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DEPARTMENT OF ENGINEERING

NEWS

UNIVERSITY OF CAMBRIDGE

In this issue

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Cover image: Amy Weatherup, Director of Cambridge i-Teams – an innovation commercialisation programme which is run out of the Institute for Manufacturing (IfM), part of the Department of Engineering. Credit: StillVision

Note from the editors

In this edition, we have a crop of alumni stories that inspire, motivate and impress in equal measure.

We introduce civil engineer Laura Kasuni Wathe, who has recently returned to Africa after completing her MPhil in Engineering for Sustainable Development (ESD). The MPhil challenged Laura to think about what it takes to design cities that work for everyone. Her goal is to take learnings about systems thinking, resilience, data use and user-centred design, and apply them in the African context, with the aim of contributing to sustainable development at scale. Laura is one to watch and we wish her well in the future (see page 6).

Then we meet Lane Painter who works at NASA Headquarters on the Mars Exploration Program, where he helps steer the future of robotic science missions. Lane completed the MPhil in Industrial Systems, Manufacture and Management (ISMM) at the Institute for Manufacturing (IfM) – a course he says proved pivotal to his future. It's fair to say that Lane's Cambridge experience laid the foundations for his future career, and he is now in a role that blends strategy and technology with an enduring sense of curiosity (see page 8).

Our final alumni introduction is teams behind two start-ups that have graduated from Founders at Cambridge – an initiative supporting and empowering innovators to make an ever-greater impact. Start-ups Pinepeak (co-founded by Dr Savvas Gkantonas and Dr Daniel Fredrich) and Sqwish Labs (co-founded by Dr Ushnish Sengupta and Federica Freddi) have been able to gain access to a growing global expert community, including other University alumni (page 16).

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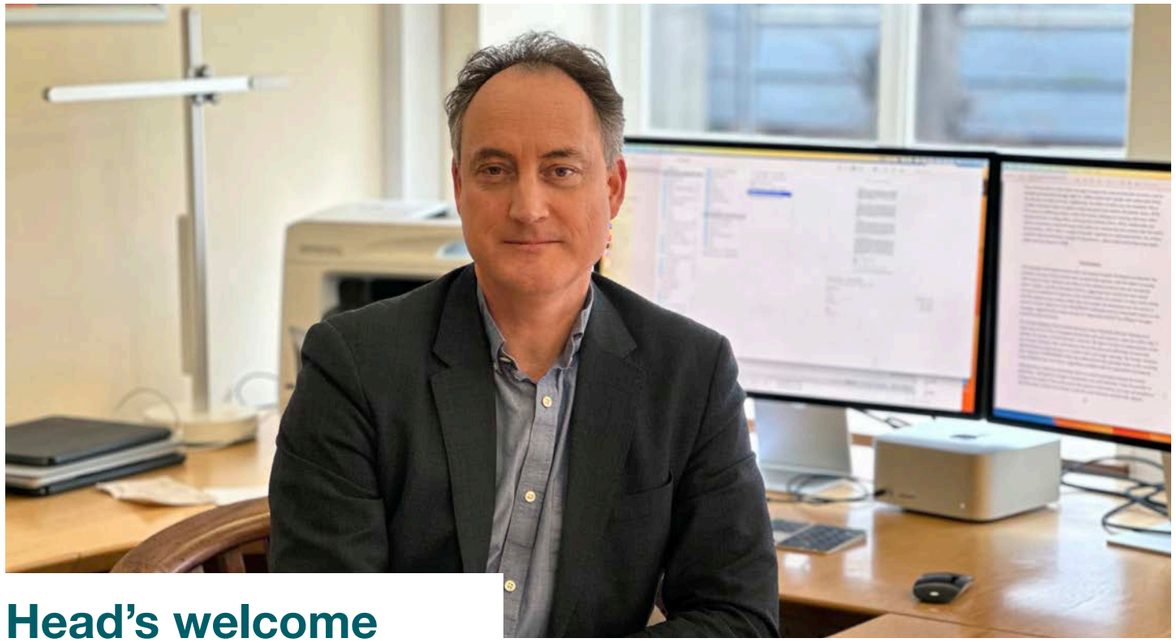


Head's welcome

Welcome to this latest edition of the Department of Engineering News for Spring 2026.

You will see that this edition is packed with an array of stories, with somewhat of a focus on aspects of Bioengineering. This is due to the recent launch of the new Institute for Biomedical Innovation, or IBI, which is a repurposing of the Nanoscience Centre.

We launched the institute on 1 January 2026, under the leadership of Professor George Malliaras, with Professor Ronan Daly as deputy director. This is the UK's first end-to-end biomedical device research and fabrication facility, focusing on implantable and wearable electronics. A story about one of the activities which will take place in this facility is on **page 12**.

Since the last newsletter, the University has firmed up on its Capital Plan, which includes the move of Engineering to Cambridge West to enable reintegration around specific research themes and teaching. The Programme board, which will oversee this, has been constituted and will meet for the first time before summer 2026. Fundraising has been stepped up significantly.

The new MPhil in Electrical Engineering has accepted its first cohort of students to start later this year. Thanks to all involved in the division and the school for making this happen.

The reform of Part I has passed the final approval process, and it is now set in stone that we will accept our first students on this Tripos in Michaelmas 2027. This is an exciting development for the Department, as not only are we looking at a tighter integration between lectures, labs and supervisions, but we are introducing a new thread of design and data-centric engineering into the Tripos.

Looking through this edition of the newsletter, starting with the story which appears on **page 4**, you will see that Professor Lengyel is leading on a substantial research project delving into the fundamental principles of intelligence and learning.

On **page 5** is a story about ongoing work by a start-up which has been created by Dr Deepanshu Singh, a researcher at the Whittle Laboratory, with colleagues from across the University, on the use of microbial action to create sustainable aviation fuel (SAF).

On **page 10** is some work from Dr David Hardman, a researcher in the Department who has been working on some flexible electronics to mimic pressure sensitivity, which is a proxy for tactile sensing, to be deployed in robotics. This is one of the key challenges in the field – the ability to sense when and how hard an object is being touched, which is a step towards replicating human-type interaction.

On **page 14** you will see that Professor Julian Allwood has been appointed to the Science and Technology Advisory Council to provide advice to the Department for Energy Security and Net Zero as we accelerate the national mission to achieve net zero by 2030. I am also delighted to share with you that Julian has just been awarded the Pilkington Prize for teaching by the University.

Then on **page 19** is a story on a new prize that we have introduced for top performance in Part IA of the Tripos. This is a repurposing of the Arthur Shercliff travel awards and is a nice way to keep Arthur in our memories.

Throughout the rest of the newsletter, you will see a range of stories about faculty, alumni and undergraduates, and as always, I hope you will find something interesting.

Professor Colm Durkan FREng FInstP FIET

→ [RIGHT] Professor Máté Lengyel

Credit: [LEFT] Julia Kuhl [RIGHT] Samuel Lengyel

Unpacking fundamental principles of intelligence that apply across species – neuroscientist to lead research

Professor Máté Lengyel will join leading scientists across neuroscience and machine learning as part of a 10-year programme set up to advance our understanding of how the brain processes information while interacting with the environment.

The newly launched Simons Collaboration on Ecological Neuroscience (SCENE) – involving 20 principal investigators including Professor Lengyel – will integrate cutting-edge neural recording technologies, computational modelling and cross-species experimentation to systematically test formal mathematical theories of how the brain represents and uses information to guide behaviour.

The collaboration will provide more than $8 million per year across six teams of researchers, enabling scientists to conduct large-scale studies that are not typically feasible under conventional grants.

Professor Lengyel's project was selected from an initial pool of 245 applications after a rigorous multi-year selection process. His research stands at the intersection of mathematics and biology, using sophisticated mathematical methods to understand the brain's complex information processing systems.

A dream come true

"In many ways, SCENE is a dream come true for me," says Professor Lengyel. "The scientific questions that we will be investigating and the ways in which SCENE's 20 different labs around the world are going to collaborate are very close to my ideal of neuroscience."

What kind of internal models drive our interactions with our environment? Are they focused on things we can control and change? Are they focused on the rewarding aspects of the world? Or do our internal models reflect all aspects of the world roughly equally, regardless of whether those aspects are controllable or rewarding?

"These sorts of questions go to the very core of human and animal intelligence – and even have implications for AI," says Professor Lengyel.

"Personally, these questions have also been very close to my heart since the early years of my career. I have also always felt strongly that to make meaningful progress on these difficult questions, we need to build on solid theoretical foundations and then have stringent empirical tests of the mathematical theories we develop."

He added: "SCENE's close collaboration between world-leading theoretical and experimental groups, with generous funding by the Simons Foundation, will allow us to realise this vision. I am honoured to be leading this team, and I am excited by the opportunities it will provide for the Department of Engineering, and for the Computational and Biological Learning Lab in particular."

Investigating human and animal cognition

The SCENE project promises to advance our understanding of how the brain works across levels – from neural circuits to behaviour. The teams include scientists dedicated to theory and data science as well as conducting experiments in species ranging from rodents and bats to humans.

Kelsey Martin, Executive Vice President of Autism and Neuroscience at the Simons Foundation, said: "We are excited to enable a collaborative research programme that uses the framework of ecological neuroscience to understand brain function. With an interdisciplinary approach, we hope to discover fundamental principles of cognition applicable across species."

This year, the Machine Learning and Machine Intelligence MPhil will introduce a new track dedicated to Biological Learning. The Biological Learning track will prepare students for applying machine learning to biological systems, with a particular emphasis on theoretical foundations, neuroscience and neurotechnology applications.

www.mlmi.eng.cam.ac.uk

→ Neela Biotech co-founders Dr Deepanshu Singh and Friederike Nintzel

Credit: King's E-Lab

Award-winning start-up secures grant funding to accelerate carbon-negative jet fuel production

Neela Biotech, a start-up co-founded by early career researchers Dr Deepanshu Singh and Friederike Nintzel, has secured grant funding from the Henry Royce Institute towards a novel method of producing carbon-negative aviation fuel.

The start-up is addressing aviation's emissions challenge using its own nature-inspired anaerobic digestion process called Controlled Microbial Upcycling (CMU), which builds on recent breakthroughs in AI-driven synthetic biology to power the future of flight with carbon-negative fuels.

Their process transforms multiple waste streams into low-cost, drop-in jet fuel by leveraging existing biogas plant and refinery infrastructure. Unlike traditional sustainable aviation fuels (SAF), which often displace food production because respective feedstocks are grown on arable land, CMU eliminates competition for food, land and water whilst reducing production costs.

Now, thanks to grant funding from the Henry Royce Institute, Neela Biotech are collaborating with the Aviation Impact Accelerator (AIA) at the Whittle Laboratory, University of Cambridge, on a feasibility study of carbon-negative fatty acid production via their novel CMU process. The goal is to bring the technology closer to market, specifically for SAF production. As the academic collaborator, the AIA will be performing techno-economic and lifecycle emissions assessments of Neela Biotech's SAF pathway.

This collaboration highlights how the system modelling at the heart of the AIA is not just about informing better policy – it is also about guiding smarter investment decisions and helping start-ups focus on where they can make the greatest impact. By linking this modelling capability with cutting-edge companies like Neela Biotech, the New Whittle Laboratory and the Bennett Innovation Lab at the University of Cambridge are helping to shape and accelerate the industries of the future.

Dr Deepanshu Singh, a researcher in sustainable aviation and Business Development Lead at the AIA, said: "Aviation is the most emissions-intensive mode of transport. SAFs offer a drop-in solution to decarbonise the sector, yet they make up less than 1% jet fuel usage today. Current SAF production pathways face scale-up challenges due to feedstock limitations and reliance on energy- and capex-intensive processes. Our CMU process tackles these barriers by using diverse feedstocks, replacing energy-intensive processes with low-cost microbial action and leveraging existing infrastructure. This makes our pathway highly scalable and cost-effective."

Friederike Nintzel, final-year Marie Curie PhD fellow in synthetic biology, adds: "Our approach has only recently become feasible due to advances in microbiome engineering and AI-driven bio-process design. Further, the demand for SAFs is rising at an unprecedented rate because of airlines' net zero targets and global SAF mandates."

Their innovation was recognised at the 2025 Cambridge Zero Climate Challenge, where Neela Biotech won first prize. And they were selected to join a new incubator programme from King's Entrepreneurship Lab (King's E-Lab), delivered in partnership with Founders at the University of Cambridge. SPARK 1.0 is a four-week residential incubator that began in late August 2025, designed to help early-stage ventures grow from research-backed ideas into investable companies.

Neela Biotech is also a part of the prestigious IAG Innovation Accelerator, where Dr Singh and Friederike Nintzel are learning about fuel supply chains, certification and validating the commercial potential of their SAF pathway. IAG is the parent company of airlines including British Airways, Aer Lingus, Iberia and Vueling.

Neela Biotech has gone on to achieve recent success in two major start-up competitions:

- Becoming a grand finalist in the 12th Lee Kuan Yew Global Business Plan Competition, competing against other next-generation entrepreneurs and leaders in the global innovation ecosystem.
- Selected as a ClimateLaunchpad Regional Champion (Europe), and will now advance to the Global Grand Final in Vienna as a recognised 'top 8' start-up from around the world, having competed against more than 2,700 global start-ups.

www.neelabiotech.com

→ Laura Kasuni Wathe

ALUMNI UPDATE

The civil engineer dedicated to building green, resilient and inclusive infrastructure for the future

Civil engineer Laura Kasuni Wathe came to Cambridge to pursue an MPhil with one goal in mind: to take learnings about systems thinking, resilience, data use and user-centred design, and apply them in the African context, with the aim of contributing to sustainable development at scale.

"Growing up in Kenya and practising as a civil engineer, I saw how project delays and budget overruns crippled progress," said Laura.

"It was frustrating, especially when you know that the social and economic impact of stalled infrastructure in a rapidly urbanising country can be severe. This is what led me to Cambridge – I want to be part of a generation of engineers who are not just building infrastructure, but building futures that are resilient, inclusive and climate-conscious."

Laura, a Mastercard Foundation Scholar, has completed her MPhil in Engineering for Sustainable Development (ESD) and has now returned to Africa.

A highlight of Laura's Cambridge experience was working on a collaborative project using data to reduce delays and cost overruns in the construction sector – a challenge close to her heart, given her first-hand professional experience in Kenya, both on-site and in high-level planning.

"I worked in the construction sector, where I was involved in mega infrastructure projects in Kenya's capital Nairobi, and in rural road infrastructure projects that had only a handful of site workers. Despite the differences in scale, most, if not all of these projects were never delivered on time, nor within budget. Poor coordination, scarce data and reactive decision-making created a vicious cycle of cost overruns, contractor disputes and even project abandonment."

Laura's involvement in the University's Innovation i-Teams programme, which brings entrepreneurial postgraduates and early-career researchers together to explore the commercial potential of cutting-edge University inventions, lasted for a period of eight weeks.

"Cambridge i-Teams completely shifted how I approach problem solving," she said. "It wasn't just about brainstorming ideas; we had to validate our assumptions with end users and industry experts, map out the technology ecosystem and think through how impact could scale."

She added: "The experience has changed my outlook. I now approach not just engineering problems, but all challenges, from both a systems and human-centred design perspective. That dual view – thinking about infrastructure not just as a technical product but as a service delivered to people – is something I'll carry forward into my career."

Designing cities that work for everyone

The MPhil in ESD challenged Laura (Churchill College) to think about what it takes to design cities that work for everyone. Her dissertation explored the relationship between socio-demographic vulnerability and flood-related transport disruption in London, England.

Laura said: "My dissertation aims to answer the question: are people who are already disadvantaged due to income, age or disability more exposed to the impacts of climate change on transportation?"

"By spatially analysing flood risk, transport networks and demographic data, I aim to identify areas where inequalities are being worsened by climate risks. The findings could inform targeted climate adaptation measures and resilience planning, contributing to strategies like the UK's National Adaptation Programme.

"In the long term, this kind of research has the potential to reduce transport poverty and systemic inequities that climate change threatens to deepen. It is about designing cities that work for everyone, not just for those with the resources to adapt."

Looking to the future

"I'm grateful for having been given the chance to immerse myself in the University of Cambridge's vibrant entrepreneurship ecosystem," said Laura. "A big shoutout to my teammates and mentors – you have made this an unforgettable experience. Here's to turning challenges into opportunities and to shaping a future full of impactful innovations!"

Read the full article at:
www.eng.cam.ac.uk/civil-engineer-alumna

→ Amy Weatherup, Director of Cambridge i-Teams

Credit: StillVision

Meet founder and investor Amy Weatherup – a champion of Cambridge innovation

Following a successful exit from an internet technology start-up, Amy Weatherup has become a pillar of the Cambridge innovation ecosystem as Director of Cambridge i-Teams, an investor at – and now co-chair of – Cambridge Angels, and a tireless supporter of an array of businesses, schools and charities in and around Cambridge.

It has been 20 years since the first Cambridge i-Teams session took place – a programme which continues to shape the next generation of innovators. Bringing together entrepreneurial postgraduates and early career researchers to explore the commercial potential of cutting-edge University inventions, Cambridge i-Teams, which runs termly, is open to students and staff from all University disciplines. There are four options available: Innovation i-Teams, Medical i-Teams, Social i-Teams and Development i-Teams.

"Everything I do is about creating the space for people to bring their own ideas and fulfil their potential," says Amy, who is based at the Institute for Manufacturing (IfM), part of the Department of Engineering.

"I did a maths degree at Cambridge (Trinity College), then started Part III Maths, which I left halfway through for a PhD in fluid mechanics at Imperial, which I left halfway through to found a start-up. You can see a pattern emerging!

"My start-up was called STNC, which ended up being the first company in the world to put web browsers onto mobile phones. When we started in the early 1990s, mobile phones were becoming a thing but only for voice calls and text messages. They certainly didn't have colour displays, cameras or email.

"My co-founder was one of the very few experts in computer networking at the time and we started offering a solution for email for low-cost, low-power handheld devices. We would go to meetings and people would say things like: "Why on earth do we need email when we've got a perfectly good fax machine? Who wants to send an email from their phone?"

"We grew very slowly to start with and then the internet happened, almost overnight. We were one of the few companies in the world that understood its possibilities. By that stage, there were 10 of us and we had some of the world's largest tech companies queuing at our door.

"We started to work with Microsoft, which eventually led to them acquiring us and our software becoming Microsoft Mobile Explorer.

The evolution of Cambridge i-Teams

"I found myself a role in the University as Entrepreneur-in-Residence at the Cambridge-MIT Institute, a partnership between the two universities that ran from 2000 to 2006. It was then that I came across MIT's i-Teams programme and started to think about how it could work for Cambridge.

"At the time, there was quite a lot of support available for students who already had an idea for a business and there were a couple of undergraduate courses and some master's programmes which included modules on entrepreneurship. But there was very little for the majority of students who were broadly interested in entrepreneurship but didn't have their own idea for a company.

"Cambridge i-Teams was designed to fill that gap by giving entrepreneurial students the opportunity to work on real technologies coming out of the University that were underpinned by great science.

"Teams of up to seven participants, from across all University disciplines, work with the support of their team mentor, the researchers who developed the technology and me. The teams investigate market opportunities and give researchers early feedback from potential partners and customers.

"The midwife community talks about holding the space for the woman who's having a baby. What I try to do is hold the space for whoever I'm working with, whether that's in a boardroom or running i-Teams.

"i-Teams is very much holding the space to give the students the appropriate support while encouraging them to work with their own skills and expertise."

Interview by Sarah Fell

Read the full interview at:
www.eng.cam.ac.uk/amy-weatherup

ALUMNI UPDATE

Lane Painter's mission to Mars

As a child growing up in New Jersey, alumnus Lane Painter (Darwin College 2022) was fascinated by robots of all kinds. He was curious about how they worked, how they were built and most importantly, what they might do.

Today, that same interest drives him as he advances robotic missions on Mars at NASA. His path to the forefront of space exploration began with an unexpected pivot: from studying Economics, to reading Engineering at Cambridge.

Now based in Washington, D.C., Lane works at NASA Headquarters on the Mars Exploration Program, where he helps steer the future of robotic science missions. It's a role that blends strategy, technology and an enduring sense of curiosity.

So how does someone with a degree in economics end up at the heart of space innovation? As Lane puts it: "So much of what I do now stems from my time at Cambridge."

While earning his Economics degree, Lane spent a formative stint working in a human-robot interaction lab at the University of Chicago. This sparked his move to Cambridge in 2022, where he joined the MPhil in Industrial Systems, Manufacturing and Management (ISMM): a course that proved pivotal to his future.

His master's cohort was made up almost entirely of engineers from around the world, bringing a diverse range of technical expertise. "I was the only outlier, coming in with an economics background," Lane recalls.

What began as an academic shift soon became a broader reimagining of his career, as Lane's learning extended far beyond the lecture theatre. "We tackled live engineering challenges with over 30 companies across Europe and Asia, travelling to apply what we learned first hand.

"I came to Cambridge expecting rigorous study and academic exploration, but I hadn't anticipated how rich the College culture would be, and how easy it was to meet people and have meaningful conversations. I was frequently meeting others working on fascinating research across every field and was constantly exposed to new ideas and industries.

"What I came to realise was that Cambridge offered the ideal mix: policy conversations at Darwin, technical learning with my cohort, and hands-on management and strategy through my course. That blend mirrors the work I do now at NASA. The way I approach problems in the Mars Exploration Program has been shaped by the foundations laid for me at Cambridge, where learning wasn't confined to the classroom – it was part of everything, trickling down into every part of my life."

For Lane, working at NASA is about far more than spaceflight. It's the depth and diversity of the science, and the people behind it, that continue to inspire him. His role has given him insight into the lesser-known sides of the organisation, from its global collaborations to its impact on life here on Earth.

"People often think of NASA as just spaceships and rocket science, and that's understandable. But the reality is far more expansive. NASA is made up of countless teams of brilliant, deeply mission-driven people working across a huge range of scientific fields. The research happening here doesn't just impact other planets or solar systems; it has real potential to improve life on Earth, making it more sustainable, more efficient and better understood."

Now two years into his role at NASA, Lane makes a point of talking to students interested in Cambridge, STEM, space or careers that seem just out of reach.

He encourages the students he mentors, and potential Cambridge applicants, to be bold. "There are so many different ways in. Where you begin doesn't limit where you can go. The key is to follow your curiosity and keep building skills and experiences along the way."

What Lane found at Cambridge – curiosity, collaboration and a culture of learning – still drive his work today.

"The more time goes by, the more I realise how much of an amazing experience being at Cambridge was – the programme, the cohort, the College, the culture of learning. It permeates every nook and cranny of the city, and it stays with you. There's no other place like it."

Read the full article at:
www.eng.cam.ac.uk/lane-painter

→ Polytecks co-founder Ruben Ruiz-Mateos Serrano demonstrates one of his prototype devices for the early and accurate detection of heart defects

Credit: [LEFT] Undine-Sophie Deumer. [RIGHT] Chaoqun Dong

Department spin-out to develop wearable e-textile tech for early detection of heart defects

Ruben Ruiz-Mateos Serrano has taken his PhD research to the next level by launching Polytecks – a spin-out dedicated to faster, earlier and more accurate diagnostics for heart defects.

Spun out of the Department of Engineering in 2025, Polytecks makes use of wearable electronic textile-based (e-textile) high-density electrode arrays to capture high-resolution bioelectrical signals from the body's surface. These electrical heart signals, captured in real time, are then transmitted wirelessly to a computer, where they are processed into detailed spatiotemporal maps using AI.

The process enables the early and accurate detection of a wide range of electrophysiological phenomena – initially cardiac abnormalities – with potential applications in neurology, neuroprosthetics, gut health, foetal health and beyond.

"We can record not only electrical heart signals but achieve higher spatial resolution than a conventional electrocardiogram (ECG)," said Ruben, co-founder of Polytecks, and former MRes + PhD student at the Centre for Doctoral Training in Connected Electronic and Photonic Systems (CEPS). "This is thanks to our flexible, textile-based electrode array, which is coated with advanced conducting polymers."

He added: "This means that Polytecks technology offers a higher electrode density compared to commercial solutions, while maintaining or improving signal quality. It can aid diagnosis of both electrical and anatomical heart problems such as valvular heart disease."

Early testing of the prototype in dogs has focused on capturing cardiac signals, refining signal processing and demonstrating usability in a real-world setting. The aim is to produce a diagnosis within a few minutes at the point of service, i.e., at a veterinary practice, rather than at a veterinary hospital. Mitral valve disease, for example, is the most common heart condition in adult dogs. Early detection is crucial, as timely medication can extend their lives.

This research has been carried out in collaboration with The Queen's Veterinary School Hospital in Cambridge, and builds upon Ruben's PhD research under the supervision of Professor George Malliaras, who leads the Bioelectronics Laboratory at the Department of Engineering.

Ruben added: "Our final design is a relatively small hexagonal device, inserted into a strap that is then attached to a patient using hook-and-loop fasteners. We found that placing the electrodes in a radially symmetrical shape is well suited for picking up signals propagated around the heart.

"By combining high-density body surface mapping with responsible, transparent AI, we aim to improve the screening, staging and monitoring of diseases, initially in cardiology and veterinary applications, then expanding to neurology, neuroprosthetics, gut health, foetal health, and any field where non-invasive electrophysiological mapping can provide actionable insights."

Learnings from Cambridge

Ruben, who continues in the Department as a postdoc, has participated in multiple programmes in the Cambridge ecosystem. He has been working closely with Cambridge Enterprise on the patenting process for Polytecks technology, and recently took part in the *impulse* programme at Cambridge – a programme designed to help equip entrepreneurs like Ruben with the skill set needed to bring his innovation from lab to market.

"Running Polytecks requires skills beyond research, including leadership, resilience and practical business execution," he said. "My Cambridge experience has given me the technical foundation, a strong work ethic and the ability to navigate interdisciplinary challenges, all of which are essential for leading a spin-out."

Reflecting on his time spent in the Bioelectronics Laboratory, Ruben added: "The best part has been collaborating on highly interdisciplinary projects. I have learned about materials science, manufacturing, clinical applications, veterinary medicine, biosensors, implantable devices and cell work, all of which have broadened my understanding of science as a tool to impact real-world health outcomes."

Read the full article at:
www.eng.cam.ac.uk/polytecks

Single-material electronic skin gives robots the human touch

Credit: David Hardman, Thomas George Thuruthel, Fumiya Iida

Scientists have developed a low-cost, durable, highly-sensitive robotic 'skin' that can be added to robotic hands like a glove, enabling robots to detect information about their surroundings in a way that's similar to humans.

The researchers, from the University of Cambridge and University College London (UCL), developed the flexible, conductive skin which is easy to fabricate and can be melted down and formed into a wide range of complex shapes. The technology senses and processes a range of physical inputs, allowing robots to interact with the physical world in a more meaningful way.

Unlike other solutions for robotic touch, which typically work via sensors embedded in small areas and require different sensors to detect different types of touch, the entirety of the electronic skin developed by the Cambridge and UCL researchers is a sensor, bringing it closer to our own sensor system: our skin.

Although the robotic skin is not as sensitive as human skin, it can detect signals from over 860,000 tiny pathways in the material, enabling it to recognise different types of touch and pressure – like the tap of a finger, a hot or cold surface, damage caused by cutting or stabbing or multiple points being touched at once – in a single material.

The researchers used a combination of physical tests and machine learning techniques to help the robotic skin 'learn' which of these pathways matter most, so it can sense different types of contact more efficiently.

In addition to potential future applications for humanoid robots or human prosthetics where a sense of touch is vital, the researchers say the robotic skin could be useful in industries as varied as the automotive sector or disaster relief. The results are reported in the journal *Science Robotics*.

Electronic skins work by converting physical information – like pressure or temperature – into electronic signals. In most cases, different types of sensors are needed for different types of touch – one type of sensor to detect pressure, another for temperature, and so on – which are then embedded into soft, flexible materials. However, the signals from these different sensors can interfere with each other, and the materials are easily damaged.

"Having different sensors for different types of touch leads to materials that are complex to make," said lead author Dr David Hardman from Cambridge's Department of Engineering. "We wanted to develop a solution that can detect multiple types of touch at once, but in a single material."

Their solution uses one type of sensor that reacts differently to different types of touch, known as multi-modal sensing. While it's challenging to separate out the cause of each signal, multi-modal sensing materials are easier to make and more robust.

The researchers melted down a soft, stretchy and electrically conductive gelatine-based hydrogel, and cast it into the shape of a human hand. They tested a range of different electrode configurations to determine which gave them the most useful information about different types of touch. From just 32 electrodes placed at the wrist, they were able to collect over 1.7 million pieces of information over the whole hand, thanks to the tiny pathways in the conductive material.

The skin was then tested on different types of touch: the researchers blasted it with a heat gun, pressed it with their fingers and a robotic arm, gently touched it with their fingers and even cut it open with a scalpel. The team then used the data gathered during these tests to train a machine learning model so the hand would recognise what the different types of touch meant.

"We're able to squeeze a lot of information from these materials – they can take thousands of measurements very quickly," said Dr Hardman, who is a postdoctoral researcher in the lab of co-author Professor Fumiya Iida. "They're measuring lots of different things at once, over a large surface area."

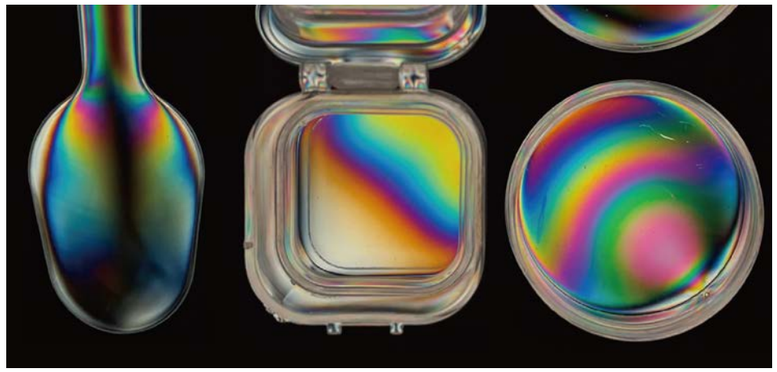
"We're not quite at the level where the robotic skin is as good as human skin, but we think it's better than anything else out there at the moment," said Dr Thomas George Thuruthel from UCL. "Our method is flexible and easier to build than traditional sensors, and we're able to calibrate it using human touch for a range of tasks."

In future, the researchers are hoping to improve the durability of the electronic skin, and to carry out further tests on real-world robotic tasks.

Written by Sarah Collins

Open access paper:
www.eng.cam.ac.uk/electronic-skin

→ Birefringence of plastic products in the lab (scale bar: 1 cm)



Credit: Science Advances

From plastic to precision: scalable broadband spectroscopy

A multinational research team, including engineers from the University of Cambridge and Zhejiang University, has developed a breakthrough in miniaturised spectrometer technology that could dramatically expand the accessibility and functionality of spectral imaging in everyday devices.

The study, titled *Stress-engineered ultra-broadband spectrometers*, published in the journal *Science Advances*, describes a novel, low-cost spectrometer platform built from programmable plastic materials rather than conventional glass. These innovative devices operate across the full visible and short-wave infrared (SWIR) range – spanning 400 to 1600 nanometres – which opens up a wealth of possibilities for real-world applications.

Traditionally, spectrometers – the tools that analyse the composition of light to detect materials or environmental conditions – have been bulky, expensive and difficult to mass-produce. Most are also limited to narrow spectral bands or rely on multiple specialised components to cover a broader range. The new approach sidesteps these issues with a lightweight, scalable alternative that leverages recent advances in polymer science and computational optics.

The team was inspired by the evolution of smartphone cameras, which now rely heavily on plastic optical components to achieve high performance in ultra-compact formats. Applying the same principle to spectrometer design, the researchers used transparent shape memory epoxies (SMPs) to engineer dispersive optical elements – components that separate light into its spectral components.

What makes this approach truly innovative is the use of internal stress to tailor the optical properties of the plastic. Normally, stress patterns that develop during the manufacture of plastic objects are uncontrolled and unstable. However, SMPs can be mechanically stretched at elevated temperatures to "program" precise and stable stress distributions into the material. These stresses create birefringence – an optical effect where light is split according to its wavelength.

"By shaping the internal stress within the polymer, we are able to engineer spectral behaviour with high repeatability and tunability, something that's incredibly difficult to achieve with conventional optics," said Gongyuan Zhang from Zhejiang University, the lead author of the study.

The resulting films act as spectral filters, encoding information that can be read by standard CMOS image sensors. With the aid of computational spectral reconstruction algorithms, these planar components can be turned into powerful, compact spectrometers.

From lab bench to consumer tech

One of the major achievements of this work is demonstrating that these stress-engineered films can be fabricated in a single step, without the need for lithography or expensive nanofabrication. This makes the devices ideal for mass production and integration into consumer electronics, such as mobile phones, wearable health monitors, and even food quality testers.

"We've shown that you can use programmable plastics to cover a much broader range of the spectrum than typical miniaturised systems – right into the SWIR," said Professor Zongyin Yang, lead author from Zhejiang University. "That's really important for applications like agricultural monitoring, mineral exploration and medical diagnostics."

The spectrometers are also highly compact, and the team successfully integrated them into a line-scanning spectral imaging system – suggesting their suitability for hyperspectral imaging in portable form. By linearly varying the stress across the length of the film, the team could create gradient filters capable of scanning a scene one slice at a time, collecting rich spectral data in the process.

A platform for the future

"This work shows how mechanical design principles can be used to reshape photonic functionality," said co-author Professor Tawfique Hasan from Cambridge's Department of Engineering. "By embedding stress into transparent polymers, we have created a new class of dispersive optics that are not only lightweight and scalable but also adaptable across a wide spectral range. This level of flexibility is very difficult to achieve with traditional optics relying on static, lithographically defined structures."

Written by Michael Shuff

Open access paper:
www.eng.cam.ac.uk/broadband-spectroscopy

→ [LEFT] A flexible microelectrode array connected to a circuit board. [RIGHT] Professor George Malliaras

Engineer and alumni join European research initiative to develop miniaturised neural implants to treat chronic diseases

Organic electronics pioneer Professor George Malliaras and medical technology start-up Coherence Neuro, founded by alumni, have joined a consortium set up to develop next generation, miniaturised bioelectronic implants to treat chronic diseases.

Project SPARCLE – also known as **S**mall form factor implantable **P**ulse gener**A**to**R**s for **C**hronic and **L**ifestyle-related disease manag**E**ment – is a European research initiative which fuses bioelectronics, flexible materials and AI-driven modelling, with the aim of transforming healthcare delivery and patient outcomes.

The project, involving some of Europe's leading neurotech companies, research organisations and universities, aims to create a microelectronic chip and a small, flexible form factor for a battery-less, implantable pulse generator. This technology will serve as a universal neurostimulator platform to be applied in treating chronic diseases such as neuro-based cancer treatments, severe migraines and spinal cord injuries.

Supported by XECS, the project specifically targets applications in three areas:

- **Severe migraines:** aiming to address an underserved market with significant demand for effective, minimally invasive solutions.
- **Oncology:** developing neurostimulation therapies for cancer treatment, particularly pancreatic adenocarcinoma – the most common type of pancreatic cancer.
- **Spinal cord injuries:** enhancing quality of life and reducing healthcare costs by restoring functions lost due to spinal cord injuries.

Professor Malliaras, who leads the Bioelectronics Laboratory at the Department of Engineering, said: "Our involvement will be on the front-end of the system, i.e. in the development of flexible microelectrodes from conducting polymers to create new peripheral nerve interfaces."

The peripheral nerve is located outside of the central nervous system (the brain and spinal cord). The peripheral nervous system acts as a communication network, relaying messages and sensory information (like pain and touch) between the central nervous system and the rest of the body.

"We will leverage and expand our expertise on miniaturised, ultraflexible electrodes that interface with sensitive nerves without causing any damage," he added.

Using advanced conductive polymer layers on the implants means that electrode impedance can be reduced, leading to enhanced safety and performance, with no hindrance to signal transmission.

Professor Malliaras said: "I am excited to collaborate with the project partners to integrate microelectrodes into a comprehensive platform for bioelectronic medicine, with the goal of addressing a wide range of conditions, including severe migraines, pancreatic adenocarcinoma and spinal cord injuries."

Joining Professor Malliaras on the project is UK medical technology start-up Coherence Neuro, co-founded and led by former Engineering PhD students Dr Ben Woodington and Dr Elise Jenkins. They first met in 2018 while carrying out research across the fields of neuroengineering and neuro-oncology in Professor Malliaras' lab.

"It's a pleasure to partner with Professor Malliaras on the UK side of this consortium," said Dr Woodington. "Professor Malliaras' mentorship and guidance formed our foundational understanding of how to invent, build and clinically translate neurotechnology."

Coherence Neuro and other consortium partners will have the option to lead specific clinical use cases, ensuring that the technological outputs align with real-world healthcare applications. This will provide an opportunity to showcase the prototypes' effectiveness in managing chronic conditions, from severe migraines to spinal cord injury and oncological neuromodulation.

Read the full article at:
www.eng.cam.ac.uk/neural-implants

Neuroscientist joins UK programme to develop next-generation neurotechnologies for chronic pain

Credit: Sebastian Kaulitzki – stock.adobe.com

Cambridge neuroscientist Dr Flavia Mancini has joined a landmark research consortium aiming to revolutionise the treatment of chronic pain through personalised neurotechnology.

The EPIONE programme – Effective Pain Interventions with Neural Engineering – is a six-year, £11 million project backed by the Engineering and Physical Sciences Research Council (EPSRC) and the Medical Research Council (MRC). It is led by the University of Oxford in collaboration with the University of Cambridge, University of Glasgow and UCL, clinicians at NHS pain clinics and leading representatives from industry, both multinationals and SMEs, to translate new concepts into clinical treatments.

EPIONE combines expertise in biomedical engineering, neuroscience and clinical medicine with input from people who live with chronic pain[1], who play a key role in shaping the design of new interventions. By closely integrating these perspectives, the consortium aims to pioneer personalised treatments fundamentally different from current approaches.

Dr Mancini, Assistant Professor in Innovative Computational Methods and MRC Career Development Fellow, will oversee all the theoretical aspects of the programme and will guide the development of the neurotechnologies.

Chronic pain has diverse biological and psychological contributors, and in many cases it persists because the nervous system adapts in ways that maintain or amplify pain signals. By combining advanced sensors, neuromodulation technologies and computational models of pain processing, EPIONE aims to create personalised therapies that directly target the mechanisms sustaining chronic pain.

Over the course of the programme, the researchers expect to deliver several world-first technologies, including:

- **An adaptive brain implant** that senses and responds to pain signals in real time, ready for clinical trials at scale for ultimate NHS approval.
- **An implantable 'closed-loop' drug delivery system**, which automatically adjusts medication based on a patient's needs, minimising side effects and risk of addiction.
- **Non-invasive ultrasound and magnetic stimulation techniques** capable of targeting multiple brain regions at once.
- **A combined 'smart' therapy system** that links brain sensors with feedback and stimulation technologies, helping patients actively retrain their brains to manage pain.

Dr Mancini said: "Chronic pain affects one in five people worldwide, yet current treatments often fail to provide sufficient relief. EPIONE will allow us to rethink pain therapy from the ground up by combining neuroscience, engineering and data-driven personalisation. My role will focus on understanding the brain's pain networks and designing technologies that adapt to each individual's biology. Traditional treatments often target symptoms rather than the underlying mechanisms that sustain chronic pain. By grounding our work in computational theory and harnessing advanced neurotechnology, we aim to design interventions that precisely target the neural processes driving pain and adapt in real time as those processes change."

Professor Tim Denison from the Department of Engineering Science at the University of Oxford said: "Each of EPIONE's members are world-renowned experts in their own field, and the programme is unique in bringing this level of expertise to work together closely on such a highly integrated project."

Professor Ben Seymour, who co-leads the Pain Theme at the NIHR Oxford Health Biomedical Research Centre, added: "Neurotechnology has the potential to realise substantial impact on reducing the burden of chronic pain in the UK and worldwide. But to date, this has not been realised – chiefly because this requires combining diverse expertise to engineer integrated therapeutic systems and translate these into clinical delivery. EPIONE will address this by leveraging Oxford's strengths in interdisciplinary research to design a new generation of pain technologies."

[1] Chronic pain, a leading global cause of disability, is one of the great unmet needs in medicine. In the UK alone, between one-third and one-half of the adult population (just under 28 million) are affected by chronic pain.

Read the full article at:
www.eng.cam.ac.uk/chronic-pain

➜ Professor Julian Allwood

Expert panel to put science and tech at the heart of clean power

Professor Julian Allwood has been appointed to the UK Department for Energy Security and Net Zero's (DESNZ) Science and Technology Advisory Council to provide expert advice on putting science and tech at the forefront of the UK's clean power mission.

Science and evidence-informed policy will be at the heart of the government's clean power mission and acceleration to net zero.

The Council will provide robust, scientific, evidence-based information to support key decisions as it overhauls the UK's energy system to reach clean power by 2030.

The Council will also offer independent viewpoints and cutting-edge research on topics from climate science, energy networks and engineering, to the latest technologies and AI. Their expert advice will allow ministers to access the most up-to-date and well-informed scientific evidence, improving decision making and effectiveness of policy implementation.

Speaking at the time, Energy Secretary Ed Miliband said: "Evidence-based decision making is fundamental to the drive for clean power and tackling the climate crisis, with informed policymaking the key to securing a better, fairer world for current and future generations.

"To give our mission the very best chance of success, the Science and Technology Advisory Council will draw on the knowledge and wisdom of some of the finest scientific minds of the nation – because clean power offers a huge prize of energy security, lower bills and good jobs."

Speaking at the time, former DESNZ Director General Chief Scientific Adviser Professor Paul Monks said: "Robust scientific research and evidence is vital to inform decisions, as we break new ground with the mission for clean power by 2030 and accelerate to net zero.

"I look forward to working with some of the country's most esteemed climate and energy scientists, engineers and mathematicians, to provide comprehensive and considered advice to government on some of the greatest challenges of our time."

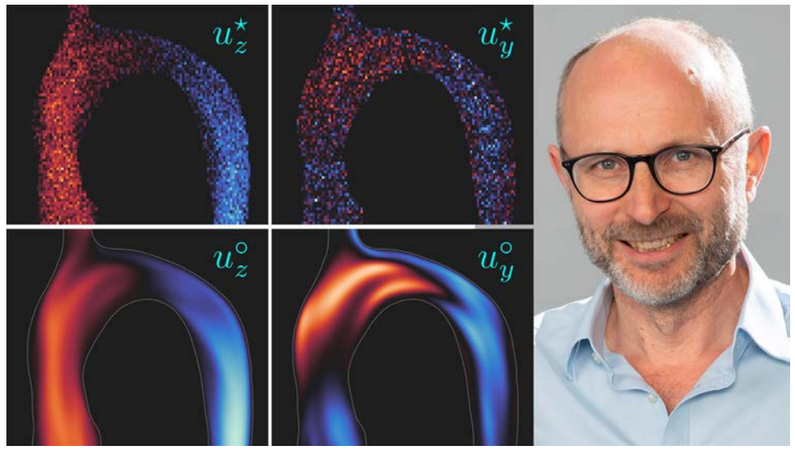
Professor Allwood said: "Many other government departments have Science Advisory Councils already, but this is a new initiative at the Department for Energy Security and Net Zero, and I'm delighted to be part of it.

"Through 20 years work in the Use Less Group at Cambridge, we have gathered broad experience in whole systems analysis of emissions, materials and industries, and in finding innovations that help reduce and save energy and material. Alongside experts from across the country in a broad range of other technologies that might support climate mitigation, I'm pleased to have the chance to share our insights on deployment rates, demand reduction and innovation in support of the government's goal of accelerating the delivery of net zero."

> "Many other government departments have Science Advisory Councils already, but this is a new initiative at the Department for Energy Security and Net Zero, and I'm delighted to be part of it.
>
> Professor Julian Allwood

www.uselessgroup.org

➜ [LEFT] Top row – raw MRI velocity data of the flow through an aortic arch. Bottom row – inferred velocity field and boundary position, having imposed physical knowledge of the fluid's behaviour. [RIGHT] Professor Matthew Juniper



Credit: [LEFT] Kontogiannis et al

Funding awarded for research in fundamental AI for physical systems

Professor Matthew Juniper has received an Advanced Grant from the European Research Council (ERC) for research in fundamental AI for physical systems which has real-world applications in medicine and engineering.

The five-year €2.5 million ERC grant will fund two postdoctoral researchers and three PhD students to apply fundamental AI to two key areas: medical Flow Magnetic Resonance Imaging (Flow-MRI) and jet engines, which were chosen for their potential positive impact on society.

Flow-MRI

The first area of research, Flow-MRI, uses magnetic fields to measure the speed of blood flows in the body. Professor Juniper's research could reduce hospital Flow-MRI scan times by 10 to 100 times while improving the accuracy of information provided to doctors.

Professor Juniper explains: "The more we know about the data beforehand, the more it can tell us about what we don't know. Take, for example, a raw Flow-MRI image that is difficult for a human to interpret.

"If we know that the image is of blood pulsing through an artery, then a computer can infer the flow more accurately than a human can because it can be programmed with prior physical knowledge about how blood behaves.

"With quicker scans providing better information, the health of your major arteries could be monitored regularly, and you could be brought in for minor preventative surgery before a problem develops, rather than major acute surgery afterwards."

Jet engines

Professor Juniper's second area of research starts from a question posed by the 20th-century mathematician John von Neumann, who is quoted as saying, "With four parameters I can fit an elephant and with five I can make him wiggle his trunk". This is often interpreted to mean that physics-based models should contain only a few parameters. Today, however, scientists frequently use neural networks with millions of parameters containing no physics at all. What might von Neumann have said?

Professor Juniper said: "Experiments on aeroplane engines are expensive but are crucial to ensure safety as the industry moves from kerosene to sustainable aviation fuel. By extracting more information from each experiment, we can move faster and with more certainty towards a sustainable future in aviation."

This research project will develop a solution rooted in probability theory and apply this to real-world problems.

Today, we have better physical knowledge, faster numerical algorithms, higher performance computers, and larger amounts of data than von Neumann did 70 years ago. Perhaps he would have said, "Put the physics in the model if you can," which is exactly what this project will do.

Professor Juniper is among 11 academics at the University of Cambridge to receive Advanced Grants from the ERC – the highest number of any institution in this funding round (announced June 2025).

"Many congratulations to our Cambridge colleagues on these prestigious ERC funding awards," said Professor Sir John Aston, Cambridge's Pro-Vice-Chancellor for Research. "This type of long-term funding is invaluable, allowing senior researchers the time and space to develop potential solutions to some of the biggest challenges we face. We are so fortunate at Cambridge to have so many world-leading researchers across a range of disciplines, and I look forward to seeing the outcomes of their work."

Read the full article at:
www.eng.cam.ac.uk/erc-advanced-grant

From left, Federica Freddi, Dr Savvas Gkantonas, Dr Ushnish Sengupta and Dr Daniel Fredrich

Credit: [Second and fourth image, from left] David Johnson

ALUMNI UPDATE

Founders at Cambridge – where innovation meets action

Two alumni-founded start-ups have graduated from Founders at Cambridge – the flagship initiative supporting and empowering innovators to make an ever-greater impact.

The second START Accelerator – a pre-seed accelerator designed to boost the journey of existing ventures – welcomed Pinepeak (co-founded by Dr Savvas Gkantonas and Dr Daniel Fredrich) and Sqwish Labs (co-founded by Dr Ushnish (Nish) Sengupta and Federica Freddi).

This strategic initiative is delivered by the University's innovation arm, Cambridge Enterprise, to connect innovators with a wealth of expertise in venture building, investment and commercialisation. This is complemented by access to a growing global expert community of more than 250 investors, industry executives, entrepreneurs and leaders, many of whom are University alumni.

Introducing Pinepeak

Pinepeak was born out of a deeply personal experience. After witnessing firsthand the devastation caused by the 2018 wildfire in Mati, Greece, co-founder and CEO Dr Gkantonas and his former PhD supervisor Professor Epaminondas Mastorakos asked themselves: "Why were some homes destroyed while others nearby remained virtually untouched? And why are there no tools available to accurately predict this?"

These questions sparked their mission to rethink wildfire modelling from first principles. Their journey began with academic research at Cambridge, leveraging their backgrounds in combustion science and AI to build a novel solution.

Pinepeak, run by a team of six full-time employees plus two full-time contractors, develops physics-driven technology to predict wildfire risk and behaviour across any terrain, anywhere in the world.

"Our technology uses 'virtual particles' to mimic how fire moves across landscapes through convection, radiation and airborne embers known as firebrands," says Dr Gkantonas. "These particles dynamically respond to wind, terrain and types of fuel on the ground (such as trees, dry grass or flammable building materials)."

Pinepeak gathers environmental data from sources like satellite imagery and processes it using machine learning. The data is then fed into its FLAMESIGHT simulator, which integrates the core physical equations describing fire behaviour.

"Because the simulator is designed for accuracy and speed, we can model thousands of potential wildfire paths in just minutes," says Dr Fredrich. "Our predictions are delivered at ultra-high resolution, providing critical insights that help firefighters, reinsurers and communities prepare for what might happen *before* it happens."

Introducing Sqwish Labs

When Cambridge engineers Ushnish Sengupta and Federica Freddi were building their first product, an AI agent for creative brainstorming, they noticed something that didn't add up: the more they optimised the system, the better it scored on their internal benchmarks. But real users were engaging less with the ideas it generated. The standard way of building products on generative AI, they realised, was fundamentally broken.

That contradiction became Sqwish Labs: an AI research and product company building enterprise-grade infrastructure that connects deployed AI directly to the real-world outcomes that actually matter.

"Most AI today is frozen the moment it ships," says Nish, whose Cambridge PhD applied AI to jet engine instabilities. "It has no idea whether it's actually helping users or losing them. We close that loop."

Sqwish learns from how users interact with an AI product and turns live usage into measurable improvements. Rather than locking companies into a single provider or a static configuration, it continuously adapts how each request is handled based on what the company actually cares about – whether that's user engagement, inference cost, response quality or something else. The founding principle is radical in its simplicity: if you can measure it, Sqwish can improve it.

"The teams that win," adds Federica, who holds a Cambridge Master of Engineering (MEng) in Information Engineering, "will be those whose AI keeps improving itself in production, not those with the best engineered prompts on launch day."

Read the full article at:
www.eng.cam.ac.uk/founders-cambridge

Credit: Cambridge University Hospitals

A systems engineering approach for health and social care

The NHS is at a critical juncture. An ageing population, mounting financial constraints and the lasting repercussions of the COVID-19 pandemic have placed unprecedented strain on the system.

Lord Darzi's independent investigation of the state of the NHS in England underscores deeply rooted systemic failures, from difficulties in accessing primary care and record-high waiting lists to overcrowded A&E departments and staff shortages. Addressing these challenges requires more than isolated, localised fixes – it demands a fundamental shift in how the NHS is structured and operates.

What if we applied engineering principles to help health and care professionals better understand and manage this complexity?

Researchers at the Engineering Design Centre at the University of Cambridge believe that a systems approach – rooted in systems thinking – offers a powerful framework for rethinking how health and care services can be designed, delivered and improved.

At its core, a systems approach is about understanding and managing complexity. With its origins in diverse disciplines, such as systems engineering, social science, design thinking, risk management, operations research, service design and software engineering, it provides a structured way to understand, analyse and improve interconnected systems – making it particularly relevant to health and care.

Unlike traditional approaches that tackle individual problems in isolation, a systems approach considers the bigger picture – how different components interact, where inefficiencies arise, and how improvements in one area may impact the rest of the system.

This holistic approach is essential in a setting as intricate as the NHS, where patient care, workforce management, technology and policy are deeply interwoven.

To apply this thinking in health and care, Professor John Clarkson, Director of the Engineering Design Centre and Co-Director of Cambridge Public Health, along with colleagues at the Royal Academy of Engineering, developed the Engineering Better Care framework – a structured methodology designed to help teams analyse problems, identify solutions and implement meaningful, system-wide improvements. It is built on four key elements, or perspectives:

1. **People:** Understanding interactions among people, at the personal, group and organisational levels.

2. **Systems:** Addressing complex and uncertain real-world problems, involving highly interconnected technical and social elements.

3. **Design:** Focusing on improvement by identifying the right problem to solve, creating a range of possible solutions and refining these to deliver good outcomes.

4. **Risk:** Identifying potential failures, managing risk and the necessary change.

A key aspect of this approach is co-creation, where engineers work alongside health care teams to develop solutions that are practical, sustainable and tailored to real-world clinical challenges.

To help teams apply these principles in practice, researchers at the Engineering Design Centre developed the Improving Improvement Toolkit – an evidence-based resource that provides structured methods for mapping system-wide challenges, refining problem-solving approaches and measuring long-term impact.

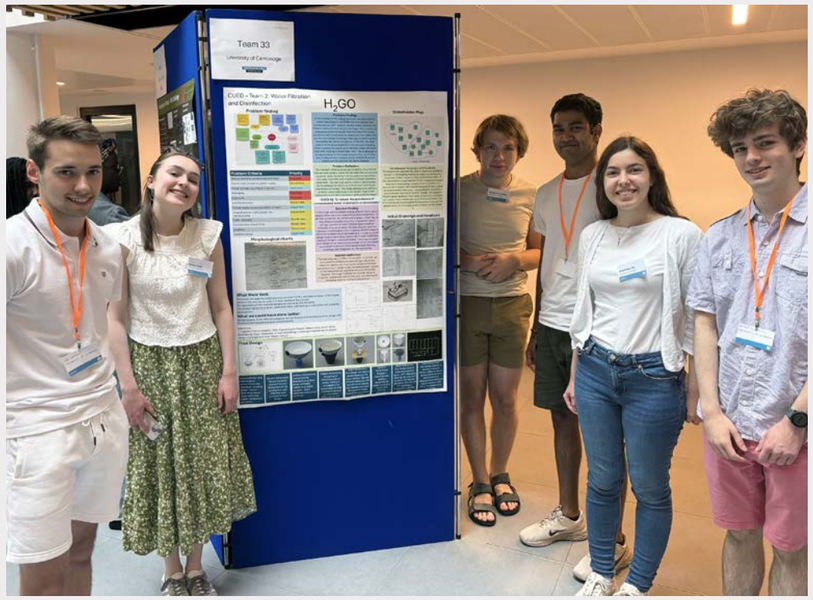
Unlike traditional approaches that tackle individual problems in isolation, a systems approach considers the bigger picture – how different components interact, where inefficiencies arise, and how improvements in one area may impact the rest of the system.

Written by Becky Wolfe

Lord Darzi's report:
http://bit.ly/4t33umb

Read the full article at:
www.eng.cam.ac.uk/systems-engineering-health

→ Team H2GO, from left, Leo James, Abbey Jones, Benjamin Gombala, Jaiden Patel, Ana Ilie and Oliver Clements



Engineering for People Design Challenge

What happens when student engineers are challenged to rethink how engineering serves communities? At the 2025 Grand Finals of the Engineering for People Design Challenge, innovation, empathy and a drive for social impact took centre stage.

The Challenge, delivered jointly with Makers Valley Partnership and Engineers Without Borders South Africa, invited students to explore Makers Valley, a vibrant but under-resourced neighbourhood on the eastern edge of Johannesburg. Home to around 46,000 people, Makers Valley is a community rich in creativity, activism and entrepreneurial spirit, yet it faces complex challenges, including high unemployment and urban decline.

Supported by a detailed written brief, video case studies and an interactive map of the area, students were encouraged to engage with the voices of local residents and organisations to understand the social, environmental and economic context. Through this immersive learning experience, they developed sustainable engineering solutions to support the community's vision – tackling issues such as access to clean water, green energy and safe public spaces.

Engineers Without Borders selected two University of Cambridge teams to participate in the national finals held at Sheffield Hallam University: team 'H2GO' and team 'Improving Digital Literacy in Makers Valley'.

H2GO is a student proposal for a water decontamination system combining a two-stage filter with UV light sterilisation – effectively removing cholera bacteria. The H2GO concept is billed as being cheap, accessible and adaptive to the unreliable energy grid, improving the health of the local community.

The student team behind Improving Digital Literacy in Makers Valley proposed a custom Linux-based operating system that can be installed on a mobile phone, allowing it to be used as both a phone and a desktop computer. A keyboard and monitor are also supplied. A selection of software is pre-installed, optimised for children learning.

For the 2024/25 academic year, the Cambridge Product Design course was reformatted to facilitate full participation in the Engineering for People Design Challenge. This involved shifting to a team-based approach, requiring both poster and video submissions from the teams.

The reformatted course was initiated with four lectures from Professor Nathan Crilly. Each team was supported with teamwork coaching from the Department of Engineering's Centre for Languages and Inter-Communication (CLIC), and project mentoring from Esdras Paravizo and Ana Boskovic, researchers working on design and sustainability.

Now entering its 15th year, the Engineering for People Design Challenge has reached more than 87,000 students across five countries, equipping the next generation of engineers with the skills and mindset to address real-world issues through globally responsible design.

Read the full article at:
www.eng.cam.ac.uk/engineering-for-people

→ The late Professor Arthur Shercliff

Credit: Argent Studio

New Cambridge prize-giving fund unveiled in memory of Professor Arthur Shercliff

A total of 18 Engineering undergraduates have been awarded Arthur Shercliff Prizes – a newly established Cambridge fund to honour the memory of former Head of Department Professor Arthur Shercliff.

This is the first time that the prizes have been awarded, with the aim being to acknowledge achievement in the first year (Part IA) of the Engineering Tripos, in both the examinations and the sustainability-oriented design project.

The prizes are a result of the repurposing of the Arthur Shercliff Memorial Trust, which was established in 1984, following Arthur's death in December 1983 while in post as Head of Department. Since that time, the Trust has awarded scholarships for technical visits abroad to Engineering students at the Universities of Cambridge and Warwick (where Arthur was also Head of Department). Arthur himself always cited the benefit of his year at Harvard during his studies.

Arthur Shercliff was also renowned for his enthusiasm and innovation in undergraduate teaching, and for the broad curriculum and strong mathematical foundation of the Engineering Tripos.

"For 40 years, the Trust has provided travel scholarships, particularly in the areas of energy and sustainable development, which were well aligned with my late father's interests," said Dr Hugh Shercliff, Emeritus Associate Professor and a manager of the fund. "But opportunities for students to work abroad are now commonplace, so we decided it was timely to reallocate the funds to prizes. It is a personal delight to see Shercliff Prizes established at both Cambridge and Warwick in his memory."

Arthur Shercliff Tripos Prizes

The Arthur Shercliff Tripos Prizes have been awarded by the examiners for Part IA of the Engineering Tripos to three of the top four candidates in the order of merit in that examination.

The awardees were:

Alex Momoiu (Jesus College); Joe Tait (St Catharine's College); Tony Zhang (Trinity College); and Jia Xuan Tan (Christ's College) – awarded the Archibald Denny Prize.

The Archibald Denny Prize is awarded annually by the examiners for the Part IA Engineering Tripos to the candidate who has shown the greatest distinction in the Theory of Structures in Paper 2.

Arthur Shercliff Design Project Prizes

The Arthur Shercliff Design Project Prizes have been awarded by the examiners to the top teams in the Part IA Design Project, which saw students on the Cambridge Product Design course compete at the 2025 Grand Finals of the Engineering for People Design Challenge.

The awardees were:

Team "H2GO" (from Jesus and Christ's Colleges): Abbey Jones; Oliver Clements; Jaiden Patel; Ana Ilie; Leo James; Benjamin Gombala; Amelia Hubbard; Eddie Hindson.

Team "Improving Digital Literacy in Makers Valley" (from Christ's College): Boyang Li; Amitan Joseph; Tin (Thanh) Nguyen; Jia Xuan Tan; Alex Lander; Marcus Lee; Zhen Yang Shen.

See page 18 for more details on the teams.

> It is a personal delight to see Shercliff Prizes established at both Cambridge and Warwick in my late father's memory.
>
> Dr Hugh Shercliff

→ The image of Sabuhi (left) that inspired the final portrait (right) titled “Sabuhi at work”

Credit: EnterpriseWOMEN / Dr Tennie Videler

Introducing Sabuhi Essa – an innovator shaping her field

Architect and spatial planner Sabuhi Essa, who is studying for a PhD in Civil Engineering, has been featured in a new portrait series celebrating women scientist-entrepreneurs at the University of Cambridge.

The *Drawn to Lead* exhibit, curated by Dr Ghina M. Halabi, was unveiled during the 2025 EnterpriseWOMEN Showcase at the Cambridge Judge Business School.

Sabuhi (Hughes Hall) is one of five women selected for “their deep engagement with the EnterpriseWOMEN programme, the quality of their work and the richness of their personal and professional journeys, standing as symbols of a much larger collective: diverse, ambitious and often unseen”.

The portrait of Sabuhi by scientist-artist Dr Tennie Videler shows her amid the Hunza Valley of Pakistan, where she grew up, with design sketches in hand. The inclusion of three lions visible on the University’s Coat of Arms point to Sabuhi’s global journey and personal support system – namely her father, husband and brothers. “It’s a portrait of a woman building, not just buildings, but possibilities,” says Dr Videler, who used pen and ink to create the A3-sized artwork.

Sabuhi credits Dr Videler with capturing the most important things in her life: the mountain communities; women’s empowerment; motivation and support from her parents, husband and brothers; and the value of research and innovation in building for the future.

“The portrait captures many things. Firstly, my drive to serve the mountain communities under the impacts of climate change, modernisation and rapid urbanisation; secondly, women’s empowerment in a field that is mainly male dominated (but with support from the men in my life: my father who gave me the vision, my two brothers who pushed and motivated me, and my husband, who has supported and guided me through this process); and thirdly, how research and innovation can help us build environments that are safe, resilient and keep cultural identity intact.”

Embarking on a PhD at Cambridge

Sabuhi’s PhD at Cambridge is focused on understanding how a systems-based collective action approach can reshape flood resilience planning and decision-making in high-risk and underdeveloped Himalayan mountain regions.

Sabuhi is based at the Cambridge Centre for Smart Infrastructure and Construction (CSIC) under the supervision of Dr Sakthy Selvakumaran and she is co-supervised by Professor Nazia Habib at the Cambridge Centre for Resilience and Sustainable Development (CRSD).

“Through my PhD research, I want to draw attention to my fellow researchers and scientists to conduct case studies in the remote regions that are at high risk of climate change impacts,” she said. “The Himalayan mountains – an area two-and-a-half-times the size of the UK – are where we need more research on climate crises; opportunities in learning from traditional knowledge; innovation in risk assessment studies; innovation in infrastructure planning and construction; and many more untouched topics.”

She added: “During my PhD, I found that only 3% of existing literature on flood resilience focuses on the Himalayan mountains. Of these, 3% are also mostly hydrological studies or risk assessment studies.

“Considering the devastations of floods this year and the past few years in Gilgit-Baltistan, this research remains extremely important and timely. I have been lucky to work with Professor Habib, who is an expert in systems thinking. I am using one of her proven methods in my PhD and created a tailored CRSD collective action framework for flood infrastructure resilience planning in high-risk regions. In short, this method not only helps in identifying the weakest links in a complex system but also helps in identifying the leverage points, providing opportunities for collective action to improve the system outcomes.”

Sabuhi received the UCA-Cambridge Trust Scholarship award for her PhD as part of the faculty development programme at the University of Central Asia.

“Coming to Cambridge with two kids while doing a PhD was not easy at all,” she said. “This would have been an unimaginable dream without the support from my family, friends, and of course my sponsors UCA and Cambridge Trust and my amazing supervisors. This story is for all those amazing women out there who dare to dream.”

Read the full article at:
www.eng.cam.ac.uk/sabuhi-essa

→ Third-year MET student Adubea Larson-Amartefio demonstrates KETL – technology designed to give teabags a “second life”

Credit: IfM

Manufacturing Engineering Tripos (MET) Design Show 2025

The 2025 Manufacturing Engineering Tripos (MET) Design Show showcased an impressive array of creative and innovative student inventions. Teams of third-year MET students have completed a major design project to develop a new product with real business potential.

Having first identified a customer need, the students researched the market, developed original design concepts and created a comprehensive business plan. The projects have generated some exciting new ideas and innovative technology.

These designs are showcased at the Institute for Manufacturing’s (IfM) yearly MET Design Show.

Below are examples of the new ideas and innovative technologies that were generated for the 2025 projects, summarised by the students in their own words:

KETL

KETL’s Brewcycle gives teabags a second life, separating plastic, reclaiming grounds, and turning tea waste into taste through compost-ready or BBQ-flavoured organic reuse blocks (ORBs). Circular waste management made practical.

Tea is one of the most consumed beverages worldwide, with over 100 million cups of tea drank daily in the UK alone. While perceived as a natural product, the packaging tells a different story. Commercially available teabags contain plastics and bioplastics that do not fully biodegrade. Current disposal practices treat the bags and grounds as one single waste stream, yet the grounds represent a valuable and underutilised waste product.

KETL is our sustainable solution. As a compact waste stream organiser, it separates the natural tea grounds from the artificial bag material, making disposal cleaner and more environmentally responsible. The teabags are processed through our proprietary BrewCycle, which shreds the bag then sifts and compresses the grounds into ORBs. Our ORBs serve two primary functions: composting enhancers and aromatic smoking briquettes. The nitrogen-rich compressed discs can be placed directly into soil to enrich plant growth and increase moisture retention. By adding our “Seed Infusion Packs”, users can transform ORBs into an easy-to-plant unit.

Alternatively, when infused with selected wood sawdusts such as applewood, oak or hickory, ORBs become sustainable, flavour-enhancing alternatives to traditional smoking woods. KETL transforms something once thrown away into a premium product for gardeners and barbecuers alike.

KETL is ideal for office buildings, hospitality venues and commercial spaces seeking to reduce their environmental footprint through simple, effective waste management. By turning a common daily by-product into a purposeful material, KETL contributes to a more circular and sustainable future.

TheASM

A new way to cut foam – a simple way to make models. TheASM (Automatic Sculpture Maker) introduces a novel method of computer-aided manufacturing (CAM), innovating on the hot wire cutters commonly used to craft foam models.

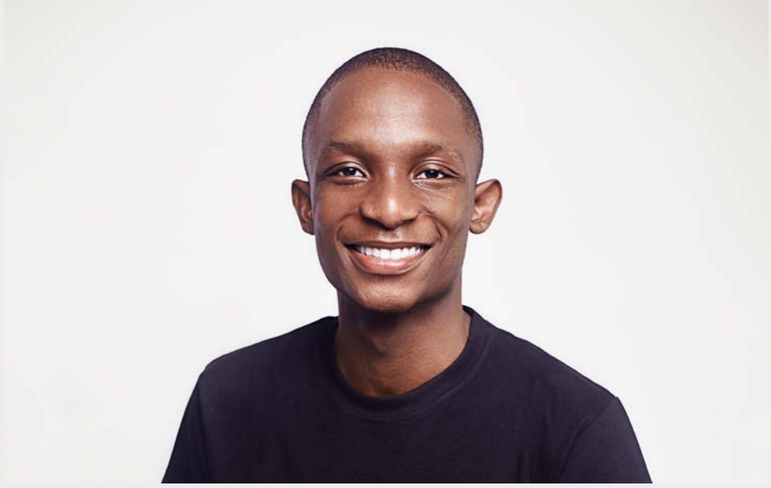
In contrast to the traditional linear cutter, a hot wire loop is mounted on vertical and horizontal actuators, reaching into a rotating block of foam, and enabling small sections of material to be removed.

Computer numerical control (CNC) is used to direct the motion of the actuators and position of the cuts, with material removed in layers; there is compatibility with standard computer-aided design (CAD) applications as well as the potential to steer the cutter manually. More intricate sculptures can be created due to the additional flexibility and resolution in foam removal.

The machine is designed to be a cheaper, more accessible form of CAM compared to milling and turning machines and 3D printers. It will be accessible for all – hobbyists and business customers. There is potential for it to have a significant impact in education – teaching manufacturing principles in schools that cannot access more expensive equipment.

The other incredibly exciting market that we are targeting is the theatre industry. TheASM machines can be used backstage to quickly and conveniently produce custom props and scenery, allowing faster implementation, greater flexibility and reduced costs. We hope this will be especially beneficial for supporting local theatres in the growing challenge of staging economically viable and high-quality productions.

Read the full article at:
www.eng.cam.ac.uk/design-show



Jeremiah Oloyede – Gates Cambridge class of 2025

Gates Cambridge Scholar Jeremiah Oloyede discusses his MPhil in Industrial Systems, Manufacture and Management (ISMM) and his aspirations for an Africa where renewable energy is produced in-house and distributed to all Africans.

Growing up in Lagos, Nigeria, infrequent electricity was my birthright. I had never confronted the status quo until I witnessed an entire production line crumble during an internship because of the same problem of unreliable electricity. Immediately, I began tinkering: if centralising electricity production failed us, how about decentralisation?

My academic journey began at Covenant University, where I graduated as the Best Student in Mechanical Engineering. My research at the Energy and Environment Research Group focused on a comprehensive techno-economic-environmental assessment of renewable energy potential in West Africa. Utilising the Multi-Criteria Analysis for Planning Renewable Energy methodology, I evaluated the feasibility of integrating solar photovoltaics (PV), concentrated solar power and wind energy into the West African Power Pool. Our findings highlighted that solar PV, with an astronomical installed capacity potential and a competitive Levelised Cost of Electricity, is the most viable option for decarbonising the region's energy supply.

Professionally, as a mechanical engineer at Space in Africa, I have been involved in projects aimed at enhancing energy access through innovative technologies. Collaborating with Maana Electric, I worked on integrating their TerraBox technology to enable rapid solar panel manufacturing in Nigeria. This project involved technical evaluations of their glass-glass frameless panels, navigating challenges in sourcing specialised solar glass locally and structuring a viable economic model for local production. Although the deal faced setbacks due to severe inflation shocks in early 2024, the experience deepened my understanding of supply chain dynamics and the critical need for localised, cost-efficient manufacturing solutions in developing markets.

Additionally, I co-founded and currently lead a team aiming to deploy 10,000 industrial-grade weather and air quality stations powered by solar energy to help develop a climate-resilient Africa at Climate in Africa. These stations provide accurate air quality and climate data for environmental monitoring by integrating precision sensors with robust mechanical designs.

My work has extended to developing a satellite mission for a 6U CubeSat project to monitor ecological conditions across the continent, which secured a significant investment. These experiences have honed my technical skills in terrestrial and space-based solar technologies, deepening my practical understanding of implementing sustainable solutions in challenging environments.

The Institute for Manufacturing's MPhil in ISMM offers the advanced training, intuitive mentoring and interdisciplinary collaboration needed to bring my vision to life. The programme's focus on sustainable industrial practices, systems optimisation and innovative manufacturing technologies aligns perfectly with my aspirations. Furthermore, the opportunity to work with the Department of Engineering and engage with research centres like the Cambridge Institute for Sustainability Leadership (CISL) and Cambridge Global Food Security will enhance my ability to design scalable and sustainable energy solutions.

I am particularly drawn to Professor Tim Minshall's and Professor Frank Tietze's research. By collaborating with them and other faculty at Cambridge, I aim to contribute to advancing technologies that utilise locally available materials, lower production costs and foster local industry growth in Nigeria.

The Gates Cambridge Scholarship represents a commitment to global impact and shared values. It will empower me to access Cambridge's transformative opportunities, amplify my contributions to renewable energy and catalyse meaningful change.

I aspire to lead Africa's renewable energy revolution, positioning the continent as a model for sustainable innovation. Moreover, I aspire to contribute to the Scholarship's goal of improving the lives of all by leveraging the knowledge and networks gained at Cambridge. Upon completion of my MPhil, I intend to lead initiatives that implement scalable energy solutions in underserved Nigerian communities, improve industrial manufacturing processes to support local economies, and mentor the next generation of African engineers and entrepreneurs dedicated to sustainability.

Finally, pursuing an MPhil in ISMM will empower me to transform innovative concepts into tangible solutions. The programme's interdisciplinary approach, emphasis on real-world impact, and access to world-class faculty and facilities provide the perfect incubating environment for my aspirations. I am eager to join Cambridge's vibrant academic community. I am confident that this opportunity will equip me with the mentorship, tools and network needed to drive sustainable development and improve lives across Africa.

Honours, awards and prizes

College Entrepreneurship Prize

Alumni Dr Amy Rochford (pictured) and Nathan Jackrazi have been announced as the winners of the 2025 King's College Entrepreneurship Prize with their start-up Axo Neurotech. Third prize went to recent MPhil in Industrial Systems, Manufacture and Management graduate Chris Tagnon, co-founder of CAST Energy.

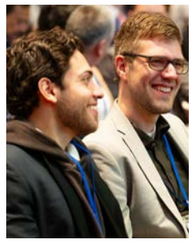
Axo Neurotech is building next-generation neural interfaces using cutting-edge material science and a biology-first approach to solving the problem of integrating electronics with the body. The aim is to improve patients' lives.

RAEng Fellow 2025

Professor Swami Swaminathan has been elected as a Fellow of the Royal Academy of Engineering (RAEng) in recognition of his outstanding and continuing contributions to the profession.

Professor Swaminathan is a world-class expert in the physics and chemistry of turbulent reacting flows, their modelling and simulations.

His significant finding in turbulence-scalar-chemistry interaction led to a robust and accurate modelling framework enabling quantitative estimates of temperature distribution, emissions, combustion noise and instabilities in combustors using single simulation.



Certificates of Achievement

PhD students Patrick Carter-Cortez (pictured left) and Maximilian Kraus attended the inaugural Nuclear Energy Agency's *Nuclear Futures: Shaping Dialogue in a Changing World* conference in Sydney and both won Certificates of Achievement for Best Abstract in Category.

Patrick's PhD research is examining the possibility of accelerating the process of qualifying new fuel designs for use in nuclear reactors by combining state-of-the-art multiphysics modelling of fuel performance with carefully designed experiments in materials test reactors.

Maximilian's PhD research is looking at ways to reduce the high investment cost linked to the expansion of nuclear as a reliable power source. He proposes building fleets of the same reactor type to leverage industrial learning and new supply chains, as well as streamlining and harmonising the regulatory framework across countries.

International prize winner

PhD student Qi Wang has been awarded two prestigious international prizes for his pioneering work on High-Temperature Superconducting magnets.

Qi is the recipient of the 2025 Leslie H. Paddle Scholarship from the Institution of Engineering and Technology and the 2025 IEEE CSC Graduate Study Fellowship in Applied Superconductivity.

These accolades recognise Qi's growing impact, especially in the development and optimisation of trapped field magnets, a transformative technology with the potential to revolutionise energy and medical systems.

ETH Postdoctoral Fellowship

Alumna Dr Wei Bi has been selected as an ETH Fellow and will spend two years at ETH Zurich conducting interdisciplinary research on infrastructure resilience and adaptation to evolving climate risks.

Dr Bi will incorporate system dependencies and climate adaptation pathways into advanced network modelling for infrastructure resilience management.

John Winbolt Prize

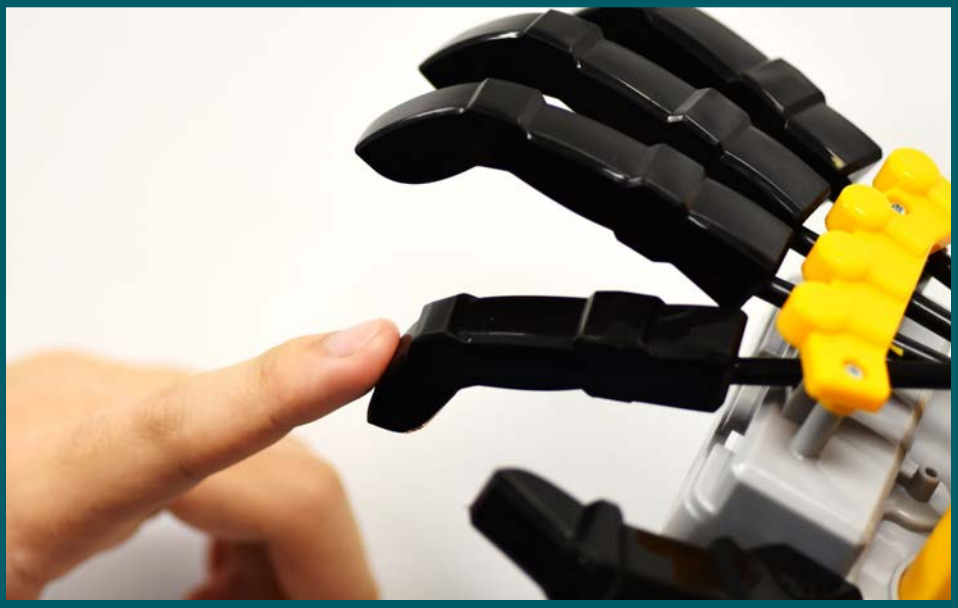
PhD student Hugh Thomas has won the John Winbolt Prize for his paper titled *Can sharing car trips deliver meaningful emissions savings? The case of Great Britain*, published in the journal *Applied Energy*.

The paper investigates whether trip sharing (carpooling) could be a useful strategy for reducing emissions from car travel.

"On the one hand, trip sharing can reduce the number of cars on the road," said Hugh. "However, it can mean the cars left on the road have to travel further as they make detours to pick up additional passengers. Our work tries to quantify this trade-off and determine the conditions under which trip sharing is beneficial for reducing emissions and energy use."

The John Winbolt Prize is awarded for a paper on a subject, selected by the candidate, that is related to the profession of a civil engineer. The paper must have been accepted for publication in an established or learned journal.

→ During ECG measurement, a human index finger was pressed against the microfibres of the robotic finger



Credit: Andy Wang

Smart microfibres turn everyday objects into healthcare monitors and energy devices

New research led by the University of Cambridge, in collaboration with Hong Kong University of Science and Technology (GZ) and Queen Mary University of London, could redefine how we interact with everyday tools and devices – thanks to a novel method for printing ultra-thin conductive microfibres.

Imagine fibres thinner than a human hair (nano- to micro-scale in diameter) that can be tuned on demand to add sensing, energy conversion and electronic connectivity capabilities to objects of different shapes and surface textures (such as glass, plastic and leather). This is what the researchers have achieved, including in unconventional materials like porous graphene aerogels, unlocking new possibilities for human-machine interaction in various everyday settings.

The researchers present a one-step adaptive fibre deposition process using 3D printing, set up to satisfy the fast-changing demands of users. The process enables the on-demand deployment of conductive material layers on different surface areas, dependent on the model's geometry, at the point of use. The findings are reported in the journal *Advanced Fiber Materials*.

The transparent layers can detect real-time electrocardiogram (ECG) and surface electromyography (sEMG) signals. The researchers demonstrated this function using a robotic hand, a pencil and a plier tool.

An array of 400 microfibres made of PEDOT:PSS (a conductive polymer) were printed to wrap around the robotic finger. During ECG measurement, a human index finger was pressed against the microfibres of the robotic finger.

"This demonstrates a cost-effective approach to rapidly equip robots with human-interactive sensing functions thanks to PEDOT:PSS microfibre electrodes," said co-author Stanley Ka, PhD student in the Biointerface Research Group at the Department of Engineering. "Transient electronic skins such as the one demonstrated here are crucial to enable robots and prosthetics to become more human-interactive and mimic the sense of touch."

In a remote care environment, an interactive robot is useful for home-based care or telemedicine (in this case, acting as a remote monitoring device).

To detect sEMG signals from the thumb-tendon area when using a pencil or a plier, an array of PEDOT:PSS microfibres (approximately 600 for the pencil and 1,000 for the plier) were wrapped around the pencil or the plier handle. The human participant was then requested to write with the pencil and cut a rigid object using the pliers, with different levels of force.

Combining the above-mentioned everyday tasks (writing with a pencil and gripping the handle of a plier tool) with real-time biopotential monitoring can alert users or caregivers to abnormal ECG or sEMG patterns. It is useful for monitoring individuals to avoid overexertion or injuries.

For workers using plier tools in hazardous environments (e.g. electrical, chemical or high heat), they too could be monitored for signs of cardiac distress, enabling early intervention in case of fatigue, arrhythmia or other health risks.

Co-author Professor Shery Huang, who leads the Biointerface Research Group, said: "Our approach for integrating customisable electronic functions onto various existing objects as shown, can help in setting up a sustainable Fibre-of-Things (FoT) future – potentially revolutionising medical diagnostics, treatment and even creating new forms of wearable technology."

Watch the video:
youtu.be/1n7mRr67lrg

Read the full article at:
www.eng.cam.ac.uk/smart-microfibres

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