University of Strathclyde Glasgow

Images of Research

Innovation for the global good

Welcome

I am delighted to welcome you to **Images of Research 2019: Innovation for the global good**

The images you see before you offer a small insight to the scale of research and innovation activities being carried out across the University's four faculties.

This year's categories draw inspiration from the University's strategic themes – our areas of strength which underpin the University's research, demonstrating its diversity as well as its significance on a local, national and international scale.

As a leading international technological and socially-progressive university, we pride ourselves on academic excellence with impact. This year's compelling images showcase our commitment to supporting the global neighbourhood, building resilience and innovating for the benefit of all.

The Images of Research exhibition is part of the Engage with Strathclyde Programme - a week-long celebration of the University's partnership with the public, private and third sectors. I hope you will join us for some of our other events so we can tell you more about the story behind the images.

You can also visit our online gallery, before the exhibition goes on tour around other venues in Scotland and beyond. I hope these inventive images illustrate the spectrum and quality of research taking place at the University of Strathclyde, and encourage you to engage further with us.

Best wishes,

Professor Sir Jim McDonald
Principal and Vice-Chancellor

Contents

Images of Research 2019

Images of Research is an annual competition for staff and students, showcasing Strathclyde's innovative work through compelling images. The images form an exhibition during Engage with Strathclyde 2019, a week-long programme celebrating and promoting the University's partnership with businesses, public and third sector organisations. The collection then embarks on a roadshow across venues in Scotland and beyond, and forms an online gallery.

The 40 shortlisted entries – comprising an image and short story – illustrate the big societal issues being tackled by researchers across our four faculties – Engineering, Science, Humanities and Social Sciences, and the Strathclyde Business School.

Some entries also have an accompanying digital story – a two minute video which provides further insight to the research behind the image – look out for highlighted entires throughout the brochure.

The competition and exhibition is sponsored by Engage with Strathclyde and Strathclyde's Researcher Development Programme.

For more information and to view all of the competition entries in the online gallery please visit:
www.imagesofresearch.strath.ac.uk

Meet the Judges

Adrian Gillespie

Adrian is Chief Commercial Officer and provides commercial and business development leadership for the University, including Strathclyde's role in major strategic international projects.

Adrian has more than 25 years' experience of economic development and commercial management, 16 of these with Scottish Enterprise (SE) where he was Managing Director Operations from 2013 until 2017 with responsibility for Business Growth, Innovation and Infrastructure. Prior to this he led SE's support for the Energy and Creative/Tech sectors. Adrian has a degree in Accountancy from University of Glasgow and an MBA from the University of Strathclyde. He is a trustee of the Glasgow Science Centre.

Professor Anja Lowitt

Prof Lowit joined the Speech and Language Therapy team at Strathclyde University in 1996 and has been actively involved in research and teaching in this area. Her research mainly focuses on the development of new clinical techniques on the basis of advances in the theoretical field, in collaboration with colleagues from signal processing and computer science. She investigates both fundamental questions on underlying neuropathologies and characterisations of acquired speech disorders as well as clinical issues that have direct impact on patient management and wellbeing.

She held a position of Vice-Dean for Research and Knowledge Exchange for the Faculty of Humanities and Social Sciences for 4 years before taking up her current role as Deputy Associate Principal for the same area. In this role she supports researchers from across the University in achieving their best potential in their research and KE activities, as well as focusing on the research and impact related Sustainable Development Agenda of the University.

William Aldridge

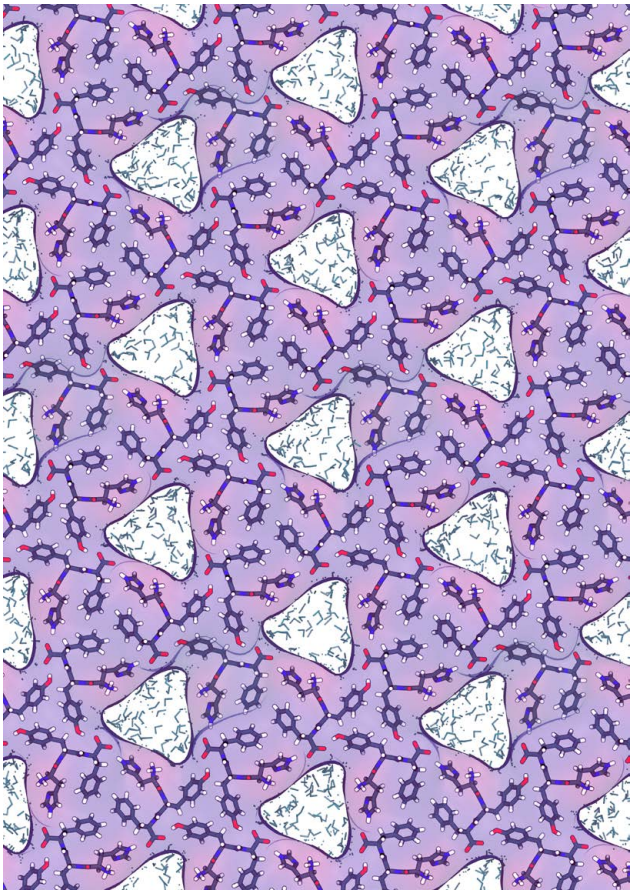
William started his photographic journey at the tender age of ten and honed his skills whilst studying at university. Following a series of freelance jobs, he then took up a position as a professional studio photographer for two years before joining Jessops.

William particularly enjoys travel photography which has seen him pursue adventures across the Andes to the Amazon jungle, though he is just as at home on the slightly more sedate Scottish weddings and events circuit.

Closing the loop

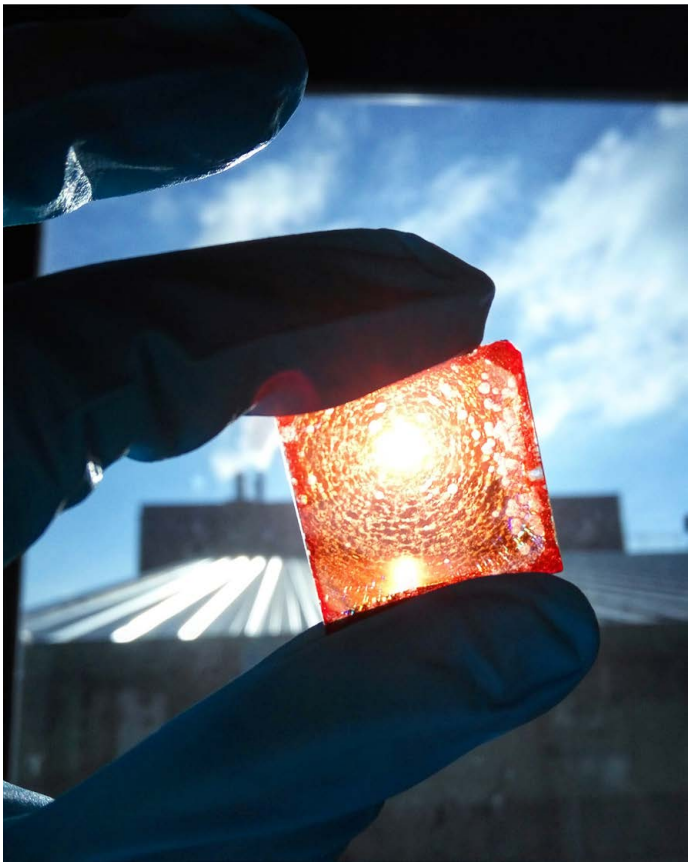
Waste fuelling antibiotic growth

They may look like exotic sponges but they're actually soil bacteria and could just be the answer to reducing the ten million tonnes of food and drinks wasted in the UK annually, whilst revolutionising antibiotic production. University of Strathclyde researchers in industrial biotechnology are exploring the use of food waste to produce more sustainable and less expensive medicines, making great strides towards a bio-based circular economy.



Responsible responsive materials

Water-responsive materials (such as His-Tyr-Phe, illustrated) convert a change in hydration level to a mechanical force. This particular biodegradable peptide increases in size by up to 65% when hydrated and could greatly reduce the environmental impact of industries such as robotics and power generation. Through its study, we're exploring the development of new, natural materials to replace the many synthetic materials currently used in research.

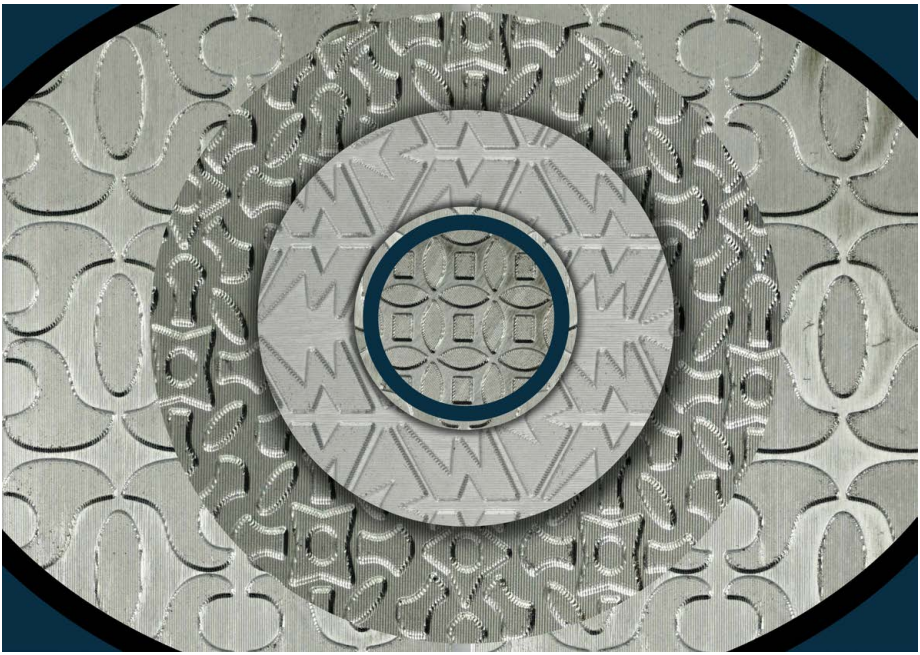


Bright future for clean energy

With concerns growing about humanity's environmental impact, clean, renewable energy is needed more than ever. Solar panels are a staple of renewable energy and perovskite solar cells are one of the frontier solar technologies but the lead used in them poses a potential hazard to the environment. In collaboration with University of Edinburgh, Strathclyde is developing an alternative lead-free perovskite absorber (pictured), in pursuit of cleaner, more efficient solar power.

Remanufacturing: extending product life

The world has limited resources that are rapidly being depleted by human consumption. However, remanufacturing enables a product to be rebuilt, to original specification, using a combination of reused, repaired and new parts, and is the best way of reducing waste. At Strathclyde, we are investigating new reclamation technologies for the remanufacture of combustion engines (pictured) which could see large-scale benefits from new technologies applied to the process.

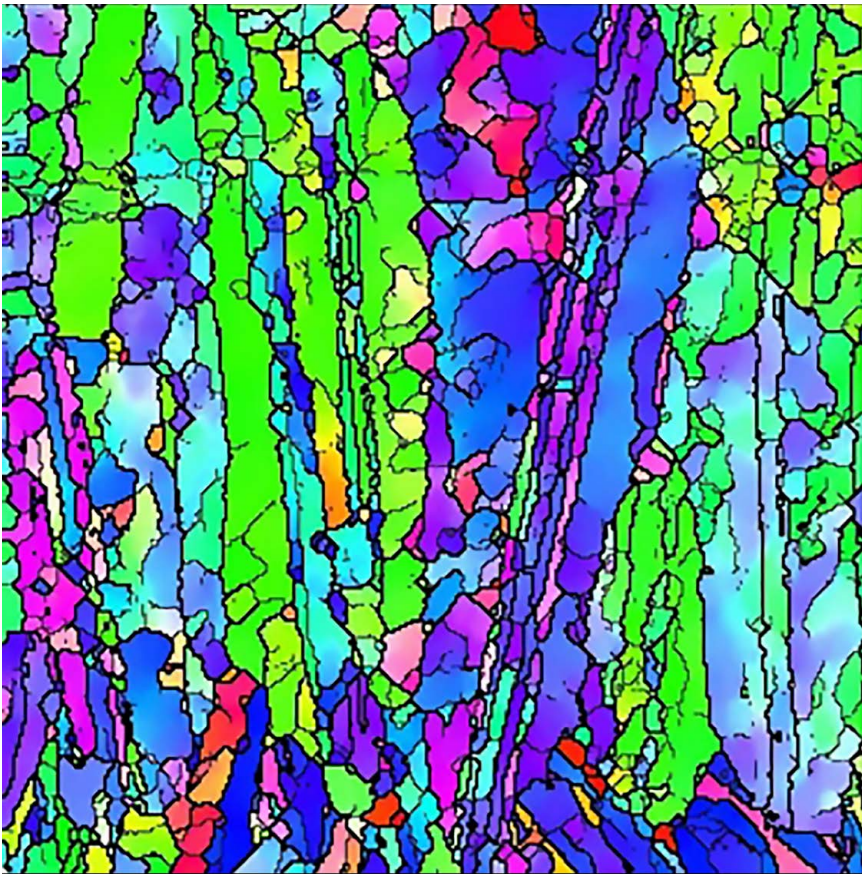


The texture of perception

Perception is one of the most important aspects of how we experience products. Our research has created sets of surface texturing and pattern designs on aluminium to explore aesthetics, emotion and tactile interaction, and how we can elicit new categories of product experience through bespoke manufacturing approaches. The textures shown were created using advanced computer-numeric-control (CNC) machining techniques arranged in the motif of a human eye.

Medicines manufacturing toolbox

The pharmaceutical industry wastes £40 billion a year due to inefficient manufacturing. Our research aims to transform how medicines are made by exploiting a wide range of characterisation and measurement tools. This provides essential information about the product at every stage of the development process, cutting down production waste effectively.



The art of greening electronics

This microscopic image of copper may hold the key to revolutionising the microelectronics industry. As the main metallic coating for electrical connections, current copper production is abundant but environmentally damaging. However, Strathclyde is investigating the use of deep eutectic solvents – a type of organic salt – to create metals with better properties. This could eliminate the need for many toxic chemicals currently used, decrease process water consumption and reduce manufacturing costs.

Power to the people

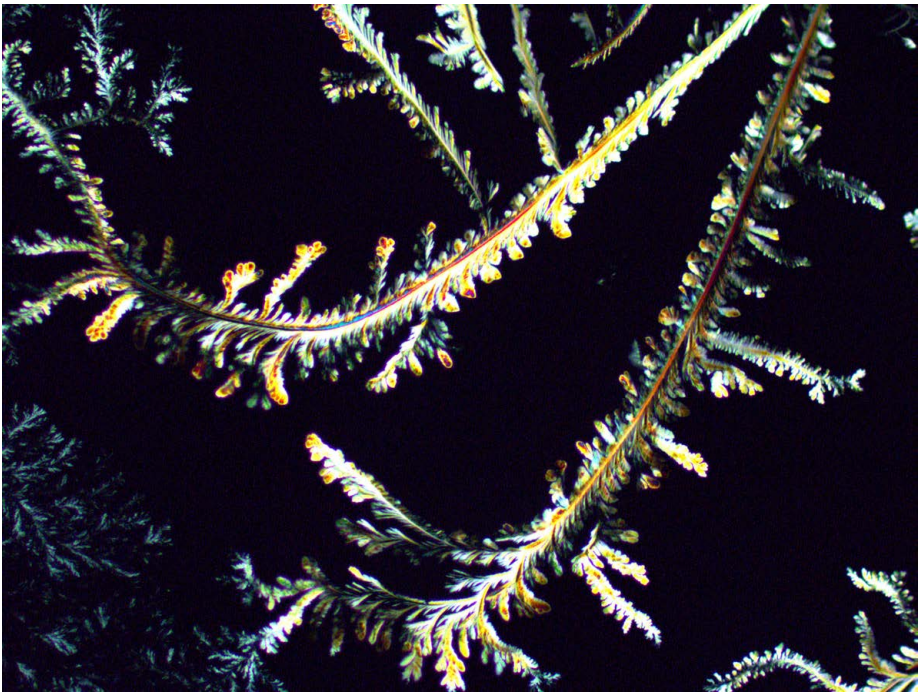
Although beaming solar power gathered in space, back to Earth, could present humanity with an unlimited supply of clean energy and provide disaster relief on demand, no demonstration projects have ever occurred to date. In collaboration with SPACE Canada, a small demonstration mission will be designed as a proof of concept for the technology with aims to launch into orbit by the mid-2020s, providing power to land-dwelling communities in Northern Canada.

It's not rocket science!

Environmental impacts of space activities have often been omitted from key legislation and regulations despite rocket propulsion being the only manmade source of emissions to inject ozone destroying compounds directly into all layers of the atmosphere. To address this, a new tool has been created at the University of Strathclyde which can be used in the design of future space missions to assist decision-makers reduce the overall environmental impact.

The sound of science

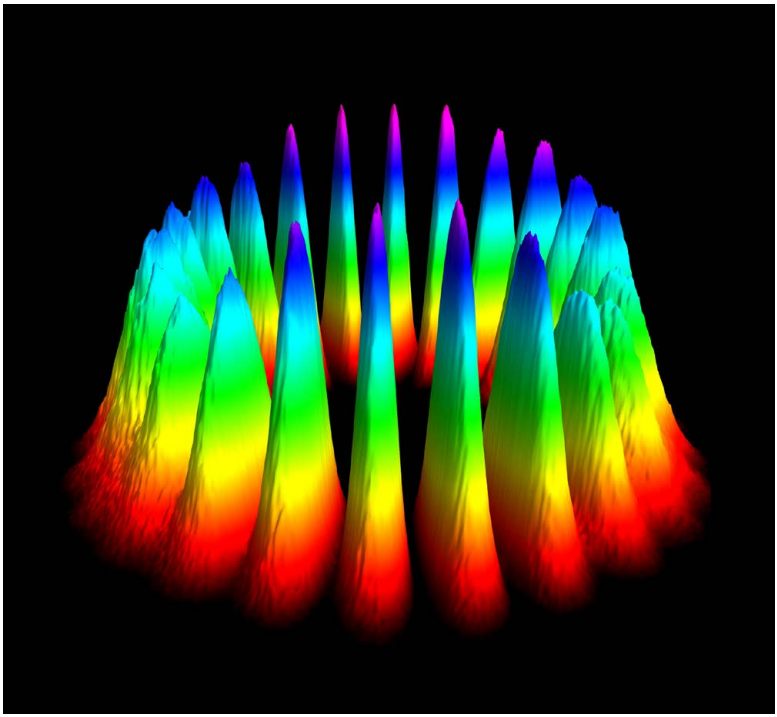
In a similar way to the needle of a vinyl player, the measuring needle of this profilometer travels across the surface of the worn sample. However, instead of producing music, the needle measures the characteristics of the scar produced from the sliding wear test the sample was subjected to. By understanding how materials wear and fail, we can then design more robust materials and components in the future.



Crystallising solutions for precision pharmaceuticals

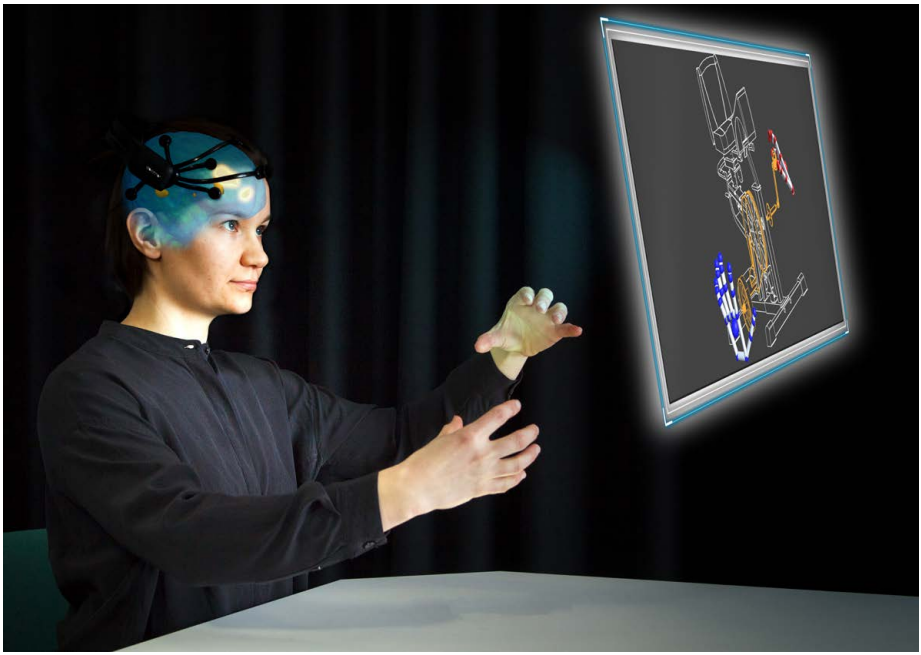
The crystallisation process of sodium bromate produced this attractive fern-like pattern but the real beauty is in the research. At Strathclyde, we are trying to understand the precise process conditions to generate specific compound crystal shapes. This research could impact multiple industries, such as pharmaceuticals, enabling the production of drugs in tailor-made doses, improving their effectiveness and even making them easier to swallow.

Digital connections



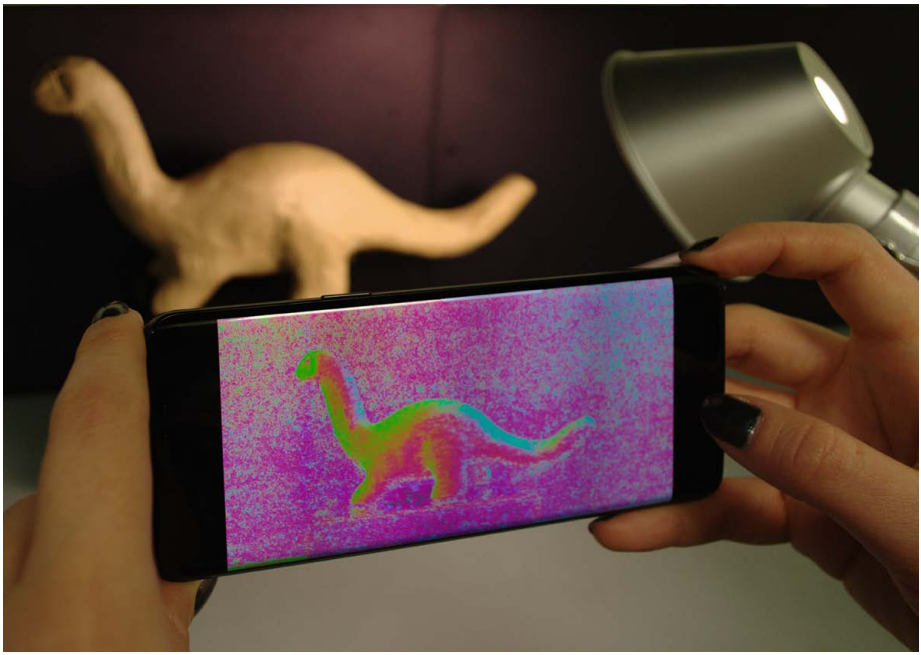
Shedding light on communication security

Digital communication has never been more prevalent but security remains a real issue with the ability of secure coding – encryption – to be unlocked by sophisticated software and powerful computers. Quantum physics can create completely secure communications but is much slower than current encryption methods. Strathclyde and Glasgow physicists are exploring orbital angular momentum (OAM) of light (pictured); with its infinite alphabet, it could be key to creating fast, unhackable communications.



ImagineD: Realising your imagination

The ImagineD research project envisions a future for Computer Aided Design where designers can seamlessly realise their imagination in the digital world. To achieve this vision, we are combining multidisciplinary expertise to study cognitive, neural and gestural activity in creative design. This image shows our vision and the results from our neurological research, highlighting the regions of the brain associated with product design engineering ideation.

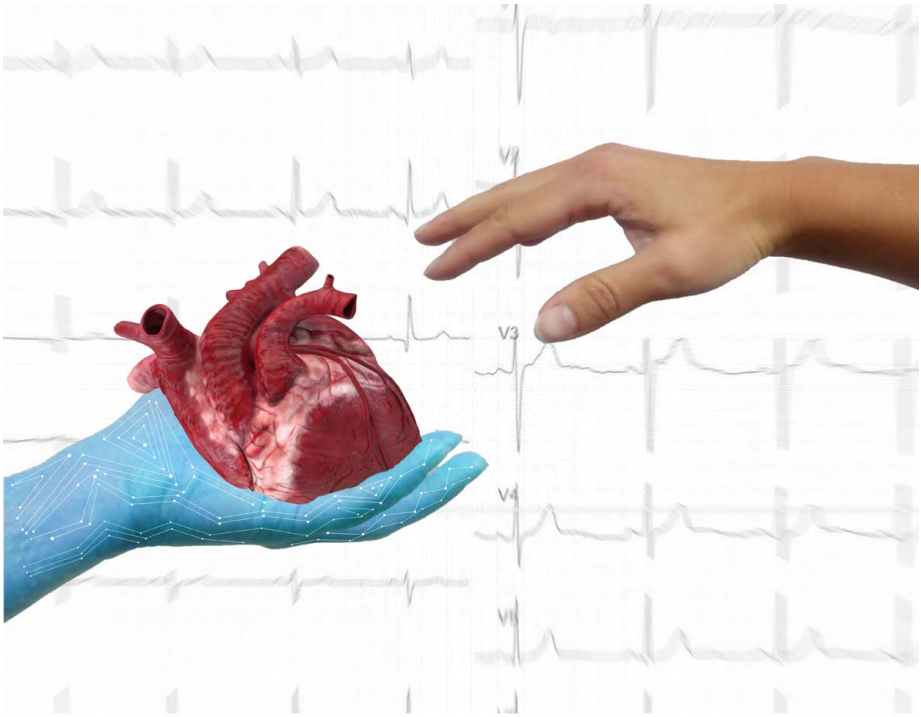


Developing opportunities through digital lighting

Our research is unlocking the true potential of light-emitting diodes (LEDs), such as the ability to provide energy-efficient, high-bandwidth wireless networks and improving the accuracy of digital identification, shown here. LEDs, made to carry a digital data signal, can enable precision positioning and 3D imaging of objects, increasing the imaging capability of accessible mobile devices. The potential applications for this technology are numerous, from domestic to industry, underwater to space.

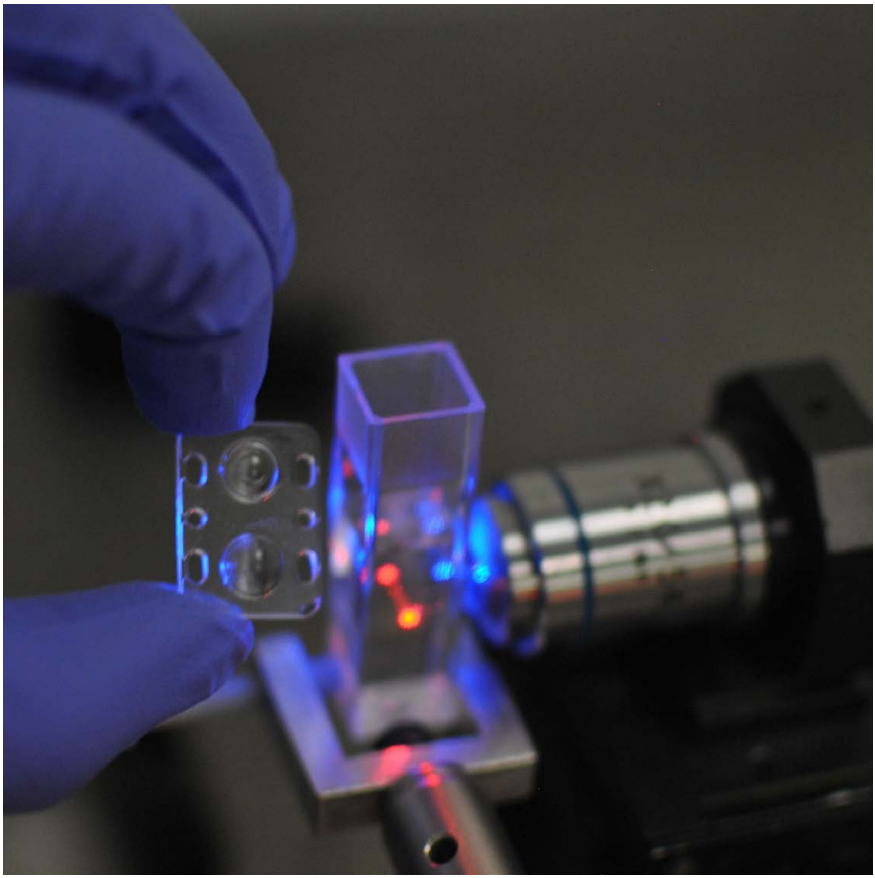
Bringing engine emissions to light

Accurate measurement of emissions is essential in the development and evaluation of new aero-engine technologies. University of Strathclyde, and collaborators, have developed the first system (the red dodecagon - pictured) for imaging the CO_2 distribution of an aero-engine exhaust plume. The system uses 126 individual laser beams to reconstruct an image of the distribution using a technique known as chemical species tomography (CST).



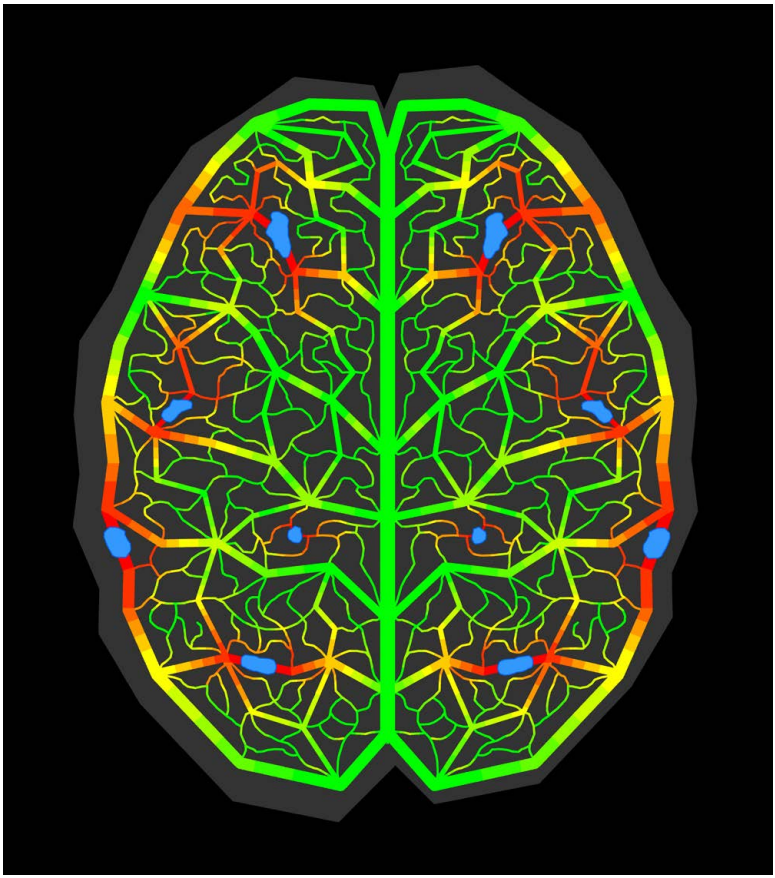
Improving surgical outcomes with AI

With an aging population, complications after heart surgery – such as kidney failure, stroke and sepsis – are becoming more common. Could artificial intelligence be the answer? Our research aims to develop algorithms to accurately predict complications following surgery, in real time. With this knowledge, complications could be better managed, benefitting patient recovery and long-term quality of life, as well as reducing the strain on healthcare resources.



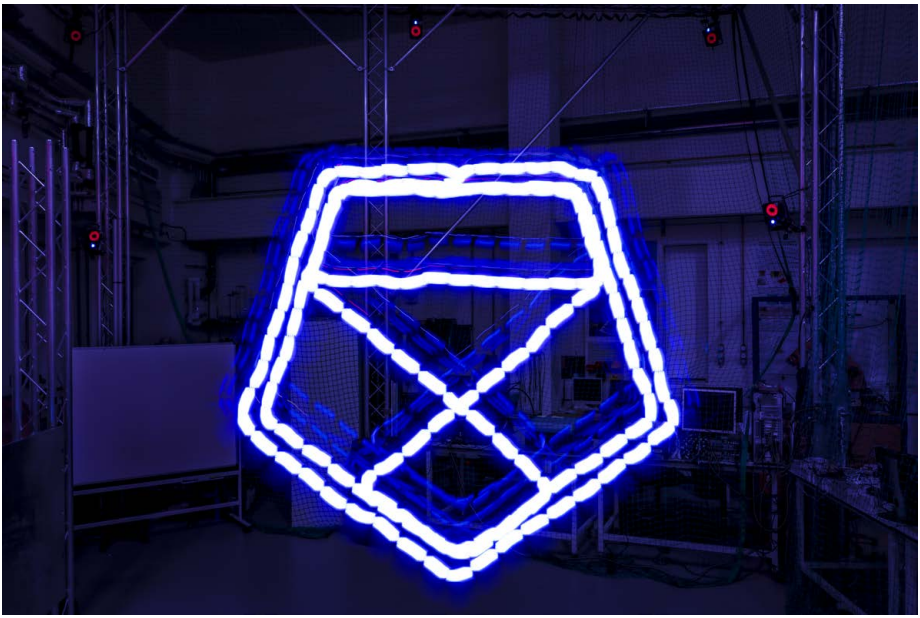
Miniaturised imaging: the bigger picture

3D printing pushes the boundaries of what is possible in prototyping and miniaturised fabrication. In this research, we aim to use 3D printing and active micro optics to create next-generation, miniaturised biomedical imaging systems. With advanced functionality and sizeably reduced production costs compared to current commercial products, they have the potential to unlock new research avenues, addressing global health challenges such as infectious disease research in developing countries.



Driving optimal decision-making

Simultaneous closure of road sections after hazardous events can quickly cause major disruption, producing significant economic and social impacts. Our research seeks to create a decision-support tool to enable transport authorities and operators to optimise resource allocation and prioritise repairs. With the incorporation of a module that simulates day-to-day drivers' travel decisions, the system aims to account for all possibilities, minimising disruption, maximising connectivity and keeping traffic on the move.



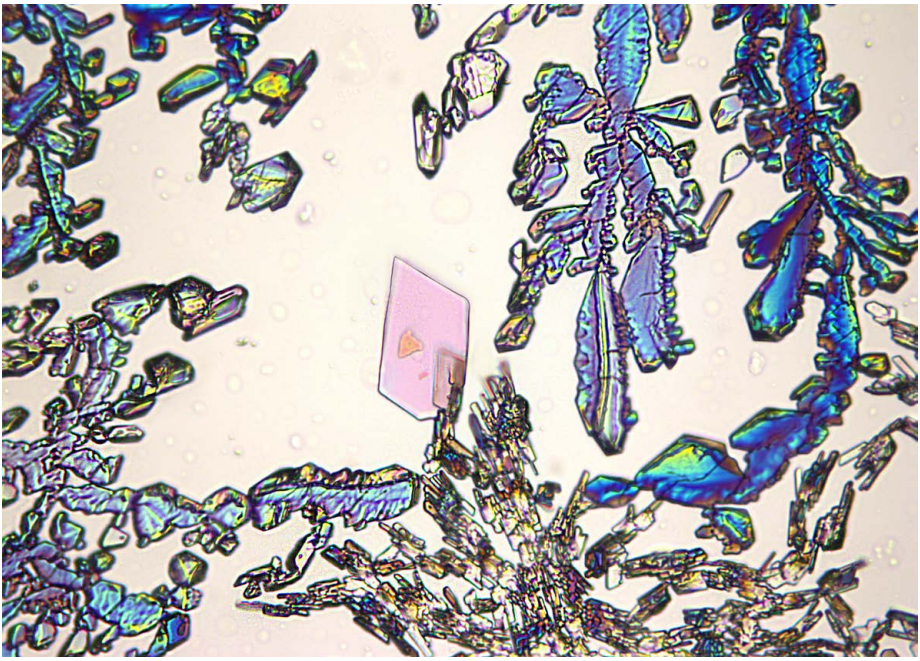
Safely inspect, detect and correct

Like them or loathe them, drones are becoming crucial to the inspection of industrial assets like nuclear plants and wind turbines. Our research seeks to improve the accuracy and insight of non-destructive, remote assessments, providing the ability to detect and track the development of minor faults whilst avoiding putting workers in dangerous situations. This image demonstrates the accuracy of a precision automated drone, recreating the University logo in light.

State of play – confusion

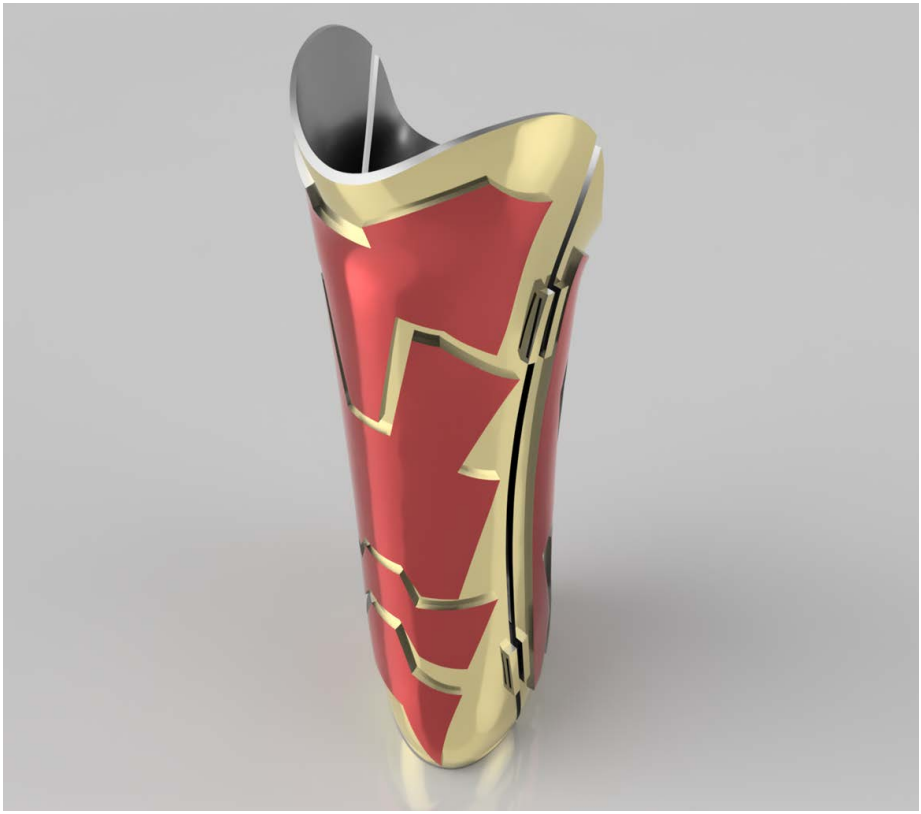
A boy wants to play. Mother watches cautiously through a SmartPhone app monitoring the insulin pump that keeps him alive. Diagnosed with type 1 diabetes, exercise can impact his glucose levels but currently it is difficult to predict by how much. By studying the experiences of families living with diabetes, our research aims to re-design guidelines, and inform new technologies to help patients lead as normal a life as possible.

Healthy perspectives



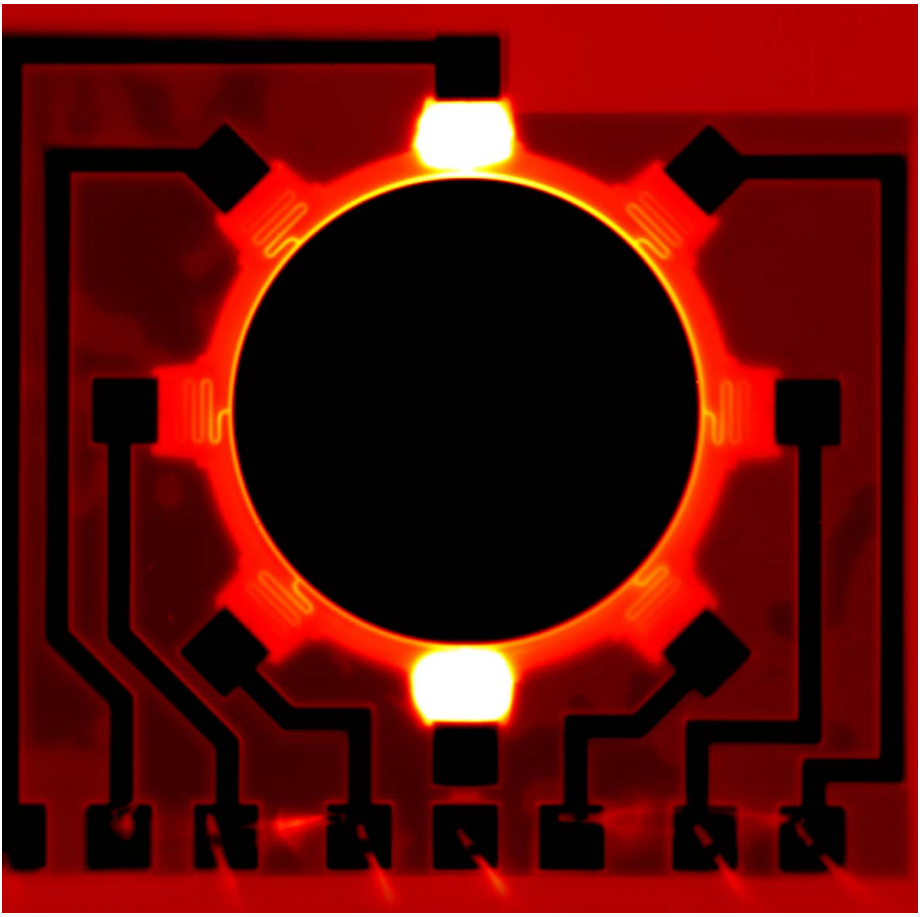
Shaping the future of pharmaceuticals

In pharmaceuticals, quality is our first priority; having the right shape, form and purity is crucial for drug safety and efficacy. Using techniques such as hot melt extrusion, where a material is heated with a polymer in order to control drug release, we aim to understand drug behaviour (such as mefenamic acid, shown, after crystallisation) in order to increase manufacturing precision and create more effective drugs.



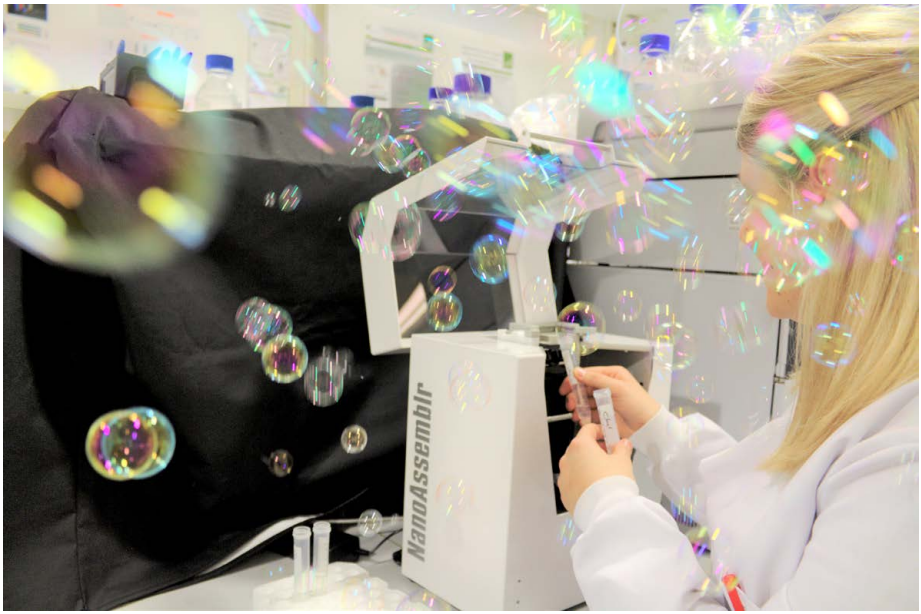
Empowering prosthetics

What if you could change the appearance of your limb as often as you change your outfit? Standard prosthetics can make people self-conscious, and can discourage children from using them, so we are developing customisable, bespoke covers to help children to feel more positive about their prosthetics. The design process aims to be fun and encourage constructive discussion of prostheses between family and friends, ultimately empowering the user.



Heat-engineered imaging for precision

This image shows the heatmap of an active micro-mirror which researchers are developing to transform biomedical imaging systems. The angle of this minute mirror can be manipulated through heating via electrical current, providing greater control of the imaging process. Incorporating these mirrors into light-sheet microscopes, we aim to reduce the size of equipment, and therefore the cost of building them, making them more accessible to developing countries.

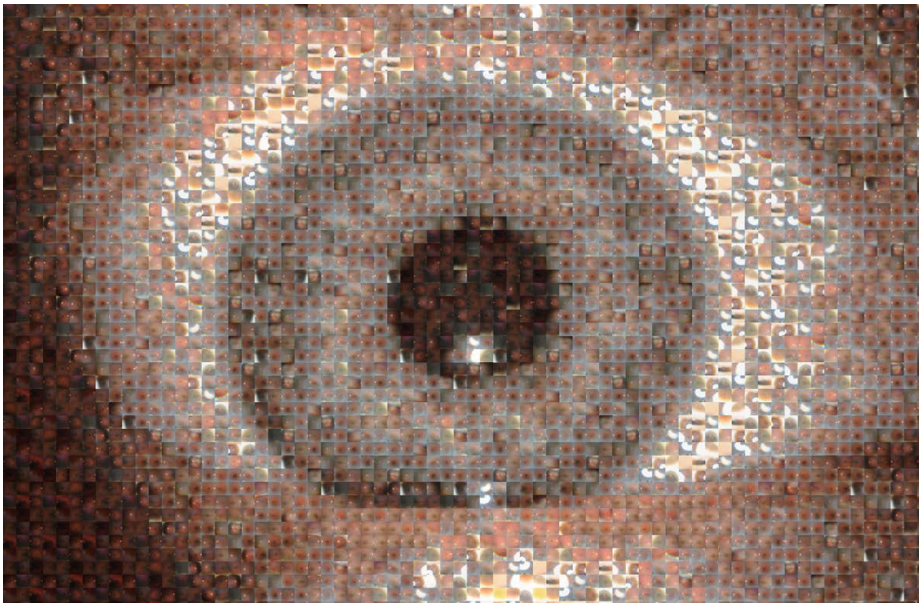


Designing drug delivery to scale

Soapy bubbles are made possible by surfactants – compounds that lower surface tension – enabling them to stretch and hold their shape. In our research, we use similar surfactants in water to make spheres, called liposomes. Used as vessels for drug and vaccine delivery, liposome size is crucial to targeting specific organs. We use advanced microfluidic technology to tailor the size of liposomes to improve their effectiveness as delivery systems.

Can you wash your hands?

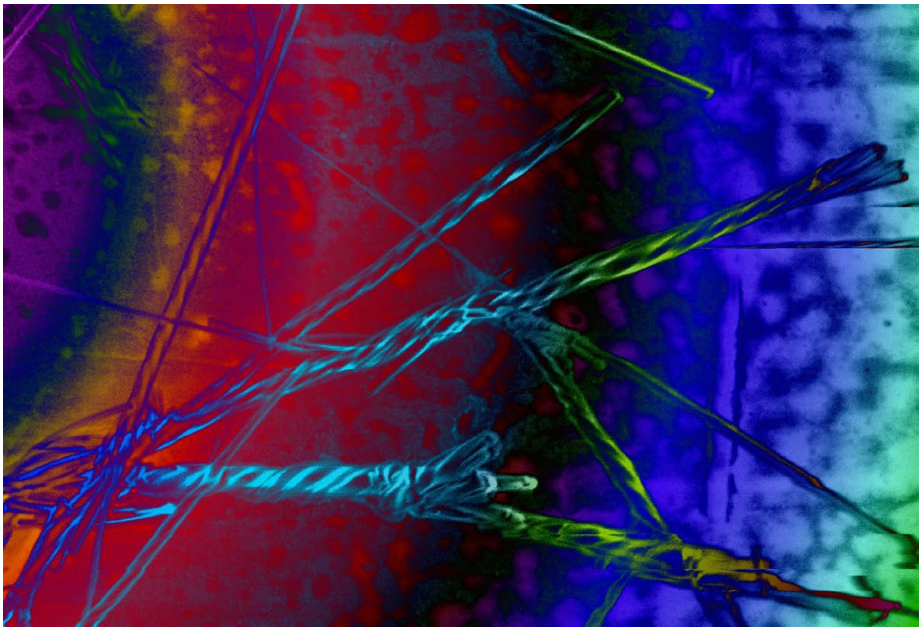
Hand washing with soap is one of the most important ways to stop diarrhoea transmission, but how can we achieve this when there is no tapped water and over 1,000 children in a school? In Malawi, we are developing and testing simple engineering solutions with locally available materials to help improve group hand washing with soap at schools. Instilling this practice at a young age can help save lives.



Seeing the bigger picture

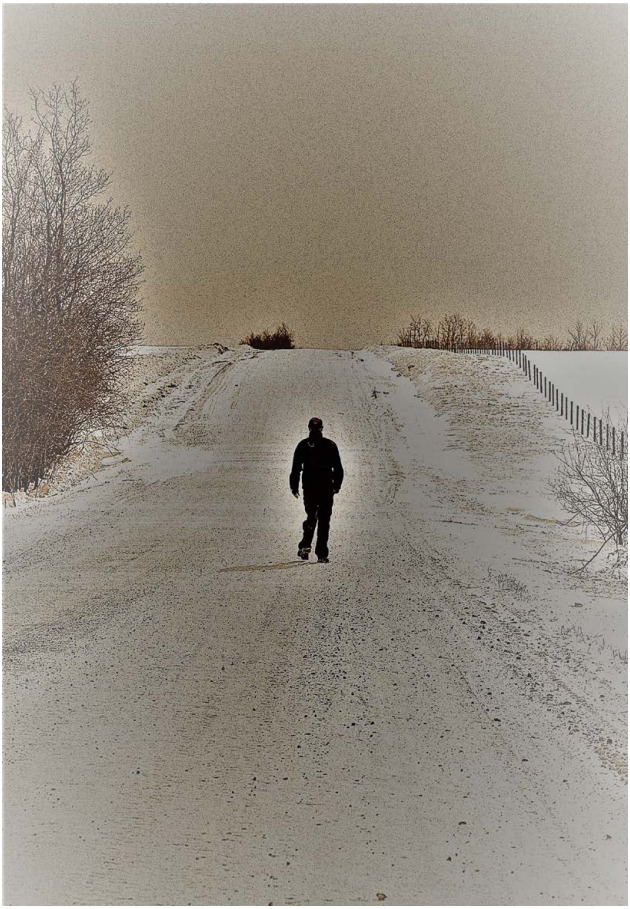
This mosaic of the front of the eye is made from images of the back of the eye, demonstrating the vast visual field of ophthalmology and the many images required to assess eye health. As such, we created an open access Comprehensive Ophthalmic Research Database (CORD) in collaboration with NHS Forth Valley, aiming to boost the development of automatic and semi-automatic diagnostic solutions for eye health worldwide.

YouTube **https://youtu.be/TWztRm6Ou2Q**



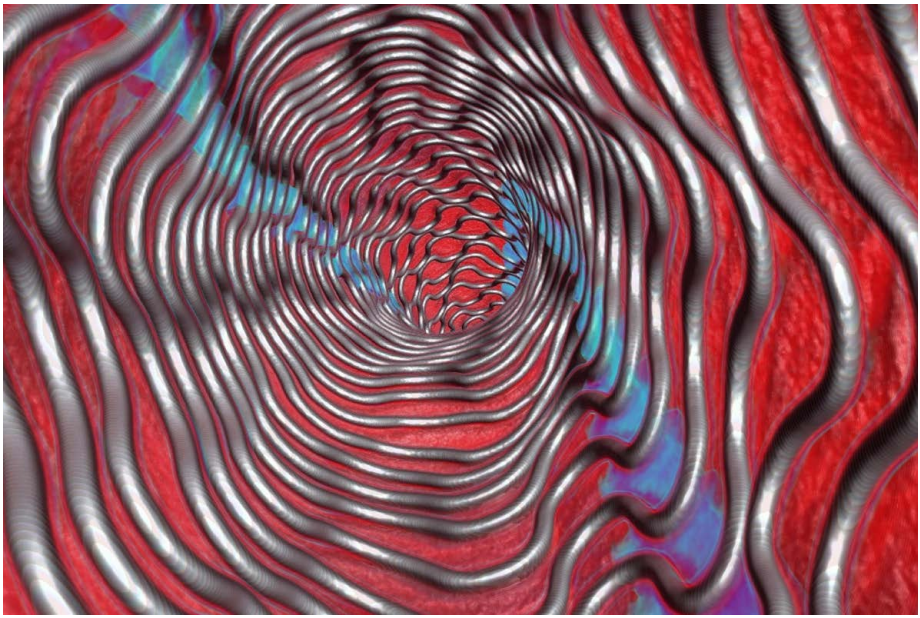
Twisted habit of pharmaceutical crystals

This image shows twisted crystals of polymorphic form III of oxcarbazepine, a commercially available pharmaceutical drug used to treat epileptic seizures. Pharmaceutical polymorphism is the ability of drugs to exist in multiple crystalline forms that often exhibit different physical and chemical properties. Our research, at Strathclyde, aims to develop new approaches for controlling polymorphism, thus ensuring that medicines are always administered in the most effective form for treating patients.



Mental health: road to recovery

By 2030, the World Health Organization estimates that mental illness will be the most common disease globally, affecting nearly 500 million people. One way of addressing this enormous challenge is investing much more in preventive strategies. Historical research at the University of Strathclyde shows that by examining how past societies dealt with mental illness, we can discover preventive strategies for today - and tomorrow.



Highway to your heart

Coronary Artery Diseases are the number one cause of death worldwide, however, stents – a kind of artery scaffold – have greatly increased survival rates. Working with S-Bahn Medical, we are developing Bioresorbable Vascular Scaffolds to reduce the potential for in-stent clots. Providing support while the artery heals, these stents will then naturally break down to be safely absorbed by the body, significantly improving patient quality of life and reducing healthcare costs.

Keys to clearer diagnosis

This tiny pipe organ, designed and created by Strathclyde researchers, could revolutionise medical imaging. Ultrasound, which uses high-frequency soundwaves to create images of the inside of the body, is notoriously difficult to interpret. Like a piano with only one note, current ultrasound operates on a single frequency, causing image distortions. By enabling ultrasound to work on multiple frequencies, our device could greatly improve image quality and therefore diagnostic capabilities.

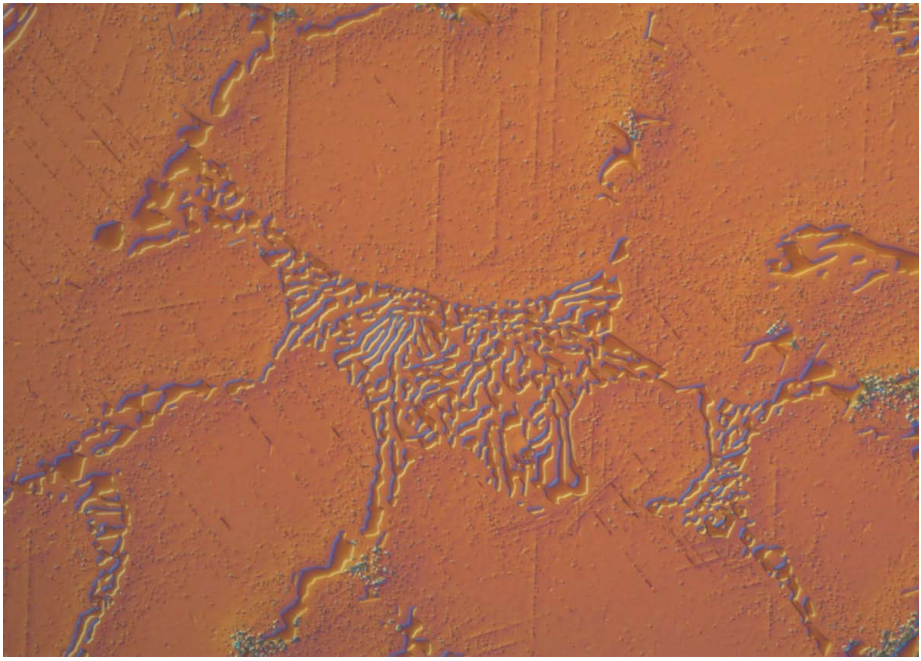
YouTube **https://youtu.be/OJJkfywsFEo**

All gowned up

Awaiting complex cardiac surgery to extract leads and have my 11th pacemaker implanted (pictured). My first was fitted when I was 11 days old; I've been dependant on pioneering medical care since and I'm passionate about promoting psychologically-informed medical care. By exploring people's experience of wearing hospital gowns, we hope to better understand how they affect identity, well-being and recovery, and to influence change to policy and practice in hospitals.

YouTube **https://youtu.be/SJga32g2HbQ**

Tackling uncertainty



Symbolic insights spark innovation

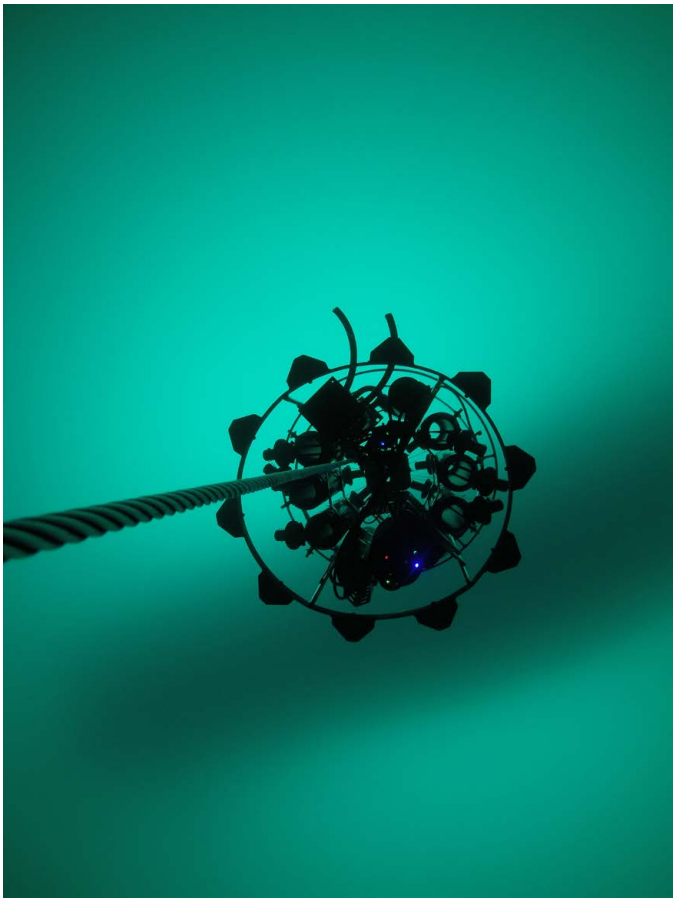
It may look like an ancient cave painting but it's actually a tiny imperfection on a fluid pump component, found during microscopic inspection. Made from Stellite superalloy – a metal compound usually prized for its corrosion and wear-resistant properties – the discovery of this feature led Strathclyde researchers to modify the component design, providing improved performance and increased lifespan for equipment vital to industry.

Building bridges, driving innovation

This lego model represents the knowledge exchange ‘bridge’ between Strathclyde and the pharmaceutical industry. This creative, reciprocal exchange is based on strong foundations leading to the delivery of common goals and objectives. The exchange of knowledge drives innovation, enabling the University to work on real world issues and understand business challenges, whilst assisting companies in the delivery of drugs that make a huge difference to people’s lives.

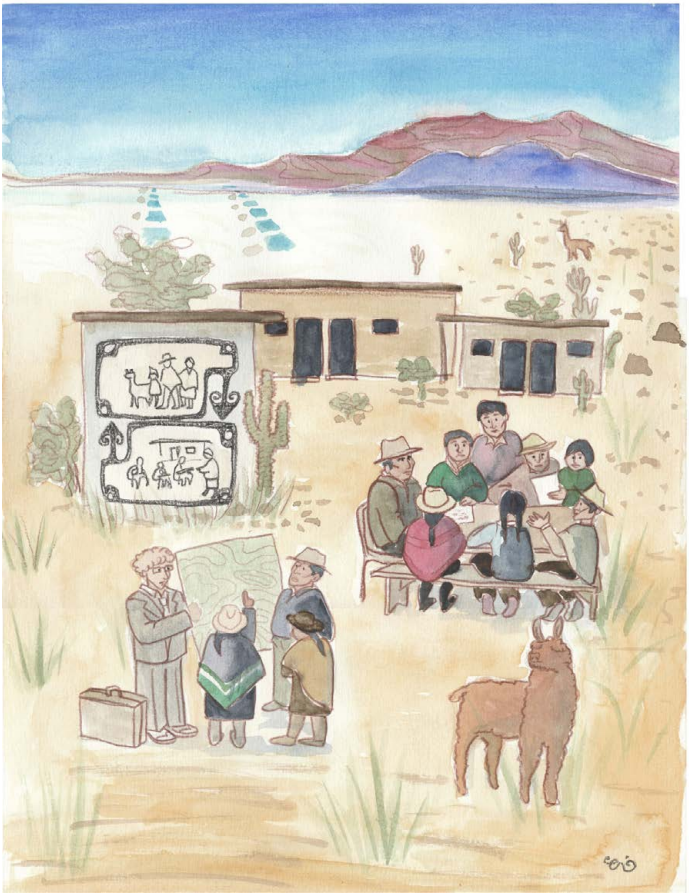
Making tradition craft resilient

For women in rural communities in India, traditional practices of weaving are a creative, cultural and economic act. Though skilled, these women have been marginalised from formal education and the mainstream economy. Through exploration of folk culture in late colonial Punjab, Strathclyde researchers have been able to give these women and their work a renewed sense of worth, creating new market opportunities and increasing their ability to command better pay.



Arctic ocean optical profiling

The Arctic is warming faster than anywhere else on the planet leading to rapid thinning and early retreat of sea-ice. We are assessing the effect of this ice loss on physical, chemical and biological processes that support the marine ecosystem. Here we see an optical profiler being deployed from the Norwegian research vessel, R.V. Helmer Hansen, to measure phytoplankton which are the primary source of food in the marine environment.



Whose natural resources?

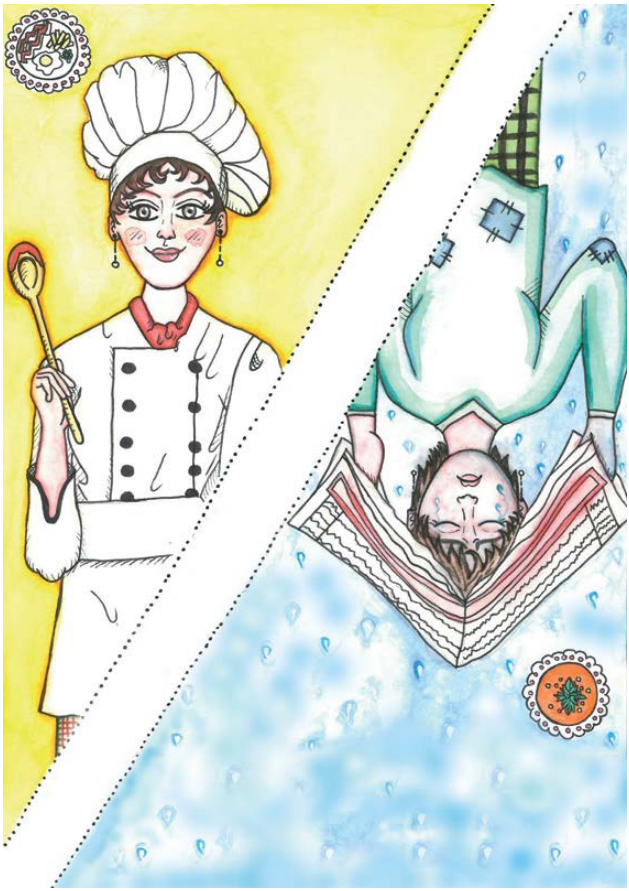
An indigenous community hears that the government is about to authorize a new mining project in their traditional lands. Can the community still say “no” to this development? What kind of benefits is the community entitled to if the project goes ahead? Strathclyde’s research in International law aims to clarify practical steps for governments and private companies to follow, to ensure respect for indigenous peoples’ human rights and environmental protection.

The hygienic family

Interventions to reduce diarrhoeal disease in developing countries like Malawi often fail because they lack cultural understanding. The University of Strathclyde-led intervention, Banja la Ukhondo (Hygienic Family) in rural Malawi uses traditional women's groups to improve hygiene through peer education and innovative behaviour change techniques. We work with communities to ensure we understand the context in which they live, and develop solutions together to achieve sustained change and health improvements.

Occupation: guaranteeing spatial rights

Our research seeks to understand the impact of a networked approach to architecture through studies of social innovation across the world. This particular study in Sao Paulo, Brazil, followed the community occupation of vacant public buildings, demonstrating the power of collective activism in upholding citizens' rights to the city, whilst also demonstrating alternative models for collective housing in response to the actual needs of citizens.



Transformation: from challenged to changed

Disadvantaged people – the poor, unemployed, those with spent convictions – face many challenges in trying to better their lives. Our research is exploring the 'transformative process' experienced by those helped by charities in the hospitality sector, where practical training and assistance in finding jobs is provided. We aim to shed light on the challenges faced by these people and evidence the important role charities play in making their lives better.

Left behind

He is…left behind by the government, the aid agencies, collecting what is left behind by us. He is a left behind entrepreneur, in a left behind informal settlement. Through study of social entrepreneurship in informal settlements, such as those on the Greater Cairo fringes, we can inform national and international policy on the ability of the marginalised themselves to play a proactive role in the advancement of their communities.

Researcher Development Programme (RDP)

The University of Strathclyde's Researcher Development Programme (RDP) is delivered by Faculties, Professional Services and external bodies to offer research students and early career academics a range of opportunities to continue their personal, professional and career management skills development.

Aligned to the national agenda supported by Research Councils UK (RCUK) and Vitae, courses, resources and events aim to help researchers enhance their transferable skills and competencies, and widen their scope for future employability both inside and outside academia.

Please visit **www.strath.ac.uk/rdp** to find out more.

Engage with Strathclyde, 29 April – 3 May 2019

The University of Strathclyde's flagship events programme, Engage with Strathclyde, is transforming the way the University reaches out to public, private and third sector organisations. This week-long series of events typically attracts around 2,000 delegates from over 600 organisations, and this year will host around 70 different events showcasing the latest research from all faculties of the University. The Images of Research exhibition takes place in the Technology and Innovation Centre, the central hub for events during the week. This is an excellent opportunity for delegates to see another interpretation of some of the research that takes place at the University.

http://www.strath.ac.uk/workwithus/engage/

Entry Information

Closing the loop index

Waste fuelling antibiotic growth
Submitter: Anna Birke
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Collaborators: Prof Paul A Hoskisson (supervisor), Dr Steve G Kendrew (GSK), Dr Benjamin D Huckle (GSK), Prof Iain S Hunter (2nd supervisor)
Funder: IBioIC, GSK

Responsible responsive materials
Submitter: Travis Hesketh
Department: Chemistry
Collaborators: Prof. Tell Tuttle (supervisor - Strathclyde); Prof. Xi Chen, Dr. Scott McPhee, Roxana Piotrowska, Prof Rein Ulijn (project collaborators - all of ASRC, CUNY)
Funder: Results obtained via Engineering and Physical Sciences Research Council funded ARCHIE WeST High Performance Computer: EP/K000586/1

Bright future for clean energy
Submitter: Petra Matusova
Department: Chemistry
Collaborators: Ivaturi Lab/SMaRDT Group, PAC
Funder: EPSRC Fellowship Grant 'Highly Efficient Elastic Perovskite Solar Cells' to Dr. Aruna Ivaturi (EP/P011500/1)

Remanufacturing: extending product life
Submitter: Sascha Ruggaber
Department: Design, Manufacture and Engineering Management
Funder: Autocraft Drivetrain Solutions Ltd and The Royal Commission for the Exhibition of 1851

The texture of perception
Submitter: Lewis Urquhart
Department: Design, Manufacture and Engineering Management
Funder: EPSRC EP/1015698/1 / Research Studentship – AFRC

Medicines manufacturing toolbox
Submitter: Monika Warzecha
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Funder: Engineering and Physical Sciences Research Council (EPSRC) Manufacturing Research Hub programme

The art of greening electronics
Submitter: Priscila Valverde
Department: Civil and Environmental Engineering
Funder: The Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT)

Power to the people
Submitter: Andrew Wilson
Department: Mechanical and Aerospace Engineering
Collaborators: Peter McGinty
Funder: SPACE Canada / Engineering and Physical Sciences Research Council (EPSRC)

It's not rocket science!
Submitter: Andrew Wilson
Department: Mechanical and Aerospace Engineering
Collaborators: Glasgow Caledonian University, European Space Agency
Funder: Engineering and Physical Sciences Research Council (EPSRC) / SPACE Canada

The sound of science
Submitter: Ronnie Woodward
Department: Mechanical and Aerospace Engineering

Crystallising solutions for precision pharmaceuticals
Submitter: Raghunath Venkatramanan
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Funder: Marie Skłodowska-Curie Innovative Training Network / Call part identifier: H2020-MSCA-ITN-2016 / Project Number: 722456 CORE

Digital connections index

Shedding light on communication security
Submitter: Aidan Arnold
Department: Physics
Collaborators: Rachel Offer (PhD student - generated the experimental data)
Funder: Leverhulme Trust (RPG-2013-386) and EPSRC (EP/M506643/1)

ImagineD: Realising your imagination
Submitter: Alex Duffy
Department: Design, Manufacture and Engineering Management
Collaborators: Madeleine Grealy
Funder: Engineering and Physical Sciences Research (EPSRC): EP/M012123

Developing opportunities through digital lighting
Submitter: Johannes Herrnsdorf
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Collaborators: Emma Le Francois, Jonathan McKendry, Alexander Griffiths, Michael Strain (PI), Martin Dawson (PI)
Funder: Engineering and Physical Sciences Research Council (EPSRC) Quantum Hub in Quantum Enhanced Imaging: EP M01326X/1

Bringing engine emissions to light
Submitter: Gordon Humphries
Department: Electronic and Electrical Engineering
Collaborators: Mark Johnston (Rolls Royce plc), Micheal Lengden
Universities of Edinburgh, Southampton, Manchester, and also Rolls-Royce, DAS Photonics, Instituto Nacional de Técnica Aeroespacial (INTA), OptoSci Ltd
Funder: EU Horizon 2020 Grant Agreement ID: 785539. “CIDAR: Combustion species Imaging Diagnostics for Aero engine Research”

Improving surgical outcomes with AI
Submitter: Linda Lapp
Department: Computer and Information Sciences
Funder: Faculty of Science, University of Strathclyde and Golden Jubilee National Hospital

Miniaturised imaging: the bigger picture
Submitter: Ralf Bauer
Department: Electronic and Electrical Engineering
Funder: Royal Academy of Engineering Felowship (GCRF) RF1516/15/8

Driving optimal decision-making
Submitter: Antonio Pellicer Pous
Department: Civil and Environmental Engineering
Funder: Strathclyde John Anderson Research Award (JARA) and IBI Group

Safely inspect, detect and correct
Submitter: Robert Watson
Department: Electronic and Electrical Engineering
Collaborators: Charles MacLeod, Gareth Pierce, National Nuclear Laboratory and EDF Energy
Funder: Engineering and Physical Sciences Research Council, iCASE program: EP R512114/1 in conjunction with the National Nuclear Laboratory, NDE Research Association and EDF Energy

State of play – confusion
Submitter: Diane Cochrane
Department: Computer and Information Sciences
Collaborators: Patsy Millar and Sean Millar
Funder: Strategic Technology Partnership Studentship (CAPITA) / Digital Health Institute funding

Healthy perspectives index

Shaping the future of pharmaceuticals
Submitter: Moulham Alsuleman
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Funder: Chevening Scholarship / Cancer Research UK Scholarship

Empowering prosthetics
Submitter: Navid Aslani
Department: Biomedical Engineering
Collaborators: Ability Matters
Funder: Starworks

Heat-engineered imaging for precision
Submitter: Spyridon Bakas
Department: Electronic and Electrical Engineering
Funder: Royal Academy of Engineering studentship

Designing drug delivery to scale
Submitter: Despo Chatzikleanthous
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Funder: Marie Skłodowska-Curie Innovative Training Network (H2020-MSCAITN-2015 Grant Agreement 675370: PHA-ST-TRAIN VAC) and Independent Research Fund Denmark (Grant 7026-00027B)

Can you wash your hands?
Submitter: Kondwani Chidziwisano
Department: Civil and Environmental Engineering
Collaborators: Tracy Morse, Tara Beattie, Chisomo Thaulo
Funder: Department for International Development through the Sanitation and Hygiene Applied Research for Equity Consortium

Seeing the bigger picture
Submitter: Matteo Menolotto
Department: Biomedical Engineering
Collaborators: Kirsty Jordan, Iain Livingstone (NHS consultant ophthalmologist), Kenneth Gilmour (NHS trainee ophthalmologist), NHS Forth Valley, Ian Coghill, Mario Giardini (supervisor)
Funder: Engineering and Physical Sciences Research Council (EPSRC): EP L015595/1) / Rosenbaum Golden Charitable Trust (Rosetrees Trust), UK: A1719 from the Teresa / University of Strathclyde PhD stipend

Twisted habit of pharmaceutical crystals
Submitter: Hector Polyzois
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Collaborators: Dr Deborah Bowering, Eleonora Paladino
Funder: NPL-linked studentship, Strathclyde

Mental health: road to recovery
Submitter: Matthew Smith
Department: History
Collaborators: Court Smith (photographer)
Funder: Arts and Humanities Research Council (AHRC): Research Fellowship AH L009641/1

Highway to your heart
Submitter: David Nash
Department: Mechanical and Aerospace Engineering
Collaborators: Prof Mark Steckel and Calum MacLeod, S-Bahn Medical & Kenneth MacLeod, Y5 Undergraduate Student

Keys to clearer diagnosis
Submitter: Botong Zhu
Department: Electronic and Electrical Engineering
Collaborators: Zhe Wang, Tony Mulholland and James Windmill
Funder: Engineering and Physical Sciences Research Council under Grant EP L022125/1 and European Research Council through the European Union's Seventh Framework Program under Grant P/2007-2013 and ERC Consolidator Grant 615030: SASATIN

All gowned up
Submitter: Liza Morton
Department: Psychology
Collaborators: Nicola Cogan

Tackling uncertainty index

Symbolic insights spark innovation
Submitter: James Kelly
Department: Mechanical and Aerospace Engineering

Building bridges, driving innovation
Submitter: Swapnil Khadke
Department: Strathclyde Institute for Pharmacy and Biomedical Sciences
Collaborators: Dr. Carla Roces Rodriguez, Organisational and Staff Development Unit (OSDU), Lonza, AstraZeneca, Pfizer

Making tradition craft resilient
Submitter: Churnjeet Mahn
Department: English
Collaborators: Samia Singh; Ratika Singh (designers and artists), Brunel University, University of Central Lancashire, University of Sussex
Funder: Arts and Humanities Research Council (AHRC): AH/N004094/1

Arctic ocean optical profiling
Submitter: David McKee
Department: Physics
Collaborators: Neil Banas, Scottish Association for Marine Science (SAMS), University of Edinburgh, University of Oxford, University of St Andrews
Funder: Arctic PriZE, funded by NERC through the Changing Arctic Ocean programme - NE/P00573X/1

Whose natural resources?
Submitter: Elisa Morgera
Department: Law
Collaborators: Margherita Brunori
Funder: ERC-2013-StG 335592: BENELEX - Benefit-sharing for an equitable transition to the green economy - the role of law

The hygienic family
Submitter: Tracy Morse
Department: Civil and Environmental Engineering
Collaborators: Kondwani Chidziwisano, Tara Beattie, Mindy Panulo, Rossanie Malolo - all were involved in the research development and implementation
Funder: Department for International Development through the Sanitation and Hygiene Applied Research for Equity Consortium

Occupation: guaranteeing spatial rights
Submitter: Donagh Horgan
Department: Architecture
Funder: Strathclyde SCDT studentship/ BRE Trust

Transformation: from challenged to changed
Submitter: Annalisa Galeone
Department: Marketing

Left behind
Submitter: Christine Habib
Department: Hunter Centre for Entrepreneurship
Collaborators: Katerina Nicolopoulou
Funder: Strathclyde John Anderson Research Award (JARA) / Global Engagements Fund

The research presented in this exhibition is funded from a variety of sources including, but not limited to, UK and international research councils, government, public and third sector organisations, as well as private sector support.

---

the place of useful learning
www.strath.ac.uk
University of Strathclyde Glasgow