ISSUE 106

THE JOURNAL FOR SCIENCE, ENGINEERING AND TECHNOLOGY

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The secret lives of Cardigan Bay dolphins

An innovative research project sheds new light on the secret lives of Cardigan Bay's iconic bottlenose dolphins through a combination of cutting-edge science, community involvement, and a bit of detective work.

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In Issue 106, Advances Wales continues to highlight pioneering projects that support the Welsh Government's Innovation Strategy Missions - education, economy, health and wellbeing, climate and nature - showcasing research and technologies that are reshaping science, public services, and everyday life.

This edition features a diverse range of innovations that are shaping the future of science, health, and environmental stewardship across the nation. From the frontiers of quantum physics to the heart of healthcare and conservation, Welsh universities, health boards, and technology pioneers are forging bold new pathways.

Early cancer diagnosis takes a transformative leap as CanSense and the University of Wales Trinity Saint David unveil an AI-driven blood test that could significantly reduce the need for invasive procedures. Meanwhile, researchers in Swansea are redefining the limits of quantum mechanics with work that could suppress quantum noise, offering profound potential for sensing and fundamental physics.

Digital transformation is a continuing theme, with Bangor University's digital twin platform providing real-time insights into the health of Wales's freshwater lakes, while Lumin Solutions' case management system is set to revolutionise child social care. In rural healthcare, a robotic medication dispenser is being trialled to improve access to urgent medicines—enhancing equity and efficiency in remote communities.

This issue also explores key environmental and ecological challenges: from tracking antimicrobial resistance in wastewater systems to uncovering the secret lives of Cardigan Bay's bottlenose dolphins through environmental DNA. In the realm of animal behaviour, researchers at Aberystwyth University reveal that horses use a surprisingly rich range of facial expressions, some once thought exclusive to primates.

Together, these breakthroughs demonstrate how Welsh science is delivering tangible impact, combining academic excellence, community insight, and technological ingenuity to address some of the most pressing and fascinating challenges of our time.

Gwyn Tudor
Editor

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For information on how to contribute features contact the editor, tel 029 2047 3455
email: advances@teamworksdesign.com

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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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Virtual Reality for Real World Training

Swansea-based Imersifi is establishing itself as a leading innovator in immersive technology, developing Virtual Reality (VR) applications for training and education across multiple sectors.

At the heart of this work is the Imersifi Platform, a VR-based training system designed to immerse users in hyper-realistic environments where they can practise skills, respond to simulated scenarios, and build knowledge in a safe, controlled setting. Unlike conventional classroom or e-learning approaches, VR places users directly into virtual spaces that closely replicate real-world conditions. This helps improve retention, engagement, and performance, while offering flexibility across fields such as healthcare, engineering, and advanced manufacturing.

Among the company's innovations is its TouchFree AI Kiosk, developed in collaboration with Swansea University. This system introduces a voice-controlled interactive experience, allowing users to ask AI personas questions on complex topics, notably semiconductor technology. The kiosk uses advanced hand-tracking technology alongside natural language AI to provide a hands-on learning experience without physical contact. It has been deployed at the Centre for Integrative Semiconductor Materials in Swansea and at public outreach events, helping to demystify semiconductor processes for students, researchers, and industry professionals.

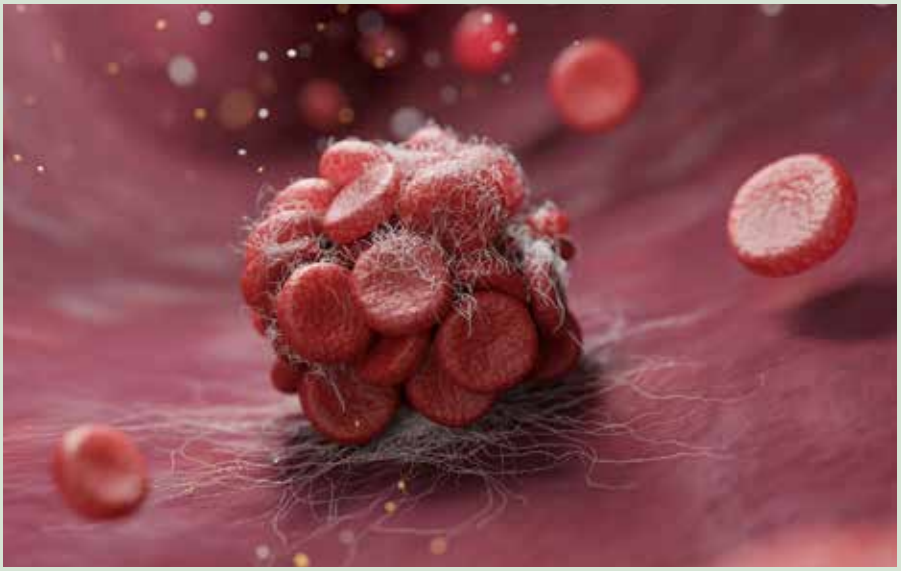
Imersifi has also created a series of VR applications, including Sand to Semiconductor, a virtual experience aimed at guiding younger learners through the complex production process of compound semiconductors. These applications demonstrate how VR can simplify intricate industrial processes, making them accessible to a wider audience while supporting skills development.

www.imersifi.com

Rheology research could transform blood clot diagnosis

A research project led by Swansea University is developing a new type of blood test that could significantly improve the diagnosis and treatment of blood-clot-related conditions, helping to reduce pressure on the NHS.

The work focuses on understanding how blood clots form and break down, which plays a critical role in medical emergencies such as strokes, heart attacks and deep vein thrombosis. These conditions cause thousands of hospital admissions and deaths each year.



The research team is using rheology, the study of how materials flow and deform under stress, to observe how blood behaves during clotting. This has led to the discovery of a key biomarker that helps track the full lifecycle of a blood clot, from formation to breakdown.

The new test measures changes in the rheology of blood in real-time, offering insights that current diagnostic methods cannot provide. This could help doctors better tailor treatments for individual patients, reducing the risks linked to clotting disorders, including excessive bleeding caused by overtreatment.

The research also incorporates microfluidic technology, which controls tiny amounts of fluid through microscopic channels, similar in scale to blood vessels. This allows scientists to study how clots break down in vessels of different sizes, offering a more precise and realistic understanding of how treatments might work in the body.

With existing treatments carrying risks, particularly serious bleeding, there is a clear need for improved diagnostic tools to support safer and more effective treatment decisions.

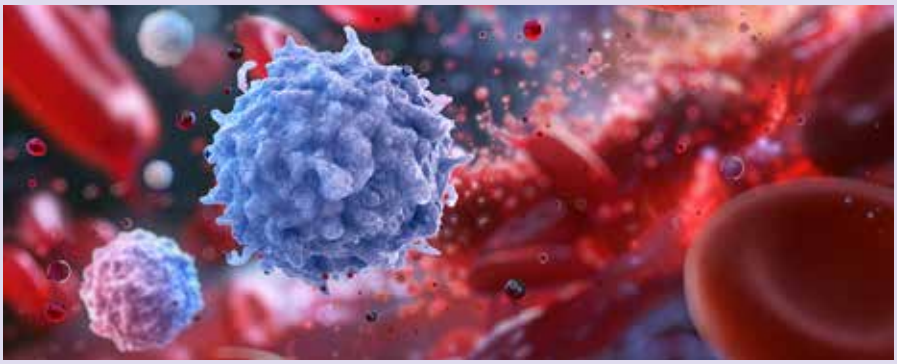
www.swansea.ac.uk

Expanding impact with scalable T cell testing platform

Cardiff-based ImmunoServ is at the forefront of immunological assessments and diagnostics, developing laboratory and home-based testing platforms that measure T cell responses — an important indicator of long-term immunity.

T cells are a type of white blood cell that help the body identify and eliminate infected or abnormal cells. Whilst antibodies can also help identify prior infection or vaccination, T cells often provide longer-lasting immune "memory". Once exposed to a virus or bacterium, memory T cells are primed to recognise it in the future and mount a fast, more effective response.

ImmunoServ's platform works by exposing a person's blood sample to short protein fragments from specific pathogens. If memory T cells in the sample recognise these fragments, they are activated and release certain biological signals, such as cytokines. These signals are then measured in the laboratory, allowing scientists to detect and quantify immune memory. This approach has been shown to offer a more detailed and durable picture of immunity to certain infectious diseases than antibody testing alone.



To improve accessibility, the company has developed user-friendly blood collection kits. These kits allow individuals to obtain blood samples at home and send samples to the lab without the need for specialist equipment or clinical procedures.

The company is also working with researchers across multiple national and international universities to expand the clinical applications of its technology. This includes evaluating vaccine responses and identifying protective immunity against infectious diseases in individuals, including in those with low or undetectable antibody levels. These collaborations are helping to demonstrate how T cell testing can be used to create novel diagnostics and help support clinical trials by enabling researchers to track immune responses to experimental drugs and vaccines in real time.

The team is now applying its platform to other areas, including autoimmune conditions such as multiple sclerosis, where the immune system attacks healthy tissue, and cancer immunotherapy, where monitoring T cell activity helps assess how well treatments are working. In future, it is thought that T cell analysis will inform more personalised treatment strategies, while in vaccine research, it will help identify the most effective immune responses to further improve vaccine design.

www.immunoserv.com

IN BRIEF

Genetic approach personalised training

Welsh company Genletics is specialising in genetics-based fitness optimisation. Their core technology analyses DNA markers linked to circadian rhythms to identify an individual's "metabolic peak" the time of day when their body is naturally primed for optimal training performance. Using an at-home cheek swab kit, Genletics collects and processes samples in their lab, interpreting genetic data to produce personalised reports. These reports are used to indicate when users can maximise workout gains and minimise strain. The approach combines circadian genomics, bioinformatics, and sports science to provide actionable insights. The company's technology has been adopted by professional sports teams and fitness organisations, offering athletes and individuals a tailored method to improve training efficiency through personalised timing.

Shining a light on space solar power

Swansea and Loughborough Universities have joined forces to develop lightweight cadmium telluride (CdTe) solar cells on ultra-thin glass, aiming to transform solar power for space applications. This technology offers the potential of a low-cost, high-performance alternative to conventional solar cells used in satellites and emerging space-based manufacturing. Currently, multi-junction solar cells dominate space missions due to their high efficiency, but their weight and complex production limit scalability. CdTe-on-glass solar cells, successfully tested in orbit aboard the AlSat-Nano CubeSat, are lighter, simpler to produce, and more resistant to radiation—key advantages for long-term use in space. The technology has already reached 23.1% efficiency on Earth and is targeting 20% in space environments. The collaboration leverages expertise and facilities at both institutions. Swansea's Centre for Integrative Semiconductor Materials is expanding its expertise into space technologies, while Loughborough brings specialist capability in solar and optoelectronic device analysis.

Zip-Clip drives global growth with export-led innovation

Mid Wales-based Zip-Clip is expanding its global presence through advanced suspension and bracing technologies developed in response to international demand. The company, which designs and manufactures high-specification wire rope systems, supplies sectors including construction, HVAC (heating, ventilation, and air conditioning), and seismic protection. Recent R&D has resulted in the launch of a heavy-duty splicing system for prefabricated piling reinforcement cages. Designed to eliminate manual handling risks during installation, the system has already been adopted by customers in New Zealand. Zip-Clip is also behind a newly listed seismic sprinkler system, approved by major insurers for fire protection applications. The company's innovation is increasingly shaped by its export markets, with new products engineered specifically for territories like New Zealand and Mexico. The company continues to invest in market-specific R&D, driven by opportunities in developing regions such as India.

Wales launches 400 MW wind power projects

Wales' publicly owned renewable energy developer, Trydan Gwyrdd Cymru, has announced proposals for three major new wind farms, designed to deliver up to 400 megawatts (MW) of clean electricity. This would meet the annual electricity needs of around 350,000 Welsh homes – approximately a quarter of all homes in Wales. The technology-led schemes represent a key step towards its target of developing 1 gigawatt (GW) of renewable generation capacity on public land by 2040. All three projects will be developed on the Welsh Government's woodland estate, which offers some of the country's best sites for wind energy. As part of Wales' wider decarbonisation strategy, aiming for 100% renewable electricity by 2035. Trydan Gwyrdd Cymru reinvests all profits into Welsh communities and public services, ensuring local benefit from renewable energy development.

Welsh-Galician collaboration on tidal turbine innovation

A new partnership is accelerating the development of advanced tidal turbine blades. Led by Menter Môn Morlais Ltd, operator of Europe's largest consented tidal energy scheme, the project brings together players from Wales and Galicia to design and test next-generation turbine blades optimised for harsh tidal conditions. The collaboration, part of the VInnovate programme, which supports collaborative innovation between Wales and Galicia, includes AMRC Cymru, ORE Catapult, and Galician engineering firms Magallanes Renovables and D3 Applied Technologies. The project aims to improve blade efficiency, durability, and manufacturability, key factors for scaling tidal energy as part of a net zero energy mix. The partnership merges advanced manufacturing expertise, innovative hydrodynamic design, and real-world deployment experience. Prototype blades will be developed and tested for performance and resilience in the strong tidal flows off the coast of Ynys Môn, helping to commercialise tidal technology and build long-term industrial capacity.

Swansea data powers global push to protect ocean giants

Research backed by Swansea University has contributed to the largest global study of marine megafauna ever undertaken, identifying key areas of the ocean in urgent need of protection.

The United Nations endorsed project, known as MegaMove, involved nearly 400 scientists from over 50 countries and tracked more than 100 species, including turtles, whales, dolphins, sharks, rays and seabirds. Using more than 12,000 movement tracks, the team mapped how these species migrate, feed and rest across over 70 per cent of the world's oceans.

Wales played an important role in the international effort, with Swansea University contributing satellite tracking data on green and hawksbill turtles in the Caribbean and Indian Ocean.

The findings show that while the new United Nations High Seas Treaty aims to protect 30 per cent of the ocean, more than 60 per cent of vital habitats for marine megafauna will remain exposed to human pressures. The study highlights the need for additional measures such as improved fishing regulation and better management of shipping traffic to help reduce the impact of human activity.

The MegaMove project demonstrates the power of international scientific collaboration, with Welsh expertise at the centre of efforts to protect some of the ocean's most iconic and threatened species.

"We helped define the critical habitats used by marine megafauna. These areas are essential for breeding, migration and feeding, and are increasingly threatened by fishing, shipping, pollution and climate change."

Dr Nicole Esteban
Swansea University

www.swansea.ac.uk

Trial targets agricultural plastic pollution in rivers

A new trial in south Wales is testing an innovative approach to reduce plastic pollution from farms by recycling up to 200 tonnes of agricultural plastics. The The Natural Resources Wales (NRW) Four Rivers for LIFE project focuses on silage wrap and similar materials, which are a major source of pollution across a number of river catchments. Plastic waste in rivers can harm wildlife and increase flood risk. This new scheme addresses the issue by introducing strategically placed collection points at livestock markets and rural hubs. These 'drop-off centres' make it easier and more affordable for farmers to recycle plastic waste, encouraging higher participation. The project incorporates lessons from European models where similar systems have dramatically increased recycling rates. By centralising collection, the scheme reduces transport costs, enabling service providers to offer lower rates to farmers. Alongside environmental improvements, the initiative supports better data collection on plastic use and disposal practices in Welsh agriculture.

Partnership advances deep-water offshore wind

A new partnership between Cierco Energy and Swansea-based Marine Power Systems (MPS) is set to accelerate the deployment of deep-water offshore wind in the Celtic Sea. The agreement marks a major step toward commercialising MPS's PelaFlex platform as part of the Llŷr Test and Demonstration projects off the Pembrokeshire coast. PelaFlex is a modular floating wind foundation designed for deep water. It reduces weight, material use, and installation time while remaining compatible with UK port infrastructure. This innovation enables faster, lower-cost deployment of floating wind farms while supporting local supply chains. The Llŷr projects will demonstrate the viability of deploying floating wind at commercial scale, using existing infrastructure and lessons learned from two decades of fixed-bottom offshore wind development in the UK. By validating new technologies in real-world conditions, the initiative aims to reduce risk and unlock deeper waters for energy generation.

Breathalyser innovation targets global safety markets

Barry-based Lion Laboratories, inventors of the original roadside breath test, is revolutionising breathalyser technology through the development of a next-generation device engineered in partnership with Cardiff Metropolitan University's Product Design and Research (PDR) team. The project combines user-led innovation with precision engineering to modernise one of the world's most trusted alcohol testing tools. Building on the success of the original breathalyser the new product introduces advanced features including a high-resolution digital display, USB-C rechargeable power, and an ergonomic grip designed for accuracy and ease of use. The development process used a 'Step-Jump-Leap' innovation framework, resulting in high-fidelity 3D prototypes that enabled real-world testing and accelerated product refinement. This strategic redesign not only enhances usability and reliability but also optimises manufacturing processes and supply chain resilience.

AI drone innovation takes off in West Wales

A European technology firm specialising in autonomous drone systems has acquired West Wales Airport, transforming the site into a strategic hub for the development and testing of unmanned aerial systems (UAS). Lisbon-headquartered Tekever, which has operated at the Aberporth site since 2023, is expanding its presence to accelerate innovation in autonomous flight systems. The airport's coastal location, existing airspace permissions, and advanced test infrastructure make it uniquely suited to support complex UAS trials. These include surveillance, maritime operations, and border security applications for UK government agencies and allied partners. West Wales Airport will now become a cornerstone of the UK's defence innovation ecosystem, supporting an ambitious development programme focused on enhancing capability through artificial intelligence and autonomy. The expansion aims to deliver next-generation aerial platforms that offer real-time decision-making, long-range endurance, and multi-mission adaptability.

Cyber resilience in aerospace collaboration

A new research collaboration between Swansea University, Novel Engineering Consultants Ltd, and Airbus Endeavr Wales is set to transform how cybersecurity is embedded into aerospace systems. The project is the first in the UK to explore how Model-Based Systems Engineering (MBSE) can enhance cyber resilience in complex aerospace environments. Led by Swansea University's Systems Security Group, the initiative combines cutting-edge research with industry expertise. The focus is on developing proactive cybersecurity solutions that anticipate and mitigate threats before they compromise system integrity. Key innovations include techniques for early threat detection, new methods for validating security in system architectures, and best practice frameworks aligned with current aerospace standards. These tools aim to integrate cybersecurity seamlessly into the design process, boosting both safety and system performance.

Digital twins are revolutionising lake management in Wales

A new project is redefining how we understand lakes by merging satellite data, sensors, and ecological models into living virtual replicas. These digital twins could revolutionise climate response, water management, and public engagement.

Bangor University is leading the development of an innovative prototype designed to create real-time virtual replicas of lakes using advanced digital twin technology. These continuously updated virtual models are set to transform how we monitor, model, and manage freshwater ecosystems in response to climate change and extreme weather events.

Digital twins are virtual models that mirror physical systems and are refreshed in real time. Already widely used in sectors such as manufacturing and urban planning, this technology is now being applied to aquatic systems. Bangor University's project integrates multiple data sources, including Earth observation, in-situ sensors, and ecological and hydrological models, to create highly detailed simulations of lake environments. These simulations enable researchers and managers to test potential scenarios, such as floods, droughts, nutrient loading, and thermal fluctuations, well before they occur.

Lakes perform many essential roles in the environment. They store water, regulate floods and droughts, support biodiversity, offer recreational opportunities, and process nutrients and carbon. However, they are increasingly under threat from climate change, pollution, and land-use pressures. Traditional monitoring methods, such as ground sampling, buoy data, and occasional satellite observations, often provide only isolated snapshots, missing short-term changes like heatwaves or sudden algal blooms. This new modelling approach addresses these limitations by offering near-continuous, holistic insights into lake dynamics.

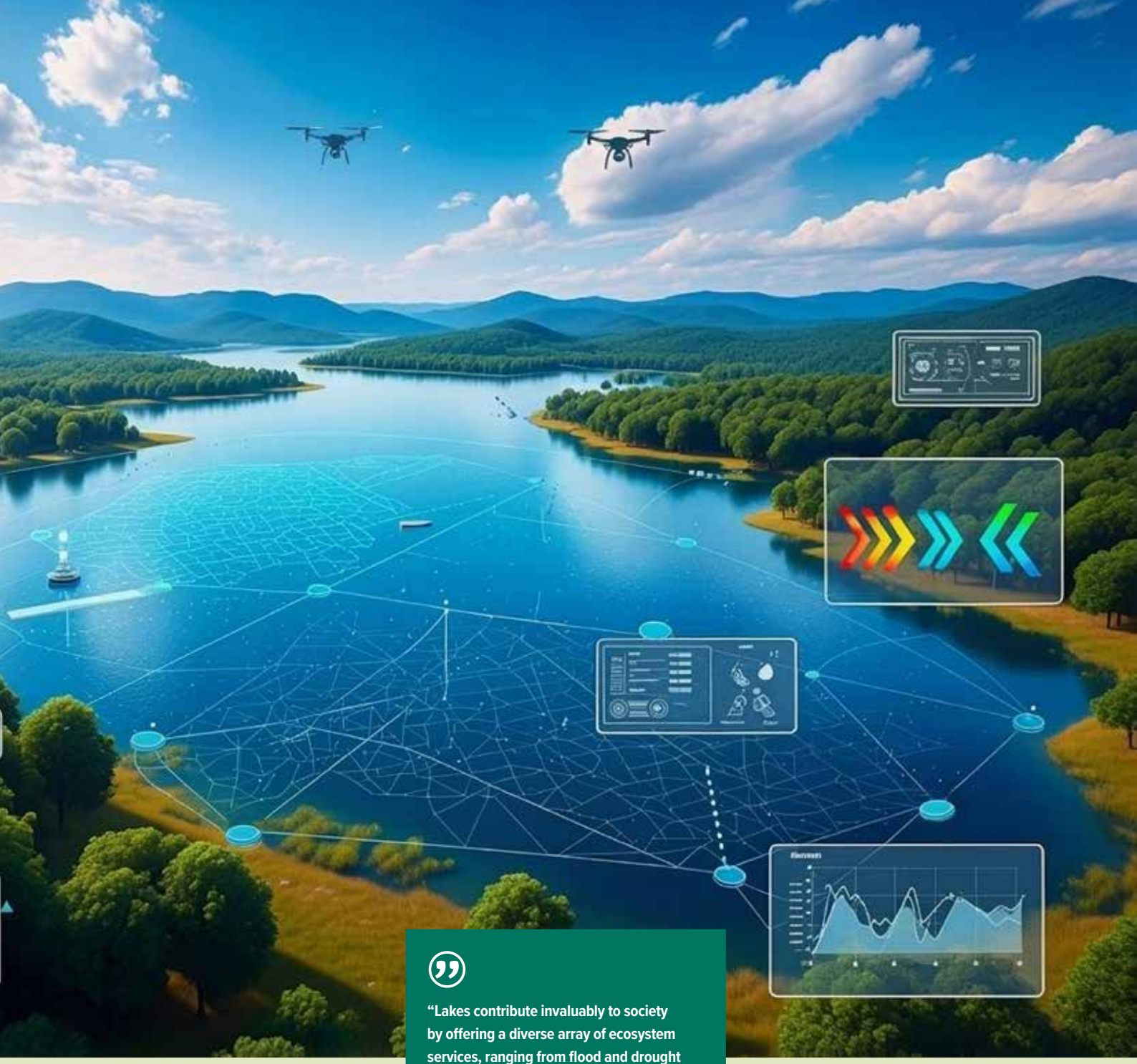
The work is part of an international collaborative project involving the UK, Italy, Sweden, Ireland, the Netherlands, and Hungary. The partnership aims to co-design a flexible digital twin toolkit with direct user input, combine Earth observation, sensor, and model data into a unified platform, and enable both near-term forecasting and long-term scenario planning. The project also seeks to improve public engagement and decision-making by using intuitive visualisations that make complex environmental information more accessible and understandable.

The modelling builds on limnological research, the scientific study of inland waters, led by Dr Iestyn Woolway at Bangor University. His studies on lake stratification, warming, deoxygenation, and heatwaves have helped shape the system's design. The project uses ensembles of models, such as the General Lake Model and hydrological simulators, calibrated against satellite and buoy data. These dynamic surface and mixing models aim to capture vertical structure, nutrient cycling, and temperature variability, which are essential for understanding lake metabolism and resilience.

The system integrates satellite imagery, which uses spectral analysis to detect surface temperature, turbidity, and ice cover, with sensor networks that measure pH, oxygen levels, temperature, and chlorophyll concentrations. This information is combined with process models that simulate lake stratification, mixing, gas exchanges, and nutrient interactions over time, creating a comprehensive virtual representation of lake systems. This detailed data fusion enables near real-time visualisations, supporting immediate forecasts as well as longer-term projections.

Artistic Impression

The technology supports a wide range of practical and strategic applications. It provides real-time forecasting to help communities anticipate extreme events, optimise water resource planning, and manage reservoir operations, which is particularly valuable for flood and drought management. The system also generates thermal and oxygen profiles that inform conservation strategies and support habitat protection and fisheries management. Real-time updates on lake conditions contribute to public safety by improving the management of water-based recreation. Its ability to track chlorophyll levels and thermal dynamics helps detect algal blooms and supports more effective water treatment. By simulating carbon flux and



nutrient retention, the system also contributes to climate mitigation and enhances assessments of ecosystem services.

The project's visualisation tools further support public engagement and help policymakers and citizens understand the trade-offs involved in different environmental management strategies.

Currently in its prototype phase, the system is being implemented across catchments in participating countries and is being tested and refined using ground-truth data and stakeholder feedback. The project's future goals include broad deployment across lakes in the EU and worldwide, integration into national water management practices, and the development of open-access portals to support public data sharing and civic education. It is also expected to serve as a testbed for emergency response planning, including scenarios such as pollutant spills and thermal stress events.

> **"Lakes contribute invaluably to society by offering a diverse array of ecosystem services, ranging from flood and drought regulation to recreation, habitat provision, and drinking water supply. However, the escalating impacts of climate change pose an imminent and severe threat to the resilience of lake ecosystems... EcoTwin leverages the power of Digital Twins as a transformative tool."**
>
> **Dr Iestyn Woolway**
> Bangor University

Contact
Bangor University

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

BANGOR

Marine detectives uncover the hidden lives of Cardigan Bay Dolphins

An innovative research project is shedding new light on the secret lives of Cardigan Bay's iconic bottlenose dolphins through a combination of cutting-edge science, community involvement, and a bit of detective work.

Located on the west coast of Wales, Cardigan Bay is home to the UK's largest semi-resident population of bottlenose dolphins *(Tursiops truncatus)*. Between 200 and 300 individuals are regularly observed in the area, making it a vital stronghold for the species in British waters. Cardigan Bay's dolphins are considered semi-resident because many return year after year to familiar feeding and breeding grounds.

Their accessibility from shore and frequent coastal presence make Cardigan Bay's dolphins an ideal population for long-term scientific study. Research into their behaviour, social structure, movements, and diet provides crucial insights that inform both national conservation efforts and international understanding of coastal dolphin populations.

The latest study, led by the Wildlife Trust of South and West Wales in collaboration with Aberystwyth University, is analysing dolphin faecal samples to uncover detailed information about their diet, behaviour, and population dynamics. The project, titled Dolphin Diet Detectives: Unveiling Dolphin Diets and Engaging Communities for UK Conservation, represents a significant advance in marine conservation science.

Central to the study is the use of environmental DNA (eDNA) techniques, which allow researchers to identify what the dolphins are eating and where they are feeding. By analysing genetic material found in faeces, the team can also build individual genetic profiles to determine gender, breeding potential, movement patterns, and family relationships. These genetic profiles are then cross-referenced with photo identification records collected by the Wildlife Trust over several years, enabling researchers to track individual dolphins through both visual and genetic data—offering a previously impossible window into their lives.

Community engagement plays a key role in the project. Local residents are invited to participate in community science days, contributing to dolphin monitoring, data collection, and gaining insight into the scientific process behind the research.

The collaboration with Aberystwyth University's Department of Life Sciences brings advanced marine biology and molecular genetics into the heart of the project. In addition to faecal samples, water samples are gathered across Cardigan Bay to assess the availability of prey species using the same eDNA methods. To further validate these findings, researchers deploy Baited Underwater Video Systems (BUVS), which record real-time footage of marine species within the bay.

By combining these approaches, the project aims to build a dynamic, detailed picture of how Cardigan Bay's dolphins live, feed, interact, and move through their environment. This knowledge is critical not only for protecting one of the UK's most charismatic marine mammals but also for fostering stronger community connections to marine conservation.

> **"This project covers an area of research that we have aspired to embark on over the past decade or so. We are thrilled to be leading this groundbreaking project, using cutting-edge eDNA and genetic techniques to unravel the mysteries of bottlenose dolphin ecology in Cardigan Bay. Our focus on understanding dolphin diet, population dynamics and interactions with prey species through innovative research methods will not only inform vital conservation strategies," said Dr Perry, "but also actively involve the community. This project is a collaborative endeavour, uniting science and community for a sustainable future."**
>
> **Dr Sarah Perry**
> Marine Conservation and Research Manager
> The Wildlife Trust

Dr David Wilcockson of Aberystwyth University adds: "Our molecular genetic and marine biology expertise dovetails with the excellent monitoring and conservation work of the Wildlife Trust and should reveal some long-kept secrets of dolphin biology. What is really exciting for us, aside from finding out more about what dolphins are eating and their behaviours, is the fact that we are involving the public in this work. They are the 'dolphin detectives' and we hope this will provide another pathway by which they can feel more connected to their local environment and encourage conservation activities beyond the project."

Contact

Aberystwyth University

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

ABERYSTWYTH

Research highlights dangerous gaps in public tidal knowledge

New research from Bangor University has revealed alarming gaps in public understanding of tides that are putting millions of coastal visitors at risk.

The study, which surveyed 1,368 people across the UK and Ireland, found that 15% of respondents had been cut off or nearly cut off by the tide at some point in their lives. Extrapolated nationally, this equates to around 10 million people across the UK.

Two-thirds of those affected were not in the water when the incident occurred. Instead, they were taking part in land-based coastal activities like walking or running. Nearly 60% reported being surprised by the speed at which the tide rose and threatened their exit.

The research, believed to be the first national study examining public awareness and attitudes towards tides, revealed that four in ten people have little to no understanding of tidal behaviour. Only half of respondents said they check tide times before visiting the coast, and just 24% demonstrated the ability to correctly read and interpret a tide timetable.

Given that nearly half of the world's coastline has a tidal range exceeding standing depth, this is not just a UK issue. The findings highlight a worldwide need for improved public education on tidal risks.

The study will help shape future public safety campaigns by the Royal National Lifeboat Institution (RNLI), who partnered with the research team. The RNLI is urging coastal visitors to take simple but potentially life-saving steps: check the tide times and weather conditions before setting out, seek local advice if unsure, and remain vigilant for changing coastal conditions.

"The tide comes in and out twice within a 24-hour period, and it varies by location and day," explains Chris Cousens, at the RNLI. "Even familiar beaches can present unexpected dangers. The results of this survey are eye-opening and show that a large proportion of the public have significant gaps in tidal knowledge. We'll be using these findings to strengthen our safety messages and education efforts."

The research highlighted widespread confusion over how tides behave. Many respondents were unsure about the direction from which tides advance, the speed at which they can rise, and the height they can quickly reach.

Beyond the UK, the research team is encouraging coastal safety organisations and ocean literacy researchers worldwide to use these findings as a starting point for improving tidal education. As sea levels rise and weather patterns shift, better public understanding of tides will become increasingly important for safety along coasts everywhere.

> **"Our findings show that many people struggle to interpret tide tables, especially when applying them to local walks or beach visits. This is understandable given the complexity of tide timetables. For example, on a sandy beach, the tide can silently fill small channels behind you, cutting off your route back to safety. Or when walking near a headland, the tide can trap you in a small bay before you realise the danger. By working with the RNLI, we hope to bridge these knowledge gaps and develop targeted educational resources to prevent avoidable emergencies."**
>
> **Dr Elisabeth Morris-Webb**
> Lead researcher

Contact

Bangor University

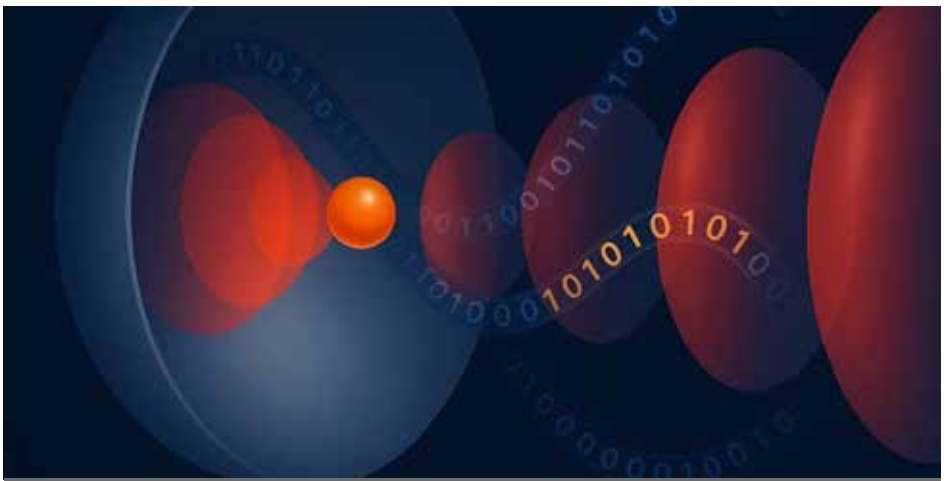
www.bangor.ac.uk
01248 383298
press@bangor.ac.uk

BANGOR

Breakthrough in reducing quantum noise

Researchers at Swansea University have made a breakthrough that could lead to more sensitive scientific instruments and new ways to explore the strange world of quantum physics.

When scientists try to measure incredibly small objects, like nanoparticles, they face a problem. The act of measuring can disturb what they are trying to observe. This happens because the tools they use to gather information, typically beams of light (made up of photons), bump into these tiny objects. This unwanted disturbance is known as "quantum backaction."



An illustration showing a standing light wave reflected from a curved mirror with a spherical particle at the centre. A stream of information, represented by 0s and 1s, emerges from the system. *Image courtesy of Swansea University*

In this study, the team has found that the relationship between measurement and disturbance works both ways. Under certain conditions, if you stop being able to measure the object, the disturbance also disappears.

Lead researcher PhD student Rafal Gajewski explains: "Our work has shown that if you create conditions where measurement becomes impossible, the disturbance disappears too."

The team achieved this by placing a tiny particle at the centre of a hemispherical mirror, like putting the particle inside half of a hollow ball with a reflective surface. Under specific conditions, the particle and its mirror image became indistinguishable from one another when viewed by scattered light. At that point, the scientists could no longer get any information about the particle's position from the light bouncing off it. Remarkably, when this happened, the backaction, the disturbance from measurement, vanished as well.

This discovery has important implications for quantum mechanics. By carefully designing the environment around a quantum object, the researchers can control both the information available about it and the level of quantum noise (random disturbances) it experiences.

This breakthrough opens the door to several exciting possibilities. It could enable scientists to create quantum states with larger objects, moving beyond atoms to larger particles. It also paves the way for new experiments that test fundamental physics, exploring the point where quantum mechanics and gravity intersect. The findings could lead to the development of ultra-sensitive sensors capable of detecting extremely small forces, with potential applications ranging from gravitational wave detection to advanced medical diagnostics. Additionally, the research supports the case for space-based experiments, such as the proposed European Space Agency mission MAQRO (Macroscopic Quantum Resonators), which aims to test the limits of quantum physics in space.

The research is part of a growing area called levitated optomechanics. This technique uses lasers to trap and control tiny particles in a vacuum. Recent experiments in the field have already cooled particles to their quantum ground state, meaning their lowest energy level—bringing them closer to purely quantum behaviour.

The Swansea team is now working on experimental demonstrations and exploring how their findings could lead to practical technologies.

Dr James Bateman, who supervised the research, said: "This work reveals something fundamental about the relationship between information and disturbance in quantum mechanics. What's particularly surprising is that the backaction disappears precisely when light scattering is maximised—the opposite of what intuition might suggest."

Quantum mechanics is a branch of physics that describes how matter and energy behave at the smallest scales such as atoms, electrons, and photons. Unlike everyday objects, which follow the predictable rules of classical physics (like Newton's laws of motion), particles in the quantum world behave in ways that often seem strange and counterintuitive.

For example:

- **Particles can exist in multiple states at once (superposition).**
- **They can become linked across distances (entanglement), so that changing one affects the other instantly.**
- **Simply observing or measuring a particle can change its behaviour (observer effect).**

Quantum mechanics provides the mathematical framework to explain and predict these behaviours. It underpins much of modern technology, including lasers, computers, and MRI scanners, and is the foundation for emerging fields like quantum computing and quantum sensing.

Contact

Swansea University

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

SWANSEA

Flushing out resistance: The role of wastewater in the spread of antimicrobial resistance

Antimicrobial resistance (AMR) remains a significant global health concern, particularly in hospital settings where infection rates continue to rise.

Antimicrobial resistance occurs when disease-causing microorganisms, including bacteria, viruses, fungi and parasites, evolve to withstand the effects of antimicrobial medicines designed to kill or control them. Resistant infections contribute to increased mortality, prolonged hospital stays, and greater risks during surgery and other routine medical procedures. Although resistance can develop naturally, it is being rapidly accelerated by human activity. Contributing factors include the overuse and misuse of antimicrobial drugs, poor infection control practices, a lack of new treatment options, and inadequate global surveillance.

A new study led by Bangor University has examined a less visible but increasingly important driver of AMR, human wastewater. By analysing samples from hospital and community wastewater sites across Wales, researchers have tracked and quantified the presence of antibiotic resistance genes (ARGs) and bacteria using a technique known as High Throughput qPCR (quantitative polymerase chain reaction).

Quantitative Polymerase Chain Reaction (qPCR), also known as real-time PCR, is a laboratory method used to detect and measure the amount of specific DNA in a sample. It works by amplifying DNA sequences and using fluorescent markers to track this process in real time, allowing researchers to determine the concentration of particular genes, including those associated with antibiotic resistance. High Throughput qPCR is used by researchers globally to quantify multiple genes across hundreds of samples in parallel.

The study's findings reveal that although wastewater treatment plants do reduce the concentration of ARGs, they are not completely effective. A considerable load of these resistance genes still enters rivers, lakes, and coastal waters, posing environmental and public health risks. The problem is further exacerbated by untreated sewage and combined sewer overflows, systems that discharge both rainwater and sewage, which are becoming more frequent as climate change drives extreme weather events.

This research is the first to apply Resistomap's Antibiotic Resistance Gene Index (ARGI) to wastewater monitoring. ARGI is a comparable metric for evaluating total burden of resistance genes across environmental samples. By providing a standardised value, it allows scientists and policymakers to compare antimicrobial resistance levels across different locations and treatment systems, helping to inform targeted interventions. The ARGI values in Welsh wastewater treatment plants in this study ranged from 2.0 to 2.3, exceeding the European mean of 2.0.

One of the study's key concerns is the accumulation of resistance genes in sediment, where concentrations were found to be higher than in the surrounding water. These sediments act as long-term reservoirs for ARGs, and during storms or other disturbances, they can be resuspended, releasing resistance material back into the water and increasing the risk of human and animal exposure. The research also found evidence that wastewater contamination can elevate antimicrobial resistance levels in shellfish, raising additional concerns for food safety and public health.

The study highlights the urgent need for clearer environmental limits on antimicrobial resistance genes and more regular monitoring to prevent its unchecked spread. While existing treatment processes provide some mitigation, they are not sufficient to fully eliminate resistance genes from wastewater.

> **"Our study highlights the hidden role of wastewater in the spread of antimicrobial resistance. While treatment plants reduce some resistance genes, significant amounts still enter the environment, accumulating in sediments and even making their way into the food chain. Strengthening wastewater treatment policies and investing in advanced technologies will need to take centre stage for us to effectively safeguard public health and prevent antimicrobial resistance from becoming an even greater global challenge."**
>
> **Dr Reshma Silvester**
> Bangor University

Contact

Bangor University

www.bangor.ac.uk
01248 388292
grh24rlt@bangor.ac.uk

BANGOR

Robotic medication dispenser delivers urgent medicines to patients in rural Wales

A pioneering technology is set to transform how patients in rural Wales access urgent medicines. The REMEDY machine, a robotic medication dispenser, is being trialled for the first time in Europe and offers a practical solution to a long-standing healthcare challenge.

In many isolated parts of North Wales, patients needing urgent prescriptions during evenings, weekends, or public holidays often have to travel long distances to collect medication. This lack of local access can delay treatment, increase pressure on emergency services, and result in avoidable hospital visits.

The machine addresses this issue by providing a patient-facing, automated medicines-issuing kiosk that securely delivers urgent medications outside conventional pharmacy hours. Fully integrated with NHS 111, the system allows patients who have completed a telephone consultation to collect their medication using a unique personal identification number (PIN) provided by a clinician.

The project is a collaboration between Betsi Cadwaladr University Health Board, Bangor University, Oxford and Aberdeen Universities, and system manufacturer Videosystems and UK distributor Pharmahub.

The dispenser is based on a modified system, adapted for outdoor use and independent operation. It is pre-loaded with a range of common out-of-hours medications, such as antibiotics, inhalers, and pain relief, which can be dispensed directly to patients following remote clinical authorisation. This keeps the same level of clinical oversight as existing mechanisms for providing out of hours medication while providing more convenient access in rural locations.

The system has been carefully designed for secure, traceable, and clinically supervised dispensing. Once a patient has completed their NHS 111 assessment, a healthcare professional issues a PIN to activate the dispenser. The patient can then retrieve their medication using this code, ensuring both safety and accountability.

A key feature of the project is its integration of tele-consultation, remote prescribing, and automated medication issuing into one seamless system. This has the potential to significantly reduce travel for patients in areas where pharmacy access is limited. For those without their own transport, a local dispensing kiosk can offer faster treatment and reduce the risk of complications.

The pilot is currently underway in Dolgellau, Gwynedd, where the machine has been installed at a community site with easy public access. The trial, which will run for two years, is evaluating the system's effectiveness, safety, and patient experience. Early feedback from patients and clinicians has been positive, with the potential for the system to be expanded to other rural areas if successful.

Bangor University is leading the evaluation, working with Oxford and Aberdeen Universities. The manufacturer has worked closely with the research team to ensure the hardware is reliable, secure, and suitable for outdoor, unattended operation.

This is the first deployment of its kind in Europe, positioning Wales as a leader in rural health innovation. The machine not only addresses a critical access issue but also demonstrates the potential for remote medicine dispensing to become part of a more flexible, patient-centred healthcare system.

If the trial is successful, the technology could be introduced across other parts of Wales and the wider UK, offering a sustainable way to improve out-of-hours healthcare, particularly in areas where maintaining a full-time pharmacy is not practical.

Dr Adam Mackridge of Betsi Cadwaladr University Health Board said: "The patient is provided with a unique code and can then access their medication from the machine at their community hospital. It is very simple and will be a huge benefit to people in the Dolgellau area who are a considerable distance from other services, particularly on weekends and evenings. This is a really positive collaboration to help improve equity of medicines access and reduce health inequalities."

Dr Rebecca Payne, Out-of-Hours GP and clinical academic at Bangor University, added: "It's fantastic to see North Wales leading the way, developing cutting-edge technology which can make a real difference to patients, particularly those in rural areas like Dolgellau."

Contact

Bangor University

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

Bangor

Sleep problems could double risk of dementia in later life

New research by Cardiff University has revealed that people who experience sleep disorders face a significantly greater risk of developing dementia and other neurodegenerative conditions in later life.

Scientists from Cardiff University, working with colleagues at the NIH Intramural Center for Alzheimer's and Related Dementias in the United States, have found that a diagnosis of a sleep disorder could make individuals up to twice as likely to develop a neurodegenerative disease within the following 15 years.

In one of the largest studies of its kind, the research team examined the relationship between sleep disorders and neurodegenerative disease, using data from more than one million electronic health records. The study explored whether disrupted sleep serves as an early warning sign of neurodegeneration or whether it increases a person's likelihood of developing dementia later.

The researchers analysed data from three major biobanks: the SAIL Databank in Swansea, the UK Biobank, and FinnGen in Finland. Across these datasets, they were able to access accurate, timestamped medical records showing when individuals were diagnosed with sleep disorders.

The study focused on people who had been diagnosed with one or more sleep disorders. For the purposes of data analysis, these disorders were grouped into categories, including those associated with circadian rhythm disruption—such as narcolepsy, sleep apnoea, hypersomnia (excessive daytime sleepiness), and parasomnias (abnormal behaviours or movements during sleep, including sleepwalking and night terrors)—as well as cataplexy. The researchers also examined 'non-organic' sleep disorders, which are not linked to a known physiological cause and include conditions such as generalised insomnia and nightmares.

Using large-scale statistical methods, the team mapped the relationships between different neurodegenerative diseases and sleep disorders. Several important patterns emerged. For dementia where the specific disease type was not recorded, both circadian sleep disorders and non-organic sleep disorders were linked to an increased risk of developing dementia within 10 to 15 years of the sleep disorder diagnosis. This risk was even higher among individuals with multiple types of sleep disorders.

In cases of Alzheimer's disease, circadian sleep disorders were associated with an increased risk of developing the condition within 10 to 15 years following diagnosis of the sleep disorder. For vascular dementia, both circadian sleep disorders and non-organic sleep disorders were linked to a heightened risk within 5 to 10 years. This risk was again further increased in people with multiple sleep disorder diagnoses. Similarly, for Parkinson's disease, both circadian and non-organic sleep disorders were associated with an increased risk of developing the condition within 10 to 15 years.

Importantly, the study also found that sleep disorders increased the risk of Alzheimer's and Parkinson's disease independently of genetic risk. Even among people with a low genetic predisposition, having a sleep disorder increased their overall risk. This suggests that sleep disorders and genetic factors are likely to influence disease risk separately, through independent mechanisms.

> **"In our study, we wanted to understand the complicated relationship between sleep and dementia. People living with dementia often experience sleep problems, but there is not yet enough evidence to say for sure whether poor sleep increases dementia risk. We set out to see if we could determine the sequence of events. By using biobank data, we had timestamped records of when people experienced sleep disorders and exactly when they were subsequently diagnosed with a neurodegenerative disease - rather than relying on self-reported information."**
>
> **Dr Emily Simmonds**
> Cardiff University

Contact

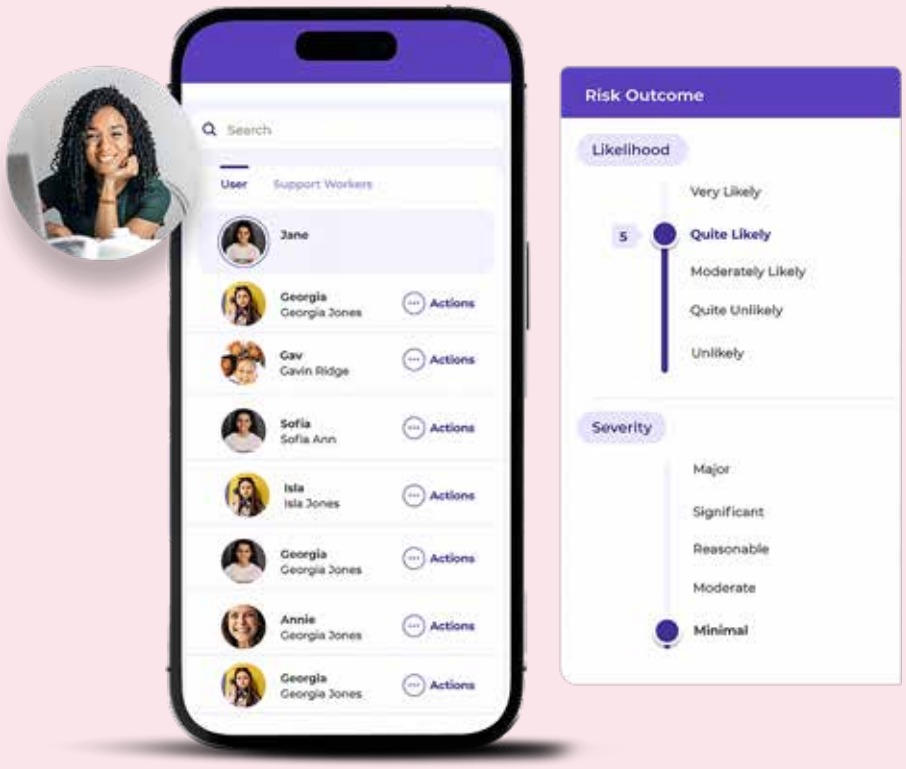
Cardiff University

www.cardiff.ac.uk
029 2087 6986
graya8@cardiff.ac.uk

CARDIFF

Innovative digital platform could transform child social care

A new digital platform developed in Wales is set to transform the way child social care providers plan, record and deliver care.



Lumin Solutions, a technology spin-out from the Alacrity Foundation in Newport, has created a dedicated case management system designed specifically to meet the complex needs of young people in care.

In 2024/25, budgets allocated for children's social care across the UK reached around £14.2 billion. These rising costs reflect growing demand and the increasing complexity of the support needed by children and young people. Despite this, around 60% of child social care providers still rely on paper records or digital systems originally designed for adult care. These systems are often unsuitable for children's services, which require tools to support detailed planning, consistent record-keeping and compliance with care regulations.

Care Inspectorate Wales and other UK regulators are placing greater emphasis on clear and reliable care records. The UK Government has now set a requirement for all social care providers to adopt digital care recording systems by 2025. Purpose-built platforms like MyLifePlan are emerging as key solutions to meet this challenge, offering child-focused care management that can improve service quality, manage costs and help providers meet inspection standards.

At the heart of the system is a Digital Care Assistant, a smart software tool that helps care providers to record daily activities, build care plans, carry out assessments and produce reports. Care plans are personalised documents that outline the specific support each child needs and track their progress. The system records every care decision, providing a clear audit trail. This is vital during inspections, as it demonstrates that care providers are meeting the required standards.

The platform also integrates AI-powered analytics. Artificial Intelligence, in this case, refers to computer systems that can quickly process large volumes of information and identify patterns that might not be easily spotted by people. In social care, this allows the platform to highlight trends such as recurring issues, emerging risks or improvements in care outcomes. These insights support faster and more informed decision-making.

One of the key innovations in the platform is its interactive, child-focused design. It offers features that encourage young people to take an active role in their own care journey. The system allows children to keep digital diaries and memory books, giving them a space to record their experiences, feelings and important moments. This approach ensures that the child's voice is heard and valued throughout their time in care.

The platform is designed to offer flexibility and ease of use, supporting existing forms and processes already in place across many care providers. It enables a transition from paper-based records to digital systems without requiring significant changes to established workflows. Onboarding processes are straightforward, allowing care teams to adopt the system quickly with minimal training. This is particularly relevant for social care providers seeking to minimise disruption to frontline services.

The system also supports providers in meeting regulatory requirements. Care Inspectorate Wales and the Care Quality Commission in England are responsible for inspecting care services and ensuring standards are maintained. Built-in templates and reporting functions assist providers in preparing for inspections and demonstrating compliance with national care quality standards.

Contact

Lumin Solutions

www.luminsolutions.co.uk
0333 339 1093
contact@luminsolutions.co.uk

NEWPORT

Transforming the speed and accuracy of UTI diagnostics

A portable device delivers accurate UTI results in 35 minutes, transforming diagnosis in primary care. Faster testing aids treatment decisions and curbs unnecessary antibiotic use.

Llusern Scientific, a spin-out company from the University of South Wales, is transforming the speed and accuracy of urinary tract infection (UTI) diagnosis with an innovative portable diagnostic device. The system delivers accurate, real-time test results in just 35 minutes, offering a practical solution to one of the most common diagnostic challenges in primary care.

UTIs are among the most prevalent infections in the UK and remain a significant global health issue, affecting more than 100 million people worldwide each year. They are a leading cause of community-acquired infections, with 50 to 60 percent of women experiencing at least one UTI in their lifetime. Misdiagnosed or untreated UTIs are a major cause of sepsis, and faster, more reliable diagnosis has the potential to improve patient outcomes and reduce hospital admissions. Rapid identification or exclusion of bacterial infection also helps clinicians avoid unnecessary antibiotic prescriptions, directly supporting efforts to combat antimicrobial resistance (AMR).

Current diagnostic methods are either slow or unreliable. Dipstick tests, although convenient, have low sensitivity and cannot identify specific pathogens, often leading to misdiagnosis. Laboratory culture tests are more accurate but typically take between 24 and 72 hours, which often results in precautionary prescribing of antibiotics before results are confirmed. This approach contributes to the growing problem of AMR, as patients may receive unnecessary antibiotic treatments based solely on symptoms.

Llusern Scientific's Lodestar DX addresses this gap by providing a rapid, point-of-care diagnostic solution that can be used directly in GP surgeries, pharmacies, and community health settings. The device uses loop-mediated isothermal amplification (LAMP), a DNA amplification method that eliminates the need for complex laboratory equipment. By detecting the DNA of the most common UTI-causing bacteria, including E. coli, Enterococcus, Proteus mirabilis, and Klebsiella pneumoniae, the test supports accurate, evidence-based treatment decisions within a single consultation.

The system has demonstrated up to 97 percent accuracy and meets international quality standards for medical devices. Clinical evaluations have confirmed that the device is both reliable and easy to use, an essential feature for busy healthcare professionals. GPs and community pharmacists involved in the trials praised the system's portability and its ability to provide trusted results on-site, removing the need to send samples to external laboratories.

This new technology builds on research originally developed during the COVID-19 pandemic, where its LAMP-based approach proved highly effective in rapid, field-based virus detection. The company is now expanding its platform by developing additional diagnostic tests for other infections, including respiratory illnesses, strep throat, and veterinary pathogens.

Contact

Llusern Scientific

www.llusern.co.uk
029 2297 2211
info@llusern.co.uk

CARDIFF

Gene therapy trial offers hope for dementia patients

A groundbreaking clinical trial taking place in Cardiff is investigating the potential of a one-time gene therapy to slow or stop the progression of frontotemporal dementia, a devastating neurodegenerative disease.

Frontotemporal dementia is one of the most common causes of early-onset dementia and can have a profound impact on patients and their families.

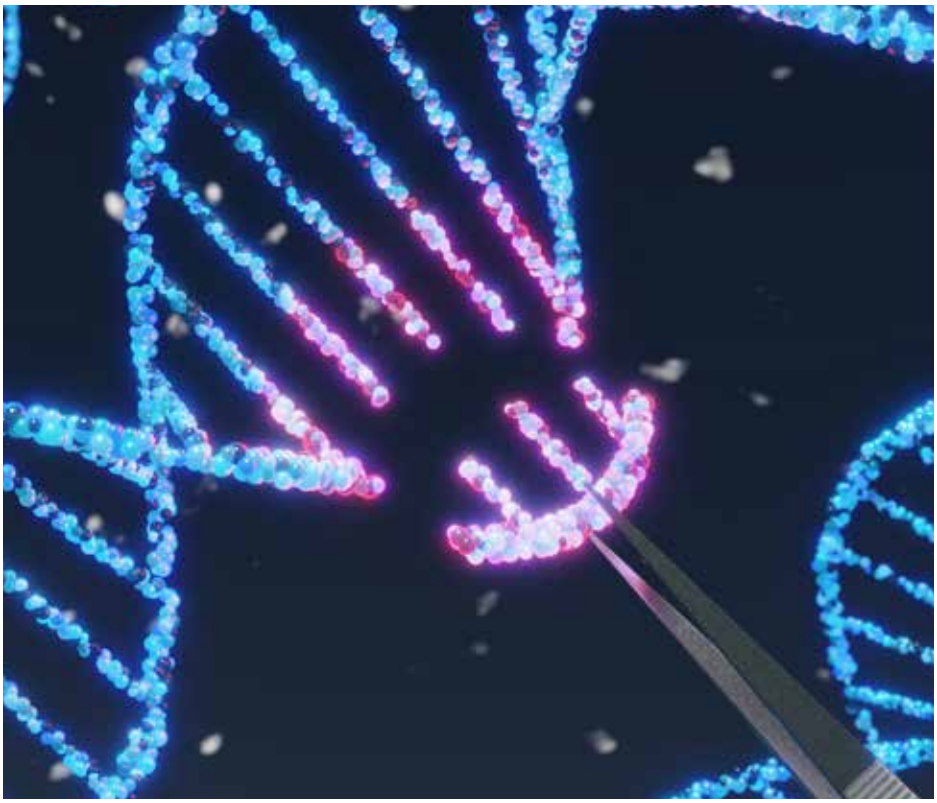
The ASPIRE-FTD clinical trial is focused on patients with frontotemporal dementia caused by mutations in the progranulin gene (FTD-GRN). This rare genetic form of the disease can severely damage the brain's frontal and temporal lobes, which are responsible for behaviour, decision-making, and language. Currently, there are no approved treatments that can halt or reverse its progression.

The trial, led by biotechnology company AviadoBio, is recruiting patients from across Europe. Cardiff has been selected as the UK's specialist surgical site, thanks to the expertise at the Advanced Neurotherapies Centre – the only centre in the UK, and one of just two in Europe, capable of delivering this type of treatment directly to the brain using MRI-guided surgery.

The therapy, known as AVB-101, is delivered as a single, one-time treatment. It uses a minimally invasive technique called stereotactic neurosurgery, which allows surgeons to accurately target specific areas of the brain. In this trial, the treatment is delivered directly to the thalamus, a region that plays a central role in the disease's progression.

Professor William Gray from Cardiff University explained:

"This new gene therapy has the potential to halt the progression of frontotemporal dementia. To achieve this, we need to overcome the challenge of getting drugs into the brain and ensure we can precisely measure how the treatment is working. At the Advanced Neurotherapies Centre, we can deliver drugs directly to the brain, targeting specific regions while monitoring the entire process in real-time using MRI imaging."



Delivering drugs directly to the brain is essential because of the blood-brain barrier – a natural defence that protects the brain from harmful substances but also makes it difficult for most medications to reach affected areas.

The ASPIRE-FTD trial represents a promising step toward developing effective treatments that could transform the outlook for people affected by this challenging condition.

"Launching ASPIRE-FTD and treating our first patients with AVB-101 are significant milestones in gene therapy development for frontotemporal dementia. We are proud to open clinical trial sites in the UK, making these innovative treatments more accessible to patients living with familial forms of the disease."

David Cooper
Chief Medical Officer
AviadoBio

Contact

Cardiff University

www.cardiff.ac.uk
029 2087 6986
graya8@cardiff.ac.uk

CARDIFF

Accelerating early bowel cancer detection

The University of Wales Trinity Saint David (UWTSD), in collaboration with Hywel Dda University Health Board, has successfully completed an 18-month project with the Welsh life science company CanSense to accelerate the early detection of bowel cancer.

The partnership has supported the development of a rapid, cost-effective, and scalable blood test that uses artificial intelligence (AI) to interpret blood-based biomarkers. Clinical trials suggest the test could reduce the need for invasive colonoscopies by up to 65%, offering faster diagnosis and more efficient patient prioritisation. This innovation has the potential to ease pressure on NHS services and improve outcomes through earlier intervention.

Bowel cancer is the fourth most common cancer in the UK, with around 43,000 new cases diagnosed each year. It is the second leading cause of cancer-related death, claiming over 16,000 lives annually. However, early diagnosis improves survival: over 90% of patients diagnosed at Stage 1 survive five years or more, compared with less than 10% at Stage 4. Introducing effective early diagnostic tools could save the NHS up to £250 million annually by reducing treatment costs and streamlining care pathways.

The project partners contributed to key stages of research and development, usability testing, and clinical readiness to support the integration of this novel approach into bowel cancer screening across the UK. Researchers at UWTSD's Assistive Technologies Innovation Centre (ATiC) engaged with General Practitioners (GPs) and phlebotomists to explore the test's practical application, perceived benefits, and potential workflow challenges. These insights informed a user-centred approach to implementation within NHS primary care.

ATiC also assessed how laboratory technicians interacted with the CanSense software and physical workspace, using tools such as behavioural observation, facial expression analysis, eye tracking, and physiological monitoring including optical oximetry and near-infrared spectroscopy (NIRS). This analysis generated valuable user experience (UX) feedback to optimise the system's design for clinical efficiency and ease of use.

The TriTech Institute supported the project by providing risk assessment and regulatory compliance guidance, ensuring alignment with ISO 13485 quality management standards, an essential step towards NHS adoption.

Completion of this project represents a major milestone in CanSense's mission to deliver accessible, early-stage bowel cancer diagnostics at scale. It also highlights the critical role of research and innovation partnerships in transforming healthcare delivery in Wales and beyond.

Professor Chris Hopkins, Clinical Director at ATiC, said: "Our collaboration with CanSense exemplifies the power of partnerships between health boards, academia, and industry in driving innovation and delivering better healthcare solutions."

In the CanSense lab, Dr Layas and Mr Stokes employ advanced real-time monitoring tools - including Noldus Portable Observation Lab, Tobii Eye Tracking Systems, and frontal brain activity monitoring system (fNIRS) - during an observational study.

"Early cancer detection saves lives. At CanSense, we are proud to be leading the way with a fast, affordable blood test for early bowel cancer diagnosis. Together, we are improving outcomes, reducing waiting times, and helping ensure more people receive the care they need, when they need it most."

Dr Adam Bryant
CEO
CanSense

"ATiC applied its specialist expertise in human-centred design and usability evaluation to support CanSense in refining the test for real-world application. We are proud to have contributed to this transformative project. By combining clinical, technological, and design expertise, this collaboration demonstrates how partnerships can help Welsh health innovation to thrive."

Dr Fatma Layas
Innovation Fellow
ATiC

Contact
University of Wales Trinity Saint David
uwtsd.ac.uk
07384 467071
rebecca.davies@uwtsd.ac.uk

SWANSEA

Why the long face? New study maps the rich facial language of horses

New research has revealed that horses have a far more expressive and complex facial "language" than previously recognised.

In a collaborative study involving Aberystwyth University, researchers have created the first comprehensive ethogram, a catalogue of equine facial behaviours, based on natural social interactions among domestic horses.

Using facial coding techniques, the team analysed more than 800 combinations of facial movements, documenting how horses communicate in affiliative (friendly), agonistic (conflict), attentional, and playful situations. Each facial expression was broken down into individual muscle movements, offering detailed insight into the emotional and social signals behind them.

Friendly behaviour was marked by forward pointing ears and extended noses, signs of attentiveness and social engagement. In contrast, conflict or dominance was shown by flattened ears, dilated nostrils, and lowered heads. During moments of heightened alertness, horses blink more, angle their heads, and direct their ears forward to process their surroundings.

Playful expressions were among the most dynamic. They included open mouths, relaxed lower lips, raised chins, backward rotated ears, and visible eye whites, behaviours closely resembling "play faces" observed in primates and dogs.

The study also documented a previously unrecorded movement: the "facial tightener," a movement previously only seen in humans and gibbons. This discovery could help researchers detect pain or emotional distress more accurately in horses.

The findings have wide reaching implications. Understanding the subtle cues horses use to express themselves can help trainers, vets, and carers better interpret equine emotions, improving welfare and strengthening human, animal relationships.

Dr Sebastian McBride of Aberystwyth University said: "Our research found that horses use a wide range of facial movements, which vary depending on the social context. What is particularly fascinating is that some of these facial behaviours, especially during play, mirror those seen in species like chimpanzees and dogs, supporting the hypothesis that these facial behaviours may be deep rooted in mammalian biology. It is a fascinating insight into how evolution has shaped communication across species."

"This is the first time we've been able to systematically document how horses combine facial movements into meaningful expressions. It opens up new possibilities for understanding equine emotions and improving welfare. This work is a game-changer for anyone working with horses. It gives us a new lens through which to view and interpret their behaviour, ultimately leading to better care and stronger human-animal relationships."

Dr Leanne Proops
Associate Professor in Animal Behaviour and Welfare
The Centre for Comparative and Evolutionary Psychology
University of Portsmouth

Contact
Alice Earp
Aberystwyth University
www.aber.ac.uk
01970 622578
ale@aber.ac.uk

ABERYSTWYTH