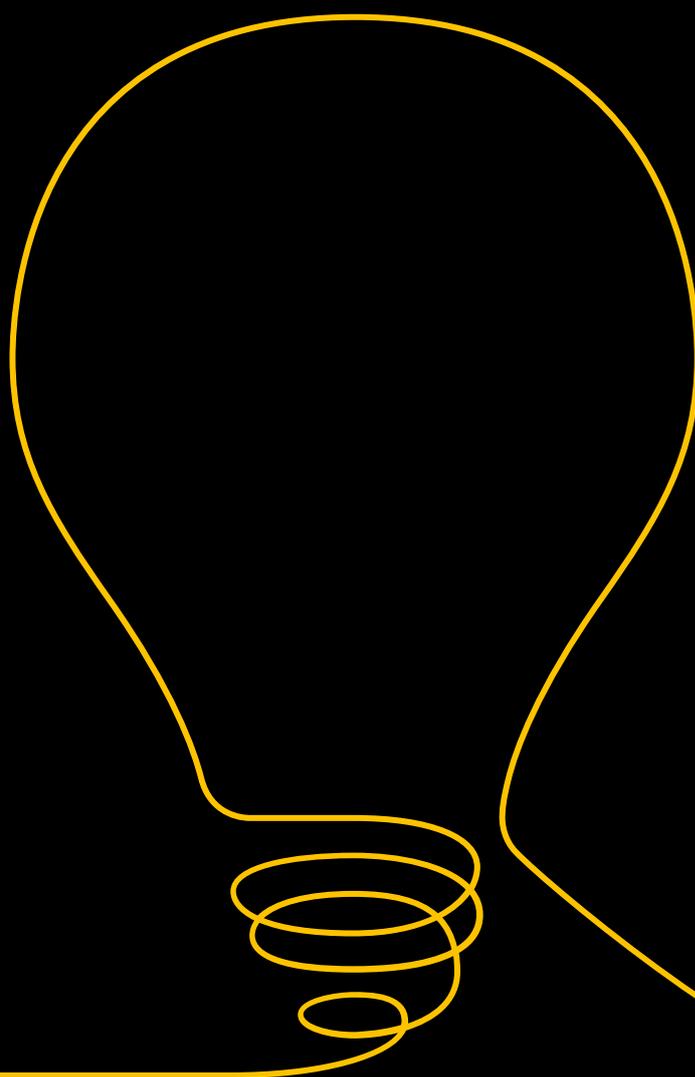


IOP Institute of Physics

IOP Business Awards **2022**



IOP Institute of Physics

www.iop.org

IOP Business Awards

The Institute of Physics (IOP) is the professional body and learned society for physics in the UK and Ireland. It seeks to raise public awareness and understanding of physics, inspire people to develop their knowledge, understanding and enjoyment of physics and support the development of a diverse and inclusive physics community. As a charity, it has a mission to ensure that physics delivers on its exceptional potential to benefit society.

IOP members come from across the physics community, whether in industry, academia, the classroom, technician roles or in training programmes as an apprentice or a student. However, IOP's reach goes well beyond our membership to all who have an interest in physics and the contribution it makes to our culture, our society and the economy. We are a world-leading science publisher and we are proud to be a trusted and valued voice for the physics community.

The IOP's Business Awards recognise the significant contribution that physics and physicists make in industry across all sectors and at all stages, celebrating entrepreneurship, excellence in innovation and the successful implementation of physics into a product or service.

Welcome



John Bagshaw MA (Oxon), PhD, CEng, CPhys, FInstP, FRAeS

IOP Vice-President for Business

It's great to see that yet again the IOP Business Awards have gone to such a worthy group of winners. This despite 2022 being a year that has presented an unprecedented set of challenges to innovators and entrepreneurs.

Changes in national leadership, and turmoil on the financial markets have contributed to a landscape where building a thriving business has never been more challenging. It really is incredibly reassuring to see that, despite the headwinds, businesses like those of our winners from the medical, nuclear, quantum, and photonics sectors, continue to succeed and make ground-breaking innovations.

This year's award winners are responsible for creating compact quantum magnetic brain imaging equipment, innovating solutions towards building the world's first million-qubit quantum computer, developments in porous semiconductors enhancing compact display technology, transformational work in breast cancer diagnosis, cancer diagnostic devices and bioelectronic therapeutic devices, and ground-breaking advances in neutron detector technology supporting nuclear decommissioning.

It is always an honour to present these awards, but in such tough times, with the UK economy needing all the wealth creators and bright ideas it can find, this year it is also a particular pleasure as well.

A message from IOP's President



Professor Sheila Rowan CBE

President of the Institute of Physics

The IOP Business Awards highlight the vital role physics and physicists play in our economy, creating jobs and powering growth by innovating to meet challenges ranging from energy security to climate change and healthcare for an ageing population. The individuals and companies celebrated by our awards have created ground-breaking products and processes which will shape the world around us for decades to come, and their work is more important than ever today. I am very pleased to congratulate these pioneers and entrepreneurs, and all those who put physics into practice in their work.



IOP Institute of Physics

Awarded to small, medium and large companies that have excelled in innovation and delivered significant economic and / or societal impact through the application of physics.

Winners

Zilico

Innovative Physics

Cerca Magnetics



IOP Institute of Physics

Awarded to young companies with a great business idea founded on a physics invention, with the potential for business growth and significant societal impact.

Winners

Universal Quantum

Porotech

Digitstain

Ceryx Medical

Zilico, Business Innovation Award Winner

“ We at Zilico are honoured to win the IOP Business Innovation Award for our innovative diagnostic for cervical cancer. ZedScan has already benefited thousands of patients across the NHS and international hospitals. We are driven to improve cancer diagnostics, especially within women’s health, an area that has been underserved. This recognition by the IOP makes us at Zilico hugely proud and reinvigorates our drive and passion for better outcomes for patients within cancer pathways. ”

Sameer Kothari, CEO

Innovative Physics, Business Innovation Award Winner

“ Winning this prestigious award is a great honour, and we are humbled to have been chosen. Our dedicated team have allowed us to grow from strength to strength, allowing us to work in places such as the Fukushima Daiichi power plant. ”

Mike Anderson, CEO

Cerca Magnetics, Business Innovation Award Winner

“ Cerca Magnetics are delighted to receive the IOP Business Innovation Award for the development of our cutting edge, quantum sensor enabled, functional brain imaging system. The Cerca OPM-MEG system, for the first time, enables functional brain imaging across the life span and in freely moving patients. This award reflects the amazing team effort to develop and deploy this world leading system. As a team we are incredibly excited about the potential future applications of our technology especially in children with debilitating conditions such as epilepsy. ”

David Woolger, Director

Universal Quantum, Business Start-Up Award Winners

“ Universal Quantum is delighted to win the IOP Business Start-Up Award. To unlock the true potential of quantum computers, these machines must scale from currently available dozens to millions of quantum bits. This is what our unique technology will deliver, and it is exciting to be recognised for that with this award. This recognition will undoubtedly be invaluable as we continue to grow both our team and technology, building the world’s first useful quantum computer. ”

Dr Sebastian Weidt, CEO & Co-founder

Porotech, Business Start-Up Award Winners

“ The Porotech team are thrilled to receive the IOP Business Start-Up award in recognition of our disruptive, engineered GaN-based microLED technology. By enabling all colours of the visible spectrum to be emitted from a single material, and now a single emitter, we are paving the way for next generation microLED displays in everything from TVs to AR glasses. ”

Tongtong Zhu, CEO & Co-founder

Digistain, Business Start-Up

“ It is an absolute honour to be recognised for our achievements by the Institute of Physics. The award from an organisation which is respected so highly gives us huge credibility as we bridge the gap between physics and medicine to offer a level of care to patients around the world who would otherwise only dream of receiving. A humble thanks for the recognition. ”

Hemmel Amrania, CEO

Ceryx Medical, Business Start-Up Award Winners

“ Ceryx Medical are honoured to receive this IOP Business Start-Up Award that recognises our innovation in medical devices. Ceryx’s unique technology promises to change the lives of the millions of patients around the world who suffer with heart failure. ”

Dr Stuart Plant, CEO

Zilico



Zilico receives a Business Innovation Award for using bioelectrical technology for the development of more accurate medical device diagnostics, which provide results in real time leading to better patient outcomes.



The Company

Zilico is a medical device developer within cancer pathways. Its bioelectrical technology analyses the changes in the electrical properties of cells and tissue. These changes act as a surrogate marker for disease and provide accurate diagnosis in real time to clinicians. ZedScan is the company's flagship product within the cervical cancer pathway.

ZedScan is improving cancer diagnostics and has benefited thousands of patients across the world.



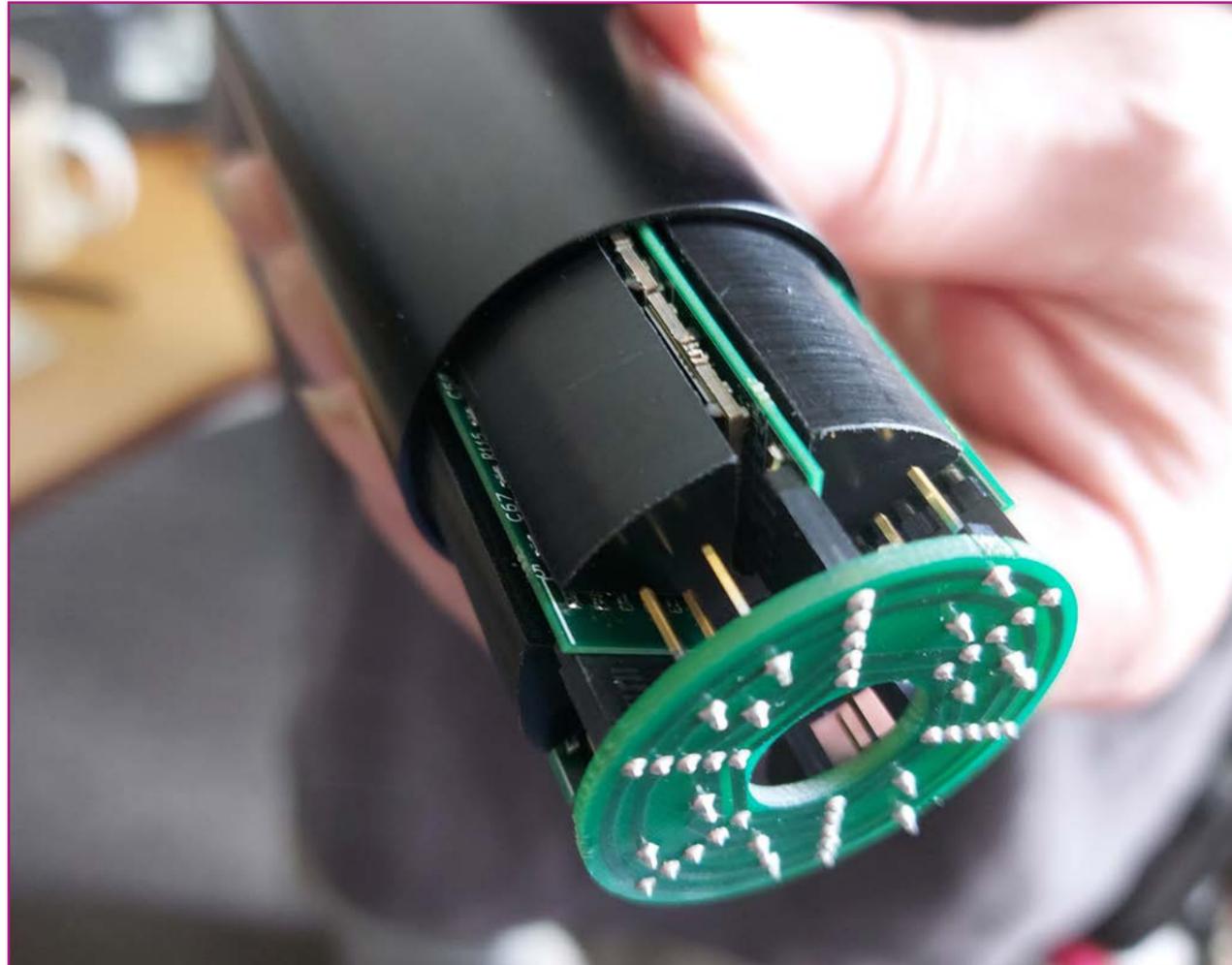
Zilico is developing the next generation of cancer diagnostic devices that remove subjectivity and increase accuracy and deliver results in real time. For diagnostic devices, these characteristics allow for the improvement and extension of clinical screening programmes globally, such as cervical and oral cancers. There is the potential for these characteristics to be utilised in surgical tools and allow clinicians to provide better-directed biopsies and improved accuracy for tissue margin excision during surgery.

Disease state of certain conditions can be challenging for clinicians to accurately diagnose. This is due to lack of clear indicators or subjectivity within methods used. Numerous diseases are still visually diagnosed by clinicians, such as oral and cervical cancers. Whilst clinicians are well trained, it is easier for them to diagnose these diseases when they have progressed into a high-grade stage. With the drive across mature healthcare markets to lower the burden of cost of health on nations, there is a new emphasis on detecting diseases earlier and many of these diseases can be effectively prevented or treated if caught at the early pre-cancer stage. Relying solely on clinicians' visualisation also introduces a high level of subjectivity, especially in the early stages of disease.

Zilico's product offering and research is centred on its patented Electrical Impedance Spectroscopy (EIS) technology, which has applicability across a wide range of neoplastic conditions. Zilico has developed its bioelectric technology as a way of analysing tissue structure as disease progresses from normal to early then late-stage pre-cancer, and then cancer. As the technology is electrically based, this enables the analysis and results to be presented in real time. EIS is based on an understanding of the fundamental principles of bioimpedance properties of tissue, enabling higher accuracy of diagnosis.

ZedScan, Zilico's flagship product, is in routine use across several NHS Trusts within the cervical cancer pathway.

Innovative Physics



Innovative Physics receives a Business Innovation Award for the development of neutron detector technology designed and deployed for decommissioning inside the stricken Fukushima Daiichi Nuclear Power Plant Primary Containment Vessels.



The Company

Innovative Physics is a physics and maths-based R&D company specialising in evolving sensor technology, artificial intelligence, and pattern recognition in the nuclear, homeland security and medical sectors. The company works with foreign governments and business leaders across Asia, Europe, Canada and the USA. It has been involved in many significant, wide-ranging projects, from developing products and systems aiding nuclear decontamination and identifying security risks at airports, to developing techniques that will help speed up the process of detecting cancer. The company comprises 19 personnel, with a combined experience of 90+ years technology innovation, working with foreign governments and business leaders globally.

Innovative Physics has developed a world-leading detection technology allowing reliable neutron detection in harsh and highly noisy environments, therefore providing a new safety tool for decommissioning and reactor operations.



Innovative Physics is an award-winning R&D company specialising in evolving sensor technology, artificial intelligence, and pattern recognition in the nuclear, homeland security and medical sectors. The company works with foreign governments and business leaders across Asia, Europe, Canada and the USA. It has been involved in many significant, wide-ranging projects, from developing products and systems aiding nuclear decontamination and identifying security risks at airports, to developing techniques that will help speed up the process of detecting cancer.

Innovative Physics has developed cutting-edge neutron detector technology using silicon carbide (SiC) and boron-10 (B10) that rejects gamma radiation to enable monitoring of neutron flux in highly radioactive environments. The technology has been commissioned to be used within the tsunami-stricken Fukushima Daiichi Nuclear Power Plant to monitor the neutron flux as the melted fuel debris is investigated in the Primary Containment Vessels and eventually extracted.

Creating the initial design, Innovative Physics has since gone on to create various formations of the neutron detector technology with differing geometric configurations to maximise the total surface area available for neutron detection, creating the optimal efficiency: maximising the capture of neutrons while minimising the capture of subsequent alphas.

This technology has the potential to be used for sub-criticality monitoring inside nuclear power plants, to monitor the neutron flux with extreme time precision closely and, if possible, aid in the prevention of critical incidents.

Cerca Magnetix



Cerca Magnetix receives a Business Innovation Award for bringing to market the world's first wearable magnetoencephalography scanner. The device measures human brain function in health and disease, providing unprecedented accuracy and unparalleled practicality.



The Company

Cerca Magnetix is a start-up company that designs, builds and supplies biomagnetic imaging equipment. The company uses quantum technology and state-of-the-art field control to image human brain function. Cerca Magnetix was launched in late 2020, is backed by the University of Nottingham and Magnetix Shields Limited, and employs six staff in the UK.

The Cerca Magnetix system enables measurement of brain activity in freely moving subjects, with complete lifetime compliance, higher accuracy and lower cost than conventional technology.

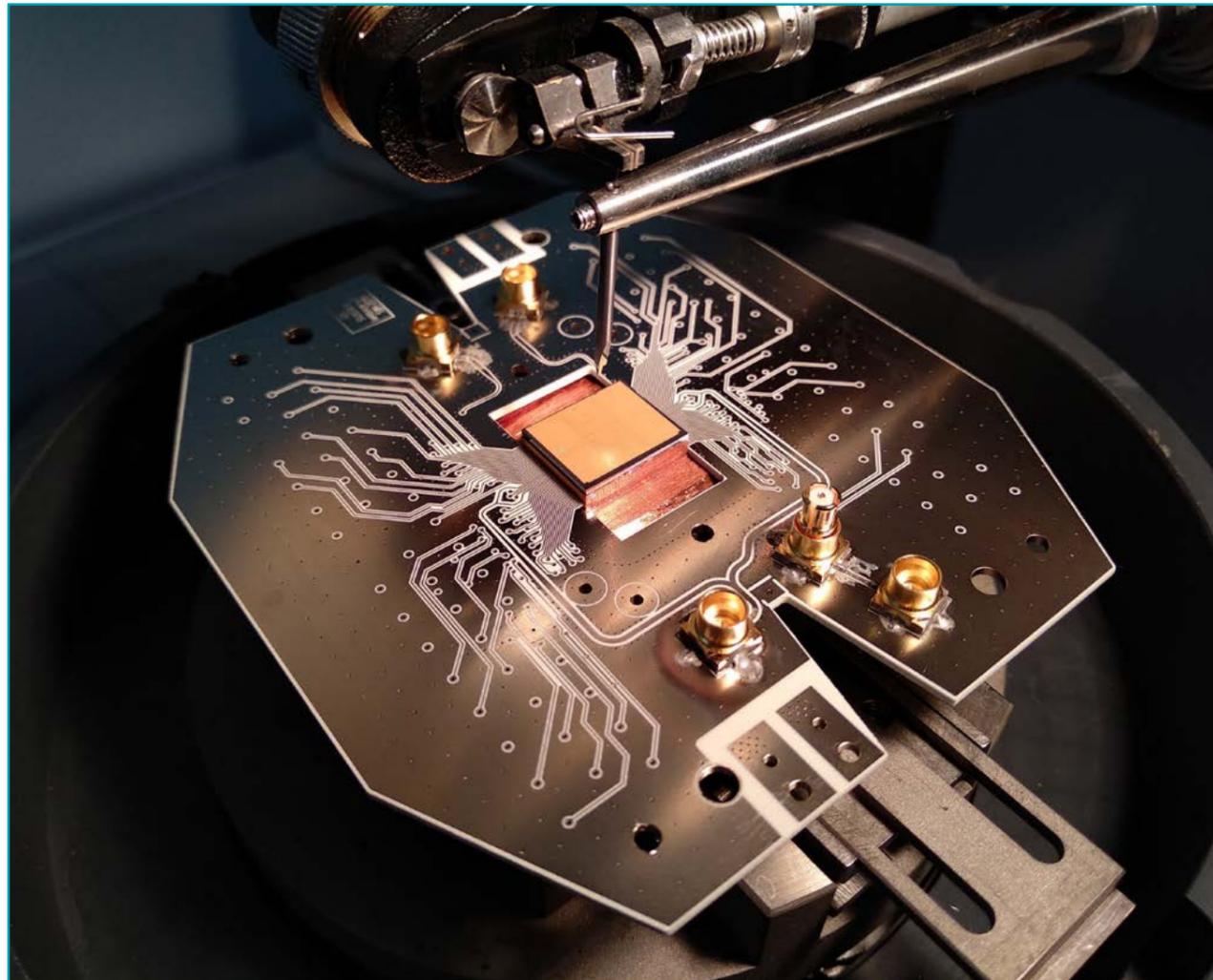


Magnetoencephalography (MEG) measures the small magnetic fields generated by current flow through neuronal assemblies in the brain. Mathematical reconstruction of these fields enables generation of three-dimensional (3D) images showing how brain activity changes – moment-to-moment – as we carry out mental tasks. Using MEG, both healthy brain function and its breakdown in disease can be assessed. MEG is an extremely useful tool for neuroscience and outperforms the accepted clinical standard (electroencephalography). It is used in disorders like epilepsy for example, to pinpoint the brain regions responsible for seizures.

Existing MEG scanners are extremely limited because they use magnetic field sensors (superconducting quantum interference devices) that must be cryogenically cooled to -269 °C. This makes scanners large and cumbersome. The machine weighs around half a tonne and has a helmet into which the patient's head is placed. Patients must remain still for long periods; the helmet is rigid (unable to adapt to different head sizes) and coverage is non-uniform, with systems poorly suited to children. Systems are also extremely expensive.

Cerca Magnetix has developed a fundamentally different MEG system. Exploiting novel quantum-technology, optically pumped magnetometers (OPMs) are used to measure the brain's magnetic field without cryogenics. OPMs are small (like a Lego brick) and can be mounted in adaptable 3D-printed helmets that are worn by subjects. Sensors can be positioned very close to the scalp, meaning coverage is uniform, with improved sensitivity and spatial resolution. The system adapts readily to babies/children, and patients can move freely during a scan. The system is also much lower in cost than conventional MEG. Cerca Magnetix offers a complete integrated system, including a sensor array and helmet, alongside advanced electromagnetic shielding that is required to remove the influence of external magnetic fields.

Universal Quantum

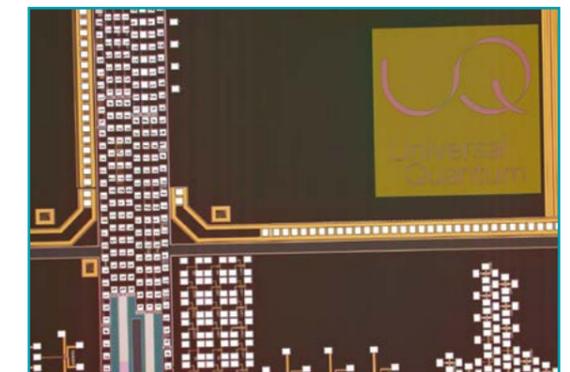


Universal Quantum receives a Business Start-Up Award for its work developing the world's first million-qubit quantum computer. Universal Quantum's electronic modules are based on silicon technology, connected using ultrafast electric field links to form an architecture that truly scales.



The Company

Universal Quantum is developing the first million-qubit quantum computer. The company's electronic modules are based on silicon technology, connected using ultrafast electric field links to form an architecture that truly scales. Universal Quantum is a spin-out from the University of Sussex with 15+ years of quantum computing experience.



Universal Quantum is developing the first million-qubit quantum computer. The company's original hardware and software blueprint addressed the key science and engineering challenges to scale and demonstrate a useful quantum computation, faster than the competition. Now, Universal Quantum is putting this blueprint into action.

To realise their full potential, quantum computers must scale to millions of quantum bits (qubits). This is now the primary challenge within quantum computing. But there are many ways to make a large-scale quantum computer – with different types of qubits being tested and developed.

Current quantum computers are made up of dozens of qubits and most of this hardware is dominated by big tech players focusing on superconducting qubits. While they provide useful proofs of concept, many existing designs could struggle to scale to millions of qubits for many reasons. For example, superconducting qubits need near-absolute zero temperatures to work.

So, many companies are now focusing on an alternative type of qubit that does not need to be cooled to such challenging temperatures – trapped-ion qubits. Trapped ion designs have led to many significant world records in the quantum computing sector, including Universal Quantum's original blueprint for a commercially viable quantum machine.

This blueprint proposes unique solutions to address the vast range of additional engineering challenges to scale up. It introduces a modular architecture where qubits can travel across a quantum computer and effectively 'talk' to one another to complete fast and accurate quantum calculations.

This is where Universal Quantum's strength in quantum computing lies – not in trying to scale pre-existing quantum computer designs but in coming up with new and innovative solutions to address the million-qubit challenge from the outset.

Porotech

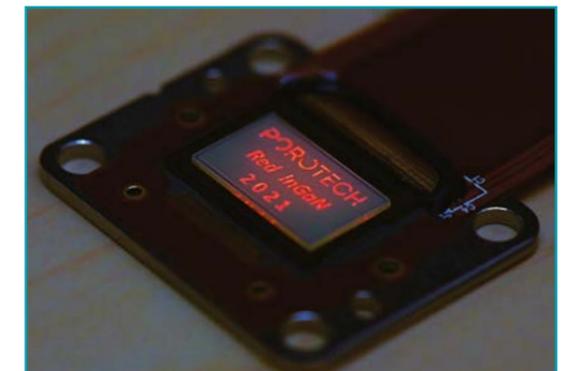


Porotech receives a Business Start-Up Award for the development of porous semiconductors enabling the world's first commercial native indium-gallium-nitride red light-emitting diode (LED) epiwafer – simplifying full-colour micro-LED display manufacture and advancing this next-generation technology towards widespread adoption.



The Company

Porotech develops and delivers engineered porous gallium nitride (GaN) with material properties tailored to wide-ranging applications. Porotech's team of physicists, innovators and industry experts believe these new technology platforms can unleash the full potential of GaN to change the semiconductor industry in many emerging markets including micro-LED displays and quantum light sources.



Porotech's proprietary engineered subsurface porous semiconductor technology is enabling new optoelectronic products for the global display industry. The technology is based on a commercially scalable electrochemical etch process enabling precise formation of subsurface porosity within gallium nitride alloys. Through careful design of structures and control of the fabrication method, high quality semiconductor wafers are produced that can be supplied to the global semiconductor manufacturing supply chain ready for mass production.

The technology enables features not previously accessible within this material. Most notably, the porosification reduces strain in the lattice enabling a higher fraction of indium to be incorporated in indium gallium nitride light-emitting diodes (InGaN LEDs), resulting in longer wavelength emission. This has resulted in the world's first commercial native InGaN red LED epiwafer for micro-LED display applications.

This world first creates the possibility for red, green and blue emitters on the same InGaN material system for the first time. Conventionally, mixed aluminium indium gallium phosphide (AlInGaP) and InGaN LEDs were required to create full-colour displays. Mixing material systems presents major manufacturing hurdles to the display industry in creating micro-LED displays, severely limiting the potential for the mass market adoption of this next-generation technology.

Porotech's full-colour micro-LED platform solves these major hurdles and provides a feature-rich platform for customers to develop compact and high efficiency micro-LED displays.

Digistain

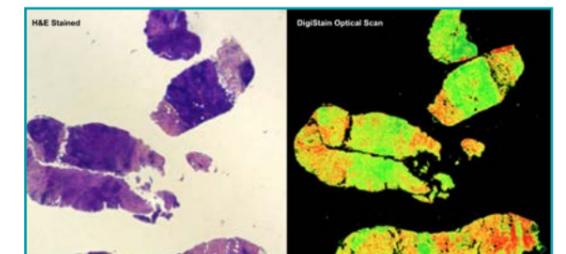


Digistain receives a Business Start-Up Award for solving treatment delays in breast cancer by using a biomedical implementation of infrared vibrational spectroscopy.



The Company

Digistain is a biotech company that began in a physics laboratory at Imperial College London. It takes the guesswork out of cancer diagnosis by measuring the chemical changes that accompany the disease. It allows physicians to decide who needs chemotherapy quickly and easily.



Digistain is a market-ready UK-based clinical diagnostics company transforming breast cancer treatment in a way that saves time, money and lives.

Whereas current diagnostics delay treatment decisions for a full month, Digistain provides oncologists with decision-making data in just 15 minutes. If chemotherapy is indicated, it can be initiated immediately, a critical concern when delays can make the difference between life and death. At the same time, the improved security of diagnosis means that unnecessary chemotherapy can be avoided in a much larger fraction of cases. Oncologists can leapfrog current technology to provide superior care quickly and affordably. The founders, Professor Chris Phillips and Dr Hemmel Amrania, hold PhDs from the University of Cambridge and Imperial College London respectively, and their innovation has been rewarded with a Royal Society Innovation Prize, a Cancer Research UK Pioneer Award and an Innovate UK SMART award.

The Digistain technology was developed over 10 years of research at Imperial College London's Department of Physics in collaboration with Professor Sir Nicholas Wright from Cancer Research UK and trialled successfully with NHS Hospitals with funding from the National Institute of Health Research.

After a landmark trial with over 800 breast cancer patients, Digistain demonstrated equivalence to the current gold standard and received Medicines and Healthcare products Regulatory Agency approval, meaning patients can now get the treatment they need without having to wait weeks or even months in frustration.

Ceryx Medical



Ceryx Medical receives a Business Start-Up Award for developing a unique bioelectronic technology that could change the way diseases such as heart failure are treated by reinstating natural communication between the heart and lungs.



The Company

Ceryx Medical is a biomedical company that develops bioelectronic therapeutic devices for treating diseases such as heart failure and other neurological disorders. These bioelectronic devices help restore the lost physiological functions within the body. This approach allows revolutionary therapies with no side effects to be employed..



Heart failure happens when the heart can no longer supply all the blood the body needs. This situation results from damage to the heart that can occur following a heart attack, an infection or chronic hypertension. Once a patient has heart failure, it is extremely difficult to prevent the disease from progressing.

Current heart failure treatment is limited, confined to the prevention and control of symptoms, preventing mortality, and in the early stages, attempting to prevent or slow cardiac remodelling. Clinicians are challenged by a disease in which they must attempt to maximise cardiac performance to minimise heart failure symptoms, while simultaneously reducing stress on a damaged heart.

In a healthy body, the heart and the lungs are linked, their function is coordinated to maximise performance. The heart and lungs receive multiple inputs that influence their function; for example, stress, both physical and emotional, stimulates an increase in heart rate and respiration. Both organs are continuously responding to the needs of the body. Despite these constant demands, communication between the organs is maintained such that the two work together to maximise cardiorespiratory efficiency. In diseases such as heart failure, this communication between the heart and lungs is disrupted, thus reducing their performance. Ceryx can restore the natural patterns of communication between the heart and lungs, improve cardiac function and bring significant therapeutic benefit to patients with cardiac diseases such as heart failure.

Ceryx Medical has developed a technology that mimics cell membranes, ion channels and action potentials using analogue circuitry, enabling the system to interpret signals directly with the body in real-time and generate realistic, biological output signals. These artificial neurons are then combined into neural networks that mimic neural structures called central pattern generators, which the body uses to control processes ranging from walking to swallowing to breathing.

11 years of IOP Business Award winners

Active Needle Technology

Advanced Hall Sensors

AEGIQ

Aeristech

Airbus Defence and Space

Aqua Cooling Solutions

Aurox

CanSense

Causeway Sensors

Cellular Highways

Cerca Magnetics

Ceryx Medical

Coherent Scotland

Creavo Medical Technologies

Digistain

Displaydata

Elekta

Endomag

FeTu

FFEI

Gas Sensing Solutions

Geotopic

Gooch & Housego

Hallmarq Veterinary Imaging

Hirst Magnetic Instruments

Horiba

ICEoxford

Ikon Science

Innovative Physics

Jaguar Land Rover

Kromek

Leonardo

Lightpoint Medical

Lynkeos

M Squared

Magnox

Matoha Instrumentation

MBDA

Metrasens

MR Solutions

Naneum

Nebu-Flow

Novosound

Opsydia

ORCA Computing

Ossila

Oxford HighQ

Oxford NI

Oxford Space Systems

OxMet Technologies

PepsiCo

Photon Force

Plastipack

Porotech

Promethean Particles

pureLiFi

QLM Technology

Quantum Dice

Reaction Engines

Rolls-Royce

Silixa

Simpleware

Sonobex

Stream Bio

Tesla Engineering

The Technology Partnership

Thornton Tomasetti Defence

Toshiba Europe

Tracerco

Teledyne e2V

Ultra Electronics

Universal Quantum

VeriVin

York Instruments

Zephir

Zilico

IOP Institute of Physics

The IOP is the professional body and learned society for physics in the UK and Ireland, with an active role in promoting cooperation in physics around the world. We strive to make physics accessible to people from all backgrounds. Our 22,000 members demonstrate their professional expertise in physics in settings ranging from schools, universities and national research facilities, to businesses of all sizes, and in roles as varied as teacher, researcher, apprentice, technician, engineer and product developer.

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