured in hours, sometimes less. Once the signal weakens, the medicine is no longer effective for imaging, meaning it cannot be stored for long periods or transported over long distances.



This makes local production essential. A dedicated facility in Southeast Wales will help ensure hospitals receive these time-critical medicines when they are needed, supporting faster diagnosis, reducing delays, and strengthening resilience in the supply chain for patients across the region.

The development forms part of the Transforming Access to Medicines (TrAMs) programme, a national initiative to modernise pharmacy technical services and strengthen the supply of specialist treatments, including anti-cancer medicines and intravenous nutrition.

Delivered by NHS Wales Shared Services Partnership (NWSSP), the project is designed to support growing demand for advanced diagnostics while improving the reliability and responsiveness of medicine supply.

nwssp.nhs.wales

AI drives carbon reduction in the ceramics industry

Researchers are using Artificial Intelligence (AI) to help reduce the carbon footprint of the ceramics industry.

A collaboration between Aberystwyth University and Parkinson-Spencer Refractories (PSR), is developing machine-learning tools to optimise how ceramic products are arranged inside industrial kilns. The goal is to pack the kilns as densely and efficiently as possible, increasing productivity while cutting energy use and emissions.

PSR manufactures ceramic components of various shapes and sizes that must be fired in large, energy-intensive kilns. At present, these kilns achieve an average volume utilisation of only around nine per cent, owing to the irregularity of the products and the complexity of manual loading. This low efficiency can limit output and increase energy consumption and carbon emissions.

The research team is designing algorithms capable of computing the optimal way to stack thousands of unevenly shaped objects within a confined space, a challenge that combines advanced mathematics with practical industrial engineering. Even modest improvements in kiln utilisation could deliver dramatic benefits: higher production capacity, lower fuel costs, and significant reductions in greenhouse-gas emissions.

> **"Creating innovative, customised algorithms to optimise the dense packing of complex-shaped objects will lead to a significant reduction in the ceramic industry's carbon footprint, driving critical environmental benefits."**
>
> **Dr Mughal,**
> Aberystwyth University

As Wales moves towards its net-zero targets, initiatives such as this demonstrate the role that mathematicians are helping to re-engineer one of the oldest manufacturing processes on Earth.

www.aber.ac.uk

IN BRIEF

Small businesses harness digital insights

A new online guide has been launched to help small businesses and independent retailers harness the power of digital technology and data to strengthen operations, attract customers, and future-proof their place on the high street. The Smart Towns Wales toolkit is designed to make crucial analytics and evidence more accessible, offering practical advice on how businesses can use digital tools. From monitoring footfall to boosting online visibility, strengthening cyber security to using AI for smarter marketing, the guide highlights practical, high-impact areas where data can drive real results. Drawing on anonymised data sources such as Wi-Fi analytics, sensors, mobile networks, and Bluetooth beacons, the guide demonstrates how insights once reserved for large corporations can now be used by smaller, independent businesses to make smarter decisions. The guide is free to download from the Smart Towns Cymru website: www.smarttowns.cymru/en/home.

Calon: One year on from groundbreaking

A year has passed since the groundbreaking ceremony for Calon, the new Computing, Engineering and Technology building at the University of South Wales. The five-storey development will house more than 40 teaching, learning and research spaces, including electronics and hydraulics labs, a flight simulator, a robotics lab, clean and industrial research areas, collaborative teaching facilities, virtual reality capability and exhibition spaces. Significant changes have taken place on the Treforest campus during construction. Two buildings were demolished. Ground stabilisation was followed by the installation of 186 concrete piles to create the foundations. Almost 950 tonnes of reinforced steel have been used. More than 140 people have been involved in the project. The next phase includes steel framing, weatherboarding, window installation and external cladding. Calon is designed to achieve high standards of operational energy efficiency and low embodied carbon and will incorporate a range of green technologies for heating, power generation and lighting.

UK's first small modular reactor for Anglesey

Wylfa on Anglesey has been chosen as the site for the UK's first small modular reactor nuclear power station. The location, set on the North Wales coast, has a long history in the nuclear sector dating back to the 1960s. Small modular reactors are designed to be quicker and less complex to build than traditional nuclear power stations, while still providing significant generating capacity. The project at Wylfa is expected to produce enough clean electricity to power the equivalent of around three million homes once operational. Construction is forecasted to support up to 3,000 skilled jobs at its peak, offering a major boost to the local economy. The investment, valued at more than £2.5 billion, adds to a growing programme of government support for North Wales, which includes the Anglesey Freeport as well as an Investment Zone focused on advanced manufacturing which includes planned improvements to the North Wales mainline rail route.

Innovation in repair and fibre optic research

Comtek Network Systems in Deeside is expanding its role as a centre for sustainable engineering through advanced repair services and significant new research activity. The company operates specialist facilities where engineers restore and reuse critical telecoms and roadside systems, extending equipment lifespans, improving network reliability and helping to reduce electronic waste across UK transport and communications networks. Comtek is investing in innovation through a partnership with Bangor University and Sorrento Networks to develop fibre optic technologies that use distributed sensing to monitor road networks in real time. This research aims to identify faults before they escalate, supporting safer, smarter and more efficient transport systems. More than £2 million has already been invested supporting a transition to greener, lower-cost and more resilient infrastructure. This activity reflects the growing strength of North Wales as a hub for advanced engineering and optical technologies, underpinned by collaboration between industry and academia.

Gene therapy shows promise in slowing Huntington's disease

A global clinical trial involving Cardiff University researchers has reported encouraging results for a new gene therapy designed to slow the progression of Huntington's disease. The treatment is delivered directly into the brain during a 12-to-18-hour surgical procedure. The Advanced Neurotherapeutics Centre at Cardiff University is the only UK facility capable of carrying out the surgical component of the trial. Professor William Gray, Director of the centre, performed the gene therapy procedures for the UK participants. Early findings from the research team at UCL show that patients receiving the therapy experienced around 75 per cent less disease progression compared with a matched group of people not receiving the treatment. This marks the first time a clinical study has demonstrated a sustained and statistically significant slowing of Huntington's progression. The trial sponsor, uniQure, now plans to seek accelerated approval from the US Food and Drug Administration early next year, with regulatory submissions in the UK and Europe expected to follow.

How dying stars forge the dust needed for planets and life

Researchers led by Cardiff University have obtained evidence showing how cosmic dust, the raw material for planets and potentially life, is forged in space. Using the James Webb Space Telescope (JWST), the team have captured the process unfolding inside the Butterfly Nebula.

The United Nations endorsed project, known as

Cosmic dust is made of microscopic grains of minerals and organic compounds. Some grains have irregular atomic structures, while others form highly ordered crystals resembling tiny gemstones. Until now, exactly where and how these crystalline particles formed in space remained unclear.

The new observations confirm that crystals emerge inside a dense, stable ring of gas and dust, known as a torus, that surrounds dying stars. The findings show this region acts as a cosmic workshop, producing dust rich in the ingredients needed to form rocky planets.

The telescope also detected complex carbon-based molecules, including polycyclic aromatic hydrocarbons, on the torus surface and along turbulent gas bubbles. These compounds, also found in crude oil on Earth, formed in more energetic, chaotic regions, highlighting multiple dust formation pathways within a single nebula.

JWST's Mid InfraRed Instrument enabled the team to map dust types and structures at different wavelengths, revealing detail previously hidden.

The discovery not only explains stellar dust formation but also offers clues to how the building blocks of Earth and other rocky planets may have first emerged.

www.cardiff.ac.uk

Smart tech supports independent living

New assisted-living technologies developed and tested in Wales are helping older people remain in their own homes for longer. Aberystwyth University's SMART Home Lab is trialling a fully functioning connected bungalow designed to evaluate real-world applications of smart devices in social care. The facility tests technologies such as voice-activated assistants and smart speakers that can prompt medication reminders, support remote GP consultations and alert carers if appliances have been left on. The Supporting Care Circles project adds an online dashboard that gathers data from sensors placed throughout a home, allowing families, carers and health professionals to monitor movement, appliance use, room temperature and whether cupboards or blinds have been left open. The lab provides a space to co-create technologies and assess how they perform in daily living environments. It also brings together health and social care professionals, technology developers and older people to explore new solutions that can prevent unnecessary hospital admissions and support earlier discharge.

Carbon-capture cement plant moves into construction

Wales is set to host one of the UK's first carbon-capture enabled industrial projects as Heidelberg Materials UK prepares to begin construction of its pioneering facility at Padeswood in Flintshire. The site will become the UK's first carbon-capture cement plant, marking a major step in reducing emissions from one of the most carbon-intensive industries. The project will capture around 800,000 tonnes of CO_2 each year from the existing cement works. Carbon capture is essential for cement production, which cannot fully decarbonise through fuel switching or efficiency improvements alone. The new facility will allow the company to produce net-zero evoZero cement, supporting the wider construction sector in cutting its carbon footprint. Padeswood will feed the captured CO_2 into the Liverpool Bay CO2 Transport and Storage network. The development is expected to support skilled jobs in North Wales and provide long-term security for the cement industry by establishing a viable route to decarbonisation.

Microbes mapped for geothermal heating

Scientists from Aberystwyth University have created a detailed map of the microbes living in abandoned coal mines, helping to unlock the potential of mine water as a low-carbon heat source for UK homes. Around a quarter of properties in Britain sit above disused mines, where naturally warmed groundwater offers the opportunity for geothermal heating. Mine water schemes are already proving their value, with projects across the UK heating hundreds of homes. However, these underground environments are rich in bacteria that can influence water chemistry, corrode infrastructure or cause biofouling. The team sampled water from old mine workings across south Wales and used DNA sequencing to identify and map the microbial communities present. The study shows that these microbes play a significant role in cycling iron and sulphur, affecting acidity, metal content and water quality. By understanding how microbial activity varies across the coalfield, the research will help engineers design more efficient and resilient geothermal systems.

Wave energy converter accelerates

Checkmate Flexible Engineering is advancing its Lobe-Tendon Anaconda wave energy technology through an 18-month development programme known as Môr Neidr. The project will deliver new hardware, testing capability and research infrastructure to help improve the performance and technology readiness of their wave energy technology ahead of planned sea trials at the Welsh Marine Energy Test Area. The converter uses a patented bulge-tube design made from reinforced natural rubber and supported by internal tendons. As waves travel along the tube, they create pressure bulges that move towards a power take-off unit, where the energy is converted into electricity. These bulges can be tuned either for maximum power output or for enhanced survivability in rough conditions. The initiative builds on two years of innovation. Over the coming months, the team will undertake numerical modelling, tank trials, dry testing and materials assessment, and will construct a section of a quarter-scale prototype.

Next-generation battery technology

A new research partnership between Swansea University and the University of Limerick is accelerating the development of cutting-edge sodium metal batteries. The project brings together expertise in battery materials and design with strengths in component development to create an "anode-free" battery that avoids handling sodium metal during manufacturing. Using sodium, an abundant and widely available element, offers a more sustainable and cost-effective alternative to lithium. The resulting batteries have the potential to deliver higher energy density than established lithium iron phosphate systems, with lightweight designs suited to applications such as electric vehicles. The collaboration aims to extend the cycle life of these anode-free batteries and advance the next generation of clean energy storage technologies. By supporting advances in sodium-based storage, the Swansea–Limerick collaboration contributes to long-term energy resilience and industrial sustainability across both nations.

Secrets of the fruit fly microbiome

Researchers from Bangor University and the University of North Carolina, have uncovered remarkable diversity in the bacteria that live inside wild fruit flies, findings that could reshape understanding of how insects and their microbes evolve and interact with the environment.

Using advanced DNA sequencing and metagenomic techniques, the team has, for the first time, closely studied the microbial communities living within individual wild fruit flies.

DNA sequencing is a method that reads the genetic code, the series of chemical "letters" that make up an organism's blueprint, allowing scientists to identify which species of microbes are present and what genes they carry. Metagenomics goes a step further by analysing all the genetic material in a mixed community at once, rather than studying each species separately. This provides a much broader picture of how different microorganisms live and work together.

By combining these techniques, the researchers were able to uncover not only how diverse the microbial partners inside fruit flies are, but also what roles they play in the insects' health, survival, and interactions with their environment.

Microbes, short for microorganisms, are tiny living things such as bacteria, viruses and fungi that can have profound effects on the organisms they inhabit. Insects, like humans, host complex communities of these microbes, collectively known as the microbiome, which can influence everything from nutrition to immunity.

Until now, most research on fruit fly microbiomes has focused on laboratory-reared insects, which tend to host only a few well-studied bacterial species. In contrast, this new study shows that wild fruit flies carry a far richer and more complex array of bacteria, many of which appear to have evolved alongside their insect hosts.

The research team collected DNA by squashing and sequencing individual fruit flies, reconstructing more than 100 complete bacterial genomes. Each genome represents the full genetic blueprint of a bacterial species, revealing what metabolic processes it performs and how it interacts with its host.

Analysis of these genomes showed that the bacteria living inside fruit flies can perform a range of important functions. Many can break down sugars and gases such as methane, while others produce natural chemicals that can kill harmful microbes. These traits may help fruit flies digest food, resist infection, and adapt to their surroundings.

The researchers also found that the bacterial species discovered in fruit flies are distinct from those found in bees, suggesting they have evolved along different paths and adapted to specific insect hosts. This points to co-evolution between insects and their microbial partners, a dynamic relationship that may have helped both groups survive in changing environments.

"The study highlights how little is still known about the microbes that live with insects in the wild. We found new types of bacteria and learned about the jobs they do. Wild fruit flies have much more diverse and complex bacteria than people usually expect. The genomes we've generated for those bacteria provide a first step towards identifying the molecules they produce and the functions they perform."

Dr Aaron Comeault
Bangor University

The study used long-read DNA sequencing technology to assemble 103 high-quality metagenome-assembled genomes (MAGs) from bacteria associated with six species of fruit flies collected in North America, Europe and Africa.

By linking microbial diversity with function, the research opens the door to studying how bacteria influence insect health and evolution in their natural environments, and how these relationships could be harnessed for beneficial use.

This pioneering work provides new insight into host–microbe partnerships in wild animals and highlights how cutting-edge DNA technology can reveal the hidden ecosystems within even the smallest organisms. The findings also suggest a rich source of novel microbial genes and natural compounds that could one day be used to inspire innovations in medicine, agriculture, and biotechnology.

Contact
Bangor University

www.bangor.ac.uk
01248 383298
press@bangor.ac.uk

BANGOR

Turning smartphones into stethoscopes

A Cardiff-based medtech company is transforming everyday smartphones into AI-powered digital stethoscopes, enabling people with chronic respiratory and cardiac conditions to monitor their health from home

Laennec AI has developed a solution that uses a smartphone's microphone and a low-cost adapter to detect subtle changes in breathing in real time. More than a diagnostic device, the platform also acts as a personal health coach, helping people with chronic obstructive pulmonary disease (COPD) and severe asthma to manage their conditions on a daily basis.

The innovation marks a move away from costly hardware stethoscopes towards a more accessible, mobile-first model, designed from the user's perspective and aligned with NHS needs. By enabling remote consultations and continuous monitoring, the technology empowers both patients and healthcare professionals. Patients can proactively track their respiratory and cardiac health, while clinicians are able to monitor progress and respond to changes without the need for in-person examinations. This approach not only improves patient outcomes but also reduces emergency hospital visits.

Laennec AI's intelligent stethoscopes have been designed around four pillars: accuracy, interoperability, intelligence and aesthetics. Unlike conventional devices, they are capable of tracking, storing and sharing information in audio and video formats. Integrated with machine learning and artificial intelligence, the system provides predictive insights to support healthcare professionals in making better decisions. The stethoscopes include a touchscreen display, a graphical user interface and a companion application that runs on both mobile and PC platforms, combining advanced functionality with user-friendly design.

The company has embraced a bottom-up approach using Health Needs Assessment (HNA), a public health tool that ensures technology development is grounded in real-world user requirements. This evidence-based method has guided the design to ensure the device is cost-effective, practical and affordable, compared with existing solutions.

Sustainability is also central to Laennec AI's vision. The company has adopted a green growth strategy, using environmentally friendly materials where possible. By enabling at-home monitoring and reducing unnecessary hospital visits, the technology contributes to lowering carbon emissions.

The global potential is significant. The stethoscope market is projected to reach £628 million by 2028. With remote healthcare and telemedicine surging since the Covid-19 pandemic, Laennec AI's approach is set to become increasingly central to mainstream healthcare delivery.

By turning smartphones into advanced monitoring devices, Laennec AI is pioneering a new generation of accessible, AI-enabled respiratory care. Its work promises not only to improve patient lives but also to ease pressure on health services.

Dr Jase John, CEO and Co-Founder at Laennec AI, explained: "Our goal is to give patients the tools they need to manage their health proactively and prevent avoidable hospital admissions.

Contact

LAENNEC AI

www.laennec.ai.
@ jase@laennec.ai

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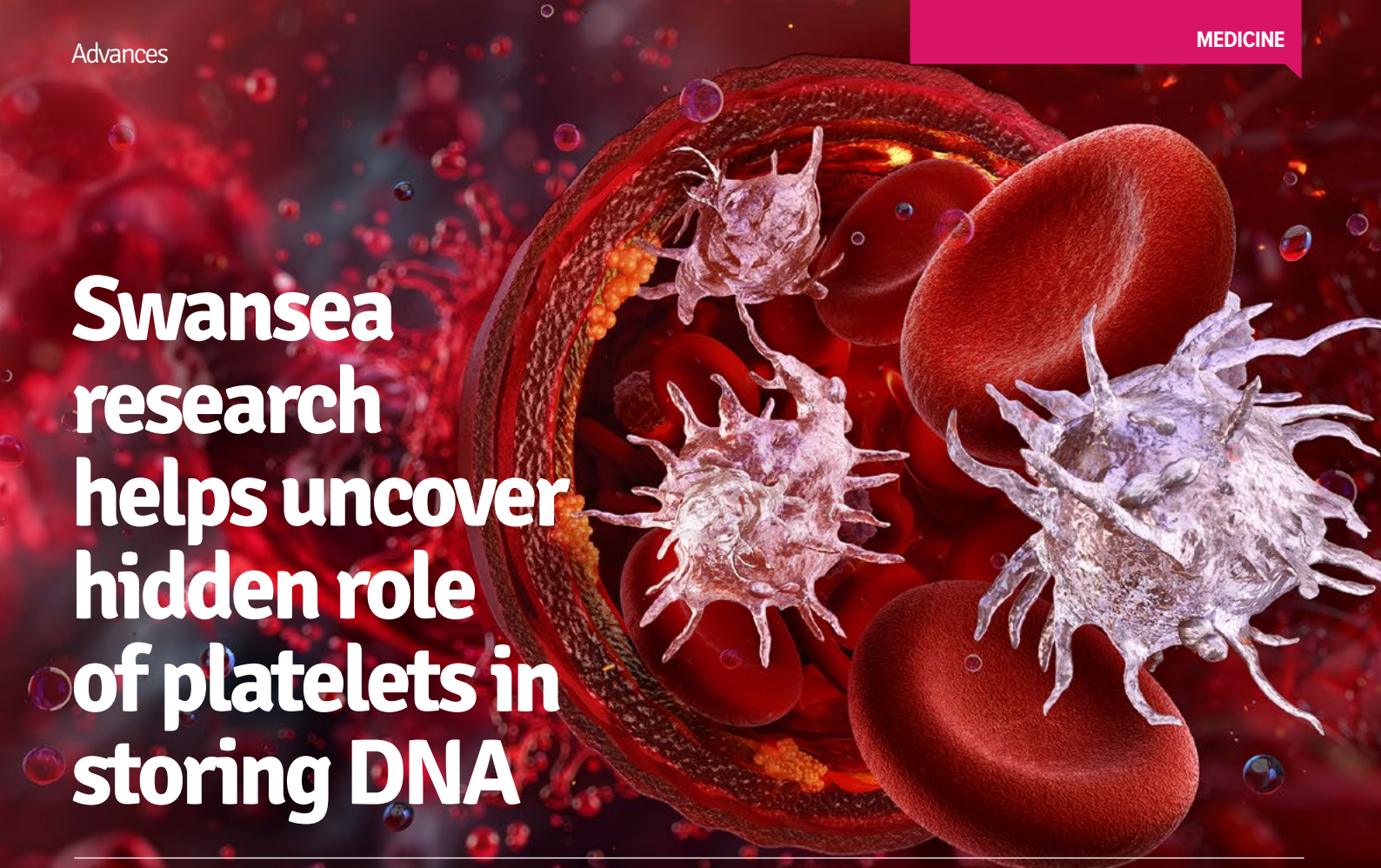

Swansea research helps uncover hidden role of platelets in storing DNA

Researchers at Swansea University have played a key role in a major international discovery showing that platelets, the tiny blood cells best known for clotting, also store DNA, a finding that could transform the future of cancer screening.

The study, led by the University of Oxford, involved specialists from Swansea University's Faculty of Science and Engineering. Using advanced microscopy and data analysis, the Swansea team helped confirm that platelets act as microscopic scavengers, capturing and storing fragments of DNA circulating in the bloodstream. These fragments include mutated DNA from cancer cells and even foetal DNA during pregnancy.

When cells die, they release genetic material into the blood. This free-floating DNA can sometimes trigger immune responses or contribute to disease, but until now, scientists have not fully understood how it is cleared from the body. The new study shows that blood platelets absorb and preserve these DNA fragments, helping to clean the blood and maintain immune balance.

Analysis of platelet DNA from a simple blood test has already been shown to detect early genetic changes linked to cancer, paving the way for more accurate and less invasive screening.

> **"The role of platelets, which are primarily involved in blood clotting, in absorbing cell-free DNA from the blood was completely unforeseen. The protection they give to the DNA fragments from degradation in the bloodstream means that this source of platelet DNA is ideal for detecting mutations that indicate diseases such as cancer at a very early stage."**
>
> **Professor Paul Rees**
> Swansea University

Liquid biopsy blood tests are already emerging as a powerful tool for cancer detection, but these methods typically discard platelets before analysis. The new findings suggest that valuable genetic information may be lost by doing so.

In another striking result, the researchers identified fragments of foetal DNA inside platelets from pregnant mothers, indicating new potential for improving non-invasive prenatal testing.

If further clinical trials confirm the findings, platelet DNA analysis could become part of routine diagnostics, offering a simple blood test capable of detecting cancer and other conditions much earlier than current methods allow.

Professor Rees said: "This is a perfect example of how interdisciplinary collaboration, drawing on engineering and biomedical expertise, can deliver discoveries that have the potential to transform healthcare."

The study shines a light on Swansea's expanding role in global life science research, helping uncover new insights that could change how diseases are diagnosed and monitored.

Contact

Swansea University

www.swansea.ac.uk
01792 602706
f.e.white@swansea.ac.uk

SWANSEA

Next-generation therapies for neuropsychiatric disorders

A Welsh drug discovery company has secured £107 million investment to develop pioneering treatments for neuropsychiatric disorders.

Draig Therapeutics, a spinout from Cardiff University, is building on decades of expertise in brain biology to address urgent unmet medical needs in conditions such as major depressive disorder, where existing therapies often fail to provide adequate relief and come with a range of limiting side effects. Neuropsychiatric disorders do not only cause tremendous burden to patients and their families, they also represent one of the largest challenges to society: According to the WHO approximately 1 in every 8 people globally are affected and the global economic cost of neuropsychiatric disorders were estimated to be £1.90 trillion.

The company's research focuses on the Glutamate and GABA pathways, which are central to maintaining balance in the brain's signalling networks. Glutamate is the primary excitatory neurotransmitter, driving neural activity and GABA (Gamma-Aminobutyric Acid) is the main inhibitory neurotransmitter, suppressing over-activity. Together, they act as the brain's "accelerator and brake". When the balance between excitation and inhibition is disrupted, the result can be a range of neuropsychiatric disorders including depression, anxiety and schizophrenia.

The company's approach centres on highly targeted allosteric neuromodulators, molecules that fine-tune receptor activity with greater precision than traditional drugs. This restores the balance in neurotransmission safely and effectively, an approach that has eluded previous generations of compounds.

Three new drug candidates form the company's initial development pipeline. DT-101 is a next-generation AMPA receptor modulator, a type of medicine that fine-tunes excitatory signalling of Glutamate. It has been designed to overcome the limitations of earlier compounds, which often had a narrow therapeutic window, (a small margin

> **"We have unique expertise in safely and effectively modulating the core Glutamate and GABA pathways, which are critical in neuropsychiatric disorders. Our knowledge of balancing chemical neurotransmitters underpins our pipeline of novel treatments."**
>
> **Professor Simon Ward**
> Chief Scientific Officer & Founder

between an effective dose and one that could cause harm). With a wider safety margin, DT-101 aims to better regulate glutamate signalling in the brain without compromising patient safety.

DT-201 and DT-301 selectively target specific subtypes of the GABAA receptor. Previous, less selective drug candidates often interacted with multiple receptor subtypes, increasing the likelihood of unwanted side effects. By narrowing this focus, these new compounds aim to retain therapeutic benefit while reducing adverse reactions. Both are expected to advance into clinical development within the next year.

For patients, these therapies have the potential to transform treatment by addressing the root causes of brain network dysfunction, rather than simply alleviating symptoms. The efficacy and safety profile of its compounds, once established by robust clinical trials, could mark a step change in how major depressive disorder and related conditions are managed.

With a strong scientific foundation, advanced clinical pipeline with focus on unmet patient need, and the support of a world-class syndicate of life science investors, Draig Therapeutics' work represents a major milestone. One that places Wales at the heart of international efforts to tackle some of the most challenging neuropsychiatric disorders.

Contact

Draig Therapeutics
www.draigtherapeutics.com
info@draigtherapeutics.com

Cardiff University
www.cardiff.ac.uk
info@draigtherapeutics.com

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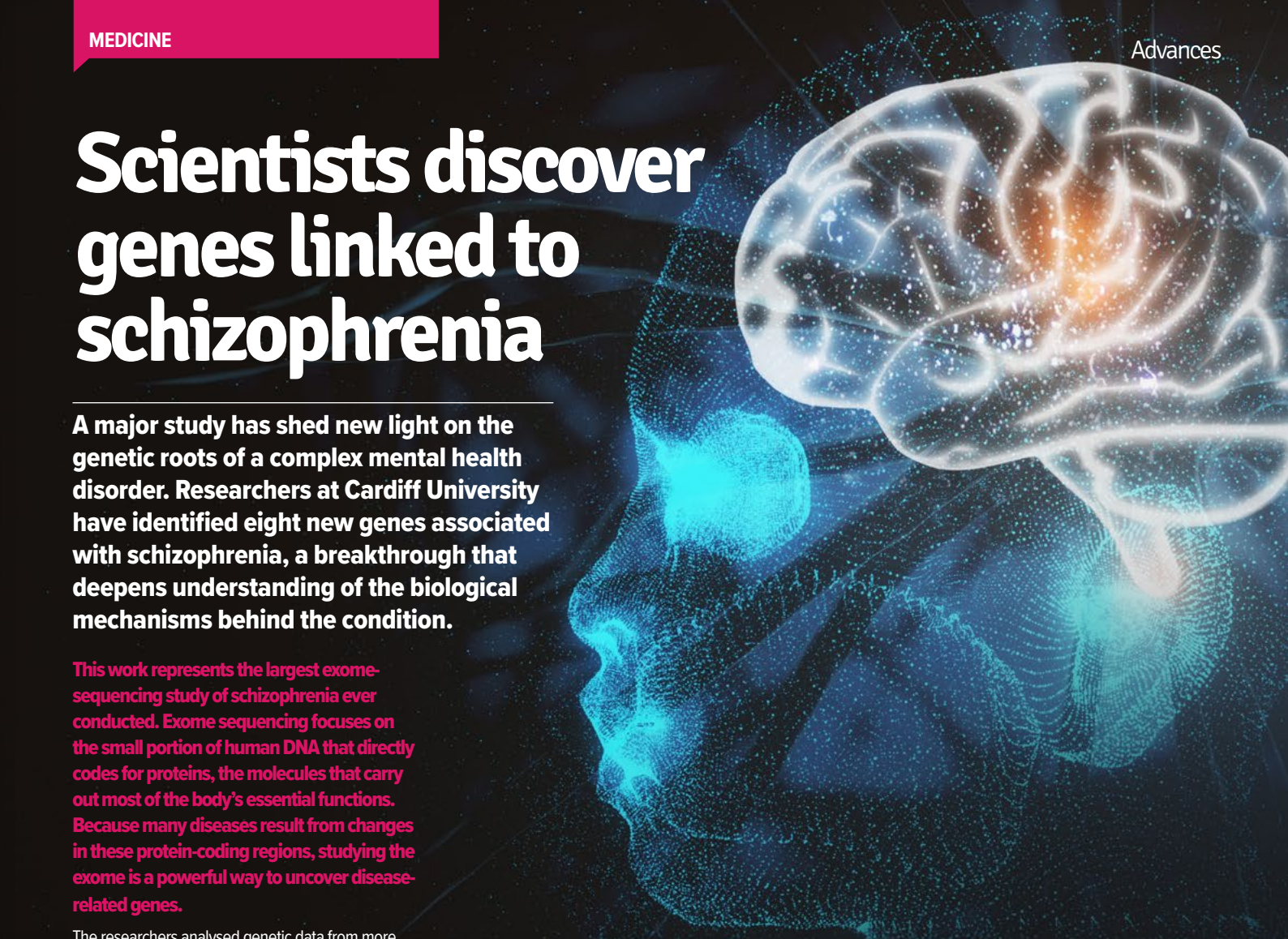
Scientists discover genes linked to schizophrenia



A major study has shed new light on the genetic roots of a complex mental health disorder. Researchers at Cardiff University have identified eight new genes associated with schizophrenia, a breakthrough that deepens understanding of the biological mechanisms behind the condition.

This work represents the largest exome-sequencing study of schizophrenia ever conducted. Exome sequencing focuses on the small portion of human DNA that directly codes for proteins, the molecules that carry out most of the body's essential functions. Because many diseases result from changes in these protein-coding regions, studying the exome is a powerful way to uncover disease-related genes.

The researchers analysed genetic data from more than 135,000 individuals worldwide, including 28,898 people with schizophrenia, 103,041 without the condition, and 3,444 families affected by the disorder. They looked for rare but significant mutations, which are changes in DNA that can strongly influence how proteins function, and found that certain mutations occurred far more frequently in people with schizophrenia.

Two genes, STAG1 and ZNF136, were identified as being strongly linked to the condition, while six more were found to have moderate associations.

Two of the newly identified genes, SLC6A1 and KLC1, are particularly significant, as they represent the first schizophrenia risk genes linked solely through missense variants, a type of genetic change that swaps one amino acid for another in a protein. Even small alterations of this kind can disrupt how brain cells communicate or how proteins fold and function.

PhD student Sophie Chick explained: "These findings are informative because they suggest that schizophrenia might be associated with changes in how DNA is organised within cells, and also to disruptions in how brain cells communicate using a chemical called GABA."

GABA (gamma-aminobutyric acid) is a key neurotransmitter, a chemical messenger that allows brain cells to send signals. Disruption to GABA pathways has previously been linked to a range of mental health conditions.

The study also revealed overlapping genetic connections between schizophrenia and other conditions. Four of the newly identified genes - STAG1, SLC6A1, ZMYND11, and CGREF1 - have previously been related to autism, epilepsy, and developmental delay, strengthening the evidence that these disorders share common genetic foundations.

Until now, only a limited number of schizophrenia risk genes had been confirmed. This new research marks a significant leap forward, expanding the number of genes confidently associated with the disorder and offering new avenues for drug development and targeted therapies.

While clinical translation remains a long-term goal, the discovery offers new hope that understanding the genetic architecture of schizophrenia could one day lead to more effective, personalised treatments.

"Rare genetic variants have long been known to have a role in schizophrenia, but identifying specific genes linked to these mutations has been a major challenge.

Dr Elliott Rees
School of Medicine
Cardiff University

Contact

Cardiff University

www.cardiff.ac.uk
graya8@cardiff.ac.uk

CARDIFF

Teaching AI to examine medical images

Researchers at Cardiff University and the University Hospital of Wales (UHW) have developed a new artificial intelligence (AI) model that analyses medical images more like a trained radiologist.

A new study demonstrates how input and expertise from clinicians can make AI tools more accurate, reliable, and easier to trust in clinical settings.

To train the system, the researcher team, led by Professor Hantao Liu, created the largest and most reliable visual saliency dataset for chest X-rays ever produced. Visual saliency refers to the parts of an image that naturally attract human attention, in this case, the areas radiologists focus on when searching for signs of disease. The dataset was built from more than 100,000 recorded eye movements as 13 radiologists examined fewer than 200 chest X-rays.

This data was used to train a new AI model, CXRSalNet (Chest X-ray Saliency Network) to identify which areas of an image are most relevant for diagnosis, effectively teaching it where to look. When combined with existing AI systems, this approach improved diagnostic performance significantly. IT also showed promise in bringing machine decision-making more closely in line with expert human judgement in initial testing.

By mimicking the visual attention patterns of trained clinicians, the system helps AI interpret images in a way that reflects real-world diagnostic reasoning.

Computers can already detect changes in medical images with remarkable precision, but humans bring contextual understanding and knowledge of where abnormalities are most likely to appear. The team's approach combines these strengths, improving both the accuracy and interpretability of automated systems.

The research also addresses pressing staff challenges in healthcare. The UK currently faces a 29% shortfall in consultant radiologists, according to the Royal College of Radiologists' 2024 census. At the same time, demand for diagnostic imaging continues to rise. Integrating AI that can "think" more like a human could help reduce reporting backlogs, speed up decision-making, and enhance patient care.

> **"If we can implement solutions such as this into clinical practice, it has the potential to enhance radiological workflow and reduce delays in care."**
>
> **Dr Richard White**
> Consultant Radiologist
> University Hospital Wales

The team now plans to extend their work to CT and MRI scans, with a focus on improving cancer detection, where subtle visual cues are critical and often challenging to identify. They are also exploring how the technology can be used in medical training, helping to guide new radiologists in how to interpret images efficiently and accurately.

By capturing how experts see and applying this insight to AI, the researchers are helping to build systems that are not only smarter, but also more transparent and aligned with human clinical expertise, a step forward for medical imaging in Wales and beyond.

Contact
Cardiff University

www.cardiff.ac.uk
graya8@cardiff.ac.uk

CARDIFF

Forging the future: Aerospace foundry accelerates innovation

A Welsh company is establishing one of the most sophisticated vacuum casting facilities available to industry, opening new opportunities for innovation, sustainability and collaboration across advanced manufacturing.

Wall Colmonoy, a specialist in high temperature and wear resistant materials, is investing in next generation production capability for the aerospace and defence sector.

Central to the development is a new equiaxed vacuum casting furnace, designed to create high performance alloys in a precisely controlled, oxygen free environment. Unlike traditional foundries, where metals are melted in open air, vacuum casting protects sensitive alloys from contamination, delivering greater purity, reliability and structural integrity. This level of precision is critical for components such as turbine blades, aerospace systems and defence applications, where materials must perform under extreme heat and mechanical stress.

The term equiaxed refers to the grain structure of the metal as it solidifies. In equiaxed casting, the alloy forms grains that are uniform in all directions, like small, evenly sized crystals. This structure improves mechanical properties, making components stronger, more reliable and less susceptible to weak points.

Alongside the new furnace, the company is deploying a digital twin approach to metal casting. Using advanced simulations of metal flow, mould design and pour rates, engineers can model the casting process virtually before production begins. This reduces waste, lowers costs and speeds up design optimisation, delivering higher quality outcomes more efficiently.

Vacuum Precision Investment Caster being installed at Wall Colmonoy's Pontardawe site

The company has also established a strategic partnership with Rolls Royce, dedicating around one third of the new foundry's capacity to aerospace engine applications. The collaboration enables advanced alloys and components to move from design to production faster, supporting the development of next generation defence technologies. The capability is expected to shorten development timelines and strengthen manufacturing resilience across the UK defence supply chain.

Sustainability is also a core focus. The facility will enable the recycling of legacy aerospace components, many of which are no longer flightworthy, by recovering valuable first- and second-generation alloys. These materials can then be recast into components for modern defence and industrial applications, converting waste into strategic value.

> **"We are building a furnace capable of casting parts up to 200 kilograms, which will be one of the largest and most advanced commercially available vacuum casting furnaces in the UK, possibly in Europe. With our digital foundry, we can create a digital twin of the part and run it through the process virtually. This means we can achieve right first-time manufacturing when we cast the physical part."**
>
> **Chris Weirman**
> Technical Director

The facility marks a major shift in accessibility. Previously, this level of casting capability was largely limited to major civil and defence aerospace organisations. The new foundry will be commercially available to the wider defence and industrial community, enabling faster, more efficient production of critical components.

Contact

Wall Colmonoy

www.wallcolmonoy.com

SWANSEA

Deep learning drives next generation of crop improvement

Scientists at Aberystwyth University have developed powerful artificial intelligence (AI) tools that can automatically measure plant seeds and seed pods, creating the opportunity to accelerate the process of breeding higher-yielding, more resilient crops.

The innovation comes in a number of flavours, depending on the crop, and combines advanced computer vision and deep-learning techniques to analyse thousands of images of plant fruits. By automatically identifying and measuring features such as length, width, area and predicting volume, the system replaces the slow, manual recording of traits that has traditionally limited the speed of crop improvement. The new approach delivers what is known as high-throughput phenotyping. In one instance, MorphPod, large-scale, automated measurement of physical characteristics collected precise data from more than 300,000 individual fruits in a single study, while still attached to the plant. A related tool, DeepCanola, is designed for brassica related crops such as Rapeseed and cabbages.

Phenotyping is central to modern plant breeding, linking the visible characteristics of a plant, its phenotype, to the underlying genetics that determine how it grows, yields and resists disease. MorphPod uses image recognition to extract these measurements, allowing researchers to map variation in the morphology of podsto specific regions of the plant's DNA, helping scientists identify the genes that influence pod size and shape. This process, known as genetic mapping, gives breeders valuable targets for selecting and combining desirable traits in future crop varieties.

> **"The tool represents a step-change in the accessibility of large-scale plant analysis. AI tools like the one we have developed have the potential to revolutionise how we develop new varieties of crops. By removing technical and time barriers, deep learning enables more researchers to explore plant traits at a scale that wasn't practical before."**
>
> **Kieran Atkins**
> PhD researcher and project lead

Deep learning refers to a type of AI model called a deep neural network, which learns complex patterns in data from large numbers of training examples. In this case, the network is trained to recognise the visual features of seed pods in photographs and to calculate their dimensions automatically. The result is consistent, unbiased data that can be used for detailed statistical analysis.

Professor John Doonan at Aberystwyth University, said: "The breakthrough demonstrates how advanced imaging, and AI can transform crop science. Deep learning can now provide data with the quality and accuracy required for genetic analysis and breeding. This is an important step toward scalable, data-rich phenotyping that supports more predictive approaches to crop improvement."

Although the technology was first tested on a small model plant commonly used in laboratories, the same methods have proven effective for agricultural species such as oilseed rape, cabbages, oats, barley and wheat. The team has made the MorphPod and DeepCanola software freely available online so that other research groups around the world can adapt it for their own crops.

This fusion of technology and biology is helping to future-proof farming, with Welsh research playing a key role in shaping the next generation of sustainable agriculture.

Contact
Aberystwyth University

www.aber.ac.uk
07496 914301
ctn1@aber.ac.uk

ABERYSTWYTH

Tree brash, a critical resource for carbon removal

Welsh company BionerG, working with Llysfasi Agricultural College, is demonstrating how tree brash, the branches and foliage left after felling, can become a reliable raw material for biochar and a practical route to carbon removal. The collaboration is turning what was once a disposal challenge into a consistent supply of high-quality soil conditioner.

Tree brash is widely available across Wales but has often gone to waste because it is bulky, difficult to handle and costly to transport. This project tackles the problem at source by compressing brash into dense, uniform bundles that can be stacked, dried and fed into processing equipment as a consistent material. In doing so, it creates a circular solution, a forestry by product becomes a valuable resource that improves soil quality and locks away carbon for the long term.

Biochar is a stable, carbon rich material made by heating plant matter, such as tree brash, in low oxygen conditions, a process known as pyrolysis. Rather than burning to ash, the biomass is thermally converted into three outputs, a solid (biochar), liquids, (bio-oil and tars), and gases (syngas). In modern systems, the gases are typically reused to provide heat for the process, helping to make production energy efficient and largely self-sustaining.

Biochar itself is not new. Its benefits have been recognised for centuries, from early agricultural practices to modern soil science. What sets this work apart is its focus on overcoming the practical barriers to production. By optimising the way branch material is collected and processed, standardising moisture content and bundle size, and maintaining close control over the heating process, the team has developed a system that delivers measurable, repeatable results.

The outcome is a reliable method that supports on-farm soil improvement and can be monitored in real time, generating carbon removal that can be verified, audited, and trusted by the carbon markets.

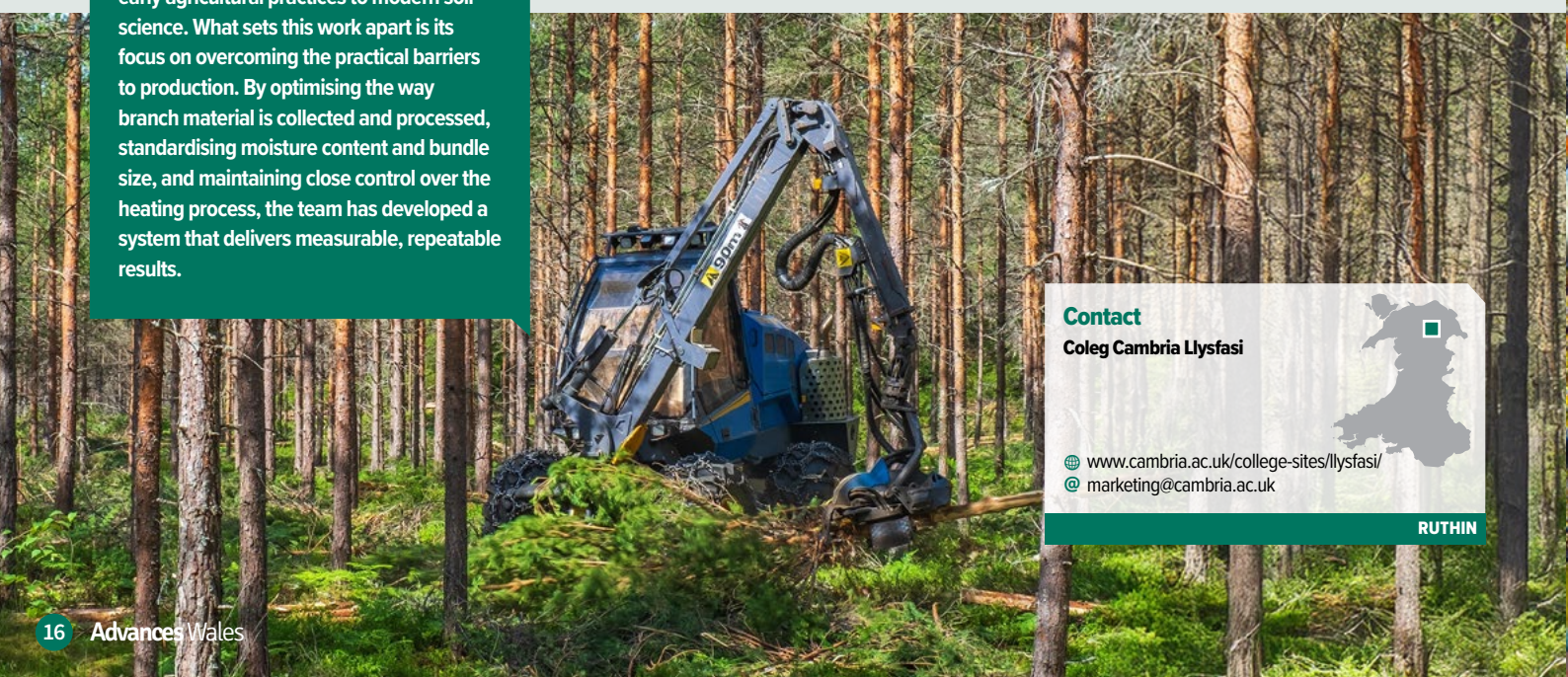
A key stage is branch logging, compacting loose brash into dense, uniform logs at the point of collection. Using specialist equipment, branches are compressed into cylindrical bundles that can be stacked, dried and handled in much the same way as conventional logs. This increases material density, improves stacking stability, reduces soil contamination caused by dragging loose piles, and makes transport and drying significantly more efficient. Once the wood reaches the correct moisture level, it is ready for controlled thermal conversion into biochar.

Conversion takes place through pyrolysis, the decomposition of organic material in the near absence of oxygen. For carbon removal, the primary product is biochar, a stable, carbon dense form that can persist in soil for decades to centuries, while also improving soil structure, water retention and nutrient availability when applied appropriately.

BionerG's production facility, the ECKO, Ecology Carbon Knowledge Outreach, Centre, is built for high throughput, year-round operation, with undercover drying and efficient feed systems to keep kilns running reliably. The site uses renewable energy, including thermoelectric generation, to minimise operational emissions, setting a benchmark for low carbon biochar production. The Centre also has a strong knowledge sharing mission, providing practical training, field demonstrations and open access to performance data so other sites can adopt proven methods rather than starting from first principles.

Llysfasi provides access to brash and field sites for testing handling, densification and soil application. BionerG leads on process engineering, quality control and commercial development, ensuring the resulting biochar meets agricultural needs while delivering measurable carbon benefits. The model aims to retain value within rural communities, creating new markets for forestry residues and giving farmers a dependable soil amendment that enhances productivity and resilience.

The immediate priorities are consistent production, rigorous quality assurance and large-scale field trials across a range of soil types. The long-term vision is a scalable blueprint for converting tree brash into a locally produced tool for soil health and carbon removal, delivering benefits for land managers, rural economies and the climate.



Contact

Coleg Cambria Llysfasi

www.cambria.ac.uk/college-sites/llysfasi/
marketing@cambria.ac.uk

RUTHIN

Hidden forces beneath the waves

Bangor University scientists help reveal how unseen ocean dynamics could hold the key to coral survival under climate change.

New research led by Bangor University and King Abdullah University of Science and Technology (KAUST) argues that the fate of the world's coral reefs cannot be understood without looking far below the surface.

For decades, predictions about reef decline have relied mainly on satellite measurements of sea-surface temperature. While valuable for identifying heat stress events such as bleaching, these models overlook powerful physical processes operating in the deeper ocean. Currents, internal waves, and upwelling can deliver cool, nutrient-rich water to reefs or, conversely, trap heat in subsurface layers.

Researchers analysed over 1,000 studies and found that fewer than ten per cent considered ecological and oceanographic information. The authors argue that this separation of disciplines has hindered accurate forecasting and effective conservation.

The data identifies global regions where oceanographic processes such as upwelling and internal tides strongly influence reef ecosystems. In some cases, these forces can protect corals. For example, during the 2015 El Niño, reefs at Palmyra Atoll survived thanks to deep currents delivering cooler, nutrient-rich water into the shallows. Elsewhere, such as the Chagos Archipelago and Moorea in French Polynesia, unseen subsurface heat layers intensified bleaching, escaping detection by satellites.

Understanding reef resilience is not only about sea surface temperature, but also about the physical mechanisms that can either buffer or amplify stress, and how these interact with the nutrient environment essential for reef health.

Supporting studies strengthen this perspective, showing how ocean currents during El Niño events can enhance upwelling and deliver nutritional subsidies to corals and other reef organisms like fish. Meta-analyses of upwelling effects reveal that such processes are highly context-dependent, sometimes beneficial, sometimes harmful, depending on local depth, current strength and pollution levels.

This integration of ocean physics and reef ecology revives a long-standing principle in marine science, linking physical conditions to the existence of marine life.

The researchers are calling for renewed cooperation between ecologists, oceanographers, and data-modelling specialists, supported by expanded in-situ sensor networks capable of measuring subsurface temperature and flow. Improved models could better target conservation investment, identify natural climate refuges, and guide global reef-management policies.

"Coral reefs are not isolated from their surroundings. They are shaped by a dynamic seascape of moving water, nutrients, and temperature layers. Many current climate models of reef survival can only tell part of the story."

Dr Laura Richardson
The study's lead-author
Bangor University

Contact
Bangor University
www.bangor.ac.uk
01248 383298
press@bangor.ac.uk

BANGOR

Rediscovering Wales's elusive hidden giants

Once thought to be vanishing from UK seas, the mysterious angelshark (squatina squatina) may be far more common off the Welsh coast than previously believed. New research is transforming understanding of one of the world's most elusive sharks and offering hope for its future.

Unlike most sharks, the angelshark is broad and flat, resembling a stingray. It spends much of its life lying motionless on the seabed, half-buried in sand or mud, waiting to ambush unsuspecting prey. Growing up to 2.4 metres (8 feet) long, its speckled, caramel-coloured skin makes it a true master of camouflage.

Once common throughout the North-East Atlantic, the species suffered severe declines due to habitat loss and accidental capture in fishing nets. Some studies estimated reductions of up to 70% since the 1970s, earning it a place on the International Union for Conservation of Nature (IUCN) Red List as Critically Endangered. Wales, however, has emerged as a stronghold for this unique species, one of the last places in northern Europe where angelsharks are still regularly recorded.

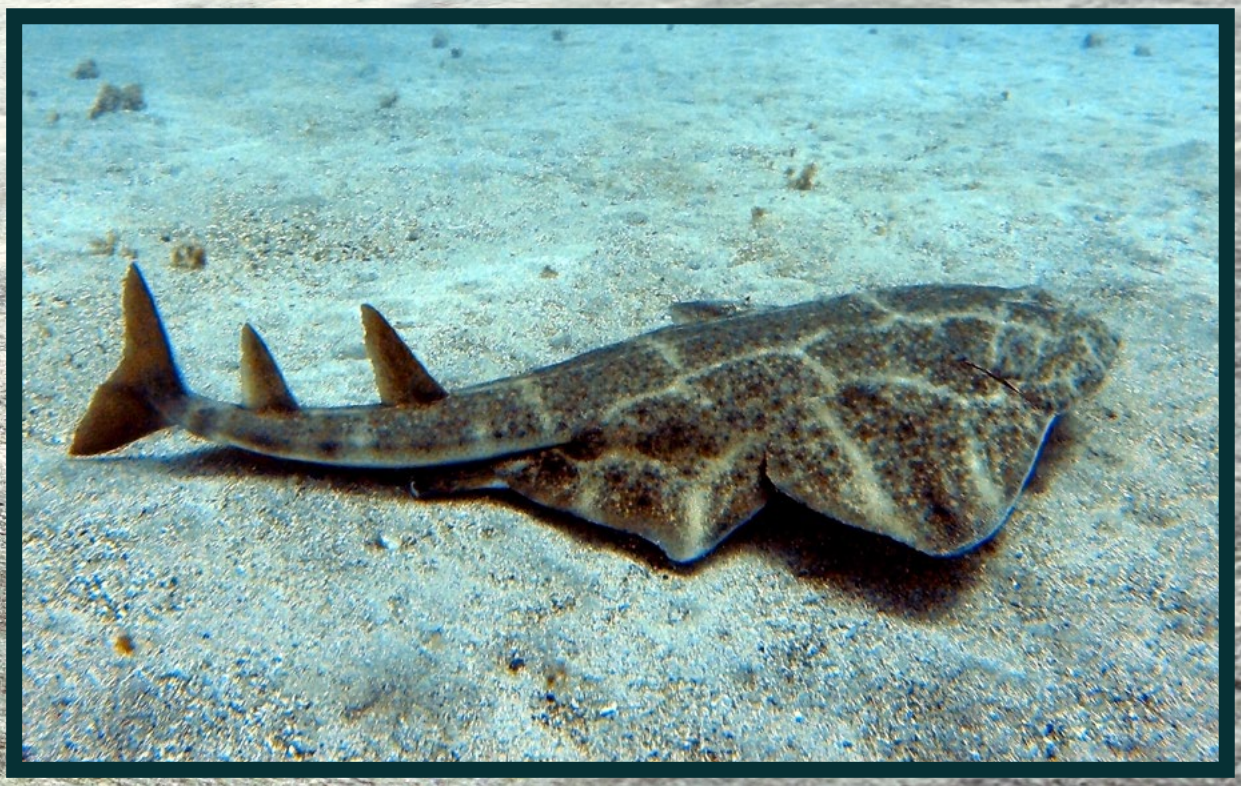
This latest study, led by the Zoological Society of London (ZSL) and Natural Resources Wales (NRW), brings encouraging news. Drawing on over five decades of fishing records and interviews with 27 fishers, researchers found that Angel sharks may be more abundant than previously thought, but harder to spot due to changes in fishing practices.

Between 1980 and 2020, more than 1,600 angelsharks were reported in Welsh waters, with notable concentrations around Cardigan Bay and the Llŷn Peninsula. The research suggests that declining sightings reflect shifts in fishing methods, such as more selective gear, changes in target species, and new regulations, rather than dwindling populations.

Lead author Francesca Mason from ZSL's Institute of Zoology explained: "This finding offers real hope for this Critically Endangered native species. While fewer accidental catches are a positive sign, it also means we need new ways to monitor them."

To reach these conclusions, the team worked closely with the Welsh Fishermen's Association (Cymdeithas Pysgotwyr) and Angling Cymru Sea Anglers, combining scientific expertise with decades of local knowledge.

Charlie Bartlett, a charter fisherman from Gwynedd and co-author of the study, said: "I've spent more than 50 years working along the coast and have been lucky enough to see angelsharks several times. They are unlike any other shark here, large, flat, and beautifully camouflaged. Being part of this project has helped us understand more about them and share that knowledge with the next generation."



Historical research revealed that Angel sharks have a deep cultural connection with Wales. Known traditionally as Maelgi, they feature in maritime folklore and were once referred to by more than a dozen regional names, including Monkfish, Banjofish, and Devilfish. This long relationship with coastal communities adds cultural depth to the scientific importance of conserving them today.

Because of their secretive nature, angelsharks are notoriously difficult to study. Now, scientists are turning to environmental DNA (eDNA), a cutting-edge tool that detects genetic traces shed by animals into their surroundings. By analysing fragments of skin, mucus, or blood found in seawater, researchers can confirm the presence of species without needing to see them.

This method is being applied through Angel Shark Project: Wales, part of the wider Project SIARC (Sharks Inspiring Action and Research with Communities), a ZSL/NWR led project, which brings together researchers, fishers, and coastal communities.

"With their incredible camouflage, angelsharks are very difficult to locate. eDNA allows us to identify where they live without disturbing them. By studying water samples from Cardigan and Carmarthen Bays, we've confirmed the presence of Angel sharks, skates, and rays, species that are otherwise very hard to monitor in these turbulent waters."

Jake Davies
Technical Specialist
Project SIARC

The research showcases Wales as a leader in community-driven marine conservation. By combining traditional knowledge with modern science, researchers are building a clearer picture of the health of native shark populations and helping to safeguard one of Europe's rarest predators.

Contact
Natural Resources Wales

naturalresources.wales
enquiries@naturalresourceswales.gov.uk

SWANSEA

Bridging the gap - training in VR

Transport for Wales (TfW) has become the first UK train operator to deploy immersive virtual reality (VR) training for front-line staff.

Developed with technology partner Denova, the system allows trainees to rehearse safety-critical procedures, on a lifelike digital twin of a train and a typical station environment, before they move on to a real platform or depot. The aim is to bridge the gap between classroom theory and real-world practice.

At the heart of the programme is a high-fidelity VR model of the Class 197 cab, door control areas and platform settings. Wearing a headset, trainees can explore the virtual cab, practise using controls, check route information and even use a whistle when preparing to dispatch a train. The software allows the user to interact with the on-board phone and speak to a driver or signaller played by the instructor in the classroom, so communication protocols can be drilled as part of each exercise. Because everything is simulated, staff can rehearse rare or risky situations safely and repeatedly, building muscle memory without exposure to live operational risk.

Scenario content covers everyday train dispatch across a range of platform layouts. It also prepares trainees for situations that are difficult to recreate in real life, such as dispatching during signal failure, bringing a train to a controlled stop, managing an on-board fire, and responding to suspicious items. Instructors control each session from a tutor console, introducing faults in real time and pausing or rewinding scenarios for review and feedback.

The approach mirrors best practice in other safety critical sectors. Immersive rehearsal creates realistic pressure and timing while delivering consistency across training sessions: every learner encounters the same conditions, and instructors can branch scenarios to test judgement and decision-making. Crucially, much of this learning can happen in a standard classroom, reducing dependency on scarce platform slots or rolling stock at the earliest stages of training.

TfW stresses that VR supports rather than replaces practical training. Learners build confidence and consistency in the simulator and then transition to supervised sessions on real platforms and trains. Over time, the software can expand with new stations, rolling stock variants and seasonal conditions, keeping training aligned with operational reality.

For passengers, the benefits are straightforward: better-prepared staff deliver safer, more reliable dispatch, clearer communication during incidents and faster recovery from disruption. By letting teams practise challenging and exceptional cases in advance, TfW is investing in a workforce that is confident, competent and consistent when it matters most.

Denova's chief executive, Brendan Morris, describes the system as a dispatch simulator analogous to a driver cab simulator but focused on platform and customer operations. "It allows trainees to practise degraded or emergency situations they might seldom see, but need to be competent in," he said. "Transport for Wales have really led the way with this innovation, and we're already seeing interest from other UK operators."

Lee Alexander, a Conductor Instructor with 18 years' experience, welcomed the change. "You can test out situations you just wouldn't typically experience when taking trainees out," he said. "I must have trained hundreds of conductors—this would have been fantastic for them."

Contact

Transport for Wales

www.tfw.wales

media@tfw.wales

PONTYPRIDD